# Base Load Power Hub (BLPH)

Installation, Operation and Maintenance Manual (IOM)

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Attachment-2 VEEAM-BRS-DOC

# 1 INTRODUCTION

## 1.1 PROJECT OVERVIEW

Crosswind, a Shell and Eneco joint venture, was awarded the tender to develop the offshore Hollandse Kust Noord (HKN) wind farm, located 18.5km off the coast of Netherlands near the town of Egmond aan Zee. The consortium plans to have HKN operational in 2023 with an installed capacity of 759MW generating at least 3.3TWh per year. This is sufficient renewable power to supply more than 1 million Dutch households with green electricity.

Offshore wind farms produce intermittent electricity and balancing these dips and peaks and integrating this electricity into the national energy system requires new technologies. For this reason, the offshore wind farm will include several new technologies that could be implemented at full-scale in the future. The new technologies being explored include a floating solar park, a short-duration battery storage as well as long-term storage via green hydrogen produced by water electrolysis and subsequently consumed in a fuel cell. The combination of these individual measures, herein referred to as the Base Load Power Hub (BLPH) will ensure a continuous power supply regardless of the wind situation.

### 1.1.1 Project Location

The Hollandse Kust Noord (HKN) wind farm is located 18.5km off the coast of the Netherlands near the town of Egmond aan Zee.

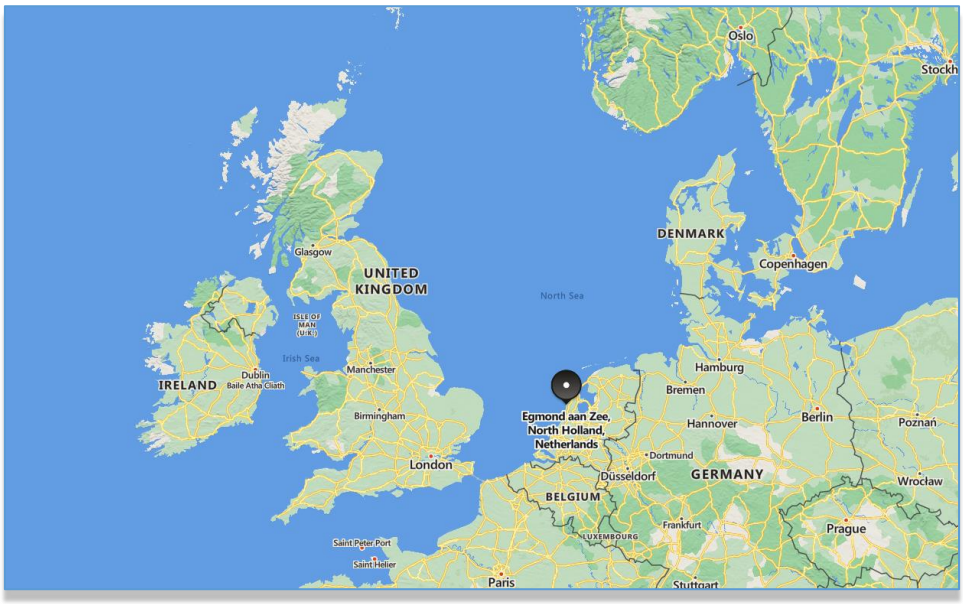



*Figure 1 HOLLANDSE KUST NOORD WIND PARK Location Map*

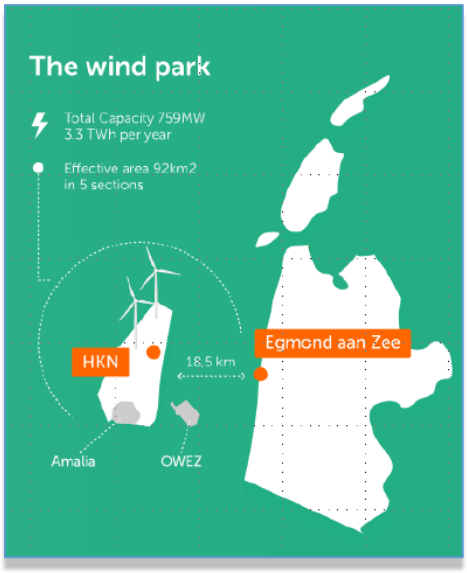



*Figure 2 - Wind Park Details*

The wind farm will consist of No. 69 x 11.5MW wind turbine generators each to be installed on a dedicated monopile structure. A 70th monopile located on coordinates E 590719.1, N 5841602.3 is reserved for installing the platform accommodating the BLPH. The monopile structure was designed and installed by Van Oord Offshore Wind (VooW) and therefore not part of the BLPH scope.

### 1.1.2 Project Concept

All components included in the BLPH will be integrated onshore on a topsides and installed in an offshore location within the boundaries of the HKN wind farm. At its simplest, the BLPH will store energy during periods of high electricity generation from renewable sources (a wind turbine generator and the floating solar PV farm) and release it during periods of low generation. In practice. It is expected that the energy stored will supplement generation from renewable sources to ensure that at least 1.0MW of power is exported to the electrical grid regardless of wind/solar availability.

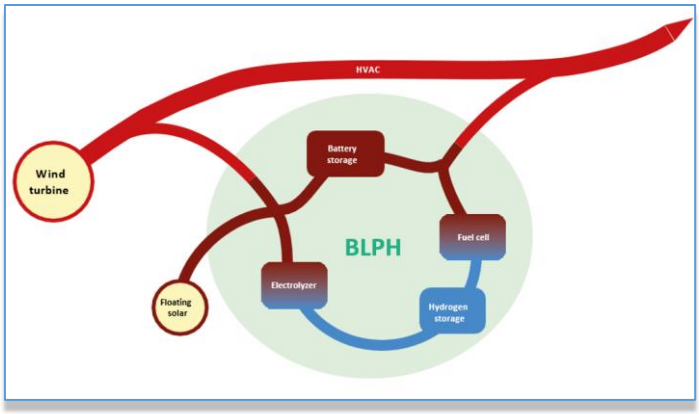



*Figure 3 – BLPH Concept*

Electricity in the BLPH will be stored in the form of electrons in a battery energy storage system (BESS) as well as converted into green hydrogen via water electrolysis. When the power output from the connecting wind turbine drops to below 1 MWe, the BLPH will return its stored energy to supplement the remaining power output. This will be by discharging the BESS, while stored hydrogen will be converted back into electricity using a fuel cell to extend the discharge duration.

The purpose of the BLPH s to function as a testbed for the integration of energy storage technologies with renewable generation. It is expected that equipment installed on the BLPH will operate as Normally Unmanned Installation for at least two (2) years with no or minimal maintenance and it will have its own independent control room with the ability to communicate with Crosswind's control room.

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# 2 DOCUMENT SCOPE

The purpose of this document is to provide essential Instructions for Operation and Maintenance (IOM) of Yokogawa PCS based on Centum VP and CI Server which will be used as operation and Monitoring of BLPH - Hollandse Kust Noor Wind Park Project.

The following subjects are covered under this document:

- Instructions for operations
- Instructions for maintenance
- Instructions for proof testing
- Instructions for troubleshooting

Note that this document is not meant to supplant the actual Operations and Maintenance Procedure of the facility. It serves only as a guideline to highlight the salient points to be considered in the development of the Operations and Maintenance Procedure which falls under the authority of the Employer

## 2.1 REFERENCES

| Doc. No. | Description |
|---|---|
| 1724000594-IN-LIS-00007 | Systems Cables List |
| 1724000594-IN-DD-00015 | System Architecture |
| 1724000594-IN-DG-00016 | Network Connection Diagram |
| 1724000594-IN-SP-00018 | PCS and SAFETY SISTEMS Software Functional Design Specification (FDS-SW) |
| 1724000594-IN-SP-00019 | EMCS Software Functional Design Specification (FDS-SW) |
| 1724000594-IN-RE-00043 | Cyber Security Settings |
| IM 33J15A20-01EN | CENTUM VP Function Blocks Overview |
| IM 33J15A30-01EN | Function Block Reference Vol.1 |
| IM 33J15A31-01EN | Function Block Reference Vol.2 |
| IM 33J15A32-01EN | Function Block Reference Vol.3 |
| IM 33J15A10-01EN | Field Control Stations Reference |
| IM 33J60F10-01EN | Input & Output Modules Vol.1 |
| IM 33J62F10-01EN | Input & Output Modules Vol.2 |
| IM 33J10D10-01EN | Engineering Reference Vol.1 |
| GS 33J01A10-01EN | CENTUM VP System Overview |

| | |
|---|---|
| GS 36K01A10-01EN | Collaborative Information Server |
| IM 33J01C10-01EN | Field Control Unit -Hardware User's Guide |
| IM 33J01C10-01EN | CENTUM VP Installation |
| IM 32P01C50-01EN | Installation Guide(ProSafe-RS) |
| IM 30B05A20-01EN | Plant Resource Manager Installation |
| IM 36K01C10-01EN | CI Server Setup |
| IM 36K10R10-01EN | CI Portal Setup |
| TI33J01J10-01EN | CENTUM VP Installation Guidance |
| TI 36K01A10-01EN | Collaborative Information Server Product Overview |

*Table 1 - Reference Documents*

## 2.2 DEFINITIONS AND ABBREVIATIONS

| | |
|---|---|
| COMPANY or Client (CPY): | Crosswind |
| CONTRACTOR (CTR): | ROSETTI MARINO S.p.A. |
| PROJECT: | HOLLANDSE KUST NOORD WIND PARK Project |
| CAP | Critical Action Panel |
| CPU | Central Processing Unit |
| EMCS | Electrical Monitoring and Control System |
| ESB | Extended Serial Bus |
| EWS | Engineering Workstation |
| LED | Light Emitting Diode |
| FDS | Functional Design Specification |
| HART | Highway Addressable Remote Transducer Protocol |
| HMI | Human Interface Station (CentumVP) |
| IAMS | Instrument Asset Management System |
| NMS | Network Management System |
| OWS | Operator Workstation (HMI) |
| PCS | Process Control System |
| PM | Preventive Maintenance |

| | |
|---|---|
| PSU | Power Supply Unit |
| UPS | Un-interrupted Power Supply |
| WSUS | Windows Server Update Services |

*Table 2 - Definitions and Abbreviations*

# 3 GENERAL INSTRUCTIONS

This section describes the general instructions for operation and maintenance of the Process Control System supplied for the HOLLANDSE KUST NOORD WIND PART Project (BLPH).

- "Operations" involve guidelines for the user to evolve procedures for normal operations of the plant and systems. This includes Operation and Monitoring. Refer Sec.4 of this document for more information.
- The "Maintenance" activities can be classified as Preventive Maintenance and Corrective Maintenance.
  - Within Preventive Maintenance, one can distinguish the actions that can be done without disturbing the process (without restrictions), so called "First line Maintenance" and maintenance that will certainly disturb the process or bear a great risk to do so, called "Shutdown Maintenance". Refer Sec.5 of this document for more information.
  - Corrective Maintenance implies the replacement of the defective part, which failed and/or caused a nuisance trip. Due to the unpredictable nature of this type of maintenance this document does not cover this in great depth, but to aid with corrective maintenance a section Troubleshooting has been introduced.
- It is the responsibility of the Customer to ensure that the plant Operations and Maintenance Procedure is kept up to date to reflect the actual status of the PCS for all "Modifications" implemented at any given time post-handover.

## 3.1 SYSTEMS INVOLVED

System comprises of the following equipment:

- CentumVP System cabinet
- Associated FIO cabinets
- CentumVP Engineering Workstation (EWS)
- CI Servers
- IAMS

## 3.2 PREREQUISITES

- It is to be noted that the responsibility to set up the necessary procedures for operation and maintenance rests with the end user.
- The personnel responsible for the operation and maintenance activities must be competent with the system and project documentation.

- It is the responsibility of the maintenance personnel to refer to the appropriate sections in the manual and to read and understand the requirements before performing the actual maintenance activities.
- During maintenance, put up wrist strap for PCS (Electrostatic Discharge) measures (If applicable).

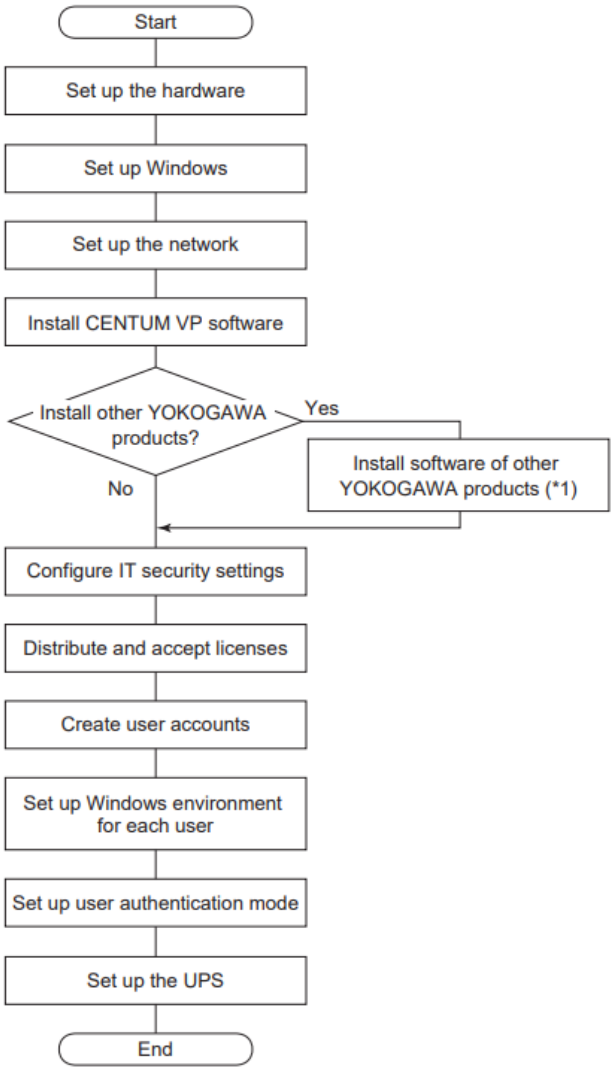
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# 4 INSTALLATION

## 4.1 CENTUMVP

In order to use CENTUM VP software packages, it is necessary to install the CENTUM VP software on a computer and then grant licenses to the computer to enable the use of the software packages

The following figure shows the setup procedure for a computer installed with only system builders.




*1: You may install other products later. If you install later, you need to configure IT security settings again.

*Figure 4 – CentumVP Installation flow chart*

Refer IM 33J01C10-01EN CENTUM VP Installation, section B for applicable hardware and software applicable as per BOM

For Hardware Component installation please refer TI33J01J10-01EN CENTUM VP Installation Guidance.

## 4.2 PROSAFE-RS

In order to use ProSafe-RS software packages, it is necessary to install the ProSafe-RS software on a computer and then grant licenses to the computer to enable the use of the software packages.

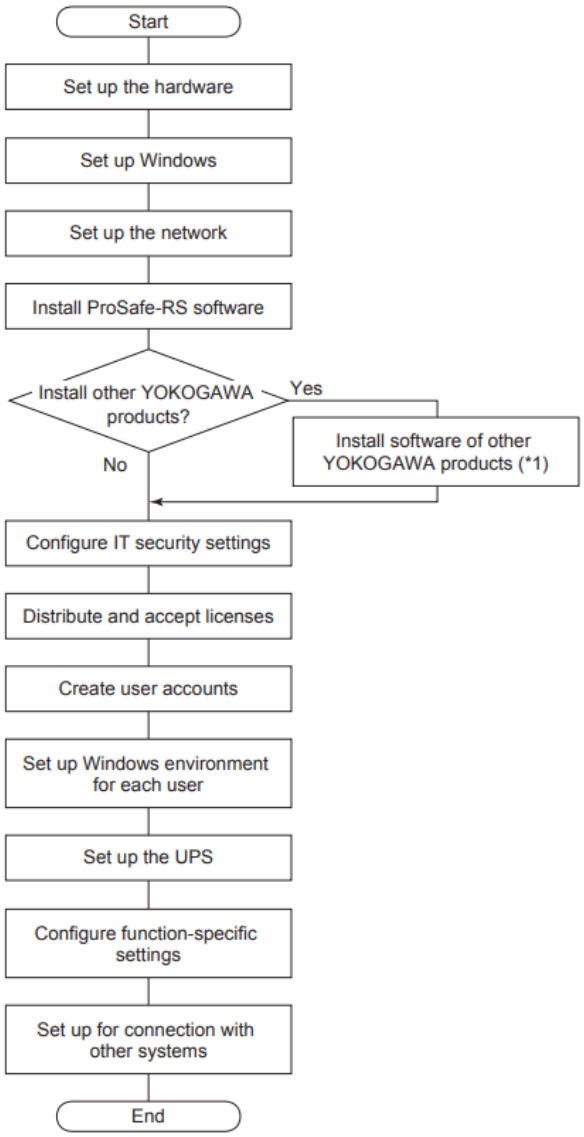



*Figure 5 – ProSafe-RS Installation flow chart*

Refer IM 32P01C50-01EN Installation Guide, section B for applicable hardware and software applicable as per BOM. CENTUM VP coexists with ProSafe-RS so the name of the PSF_MAINTENANCE group you have created will change to PSF_MAINTENANCE_LCL and add the user to the CTM_MAINTENANCE group.

## 4.3 IAMS (PLANT RESOURCE MANAGER- PRM)

following media for installing IAMS hereinafter referred to as PRM:

• PRM R4 Software Media (hereinafter referred to as PRM installation media)

There are two discs. Disc 1 contains the following software installers:

- PRM software
- License Manager software
- DeviceViewer for HIS
- Control bus driver
- Vnet/IP open communication driver
- Electronic instruction manuals

Disc 2 contains the InsightSuiteAE Starter Edition installer.

• Device Files Media (hereinafter referred to as Device Files medium) This medium contains YOKOGAWA device DTMs and device files from other manufacturers

PRM R4 License Media (hereinafter referred to as PRM license medium) This medium contains the ordered licenses for PRM software packages, in the form of license key files.

• PLUG-IN Application Media for PRM (hereinafter referred to as PLUG-IN application medium) This medium contains optional PLUG-IN applications.

A PRM station is a computer on which PRM software is installed. The station type determines the PRM packages that can be installed on a computer. Select one of the following PRM station types to install depending on your system requirement:

• PRM Server

• PRM Client

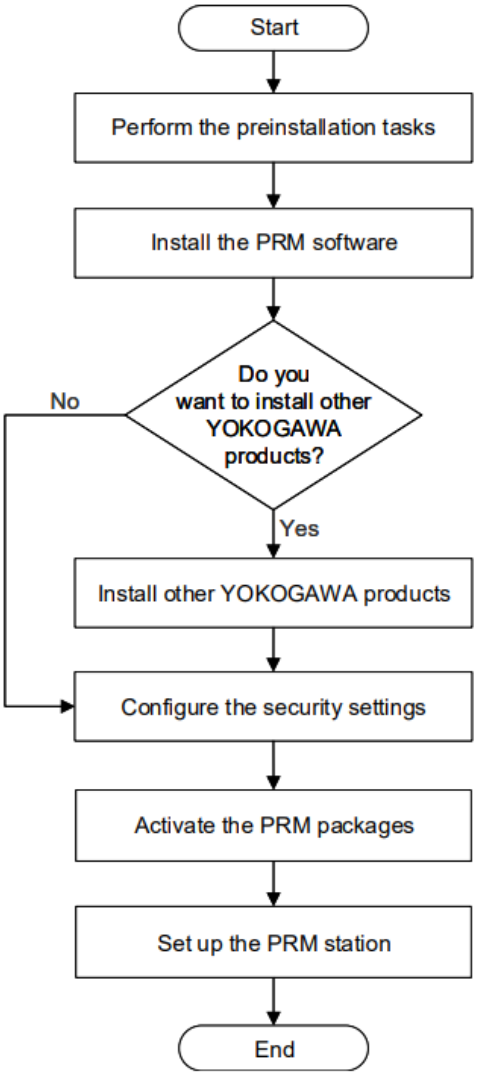



*Figure 6 – IAMS(PRM) Installation flow chart*

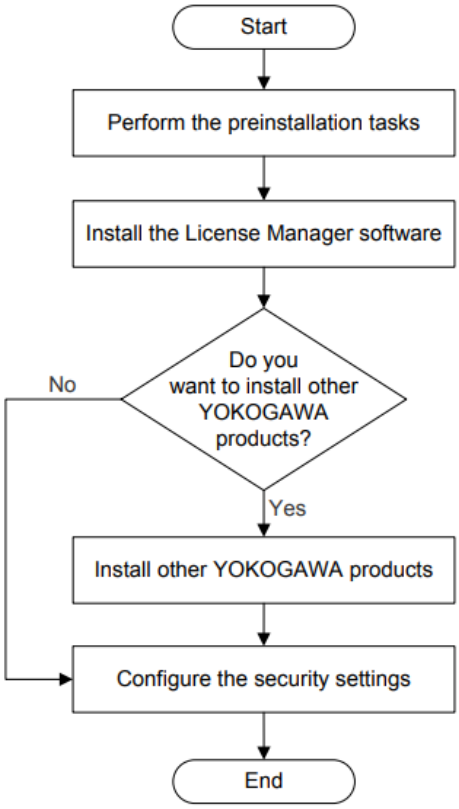



*Figure 7 – IAMS License Manager Installation flow chart*

Refer IM 30B05A20-01EN Plant Resource Manager Installation, section 6 for applicable hardware and software applicable as per BOM.

## 4.4 CI CORE/ PORTAL /VIEW

Have the following items at hand before you set up CI Server.

- CI Server software medium
- Activated License File (there is one for each server computer)

The installation is performed by running setup from the CI Server DVD. In setup, all CI Server functions are installed regardless of the type of CI Server package. However, by applying the appropriate license for the CI Server package(Core/Portal), it becomes the configuration suitable for that package.

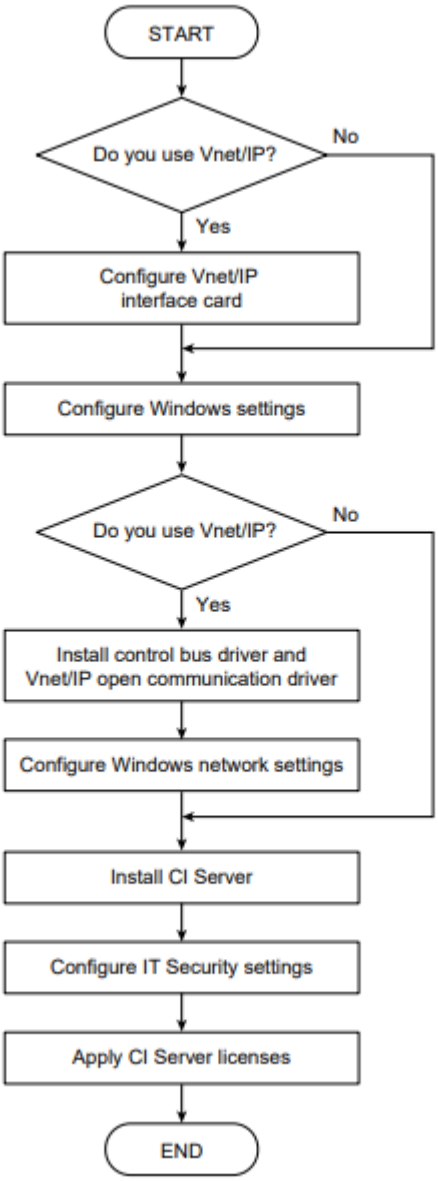



*Figure 8 – CI Core/Portal Installation flow chart*

Refer IM 36K01C10-01EN CI Server Setup, section 2 for applicable hardware and software applicable as per BOM.

### CI View

On CI View (computer prepared as CI View), software called Remote Connect can be used to perform operator interface, edit module, and engineering module as Java applications. To download Remote Connect, open a browser and browse by adding the port number after the IP address of the node running CI Portal (or CI Core and CI Portal) connected to CI View.

Example: http://192.168.1.100:8080/

Thus, even if 8080 is used in the browser, the communication between CI View and CI Portal (server or data gateway) will be secure communication using 8443 port by default.

It can be started by typing:

https://192.168.1.100:8443

Refer IM 36K10R10-01EN CI Portal Setup, section 2.2 for CI view setup.

# 5 OPERATIONS

Operational requirements are defined by the End-user. Normally this will be included in the overall plant operation procedures and manuals. The following paragraphs will provide brief details on the operating procedures of the PCS. The main functions that are executed by the operator are:

- Power up
- Operator interfaces and system monitoring
- Forcing Analog Values

CentumVP installation guidance (TI 33J01J10-01EN) for the Environmental conditions of supplied products.

## 5.1 POWER UP

The power supplies that must be available for the system are:

System power supplies:

- PCS : 230 VAC UPS (UPS-1 & UPS-2) with autonomy of 30 min

Utility power supply:

- One 230 VAC 50Hz

The utility power supply will be used to feed the following equipment per cabinet

- Cabinet fans
- Utility sockets
- Cabinet lighting

The starting point for system power up is:

- All power cables connected.
- All field cables connected (If available during the system start-up).
- All grounding cables connected.
- All interface cables to other systems connected (If available during the system start-up).
- All main switches and circuit breakers switched OFF.

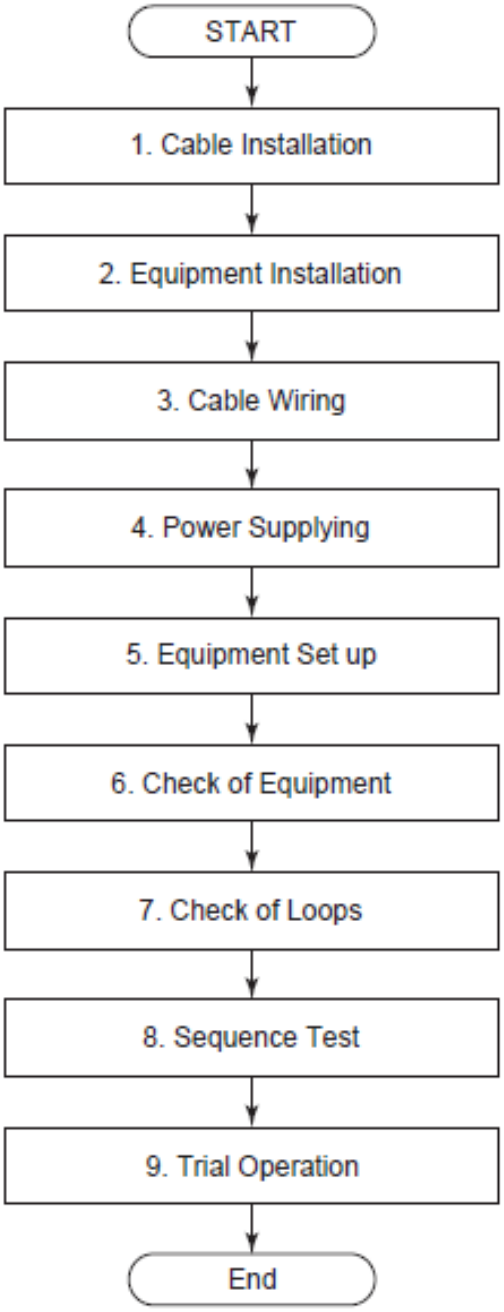



Figure 9 – Start-up

## 5.2 INTERFACES AND SYSTEM MONITORING

The system provides the following interfaces:

- Critical Action Panel (CAP)
- System status on EWS
- System status on OWS
- LED indications on modules
- IAMS Client
- EWS0164

### 5.2.1 Critical Action Panel (CAP)

A Critical Action Panel (CAP) shall be software-based control located at CCR for PCS and SIS, FGS. A dedicated tower type PC and screen with installed CI view/License software shall be used to control the action push buttons and monitor the trip status information.

### 5.2.2 System Status on OWS

NMS (Network Management System) shall be accessible from OWS to monitor all Computers and network switches and firewall status.

CI Core Server, CI portal Server redundancy Status can be monitored from OWS.

For More details refer PCS and SAFETY SISTEMS Software Functional Design Specification (FDS-SW).

### 5.2.3 System Status on EWS

The FCS Status Overview window displays a list of FCSs assigned to the given CentumVP project. In addition to the current operating conditions of FCSs, it also displays if there is any diagnostic information message from any of the FCS diagnostic functions; it is easy to know which FCS has errors.

If there is an error, the erroneous area is shown using a different colour. It also displays whether there are any messages that have not been acknowledged.

The System Status Overview window display the operating mode, scans period and security level along with the operating status and connection status of CPU and I/O modules.

The System Alarm window displays a list of diagnostic information messages that notify hardware, software, and communication errors in the system as system alarm messages.

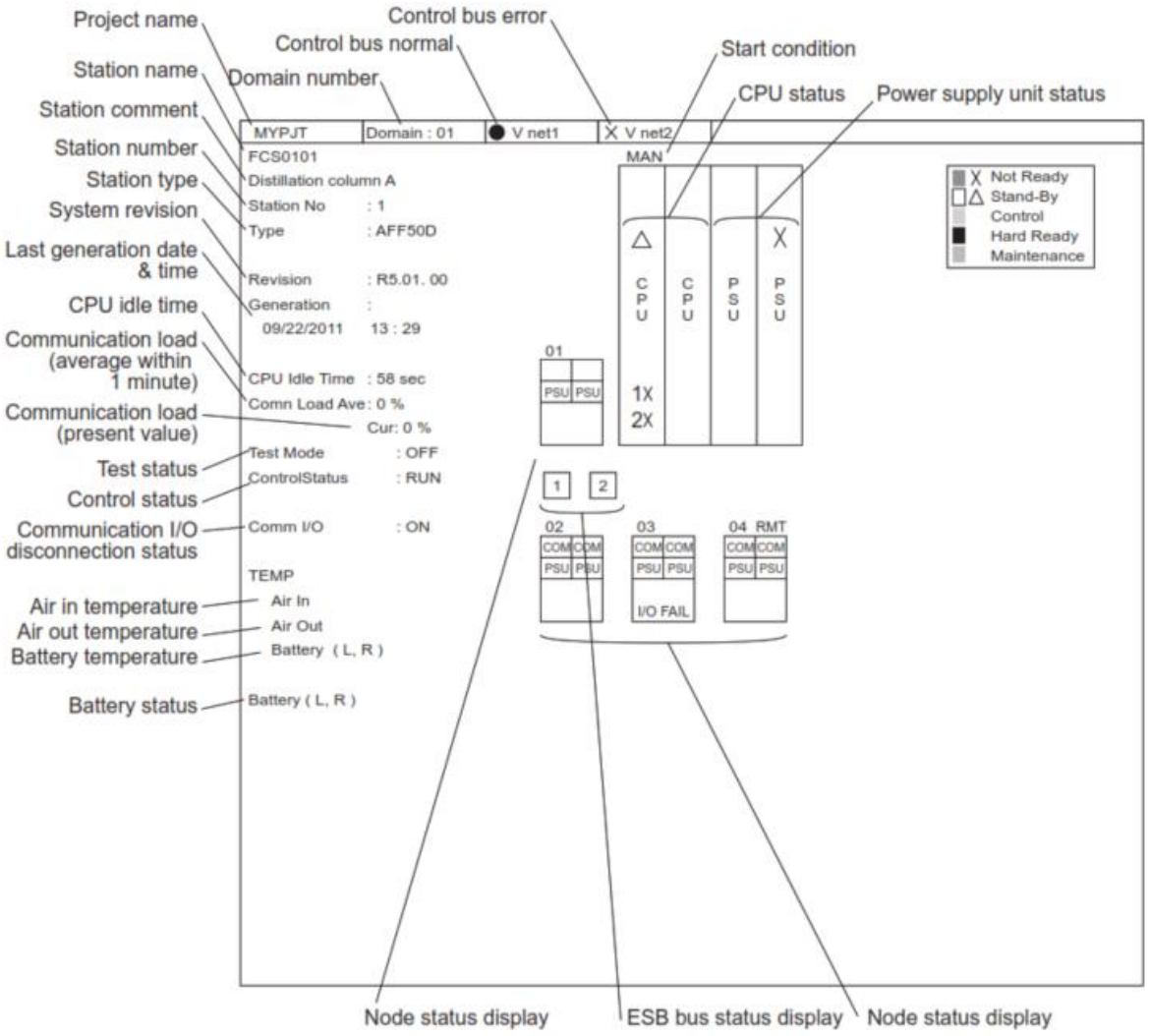



*Figure 10 – System Status on OWS*

### 5.2.4 LED Indication on modules

For health status of module, the following LEDs will be lit:

- Node Power Supplies – SYS and FLD

SYS- Power supply module +5V

FLD- Power supply module +24V

- Active Controller – SYNC, HRDY, RDY, COPY, RCV1,2 , SND1,2 and CTRL

SYNC- Synchronizing with external clock.

HRDY- Hardware normal

RDY- Both hardware and software are normal.

COPY- Copying normal

RCV1,2- Receiving frames from Vnet/IP

SND1,2- Sending frames from Vnet/IP

CTRL- Module is operating normally

- Standby Controller – SYNC, HRDY and RDY
- Active I/O Module – STATUS, ACT and DX

STATUS- This LED turns on when the module is operating normally

ACT- This LED turns on when the module is in the controlling status

DX- This LED turns on when the module is in the dual-redundant configuration

- Standby I/O Module – STATUS and DX

## 5.3 SYSTEM ACCESS

This chapter gives an overview of Authorisation levels, how to log in and how to log out.

*Authorisation levels*

The following authorisation groups are defined and used within the system:

- View
- Operator
- Supervisor
- Administrator

Each user can be assigned to one of these groups. Table 3 shows the privileges within each authorisation group:

| System function | Authorisation levels | | | |
|---|---|---|---|---|
| | View | Operator | Supervisor | Administrator |
| Display variables | X | X | X | X |
| Change setpoints | - | X | X | X |
| Acknowledge alarms | - | X | X | X |
| Modify tuning panel settings (e.g. alarm limits) | - | - | X | X |
| Modify database (e.g. passwords) | - | - | - | X |
| Modify/add displays | - | - | - | X |

*Table 3 – Authorisation levels*

### 5.3.1 Log in / log out

Access to the SCADA system is granted manually. After the workstation is started, the user needs to logon into the Windows Domain environment.

This section describes the procedure to open the Operator Interface from an Operator WorkStation (OWS).

Double click the "Operator Interface" icon located on the desktop.

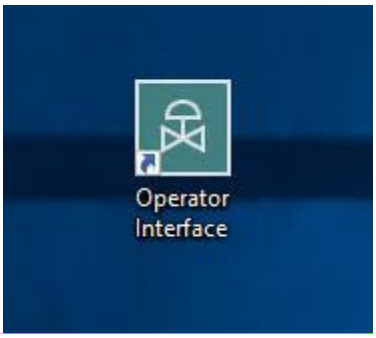



*Figure 11 – Operator Interface icon*

The login screen of CI SERVER will pop up as indicated in Figure 12 – Operator Interface Login Window

The username and password should be entered here to open the "Operator Interface" which provides access to the process displays.

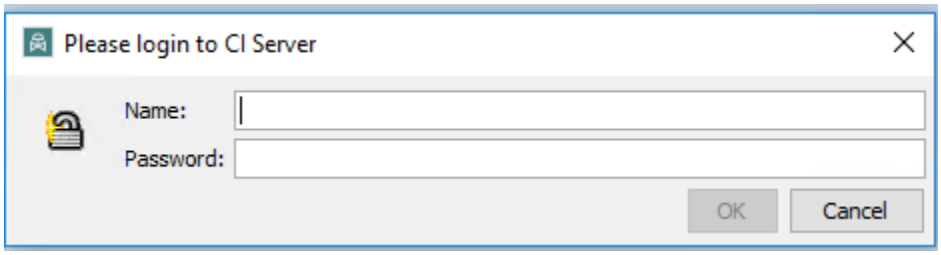



*Figure 12 – Operator Interface Login Window*

To exit, Select from the File menu, Exit in the Operator Interface.

Active Directory shall be used for login/logout user configurations. The AD integration function of CI Server has priority over the logon method (Login method) configured for each application using the following Authentication and authorization setup file (dssana.sup).

### 5.3.2 Operator interface

This chapter gives information on the Operator Interface, displays, navigation, menu, etc.

*Operator Interface Layout*

This section describes the layout and the functionality of the Operator Interface.




*Figure 13 – Operator Interface Layout*

*Windows heading*

This is the default windows heading area which allows the operator to minimise or relocate the Operator Interface.

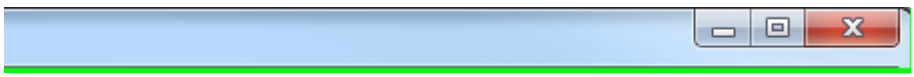


*Figure 14 – Windows heading*

*Menu area*

The menu area gives a number of options to the operator, like printing, zoom functions etc. Table 4 describes the available menu options.

| Menu item | Sub menu item | Description |
|---|---|---|
| File | | |
| | Select Print Area | Select a frame to print |
| | Print | Print the selected frames |
| | Page Setup | Page setup for printing |
| | Print Preview | Print preview |
| | Login | Log on as temporary user |
| | Logout | Log off as temporary user |
| | Exit | Exit the Operator Interface |
| View | | |
| | Reload | Refresh the current mimic |
| | Reload All | Refresh all mimics |
| | Toolbars | Turn the toolbar on or off |
| | Status Line | Turn the status line on or off |
| Zoom | | |
| | Zoom In | Zoom in to the mimic |
| | Zoom Out | Zoom out of the mimic |
| | Reset | Reset to original mimic size |
| | Fit | Fit the mimic in the frame |
| Go | | |
| | Back | Previous Page |
| | Forward | Page Forward |
| | Up | The parent page of a mimic (if defined in the mimic) |
| | Home | Main Page |
| Playback | | |
| | Record | Start recording the display actions |
| | Open viewer | Open the recorded item |

*Table 4 – Menu area*

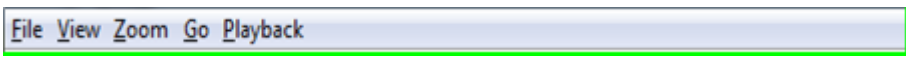



*Figure 15 – Menu area*

*Mouse operation*

This chapter describes the operation of the mouse for the operator workstation.

### Mouse buttons

Mouse button 1: Select/action
Mouse button 2: Call special information pop-up

### Scroll Wheel usage

CTRL + scroll Up: zoom in (only available for Process Area Display)
CTRL + scroll Down: zoom out (only available for Process Area Display)

*Toolbar area*

The Toolbar area provides shortcuts to a number of functionalities. Table 5 describes the available functionalities.




*Figure 16 – Toolbar Area*

| Item | Description |
|---|---|
| 1 | Go to current alarm list |
| 2 | Go to shelves alarm list |
| 3 | Go to historical alarm list |
| 4 | Go to system alarm list |
| 5 | Back to display |
| 6 | Forward to display |
| 7 | Go to parent display |
| 8 | Go to home screen |
| 9 | Reload display |
| 10 | Display name |
| 11 | Zoom in |
| 12 | Zoom out |
| 13 | Reset to actual size |
| 14 | Fit the size of display to process display area |
| 15 | User login |
| 16 | Go to trending |
| 17 | Print |

*Table 5 – Toolbar area*

*Navigation area*

The navigation area provides shortcuts to process displays. The display navigation is explained in Figure 22.

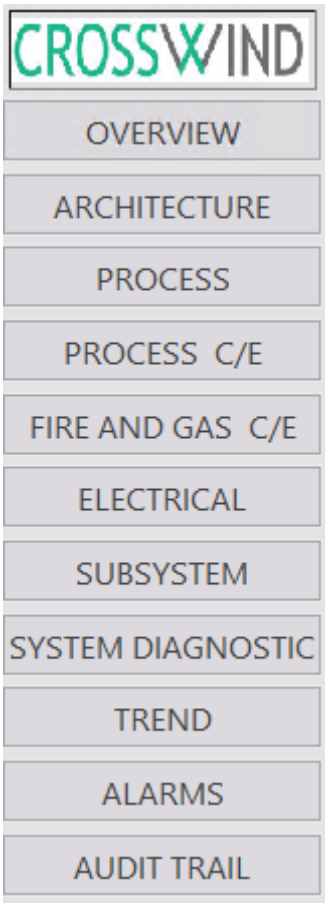



*Figure 17 – Navigation area*

*Process display area*

In this area all the process mimics are displayed. Displays can be selected from both toolbar area and navigation area, and are opened in this frame.

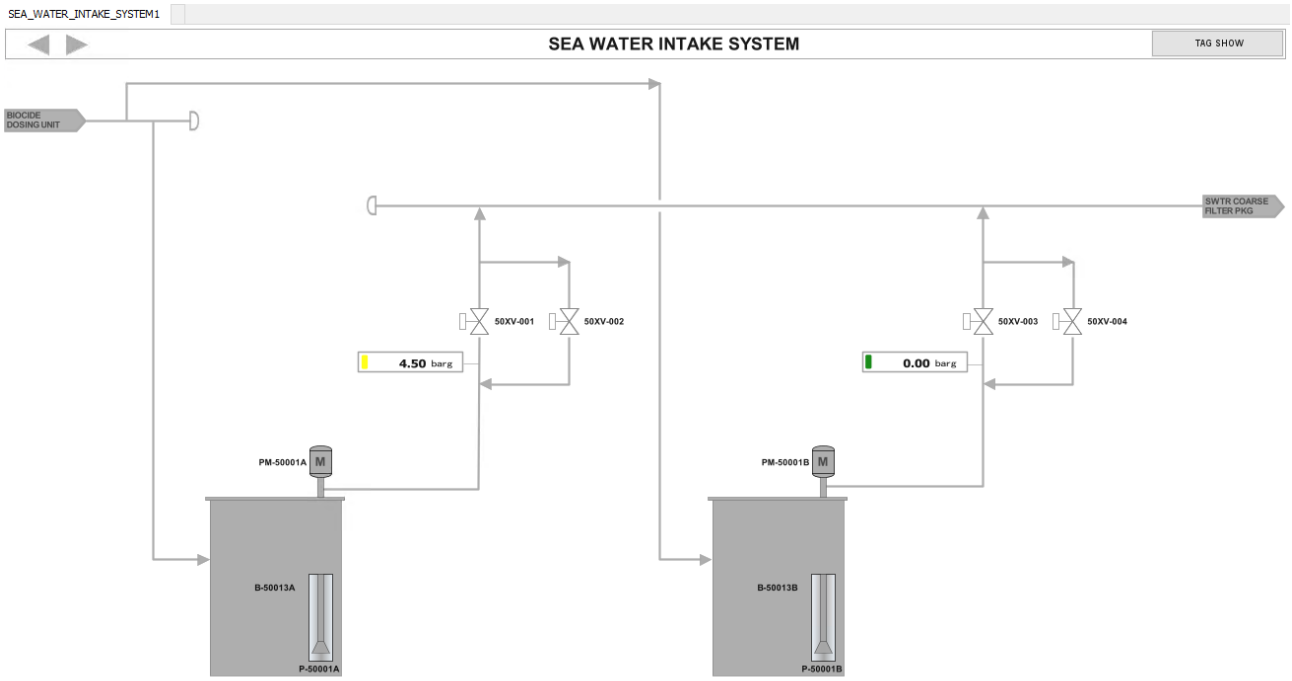



*Figure 18 –Process display area*

A display is opened in a tab. By clicking in the area besides the most right tab and then selecting a display to open, it will open in a new tab. Maximum 5 tabs are available.

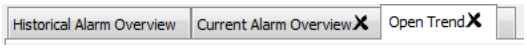
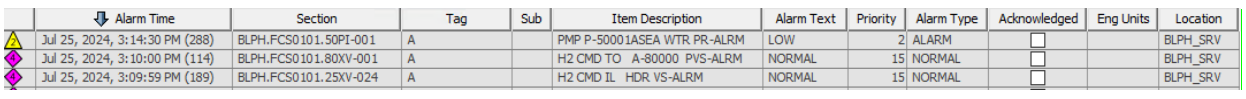



*Figure 19 – Opening multiple displays by using tabs*

*Alarm banner*

The alarm banner is located below the Process display area, it is non-removable. The newest outstanding alarms are sorted on the top of this alarm page to highlight the alarms to the operator. Once an alarm is noted, the operator can decide to navigate to the full-scale current alarm page as described in section 5.3.3 Current Alarm overview.



| Alarm Time | Section | Tag | Sub | Item Description | Alarm Text | Priority | Alarm Type | Acknowledged | Eng Units | Location |
|---|---|---|---|---|---|---|---|---|---|---|
| Jul 25, 2024, 3:14:30 PM (288) | BLPH.FCS0101.50PI-001 | A | | PMP P-50001ASEA WTR PR-ALRM | LOW | 2 | ALARM | | | BLPH_SRV |
| Jul 25, 2024, 3:10:00 PM (114) | BLPH.FCS0101.80XV-001 | A | | H2 CMD TO A-80000 PVS-ALRM | NORMAL | 15 | NORMAL | | | BLPH_SRV |
| Jul 25, 2024, 3:09:59 PM (189) | BLPH.FCS0101.25XV-024 | A | | H2 CMD IL HDR VS-ALRM | NORMAL | 15 | NORMAL | | | BLPH_SRV |

*Figure 20 – Alarm banner*

*Status line*

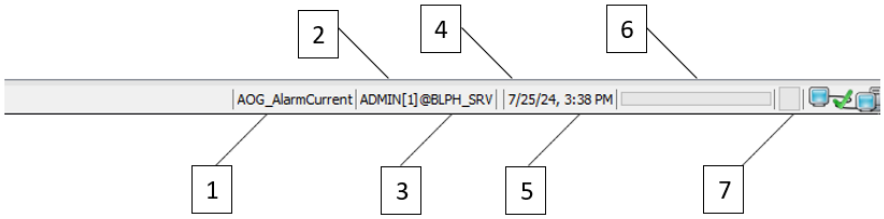



*Figure 21 – Status line*

| Item | Description |
|---|---|
| 1 | File Name of the current display presented in the process display area |
| 2 | Username of the current loge in user |
| 3 | Node number of the licensed station |
| 4 | Date (layout depending on regional settings) |
| 5 | Time (layout depending on regional settings) |
| 6 | Graphics Queue Level |
| 7 | Connection State between the Workstation and the main server |

*Table 6 – Status line*

*Display navigation*

The navigation of the process graphics is arranged hierarchically in a top-down structure. Once a detailed graphic is opened, it is always possible to navigate to a parent display or, if applicable, to a more detailed graphic. Figure 22 displays the navigation philosophy of the process graphics.

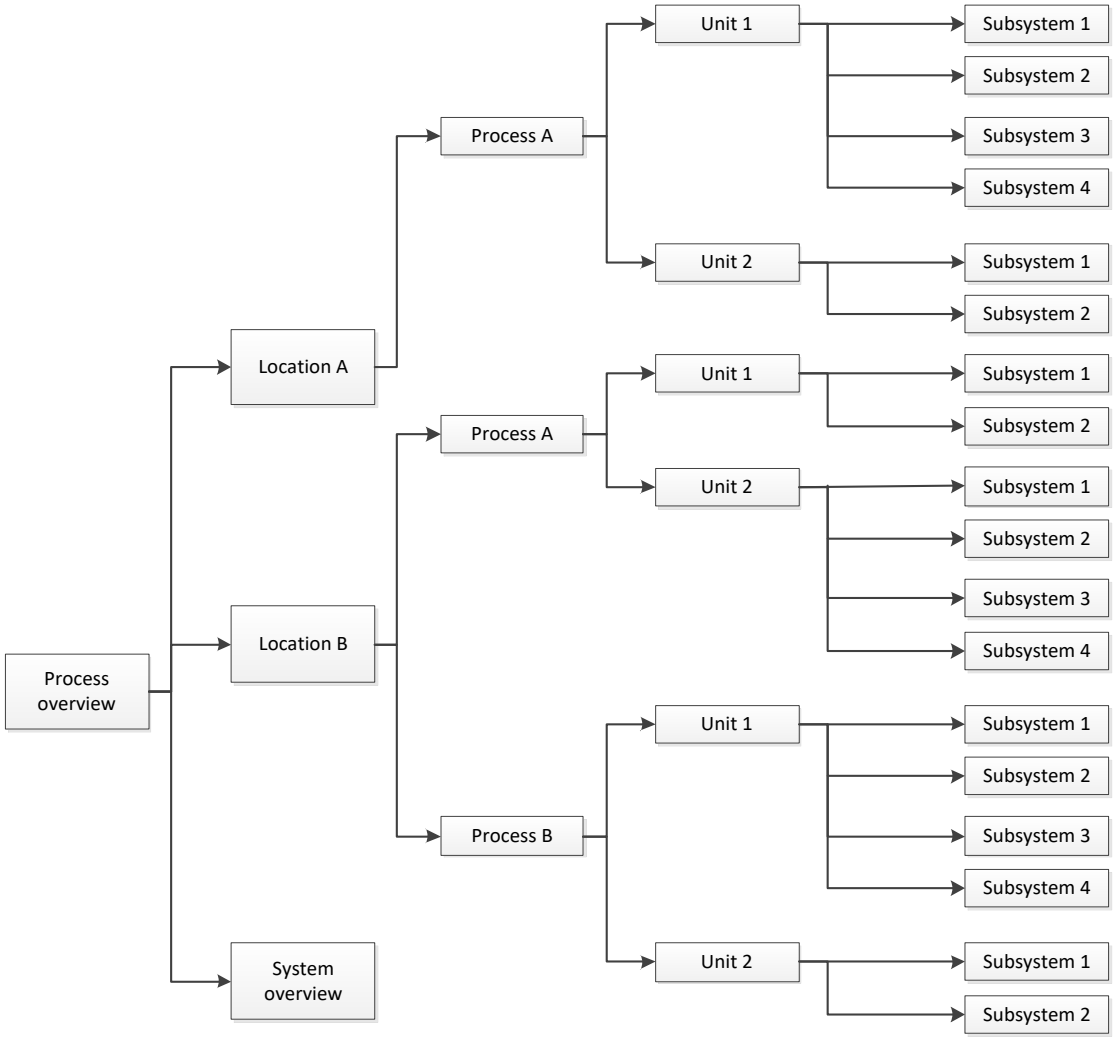



*Figure 22 – Display navigation Philosophy*

### 5.3.3 Key displays

*Current Alarm overview*

The current alarm overview displays the outstanding alarms.

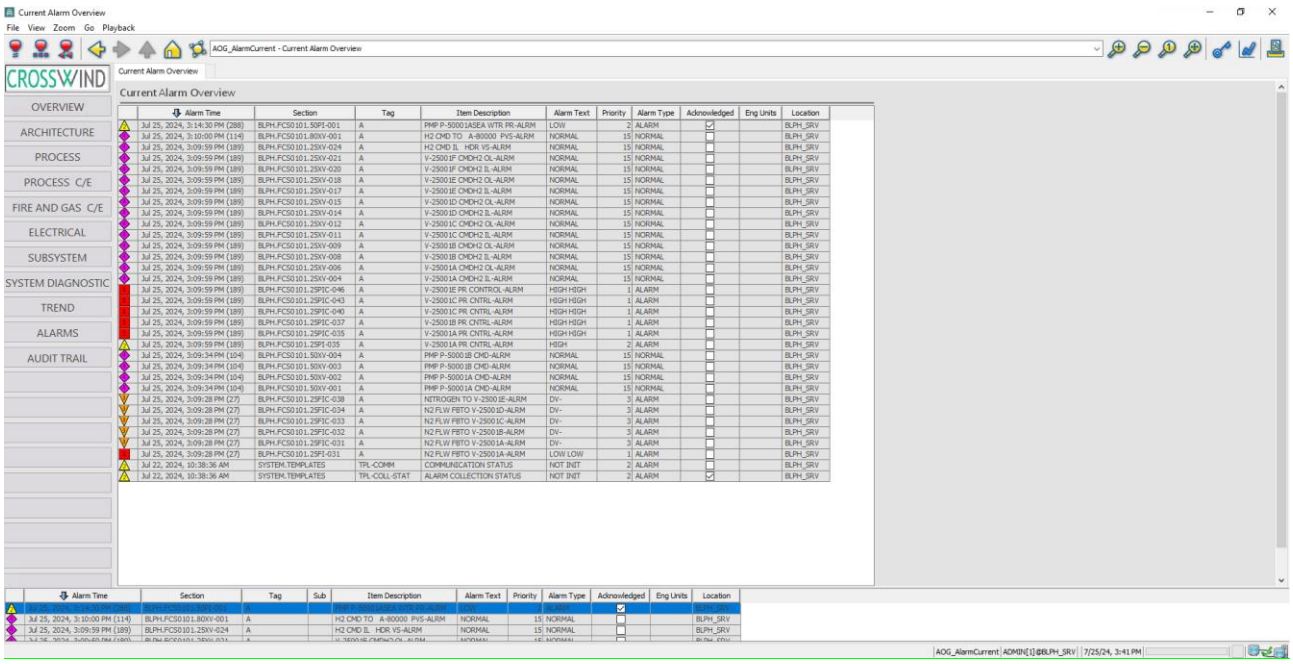



*Figure 23 – Current alarm overview*

*Acknowledgement*

Whenever an acknowledgment is required, the alarm message will be displayed on the screen blinking.

Some alarms are automatically acknowledged by the system. E.g. when a tag has an acknowledged High-High alarm and falls down to the High alarm status, it is automatically acknowledged and no (new) operator interference is required.

*Alarm filters*

This section describes the available filter functions for an operator.

By default there is no filter activated for the alarm displays and alarms are listed in the alarm display. However the operator has the possibility to filter out specific alarms using the filter options in the right bottom area of the alarm page.

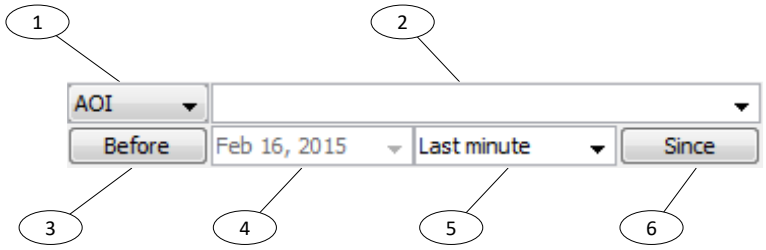



*Figure 24 – Alarm filters*

Table 7 Description of the alarm filter

| Menu item | Available options | Description |
|---|---|---|
| 1: type of filter | | |
| | None | No filter is selected, default |
| | AOI | Filter on Area of Interest |
| | ASA | Filter on Alarm Selection Area |
| | Installation | Filter on installation name of tags |
| | Unit | Filter on unit name of tags |
| | Section | Filter on section name of the tags |
| | Tag | Filter on a specific tag |
| 2: filter options | | |
| | Dropdown menu | Based on type of filter the available options can be chosen by a dropdown menu. |
| | Text entry | Text can be entered for a matching filter |
| 3: fetch data before chosen date | | |
| | Single mouse click | Will fetch data before the chosen date and time |
| 4: date picker | | |

| Menu item | Available options | Description |
|---|---|---|
| | Single mouse click | Will activate a date picker to select the date |
| 5: time picker | | |
| | Single mouse click | Will activate a time picker to select the time |
| 6: fetch data since chosen date | | |
| | Single mouse click | Will fetch data after the chosen date and time |

*Table 7 – Alarm filters*

Further note that column filtering is available on each column in the alarm overview.

*Available Mouse Actions in Alarm grid*

With the mouse, a number of actions can be executed on an individual alarm line. With a left mouse button click an individual alarm can be acknowledged. With a right mouse button click an Example of context menu appears as shown below.

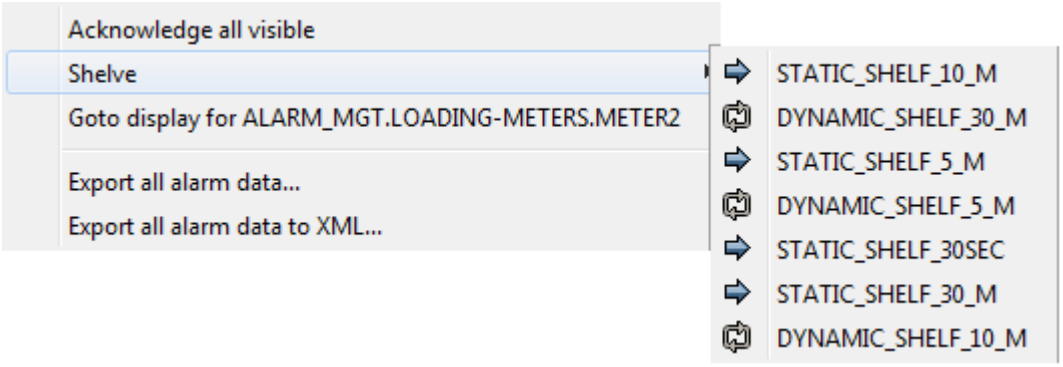



*Figure 25 – Right mouse button activated (example)context menu actions*

The function of each is explained below.

| Action | Object | Result |
|---|---|---|
| Left mouse click | | |
| | Individual alarm line | Acknowledge alarm |
| Right mouse click | | |
| Acknowledge all visible | Current alarm page | Acknowledge all visible alarms |
| Shelve Static | Individual alarm line | Place alarm on static shelf |

| Action | Object | Result |
|---|---|---|
| Shelve Dynamic | Individual alarm line | Place alarm on dynamic shelf |
| Goto display for … | Individual alarm line | Go to display which has this alarm |
| Export all alarm data… | Current alarm page | Export alarms to csv file |
| Export all alarm data to XML | Current alarm page | Export alarms to XML file |

*Table 8 – Actions*

For alarm shelving two types exist, dynamic and static shelving. For each a number of different time periods have been predefined. When an operator selects to shelve an alarm, the alarm is removed from this alarm overview. However, the alarm is still active and can be viewed from the Shelved alarm overview. For more on alarm shelving, please refer to section on Shelved alarm overview.

*Historical alarm overview*

The historical alarm overview shows all past occurred alarms. Functionality wise it is very similar to the Current alarm overview. However, there are 2 differences:

- Alarms cannot be acknowledged in the historical alarm overview
- Alarms cannot be shelved in the historical alarm overview.

*Shelved alarm overview*

In some cases, the number of alarms might be high, and a number of these alarms might not be important to monitor for the time being. For example, a particular plant area is in maintenance, causing many alarms, which are irrelevant as it is currently not in operation. In such a case these alarms can be placed on a 'shelve'. This will remove them from the current alarm overview. The alarms can be viewed from the Shelved alarm overview instead.

There are two types of shelving:

- Static: In this case the operator shelves an alarm. If the status of the alarm changes, it is automatically placed back in the Current alarm overview. If the same state happens again while the time period has not yet expired the alarm is not shelved automatically again.
- Dynamic: In this case the operator shelves an alarm. If the status of the alarm changes, it is automatically placed back in the Current alarm overview. If the same state happens again while the time period has not yet expired the alarm is shelved automatically again.

Shelving is always for a predefined time period. The time period is selected when shelving an alarm.

For Filtering and Exporting functions, please refer to previous paragraphs.

### 5.3.4 Critical system alarms

The following alarms shall be categorised as critical System alarms.

- Alarm indicating unavailability of emergency systems e.g. firewater pumps.
- Alarm indicating loss of temporary refuge pressurisation.
- Alarm indicating control or protective systems running on batteries.
- Alarm indicating low instrument air pressure to a site or unit.
- Alarm indicating dangerous SIF failure e.g. partial stroke test failure, SIF instrument failure diagnostic.
- Alarm indicating unavailability or failure of F&G detector e.g. beam block alarm on line-of-sight gas detector.
- Alarm indicating bad PV on BPCS layer of protection.
- Alarm indicating degraded redundancy in an SIS or F&G logic solver.
- Others as deemed appropriate by alarm class owners.

### 5.3.5 Trending

The Trend is a utility which renders historical and real time values for one up to 20 items, in a single graph. Following interfaces is available for viewing trends:

- From the Operator Interface, by pressing trend button which opens a display with the trend module, here the module is integrated on a graphic page.



Adding an item to trend

In the pen-panel (the area at the bottom of the application main frame), click on the 3 dotted buttons as shown in the picture below. If the pen panel is not shown at start-up, click on the small fountain pen icon in the top menu bar.

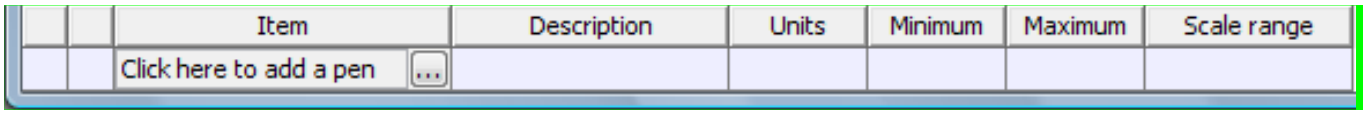



*Figure 26 – Pen Panel*

Now you will be able to select and add the data points (items) you want to see in the trend.

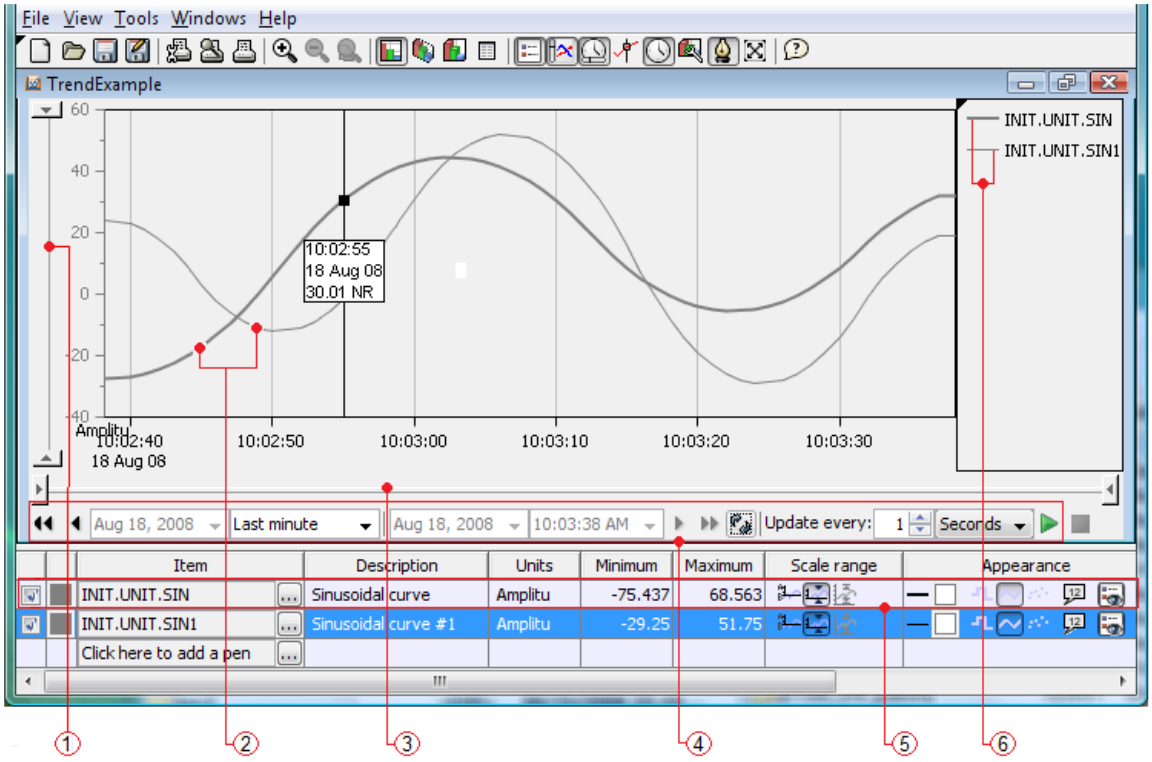



*Figure 27 – Introduction to trend application*

Legend:
1) Value slider
2) Plots
3) Time slider
4) Time control
5) Pen settings
6) Trend legend

The information shown for an item is not limited to the value attribute of an item. It is also possible to show various other item attributes, these are:

- High High limit
- High limit
- Low limit
- Low Low limit
- Deadband

The toolbar provides quick access to common functions.

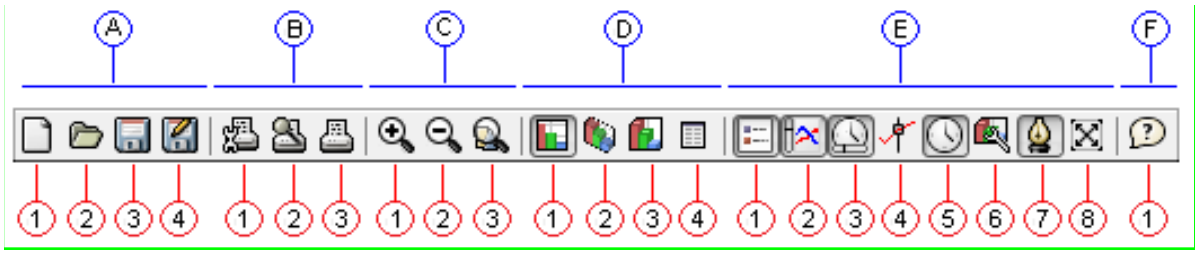



*Figure 28 – Trend Toolbar*

A: *Create* and *save trends*
1 Create a new trend
2 Open a trend
3 Save a trend
4 Save a trend as

B: *Print*
1 Print page setup
2 Print preview
3 Print

C: *Zoom*
1 Zoom in
2 Zoom out
3 Fit to show complete trend contents

D: *Rendering*
1 Switch to 2d rendering
2 Switch to 3d orographic rendering
3 Switch to 3d oblique rendering
4 Switch to table rendering

E: *Properties*
1 Show / Hide legend
2 Show / Hide value slider
3 Show / Hide time slider
4 Show / Hide Hairline
5 Show / Hide time control
6 Show / Hide 3d control panel
7 Show / Hide pen selection panel
8 Maximize current trend

F: *Help*
1 Help

More functions are available by right clicking on the trend itself. A context menu will appear.

### 5.3.6 Reports

Reports in CI SERVER are managed by a reporting utility in Engineering Module. The reporting module can be used for generating various types of predefined reports, e.g. production reports, alarm reports, device status reports, etc. It is possible to have user defined reports which require user input, e.g. a start and end time. Reports can be generated time scheduled based, event-based (e.g. the change of an item value) or ad-hoc based.

Report definitions are created from the Engineering Module (by Engineer), defined reports can be generated and viewed both in Engineering Module and Operator Interface.

*Generate a report from Engineering Module*

The Engineering module, under Reporting => Reports, lists all predefined reports. To generate a report, select a report and left click on it, from the context menu, select Generate. The generate form will show.

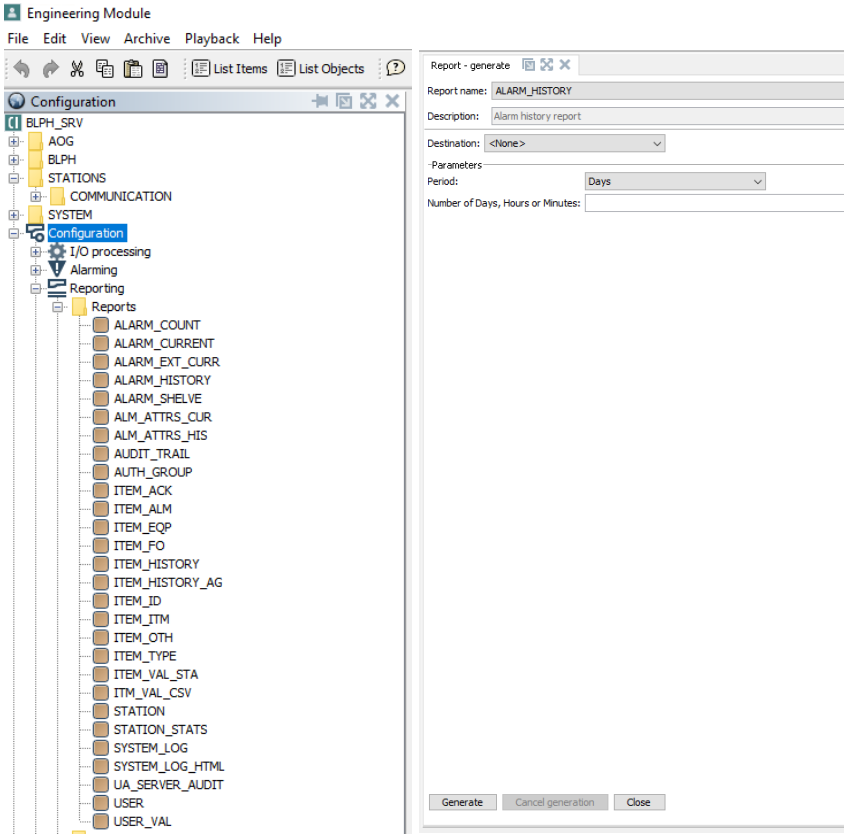



Figure 29 – Manually generating a report

Some reports require user input (under Parameters), after filling these parameters click Generate and in the project tree under the report name a new file will show up, this is the report. The report can be viewed by right mouse click and selecting View option.

*Printing report*

A generated report is saved in CI SERVER database with a predefined lifetime. However, it is also possible to print a report. This is possible at the time of generating the report by selecting a predefined destination.

*Available Reports*

The following reports are available:

| Report | Description |
|---|---|
| ALARM_COUNT | Reports the alarm count |
| ALARM_CURRENT | Reports the current alarms |
| ALARM_EXT_CURR | Reports the current external alarms |
| ALARM_HISTORY | Reports the alarm history |
| ALARM_SHELVE | Reports the alarm shelving status |
| ALM_ATTS_CUR | Reports the current alarms with alarm attributes |
| ALM_ATRS_HIS | Reports the historical alarms with alarm attributes |
| AUDIT_TRAIL | Reports the user operations, and histories of item/object/class changes. |
| AUTH_GROUP | Reports the authorization group definition information |
| ITEM_ACK | Reports items and their acknowledgment type definition information |
| ITEM_ALM | Reports items and their alarm information |
| ITEM_EQP | Reports items and their equipment information |
| ITEM_FO | Reports items and their first-out group definition information |
| ITEM_HISTORY | Reports history data of item |
| ITEM_HISTORY_AG | Reports historical data of item aggregation values |
| ITEM_ID | Reports items and their item ID definition information |
| ITEM_ITM | Reports items and their item table information |
| ITEM_OTH | Reports items and other related information |
| ITEM_TYPE | Reports items by item type |
| ITEM_VAL_STA | Reports item values and their status |
| ITM_VAL_CSV | Exports CI Server data in CSV format |
| STATION | Reports station definition information |
| STATION_STATS | Reports statistics information of station |
| SYSTEM_LOG | Report of system log |
| SYSTEM_LOG_HTML | Reports system logs in HTML format |
| UA_SERVER_AUDIT | Reports the audit trail of OPC UA activity |
| USER | Reports the user definition information |
| USER_VAL | Reports the user value overview |

*Table 9 – Actions*

*Generate a report from the Report display*

Navigate to the Report display. The Report display contains the report viewer component (see Figure 30 – Report viewer). On the left top side all available report definitions are listed (Select a report area). Select a report by left mouse click. If reports have been generated before, they are listed in the area below this list (Select a generated report). To view a previously generated report, select one via left mouse click. Next make sure the View tab is selected. The generated report is displayed here.

In case of generating a report manually, select a report definition first, as explained above. Next select the Generate tab. If printing of the report is required, select a printer from the Destination dialog. Some reports require user input; if this is required additional fields will show up in the Parameters area. The report can be generated by pressing the Generate button. This button will be greyed out until the report generation is finished. For viewing this report follow the procedure explained above.

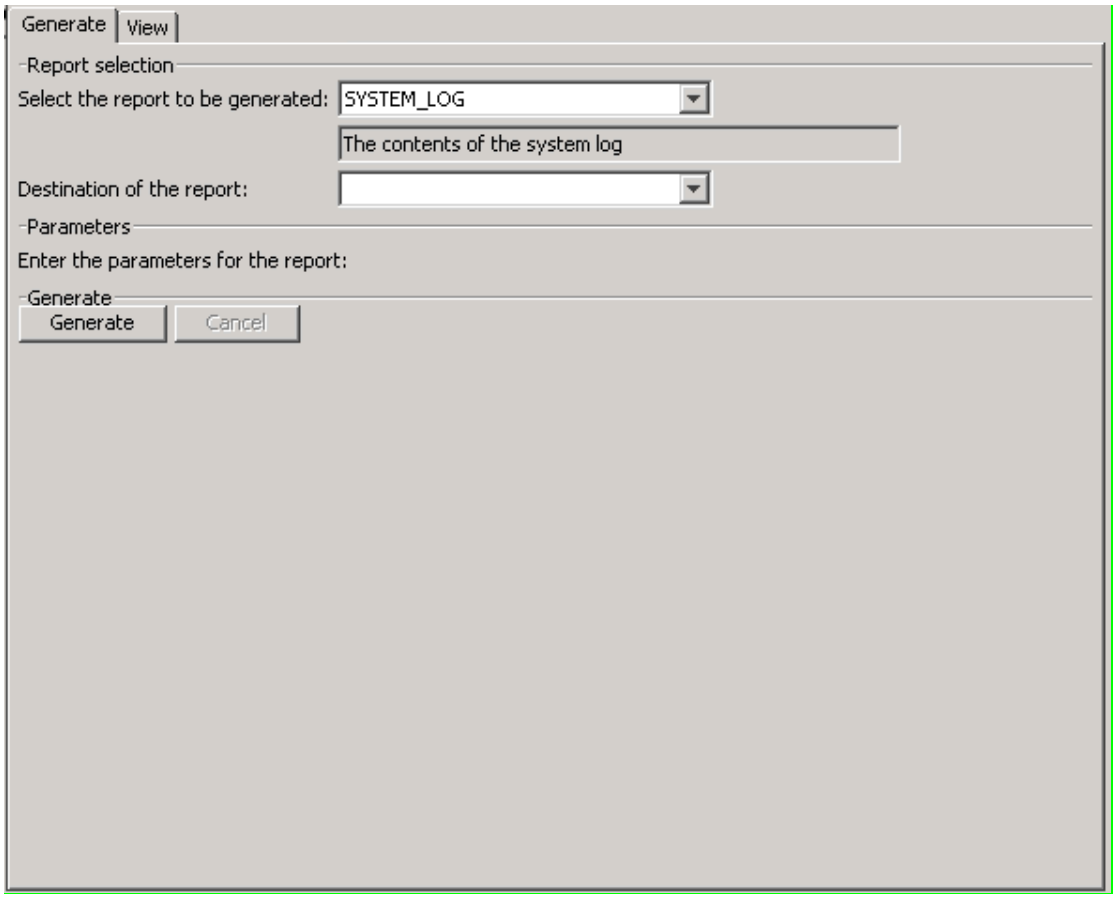



*Figure 30 – Report viewer*

### 5.3.7 Project-specific displays

As listed in section 5.3.10 Display navigation, are generically used throughout the project, for the list of displays refer to HMI display screen Document 1724000594-IN-DD-00028.

### 5.3.8 Typical overview

Typical Overview shall have navigation touch targets to various area i.e. BESS, Electrolyser, fuel cell, Electrical etc.

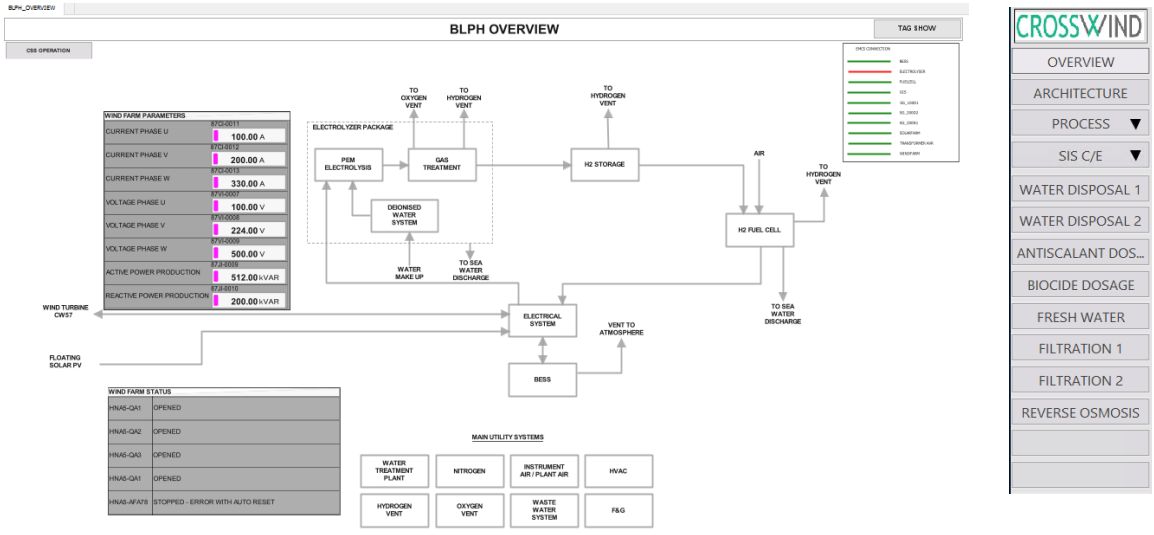



*Figure 31 – Overview*

*Typical introduction*

Process displays consist out of symbols with supportive graphic elements (e.g. line, text comment, etc) which together represent the dynamic behaviour of actual field process. And it provides the means for an operator to control the process (e.g. changing a set point or controlling a valve).
The symbols are mapped to the so called CI Server function block library in the PCS,SIS and FGS controller. These symbols together with the CI SERVER logic behind it which makes interacting with PCS,SIS and FGS Function block library possible, defines the so called typical.

Typicals will guarantee the repeatability of the behaviour of a certain type of device (e.g. valves, pumps, indicators, etc.).

A typical symbol has three main user interface components as indicated in Figure 32 – . Symbol, faceplate and Tuning Panel. A left mouse click on the symbol will activate the faceplate. From the faceplate, the Tuning Panel can be activated.

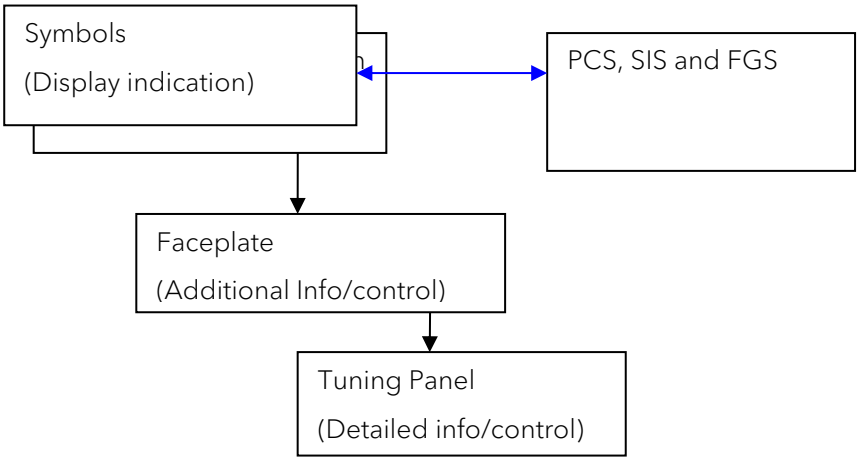



*Figure 32 – Typical Display Hierarchy*

The *general* behaviour of these typical like faceplates, tuning panel and alarming are described in this section.

Based on the general behaviour of the CI Server Library, the more detailed typical description is described in the following chapters. See Table 10.

| Symbol | Description | CI Server Typical | Paragraph |
|---|---|---|---|
| Process value indicator | Analogue input indicator PVI | DCS_PVI | 5.3.9 |
| Analogue output indicator<br>Choke valve | Analogue output indicator MLD/MLD-SW | DCS_MLD | 5.3.9 |
| PID Controller | PID | DCS_PID | 5.3.9 |
| Analog Sept point | DSET | DCS_DSET | 5.3.9 |
| Pump,<br>Compressor,<br>Generator,<br>Alarm indicator,<br>MOS indicator,<br>ESD indicator,<br>Valve | SO_1,<br>SIO_11,<br>SIO_12,<br>MC-2/MC-2E<br>*Digital input, output or input/output indicator | Digital switch instruments SIO* | 5.3.9 |

*Table 10 – Typical definitions*

### 5.3.9 Faceplate

This paragraph will describe the general layout of the faceplates.

*General Characteristics*

A Faceplate display is activated by left mouse click on an indicator.
Figure 33 – shows the graphical elements of the faceplate. The faceplate uses standard window decoration. It can be moved across the user screen. It can be closed by using the normal close (X) button but cannot be minimized or resized.
The SCADA faceplate library has a uniform look and feel. However, the configurable elements of the faceplate will differ according to the characteristics of the associated function block, e.g. a Selector function block will have buttons on the Faceplate, while an indicator Faceplate will show a vertical indication bar.
The standard faceplate is drawn to 136 x 600 in pixels.

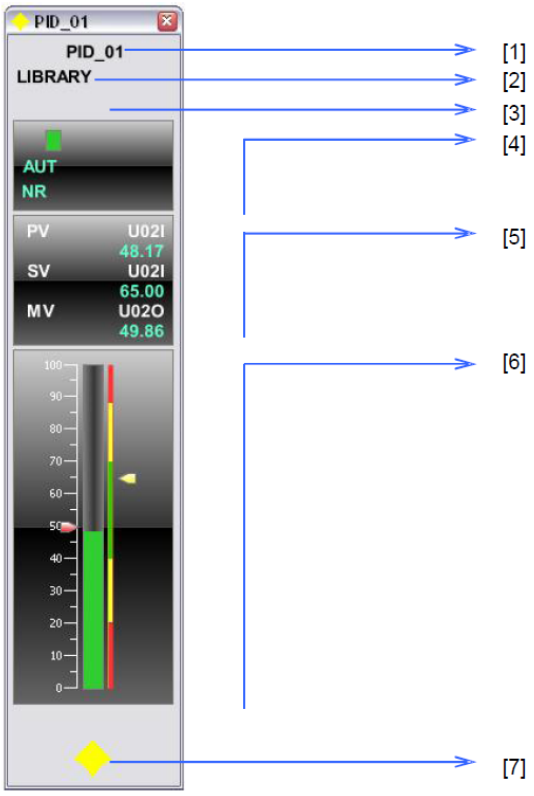



*Figure 33 – Faceplate Overview*

| Item | Description |
|---|---|
| 1 | Tag Name |
| 2 | Description line – 1 |
| 3 | Description line – 2 [Can be Blank] |
| 4 | Status Area-Alarm Indication, Mode Control and Indication |
| 5 | Value Area-shows the variables value with Engineering Unit |
| 6 | Vertical Bar –Graphical representation of the value of Key item of the block. The graph is scaled between High and Low Limits of the Display variable. |
| 7 | Tuning Panel-Access Point-Left Mouse click to activate the Tuning Panel of the Block. |

*Table 11: Faceplate definition*

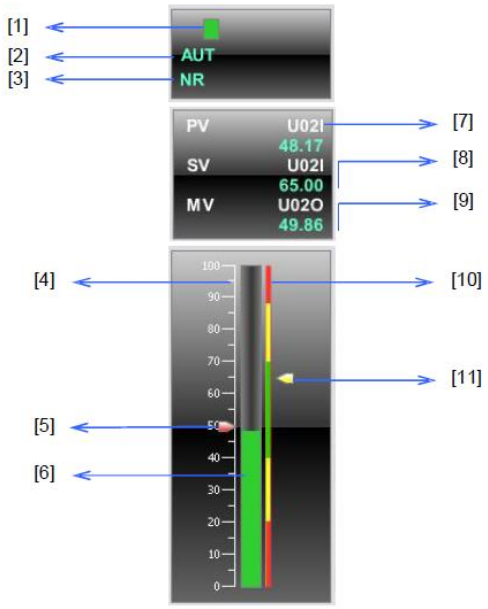



*Figure 34 – Detailed faceplate overview*

| Item | Description |
|---|---|
| 1 | Alarm Indicator |
| 2 | Control Mode |
| 3 | Alarm Text |
| 4 | Vertical Linear Scale |
| 5 | MV Arrow Indicator |
| 6 | Vertical Bar |

| Item | Description |
|---|---|
| 7 | Engineering Unit |
| 8 | Set Value |
| 9 | Manipulated Value |
| 10 | Vertical Limit Bar-Graphical Representation of High-High, High, Low, Low-Low Values. |
| 11 | SV Arrow Indicator |

*Table 12 – Detailed faceplate definition*

The Vertical Bar component indicates the alarm trip ranges. These ranges are configurable through the tuning panel for each typical and are stored in the PCS,SIS and FGS controller. If the limits are changed in the controller the scale and limit settings are automatically updated on the faceplate.

The example in Figure 35 – shows a HH limit of 80, H limit of 60, L limit of 40, LL limit of 20. In this example the value is below the Low Low alarm limit, consequently the alarming state is Low-Low, and this is reflected by the color of the indicator bar which is red for this case.

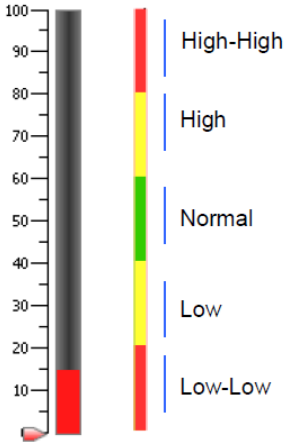



*Figure 35 – Vertical Scale & High-Low Alarm Indicator*

*Varied Configurations*

Faceplates are built up from standard graphic components. For example, the vertical bar shown in previous section is both used for the DCS_PVI and DCS_PID control block.

*Mode Control*

Block mode indicates the control state and the output state of a control block. In general there are 9 kinds of basic block mode. See Table 13 for an overview.
A transition of block mode can be initiated by a mode change command in the faceplate, or it may take place automatically when a mode transition condition is established inside the controller.

| Mode | Mode | Description |
|---|---|---|
| OOS | Out of Service | All functions of PCS, SIS and FGS logic are currently stopped. |
| IMAN | Initialisation Manual | Calculation processing and output processing are currently stopped. |
| TRK | Tracking | Calculation processing is currently stopped and the specified value is forced as output. |
| MAN | Manual | Calculation processing is currently stopped and the manipulated value MV, which is set manually, is used as output. |
| AUT | Automatic | Calculation processing is being executed, the set value SV is used for calculation, and the calculation result is used as output. |
| CAS | Cascade | Calculation processing is being executed, the set value CASV which comes from the cascade connected upstream block is used for calculation, and the calculation result is used as output. |
| PRD | Primary Direct | Calculation processing is currently stopped, the set value CASV which comes from the cascade connected upstream block is outputted directly. |
| RCAS | Remote Cascade | Control and calculation processing are being executed using the remote set point value RSV which is set remotely from a supervisory system, and the calculation result is used as output. |
| ROUT | Remote Output | Calculation processing is currently stopped and the remote manipulated value RMV, which is set remotely from a supervisory system, is used as output. |

*Table 13 – PCS, SIS and FGS Block Modes*

Left click on the Mode text for changing the block mode of the function block. A pop-up Menu is shown for selecting required mode settings. If the operator selects an invalid mode, the controller returns to the previous running mode prior to mode change.

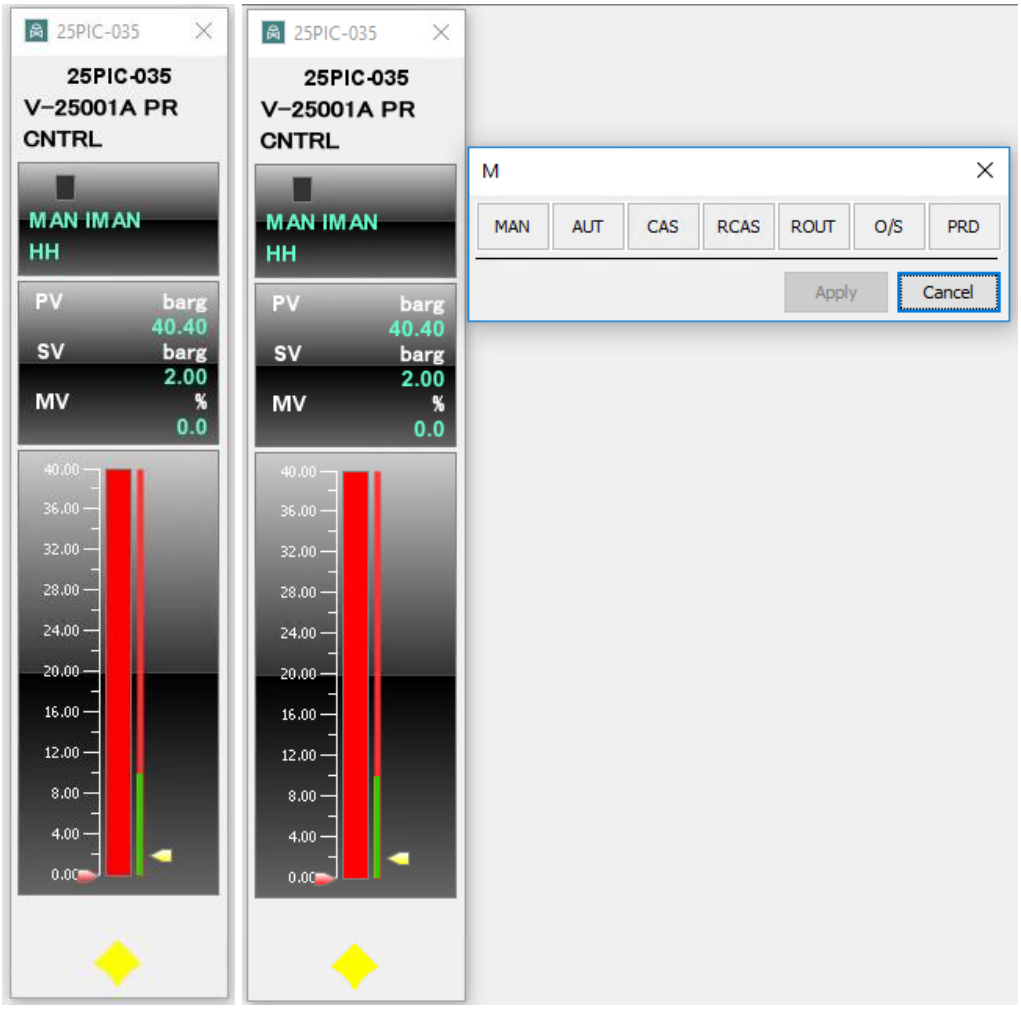



*Figure 36 –Mode Command*

| PCS, SIS and FGS Block | OOS | IMAN | TRK | MAN | AUT | CAS | PRD | RCAS | ROUT |
|---|---|---|---|---|---|---|---|---|---|
| PVI | ✓ | | | | ✓ | | | | |
| PID | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| SI_1 | ✓ | | | | ✓ | | | | |
| SI_2 | ✓ | | | | ✓ | | | | |
| SO_1 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ |

| PCS, SIS and FGS Block | OOS | IMAN | TRK | MAN | AUT | CAS | PRD | RCAS | ROUT |
|---|---|---|---|---|---|---|---|---|---|
| SO_2 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ |
| SIO_11 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ |
| SIO_12 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ |
| SIO_21 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ |
| SIO_22 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ |

*Table 14 – Block mode availability*

*Tag Item Access*

The Value area of the faceplate has built in pop-up displays which allow the user to change the values depending on the operational mode of the function blocks and the authorisation level.

To change a value, left click on the item which has to be modified and a dialog is displayed for entering the value. The selected tag has a green border around the symbol to indicate the item is selected. The selected item is also LOCKED by the user, so any item update by a different user is not allowed until the user closes the dialog. The border disappears when the pop-up dialog is acknowledged or cancelled.
The Dialogs pop-up displays are always "on top" and locking other displays.
The pop-up has to be confirmed or cancelled before returning to any other display.




*Figure 37 – Tag Locking*

*Tuning Panel*

The Tuning Panel display provides the operator with extended parameter options related to the particular PCS, SIS and FGS function block. The size of standard CI Server Tuning panel display is 900 x 600 (pixels). The Display consists of the following components.

1. Tuning Parameter Area
2. Faceplate Component
3. Trending Area
4. Alarm / Status Bar




*Figure 38 – Tuning panel*

### Tuning Parameter area (1)

This area displays the detailed parameters of the function block and gives access to advanced controls of the function block and tuning parameters.

For instance, in a PID block the key tuning parameters like Proportional gain, Integral and Derivative time units can be adjusted. The values can be changed by clicking on the required parameter, which enables the operator to enter the new value and confirm the change. The parameters which are editable can be identified by equal (=) sign. Entries with a colon (:) sign are read only and cannot be modified by the user.




*Figure 39 – Tuning Area*

### Faceplate Component: (2)

The Faceplate component is always similar to the Faceplate from which the Tuning panel was opened from. This is to give the operator an additional view of the block dynamics like the vertical bar.

Trending Area: [3]

The Trending area shows the trend of the preconfigured variables called Pen Items against time. The configured variables are specific for each typical. The trend component has extensive options for render, view, zoom and export trend data to external applications. To access the trend menu right click anywhere on the plot area to display the trend options.

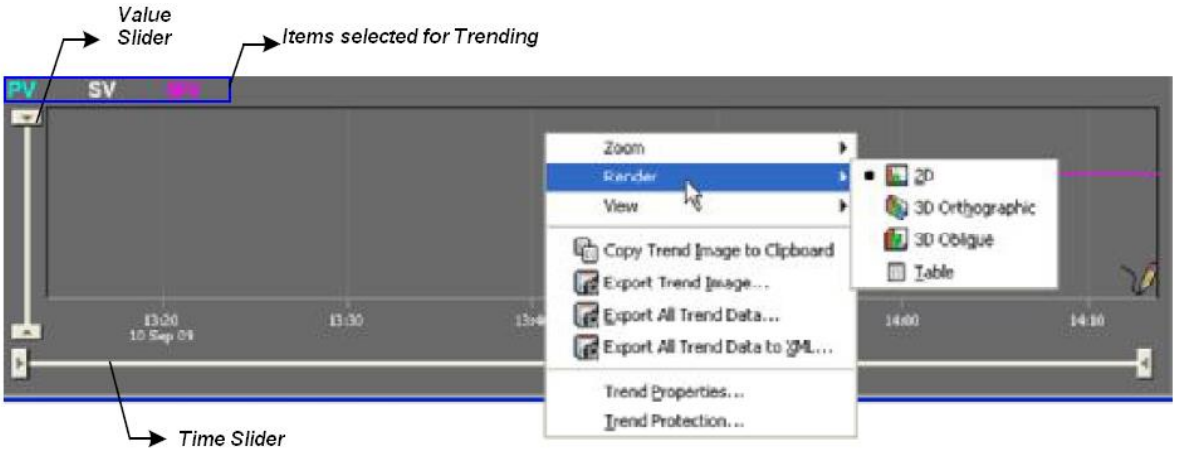



*Figure 40 – Tuning Panel Trending Area*

*Alarm Processing*

The PCS, SIS and FGS alarm processing consists of the following two functions:

- Alarm detection function for detection of any abnormality within the process
- Alarm notification function to further process the detected alarms.

The following figure represents the function structure of alarm processing in PCS, SIS and FGS.

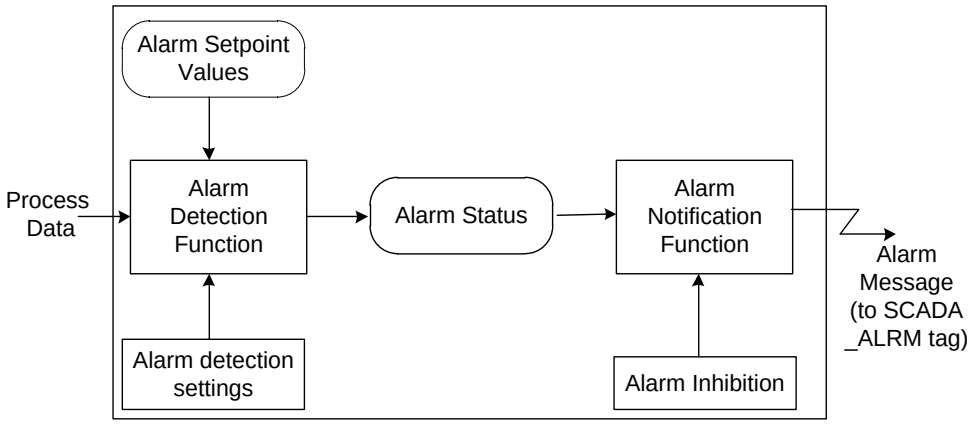



*Figure 41 – PCS, SIS and FGS Alarm Processing*

The following alarm checks are done under the Alarm Detection Functions. For alarm status text abbreviations and description refer to section 5.3.3.

- Input open alarm check
- Input error alarm check
- Input high-high and low-low limit alarm check
- Input high and low limit alarm check
- Input velocity alarm check
- Deviation alarm check
- Output open alarm check
- Output failure alarm check
- Output high and low limit alarm check
- Connection failure alarm check

*Alarm Availability for PCS,SIS and FGS Library*

Table 15 and Table 16 list the available alarm checks used for the PCS,SIS and FGS library.

| | Process alarms | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | NR | OOP | IOP+ | IOP- | HH | LL | HI | LO | DV+ | DV- | VEL+ | VEL- | MHI | MLO | CNF | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |

*Table 15: PCS, SIS and FGS Regulatory Control*

| Type | Process alarms | | | | | | | | | | | | | | | Other alarms |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | NR | OOP | IOP+ | IOP- | HH | LL | HI | LO | DV+ | DV- | VEL+ | VEL- | MHI | MLO | CNF | |
| SI_1 | ✓ | | ✓ | ✓ | | | | | | | | | | | ✓ | PERR |
| SI_2 | ✓ | | ✓ | ✓ | | | | | | | | | | | ✓ | PERR |
| SO_1 | ✓ | ✓ | | | | | | | | | | | | | ✓ | - |
| SO_2 | ✓ | ✓ | | | | | | | | | | | | | ✓ | - |
| SIO_11 | ✓ | ✓ | ✓ | ✓ | | | | | | | | | | | ✓ | PERR |
| SIO_12 | ✓ | ✓ | ✓ | ✓ | | | | | | | | | | | ✓ | ANS+ |
| SIO_21 | ✓ | ✓ | ✓ | ✓ | | | | | | | | | | | ✓ | ANS- |
| SIO_22 | ✓ | ✓ | ✓ | ✓ | | | | | | | | | | | ✓ | |

*Table 16 – PCS, SIS and FGS Sequence control*

*Alarm Status and Priority*

An alarm status is information that represents the alarm state of a process which was detected by the PCS, SIS and FGS logic. The alarm statuses are depending of the type of the PCS, SIS and FGS logic which is used. The alarm status for the operation and monitoring function is displayed in the access parameter ALRM.

| Status Text | Alarm Name | Description |
|---|---|---|
| NR | Normal | Indicates a state in which no alarm has occurred. |
| OOP | Output Open Alarm | Indicates a state in which the output data status has become output failure (PTPF) as a result of the failure or disconnection of an operation terminal or process I/O device or the abnormality of output destination data. Normally, the output function is stopped. |
| IOP<br>IOP+ | High Input Open Alarm | Indicates a state in which the input data status has become bad value (BAD) as a result of the failure or disconnection of a detection terminal or process I/O device or the abnormality of input destination data. Normally, any processing that uses input signals is stopped. If the input signal has been overshot due to disconnection, etc., this alarm indicates a state in which input is overshot to the high-limit direction. |
| IOP– | Low Input Open Alarm | Indicates a state in which the input signal has been overshot to the low-limit direction due to disconnection, etc. The input data status becomes bad value (BAD). Normally, any processing that uses input signals is stopped. |
| HH | High–HighAlarm | Indicates a state in which the process variable exceeds the high high-limit alarm setpoint |
| LL | LowLow Alarm | Indicates a state in which the process variable falls below the low low-limit alarm setpoint. |
| HI | High Alarm | Indicates a state in which the process variable exceeds the high-limit alarm setpoint. |
| LO | Low Alarm | Indicates a state in which the process variable falls below the low-limit alarm setpoint. |
| DV+ | Deviation Alarm + | Indicates a state in which the deviation between the process variable and the setpoint value exceeds the deviation alarm setpoint in the positive direction. |
| DV– | Deviation Alarm – | Indicates a state in which the deviation between the process variable and the setpoint value exceeds the deviation alarm setpoint in the negative direction. |
| VEL+ | Velocity Alarm + | Indicates a state in which the change amount of the input signal within a specified time exceeds the velocity limit alarm setpoint in the positive direction. |
| VEL– | Velocity Alarm – | Indicates a state in which the change amount of the input signal within a specified time exceeds the velocity limit alarm setpoint in the negative direction. |

| Status Text | Alarm Name | Description |
|---|---|---|
| MHI | Output High Alarm | Indicate a state in which the output signal almost exceeded the output high-limit value. The actual output is limited to the output high-limit value. |
| MLO | Output Low Alarm | It indicates a state in which the output signal almost fell below the output low-limit value. The actual output is limited to the output low-limit value. |
| CNF | Connection Failure Alarm | Indicates a state in which a block mode of the NPAS logic in the I/O connection destination is in the out of service (OOS) mode.<br>This alarm controls a temporary out of service state due to maintenance, and indicates a PCS, SIS AND FGS block which is still in operation. Normally, IOP or OOP occurs simultaneously. |
| PERR | Computation Error – Answerback Undefined Alarm | Indicates a state in which an illegal input pattern has occurred, such as when the full-open and full-close signals are inputted simultaneously. (Position Error) |
| ANS+ | Answer back Error + | Indicates a state in which answerback check is being performed and the manipulated output value (MV) of ON operation and the answer backed process variable (PV) do not agree. |
| ANS– | Answer back Error – | Indicates a state in which answerback check is being performed and the manipulated output value (MV) of OFF operation and the answer backed process variable (PV) do not agree. |

*Table 17: Alarm status*

When multiple alarms are occurring, the alarm status with the highest alarm display priority will be displayed. In Table 18 the priorities are listed from high to low:

| | |
|---|---|
| Regulatory Control | OOP<br>> IOP+<br>> IOP-<br>> HH<br>> LL<br>> HI<br>> LO<br>> DV+<br>> DV-<br>> VEL+<br>> VEL<br>> MHI<br>> MLO<br>> CNF |
| Sequence | OOP<br>> IOP+<br>> PERR<br>> ANS+<br>>ANS-<br>> CNF |
| Calculation | IOP+<br>> IOP-<br>> HH<br>> LL<br>> HI<br>> LO<br>> VEL+<br>> VEL-<br>> CNF |

*Table 18 – Alarm priority*

### 5.3.10 Typical Graphic Object Library

Refer to PCS and SAFETY SYSTEMS Software Functional 1724000594-IN-SP-00018 Appendix-1HMI Graphic Symbols

### 5.3.11 Typical Faceplate Library

Refer to PCS and SAFETY SYSTEMS Software Functional 1724000594-IN-SP-00018 Appendix-1HMI Graphic Symbols

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# 6 MAINTENANCE

Maintenance is required to:

- Ensure the lifetime of the system.
- Maintain and detect dormant.
- Correct failures
- Keep the system up to date by updating system software and system documentation.

For the maintenance activities in general, a distinction is made between Preventive and Corrective Maintenance. (Most actions are covered when a Yokogawa maintenance contract is applicable)

## 6.1 PREREQUISITES

Test equipment, required for maintenance:

{This list of equipment contains the tools needed for the maintenance of the System cabinet. The tools needed for the maintenance of the valves / solenoids and the pressure transmitters should be listed in their respective documentation. If not, these tools should be added to the list here (for example pressure generator with indication}

- Clamp-on current probe
- Multimeter
- Hand tools
- Oscilloscope
- HART Handheld terminal

Note: All measurements must be performed with calibrated tools.

## 6.2 OWNER ACTIONS

A system custodian must be appointed on site to coordinate all activities and gather all facts and reports with respect to the system. All system anomalies must be logged into a system logbook. This logbook must be stored in the vicinity of the system for quick access.

A maintenance planning is required ahead of the maintenance activities. Since some of the activities are likely to disturb the process, these should be scheduled together with the scheduled shutdown of the process. The logbook must be reviewed before the maintenance activities are taken up for any follow-up actions.

The system documentation must be stored in the vicinity of the system for quick access. Care must be taken that every modification to the system is marked up in the site master copy of the system documentation.

Sufficient maintenance spares must be stored on site.

## 6.3 SECURITY OF THE INSTALLATION

In all work on the system it is important that the system is in a secure mode after work has been finished. This prevents uncontrolled configuration changes.

## 6.4 SAFETY PRECAUTIONS

In all activities regarding the system, extreme care must be taken because of sensitive electronics involved. Extreme care must be taken while handling AC supply. Negligence on part of personnel could be lethal.

Circuit must be disconnected at the surge protection devices provided with disconnect feature in the marshalling cabinets before performing any maintenance activity on field devices which are connected to system.

## 6.5 CENTUMVP BACKUP

### 6.5.1 Backup Tool

There is the Backup Tool to back up the project data in CENTUM VP. The backup tool can be started from System View.

The following flowchart shows the flow of the project backup.

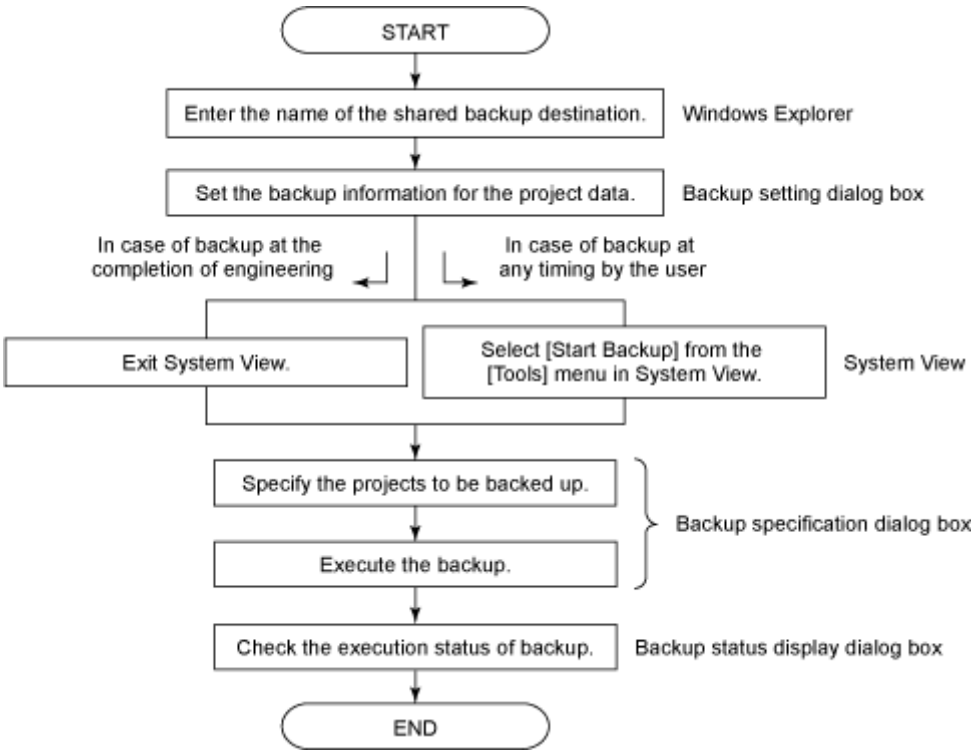



*Figure 42 – Project Backup*

### 6.5.2 Setting Backup Information for Projects

Set backup information for projects that are to be backed up. Project databases for which no backup information is set are excluded from the backup targets.

Set the backup information in the Backup setting dialog box.

Select [Set Backup] from the [Tools] menu.

The Backup setting dialog box is displayed.

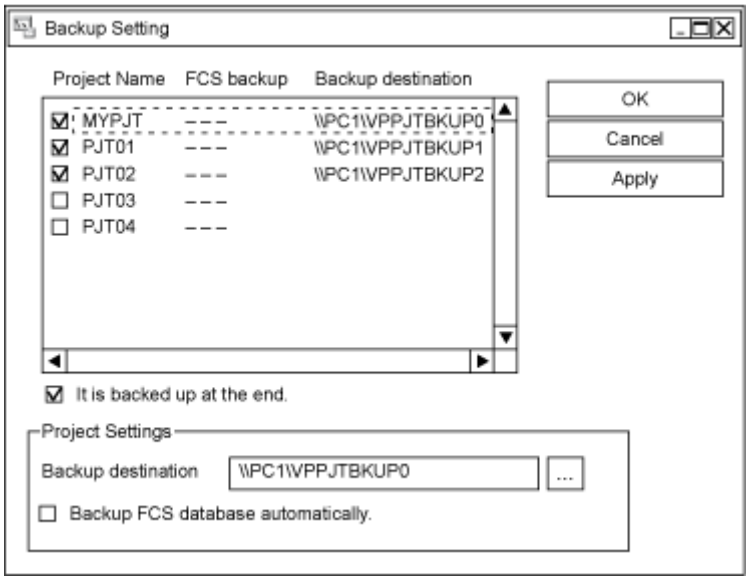



*Figure 43 – Project Backup Setting dialog box*

### 6.5.3 Execution of Backup

The execute backup, exit System View or select [Start Backup] from the [Tools] menu.

The Backup specification dialog is displayed. A list of the projects whose backup information is set in the Backup setting dialog box among the projects opened in System View is displayed in the Backup specification dialog box.

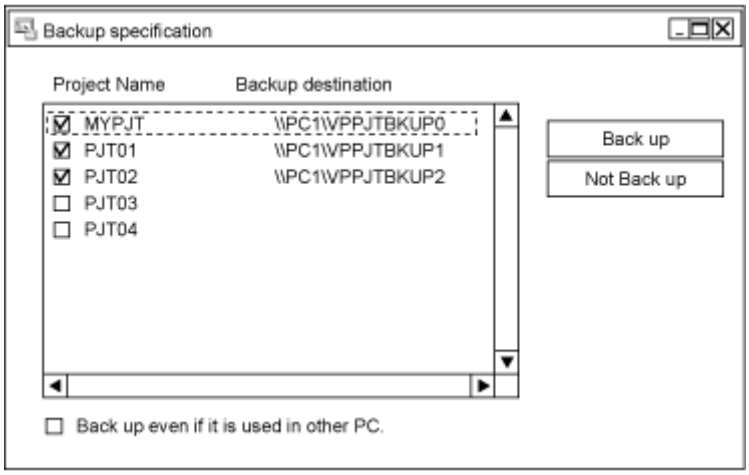



*Figure 44 – Process Backup Execution*

In the Backup specification dialog box, set the following items for each project listed.

### 6.5.4 Checking the Progress of Backup

When a backup is being executed, the Backup status display dialog box is displayed.

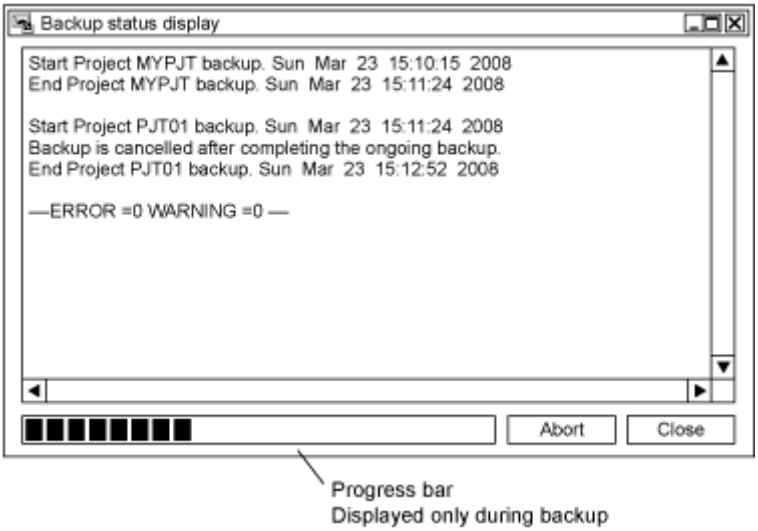



*Figure 45 – Project Backup Progress*

The progress of the backup is displayed for each project in the Backup status display dialog box.

The user can stop a backup at the end of each project backup by clicking the [Abort] button. The backup is aborted at the point where the backup currently in progress is completed. In this case, any project set to be backed up after the aborted project will not be backed up.

Click the [Close] button to close the Backup status display dialog. This button cannot be operated while a backup is in progress.

## 6.6 PCS PREVENTIVE MAINTENANCE

### 6.6.1 General

In general, the Preventative Maintenance of the system involves a routine check of the status of the system. The purpose of PM is to detect system defects which are not detected during normal operation. They might have a degrading effect on the system leading to an increase in nuisance failures.

### 6.6.2 Schedule

Preventive Maintenance must be carried out on a regular basis. The following is recommended intervals for the PM to ensure an operational system:

| Preventative Maintenance Schedule: |
|---|

| | |
|---|---|
| System Cabinet | Once per year |
| Network switches, KVM interfaces | As per product manual |
| Power supply units and diode modules | As per product manual |
| Terminal boards, barriers, relays | As per product manual |
| Cabinet accessories | As per product manual |

Peripherals such as printers, HIS do need some regular attention to ensure their lifetime and prevent failures. Refer to their respective manuals for details.

### 6.6.3 Timing/planning

One can distinguish the actions that may be done without disturbing the process and the actions that will certainly disturb the process or bear a great risk to do so. In order to perform the latter it is essential to start the preparations for these actions timely, in advance of a scheduled shutdown.

## 6.7 PCS OFFLINE (SHUTDOWN) PREVENTIVE MAINTENANCE

### 6.7.1 Cleaning

Cleaning may be done with a soft brush to remove dust etc. air filters must be cleaned to ensure required air flow through the cabinet.

### 6.7.2 Online Preventive Maintenance

The following necessary actions will not disturb the process:

Temperatures

All cabinets are provided with a thermostat to detect the high temperature. It is wired to PCS system as part of common cabinet alarm. Measure the temperature for all cabinets with the door closed. The value should be less than 30 degrees Celsius at normal conditions.

Vnet/IP Network

The healthiness of the Vnet/IP network must be checked at frequent intervals. Network health can be viewed at system overview window in HIS.

I/O Module Handling:

Handling of I/O modules and its connections during maintenance shall be performed cautiously in a simplex configuration to avoid 'spurious' trip.

Online Replacement of Modules:

When system is in operation, if it is necessary to install or remove the modules, cables, connectors, refer sec.1.4.3 of this document, which explain how to remove or install the common modules of the Field Control Unit -Hardware User's Guide - IM 33J01C10-01EN Sec.C.6.1.

The dual-redundantly configured modules (such as PSU, CPU, N-ESB Modules) can be removed and installed one by one without turning off the power supply to the safety control unit. The detailed procedures for the following modules are explained therein:

- Power Supply Module
- Processor Module
- ESB Bus Coupler Module

Refer 'PCS and SAFETY SISTEMS Software Functional Design Specification (FDS-SW) 1724000594-IN-SP-00018 for detailed information.

### 6.7.3 Visual Inspection

System healthiness must be checked and any alarms, faults or failures must be investigated and rectified.

- Check the system status on the HIS and confirm all components are healthy.
- Check the system alarm window on the HIS and confirm there are no system alarms.
- Check the LEDs on controller, power supply, communication, and I/O modules and confirm all are healthy.
- Check the LEDs on terminal boards and confirm availability of redundant power.
- Check fused terminals and confirm there is no fuse blown indication.

### 6.7.4 Mechanical Inspection

All physical connections and mechanical elements must be inspected.

- Check network cables connectors are not damaged.
- Check system cables are firmly screwed to their sockets.
- Check for loose connections at termination points inside the cabinets.
- Check proper working of cabinet lights and cabinet fans (as applicable).
- Check proper working of thermostat and air flow switches.
- Check door hinges and door locks.
- Check for mechanical damage in general.

### 6.7.5 Power supplies

All cabinets have 240VAC Non-UPS supply and most of the cabinets have 110VAC UPS supply to power components. Marshalling cabinets have 24VDC power supplies mounted inside.

Measure the voltage on 110VAC incoming feeders. The value should be within 110VAC +/- 10%.

Measure the voltage on 240VAC incoming feeders. The value should be within 240VAC +/- 10%.

Measure the voltage on the 24VDC power supply distribution terminals. The value should be within 24VDC +/- 1%.

### 6.7.6 System spares

System spares must be inspected on a yearly basis on their status. Inspection must cover the following:

- Packing of available parts is undamaged.
- Available spare parts.
- Update inventory records, if any.

### 6.7.7 Hardware replacement

Replacement of the hardware must be carried out during the shutdown. However, if one of the hardware of the dual redundant set has failed, then online replacement is possible.

## 6.8 PCS CORRECTIVE MAINTENANCE

In general, the Corrective Maintenance of the system involves a finding defective part in the system. The operator will be warned of any fault occurring in the system by an alarm on the HIS under the alarm window.

### 6.8.1 Troubleshooting facilities

The system provides the following tools to find the defective part in the system:

- System status/alarm window on the HIS
- LED indications on modules
- Test/disconnect terminals

### 6.8.2 System Status/Alarm window

PCS status is shown on the system overview window. Also diagnostic information are displayed in system and process alarm window.

LED indication on modules

All modules are provided with LEDs to indicate module status and digital and communication modules are also provided with LEDs to indicate status of individual channels.

### 6.8.3 Test/disconnect terminals

Surge protection devices are provided with disconnect feature to disconnect loops, to allow field loop testing.

## 6.9 IAMS

IAMS is equipped with other useful functions in device management such as inspection scheduler, inspection record manager, spare parts manager, and document register.

IAMS processes various diagnoses and integrates those diagnostic results that are related to the plant equipments. The diagnostic types are divided into two categories as shown below.

(1) Diagnosis carried out by devices or equipment

(2) Diagnosis carried out by acquiring data from devices or equipment

The diagnosis results carried out by the devices or equipments are stored in IAMS as device related data via fieldbus and displayed on the status display icon. Loop or equipment diagnoses are performed based on the data acquired from the devices and equipments. IAMS also displays the diagnostic results obtained via other companies' diagnostic solutions through an open interface. By utilizing the data accumulated in IAMS, diagnostic algorithms can be developed. In these manners, IAMS can be applied as the platform of diagnostic functions, and the accumulation of the diagnostic data enables to shift the current breakdown maintenance (BM) into preventive maintenance, or even into the predictive maintenance.

### 6.9.1 Database Maintenance Tool

Using the Database Maintenance Tool, you can manage and maintain the volume of data stored in the PRM Server and the Device Diagnosis Data Historian Server.

The Database Maintenance Tool enables you to archive, retrieve, and delete PRM data. It also enables you to clean up unwanted data from the PRM and Historian databases.

The main functions of the tool are:

- Archiving, retrieving, and deleting data

Free up space in the PRM and Historian databases by either archiving or deleting data that exceeds a certain age. Archived data can be retrieved back into the databases.

- Cleaning up the PRM database

When a device is deleted in a PRM Client, it no longer appears in the PRM Client, but its data remains in the database. Obsolete data can be removed, including the e-EDDL persistent data of the device, by cleaning up the PRM database.

- Cleaning up the Historian database

Free up space in the Historian database by manually removing obsolete data related to deleted devices in the Historian database. In addition, archive, retrieve, and clean-up operations can be set to run automatically at regular intervals, based on a predefined schedule.

However, when you set the clean-up to run automatically, it runs on the first day of every month by default. You cannot change this default setting. You can also use the tool to archive, retrieve, and delete data manually.

In Device Viewer, Custom View This explorer-like tree view can be freely configured to display and manage user-defined information by the maintenance schedule, or by persons in charge.

### 6.9.2 IAMS Backup

PRM Backup Tool to back up the PRM system or PRM databases, or both. The PRM Backup Tool provides the following backup modes:

- System Backup Mode

This mode enables you to back up the PRM system, along with all PRM databases, and any folders, or files on the computer.

- Database Backup Mode

This mode enables you to back up the PRM Server depending on the packages that are activated on your compute

Refer PCS and SAFETY SYSTEMS Software Functional Design Specification (FDS-SW) for more details

## 6.10 CI SERVER

All CI Clients are not scheduled for automatic back-up. For these stations a back-up can be initiated on demand.

### 6.10.1 Restore

Whenever a system needs to be restored it must be booted with the Back-up Exec recovery CD. From the recovery utility one can select the image to restore. After the image has been restored, the machine must be rebooted. After reboot the system is up and running again.

### 6.10.2 Restore individual files

The backup software as described in the previous section provides the possibility to retrieve individual files and/or folders from a system back-up.

Note: When a CI server folder structure is retrieved, the CI server software on that particular machine must be stopped beforehand.

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# 7 NETWORK MANAGEMENT AND SECURITY PRODUCTS

NMS, Backup Recovery, EMCS, Antivirus, WSUS and Domain Controller are either Vendor Supplied or MS Windows configurations. PCS and SAFETY SISTEMS Software Functional Design Specification (FDS-SW) document shall have the configuration settings.

## 7.1 NETWORK MANAGEMENT SYSTEM (WHATSUP GOLD)

### 7.1.1 Installation

1. Launch the WhatsUp Gold installation program.
2. When prompted, select the language in which you want the WhatsUp Gold installer to run, then click **OK**.
3. Read the Welcome screen and indicate if you want to configure WhatsUp Gold using either **Standard installation** or **Advanced installation** mode.
    a. If you select **Standard installation**, WhatsUp Gold will be installed with a dedicated instance of SQL Server Express 2022. Additionally, if your license includes Log Management features, a dedicated instance of Elasticsearch will also be installed. If you want to use an existing instance of SQL Server or Elasticsearch, choose the **Advanced installation** option and provide your connection information when prompted during the installation process.
    b. If you select Advanced installation you can install WhatsUp Gold using more user-defined settings including specifying a dedicated Windows account for IIS and, depending on your license, enabling Failover and/or Distributed features, and pointing to an existing instance of SQL Server and/or Elasticsearch. Click Next to proceed.
4. If you are presented with results of a system configuration check, please review the results prior to continuing the installation process. If any prerequisite checks did not pass, please resolve them, then click Revalidate to perform the system configuration check again. Click Next to proceed.
5. Enter your WhatsUp Gold Activation Key, then click **Next** to proceed.
6. Configure your SQL Server instance as follows:
    a. If you chose **Standard installation**, enter and confirm a password for the SQL Server Administrator account to use to access the database instance, then click **Next**.
    b. If you chose **Advanced installation** and would like to use the local SQL Server 2022 Express instance included with WhatsUp Gold:

- Select Yes, install a local copy of Microsoft SQL Server 2022 Express named WHATSUP, then click Next.
- Enter and confirm a password for the SQL Server Administrator account to use to access the database instance, then click Next.
- Select the destination folders for the SQL Server Express application and data files, then click Next.

- Enter names for the WhatsUp and NetFlow databases, then click Next.

Important: We recommend using the default names provided for your databases. If you choose to use non-standard database names, please do so during WhatsUp Gold installation as modifying them after installation is complete could cause potential issues with network monitoring.

- Enter and confirm a password for the new SQL Server Login WhatsUp Gold will use to access the databases, then click Next.
- Select the destination folder for the WhatsUp Gold installation, then click Next.
- Select the binding protocol(s) WhatsUp Gold will use for the IIS website. You may select HTTPS, HTTP, or both depending on your specific security needs. If you are using an existing binding, select it from the applicable drop-down menu, then click Next. If your are adding a new binding, specify the desired port number(s) to use if you do not want to use the default port number(s) populated by the installer. If you chose to use HTTPS and a new binding will be added, specify the source of the certificate required for binding. You may select a certificate from a certificate store, navigate to and select a certificate file on your local machine, or generate a self-signed certificate. Then, click Next to proceed.
- Enter a password for the new Windows account created for dedicated WhatsUp Gold use, then click Next.

Note: You will only be presented with the Windows account dialog if you are updating the application from a version prior to WhatsUp Gold 2024 and the existing IIS configuration references the Windows account and that configuration has been modified from what was configured by the initial WhatsUp Gold installation prior to upgrade.

c. Select the language or languages you would like to install for use with the application, then click Next.

d. If you choose Advanced installation and would like to use an existing SQL Server instance:

- Select No, I want to select an existing local or remote installation of Microsoft SQL Server for use with WhatsUp Gold, then click Next.
- Enter the SQL Server name or IP address (followed by the database instance if you are connecting to a non-default database instance, e.g., ip address\database name) along with the SQL Server Administrator Login name and password for WhatsUp Gold to use to access the existing instance, then click Next.
- Enter names for the WhatsUp, and NetFlow databases, then click Next.
- Enter and confirm a password for the new SQL Server Login WhatsUp Gold will use to access the databases, then click Next.
- Select the destination folder for the WhatsUp Gold installation, then click Next.
- Select the binding protocol(s) WhatsUp Gold will use for the IIS website. You may select HTTPS, HTTP, or both depending on your specific security needs. If you are using an existing binding, select it from the applicable drop-down menu, then click Next. If your are adding a new binding, specify the desired port number(s) to use if you do not want to use

the default port number(s) populated by the installer. If you chose to use HTTPS and a new binding will be added, specify the source of the certificate required for binding. You may select a certificate from a certificate store, navigate to and select a certificate file on your local machine, or generate a self-signed certificate. Then, click Next to proceed.

- Enter a password for the new Windows account created for dedicated WhatsUp Gold use, then click Next.

Note: You will only be presented with the Windows account dialog if you are updating the application from a version prior to WhatsUp Gold 2024 and the existing IIS configuration references the Windows account and that configuration has been modified from what was configured by the initial WhatsUp Gold installation prior to upgrade.

- Select the language or languages you would like to install for use with the application, then click Next.

7. Select the binding protocol(s) WhatsUp Gold will use for the IIS website. You may select HTTPS, HTTP, or both depending on your specific security needs. If you are using an existing binding, select it from the applicable drop-down menu, then click Next. If your are adding a new binding, specify the desired port number(s) to use if you do not want to use the default port number(s) populated by the installer.

Note: If you are using the Advanced installation workflow and have already configured your HTTP/HTTPS binding options, please proceed to the next step.

8. Click Proceed. The WhatsUp Gold install program begins the installation. When the installation program completes, the InstallShield Wizard Complete dialog appears.
9. Click Finish. The setup program closes.

### 7.1.2 Operations

- Device Discovery: WhatsUp Gold provides you the capability called Device Discovery that allows you to discover devices connected to your network.
- Manually adding a device to a device group: When you manually add a device, you are prompted to enter the IP address or host name. WhatsUp Gold attempts to resolve the IP address or hostname, then scans the device for Active Monitors. When the scan is complete, you can further configure the device as needed.
- Organizing Devices, Device Groups, and Maps with drag-and-drop: In the Device and Map views, you can quickly and easily organize your devices and device groups by dragging the device you want in a particular group to the device group folder.
- Polling: Polling is the active watching, or monitoring, of your network by WhatsUp Gold. This is done in a variety of ways, depending on the service monitors you have configured on your devices. The default polling method is done through Internet Control Message Protocol (ICMP). The default polling interval for WhatsUp Gold is 60 seconds.

- Active monitoring: Active monitors query network services installed on a device, then wait on the response. If a response is not received or if the response does not match what is expected, the service is considered down, and a state change occurs on the device.

- Actions: When a device or monitor state change occurs, WhatsUp Gold can perform an action to try to correct the problem, notify someone of the state change, or launch an external application.

- Passive monitoring: Unlike active monitors or performance monitors, which actively poll a device to check its status or to gather statistical data, passive monitors passively listen for events on devices. Passive monitors are also useful because some devices on a network may not provide a clear up or down status when queried.

- Performance monitoring: Performance Monitors in WhatsUp Gold gather important information about the devices running on your network, then use that data to create reports trending the utilization and availability of different aspects of those devices. Through WhatsUp Gold, you can gather statistics on the following areas:
  - CPU utilization
  - Memory utilization
  - Interface utilization (bandwidth)
  - Ping availability
  - Disk utilization

- Report generation: Device reports display information relating to a specific device. For example, when choosing to view the CPU Utilization report for a specific device, only CPU utilization information is listed for the specific device you choose for the report.

### 7.1.3 Maintenance

Maintenance mode:

This feature lets you place devices in Maintenance mode, where they will not be polled by the engine. Any device placed in maintenance mode is not polled, and actions are not fired for it, but it remains in the device list and historical data is preserved. By default, the maintenance state is represented by an orange color in both the device list view and the map view.

The mode can be set in two ways:

- Force this device into maintenance mode now. Set this device options manually by selecting Device Properties > Polling.
- Scheduled maintenance times. Schedule maintenance times for the device.
- Click Add to schedule a new maintenance time for the device.
- Select an existing entry, then click Edit to change a scheduled time.
- Select an existing entry, then click Remove to delete a scheduled time from the list.

Troubleshooting Tools:

WhatsUp Gold includes several network tools. These troubleshooting tools allow you to take a closer look at the status of your network devices.

The following tools help you check the connectivity of networked devices:

- Ping Tool

- Trace Route Tool
- Lookup Tool
- Telnet Tool

The following tools help you identify information about MIB objects that network devices support:

- SNMP MIB Walker Tool
- SNMP MIB File Explorer Tool

The following tools help you identify problems with network devices so you can take corrective action to resolve issues:

- MAC Address Tool
- Diagnostic Tool
- Using WhatsUp Gold v12
- Web Performance Monitor
- Web Task Manager

Refer https://docs.ipswitch.com/NM/WhatsUpGold2022/02_Guides/Install/index.html for more details

## 7.2 BACKUP & RECOVERY SYSTEM

For system / image backup of Yokogawa solutions and applications, a centralized backup and recovery management system will be deployed. Veeam Backup & Replication will be installed in the BRS server. The Backup Recovery System (BRS) will be placed in the Level 3 of the Purdue Model.

### 7.2.1 Installation

Installing Veeam Backup & Replication
Before you install Veeam Backup & Replication, check prerequisites. Then use the Veeam Backup & Replication setup wizard to install the product.

1. Start the setup wizard.
2. Select the component to install.
3. Read and accept the license agreement.
4. Provide a license file.
5. Install missing software.
6. Review the default installation settings.
7. Specify service account settings.
8. Specify the database engine and instance.
9. Perform the configuration check.
10. Specify data locations.
11. Specify service ports.
12. Begin installation.

To install Veeam Agent for Microsoft Windows and all the required components, do the following:

Upload Veeam Agent setup files on the computer you want to protect. Then navigate to the folder where you have saved setup files.

Keep in mind that you must use Veeam Agent setup files that are generated by Veeam Backup & Replication after the protection group for pre-installed Veeam Agents is created.

To install the .NET Framework 4.5.2, double-click the NDP452-KB2901907-x86-x64-AllOS-ENU.exe file located in the <path_to_setup_files>/Windows/6.0.0.960 folder.

If a later version of the .NET Framework is already installed on the computer, you can skip this step.

To install Windows Universal C Runtime (CRT), find and double-click the file depending on your computer OS architecture and version:

| OS Architecture | OS Version | File Location | File Name |
|---|---|---|---|
| 32-bit | Windows 7 or Windows Server 2008R2 | <path_to_setup_files>/Windows/6.0.0.960/VAW/x86/CRT | Windows6.1-KB2999226x86.msu |

| | | | |
|---|---|---|---|
| | Windows 8 or Windows Server 2012 | | Windows6.1 - KB2999226x64.msu |
| | Windows 8.1 or Windows Server 2012 R2 | | Windows8-RTKB2999226x86.msu |
| 64-bit | Windows 7 or Windows Server 2008 R2 | <path_to_setup_files>/Windows/6.0.0.960/VAW/x6 4/CRT | Windows8-RTKB2999226x64.msu |
| | Windows 8 or Window8.1 | | Windows8.1-KB2999226x86.msu |
| | Windows Server 2012 | | |
| | Window s 8.1 or Windows Server 2012 R2 | | Windows8.1 – KB2999226x64.msu |

To install Veeam Agent for Microsoft Windows, use one of the following files depending on the architecture of your computer OS:

For 32-bit Windows

Double-click the `Veeam_B&R_Endpoint_x86.msi` file located in the `<path_to_setup_files>/Windows/6.0.0.960/VAW` folder

For 64-bit Windows

Double-click the `Veeam_B&R_Endpoint_x64.msi` file located in the `<path_to_setup_files>/Windows/6.0.0.960/VAW` folder

To install the Veeam Installer Service, double-click the `VeeamInstallerSvc` file located in the `<path_to_setup_files>/Windows/6.0.0.960` folder.

### 7.2.2 Configuration

To configure Veeam Agent for Microsoft Windows, you must apply connection settings from the configuration file. You obtained this file together with other setup files when the protection group for pre-installed Veeam Agents was created. To do configure Veeam Agent, execute the following command from the folder where Veeam Agent setup files are located:

```
"C:\Program Files\Veeam\Endpoint Backup\Veeam.Agent.Configurator.exe" -
setVBRse ttings /p:"<protection_group_name>.xml"
```

where <protection_group_name> is a name of the protection group for pre-installed Veeam Agents. Alternatively, you can specify the full path to the configuration file passed with the /p option.

Mind that the connection between Veeam Backup & Replication and Veeam Agent is not persistent. Veeam Agent synchronizes with Veeam Backup & Replication every 6 hours. After you apply new backup policy settings in the Veeam Backup & Replication console, Veeam Agent will get these settings during the next synchronization.

To synchronize Veeam Agent immediately, run the following command on the Veeam Agent computer:

```
"C:\Program Files\Veeam\Endpoint Backup\Veeam.Agent.Configurator.exe" -
syncnow
```

### 7.2.3 Operations

Main functionality of Veeam Backup & Replication includes:

- **Backup:** creating image-level backups of virtual, physical, cloud machines and backups of file shares and object storage repositories.
- **Restore:** performing restore from backup files to the original or a new location. Veeam Backup & Replication offers a number of recovery options for various disaster recovery scenarios, including Instant Recovery, image-level restore, file-level restore, restore of application items and so on.
- **Replication:** creating an exact copy of a VM and maintaining the copy in sync with the original VM.
- **Backup Copy:** copying backup files to a secondary repository.
- **Recovery Verification**: testing VM backups and replicas before recovery.
- **Scale-Out Backup Repositories**: a repository system that allows you to distribute data between performance, capacity and archive tiers.

Refer Veeam-BRS- Document for more details

## 7.3 ANTIVIRUS MANAGEMENT

### 7.3.1 Installation

Configuring SQL Server

- Launch the SQL Server installer.
- Click "New installation or add features to an existing installation."
- Click "I accept the license terms". Uncheck"Send feature usage data to Microsoft" and click "Next"
- In Microsoft Update, uncheck the recommended option and click "Next"
- Click "Next" to skip update checking.
- After the wizard is done with its checks, click "Next"
- In Feature Selection, select "Database Engine Services" only.
  Note: Instance root directory and other directories may be changed to a different drive other than the OS partition
- In Instance Configuration, specify Named Instance for Trellix ePO server as "EPOSERVER", same with the Instance ID. Click "Next".
- Proceed with the default values for the Account Name and Startup Type and click "Next".
- In Database Engine Configuration, Select "Windows authentication mode" and leave default selection for SQL administrators. Click "Next"
- A warning to restart the computer may or may not appear. Click "OK" in case it appears.
- If no error has been encountered, click "Close" to end the installation process.
- Open SQL Server Configuration Manager in Apps.
- Expand SQL Server Network Configuration and click on Protocols for EPOSERVER. Right click on TCP/IP and click on "Enable".
- Right click on "TCP/IP" and click on "Properties".
- Scroll down the TCP/IP Properties and expand "IPAll". Under TCP Port enter "1434" and click OK.
- Restart SQL Service by Selecting SQL Server Services on the left pane. Select SQL Server (EPOSERVER) on the right pane. Click Action and Restart.

Installation of ePolicy Orchestrator

- Double click "SETUP.exe" to start installation.
- Click "OK" on the warning regarding RAM recommendation.
- In the InstallShield Wizard, Click "Next" to start installation.
- Additional software will be installed together with ePO. Click Next to proceed.
- Change destination folder to the partition other than the OS partition.
- Specify Database Server by Computer Name and SQL Instance Name (Created upon installing the SQL Server Express). In Database Server credentials, select "Windows Authentication" and specify Domain, Username and Password fields. Windows credential should be the same as specified during SQL Server Database Engine Configuration. Click on "Next".
- Click "OK" on the pop up window regarding access to UDP Port. In SQL server TCP port manually enter "1434"
- In HTTP Port Information, under Agent-server communication port, manually enter "8080". Verify the information before clicking "Next" to proceed.
- In Administrator Information, enter the credentials that will be used for ePO management web console.
- In Type License Key, enter the license key as indicated otherwise, click Evaluation and click Next to proceed. Click OK to acknowledge expiration of Evaluation license.

- In Trellix Licensing, accept the license agreement by clicking on the corresponding button. Click "OK" to proceed. Click "Install" to start the installation.
- Click "Finish" to end ePO installation.

IIS / FTP Installation

- At the Server Manager, click "Add Roles and Features".
- "Add Role and Features" Wizard will open, Click Next. Under "Installation Types", choose "Role based…" and click on "Next".
- Under "Server Selection", choose "Select a server from…" then click on "Next".
- Under Server Roles, select Web Server IIS and ensure FTP Server is also selected then click "Next"
- Under Select Features, click "Next" to proceed.
- Select "Restart the destination server automatically if required" and click "Install" to start installation process.
- Installation progress will be shown. Wait until the installation process is complete.
- Once installation succeeds, click "Close"

FTP Site configuration

- At the Server Manager, click "Tools" and choose Internet Information Services (IIS) Manager.
- On the Connections Pane on the left, click on "Sites" then on the Actions Pane on the right click "Add FTP Site…
- Enter FTP Site Name, and physical content for the site information.
- Enter IP address of ePO Server, and use port 21. Under SSL, select "No SSL". Click Next.
- Under Authentication window, Select Anonymous as authentication and put a Read Only Permission. Click Finish to create the FTP Site.
- After Creation of Site, newly created FTP Site will be shown under "Sites". On the Actions Pane on the right, click "Restart".
- To check if the FTP is up, open a browser and type the FTP address.

Extensions Installation

- Extensions contains files, components, and information necessary to manage a product.
- Open ePO, Click Menu, under Software, choose Extensions
- Under Extensions window, Click Install Extension.
- Browse the location of the extension file to be added. Click Ok to continue.
- Check the package and click Ok to install the extension.
- Under Extension, click VirusScan Enterprise and view the installed extension.

Check-in Package

- Once logged on to the ePO console, click Menu button. Under Software, click Master Repository.
- In Master Repository, click "Check in Package button"
- Browse and add the needed package(s). For VSE8.8, Click "Next" to proceed
- Choose on which repository branch the packaged will be checked in then click "Save".
- Notice that the added VirusScan Enterprise package is now listed in the Master Repository.
- Browse and add the needed package(s). For DAT file, select the package and Click "Next" to proceed.
- Choose on which repository branch the packaged will be checked in then click "Save".
- Notice that the added DAT package is now listed in the Master Repository.

Source Site Configuration

- The source site provides all updates for your master repository. The default source site is the Trellix Http update site, but you can change the source site or create multiple source sites if required.
- For the ePO server in DMZ, Source Site can be either from Internet or ePO server in the office domain, depending on the system architecture. In Crosswind-BLPH source site is from the ePO server in office domain.
- The Source Site for ePO server on DMZ is from the ePO server in office Domain.
- Click Menu, under Configuration click on Server Settings.
- Under Server Settings, in Settings Category select Source Site.
  Click Edit button (lower right corner) to configure Source Site.
- Click Add source Site to add Source Site
- Enter Repository Name. Select Type as "FTP". Click Next.
- Select IPv4. Enter the address of the FTP Server with port number as port 21. Click Next.
- Select IPv4. Enter the address of the FTP Server with port number as port 21. Click Next.
- Summary of all the details will be shown. Click Save.
- The new Source Site will be shown in the site list. Click Save.

Repository Pull

- Repositories house software packages and updates for distribution to managed systems.
- In ePO menu, under Software, Click on Master Repository.
- Master Repository window will open, Click Pull now to trigger pull action from source site
- Select Source site for the Pull action. All source Site configured in the ePO will be shown. Click Next
- Select required packages for the Pull action. Click Next to continue.
- Summary page will be shown review pull action summary and click Start Pull to trigger pull action.
- Server Task Log will open to show the status.
- Once the pull is complete, click Close.
- Master Repository will now reflect the pulled packages.

System Tree - Creating Groups

- Groups are used to segregate the systems so that common tasks and policies can be applied to them independently.
- Open ePO and Select System Tree from the Tab. Click New Subgroups
- Enter the Group Name, then click OK.
- The new created Group will be shown under My Organization in the System Tree.

System Tree - Adding new system to ePO

- Open ePO and select System Tree from the Tabs.
- The client machines can be added by selecting the "New System" Option from the System Tree Tab.
- Under How to add systems, choose "Add systems to the current group (current selected group in System Tree), but do not push agents".
- Under the target systems, add the IP address of the target computer
- Click "OK".
- System tree will display the added system in Unmanaged State.
- Click Actions > Agent > Deploy Agents to change the state to Managed.
- In Deploy Trellix Agent window, enter the required credentials for agent installation (local administrator on the unmanaged system). Click "OK" to proceed.
- Server Task Log will display the progress of the deployment. Click on the task to view more details.

- Once the task is completed click Close to go back to System Tree.
- In System Tree, the system will now be displayed as Managed.

Client Task Catalog

- Open ePO, Click Menu, under Policy choose Client Task Catalog.
- In Client Task Catalog window, choose Product Deployment. Click New Task
- In New Task, choose Product Deployment under Task Types.
- Enter the Task Name and Description. Under Products and components, choose VirusScan Enterprise , Install from Branch Current. Click Save
- The newly created Task will be shown under Product Deployment.
  Under Actions column, Click on Assign to assign the task to a node in the System Tree.
- Assign Client Task to My Organization (or the node where it is applicable)
  Click OK.
- In the Client Task Assignment Builder, ensure that all parameters are correct.
  Schedule can also be set in this window. Once done, click Save.
- The Client Task Catalog should display the product deployment task created with its corresponding assignment.
- To deploy VirusScan Enterprise, select the system that will be deployed with the product.
  Go to Actions menu by clicking Actions. Select Agent > "Run Client Task Now"
- In the Run Client Task Now window, select the Client Task created for product deployment.
  Click "Run Task Now".
- Once deployment task is complete, click Close.
- Check the deployment in the system by logging in to the system
- From ePO menu, open Client Task Catalog, select Product Update. Click New Task to create a new task
- In Task Type, select Product Update and click OK.
- In Client Task Catalog, enter the necessary details. Click Save.
- Once completed, the created task should appear in Client Task Catalog.
- Under Actions Pane, click Assign to assign the task to a node in the System Tree.
- Select the node in the System Tree to assign the created task and click OK.
- In the Client Task Assignment Builder, ensure that all parameters are correct.
  Schedule can also be set in this window. Once done, click Save.
- In System Tree, select the system to update. Go to Actions menu by clicking Actions.
  Select Agent > "Run Client Task Now"
- In the Run Client Task Now window, select the Client Task created for product update.
  Click "Run Task Now".
- Once product update task is complete, click Close.

Policy Catalog

- Policies ensure that the managed security software products are configured and perform accordingly
- From the ePO menu, select Policy Catalog under Policy.
- In Policy Catalog window, under Product select VirusScan Enterprise. Under Category select General Options Polices Click New Policy.
- Provide the necessary details and click OK.
- Open the created policy by clicking on the name.
- Under Display Options tab, select "Display managed tasks in the client console"
- Do the same settings for "Server"

- Click "Password Option Tab", click Password protection for all selected items.
- Do the same settings for "Server". Click save.
- In the System Tree go to Assigned Polices tab and under Category select General Options Policies and click Edit Assignment
- In the Policy Assignment window, under assigned policy, select the created task and Click Save.
- In the System select the client and click Wake Up Agents
- In client VirusScan Console, the view should be updated according to the policy assigned.
- To unlock VirusScan console, go to Tools and click Unlock User Interface. You must know the administrator password that was set from the ePO server.
- Enter the needed credentials to unlock interface.

## 7.3.2 Implementation and configuration

### 7.3.1.1 Trellix ePolicy Orchestrator Server (ePO 5.10)

The target Trellix ePO Server must meet the specific system and hardware requirements to run the Trellix ePolicy Orchestrator (ePO). Assess the requirements before installing the Trellix ePO software to guarantee a successful installation.

The following table provides the settings that are required to be configured on the Trellix ePO server of PIN and DMZ.

| Description | Trellix ePO Server (DMZ) | Trellix ePO Server (PCN) |
|---|---|---|
| Disable the Product Improvement Program | Required | Required |
| Disable Global Update | Required | Required |
| FTP Server Configuration | Required | Not Applicable |
| FTP Distributed Repository | Required | Not Applicable |
| FTP Source Site | Not Applicable | Required |
| Export of Security Keys | Required | Not Applicable |
| Import of Security Keys | Not Applicable | Required |
| ENS Platform Check-In | Required | Required |
| ENS Threat Prevention Check-In | Required | Required |
| ENS AMCore Check-In | Required | Required |
| Trellix Agent Check-In | Required | Required |

| | | |
|---|---|---|
| Delete Unmanaged Products | Required | Required |
| Trellix Agent Extension | Optional | Required |
| Endpoint Security Extension | Optional | Required |
| Threat Prevention Extension | Optional | Required |
| Disable Master Repository Update | Required | Required |
| Disable Download Software Product List | Required | Required |
| Disable Download and Schedule Deployment of Software Product Updates | Required | Required |
| Creating Groups | Optional | Required |
| Trellix Agent Deployment | Optional | Required |
| Import Yokogawa Advanced Policy | Optional | Required |
| Import Yokogawa Advanced Task | Optional | Required |
| Adding the Yokogawa AMCore Update Task | Optional | Required |
| Adding the Yokogawa Standard AV (ENS) Deployment Task | Optional | Required |
| Adding the Yokogawa Standard AV (ENS) Uninstallation Task | Optional | Required |
| Adding the Trellix Agent Update Task | Optional | Required |
| **Optional** – Required when there is a client to be managed in the DMZ Trellix ePO Server | | |

*Table 19- Trellix ePO Server Matrix Table*

Refer Cyber Security Settings Document for more details

## 7.4 OS PATCH MANAGEMENT

The Windows Server Update Services (WSUS) is a Microsoft solution that provides a platform for managing and distributing the latest Microsoft product updates to computers on the network. Implementing this solution and following the recommended configuration gives the plant asset administrator the capability to control the patches that would be installed on the plant asset.

### 7.4.1 Component and Functions

#### Windows Server Update Service (WSUS) Server

The WSUS server provides a management console to centrally manage and enforce updates to the client. The WSUS stores all the applicable updates and ensures availability to the clients upon patch approval. The WSUS console provides detailed client updates information and reports through the dashboard. In the Yokogawa OS Patch implementation, the WSUS server must be able to connect to the Microsoft Update to get the latest available update information. This server shall have a secure connection to the Microsoft website.

#### Windows Update Clients

Embedded in each installation of the Microsoft Windows operating system is the Windows Update. This is a built-in service provided by Microsoft for a routine check and installation of updates to the operating system. By default, Windows Update is configured to connect to the Microsoft Update site via the internet, however, this configuration is changed to connect to an onsite WSUS server.

### 7.4.2 Configuration and Settings

#### Update Source

The update source is the location from which the WSUS server gets its updates and update metadata. In the Yokogawa implementation, the WSUS server is configured to download updates directly from the Microsoft Update. By design, the initial synchronization will download all the updates that are specified on the WSUS server. Subsequent synchronization shall download only new updates from the update source, as well as revisions in metadata for existing updates, and expirations to updates.

#### Update Files and Languages

- Storing Updates
  The update files are stored in the WSUS server based on the configured update files settings. In the Yokogawa implementation, the WSUS server is configured to store all selected classification and product updates locally. This will ensure that the required updates during the approval of updates are already available on the WSUS server.
- Selected Languages
  The update files are downloaded based on the languages that are selected on the WSUS server. It is possible to synchronize updates in all the languages in which they are available, or you can specify a subset of languages. In the Yokogawa implementation, only the required language shall be selected on the WSUS server during the configuration.

### Supported Products and Classification

The WSUS downloads updates based on the products and classifications that are configured on the server. By default, the WSUS is configured to download all the critical and security updates of all the Windows products.

### Computer Groups

The computer node refers to a central access point in the WSUS administrative console for managing computers. The clients can be organized into logical groups/subgroups based on their machine type, topological/ geographical locations, or their functionality boundaries. Creating groups/subgroups for systems with similar properties or requirements allows the administrator to target updates to a group of client computers, so you can ensure that target computers always get the right updates.

The default computer group includes the All Computers and the Unassigned Computers group.

- All Computers – computer clients are always assigned or part of the All Computers Group
- Unassigned Computers – computer clients are part of the Unassigned Computer Group until it is assigned to another computer group.

### Schedule

The scheduled configuration on a WSUS depends on the component type. Each component type has its own recommended behavior when it comes to downloading updates.

- WSUS Server Schedule

  During a scheduled synchronization, the WSUS server downloads updates (update metadata and files) from an update source. The frequency of the synchronization depends on the configured timing on the WSUS server. In the Yokogawa implementation, the WSUS server is configured to synchronize every day to the Microsoft Website.

- WSUS Client Schedule

  During a Windows Update, the WSUS clients download the approved updates from the WSUS server. The frequency of the synchronization depends on the configured timing of the WSUS client policy. In the Yokogawa implementation, the WSUS client has no automated schedule on when to download the approved updates. The Windows updates are triggered manually on the client during the approved maintenance schedule.

### WSUS with Secure Sockets Layer (SSL)

WSUS with SSL ensures integrity between the WSUS clients and the WSUS server. In the Yokogawa implementation, the Active Directory Certificate Services (AD CS) role is used to manage the digital certificates in implementing the certificate-based authentication of WSUS.

### WSUS Permission Groups

In order to use all the features of the WSUS console, the user shall be added as part of the Administrator group or the WSUS Administrator group. It is recommended to provide only the necessary permission based on user job responsibility. For the Windows Domain user management implementation, refer to the reference document.

By default, the two security groups are created on the WSUS server upon setup.

- WSUS Administrator – members of this group can fully manage the distribution of updates to computers on the network and administer the WSUS role
- WSUS Reporter – a member of this group can generate reports but cannot approve updates or configure the WSUS role

### Application Pool Configuration

The WSUS application pool private memory threshold is set to 1843200(KB) which at times is too small. When the private memory threshold limit is reached due to heavy load, the WSUS application pools are automatically recycled and clear the WSUS Metadata cache.

### 7.4.3 WSUS Installation Setps

**WSUS Role Installation Procedure**

- Open Server Manager and select Add roles and features. This will start the Add Roles and Features Wizard.

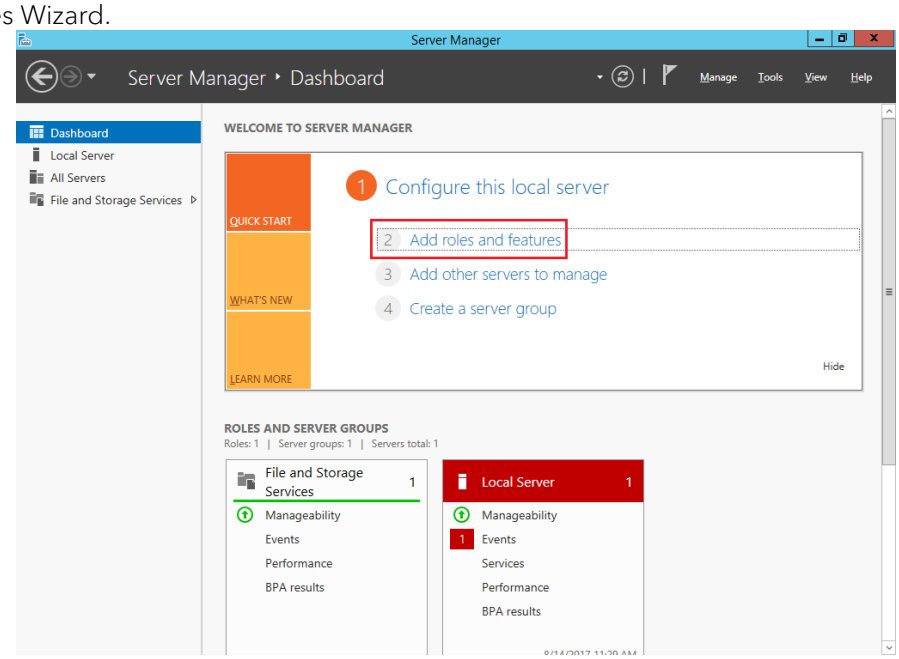



*Figure 46 – Server Manager Console*

- Once the Wizard opens, click on the "Next" button on the Before You Begin task.

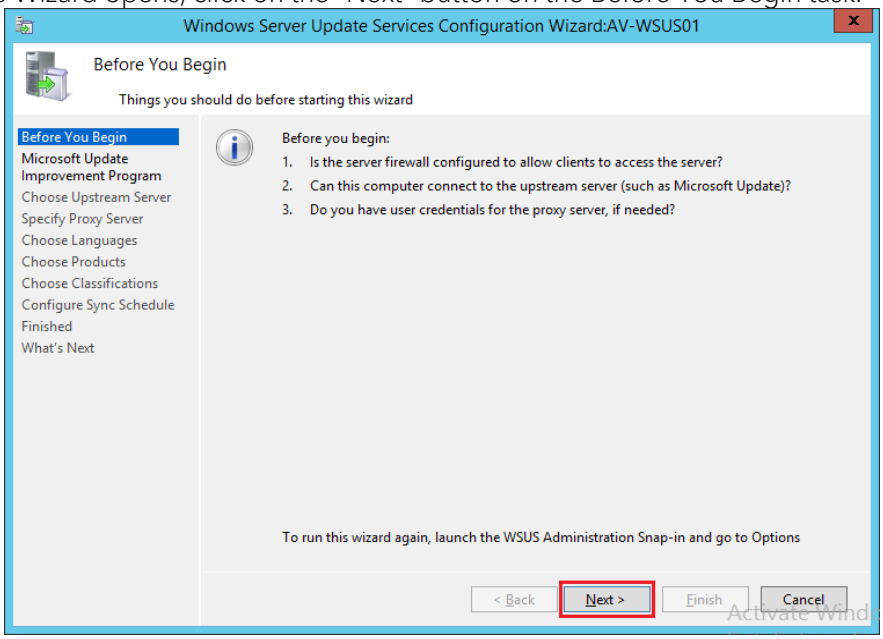



*Figure 47 – Prerequisites for WSUS Configuration*

- Make sure to select Role-based or feature-based installation before clicking on Next button.

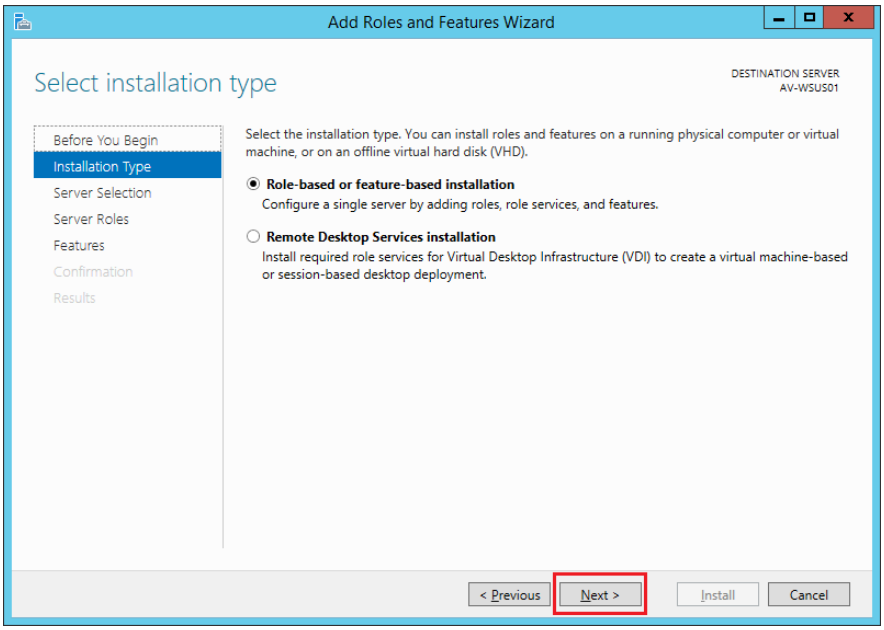



*Figure 48 – Roles and Features Wizard to select type of Installation*

- Click on Select a server from the server pool and make sure to select the WSUS server on the Server Pool List. Click Next.

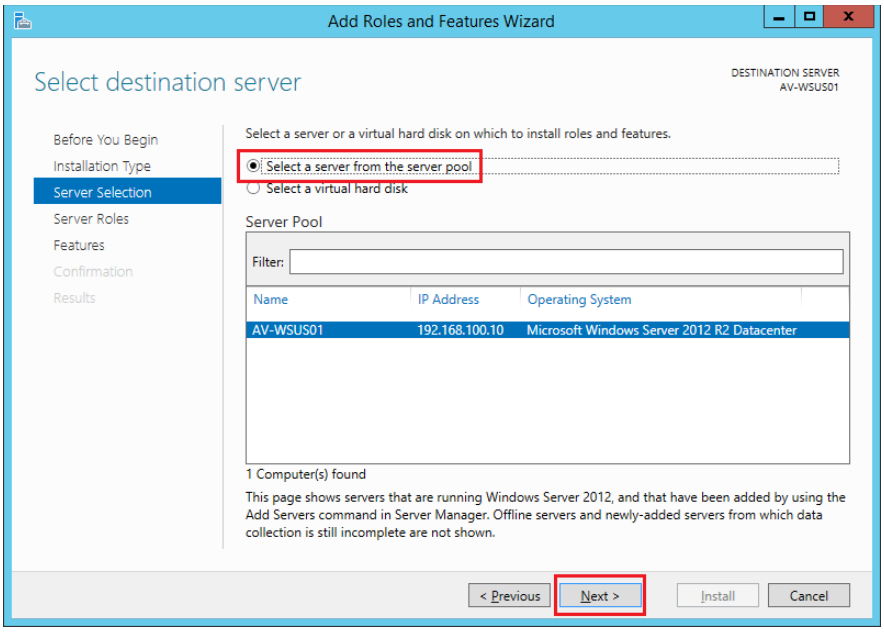



*Figure 49 – Roles and Features Wizard to select destination server*

- Select Windows Server Update Services and click Next

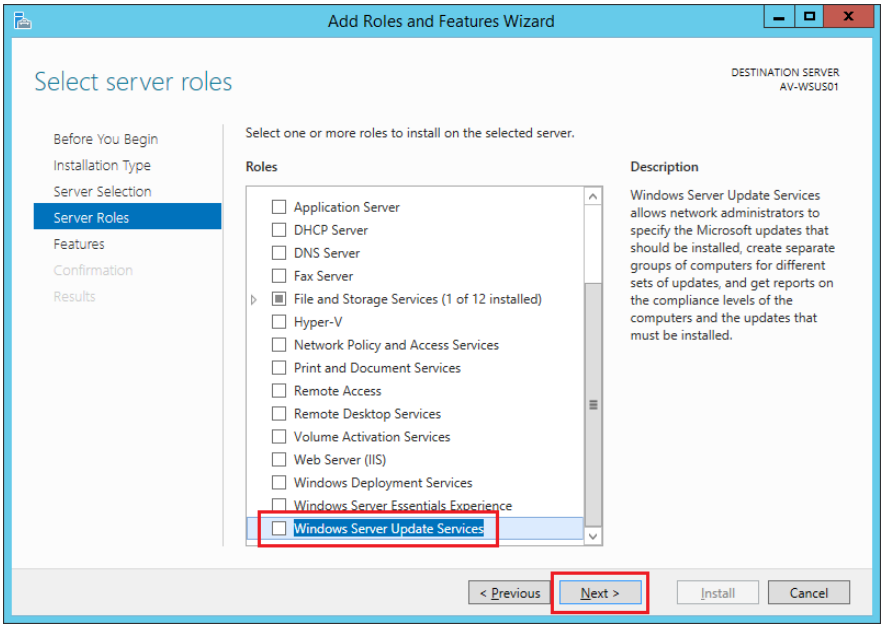



*Figure 50 – Roles and Features Wizard to select server roles*

- Required role services and features will be automatically selected. Ensure Include management tools (if applicable) is selected. Click Add Features

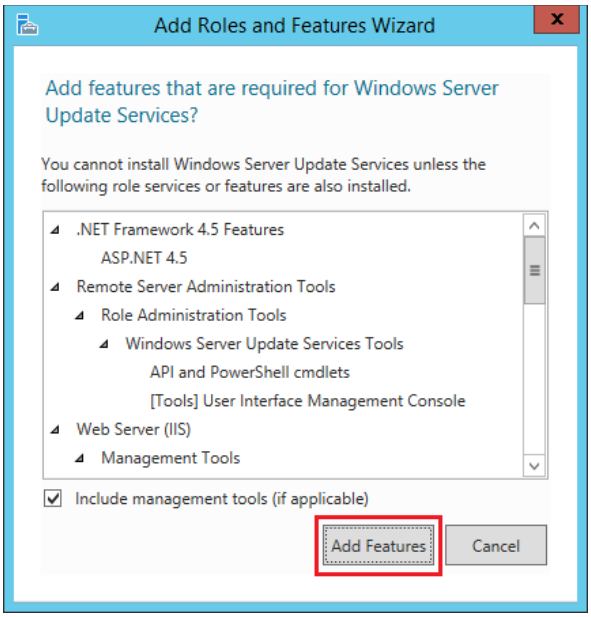



*Figure 51 – Roles and Features to include for WSUS setup*

- Same as step 5, click Next

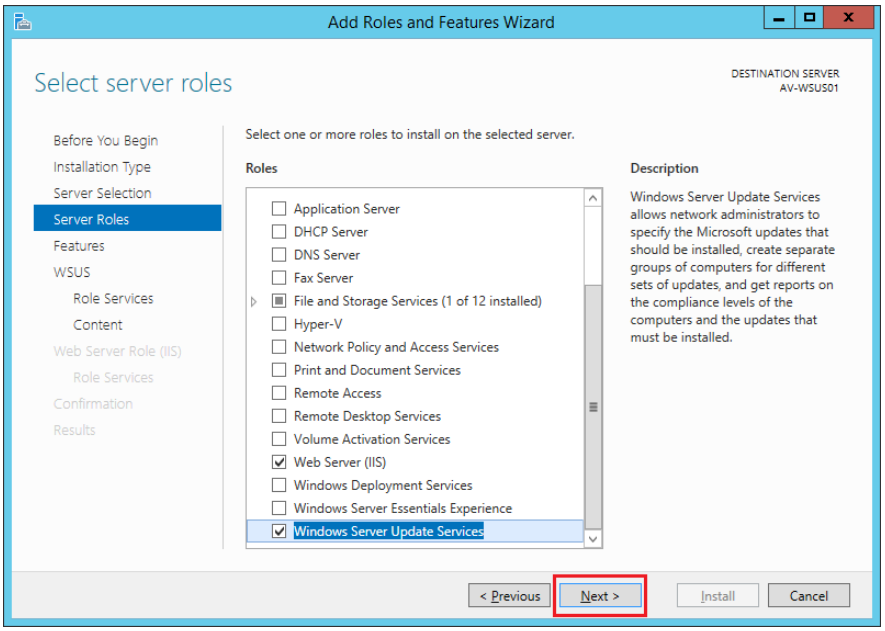



*Figure 52 – Roles and Features wizard to select server roles(WSUS,IIS)*

- Other required role services and features will be automatically selected. Select .NET Framework 3.5 Features. Click Next.

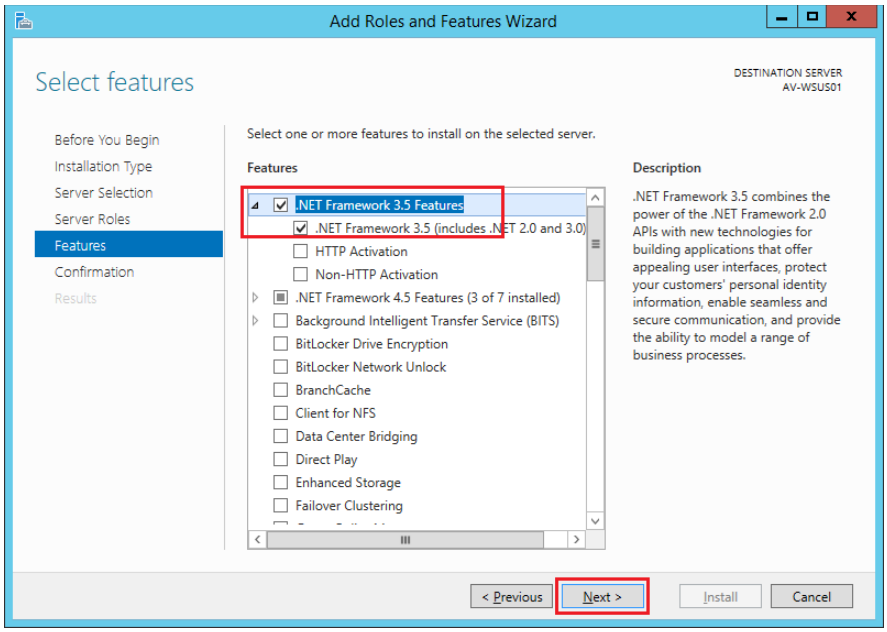



*Figure 53 – Roles and Features wizard to include .NET framework*

- Click Next.

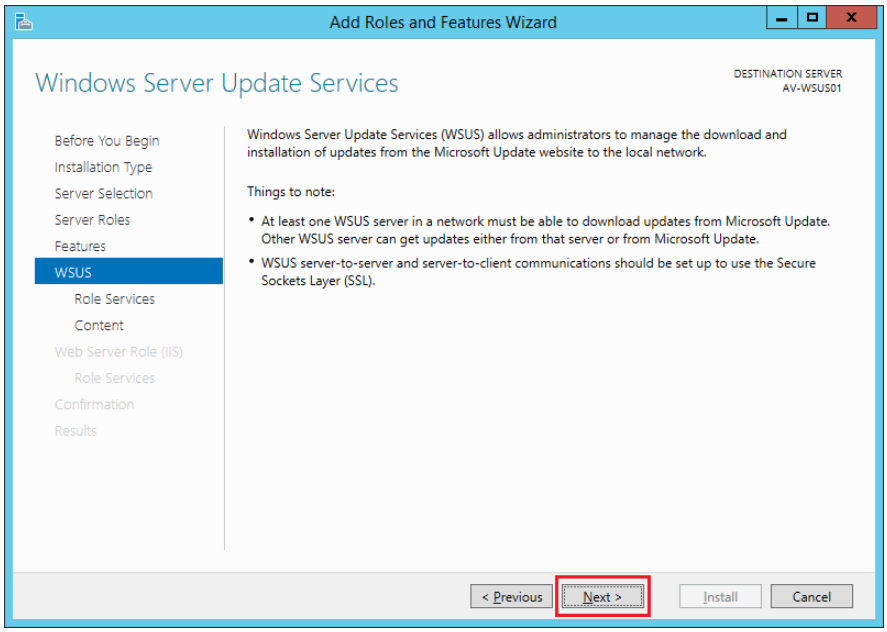



*Figure 54 – WSUS Configuration*

- Ensure that WID Database and WSUS Services are selected and click Next.

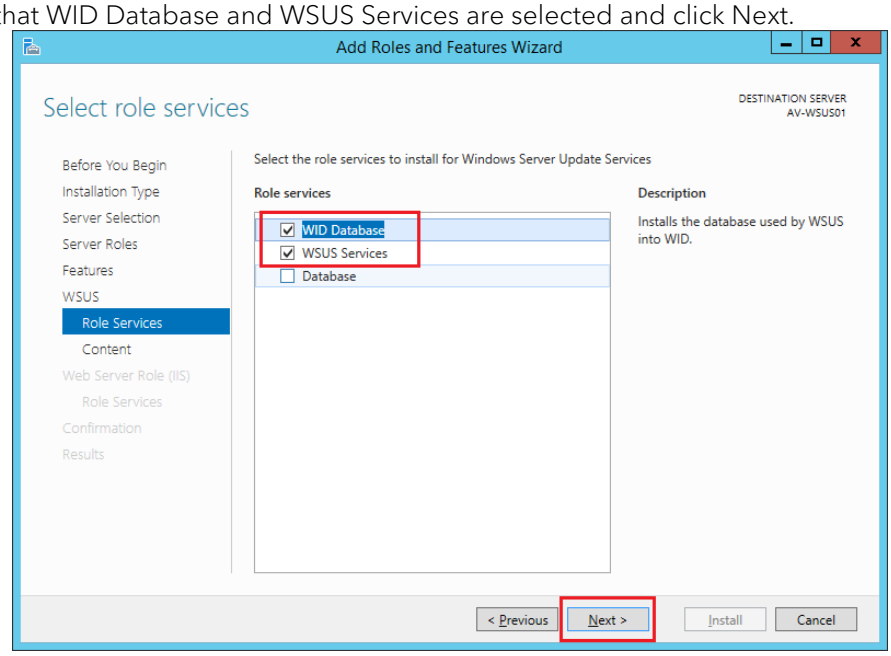



*Figure 55 – Installation of database to WID*

- Specify the path where the updates will be stored. In this case E:\WSUS\. Click Next.

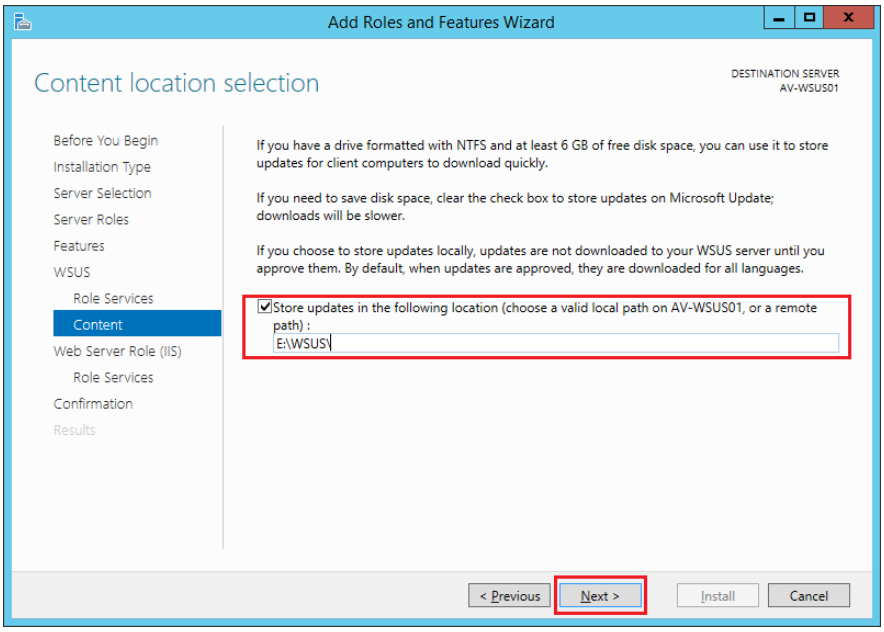



*Figure 56 – Roles and features wizard to select the content location*

- Under Web Server Role (IIS) Click Next

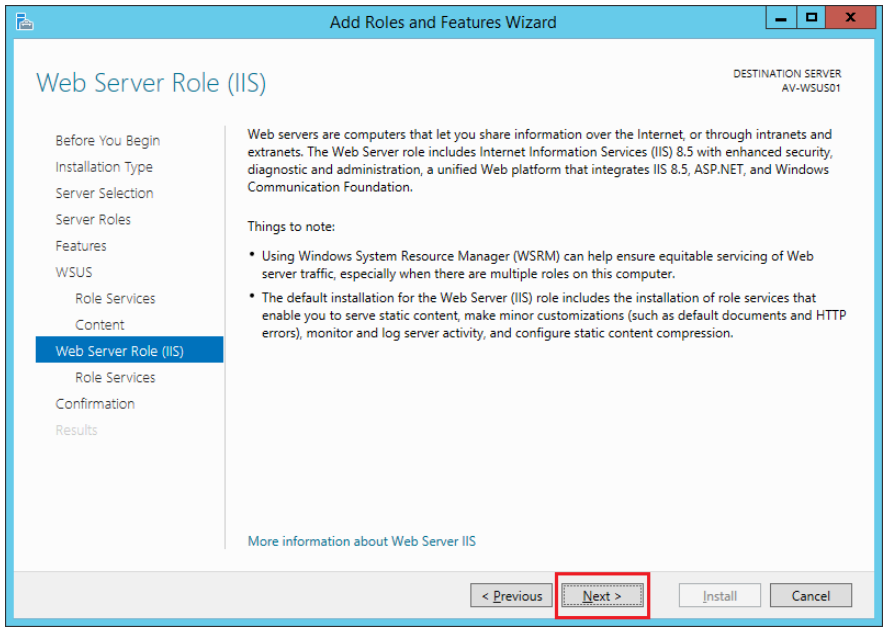



*Figure 57 – Web Server role wizard*

- Under Role Services for IIS, default requirements are automatically selected, click Next.

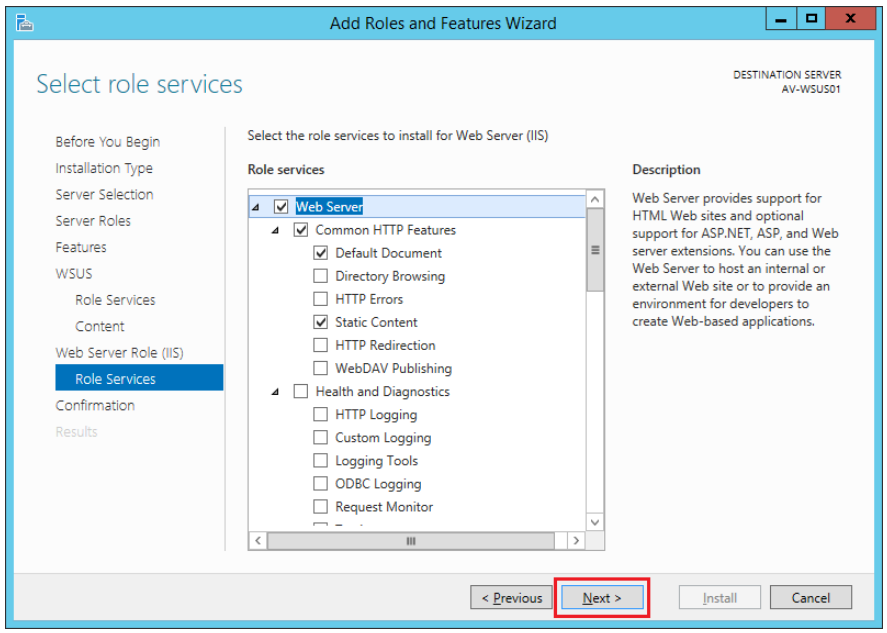



*Figure 58 – Roles and features wizard to install services for IIS*

- Confirm the installation details. Select Restart the destination server automatically if required. Click Install.

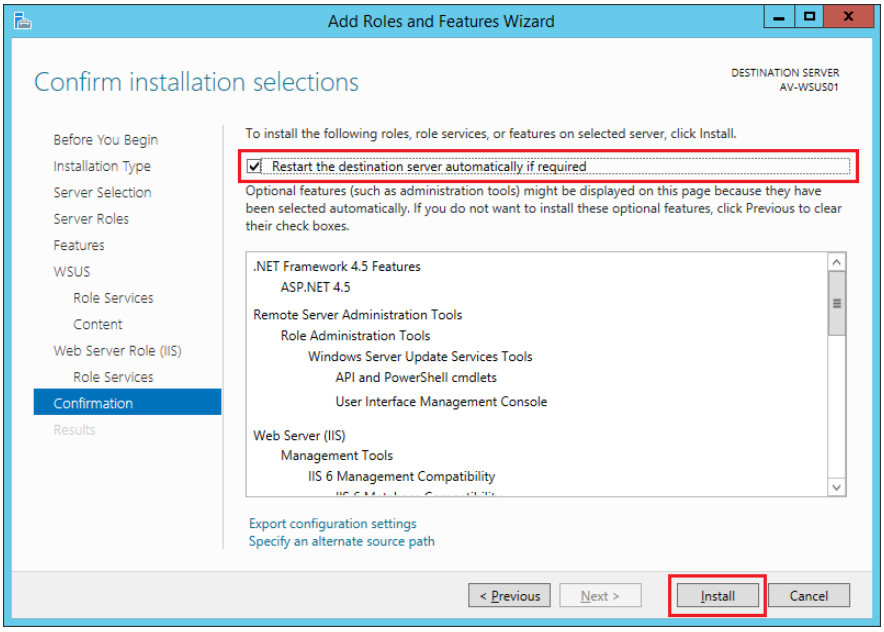



*Figure 59 – WSUS Installation wizard*

- Wait until the feature installation is done. Click Close.

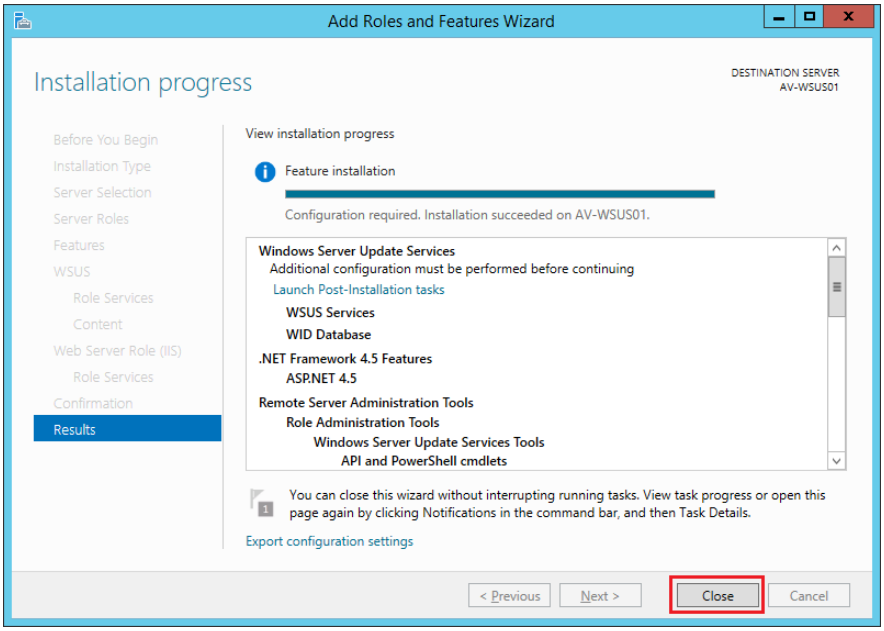



*Figure 60 – WSUS Installation Completion wizard*

### Post Installation Task

- In Server Manager click on the Notifications icon, and click on Launch Post-Installation tasks

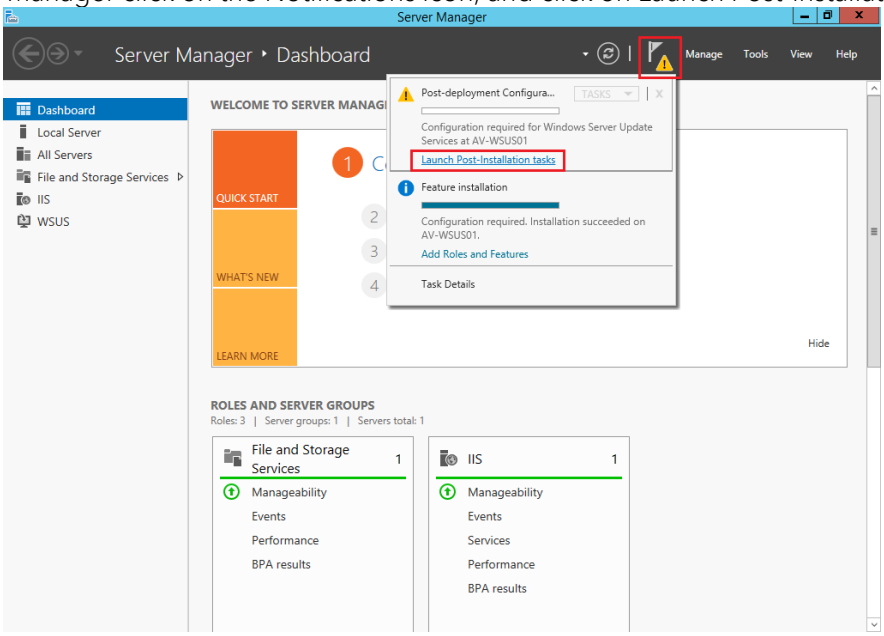



*Figure 61 – Server manager console for post deployment configuration*

### Configuration Wizard

- To open WSUS Management Console. In Server Manager, click on Tools > Windows Server Update Services

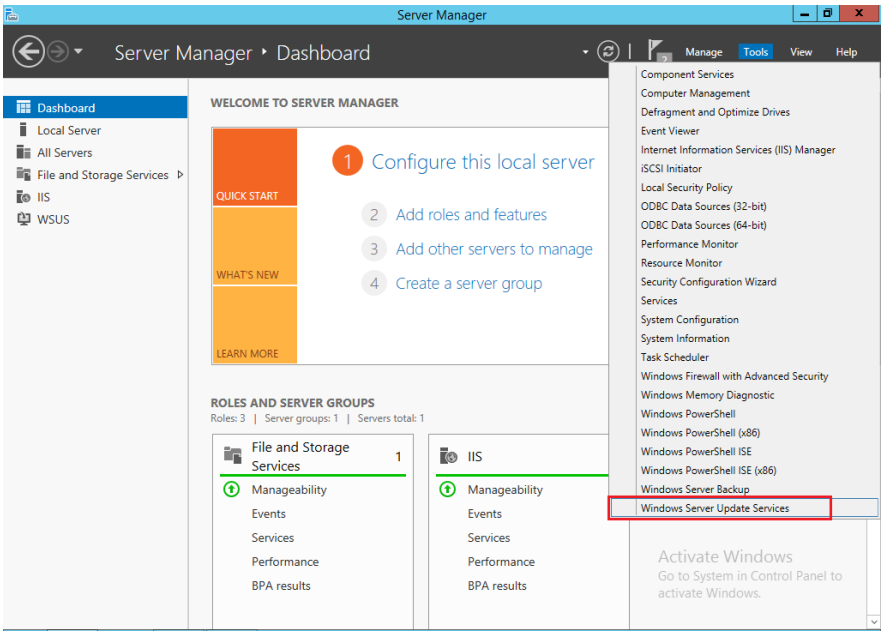



*Figure 62 – Server manager dashboard to select WSUS*

- Once the configuration wizard launched, click on Next.

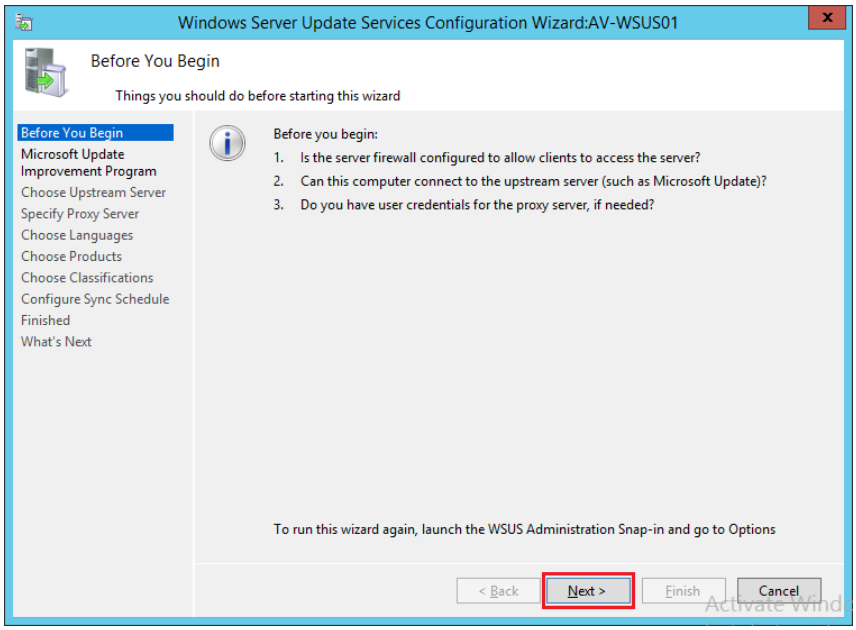



*Figure 63 – Windows Server Update Services Configuration Wizard*

- Under Microsoft Update Improvement Program, make sure NOT to select Yes, I would like to join the Microsoft Update Improvement Program.

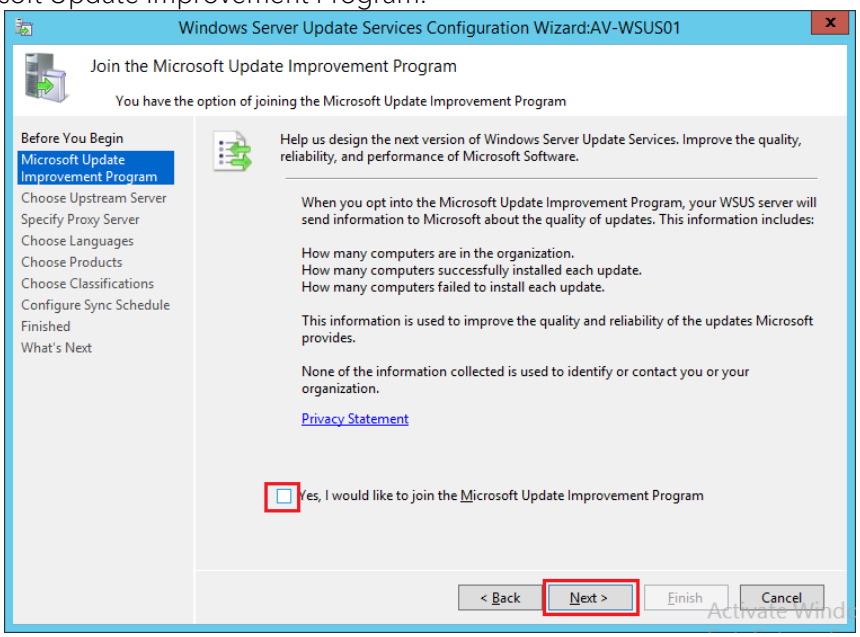



*Figure 64 – Windows Update Improvement Program Wizard*

- When choosing the upstream server for DMZ WSUS select Synchronize from Microsoft Update.

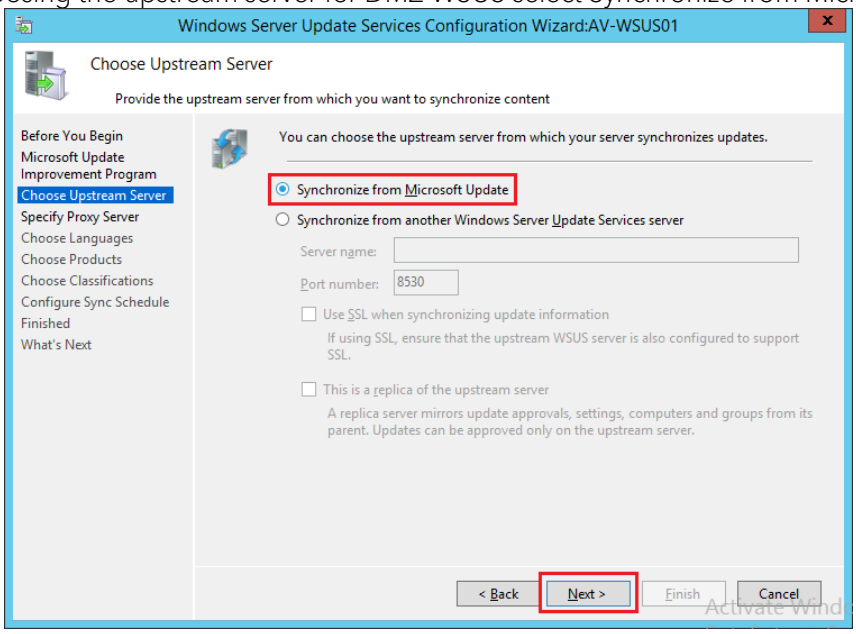



*Figure 65 – WSUS wizard to configure the synchronization*

- When choosing the upstream server for DMZ PCN select Synchronize from another Windows Server Update Services server and key in the IP Address Ex:192.168.100.10 and port number on the corresponding fields. Click Next.

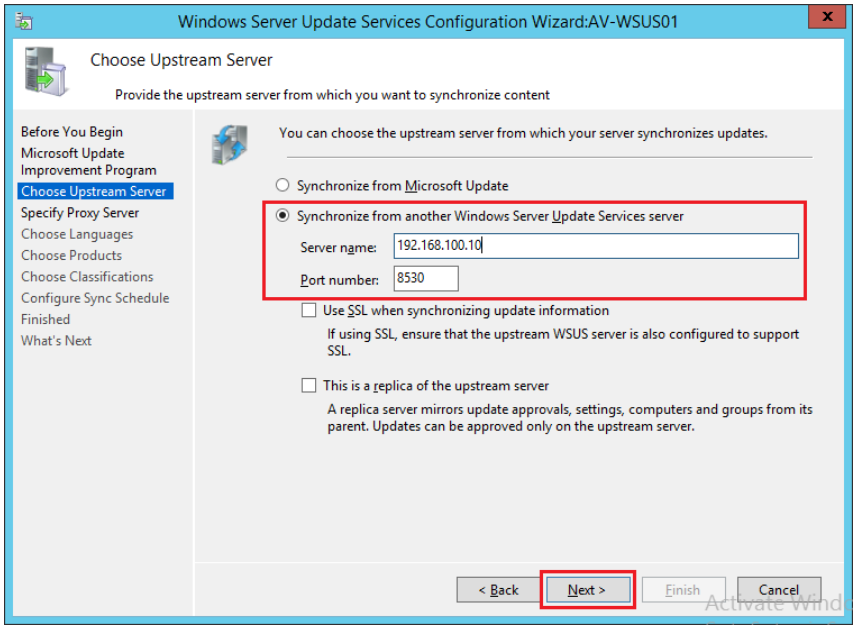



*Figure 66 – WSUS wizard to configure the server name & port number of upstream server*

- Specify the Proxy server if any and if required. Click Next

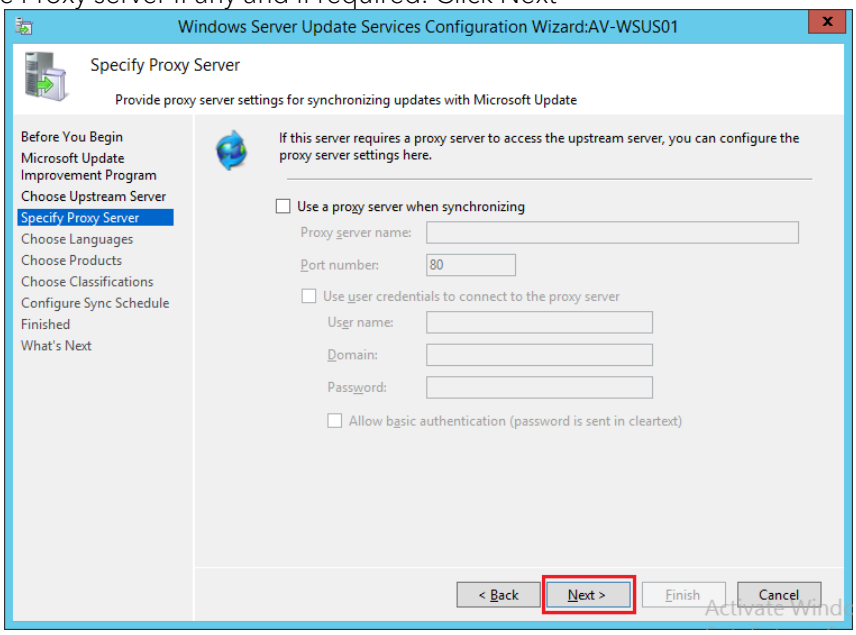



*Figure 67 – WSUS wizard to configure the proxy server*

- Click Start Connecting to test the connection to the specified Upstream Server.

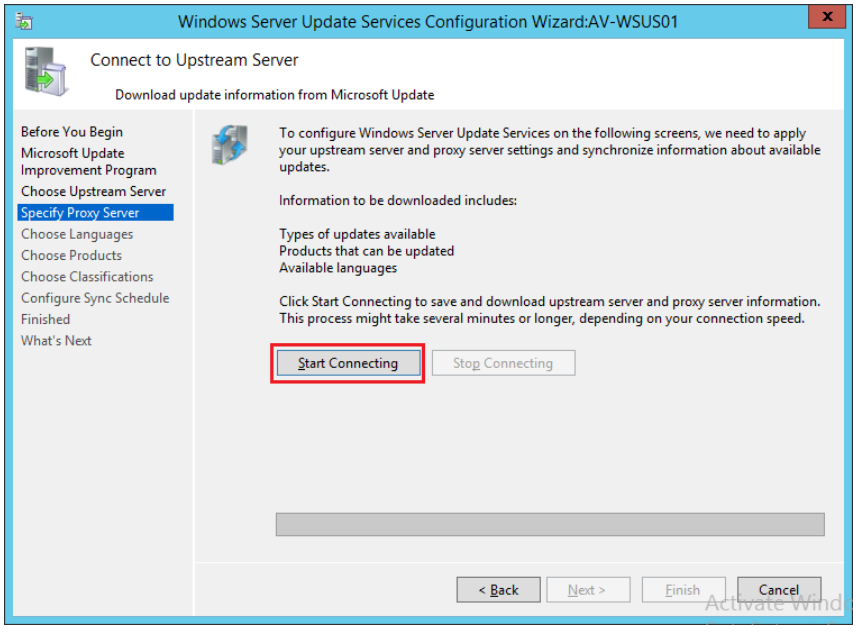



*Figure 68 – WSUS wizard to download the update information*

- It may take a while to connect, but once done, click Next.

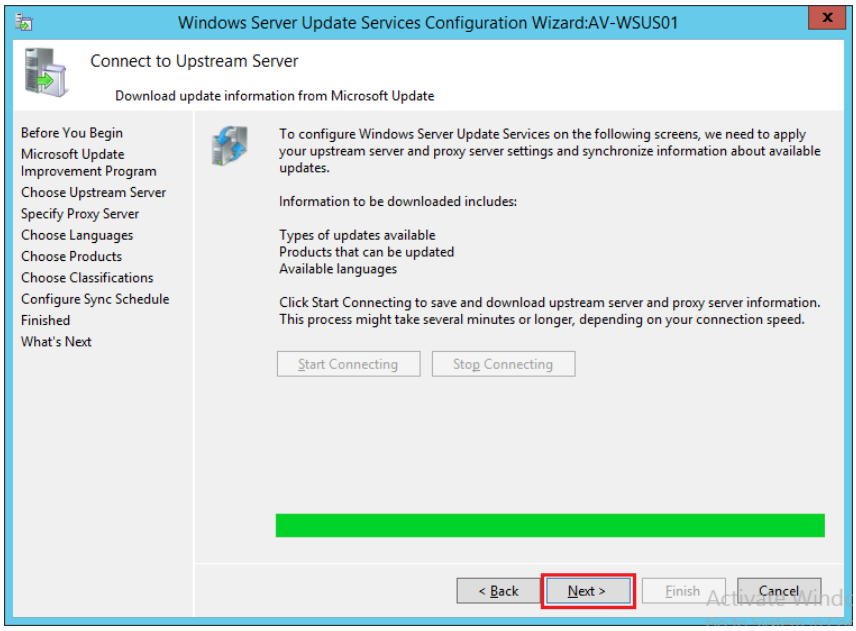



*Figure 69 – WSUS wizard showing the completion of downloading the Updates*

- Select Download updates only in these languages and select English. Click Next.

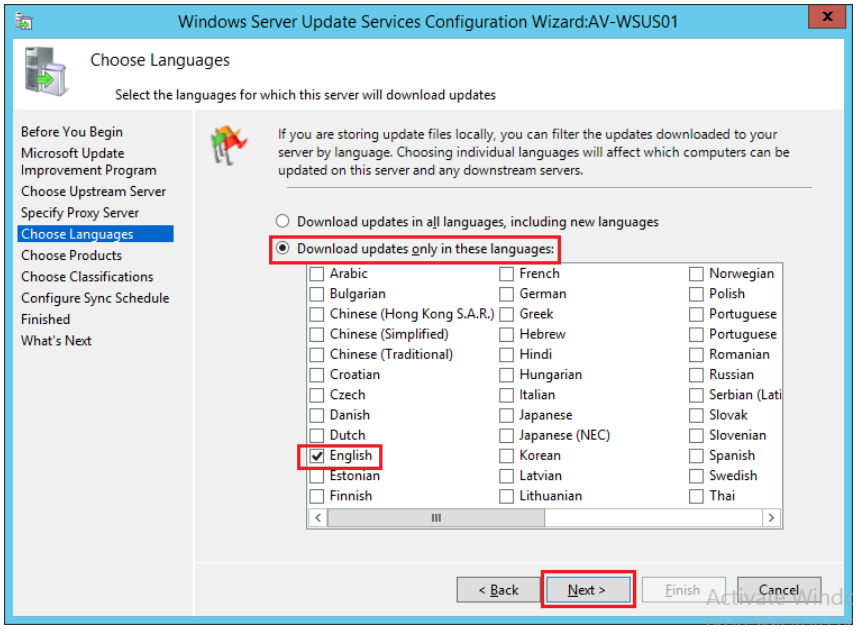



*Figure 70 – WSUS wizard for selecting the languages*

- Select the supported products that needs to be updated. Click Next.

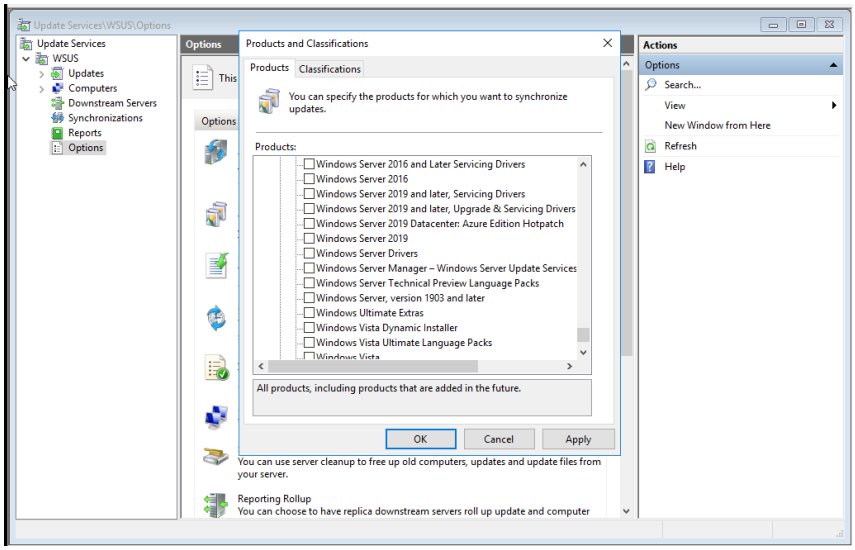



*Figure 71 – WSUS wizard for selecting the supported products*

- Under Classifications, select Security Updates only. Click Next.

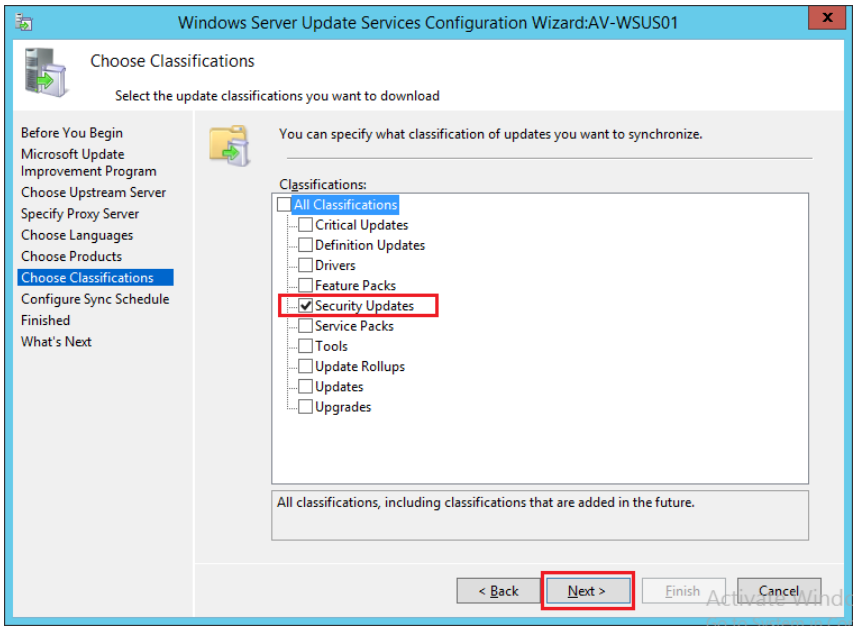



*Figure 72 – WSUS wizard for selecting the Updates*

- To configure Sync Schedule, select Synchronize automatically and set the time of First Synchronization and frequency of synchronization. Click Next.

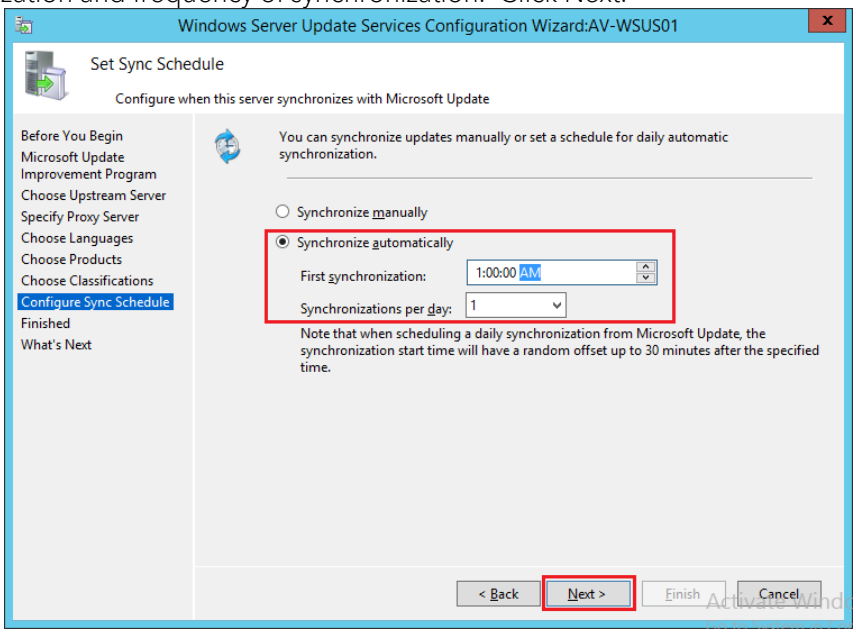



*Figure 73 – WSUS wizard for configuring the server synchronization*

- Select Begin initial synchronization. Click Next.

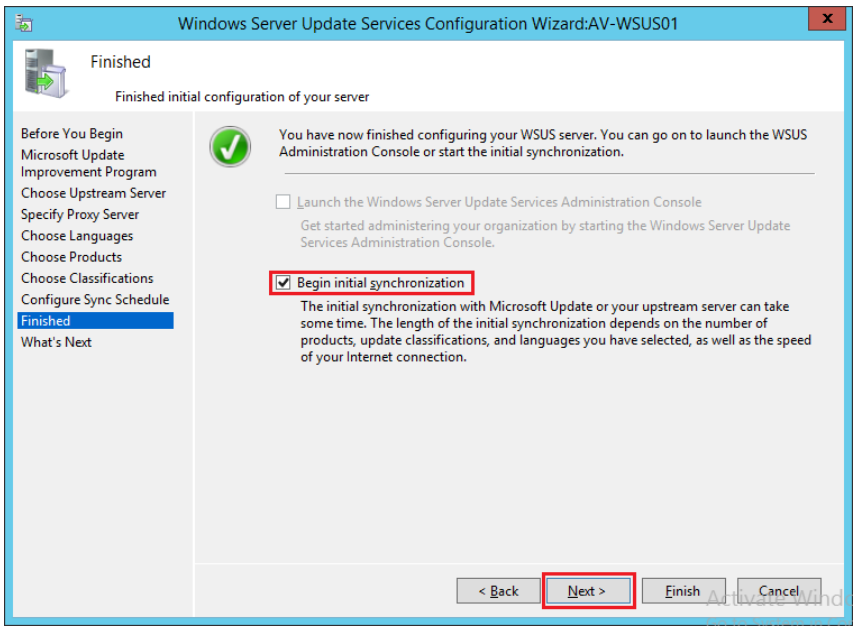



*Figure 74 – WSUS Configuration Wizard showing the initial synchronization*

- Click Finish. A manual synchronization should appear under Synchronizations.

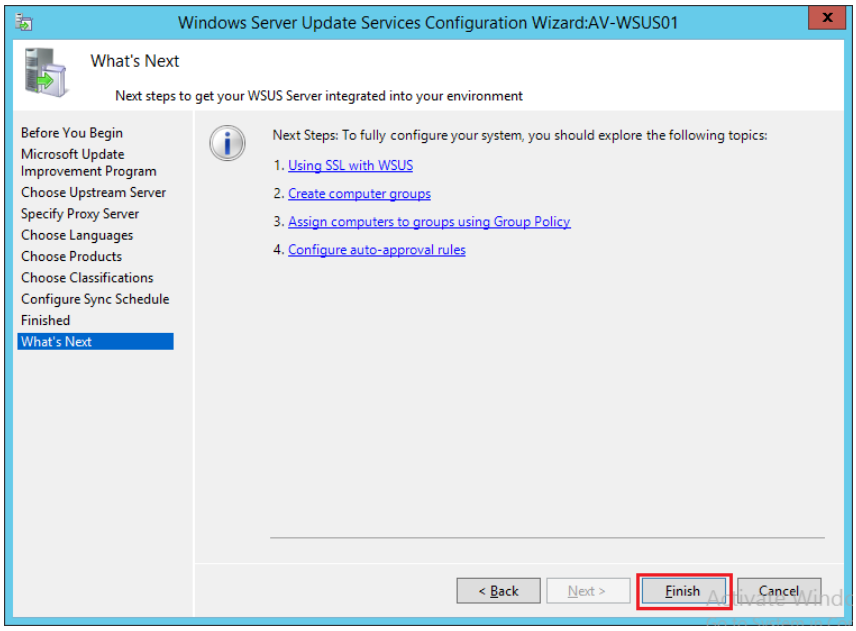



*Figure 75 – WSUS Configuration wizard*

## Synchronization

- To execute a manual synchronization, go to Synchronizations, click Synchronize Now on the Actions Pane on the right

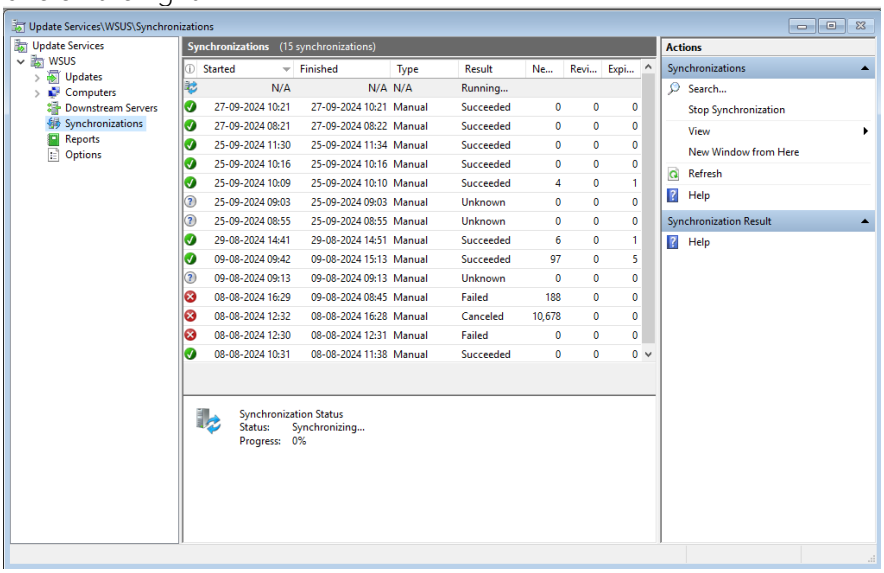



*Figure 76 – Initial synchronization status*

- A summary of the synchronization will appear on the same window.

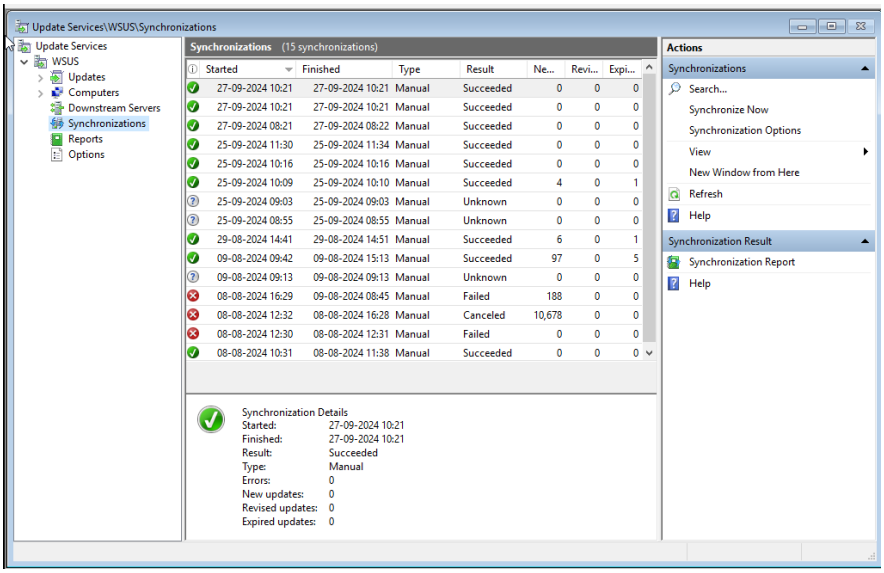



*Figure 77 – Synchronization Summary*

- Under Updates, a dashboard type of overview of updates is shown.

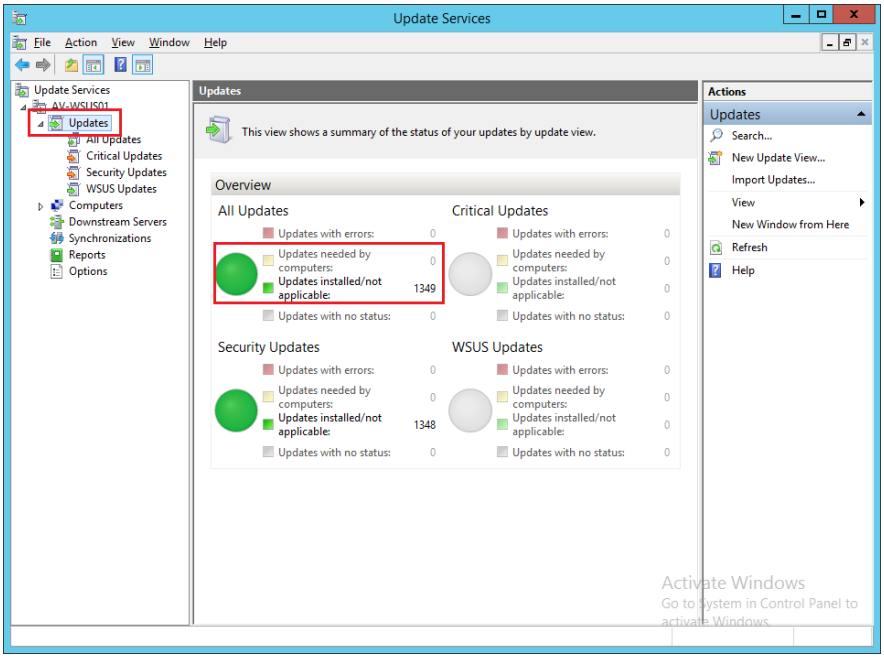



*Figure 78 – Summary of the status of updates*

## Groups and Membership Creation

- To create a group, go to All Computers and click on Add Computer Group on the Actions Pane on the right.

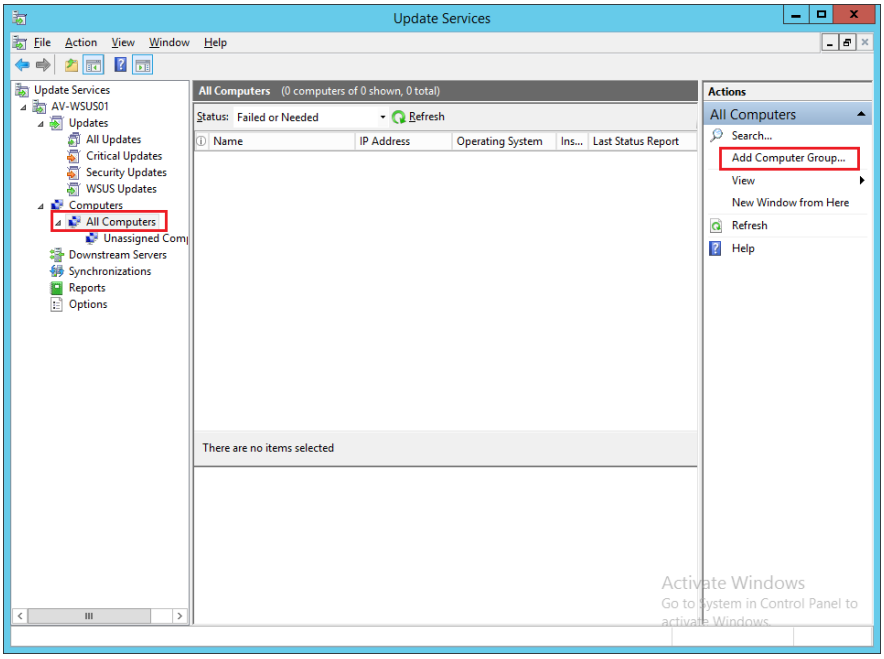



*Figure 79 – Creation of group and computers*

- Type in the desired group name on the field Name and click Add

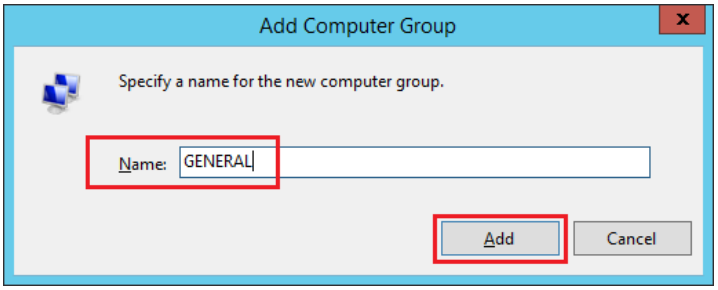



*Figure 80 – Specifying Name to a group*

Refer Cyber Security Settings Document for more details

# 8 EMCS INSTALLATION, OPERATION AND MAINTENANCE

## 8.1 INTRODUCTION

The core of EMCS is built with industrial computers and IO modules:

- 2 SEL-RTAC 3555: redundant computers where the main control logic is executed.
- 2 SEL-Axion 2240: redundant computers mainly used to acquire hardwired signals and to communicate with IE 61850 devices. The Axion is provided with a set of DI/DO modules.

For the position of these computers inside the BLPH network infrastructure, please refer to the System Architecture document (1724000594-IN-DD-00015).

### 8.1.1 SEL-RTAC 3555

The SEL-3555 Real-Time Automation Controller (RTAC) is a high-performance industrial automation device designed by Schweitzer Engineering Laboratories (SEL). It serves as a powerful programmable logic controller (PLC) and substation automation platform, integrating protection, control, and communication functions for power systems and industrial applications.

Key Features:

- High-Speed Processing: Advanced multi-core processing for fast and reliable control logic execution.
- Secure Communications: Supports multiple protocols (IEC 61850, DNP3, Modbus, etc.) with encryption and authentication for cybersecurity.
- Flexible I/O and Expansion: Interfaces with a wide range of field devices, sensors, and relays.
- SCADA and HMI Integration: Acts as a data concentrator, supporting real-time monitoring and automation.
- Industrial-Grade Reliability: Designed for harsh environments, with ruggedized hardware and redundant power supply options.
- Programming and Configuration: Uses ACSELERATOR RTAC® SEL-5033 software for easy setup, logic development, and maintenance.

The SEL-3555 RTAC is ideal for applications such as substation automation, microgrid control, renewable energy integration, and industrial process automation.

For detailed information about the RTAC 3555, please refer to the manufacturer documentations:

- 3555_IS-GettingStarted_20180727.pdf
- 3555_RTAC_PF00343.pdf
- 3555-2_DS_20241218.pdf

For a full list of the document please visit https://selinc.com/products/3555/docs/.

### 8.1.2 SEL-Axion 2240

The SEL-2240 is a combination of compact RTAC (SEL-RTAC 2241) and IO Module used in industrial and utility automation applications. It serves as a remote I/O module that seamlessly integrates with SEL's RTAC family, including the SEL-3555, to expand I/O capabilities in power system automation and control systems.

Key Features:

- Distributed I/O Expansion: Provides additional digital and analog I/O for RTAC-based automation systems.
- Secure Communication: Supports IEC 61850, DNP3, Modbus over Ethernet or serial connections.
- Rugged Design: Built for harsh environments, with high immunity to electrical transients and extreme temperatures.
- Flexible Mounting Options: DIN rail or panel mounting for easy installation in substations, industrial plants, and renewable energy systems.
- Seamless Integration: Works as an extension of SEL-3555 or other RTAC controllers, enabling scalable automation solutions.

The SEL-2241 RTAC is ideal for substation automation, distributed energy resource (DER) control, and industrial process monitoring, where additional remote I/O is needed for real-time data acquisition and control.

For detailed information about the RTAC 3555, please refer to the manufacturer documentations:

- 2240_IM_20241217_20241217.pdf
- 2240_DS_20241025.pdf
- 2240_PF00274.pdf

For a full list of the document please visit https://selinc.com/products/2240/docs/.

The picture below shows the composability of the IO modules and how they are connected to the RTAC 2241 using a backplane.



*Figure 81- RTAC 2241 and IO Modules*

## 8.2 INSTALLATION

This chapter provides detailed guidelines for the proper installation of the SEL-3555 Real-Time Automation Controller (RTAC) and the SEL-2240 Axion. Following these instructions ensures optimal performance, safety, and longevity of the system.

### 8.2.1 Pre-Installation Requirements

Before proceeding with the installation, ensure the following:

Site Requirements

- Environmental Conditions:
  - Operating temperature: **−40°C to +75°C**
  - Humidity: **0–95% non-condensing**
  - Protection against **dust, moisture, and electromagnetic interference (EMI)**
- Mounting Location:
  - Securely fasten on a **control panel**, **relay rack**, or **DIN rail**
  - Ensure proper **ventilation** to prevent overheating
- Power Supply:

- Input voltage range: **125/250 VDC or 120/240 VAC**
- Adequate grounding and protection against **power surges**

**Required Tools & Equipment**

- **Screwdrivers** (flathead and Phillips)
- **Multimeter** (for voltage and continuity checks)
- **Crimping tools** (for cable termination)
- **Shielded twisted-pair cables** (for communication connections)
- **Ethernet cables** (for network setup)
- **Personal protective equipment (PPE)**

**Safety Precautions**

- Disconnect power before installation.
- Follow lockout/tagout (LOTO) procedures.
- Ensure proper electrostatic discharge (ESD) protection.

### 8.2.2 SEL-3555 RTAC Installation

The **SEL-3555 RTAC** can be installed using either **panel mounting** or **DIN rail mounting**.

**Panel Mounting**

1. Align the SEL-3555 with the designated mounting holes.
2. Secure the unit using M4 or #8 screws.
3. Verify the unit is firmly attached to prevent vibration damage.

**DIN Rail Mounting**

1. Attach the DIN rail clips to the RTAC's backplate.
2. Clip the unit onto the 35mm DIN rail.
3. Ensure the RTAC is securely fastened and does not move.

**Power Supply Connections**

- Use appropriately rated cables and connect to the power terminals.
- Verify polarity when using DC power:
  - + Terminal → Positive
  - − Terminal → Negative
- For AC power, ensure proper phase and neutral connections.
- Connect the protective earth (PE) to a proper grounding point.

### Communication Interfaces

The SEL-3555 RTAC supports multiple communication protocols, including:

- Ethernet (RJ-45)
- Serial (RS-232, RS-485)

### Ethernet Connection

1. Connect CAT5e or CAT6 cables to the RJ-45 Ethernet ports.
2. Ensure proper IP configuration via ACSELERATOR RTAC® SEL-5033.

### Serial Connection

1. Connect RS-232 or RS-485 cables to the DB-9 or terminal block.
2. Set the correct baud rate and parity settings.

## 8.2.3 SEL-2240 Axion Installation

The Axion system consists of a backplane chassis, power supply module, RTAC processor module, and I/O modules. It can be installed using a panel mounting:

1. Position the Axion chassis on the mounting surface.
2. Secure the unit using M6 or #10 screws through the mounting holes.
3. Ensure the chassis is firmly attached to prevent vibration-related failures.

### Power Supply Connections

The SEL-2240 Axion supports multiple power supply options:

- 24–48 VDC
- 110–250 VDC / 120–240 VAC

Steps for Power Connection:

1. Connect the positive (+) and negative (−) terminals of the DC power source.
2. For AC power, connect L (Line) and N (Neutral) terminals correctly.
3. Securely fasten the protective earth (PE) ground connection.
4. Verify power input voltage and polarity using a multimeter before energizing.

### Communication Interfaces

The Axion RTAC module provides multiple communication ports:

- Ethernet Ports (for SCADA, RTU, or RTAC integration)
- Serial Ports (RS-232, RS-485) for legacy device communication

### Ethernet Connection (RJ-45 Ports)

1. Use CAT5e or CAT6 cables for Ethernet connectivity.
2. Connect the Ethernet cable to the LAN/WAN ports on the RTAC module.
3. Configure IP settings via ACSELERATOR RTAC SEL-5033 software.

### Serial Connection (RS-232/RS-485 Ports)

1. Connect the serial cable to the DB-9 or terminal block.
2. Set the correct baud rate, parity, and stop bits.
3. Use RS-485 termination resistors if required.

### I/O Module Wiring

The SEL-2240 Axion supports modular I/O expansion, with digital and analog I/O modules.

### Digital I/O Wiring (DI/DO Modules)

- Use shielded cables to minimize electrical noise.
- Connect dry contact inputs or relay outputs as per system requirements.
- Verify voltage levels (12V, 24V, 125V DC/AC) before connection.

### Analog I/O Wiring (AI/AO Modules)

- Use twisted-pair cables for 4-20mA or 0-10V signals.
- Ensure proper calibration before connecting to field devices.

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## 8.3 OPERATION

This chapter describes the operation, functionality, and management of the SEL-3555 Real-Time Automation Controller (RTAC) and the SEL-2240 Axion, including system startup, user interface navigation, communication setup, control logic execution, and troubleshooting.

### 8.3.1 Powering Up the System

1. Ensure all power supply connections are secure.
2. Apply power to the RTAC and Axion modules.
3. Observe the LED indicators to confirm normal operation.

| LED Indicator | Status | Meaning |
|---|---|---|
| Power LED | Solid Green | Normal operation |
| Status LED | Flashing Green | Device booting up |
| Status LED | Solid Red | System error (check logs) |
| Ethernet LED | Blinking Green | Active network communication |

4. If error LEDs are illuminated, refer to troubleshooting (Section 5.7).
5. Verify network connectivity via ping test or ACSELERATOR RTAC software.

### 8.3.2 Web User Interface Navigation

The SEL-3555 RTAC and Axion RTAC module provide a web-based user interface for configuration and monitoring.

Steps to Access Web Interface:

1. Open a web browser (Chrome, Edge, or Firefox).
2. Enter the RTAC's URL address (https://<IP-Address>).
3. Log in using administrator credentials.
4. Navigate through the menus:
    - Status Dashboard: Displays real-time system status.
    - Network Interfaces: To configure the ethernet interfaces
    - Network Utilities: To test network connectivity toward field devices (Ping, TCP Port Check)
    - Communication Diagnostics: Monitor Ethernet and serial connections.
    - Security Settings: Configure user access control and encryption.

### 8.3.3 ACSELERATOR RTAC Software

For advanced configuration and logic development, use ACSELERATOR RTAC SEL-5033:

1. Open ACSELERATOR RTAC on a PC.
2. Connect via USB, serial, or Ethernet.
3. Import or create a project file.
4. Use the Logic Editor to develop control logic.
5. Upload and validate the configuration.

For details about the AcSELelerator RTAC Software please refer to the **SEL-5033 Manual.pdf** manufacturer document.

### 8.3.4 Troubleshooting

| Issue | Possible Cause | Solution |
|---|---|---|
| **No Power** | Faulty power supply | Check voltage, replace power source |
| **No Network Communication** | IP conflict, firewall block | Verify IP settings, disable firewall |
| **RTAC Not Responding** | Overloaded CPU/memory | Restart device, check CPU usage |
| **I/O Module Not Detecting Inputs** | Loose wiring, incorrect addressing | Recheck wiring, verify I/O configuration |
| **Serial Port Not Communicating** | Incorrect baud rate, bad cable | Adjust baud rate, replace cable |

### 8.3.5 Redundancy

The system is configured in a Master/Slave redundancy mode at both the RTAC 3555 and Axion levels, ensuring fault tolerance even if one RTAC 3555 and one Axion module fail (or are powered down) simultaneously.

### 8.3.6 System Shutdown & Restart

#### 8.3.6.1 Safe Shutdown Procedure

1. Save all configuration changes.
2. Disable network connections if necessary.
3. Power down Axion I/O modules first.
4. Power down the **RTAC last**.

#### 8.3.6.2 Restart Procedure

1. Power on the **RTAC first**.
2. Power on Axion **I/O modules** sequentially.
3. Verify all **LED indicators** for proper startup.
4. Test communication and system performance.

## 8.4 MAINTENANCE

Regular maintenance ensures reliable operation, longevity, and optimal performance of the SEL-3555 RTAC and SEL-2240 Axion. This chapter provides guidelines for preventive maintenance, firmware updates, diagnostics, troubleshooting, and corrective actions.

### 8.4.1 General Maintenance Guidelines

To maintain the RTAC 3555 and Axion 2240 in optimal condition:

- Schedule routine inspections every 3 to 6 months.
- Keep firmware and software updated to ensure security and performance enhancements.
- Monitor system logs for early detection of issues.
- Maintain proper ventilation to prevent overheating.
- Regularly verify communication links and I/O module integrity.
- Follow cybersecurity best practices to prevent unauthorized access.

### 8.4.2 Preventive Maintenance

#### 8.4.2.1 Visual Inspection

Regularly inspect both the RTAC 3555 and Axion 2240 for:

- Loose cables and connectors
- Signs of overheating, corrosion, or dust accumulation
- LED status indicators to detect warnings or errors
- Proper grounding to avoid electrical faults

Action Steps:

- ☐ Tighten any loose connections.
- ☐ Clean the ventilation openings to ensure proper airflow.
- ☐ Replace any damaged cables immediately.

#### 8.4.2.2 Cleaning and Environmental Maintenance

- Dust and debris can cause overheating and affect device performance.
- Use compressed air or a soft brush to clean around the vents and ports.
- Ensure the ambient temperature remains within the operational range:
  - RTAC 3555: −40°C to +75°C
  - Axion 2240: −40°C to +75°C
- Verify that humidity levels do not exceed 95% (non-condensing).

**Warning:** Do **not** use liquid cleaners or solvents directly on the devices.

### 8.4.3 Firmware and Software Updates

Keeping the firmware and software up to date is crucial for security, performance, and compatibility with new features.

#### 8.4.3.1 Checking Firmware Version

1. Access the RTAC/Axion Web Interface.
2. Navigate to System > Device Information.
3. Note the current firmware version and compare it with the latest version from Schweitzer Engineering Laboratories (SEL).

#### 8.4.3.2 Updating Firmware

1. Download the latest firmware from SEL's official website.
2. Open ACSELERATOR RTAC SEL-5033 and connect to the device.
3. Navigate to Firmware Update in the settings menu.
4. Upload the new firmware file and initiate the update process.
5. Restart the device after the update completes.

**Important:** Always back up configuration settings before updating firmware.

### 8.4.4 System Diagnostics and Health Monitoring

Regular system diagnostics help detect potential failures before they lead to major disruptions.

#### 8.4.4.1 Monitoring System Performance

Use the RTAC Web Interface or ACSELERATOR RTAC to monitor:

- ☐ CPU usage and memory utilization
- ☐ Network traffic and latency
- ☐ Error logs and event history

#### 8.4.4.2 Checking I/O Module Status

1. Open the RTAC Web Interface.
2. Go to I/O Monitoring.
3. Check for non-responsive modules or unexpected input/output states.
4. If a module is unresponsive, reseat it and verify connections.

### 8.4.5 Troubleshooting and Corrective Actions

#### 8.4.5.1 Common Issues and Solutions

| Issue | Possible Cause | Solution |
|---|---|---|
| RTAC not powering on | Power supply failure | Check input voltage and replace power source if needed |
| Intermittent communication loss | Loose cables or network congestion | Reconnect cables and check network load |
| I/O module not responding | Faulty module or incorrect wiring | Verify wiring, reseat module, or replace if necessary |
| Slow system performance | High CPU load or memory usage | Restart device, optimize logic execution |
| Unexpected relay operations | Incorrect logic configuration | Review and correct control logic |

#### 8.4.5.2 Resetting the System

If troubleshooting steps do not resolve the issue, a system reset may be necessary.

**Soft Reset (Recommended First Step)**

1. Open ACSELERATOR RTAC or the Web Interface.
2. Navigate to System > Restart.
3. Confirm the reset.

**Hard Reset (If Necessary)**

1. Power off the device.
2. Disconnect it from the power source for 30 seconds.
3. Reconnect and power on the device.

**Caution:** A **hard reset** may clear some configurations. Always back up settings before performing this action.

### 8.4.6 Backup and Restore Procedures

#### 8.4.6.1 Backing Up Configurations

1. Open **ACSELERATOR RTAC** with a normal PC.
2. Press the Read button.
3. Connect to the RTAC (3555 or 2241). The current online project is stored in the local database
4. Select the saved project, press the right mouse button and select the **Export** item.
5. Save the exported project folder in a secure location.

#### 8.4.6.2 Restoring Configurations

1. Open **ACSELERATOR RTAC**.
2. Load the project folder inside the local database
3. Open the project
4. Push the project by pressing the **Go Online** button
5. Connect to the RTAC (3555 or 2241). The project is uploaded to the PLC.
6. The device restarts automatically with the new loaded project.

## 8.5 SEL DOCUMENTATION REFERENCE

The following table contains the link to download the documentation referenced in this document:

| Document Name | URL |
|---|---|
| 3555_IS-GettingStarted_20180727.pdf | https://selinc.com/api/download/107768/ |
| 3555_RTAC_PF00343.pdf | https://selinc.com/api/download/107948/ |
| 3555-2_DS_20241218.pdf | https://selinc.com/api/download/126001/ |
| 2240_DS_20241025.pdf | https://selinc.com/api/download/10595/ |
| 2240_IM_20241217_20241217.pdf | https://selinc.com/api/download/97906/ |
| 2240_PF00274.pdf | https://selinc.com/api/download/97809/ |
| SEL-5033 Manual.pdf | https://selinc.com/api/download/101452/ |

# Technical Information

CENTUM VP
Installation Guidance

TI 33J01J10-01EN

*[Release 6]*

YOKOGAWA

Yokogawa Electric Corporation
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# Introduction

**The CENTUM VP is a distributed control system (abbreviated as DCS) for small to large plants.**

**This manual describes the requirements for installation (control room size and power supply requirements), storage and transportation, and wiring.**

Chapter 1 System Installation Requirements

This chapter describes engineering specifications covering control room design/environment, power supply system, grounding and noise prevention. For power consumption specifications and list of consumable parts, see Chapter 4.

Chapter 2 Transportation, Storage and Installation

This chapter describes precautions in transit, unpacking and storage, such as humidity, temperature change, and how to install devices.

Chapter 3 Cabling

This chapter describes how to connect power, ground, signal and bus cables to the installed devices, and how to connect optical fiber cables.

Chapter 4 Installation Specifications

This chapter covers power consumption and power dissipation, in-rush current, fuse and breaker ratings, and parts that need replacement within 10 years. Read this section when deciding power supply capacity.

Chapter 5 Post-installation Inspection and Environmental Preservation

This chapter describes items that must be checked before applying power and the precautions to be taken to safeguard the environment after installing the system.

## Drawing Conventions

Some drawings may be partially emphasized, simplified, or omitted, for the convenience of description.

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# Safety Precautions

## Safety, Protection, and Modification of the Product

- In order to protect the system controlled by the product and the product itself and ensure safe operation, observe the safety precautions described in this Technical Information. We assume no liability for safety if users fail to observe these instructions when operating the product.
- If this product is used in a manner not specified in this Technical Information, the protection provided by this product may be impaired.
- If any protection or safety circuit is required for the system controlled by the product or for the product itself, prepare it separately.
- Be sure to use the spare parts approved by Yokogawa Electric Corporation (hereafter simply referred to as YOKOGAWA) when replacing parts or consumables.
- Do not use the accessories (Power supply cord set, etc.) that came with the product for any other products.
- Modification of the product is strictly prohibited.
- The following symbols are used in the product and instruction manual to indicate that there are precautions for safety:

| | |
|---|---|
| ⚠ | Indicates that caution is required. This symbol for the Product indicates the possibility of dangers such as electric shock on personnel and equipment, and also indicates that the user must refer to this Technical Information and the User's Manuals for necessary actions. In this Technical Information and the User's Manuals, this symbol is used together with a word "CAUTION" or "WARNING" at the locations where precautions for avoiding dangers are described. |
| | Indicates that caution is required for hot surface. Note that the devices with this symbol become hot. The risk of burn injury or some damages exists if the devices are touched or contacted. |
| ⏚ | Identifies a protective conductor terminal. Before using the Product, you must ground the protective conductor terminal to avoid electric shock. |
| ⏚ | Identifies a functional grounding terminal. A terminal marked "FG" also has the same function. This terminal is used for grounding other than protective grounding. Before using the Product, you must ground this terminal. |
| ~ | Indicates an AC supply. |
| ⎓ | Indicates a DC supply. |
| I | Indicates the ON state. The state of a power on/off switch and others is indicated. |
| ○ | Indicates the OFF state. The state of a power on/off switch and others is indicated. |

## Symbol Marks of Installation Guidance

Throughout this Technical Information, you will find several different types of symbols are used to identify different sections of text. This section describes these icons.



**WARNING**

Identifies important information required to understand operations or functions.



**CAUTION**

Identifies instructions that must be observed in order to avoid physical injury and electric shock or death to the operator.

**IMPORTANT**

Identifies important information required to understand operations or functions.

**TIP**

Identifies additional information.

**SEE ALSO**

Identifies a source to be referred to.

## Cautions for Safely Applying the Device

### Wiring Power Cable

**WARNING**

Connect the power cables according to the procedure in this document.
Power cables must conform to the safety standards of the country where the device is installed.

SEE ALSO For Wiring Power Cable, refer to 3.2, “Connecting Power.”

### Earth Wiring

**WARNING**

This equipment requires a protective grounding defined by the safety standard.
Ground the device following the procedure in this document to prevent from electric shock and to minimize the noise.

SEE ALSO For Earth Wiring, refer to 3.3, “Connecting Ground Cable.”

### Tightening Torque of Screws

**IMPORTANT**

The tightening torque that the Product recommends is showed in the following table. However, if the tightening torque of the screw is specified in the User’s Manuals, follow the instructions described in the User’s Manuals.

**Table Table of Recommended Tightening Torque**

| Nominal diameter of a screw | M2.6 | M3 | M3.5 | M4 | M5 | M6 | M8 | M10 |
|---|---|---|---|---|---|---|---|---|
| Recommended tightening torque (N•m) | 0.35 | 0.6 | 0.8 | 1.2 | 2.8 | 3.0 | 12.0 | 24.0 |

## Battery

**CAUTION**

- Must use Yokogawa designated batteries.
- Mounting and changing batteries must follow the procedure in the hardware instruction manual for each device.
- When changing batteries while the power supply is not shutdown, do not put hands inside of the device since it is danger of electric shock.

## Air Filter

**CAUTION**

Wash the air filters periodically (such as every three months). Use water and the neutral detergent to clean the filter then reuse it after drying.

- Follow the procedure in the hardware instruction manual for each device to exchange the air filter at the specified period.

**SEE ALSO** For Air Filter, refer to 4, “Installation Specification Parts Durability.”

## Fan Unit

**CAUTION**

When changing fan unit while the power supply is not shutdown, be careful not to touch other parts so as to avoid electric shock.

**SEE ALSO** For Fan Unit, refer to 4, “Installation Specification Parts Durability.”

## Wiring I/O Cables

**CAUTION**

Wiring I/O cables must follow the procedure in this document.

**SEE ALSO** For Wiring I/O Cables, refer to 3.5, “Connecting Signal Cable.”

## Connecting Devices

**IMPORTANT**

To ensure this system compliance with the CSA safety standards, all devices connected to this system shall be CSA certified devices.

## Power Distribution Board

**WARNING**

Exchanging the fuses must follow the procedure in the hardware instruction manual for each device since it has danger of electric shock.

- The fuses for exchange must be the Yokogawa designated fuses.
- Exchanging relay must follow the procedure in the hardware instruction manual for each device so as to avoid electric shock.

SEE ALSO For Power Distribution Board, refer to 3.4, “Power and Ground Cable.”

## Exchanging Relay

**CAUTION**

Exchanging relay must follow the procedure in the hardware instruction manual for each device so as to avoid electric shock.

## Exchanging Fuse

**WARNING**

- The fuses for exchange must be the Yokogawa designated fuses.
- Switch off the power supply before exchanging the fuses.

### Maintenance

**CAUTION**

- The maintenance work for the devices described in this manual should be performed only by the educated experts.
- When the device becomes dusty, use a vacuum cleaner or a soft cloth to clean it.
- During maintenance, put up wrist strap, and take other ESD (Electrostatic Discharge) measures.
- If the existing caution label is dirty and illegible, prepare a new label (part number:T9029BX) to replace it.

SEE ALSO For Maintenance, refer to 1.5.2, “Countermeasures against Static Electricity.”

# Trademark

## Trademark Acknowledgment

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# CENTUM VP
# Installation Guidance

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# 1. System Installation Requirements

**This section describes installation requirements such as environmental conditions, required space and layout considerations, power consumption, cabling and grounding.**

## 1.1 Control Room Design

**The control room, in which the system control equipment is to be installed, should be designed in accordance with the following conditions:**

### General

In designing a control room, ensure adequate floor strength and air conditioning including dust, and moisture-proofing.

SEE ALSO

- 1.1 Control Room Design — Air Conditioner
- 1.2 Control Room Environment — Air Purity
- Installation Environment Specifications

### Floor Strength and Space

The floor should have adequate strength, and you should design the layout in accordance with the weight and size of equipment to be installed.

SEE ALSO

- For the maintenance space required, refer to 2.4, “Servicing Area.”
- For the weight and dimensions of standard equipment, refer to “General Specification” (GS).

### Floor Structure

To prevent damage to cables by operators and maintenance equipment, do not lay cables on the floor.

Lay cables under the floor as follows:

- Provide an “accessible” floor which also facilitates maintenance work.
- Make cable pits under the floor if it is concrete.

### Flooding- & Dust-proof Floor

To protect equipment and cables, design a flooding-proof floor.

After the cabling is completed, seal all cable conduits using putty to prevent intrusion of dust, moisture, rats, and insects into the equipment.

## Clearance From The Wall and The Floor Surface

There are ventilation holes on the front and rear doors of the cabinets (AFV40S/AFV40D, ACB51, and A2CAB1). To ensure good air ventilation and easy maintenance, provide a clearance of at least 1000 mm (including the service areas) from the wall to the front and rear doors of the cabinets. Also make sure the height of the ceiling is at least 2400 mm from the floor.

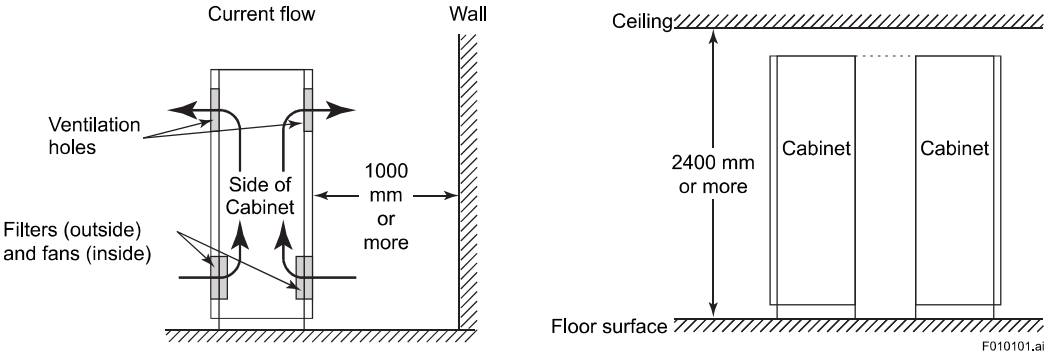



**Figure Wall Clearance and Ceiling Height**

## Illumination

The illumination level around a display unit should be 700 to 1500 lux (target illumination level: 1000 lux). The illumination level inside the control room should be reasonably uniform. Select proper light fixtures and install them in positions where they don't cause glare on the LCDs.

**TIP**

REFERENCE (Illumination standards):

| | |
|---|---|
| For ultra-precision work: | 1500 to 3000 lux (illumination level: 2000) |
| For precision work: | 700 to 1500 lux (illumination level: 1000) |
| For ordinary work: | 300 to 700 lux (illumination level: 500) |
| For non-detail work: | 150 to 300 lux (illumination level: 200) |
| Passages, warehouses: | 30 to 150 lux (illumination level: 50 to 100) |

(Source: JIS Z9110)

## Outlets for Maintenance

Outlets (approx. 1.5 kVA) for measurement devices should be provided near the installed equipment for maintenance.

## Telephone

Telephones should be installed for communications with related stations.

## Air Conditioner

The air conditioner should be operated following the conditions below to prevent dew condensing on the installed equipment:

- Keep the change of temperatures within ±10 °C/h.
- Install air conditioner away from equipment.
- Install substitute air conditioners to prevent dew condensing as a result of temperature rise or fall if an air conditioner fails.

## Windows

Close the windows of the control room. If a draft comes in around the windows, seal around the windows.

Opening the window while air conditioning is running may result in condensation forming, or let in dust or corrosive gas, adversely affecting the installed equipment. Windows on the sea side must be closed to keep out salt air.

Install blinds, if necessary, to prevent sunlight reflecting from LCDs.

## Side-by-Side Cabinet Installation

When cabinets are placed side by side, make sure of their ventilation system.

For cabinet ventilation system, we have air-cooling without blower and with blower. Moreover, either blast fan pressurization (door fan) or exhaust fan (ceiling fan) is used for air-cooling with blower.

As cabinets with the same ventilation system can be placed side by side, group them according to ventilation system and place them in the same group side by side with side board.

CENTUM VP, CENTUM CS 3000 and CENTUM CS cabinets get air from the bottom front and rear of the cabinet doors, and emit air from the top front and rear of the doors, using a “fan pressurization” system. On the other hand, CENTUM-XL cabinets get air from rear of the doors, and emit air from the top of the cabinets, using an “exhaust fan” system.

When cabinets with different ventilation systems are placed side by side, a special partition board (ETBP) must be placed between cabinets. For the board, please contact Yokogawa.

# 1.2 Control Room Environment

**This section describes environmental conditions of the control room to operate the system safely, and stably over a long period of time.**

**It is recommended that user have the control room environment assessment. Consult Yokogawa for the assessment if necessary.**

## Temperatures and Humidity

When equipment is brought from the place out of operational temperature range to the place in operational temperature range, bring it without a package, keep it within temperature change rate and avoid condensation. Keep ambient temperature within operational temperature range and leave it for more than three hours before starting operation.

Under normal operation, the rate of change of ambient temperatures should be within 10 °C/h. All the equipment should be kept out of direct sunlight.

**SEE ALSO** See “Table of Equipment Installation Specifications” in this section, for the temperatures and humidity limits for operating and storing this equipment.

## Condensation

Prevent condensation. If condensation occurs, or its trace is found on the control room equipment, contact Yokogawa.

**SEE ALSO** See “Section 2.3 Storage” for more information.

## Vibration

Vibration in the control room should be limited as follows:

- For vibration frequency up to 14 Hz: Limit displacement amplitude to 0.25 mm or less.
- For vibration frequency over 14 Hz: Limit acceleration to 2 $m/s^2$ or less.

The following is the relationship of the vibration frequency, displacement amplitude, and acceleration:

Acceleration ($m/s^2$) = $4\pi^2 \times A \times F^2 \times 10^{-3}$

A: Displacement amplitude (mm)
F: Frequency (Hz)

F010201.ai

The allowable range of displacement amplitude is shown below. Consult Yokogawa if complex vibrations are involved.

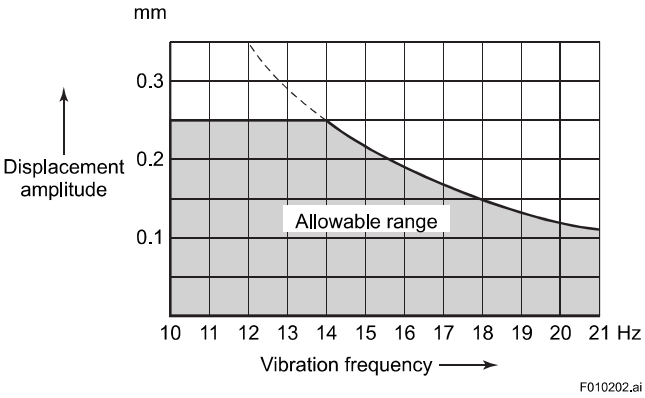



**Figure Range of Allowable Displacement Amplitude**

## Air Purity

The dust in the control room should be kept below 0.3 $mg/m^3$. Avoid corrosive gas such as hydrogen sulfide ($H_2S$), sulfur dioxide ($SO_2$), chlorine, and conductive dust such as iron powder and carbon.

The allowable content of $H_2S$, $SO_2$, or any other corrosive gas varies with temperatures, humidity, or existence of other corrosive gas. Consult Yokogawa if corrosive gas exists.

## Magnetic Field

Do not install a magnetic disk, or the like near cables with large current flowing or in the magnetic field of a power supply. If installed in such locations, the storage medium data may be corrupted by the magnetic fields.

## Electric field strength (Electric wave condition)

To ensure stable operation of the system equipment, use it with the door closed. Consider keeping the electric field strength at the installation location of the system equipment below the values listed below.

For N-IO nodes (excluding equipment for RIO system upgrades) (*1):

10 V/m or less (80 MHz to 1.0 GHz)
3 V/m or less (1.4 to 2.0 GHz)
1 V/m or less (2.0 to 2.7 GHz)

Other than above;

3 V/m or less (26 MHz to 1.0 GHz)
3 V/m or less (1.4 to 2.0 GHz)
1 V/m or less (2.0 to 2.7 GHz)

*1: For specifications of RIO system upgrades, please refer to GS 33J64E10-01EN.

Furthermore, the relationship between the transmission output of the wireless device, the distance from the system device, and the electric field strength is expressed by the following formula.

However, the value derived by this formula is a theoretical value under ideal conditions, so it may be worse under actual usage conditions. Also, this formula does not hold true when the device is close to the equipment, resulting in even worse electric field conditions, so please consider this value as a reference value only.

$$E=\frac{k\sqrt{P}}{d}$$

E: Electric field strength (V/m)
k: Electromagnetic wave propagation characteristic coefficient (7.0) (*1)
d: Distance (m)
P: Radiated power (W)

*1: Using the coefficient values from Annex E of IEC 61000-4-3:2020.

When using wireless devices with the door open for maintenance of system equipment, please be aware of the following points, as the system equipment may be affected by radio frequency interference from the wireless devices, potentially impacting its operation:

- Do not use wireless devices with a transmission power exceeding 1W, such as transceivers, in the vicinity of this equipment.
- When using wireless devices with a transmission output of 1W or less, such as mobile phone terminals, in the vicinity of this equipment, ensure a distance of at least 50cm from this equipment. If it is not possible to maintain a distance of 50cm or more, turn off the power of the wireless devices.

The following are guidelines for the transmission output of wireless devices. For other cases, please consult the manufacturer of the wireless device.

[Reference]

| Generation of Communication Method | Maximum Transmission Output |
|---|---|
| 5th Generation (5G) | 200 mW |
| 4th Generation (4G) | 200 mW |
| 3rd Generation (3G) | 250 mW |
| 2nd Generation (2G) (*1) | GSM 1800/1900MHz Band: 2 W<br>GSM 850/900MHz Band: 1 W<br>PDC: 800 mW<br>iDEN/MIRS: 600 mW<br>cdmaOne (IS-95): 200 mW |

*1: The maximum transmission output varies depending on the communication method.

## Installation Specification

Installation height: N-IO node (*1) (*2): Altitude of up to 3000 m (*3)
Other than N-IO node: Altitude of up to 2000 m

Installation category based on IEC 61010-1 (*4)

Category I

- For YOKOGAWA products, category I applies to the device that receives the electric power not more than 30 V AC, 60 V DC.

Category II

- For YOKOGAWA products, category II applies to the device that receives the electric power exceeding 30 V AC or 60 V DC.

Pollution degree based on IEC 61010-1: 2 (*5)

*1: For more information about specifications of device, refer to General Specification (GS).
*2: Except for equipment for RIO System Upgrade. For specification of RIO System Upgrade, refer to the GS 33J64E10-01EN.
*3: Up to 2000 m for A2BN4D and A2BN5D.
*4: The installation category, also referred to as an overvoltage category, defines the standard for impulse voltage. The category number from I to IV applies the devices to determine the clearance required by this standard.
Category I applies to the device intended to be connected to a power supply with impulse voltage reduced to the safe level.
Category II applies to the device intended to be supplied from the building wiring.
*5: Pollution degree indicates the adhesion level of foreign matter in a solid, liquid, or gaseous state that can reduce dielectric strength. Degree 2 refers to a pollution level equivalent to the general indoor environment.

**SEE ALSO** See “Installation Environment Specifications” at the end of this chapter.

## Measurement Categories

Regarding the measurement inputs, the following requirements must be satisfied to meet the specifications for the device:

The category of the equipment applies to O (Other) in the following table.

The rated transient overvoltage is 1500 V.

Note: Do not use the equipment for measurements within measurement categories II, III and IV.

**Table Measurement category**

| No. | Applicable Standard<br>EN IEC 61010-2-030<br>CAN/CSA-C22.2 No.61010-2-030 | Description |
|---|---|---|
| No.1 | O (Other) (*1) | Measuring circuits without a MEASUREMENT CATEGORY. |
| No.2 | Measurement category II | For measurements performed on circuits directly connected to the low voltage installation. |
| No.3 | Measurement category III | For measurements performed in the building installation. |
| No.4 | Measurement category IV | For measurements performed at the source of the low-voltage installation. |

*1: Measurement category I defined in IEC/EN 61010-1 and CAN/CSA-C22.2 No.61010-1 has been changed to “O (Other)” in EN IEC 61010-2-030 and CAN/CSA-C22.2 No.61010-2-030.

## Applied Standards

The CENTUM VP system complies with the standards shown below.

**IMPORTANT**

Different standards are applied according to the types of equipment. For details, refer to Integrated Production Control System CENTUM VP System Overview (GS 33J01A10-01EN).

### Safety Standards (*1) (*2) (*3)

[CSA]

CAN/CSA-C22.2 No.61010-1, CAN/CSA-C22.2 No.61010-2-030
CAN/CSA-C22.2 No.61010-2-201

[CE Marking] Low Voltage Directive

EN 61010-1, EN IEC 61010-2-201, EN IEC 61010-2-030
EN 60825-1

[EAC Marking]

CU TR 004

[Morocco Compliance Marking (C Marking) ] Low Voltage Directive

NM EN 61010 1
NM EN 61010 2 201
NM EN 61010 2 030
NM EN 60825 1

[UKCA Marking] Safety Regulation

EN 61010-1, EN IEC 61010-2-201, EN IEC 61010-2-030, EN 60825-1

*1: The ground suitable for the power distribution system in the country or region has to be used for protective grounding system.
*2: For the rack mountable devices, DIN rail mountable devices, and wall mountable devices to meet the Safety Standards and EMC Standards, the devices must be installed in a lockable metal cabinet. The cabinet must conform to IEC/EN/CSA 61010-2-201 or provide degrees of protection IP3X or above and IK09 or above.
*3: CENTUM measurement input corresponds to the measurement category O (Other) based on EN IEC 61010-2-030 and CAN/CSA-C 22.2 No. 61010-2-030. The measurement category I defined in IEC/EN 61010-1 and CAN/CSA-C 22.2 No. 61010-1 has been changed to O (Other).

## EMC Conformity Standards (*1) (*2) (*3)

[CE Marking] EMC Directive

EN 55011 Class A Group 1 (*4)
EN 61000-6-2
EN 61000-3-2 (*5)
EN 61000-3-3
EN 61326-1 (*6)

[RCM]

EN 55011 Class A Group 1 (*4)

[KC Marking]

Korea Electromagnetic Conformity Standard

[EAC Marking]

CU TR 020

[Morocco Compliance Marking (C$_{\text{M}}$ Marking) ] EMC Directive

NM EN 55011 Class A Group 1 (*4)
NM EN 61000 6 2
NM EN 61000 3 2 (*5)
NM EN 61000 3 3

[UKCA Marking] EMC Regulation

EN 55011 Class A Group 1 (*4)
EN 61000-6-2
EN 61000-3-2 (*5)
EN 61000-3-3
EN 61326-1 (*6)

*1: For the rack mountable devices, DIN rail mountable devices, and wall mountable devices to meet the Safety Standards and EMC Standards, the devices must be installed in a lockable metal cabinet. The cabinet must conform to IEC/EN/CSA 61010-2-201 or provide degrees of protection IP3X or above and IK09 or above.
*2: A lightening arrester or the like is required to meet this surge immunity standard except for A2ZN3D, A2ZN4DC, and A2ZN5DC. The length of the cable to feed the external power supply for AGS813 AO channels should not exceed 30 meters.
*3: To the field power supply input connector of the base plate for adaptor A2BN3D and the barrier power supply input connector of the base plates for barrier A2BN4D and A2BN5D, power must not be supplied directly from a DC distribution network.
*4: A Class A hardware device is designed for use in the industrial environment. Please use this device in the industrial environment only.
*5: An external device such as a power unit with harmonic current neutralizer and an active harmonics conditioner must be connected to meet this harmonic current emission standard. See Section 1.3 “Power Supply System”.
*6: The base plate for barrier A2BN5D conforms to EN 61326-1. If A2BN5D is used with intrinsic safety barriers for analog input, analog output, or temperature input mounted, the accuracy under the electromagnetic immunity conditions (acceptance criteria A) is within ±1 % of the span.

## Standards for Hazardous Location Equipment

[Nonincendive]

[Ex “ec”]

[Type i (Intrinsic Safety)]

**SEE ALSO** For more information about Standard for Hazardous Locations, refer to TI 33Q01J30-01E “Explosion Protection”

## Marine Standards

For more infomation about the marine standards, refer to 1.8, “Compliance with Marine Standards.”

ABS (American Bureau of Shipping)

BV (Bureau Veritas)

LR (Lloyd’s Register)

DNV

## Installation Environment Specifications

The following table lists environmental requirements for the installation of the CENTUM VP system:

For environmental requirements for devices including PC and UPS, refer to their environmental specifications.

**SEE ALSO** For details, refer to the hardware general specifications (GS) for each equipment.

**Table Equipment Installation Specifications (1/2)**

| Item | | Specifications (except for FIO Node Unit, Optical ESB Bus Repeater Unit, AEP7D, AEP9D, AEPV7D, N-IO node) (*1) | Specifications (FIO Node Unit, Optical ESB Bus Repeater Unit, AEP7D, AEP9D, AEPV7D) (*1) | Specifications (N-IO node) (*2) | Remarks |
|---|---|---|---|---|---|
| **Temperature** | Normal operation | 0 to 50°C | 0 to 60°C (Temperature option: -20 to 70°C) (*3) | 0 to 60°C (Temperature option: -40 to 70°C) (*5) (*6) | Avoid direct sunlight. |
| | Transportation | -20 to 60°C | -20 to 60°C (Temperature option: -40 to 85°C) (*4) | -20 to 60°C (Temperature option: -40 to 85°C) (*6) | Avoid direct sunlight. |
| **Humidity** | Normal operation | 10 to 90% RH (In case of FIO / 5 to 95 %RH) | 5 to 95% RH | 5 to 95% RH | No condensation |
| | Transportation | 10 to 90% RH (In case of FIO / 5 to 95 %RH) | 5 to 95% RH | 5 to 95% RH | No condensation |
| **Temperature fluctuation** | Normal operation | Within ±10°C/h | Within ±10°C/h | Within ±10°C/h | – |
| | Transportation | Within ±20°C/h | Within ±20°C/h | Within ±20°C/h | – |
| **Power source** | Voltage range | 100-120 V AC ±10%<br>220-240 V AC ±10%<br>24 V DC ±10% (including ripple) | 100-120 V AC ±10%<br>220-240 V AC ±10%<br>24 V DC ±10 % (including ripple) | 100-120 V AC -15% +10%<br>220-240 V AC -15% +10%<br>24 V DC -15% +20% (*7) | – |
| | Frequency | 50/60 ±3 Hz | 50/60 ±3 Hz | 50/60 ±3 Hz | – |
| | Distortion factor | 10% or less | 10% or less | 10% or less | – |
| | Peak value | 125 V or larger (for 100-120 V AC)<br>274 V or larger (for 220-240 V AC) | 125 V or larger (for 100-120 V AC)<br>274 V or larger (for 220-240 V AC) | 118 V or larger (for 100-120 V AC)<br>258 V or larger (for 220-240 V AC) | – |
| | Momentary failure | 20 ms or less (for 100-120/220-240 V AC) | 20 ms or less (for 100-120/220-240 V AC) | 20 ms or less (for 100-120/220-240 V AC) | With rated voltage supplied |
| | Withstanding voltage | 1500 V AC for 1 minute (for 100-120/220-240 V AC)<br>500 V AC for 1 minuite (for 24 V DC) | 1500 V AC for 1 minute (for 100-120/220-240 V AC)<br>500 V AC for 1 minuite (for 24 V DC) | 1500 V AC for 1 minute (for 100-120/220-240 V AC)<br>42 V DC cobtubyiys<br>500 V AC for 1 minuite (for 24 V DC) | Between power and grounding terminals |

*1: FIO Node Unit and Optical ESB Bus Repeater Unit mean ANB10□, ANB11□, ANT10U, and units constructed with Base Plate A2BE2D.
*2: Except for equipment for RIO System Upgrade. For specification of RIO System Upgrade, refer to the GS 33J64E10-01EN.
*3: When an AAP149, AAP849, ADV161, ADV561, ADV859, ADV159, ADV559, ADV869, ADV169, ADV569, ALR111, ALR121-□□0, ALR121-□□1, ALE111-□□0, ALE111-□□1, ALF111, ALP121, A2LP131, and A2LP141 is installed, the ambient temperature should range from 0 to 50°C.
*4: When use at -20 to 70°C, the installation environment must be within the temperature specification range of the communication module and power supply module to be incorporated.
*5: For A2BN4D, use within the range of -20 to 60°C.
For A2BN5D, the maximum ambient temperature specifications depend on style code and compliance criteria.
For details, refer to GS 33J01A10-01EN "Integrated Production Control System CENTUM VP System Overview".
*6: To use A2BN4D or A2BN5D at -20 to 0°C, specify the temperature environment support option for the I/O modules to be mounted. The environment in which A2BN4D or A2BN5D is used depends on the specifications of the barrier mounting to A2BN4D or A2BN5D.
To use A2BN3D with the temperature environment support option (at -40 to 70°C), specify the temperature environment option for the I/O modules and I/O adaptor as well. For the cable connector connection of Base plate for analog digital I/O (A2BN3D-□9), the normal operation temperature is -20 to 70°C depend on the temperature specification of the dedicated cable.
To maintain A2NN30D with the temperature environment support option (at -40 to 70°C), specify the temperature environment support option for the power supply units and N-ESB bus modules as well.
*7: For A2BN3D, 24 V DC ±10%. For A2BN4D and A2BN5D, 24 V DC −14% +10%.

**Table Equipment Installation Specifications (2/2)**

| Item | | Specifications (except for FIO Node Unit, Optical ESB Bus Repeater Unit, AEP7D, AEP9D, AEPV7D, N-IO node) (*1) | Specifications (FIO Node Unit, Optical ESB Bus Repeater Unit, AEP7D, AEP9D, AEPV7D) (*1) | Specifications (N-IO node) (*2) | Remarks |
|---|---|---|---|---|---|
| **Power source** | Insulation resistance | 20 Mohms at 500 V DC | 20 Mohms at 500 V DC | 20 Mohms at 500 V DC | Between power and grounding terminals |
| **Grounding** | | Apply the grounding system which is defined by the rules and standards of the country or the region. | Apply the grounding system which is defined by the rules and standards of the country or the region. | Apply the grounding system which is defined by the rules and standards of the country or the region. | – |
| **Noise (*9)** | Electric field | 3 V/m or less (26 MHz to 1.0 GHz)<br>3 V/m or less (1.4 to 2.0 GHz)<br>1 V/m or less (2.0 to 2.7 GHz) | 3 V/m or less (26 MHz to 1.0 GHz)<br>3 V/m or less (1.4 to 2.0 GHz)<br>1 V/m or less (2.0 to 2.7 GHz) | 10 V/m or less (80 MHz to 1.0 GHz)<br>3 V/m or less (1.4 to 2.0 GHz)<br>1 V/m or less (2.0 to 2.7 GHz) | – |
| | Magnetic field | 30 A/m or less (AC)<br>400 A/m or less (DC) | 30 A/m or less (AC)<br>400 A/m or less (DC) | 30 A/m or less (AC)<br>400 A/m or less (DC) | Earth magnetism not included in DC magnetic field |
| | Static electricity | 4 kV or less (direct discharge)<br>8 kV or less (aerial discharge) | 4 kV or less (direct discharge)<br>8 kV or less (aerial discharge) | 4 kV or less (direct discharge)<br>8 kV or less (aerial discharge) | In accordance with IEC 61000-4-2 |
| **Vibration** | Vibration | Displacement amplitude: 0.25 mm or less (1 to 14 Hz)<br>Acceleration: 2.0 $m/s^2$ or less (14 to 100 Hz) | Displacement amplitude: 0.25 mm or less (1 to 14 Hz)<br>Acceleration: 2.0 $m/s^2$ or less (14 to 100 Hz) | Continuous tremor amplitude: 1.75 mm or less (5 to 8.4 Hz)<br>Acceleration: 4.9 $m/s^2$ or less (8.4 to 150 Hz)<br><br>Discontinuous vibration amplitude: 3.5 mm or less (5 to 8.4 Hz)<br>Acceleration: 9.8 $m/s^2$ or less (8.4 to 150 Hz) | |
| | Quake resistance | 4.9 $m/s^2$ or less | 4.9 $m/s^2$ or less | 4.9 $m/s^2$ or less | |
| | Vibration during transportation | For cabinets:<br>Horizontal: 2.9 $m/s^2$ or less<br>Vertical: 4.9 $m/s^2$ or less<br>For others:<br>Horizontal: 4.9 $m/s^2$ or less<br>Vertical: 9.8 $m/s^2$ or less | Horizontal: 4.9 $m/s^2$ or less<br>Vertical: 9.8 $m/s^2$ or less | Horizontal: 4.9 $m/s^2$ or less<br>Vertical: 9.8 $m/s^2$ or less | In packed condition |
| **Impact** | Transportation impact | Horizontal: 49 $m/s^2$ or less<br>Vertical: 98 $m/s^2$ or less | Horizontal: 49 $m/s^2$ or less<br>Vertical: 98 $m/s^2$ or less | 147 $m/s^2$ or less, 11 ms | In packed condition |
| **Dust** | | 0.3 $mg/m^3$ or less | 0.3 $mg/m^3$ or less | 0.3 $mg/m^3$ or less | – |
| **Corrosive gas** | | ISA S71.04.G2 (ISA G3 option: ISA S71.04. G3) | ISA S71.04 G2 (ISA G3 option: ISA S71.04 G3) | ISA S71.04 G2 (ISA G3 option: ISA S71.04 G3) | – |
| **Altitude** | | 2000 m or less | 2000 m or less | 3000 m or less (*8) | |

*1: FIO Node Unit and Optical ESB Bus Repeater Unit mean ANB10□, ANB11□, ANT10U, and units constructed with Base Plate A2BE2D.
*2: Except for equipment for RIO System Upgrade. For specification of RIO System Upgrade, refer to the GS 33J64E10-01EN.
*8: When the Node Interface Unit (A2NN30D) with the following optical ESB bus specifications is used at an altitude of 2000 m or higher, the ambient temperature range is -40 to 60°C.
A2NN30D- □□□□□ 01 □□ A2NN30D- □□□□□ 02 □□ A2NN30D- □□□□□ 10 □□
A2NN30D- □□□□□ 11 □□ A2NN30D- □□□□□ 12 □□ A2NN30D- □□□□□ 20 □□
A2NN30D- □□□□□ 21 □□ A2NN30D- □□□□□ 22 □□
*9: The devices must be installed in a metal cabinet.

**SEE ALSO** For the level of corrosive gases permitted in an ordinary office, refer to “Guidelines for Installation Environment” (TI 33Q01J20-01E).

# 1.3 Power Supply System

**To stable system operation, the following conditions should be met:**

- **Voltage and frequency fluctuations are within the limits specified for each system component.**
- **Relationship between the waveform's effective values and peak value is within the specified range.**
- **High-frequency noise is not at a level that affects system operation.**
- **Use an UPS (uninterruptible power supply) if necessary.**

## AC Power Specification

AC power used for the system must satisfied rated voltage and the peak value must be greater than the minimum specified (see below). DC power must satisfied 24 V DC at the power supply terminals.

**IMPORTANT**

If the power unit has high output impedance or high wiring impedance, the resulting voltage drop flattens the input voltage wave, forming a distorted waveform with a low peak value ("B" in the chart below).

Even if the effective value of the distorted input voltage wave is the same as that specified for a non-distorted input voltage wave, the voltage across the terminals of the smoothing capacitor in the power circuit may be so low that the system detects power failure. If input voltage waves A and B shown below, have the same effective value of 100 V AC, wave B will have a lower smoothing capacitor terminal voltage.

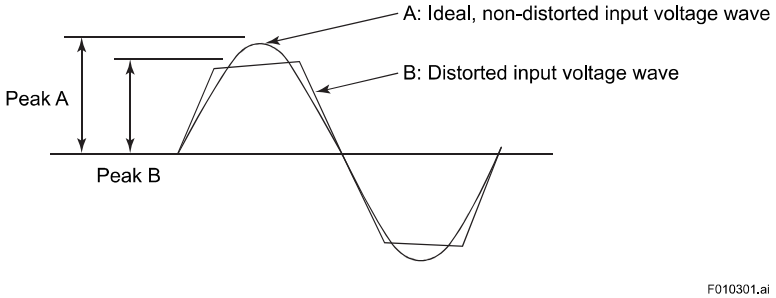



**Figure Distorted Input Voltage Waveform**

The system operating voltage range is shown below based on the relationship between effective and peak values at the power input terminal of each system. Apply AC power within these ranges to operate the system.

**TIP**

Average rectified measuring meters such as testers cannot measure effective values accurately. Use Yokogawa's WT series power meter or an meter, which enables effective values, peak values, and waveform distortion to be measured with one unit.

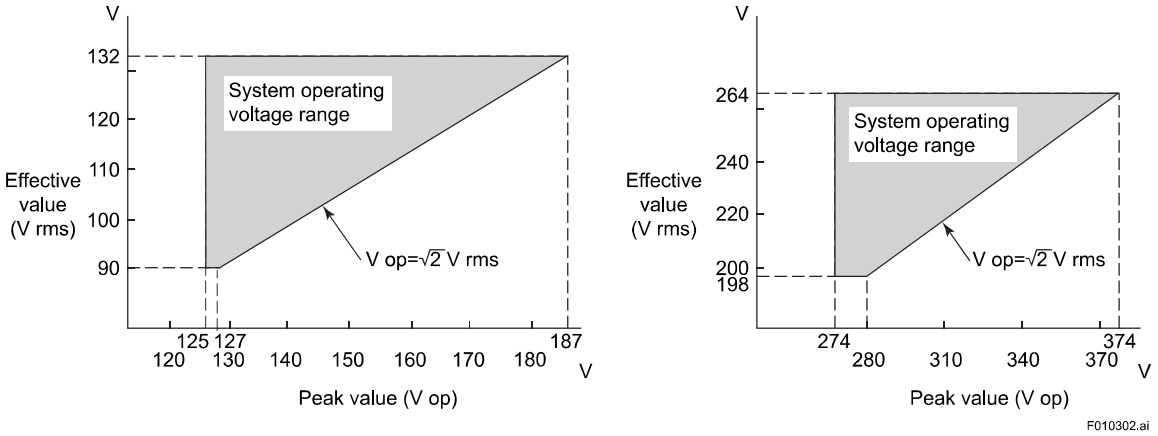



**Figure System Operating Voltage Range**

The DC stabilized power supply used by Field Control Unit of the CENTUM VP uses a compact and efficient switching regulator circuit. In this circuit, output voltage cannot be maintained if the energy (terminal potential) of the smoothing capacitor falls below a predetermined value. The circuit monitors the capacitor terminal voltage and regards it as power failure if the voltage falls in the danger zone, causing the system to enter power fail mode (non-detected momentary power failure: up to 20 ms).

Current flows to the capacitor in this circuit when AC input voltage is higher than the capacitor terminal voltage. Since the capacitor is charged by the peak value of the input waveform, it is required that both the effective voltage value and the peak value conform to specifications.

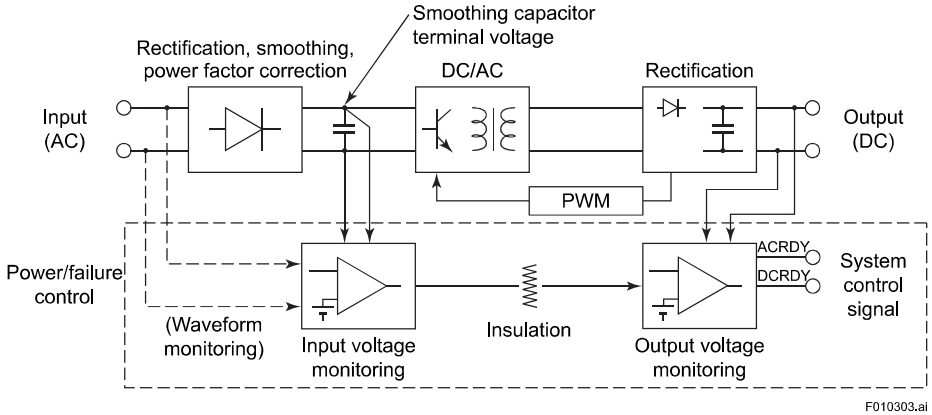



**Figure FCU Power Circuit Diagram**

## Selecting a Power System

The CENTUM VP system requires a power supply that satisfies power requirements in accordance with EMC regulations. It is recommended that an external power supply unit is employed in order to prevent disruptions due to momentary or extended power failure, line noise, or lightening surges, as well as to suppress harmonic current from various devices. For selection of the power supply unit, consult with a power unit manufacturer taking the following points into consideration.

### Source Output Capacity

Take the following items into consideration when consulting with a power unit manufacturer to determine the output capacity.

| | |
|---|---|
| Power consumption: | Both volt-ampere and watt data should be studied (refer to Chapter 4). |
| Device crest factor: | Ratio of the peak value to the effective value of the device input current. |
| Device in-rush current: | See Chapter 4 Table “In-rush Current.” The method of turning on the power should also be studied. |
| Backup ready time after failure: | Time period required to backup the devices when power fails. |
| Reserve capacity: | An extra power capacity should be determined as reserve to meet any device additions. |

### Crest factor

The crest factor is the ratio of the peak value to the effective value of the device input current.

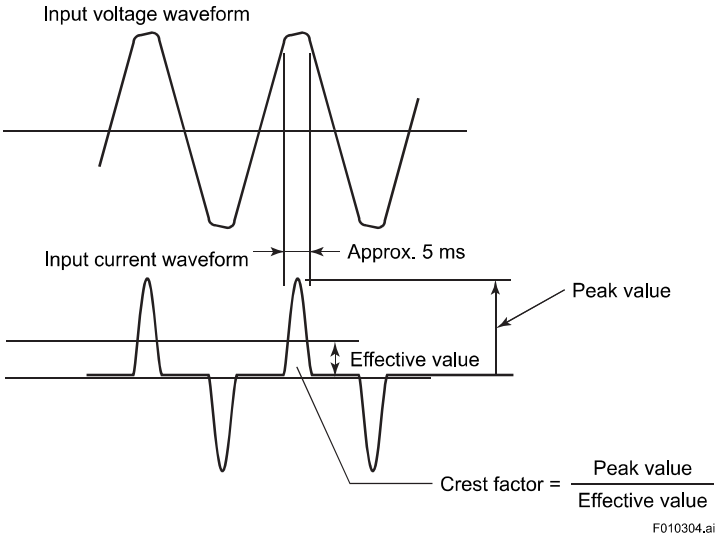



**Figure Input Voltage and Input Current Waveforms**

Crest factor = Peak value of device input current/Effective value of device input current

The crest factor must be considered for the input current supplied to every device connected to the system when estimating the power output capacity in selecting the power unit. Approximate device crest factors should be as follows:

100-120 V supply voltage: Crest factor About 3.

220-240 V supply voltage: Crest factor About 6.

## Common Method to Determine Power Unit Capacity

The following shows the commonly used method used to determine the power unit capacity taking the crest factor into consideration - the final determination should be made in consultation with a power unit manufacturer:

- If the specification of power unit crest factor (the peak current value allowable for the effective current value) is larger than the above device crest factor, the power unit can be used for up to full rated capacity. However, in-rush current, backup time, reserve capacity, etc., must be separately taken into consideration.
- If the power unit crest factor is smaller than the device crest factor, the power unit capacity needs to be calculated in the expression shown below. In-rush current, backup time, reserve capacity, etc., must be separately taken into consideration.

Power unit output capacity = Total device power consumption x Capacity coefficient

Capacity coefficient = Device crest factor / Power unit crest factor specification

## In-Rush Current

When the equipment is turned on, a large in-rush current flows as the capacitor is instantaneously charged and the transformer is excited. When any equipment is turned on, this should not cause any voltage fluctuation that could adversely affect other equipment. Do not turn on all equipment at the same time. Start equipment one by one.
Power may be switched to backup or AC line power if in-rush current activates the overload protection circuit on power-up. After such an overload, select an uninterruptible power unit, with automatic-recovery.

## Suppressing Harmonic Current

In order to suppress harmonic current supplied to a low-voltage distribution system, it is necessary to install a power unit or an active harmonic suppressor, such as indicated below, between a device and the distribution system:

- Power unit equipped with the harmonic suppression function (a high power-factor inverter-type uninterruptible power unit, etc.)
- Active harmonic suppressor

In Europe, a power unit should be selected so that harmonic current emissions are within the limits specified by EMC regulations.

The capacity of the harmonic suppression unit should be determined in consultation with a power unit manufacturer in the same manner as the selection of power unit's output capacity previously discussed.

### Notes for the field power supply unit of N-IO

As described in GS 33J62F40-01EN “Models A2BN3D, A2BN4D, A2BN5D Base Plates (for N-IO)”, field power supply (24 V DC) is required for “Base plate for adaptor” (Model A2BN3D).

When using the node interface unit A2NN30D-□4□□□□□□□ (24 V DC power input type) in combination with A2BN3D and the power supply unit as shown on the left side of the figure below, it is recommended to separate the power supply as shown in right.

This is because the rapid change of the field output load of A2BN3D may causes an influence on 24 V power line, it is worried that the input voltage rating of A2NN30D will not be satisfied.

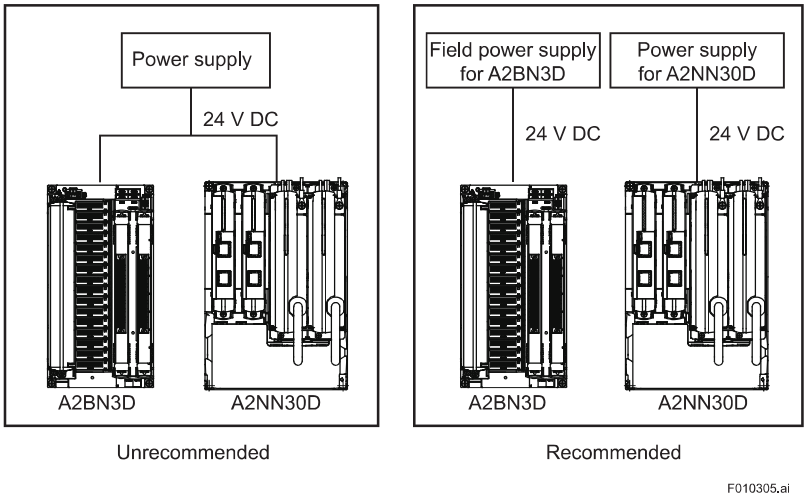



**Figure Connection of the field power supply of A2BN3D**

## Cabling

Observe the following when cabling the power unit to the CENTUM VP system equipment:

- Protect signal cables from induced noise.
- Protect signal cables from induction from high-voltage power lines.
- Separate the CENTUM VP system power supply from other equipment power supplies-use a separate power distribution board.
- Provide a dedicated breaker for each power supply. Install breakers and devices they control in the same room.
- Label the breakers with the name of the connected equipment.
- Install the breakers where they can be easily operated.
- The breaker, must not interrupt connection by wiring to protective grounding system.
- Install power supply cables and high-voltage power lines in metallic conduits as much as possible.
- Use shielded cables if metallic conduits cannot be provided.

# 1.4 Grounding

To avoid electric shocks and minimize the influences of external noise, the installed devices must be grounded to the protective grounding system which complies with the safety standards, the electrical installations standard, and the power distribution system of the country or the region.

In the CENTUM VP cabinets, grounding bars are provided.

As for the protective grounding systems, the meshed grounding systems described in IEC 60364, IEC 62305 and IEC 61000-5-2 can be applied

A protective device is to be installed in compliance with the rules and regulations, in order to prevent electric shocks caused by a ground fault.

A plug type power cable has to be connected to the receptacle connected to the protective grounding system.

A functional grounding terminal of the equipment has to be connected to the grounding bar for protective grounding in a cabinet in accordance with the instructions in this document. A grounding bar for functional grounding connects to a grounding bar for protective grounding in a cabinet. A functional grounding terminal is electrically connected with a protective grounding system. In order to minimize the influence of noise a grounding cable for other system's cabinets must be connected individually to ground bus inlet.

# Grounding

## Cabinet

- In the AFV40S/AFV40D, ACB51, and A2CAB1 the channel base is isolated from the cabinet by a Bakelite sheet (t=5 mm) to allow one point grounding.
- The grounding bar (1) to connect a grounding cable is located at the bottom of the cabinet near the front panel and it is electrically connected to the cabinet.
- The grounding bar (2) for shielding the inside of the cabinet is on the bottom of the cabinet near the back panel, which is isolated from the cabinet. Another grounding bar (3) for shielding the inside of the cabinet is on the bottom of the cabinet near the front panel.
- The grounding bars (2) and (3) are connected to the grounding bar (1) by a cable of 5.5 $mm^2$ (This is used for grounding shields of input/output cables).
- When the grounding bars must be grounded separately depending on the purpose (for shielding and for connecting a grounding cable), disconnect the cable between the grounding bar (1) and (3) or (1) and (2), then ground separately.

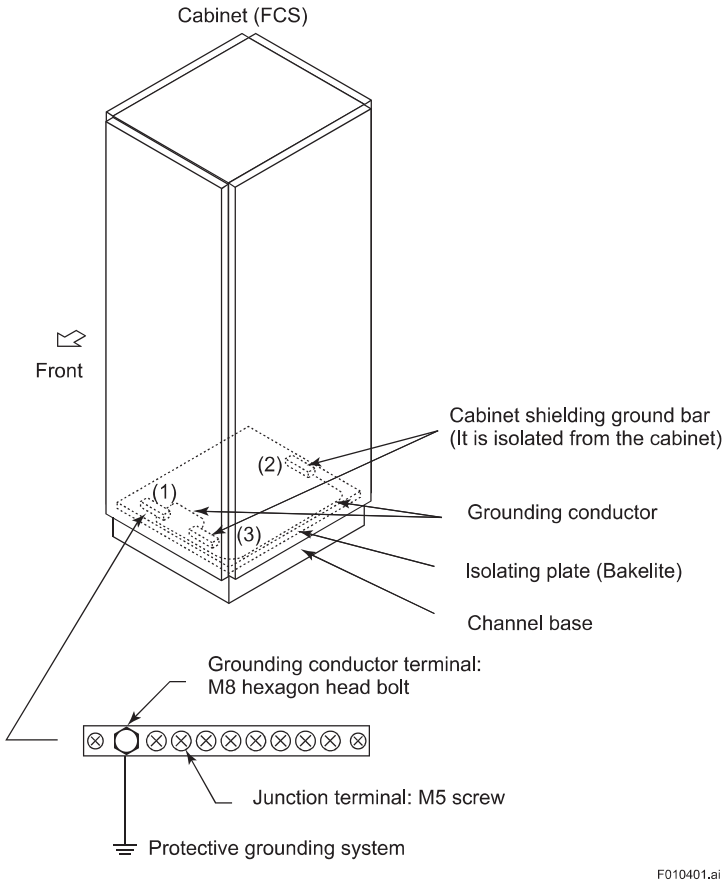



**Figure Grounding Bars**

## Grounding Circuit

A cabinet must be grounded according to the grounding network topology of the building or plant for installation.

In order to connect a cabinet with a protective grounding system, the grounding topology shown in the figures “Grounding connected to single grounding bus inlet” or “Grounding connected to each grounding bus inlet” can be used.

When providing lightning arresters on power and signal lines, those arresters need to be grounded to the same bus. For details, see Section 1.5, “Noise Countermeasures.”

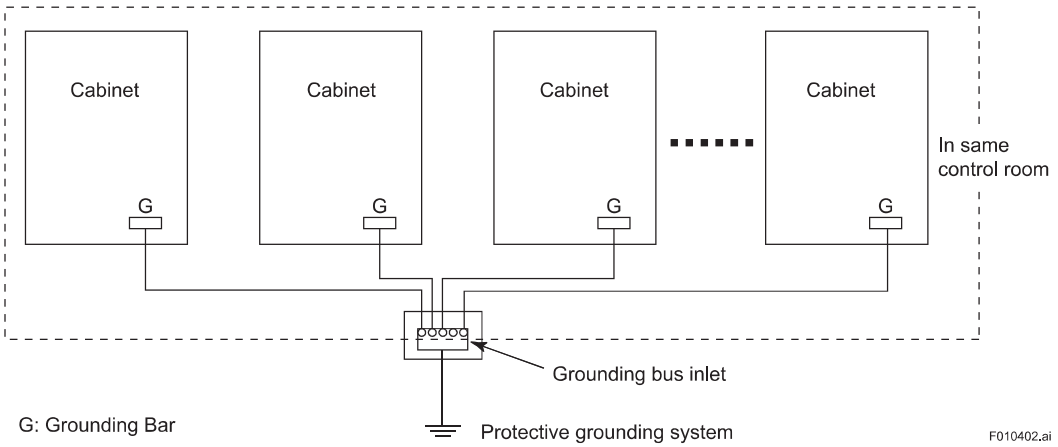



**Figure Grounding connected to a single grounding bus inlet**

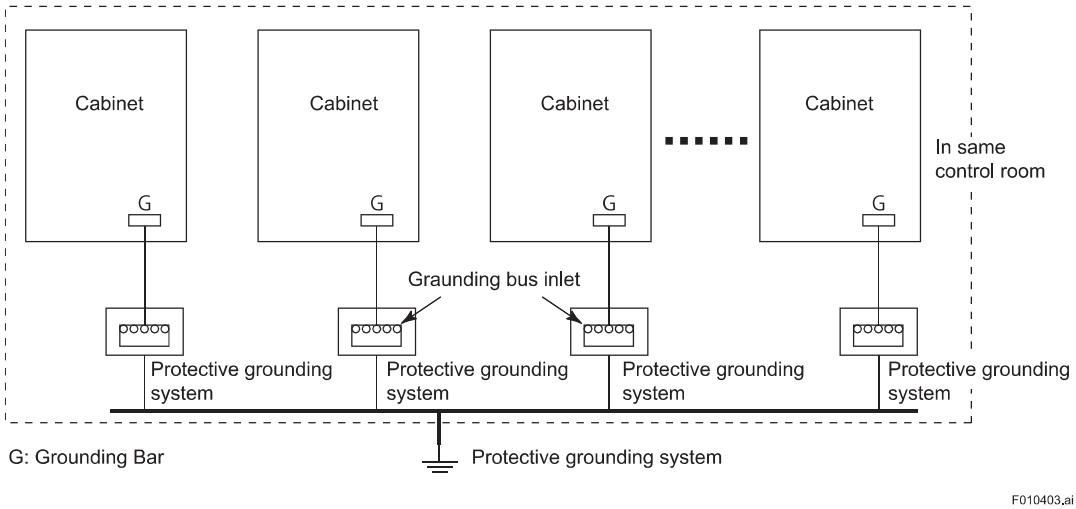



**Figure Grounding connected to each grounding bus inlet**

## Grounding when joining CENTUM VP side by side with other system

Do not connect CENTUM VP's cabinet with other cabinets electrically using bolts or other connection mechanism in order to avoid unexpected electrical connection or interference.

When CENTUM VP is joining side by side with other cabinets, ensure to insert insulating sheets.

The cabinets other than CENTUM VP must be insulated from a floor and connect it to a protective grounding system using a different grounding cable.

The CENTUM VP system in this page can also be read as cabinet of CENTUM CS 3000, CENTUM CS, or ProSafe-RS.

**CAUTION**

Do not install the following systems side-by-side with CENTUM VP:

- Systems using power supply voltages over 300 V AC.
- Systems with current consumption over 50 A.
- System containing high frequency sources.

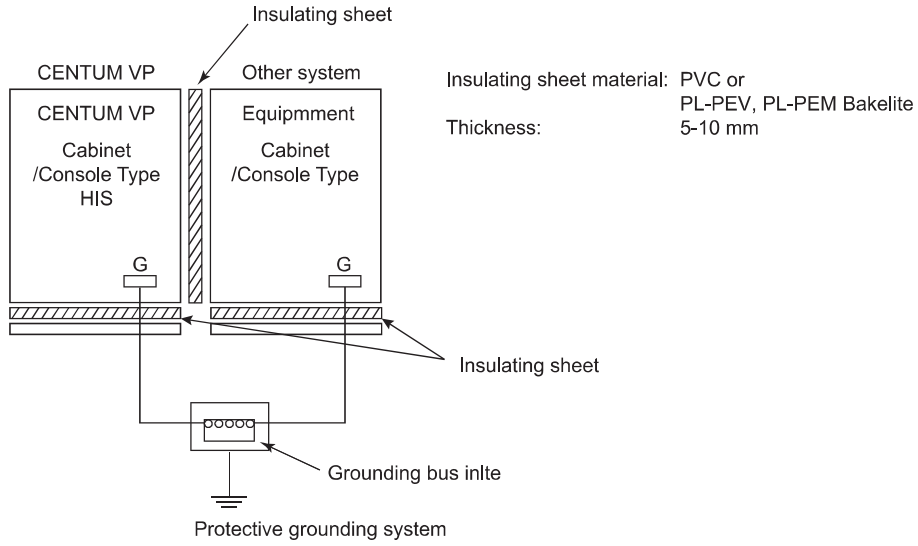



**Figure Grounding Using Insulating Sheets**

**TIP**

The CENTUM VP cabinets (e.g. AFV40S/AFV40D, and ACB51) are insulated from the floor by the insulating sheet.
When other cabinets and consoles are used with CENTUM VP, insulate them from the floor using the insulating sheets.

# 1.5 Noise Countermeasures

**Noise may be induced by electromagnetic induction, electrostatic induction, or from radio waves, lightning, inductive loads, static electricity and ground potential differences. It can be picked up by power, signal and ground cables, and devices. With computerized control systems, noise-induced errors in A/D conversion or in an instruction word may lead to malfunction.**

**To prevent noise and electrostatic buildup, take the measures described in this section in deciding cable type, cable routing, and grounding.**

## 1.5.1 Noise Sources and Noise Countermeasures

**It is not easy to identify the cause of any noise-triggered errors or failures due to their lack of reproducibility.**

**If noise problems occur, take the following countermeasures.**

The following table lists typical noise sources, symptoms of noise problems, and preventive countermeasures:

**Table Noise Sources & Countermeasures**

| Noise sources | Effects | Countermeasures |
|---|---|---|
| **Electromagnetic induction (magnetic field)** | • Destroys magnetic disk data. | • Maintain separation from magnetic-field source.<br>• Shield power cables with metallic conduits.<br>• Shield magnetic field using ferromagnetic substance (e.g. Permalloy).<br>• Use twisted-pair cables. |
| **Electrostatic induction** | • Equipment maloperation.<br>• Interference with signals. | • Use shielded signal cables.<br>• Electrically separate power and signal cables using metallic conduits and separators.<br>• Lay power and signal cables which intersect at right angles. |
| **Lightning** | • Interference with signals.<br>• Equipment maloperation.<br>• Component damage. | • Lay cables underground.<br>• Use optical fiber cables.<br>• Lay cables as close to ground as possible if the cables cannot be laid underground.<br>• Install and ground arresters on field and system. |
| **Electrostatic discharge** | • Equipment maloperation.<br>• Electronic component deterioration, damage.<br>• Paper jam. | • Discharge static electricity from operators.<br>• Provide proper humidity.<br>• Ground equipment properly.<br>• Use antistatic floor material and clothing. |
| **Inductive load open/close** | • Spike noise interference to power andsignal lines. | • Add protection circuit for noise caused by inductive load.<br>• Separate laying of cables. |
| **Radio (electric field)** | • Equipment maloperation.<br>• Interference with signals. | • Use devices (transceivers, mobile phones, smartphones, etc.) that transmit radio waves away from the system so as not to exceed the electric field specifications. |
| **Ground potential difference** | • Equipment Maloperation (noise imposed on signal lines) | • Avoid multipoint grounding of signal cable. |

## Grounding with Lightning Arresters

Connect the protective grounding terminals of arresters and CENTUM VP equipment to the grounding pole as shown in the diagram below.

The grounding method must comply with the grounding system defined by rules and standards of the conuntry or the region.

Concatenation grounding a lightning arrester and other equipment may cause high-tension in each equipment by the product of lightning current from arrester and grounding resistance. To prevent from electrification, overall connection should be equipotential including the floor and the case of other equipment.

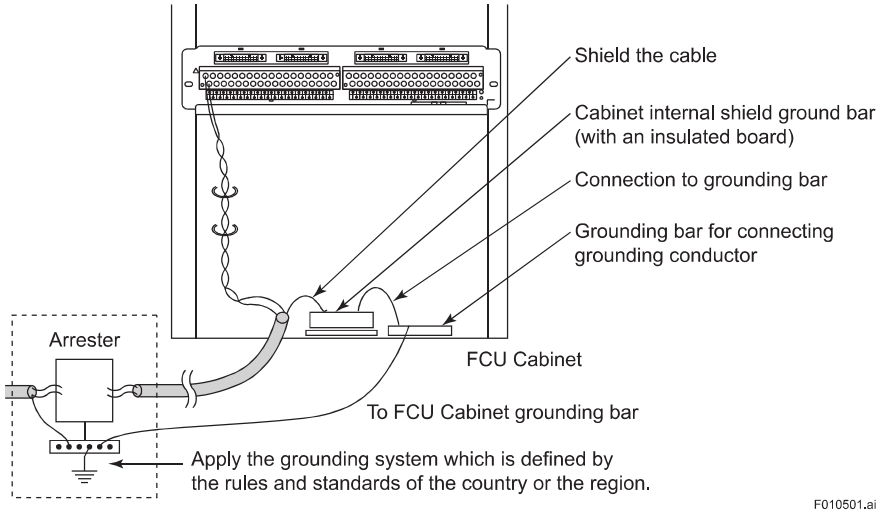



**Figure Grounding with Lightning Arresters**

## Examples of Arrester

The following shows how to install an arrester as a countermeasure against lightning-induced noise :

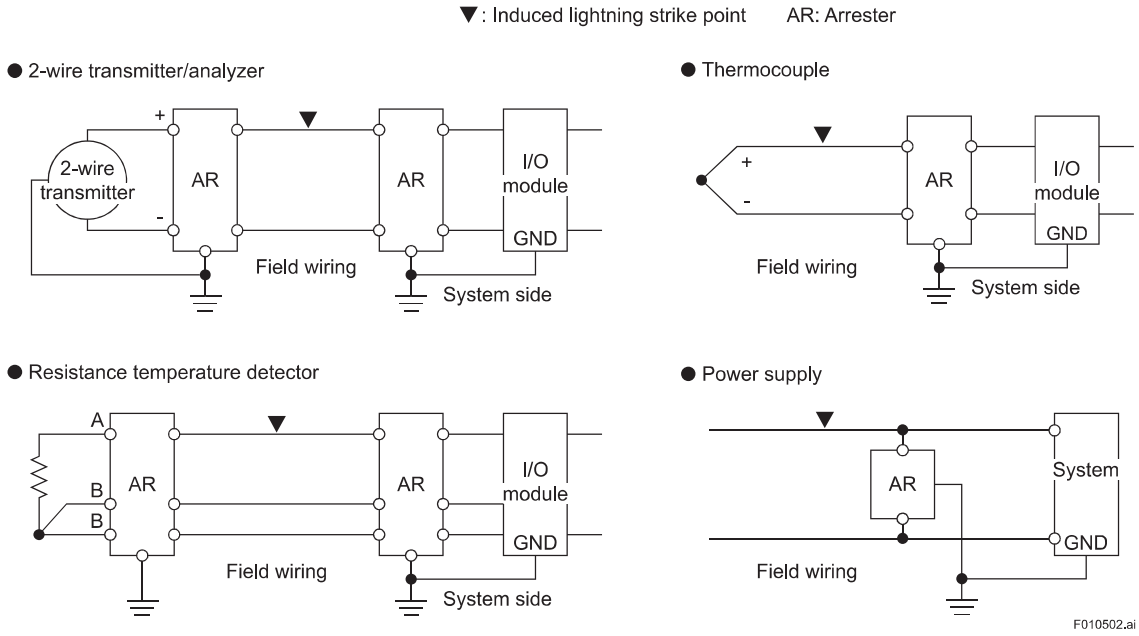



**Figure Examples of Arrester Installation**

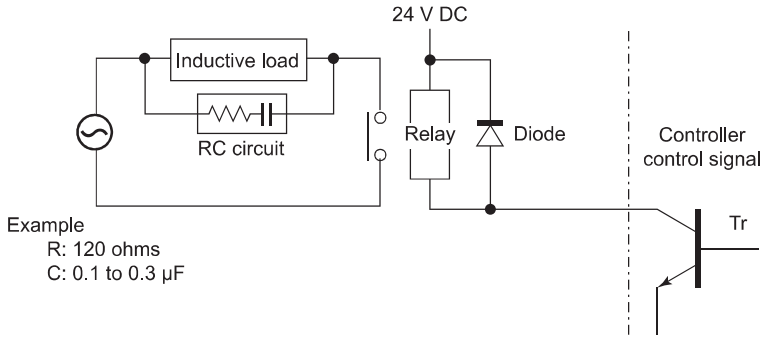
## Examples of installing protection circuit for noise caused by inductive load

The following shows how to install a RC circuit and a diode as a countermeasure against noise caused by inductive load:

● Relay contact

The diode protects the output transistor from noise occurring during on-to-off transitions of the relay.

The RC circuit protects the output relay contact.




● Power supply

The RC circuit prevents noise-caused equipment failure when a fluorescent lamp or fan is turned on or off.

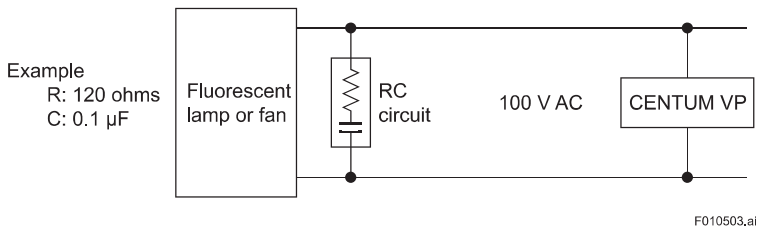



**Figure Examples of installing protection circuit for noise caused by inductive load**

## 1.5.2 Countermeasures against Static Electricity

**Take countermeasures against electrostatic damage when handling cards with semi-conductor IC components, for maintenance or to change settings.**

Observe the following to prevent electrostatic damage:

- When storing or carrying maintenance parts, be sure to enclose them in an antistatic bag. (For shipment these parts are enclosed in an antistatic bag labeled with precautions against electrostatic charge.)
- During maintenance work use a wrist strap with a ground wire via a grounding resistance of 1 M ohm. Be sure to ground the wrist strap.
- When performing maintenance work on a desk or a table, place a conductivity sheet grounded via a grounding resistance of 1 M ohm. The maintenance person must wear a wrist strap while performing maintenance work. Take any plastic and other materials that can easily be charged away from the work area.
- Exercise caution so as not to touch any of the maintenance parts while the wrist strap and a conductivity sheet are not being used.

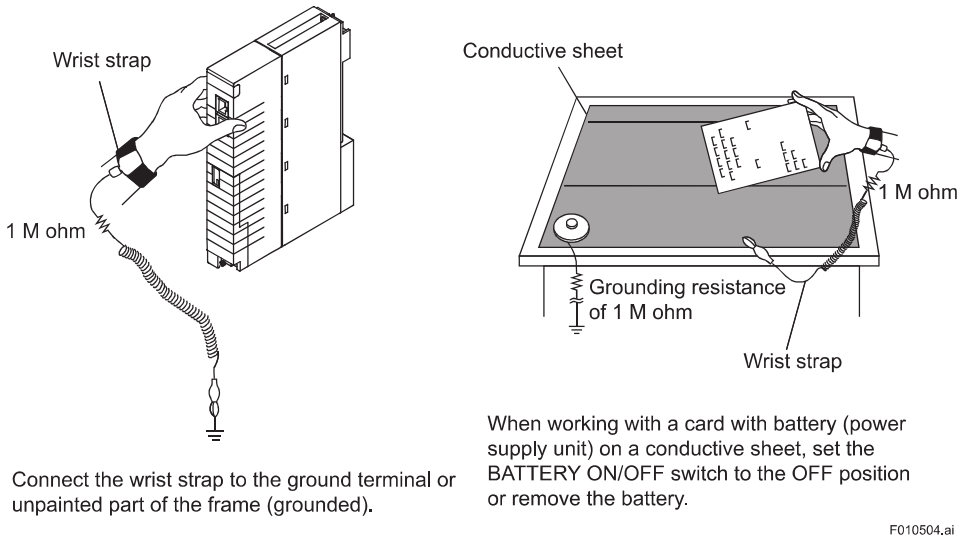



**Figure Example of Using a Wrist Strap and Conductive Sheet**

# 1.6 Cabling Requirements

**The following requirements must be fulfilled when laying power and signal cables (These are shielded cables unless specified).**

**Any signal cable used for high-voltage, high-frequency signals (inductive load ON/ OFF) must be separated from other signal cables.**

## Separator

Provide a separator between power and signal cables as illustrated below:

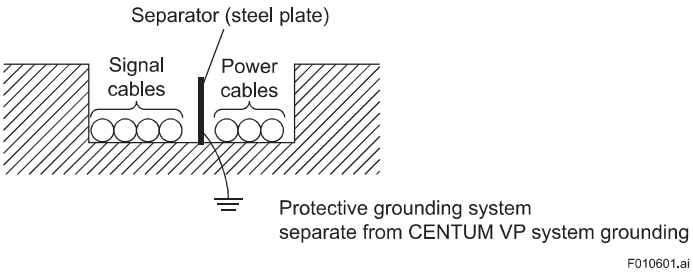



**Figure Separator Used in Duct/Pit**

## Distance between Cables

If a separator cannot be used, keep a distance between signal cables and power cables.

The distances between cables due to operating voltages and currents are shown below.

**Table Required Distance between Power & Shielded Signal Cables**

| Operating voltage | Operating current | Distance |
|---|---|---|
| 240 V AC max. | 10 A max. | 150 mm min. |
| 240 V AC max. | 10 A min. | 600 mm min. |
| 240 V AC min. | 10 A max. | 600 mm min. |
| 240 V AC min. | 10 A min. | Cannot be laid together. |

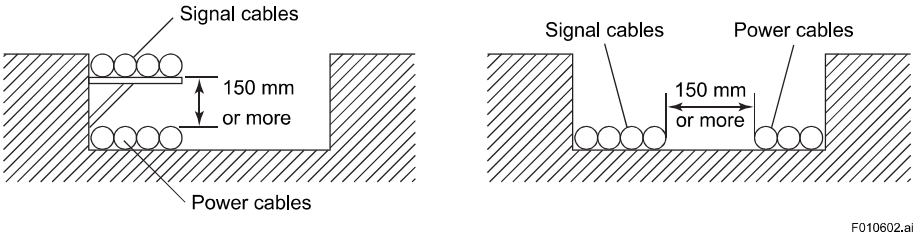



**Figure Distance between Cables under Pit/Free-access Floor**

## Intersecting Cables

With unshielded power cables, place a grounded steel plate with a thickness of at least 1.6 mm over the cables where they intersect with signal cables.

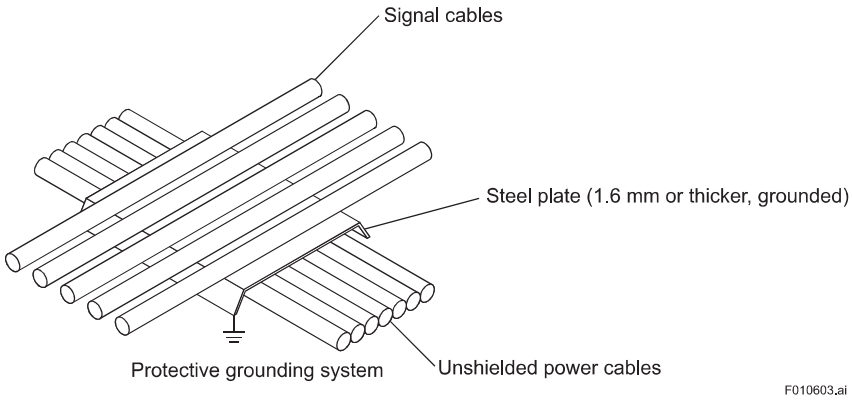



**Figure Intersecting Cables under Pit/Free-access Floor**

## Ambient Temperature

The ambient temperature where signal and bus cables are laid must be within the range -10 to 60 °C.

When using FIO Node Unit, Optical ESB Bus Repeater Unit to conform to the temperature specification, the ambient temperature where the cables are laid must be within the range -20 to 70 °C.

When using N-IO Node (A2NN30D, A2BN3D) to conform to the temperature specification, the ambient temperature where the cables are laid must be within the range -40 to 70 °C.

When using BasePlate Barrier A2BN4D, the ambient temperature where the cables are laid must be within the range -20 to 60 °C.

When using BasePlate Barrier A2BN5D, the maximum ambient temperature specifications for A2BN5D depend on compliance criteria.

For details, refer to GS 33J01A10-01EN “Integrated Production Control System CENTUM VP System Overview”.

When connecting the field signal to the base plate (A2BN3D) via a dedicated cable and terminal board (A2BM4), the ambient temperature where the cables are laid must be within the range -20 to 70 °C.

## Measures against EMI

As a rule, avoid laying the cables on the floor. However, lay them on the floor when there are no ducts and no pits. In that case, it is required to cover them with shield plates or take other measures to suit the EMC Directive.

# 1.7 Corrosive-gas Environment Compatibility

**The CENTUM VP system employs Node units, I/O modules, and cables which meet the ANSI/ISA G3 environment requirements and are compatible with the corrosive gas-susceptible environment.**

## G3 Environment-compatible Products

**Table G3 Environment-compatible Products (1/3)**

| No. | Product | Model | Description |
|---|---|---|---|
| 1 | Field control unit | AFV30□- □□□□6□<br>□□□□F□ | Field Control Unit (for Vnet/IP and FIO, Rack Mountable type) |
| | | A2FV50□-□□□□1□ | Field control unit (for N-IO, 19-inch Rack Mountable) |
| | | A2FV70□-□□□□1□ | Field control unit (for RIO System Upgrade, 19-inch Rack Mountable) |
| 2 | Node unit | ANB10□ -□□6<br>-□□7<br>-□□F<br>-□□G | Node Unit for ESB Bus |
| | | ANB11□ -□□6<br>-□□F | Optical ESB Bus Node Unit |
| 3 | Unit | ANT10U -□□6<br>-□□F | Unit for Optical ESB Bus Repeater Module |
| 4 | Bus Interface Module | A2EN402 -□□□□1 | N-ESB Bus Coupler Module (2-Port) |
| | | A2EN404 -□□□□1 | N-ESB Bus Coupler Module (4-Port) |
| | | A2EN501 -□□□□1□<br>-□□□□3□ | N-ESB Bus Module |
| | | EC401-□1 | ESB Bus Coupler Module |
| | | EC402-□1 | ESB Bus Coupler Module |
| | | ANT401-□3 | Optical ESB Bus Repeater Master Module 5 km |
| | | ANT411-□3 | Optical ESB Bus Repeater Master Module 5 - 50 km |
| | | ANT502-□3 | Optical ESB Bus Repeater Slave Module 5 km |
| | | ANT512-□3 | Optical ESB Bus Repeater Slave Module 5 - 50 km |
| | | SB401-□3 | ESB Bus Interface Slave Module |
| | | A2EE1A | ESB Bus Adapter (for SB401) |
| | | A2EE2A | ESB Bus Adapter (for ANT4□1) |
| | | A2EE3A | ESB Bus Adapter (for ANT5□2) |
| 5 | Analog I/O modules | A2MMM843-□□□□1□<br>-□□□□3□ | Analog Digital I/O Module |
| | | AAI141-□□3 | Analog input module (4 to 20 mA, 16-channel, non-isolated) |
| | | AAV141-□□3 | Analog input module (1 to 5 V, 16-channel, non-isolated) |
| | | AAB141-□□3 | Analog input module (1 to 5 V / 4 to 20 mA, 16-channel, non-isolated) |
| | | AAI841-□□3 | Analog I/O module<br>(4 to 20 mA input, 4 to 20 mA output, 8-channel/8-channel, non-isolated) |
| | | AAB841-□□3 | Analog I/O module<br>(1 to 5 V input, 4 to 20 mA output, 8-channel/8-channel, non-isolated) |
| | | AAB842-□□3 | Analog I/O module (1 to 5 V / 4 to 20 mA input, 4 to 20 mA output, 8-channel input / 8-channel output, non-isolated) |
| | | AAI143-□□3 | Analog Input Module (4 to 20 mA, 16-Channel, Isolated) |
| | | AAI543 -□□1<br>-□□3 | Analog Output Module (4 to 20 mA, 16-Channel, Isolated) |
| | | AAV144-□□3 | Analog input module (–10 to +10 V, 16-channel, isolated) |
| | | AAV544-□□3 | Analog output module (–10 to +10 V, 16-channel, isolated) |

Table G3 Environment-compatible Products (2/3)

| No. | Product | Model | Description |
|---|---|---|---|
| 5 | Analog I/O modules | AAI135-□□3 | Analog input module (4 to 20 mA, 8-channel, isolated channels) |
| | | AAI835-□□3 | Analog I/O module (4 to 20 mA, 4-channel/4-channel, isolated channels) |
| | | AAT145-□□3 | Thermocouple/mV input module (16-channel, isolated channels) |
| | | AAR145-□□3 | Resistance temperature detector/potentiometer input module (16-channel, isolated channels) |
| | | AAP135-□□3 | Pulse input module (8-channel, 0 to 10 kHz, isolated channels) |
| | | AAP149-□□1 | Pulse input module for compatible PM1 (16-channel, pulse count, 0 to 6 kHz, non-isolated) |
| | | AAP849-□□1 | Pulse input/Analog output module for compatible PAC (Pulse count input, 4 to 20mA output, 8-channel/8-channel, non-isolated) |
| 6 | Digital I/O modules | A2MDV843-□□□□1□<br>-□□□□3□ | Digital IO module (16-channel, isolated) |
| | | ADV151-□□3 | Digital input module (32-channel, 24 V DC, isolated) |
| | | ADV551-□□3 | Digital output module (32-channel, 24 V DC, isolated) |
| | | ADV161-□□1 | Digital input module (64-channel, 24 V DC, isolated) |
| | | ADV561-□□1 | Digital output module (64-channel, isolated) |
| | | ADV859-□□1 | Digital I/O module for compatible ST2 (16-channel input/16-channel output, isolated channels) |
| | | ADV159-□□1 | Digital input module for compatible ST3 (32-channel, isolated channels) |
| | | ADV559-□□1 | Digital output module for compatible ST4 (32-channel, isolated channels) |
| | | ADV869-□□1 | Digital I/O module for compatible ST5 (32-channel input/32-channel output, isolated, common minus side every 16-channel) |
| | | ADV169-□□1 | Digital input module for compatible ST6 (64-channel, isolated, common minus side every 16-channel) |
| | | ADV569-□□1 | Digital output module for compatible ST7 (64-channel, isolated, common minus side every 16-channel) |
| 7 | Communication modules | ALR111-□□1 | RS-232C Communication Module (2-Port, 1200 bps to 115.2 kbps) |
| | | ALR121-□□1<br>-□□3 | RS-422/RS-485 Communication Module (2-Port, 1200 bps to 115.2 kbps) |
| | | ALE111-□□1<br>-□□3 | Ethernet Communication Module (1-Port, 10 Mbps) |
| | | ALF111-□□1 | Foundation Fieldbus (FF-H1) Communication Module (4-Port, 31.25 kbps) |
| | | ALP121-□□1 | PROFIBUS-DP Communication Module (1-Port, 9600 bps to 12 Mbps) |
| | | A2LP131-□□1 | PROFINET Communication Module (1-Port, 100 Mbps) |
| | | A2LP141-□□1 | PROFINET Communication Module (1-Port, 100 Mbps) |
| 8 | Router | AVR10D-□□□□1 | Duplexed V net Router |
| | | AW810D-□□□□□6 | Wide Area Communication Router |
| 9 | Turbomachinery I/O Modules | AGS813-□□1 | Servo Module (Isolated) |
| | | AGP813-□□1 | High Speed Protection Module (Isolated) |
| 10 | Node Interface Unit | A2NN10D -□□□□□□□□1 | Node Interface Unit (for RIO System Upgrade) |
| | | A2NN20D -□□□□□□□□1 | Node Interface Unit (for RIO System Upgrade, Cabinet Installation Type) |
| | | A2NN30D -□□□□□□□□1<br>-□□□□□□□□3 | Node Interface Unit |
| 11 | Base Plate | A2BN3D -□□□□1□<br>-□□□□3□ | Base Plate for Adaptor |
| | | A2BN4D | Base Plate for Barrier (MTL) |
| | | A2BN5D | Base Plate for Barrier (P+F) |
| | | A2BE1D-□□1□ | Base Plate (for FCU) |
| | | A2BE2D-□□1□ | Base Plate (for FIO) |

**Table G3 Environment-compatible Products (3/3)**

| No. | Product | Model | Description |
|---|---|---|---|
| 12 | Nest | A2BA3D-□□□1□ | Nest for I/O Adaptor (for RIO System Upgrade) |
| 13 | Power Supply Unit | A2PW503 -□□□□1□<br>-□□□□3□ | 24 V DC Power Supply Unit (120 W, 100 to 240 V AC Input) |
| | | A2PW504 -□□□□1□<br>-□□□□3□ | 24 V DC Power Supply Unit (120 W, 24 V DC Input ) |
| | | PW481-□1 | 100 - 120V AC Input Power Supply Module |
| | | PW482-□1 | 220 - 240V AC Input Power Supply Module |
| | | PW484-□1 | 24 V DC Input Power Supply Module |
| 14 | Adaptor | A2SAP105 -□□1□<br>-□□3□ | Pulse Input Signal Adaptor |
| | | A2EXR001 -□□□□□3□ | Shunt Resistor Unit (for A2SAP105) |
| | | A2SDV105 -□□1□<br>-□□3□ | Digital Input Adaptor |
| | | A2SDV505 -□□1□<br>-□□3□ | Digital Output Adaptor |
| | | A2SDV506 -□□1□<br>-□□3□ | Relay Output Adaptor |
| | | A2SMX801 -□□1□<br>-□□3□ | Pass-through I/O Signal Adaptor |
| | | A2SMX802 -□□1□<br>-□□3□ | Pass-through I/O Signal Adaptor (With field power output) |
| | | A2SAM105 -□□1□ | Current Input/Voltage Input Adaptor |
| | | A2SAM505 -□□1□ | Current Output/Voltage Output Adaptor |
| | | A2SAT105 -□□1□ | mV/TC/RTD Input Adaptor |
| 15 | Terminal board | AEA3D -□6<br>-□F | Terminal Board for Analog<br>(single and dual-redundant, 8-channel) |
| | | AEA4D -□6<br>-□F | Terminal Board for Analog<br>(single and dual-redundant, 16-channel) |
| | | AET4D -□6<br>-□F | Terminal Board for Thermocouple<br>(single and dual-redundant, 16-channel) |
| | | AED5D -□6<br>-□F | Terminal Board for Digital<br>(single and dual-redundant, 32-channel) |
| | | AER4D -□6<br>-□F | Terminal Board for resistance temperature detectors<br>(single and dual-redundant, 16-channel) |
| | | AEF9D -□6<br>-□F | Terminal Board for Fieldbus<br>(single and dual-redundant) |
| | | A1BA4D -□6<br>-□F | Terminal Board for Analog<br>(single and dual-redundant, 16-channel x 1 or 8-channel x 1, DIN rail mount type) |
| | | A1BT4D -□6<br>-□F | Terminal Board for Thermocouple<br>(single and dual-redundant, 16-channel x 1, DIN rail mount type) |
| | | A1BR4D -□6<br>-□F | Terminal Board for RTD input<br>(single and dual-redundant, 16-channel x 1, DIN rail mount type) |
| | | A1BD5D -□6<br>-□F | Terminal Board for Digital<br>(single and dual-redundant, 32-channel x 1, DIN rail mount type) |
| | | A2BM4 -□1□<br>-□3□ | Terminal board for analog digital I/O |
| 16 | Interface unit (for FCU) | A2FU1-1□ | HKU interface unit |
| | | A2FU2-□□1□ | Primary power distribution unit (for FCU) |
| 17 | Processor Module | CP471-□1 | Processor Module |

## Outline of G3 Environment Compatibility

The classification of the environment in which the process control equipment is installed is determined by the ANSI/ISA S71.04-1985 “Environmental Conditions for Process Control Systems” standard. The environment having an atmosphere which contains steams and mists (liquids, coded L), dusts (solids, coded S), or corrosive gases (gases, coded G) is classified into four categories according the levels of these substances determined.

The four categories of the corrosive gas environment are defined as follows:

G1 (Mild): A well-controlled environment in which corrosive gas is not the major cause adversely affecting the reliability of plant equipment. The corrosion level on the copper test piece is below 0.03 µm (see note below).

G2 (Moderate): An environment in which corrosive gas can be detected and it could be determined that the gas is the major cause adversely affecting the reliability of plant equipment. The corrosion level on the copper test piece is below 0.1 µm (see note below).

G3 (Harsh): An environment in which corrosive gas is frequently generated to cause corrosion and that it is necessary to provide special measures or employ specially designed or packaged plant equipment. The corrosion level on the copper test piece is below 0.2 µm (see note below).

GX (Severe): A corrosive gas-polluted environment that demands special protective chassis for the plant equipment, specifications of which should be seriously determined by the user and a power unit manufacturer. The corrosion level on the copper test piece is 0.2 µm or more (see note below).

Note: Copper test pieces are used to determine the level of corrosion for the classification of the plant environment. The test piece is an oxygen-free copper sheet, which is 15 $cm^2$ in area, 0.635 mm in thickness, 1/2 to 3/4 H in hardness. The test piece is placed in the plant site for one month and checked for any change before and after the test to determine the degree of corrosion (see table below). If the test period is shorter than one month, the result is calculated to obtain equivalent data using a expression defined by the standard.

**Table Classification of Corrosive-gas Corrosion Levels**

| Environment category | | G1 (Mild) | G2 (Moderate) | G3 (Harsh) | GX (Severe) | |
|---|---|---|---|---|---|---|
| Copper corrosion level | | < 300 (< 0.03) | < 1000 (< 0.1) | < 2000 (< 0.2) | ≥ 2000 (≥ 0.2) | [Å] ( [µm] ) |
| Group A | $H_2S$ | < 3 | < 10 | < 50 | ≥ 50 | [$mm^3/m^3$] |
| | $SO_2$, $SO_3$ | < 10 | < 100 | < 300 | ≥ 300 | |
| | $Cl_2$ | < 1 | < 2 | < 10 | ≥ 10 | |
| | NOx | < 50 | < 125 | < 1250 | ≥ 1250 | |
| Group B | HF | < 1 | < 2 | < 10 | ≥ 10 | |
| | $NH_3$ | < 500 | < 10000 | < 25000 | ≥ 25000 | |
| | $O_3$ | < 2 | < 25 | < 100 | ≥ 100 | |

Note: The gas density data indicated in the table are for reference only, with the relative humidity of 50 %RH or less. The category goes up one rank higher every time the humidity increases 10 % exceeding the 50 %RH or over 6 % per hour.

The Group-A gases shown in the table may coexist and cause inter-reaction. Inter-reaction factors are not known for the Group-B gases.

# 1.8 Compliance with Marine Standards

**The CENTUM VP comply with the following marine standards, and installation methods.**

- **ABS (American Bureau of Shipping)**
- **BV (Bureau Veritas)**
- **LR (Lloyd's Register), ENV2**
- **DNV**

## Precaution on Selecting System Components

When building a system, use components which have already obtained type approval of marine standards. For the HISs, also use generic computers (including monitors, keyboards, mice, and other peripheral devices) which are accredited by the required marine standards.

## Marine Standard-compliant CENTUM VP (Vnet/IP) Components

The CENTUM VP (Vnet/IP) components which comply with the marine standards, refer to the GS 33J01A10-01EN "Integrated Production Control System CENTUM VP System Overview".

When using the systems components not listed there, compliances to the marine standards and installation methods need to be confirmed individually in advance.

## Precaution on Installing Components

In order to comply with the marine standards, the specific installation methods must be followed. Please contact "Process Automation PMK Dept., IA Systems Business Division, IA Platform Business Headquarters" for more details.

# 2. Transportation, Storage and Installation

**This chapter describes the precautions in transporting, storing, and installing the CENTUM VP system equipment.**

**SEE ALSO** See “Section 1.2 Control Room Environment” for the environmental requirement for each piece of equipment.

# 2.1 Precautions for Transportation

**This section describes the precautions required to prevent accidents and damage when transporting CENTUM VP system equipment. These precautions apply when the equipment is contained in our original packing.**

## Transportation

SEE ALSO See "Table Equipment Installation Specifications" in Section 1.2 Control Room Environment for ambient temperature, humidity, vibration and impact.

### Loading

- Do not load crates on top of others or turn them on their sides.
- Keep all crates upright.
- Secure loaded crates using ropes, and cover them completely with waterproof coverings.
- Do not load crates outdoors when it is raining.

### Don't Stack Outdoors

Be sure to store cargoes inside a warehouse if they must be stored for some time.

### Transportation

Cargoes contain precision instruments. Select a company specializing in the transportation of computers and precision instruments.

Keep all products upright during air transport, freightage, or truck transport. When transporting by track, drive at low speed to avoid vibration and impact. Also, slow down to the limit on a bad road.

### Others

Do not transport equipment through areas where there may be corrosive gas, intense electric or magnetic fields.

# Unloading

Prepare special equipment for unloading. Avoid unloading outdoor in case of rain.

## Location for Unloading

To select a location for safe unloading, check that:

- There is ample space for crane and forklift maneuvering.
- Ground is solid.
- The handrails of scaffold can be removed.
- There is enough working space for unpacking (at least 2500 mm by 4000 mm). Provide a platform if necessary.
- There is a height of at least 3000 mm under the roof.
- Outdoor-indoor temperature difference should be less than 10 °C to avoid condensation.

## Keep Upright

Keep crates upright when unloading.

## Avoid Physical Shock

Avoid physical shock. Be careful not to lose balance or swing when lifting or placing cargoes on the ground or platform. Also check scaffold strength.



**CAUTION**

- When lifting Hardware with a crane, do not unpack it, but attach lifting bolts or wire ropes to the baseboard positions shown to lift it. Keep the distance between the crane hook and the cargo to be lifted at a minimum.
- If it is difficult to do this, tie four belts together at a point close to the cargo to keep it from falling.
- Unpacked items are more likely to lose their balance and fall.

## Craning the cabinet

When lifting a cabinet by a crane, please follow the instructions below.

- Use two of the eyebolts in diagonal positions, or all four of the eyebolts to lift the cabinet.
- Keep the wire lifting angle of the cabinet less than 90 degrees.
- Use a wire pair each eyebolt.

When craning the cabinet, the wire or the crane must have enough strength against the cabinet weights.

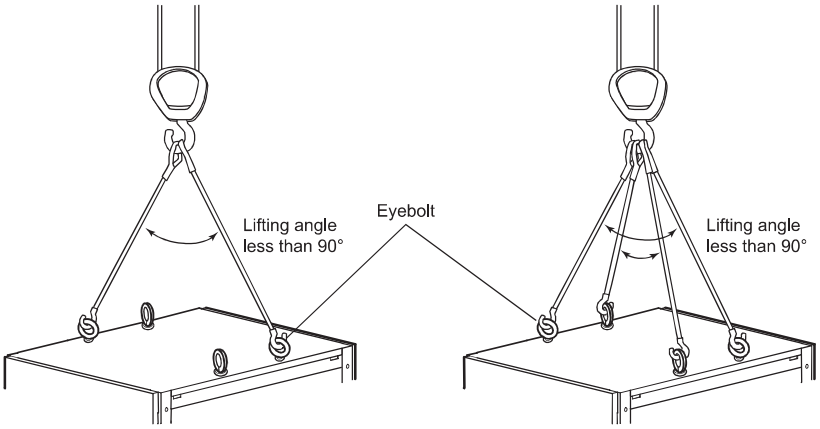



**Figure How to lift of a cabinet**

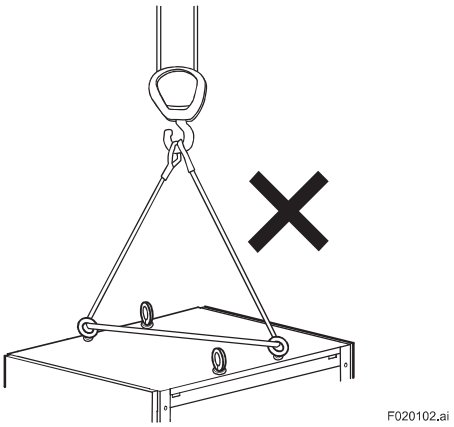



**Figure Wrong way of lifting**

# Carrying

This section describes how to carry cabinets.

## Carrying Space

Carry cabinets into the location of installation without unpacking.

To carry them in on the second floor or upper floors using a crane, a scaffold of about 2500 by 4000 mm is required for placing as well as unpacking.

**Table Required Entrance and Elevator Size**

| | Cabinet |
|---|---|
| Width | 800 mm |
| Height | 2400 mm |
| Depth | 1000 mm |
| Max. loading capacity | 400 kg |

## Passage

The passage must be wide enough as shown below. It must also be strong enough to withstand the weight of the cabinet. Determine the passage according to the cabinet's and carrier's size and weight.

- Carrying cabinet in

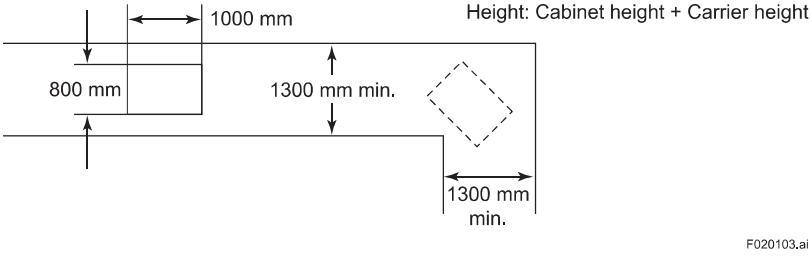



**Figure Passage Requirements**

## Carrying when Headroom is Low

The cabinet should be carried upright. If this is impossible due to low headroom,

- Remove the side boards.
- Turn the cabinet's right or left side (viewed from its front) down.
- Gently carry the cabinet with the side down.
- Turn the cabinet to its upright position as soon as the cabinet passes through a place with low headroom. Attach the side boards to the cabinet.

## Using Rollers

The cabinet should be carried in to or near the installation location without unpacking. Do not use rollers if possible. When using them, take the following precautions:

- Use wooden rollers which are long enough so that more than 200 mm remains outside of the cabinet on each side.
- Make sure that two or more rollers are always under the cabinet.
- Do not use a hammer to correct roller positions on the move.

# 2.2 Unpacking

**In unpacking the received cargoes and equipment, inspect them according to inspection list below. It is recommended to unpack by Yokogawa engineers or in their presence.**

**Table Inspection List**

| | Inspection Items | Result | | Measures Required |
|---|---|---|---|---|
| Exterior | • Environment of unpacking location (temperature, humidity, dust) | Suitable | Unsuitable | If unsuitable, select proper location according to specified environmental requirements. |
| | • Rapid temperature fluctuation (should be within ±10 °C/h) | No | Yes | If yes, do not unpack and wait until the fluctuation remains within ±10 °C/h. |
| | • Damage to equipment exterior | No | Yes | If damaged badly, inform Yokogawa. |
| | • Condensation or its trace on equipment exterior. (*1) | No | Yes | If yes, inform Yokogawa. |
| Interior | • Loose parts inside equipment. | No | Yes | If yes, remove them and check the surrounding. |
| | • Damage to equipment interior. | No | Yes | If damaged badly, inform Yokogawa. |
| | • Condensation or its trace on equipment interior. (*1) | No | Yes | If yes, inform Yokogawa. |

*1: Condensation symptoms are as follows:
- Dew patterns on PCBs.
- Printed circuit copper trace is floating off the board.
- Label characters on PCBs are smudged.
- Connectors on PCBs are smudged.
- Dew patterns or traces of droplets are found on cabinet panels.

**CAUTION**

Condensation may cause a fatal system failure in the CENTUM VP system. Be sure to unpack the equipment indoor under the specified environmental conditions. Strictly observe the allowable temperature fluctuation range of ±10 °C/h. Do not bring the equipment into a heated room straight from the outside in winter. Our warranty does not cover any damage caused by condensation.

**CAUTION**

Be careful not to let the products fall when you handle them.

When they are hit hard, the interior of them can be damaged, although there is no damage in the exterior.

If you accidentally drop an product, stop using it immediately and report it to Yokogawa.

# 2.3 Storage

**The delivery date should be determined in accordance with your installation schedule. Avoid storing products more than three months. If long-term storage more than three months cannot be avoided, consult Yokogawa in advance because it is necessary to provide waterproofing, condensation prevention, and dustproofing measures as well as periodical inspections.**

## Storage Condition

Store products without unpacking. Be sure to confirm that the crate is not damaged. To store them after unpacking, be sure to take the precautions described below.

## Location of Storage

Store products in a warehouse or indoor facilities - never in an open-air location.

## Storage Environment

- Ambient Temperature for storage: 5 to 40 °C
- Avoid direct sunlight.
- Prevent condensation.
- Do not store products where corrosive gas or salty air may be present.

**SEE ALSO** See “Section 1.2 Control Room Environment” for permissible temperature, humidity and temperature fluctuation of storage area.

## Storage of Packed Equipment

- Place squared pieces of lumber with a height of 100 mm or higher on the floor. The lumber should be long enough so that more than 100 mm remain outside of the crate on every side.
- Securely place unopened crates on the lumber platform.
- Do not stack crates in piles.
- Make sure to provide good air circulation in the storage area and periodically inspect the crates to keep them under proper conditions.

## Storage of Unpacked Equipment

To store unpacked products without power connection, follow the specified environmental requirements. If stored in a non-air-conditioned room, cover them with polyethylene or other sheets for protection against dust and moisture. For moisture-proofing, place a sufficient amount of Silica gel or other desiccating agent inside the covering and inspect replace from time to time. When using desiccating agent or corrosion inhibitor etc., please select the appropriate one. Also, please make sure that it does not affect the function and performance of the product before actually using it.

# 2.4 Servicing Area

**Take enough space around equipment for its operation and maintenance service. This servicing area is indicated for each equipment.**

**The servicing area should be considered in determining the size of installation location. When installing a number of equipment side by side, take the largest service-area between them if different dimensions are indicated for different side of equipment (see below).**

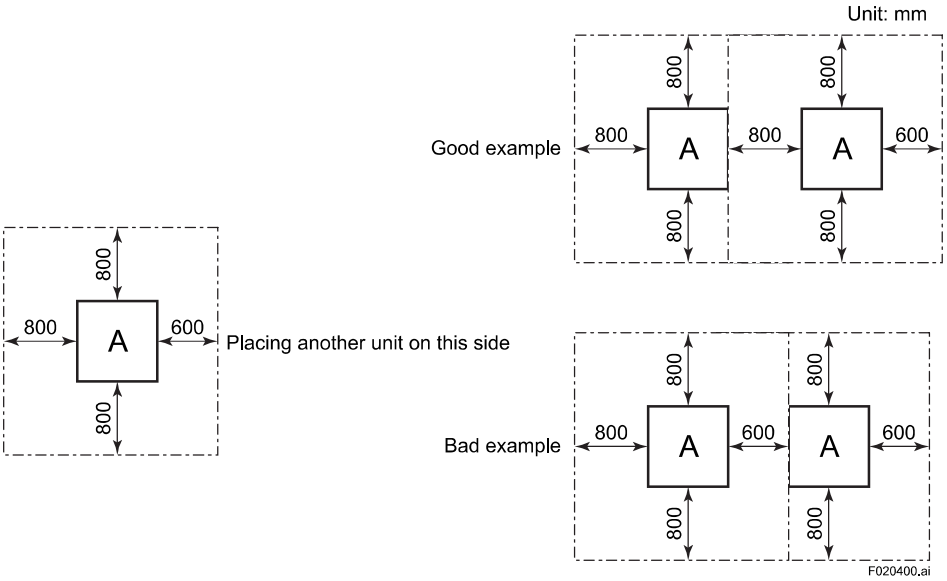
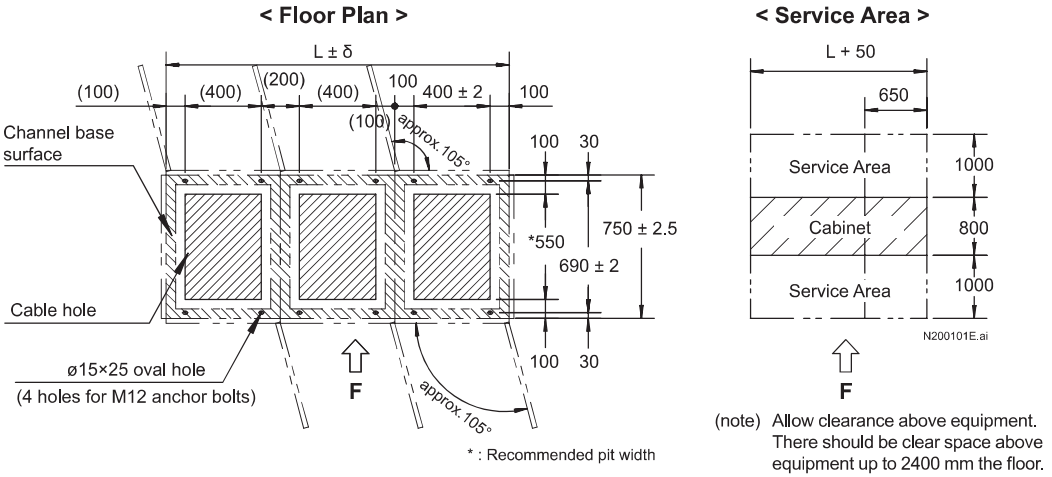



**Figure Servicing Area when Installing Units Side-by-side**




| | Outside dimension | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Number of cabinets | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| L | 600 | 1200 | 1800 | 2400 | 3000 | 3600 | 4200 | 4800 |
| ± δ | 2 | 4 | 6 | 8 | 10 | 12 | 14 | 16 |

Nominal Tolerances :

When the reference dimension is over 0.5 mm and equal or less than 120 mm, its nominal tolerance shall be ± 0.8 mm, while its combination of nominal tolerance is ± 1.5 mm.

When the reference dimension is over 120 mm, its nominal tolerance shall be in accordance with JEM 1459.

F020401.ai

**Figure Servicing Area when Installing AFV40S/AFV40D/ACB51/A2CAB1**

# 2.5 Installation

**Before installation, be sure that anchor bolts, pedestals, and cable holes are provided according to the customer's system configuration plans. Check that the positions of holes on the floor fit the anchor bolt holes in the channel base of each piece of equipment.**

## 2.5.1 Installation on Floor

The installation method varies with the type of the floor and building.

- After unpacked, be careful not to put any impact until it is fixed to the floor to prevent from tip-over.
- Install devices as specified in the plans.
  Check the position of front and back panels of the cabinet.
  Avoid physical shock. Never use hammers.
- Fix each equipment to the floor. The explanation below shows how to fix devices on different types of floors.

### Concrete Floor

Clamp the equipment to the floor using anchor bolts. It is recommended to use M12 bolts and 3,200 N•cm tightening torque.

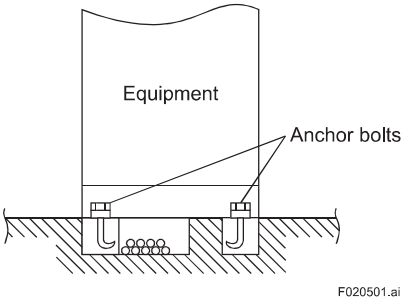



**Figure Using Anchor Bolts**

## Steel Floor

Clamp the equipment to the floor using clamp bolts.

After cabling through the riser duct, fill the duct with rubber sponges and seal the top with putty.

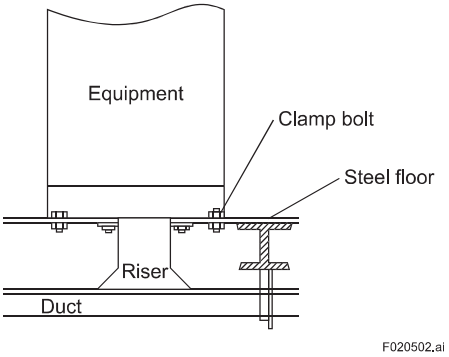



**Figure Using Clamp Bolts**

## "Free-access" Floor

Clamp the equipment to pedestals which are anchored to the base floor.

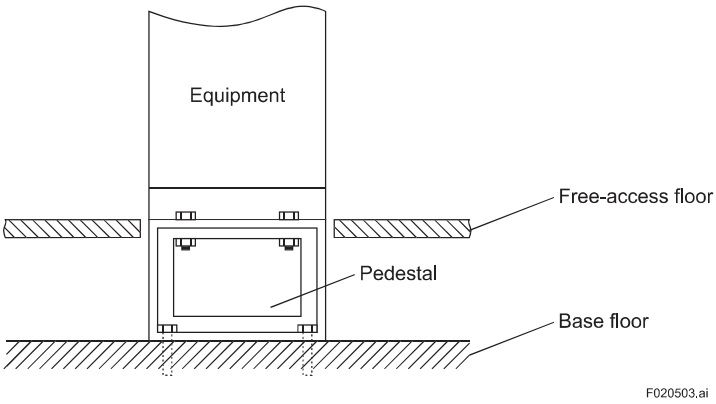



**Figure Using Pedestal**

In the "free-access" floor, make holes for riser cables to connect to each piece of equipment as follows:

- If one floor tile is removed, be sure to reinforce the opening with an angle frame for floor stability.

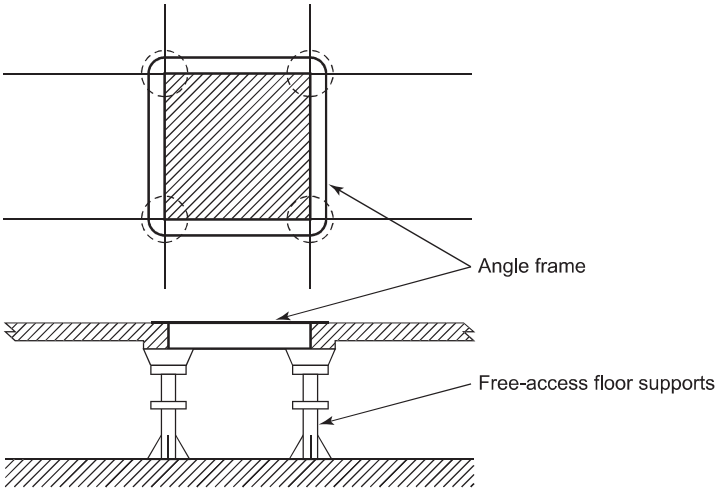



**Figure Removing One Floor Tile**

- Do not make a holes near the floor supports.
- Do not cut away more than 1/3 of a floor tile.

## IMPORTANT

If a number of neighboring floor tiles are removed, be sure to provide angle frames or pedestals for reinforcement.

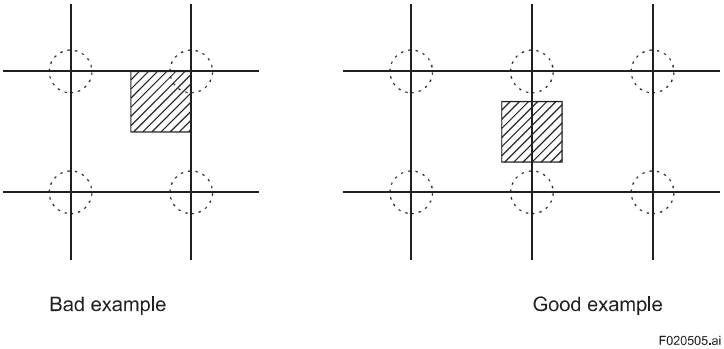



**Figure Partially Cutting Floor Tile**

## Size of Cabling Holes in Floor

For ease of cabling, and for separating power cables from signal cables, it is recommended that you create holes in the floor for cabling that are the maximum size indicated in the floor plans.

**SEE ALSO** Refer to “General Specification” (GS) for the weight and dimensions.

Refer to "2.4 Service Area" for the floor plan about AFV40☐, ACB51, A2CAB1.

If the specified maximum size hole cannot be provided due to the floor construction or pit dimensions, the size may be smaller within the range indicated in the plans. If you use the specified minimum size of hole, use flexible cables that can bend inside the channel base.

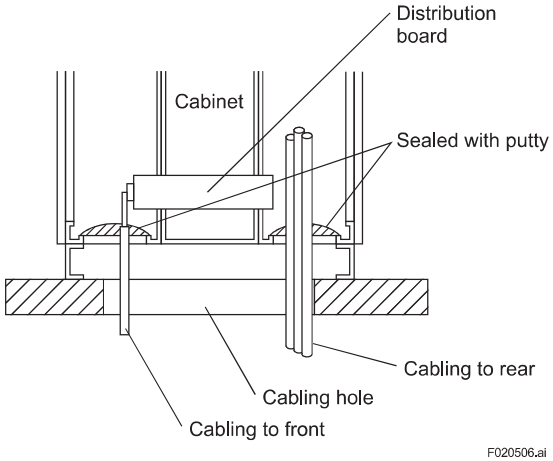



**Figure Cabling through Maximum Size Hole**

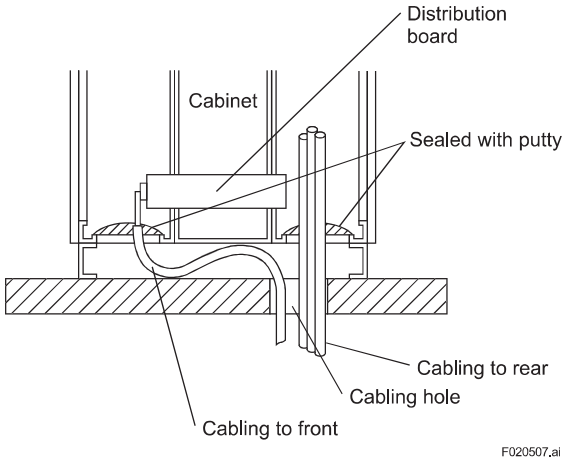



**Figure Cabling through Minimum Size Hole**

## 2.5.2 Installing Cabinets in a Side-by-Side Arrangement

Install two or more cabinets (AFV40S/AFV40D, ACB51, and A2CAB1) in a side-by-side arrangement as described below.

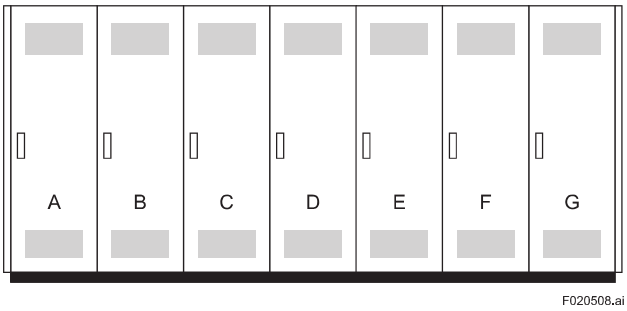



**Figure Example of Installing Cabinets in a Side-by-Side Arrangement**

### Installation

(a) Level the floor surface on which cabinets are to be installed.

(b) To install two or more cabinets in a line, install the central one first (D in Figure), and next ones on both sides (C→B→A, E→F→G).

(c) With bottom plate (a) (see Figure on next page) off, install the cabinet in position, making sure that the anchor bolt position and channel base hole align with each other.

(d) Tighten anchor bolt nut [A] (see Figure on next page) when the installation is complete. When linking many cabinets in a row, tighten the nuts only finger-tight first, fully tightening them when the cabinet interconnection is complete.

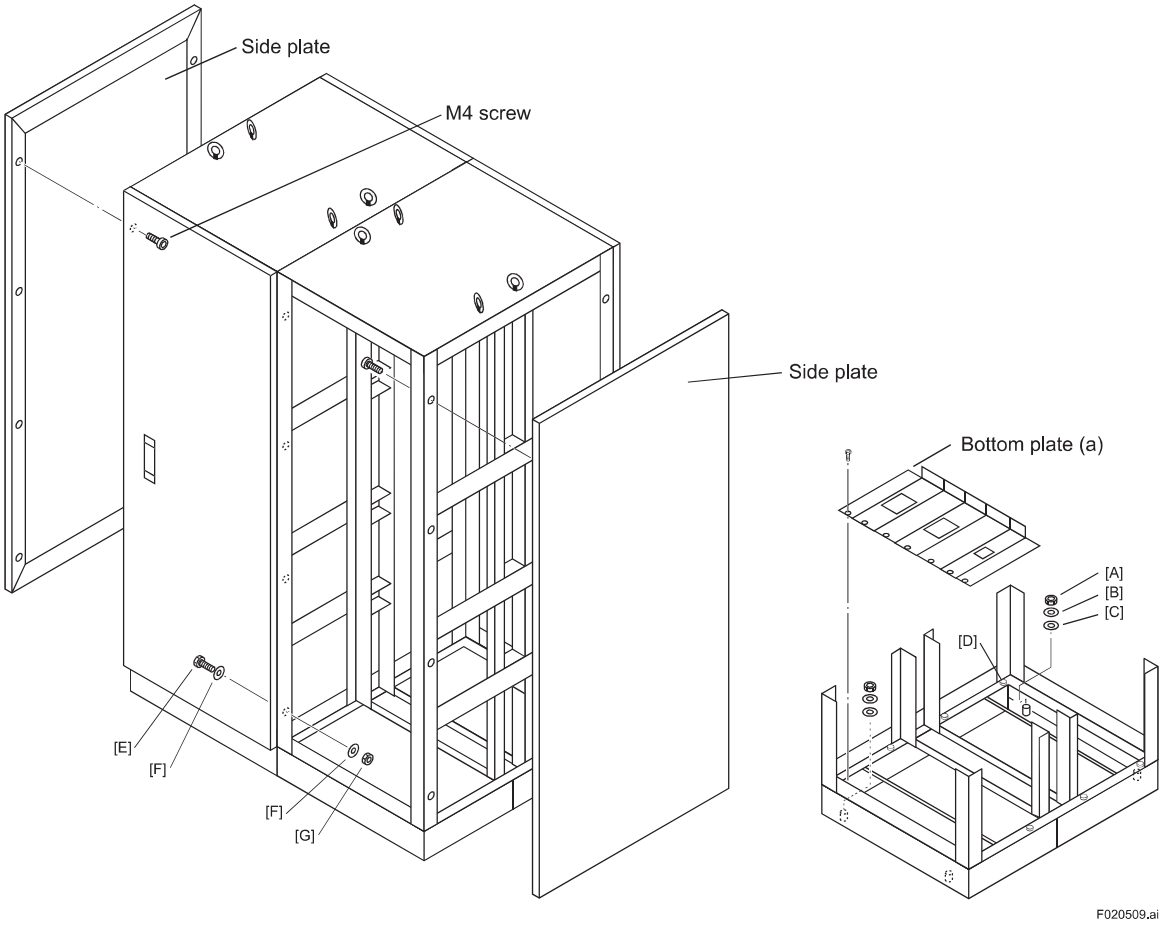



**Figure Installing Cabinets Side by Side**

## Interconnecting cabinets

(a) Using a hexagon wrench, loosen hexagonal socket head bolts [D] (eight bolts) securing the main body and the channel base to each other.

(b) With the front and rear doors open, clamp bolt screw [E], toothed washer [F] and nut [G] using a wrench (at eight positions on the front and rear in total).

(c) After verifying that the cabinet is level in all orientations, clamp hexagonal socket head bolts [D] (eight bolts) securing the main body and the channel base to each other using a hexagonal wrench. If there is a gap between the main body and channel base when the hexagonal socket head bolts are clamped, insert liners into the gap for adjustment.

(d) Replace all bottom plates that have been removed in their original position.

**SEE ALSO** For details on the related tools and parts for joining cabinet's side-by-side, refer to "Tools and Parts Required for Joining Cabinets."

## Tools and Parts Required for Joining Cabinets

Connecting kit to install cabinets side by side. Table lists those parts needed to connect two cabinets together.

- AKT211: Connection kit for Cabinet

**Table Joining Parts and Tools (required per additional station)**

| No. | Names | Part numbers | Quantity |
|---|---|---|---|
| a | Nut or bolt (M12) (*1) | – | 4 |
| b | Spring washer (M12) (*1) | – | 4 |
| c | Flat washer (M12) (*1) | – | 4 |
| d | Hex hole bolt (M10) | – (Cabinet accessory) | 8 |
| e | Bolt (M8) | Y9820NS | 8 |
| f | Toothed (serrated) washer (M8) | Y9801WL | 16 |
| g | Nut (M8) | Y9801BS | 8 |
| h | L-shaped hex wrench | S9103PB | 2 |

*1: Parts “a” “b” and “c” need to be provided by the user.

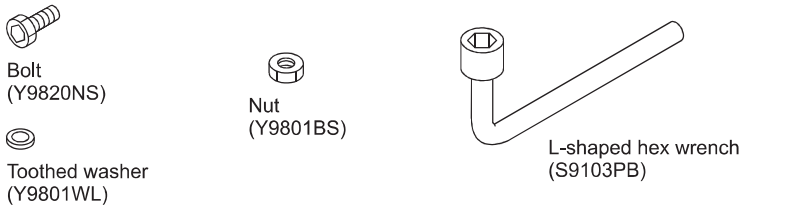



**Figure Cabinet Connecting Parts**

## 2.5.3 19-inch Rack Mount Devices

**Before use, mount the following devices in a rack. AFV30S/AFV30D, A2FV50S/A2FV50D, A2FV70S/A2FV70D, ANB10S/ANB10D, ANB11S/ANB11D, ANT10U, A2BE1D and A2BE2D Unit for FIO and AVR10D Duplexed V net Router and AW810D Wide Area Communication Router and A2NN10D Node Interface Unit.**

**CAUTION**

- To meet the Safety Standards and EMC Standards, the devices must be installed in a lockable metal cabinet. The cabinet must conform to IEC/EN/CSA 61010-2-201 or provide degrees of protection IP3X or above and IK09 or above.
- Do not install the 19-inch rack mountable devices close to each other. When installing an 19-inch rack mount devices on the same rack, maintain a 3-unit spacing (*1) (1 unit: 44.45 mm) between devices.

*1: Space between devices can be smaller than 3 unit to the extent it does not interfere with device mounting and maintenance, only if Cabinet Utility Kit (ACUKT1) is used or the cabinet interior has been provided with a thermal design and the ambient temperature is within the product specifications.

### Notes on Installation

**CAUTION**

For installation, secure ample working space and work in a team for safety.

Be sure to observe the following when installing in the rack or on an instrumentation panel:

#### Providing Space for Heat Radiation

Leave space at the top and bottom of rack-mount equipment to permit heat radiation.

- Separate the top of the instrumentation board at least 100 mm away from the ceiling, and cut a ventilation hole of 200 $cm^2$ or larger in the ceiling or install a ventilation fan.
- Keep at least 50 mm between the back of the equipment and the instrumentation panel or wall.
- When installing an 19-inch rack mount devices on the same rack, maintain a 3-unit spacing (1 unit: 44.45 mm) between devices.
  Do not use any space between equipments for cable wiring or anything.
- Do not block ventilation openings in top and bottom face of equipment.

## Providing Area for Servicing

When mounting devices in the 19-inch rack, the mounting plate cut out of instrumentation panel, and so on, leave an area for servicing.

Leave an area for servicing.

- All the work to connect cables to 19-inch rack mountable devices and I/O modules will be performed from the front.
- The work to confirm indicator lamps, configure card settings, and remove/insert cards will be performed from the front.
- The front is the area for wiring and servicing. Leave at least 1000 mm of space at the front.

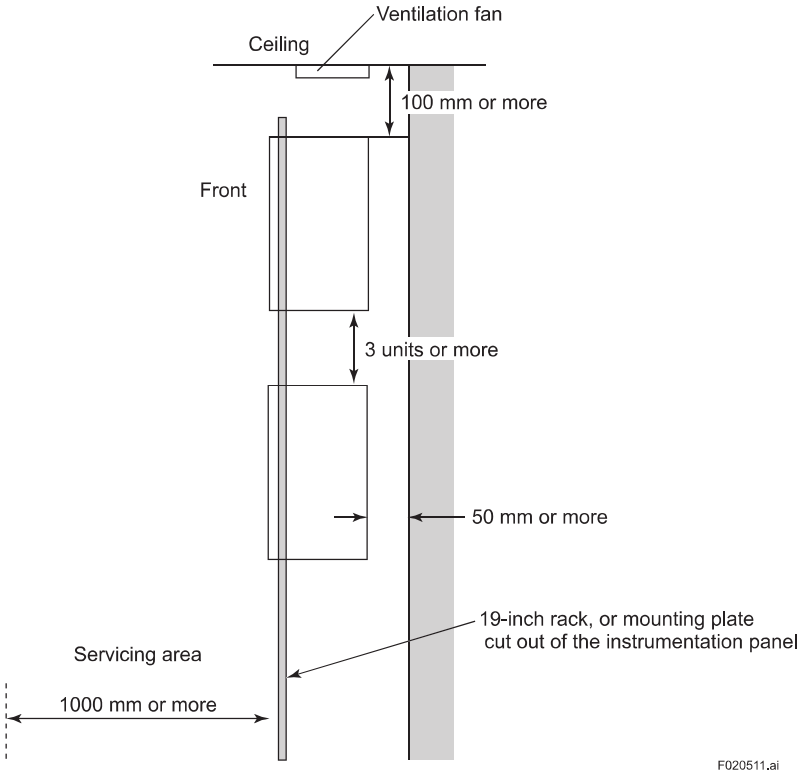



**Figure Space Required for Rack-mount Equipment**

## Isolation from Rack

Isolate the rack mountable devices from the rack by attaching insulating bushings. Fasten a pair of insulating bushings together to each of the screw holes on the plate or the bracket on the devices to prevent the devices from touching the rack. And then screw the devices to the rack. After screwing the devices to the rack, confirm that the devices is electrically isolated. insulating bushings are supplied with the rack mountable devices.

**CAUTION**

When you install the 'devices with insulating bushings attached' on a rack or an instrument panel, do not keep the devices hung on loose screws in an unstable status. Too much force may apply to the insulating bushings and cause damaged or broken insulating bushings.

## Installation Procedure

1. Fasten a pair of insulating bushings together to each of the screw holes on the plate or the bracket on the device. The tapering end of the insulating bushings must come to the front side where a screw enters.

2. Using eight M5 screws to fix the device onto the rack or the panel.

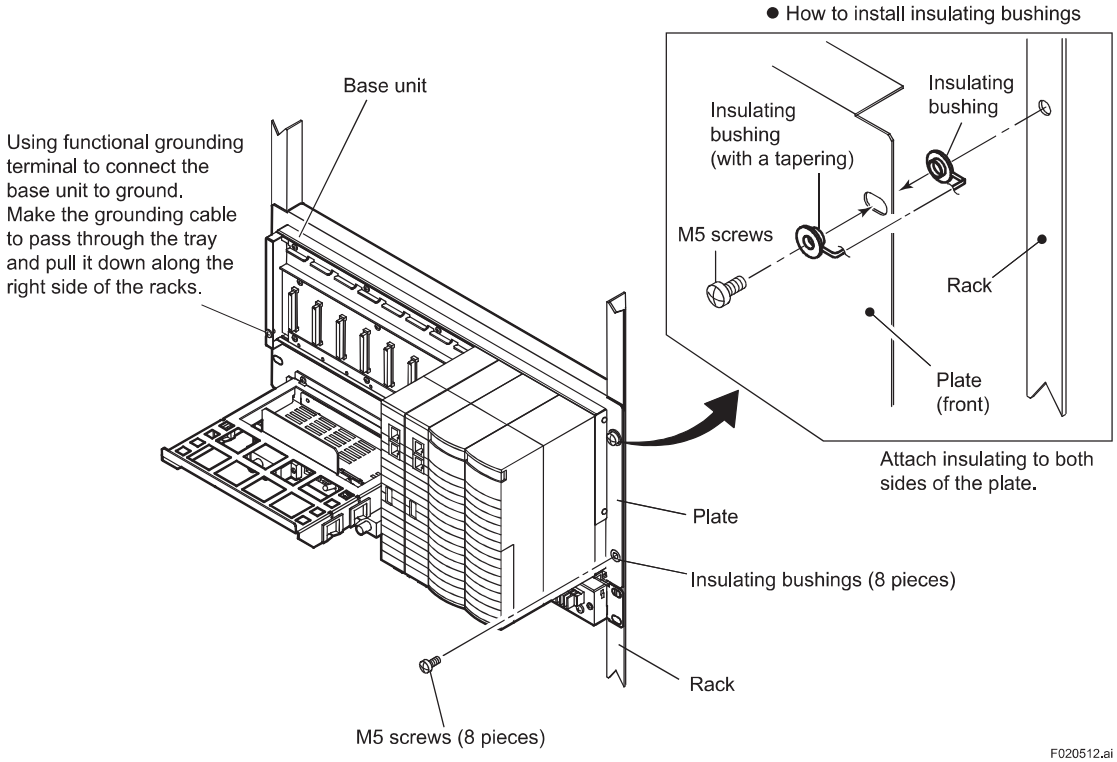



**Figure Example of Mounting FCU on a Rack**

## Isolation Bush

In the front of the I/O expansion cabinet (ACB51) (*1): for cabinet installation type node and the rear: for 19-inch rack mount type, the cabinet installation type node is installed in the front. For this node, the independent grounding plays an important role in the circuit systems.
Therefore, in order that the rear 19-inch rack mount devices do not pass the grounding current which is important to the node, it and devices manufactured by other companies, must be insulated with an insulation brush. As devices manufactured by Yokogawa also do not have the guarantee that it will share a common power supply or grounding with the Model ACB51 itself, make sure to insulate with an isolation bush.

**TIP**

The isolation bush of Yokogawa devices can be eliminated if both I/O expansion cabinet types are installing Yokogawa devices and shares a common power supply and grounding with Model ACB51 and only when other company devices are insulated with an isolation bush.

*1: The same operation is applied to I/O expansion cabinet constructed with Standard Cabinet (A2CAB1) and Cabinet Utility Kit (A2CUKT4).

## Installation Orientation

Install the device in the rack with the screws in the vertically correct orientation.

When installing the unit in the rack, confirm the direction according to the front view shown on General Specifications (GS).

**TIP**

When the device is supplied with power even if it is temporary, the device must be installed on the rack.
Placing the device on a desk etc. and laying it on its side should be avoided.
The device may become malfunction if the heat radiated from the device cannot be cooled smoothly.

## 2.5.4 DIN Rail Mountable Devices

The following devices can be mounted to a DIN rail.

| | |
|---|---|
| Node interface unit: | A2NN30D-□□□0□□□□□ |
| Adaptor base plate: | A2BN3D-0□□□□ |
| Barrier base plate: | A2BN4D-2□□□□ |
| | A2BN5D-2□□□□ |
| Power supply unit: | A2PW503/DN, A2PW504/DN |
| Terminal board: | A1BA4D, A1BT4D, A1BR4D, A1BD5D, A2BM4 |
| Relay board: | ARS15M, ARS55M |

**IMPORTANT**

Install a DIN rail mountable device inside a metal cabinet.

Installation inside a metal cabinet with a lock is required to comply with standards; in particular, safety standards and EMC conformity standards.

### Notes on Installation

**CAUTION**

For installation, secure ample working space and work in a team for safety.

#### Provide Space for Mounting

A2NN30D, A2BN3D, and A2BN5D need to be slide when they are mounted on the DIN rail. For that reason, provide a space shown in the following figure. Refer to the General Specifications (GS) for the external dimensions.

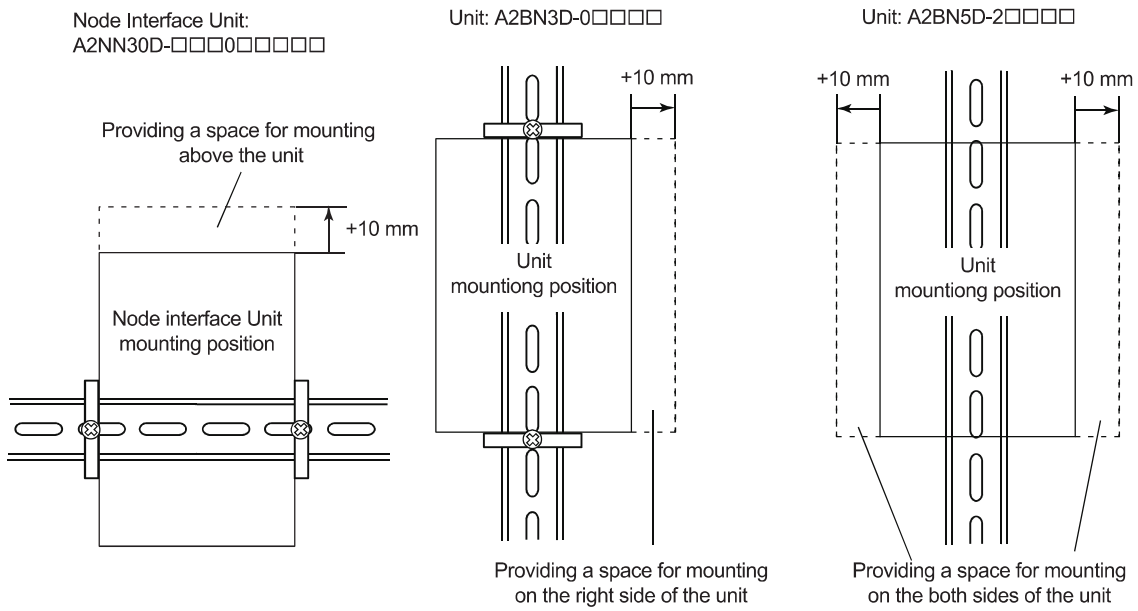



**Figure Providing a Space for Mounting (Front View)**

## Mounting

- When mounting the I/O Units (A2BN3D, A2BN4D) spaced apart from each other on the DIN rail, install the stoppers in both the top and bottom ends of each unit.

When mounting the units close to each other on the DIN rail, install the stoppers in the bottom end of each unit and in the top end of the unit in the highest position.

- When mounting the I/O Units (A2BN5D), fix the both the top and bottom ends to the DIN rail with the built-in stoppers.
- When mounting the Node Interface Unit (A2NN30D), install the stoppers in both the right and left ends of the unit.
- When mounting the Power Supply Unit (A2PW503/DN, A2PW504/DN), fix the both ends to the DIN rail with the built-in stoppers.

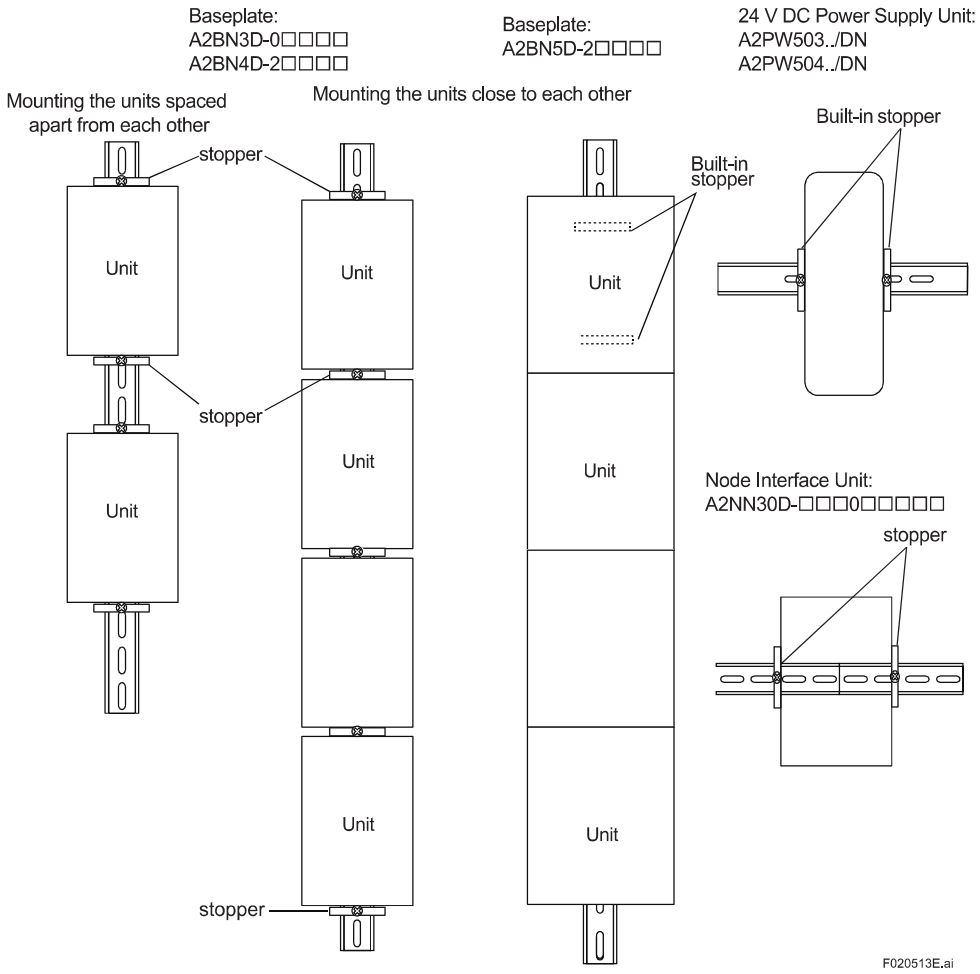



**Figure Mounting stopper to the DIN rail**

## Providing Space for Heat Dissipation

Leave space at the top and bottom of the device to permit heat dissipation.

- Separate the top of the instrumentation board at least 100 mm away from the ceiling, and cut a ventilation hole of 200 $cm^2$ or larger in the ceiling or install a ventilation fan.
- Do not block the openings (ventilation holes) in the top and bottom surfaces of the device.
- A 1-unit (44.45 mm) or more space shall be provided between the Node Interface Unit and other base plates.

## Providing Area for Servicing

Leave an area for servicing.

- All the work to connect cables to DIN rail mountable devices and I/O modules will be performed from the front.
- The work to confirm indicator lamps, configure card settings, and remove/insert cards will be performed from the front.
- The front is the area for wiring and servicing. Leave at least 1000 mm of space at the front.

## Compatible DIN Rail

**Table Compatible DIN Rail Symbols (DIN 60715, JIS C 2812, IEC 60715, EN50022)**

| Cross section shapeType symbol | Width - height symbols | Material (chemical symbol) |
|---|---|---|
| TH | 35-7.5 | Fe or Al |

## Installation of DIN Rail

- Install a DIN rail in a metal mounting plate with screws at 120-mm or less intervals.
- When mounting a DIN rail mountable device to a DIN rail, confirm that the device is securely fixed after the mounting.
- Be sure to bring a DIN rail into contact with a mounting plate in order that the heat generated from the DIN rail mountable device can be radiated to the mounting plate via the DIN rail.

## Grounding

Be sure to ground the equipment using the functional grounding terminal of the base plate. Even if there is electrical conduction between the base plate and wall surface via the mounting mechanism, the equipment must be grounded using the functional grounding terminal.

## Installation Orientation for base plate, node interface unit, and power unit

Mount the device to the DIN rail in the vertically correct orientation. Check the installation orientation in General Specifications (GS).

## Installation Orientation for terminal board

Mount a terminal board in the orientations as shown in the below figure. Refer to the General Specifications (GS) for the external dimensions.

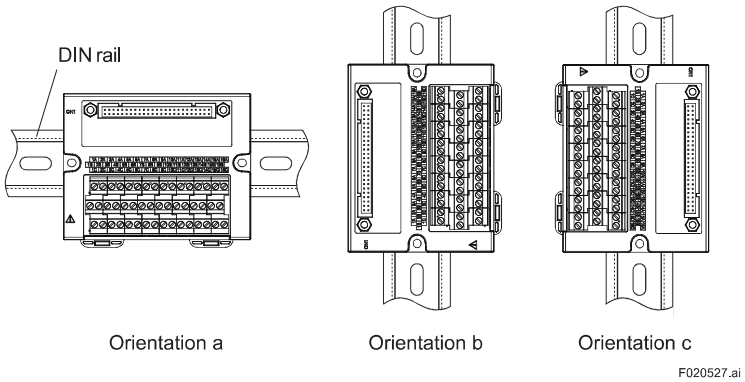



**Figure Installation Orientation for terminal board**

## Remarks for Mounting on a DIN Rail

On the back of DIN rail mountable terminal board, there are two bumps (projections) for fixing screws on the wall. Be sure not to let mechanical interference happen between these bumps and screw tops from the DIN rail. The height of the shaded areas in the below figures must be kept as 2.5 mm or shorter than the DIN rail surface.

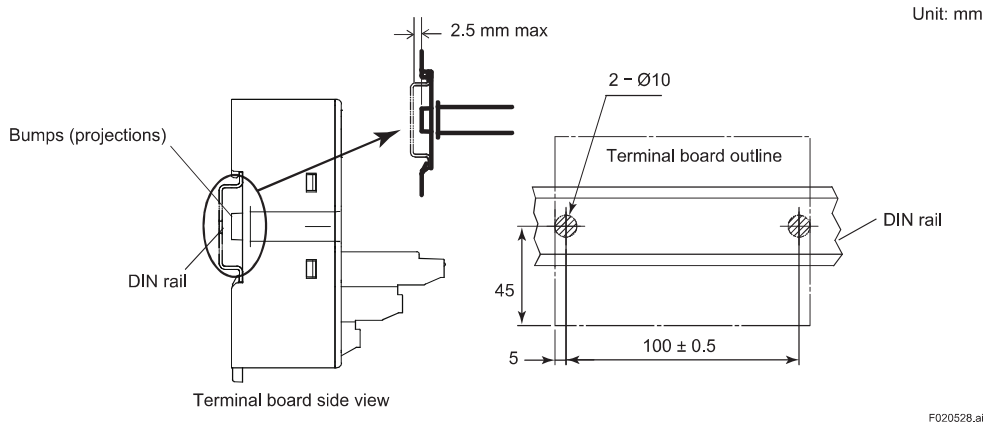



**Figure Remarks for Mounting on a DIN Rail**

## 2.5.5 Wall Mountable Devices

The following devices can be mounted to a wall with screws.

| | |
|---|---|
| Node interface unit: | A2NN10D, A2NN30D-□□□□1□□□□ |
| Adaptor base plate | A2BN3D-1□□□□ |
| Barrier base plate: | A2BN4D-2□□□□ |
| | A2BN5D-2□□□□ |
| Terminal board: | A2BM4 |

**IMPORTANT**

Install a wall mountable device inside a metal cabinet.
Installation inside a metal cabinet with a lock is required to comply with standards; in particular, safety standards and EMC conformity standards.

### Notes on Installation

#### Providing Space for Mounting

A2BN4D need to be slide when this is mounted to a wall. For this reason, provide a space shown in the following figure. Refer to the General Specifications (GS 33J62F40-01EN) for the external dimensions.

Unit: A2BN4D-1□□□□

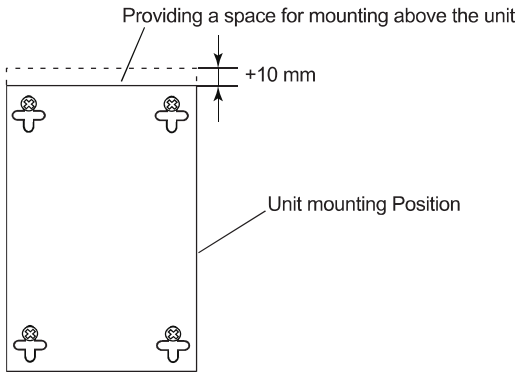



**Figure Providing a Space for Mounting (Front View)**

#### Providing Space for Heat Dissipation

Leave space to permit heat dissipation just as for a DIN rail mountable device.

#### Providing Area for Servicing

Leave an area for servicing just as for a DIN rail mountable device.

#### Gounding

Be sure to ground the equipment using the functional grounding terminal provided on the base plate.

## Mounting of Base plate

- Mount a wall mountable device to a metal mounting plate using screws.
- Be sure to bring a device into contact with a mounting plate in order that the heat generated from the device can be radiated to the mounting plate.

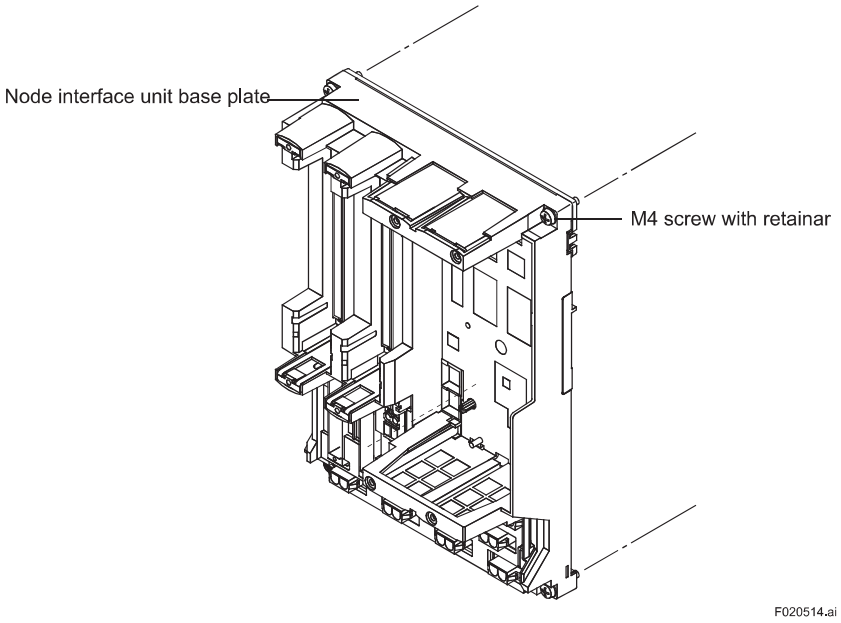



**Figure Example of Mounting Node Interface Unit to Wall**

**Table Tighening Torque for Wall Mountable Devices**

| Model | Torque (N·m) |
|---|---|
| A2NN30D | 0.8~1.0 |
| A2BN3D | 0.8~1.0 |
| A2BN4D | 1.2 |
| A2BN5D | 1.2 |

## Remarks for Mounting terminal board on a Wall Surface

The following figure shows the screw installation dimensions for a wall mountable terminal board. Installation screws for the terminal board are not supplied and should be purchased separately. You need two installation screws. If you are using binding heads, use M4 screws with a length of at least 10 mm. If you are using screws with washers, use M4 screws with a length of at least 12 mm. The screw tightening torque is approximately 0.8 N·m.

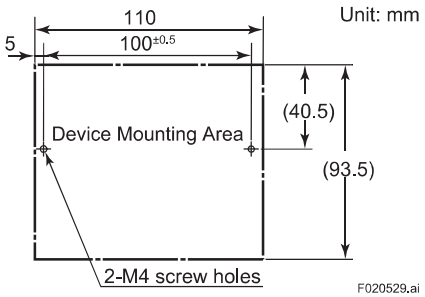



**Figure Screw Installation Dimensions for A2BM4**

SEE ALSO For the screw mounting dimensions for wall mounting, refer to the General Specifications (GS) for the corresponding device.

## Grounding

Ground the equipment using the functional grounding terminal provided on the base plate. Even if there is electrical conduction between the base plate and wall surface via the mounting screws, the equipment must be grounded using the functional grounding terminal.

## Insulation from a wall (Node Interface Unit A2NN10D)

To prevent noise from coming into the device through the wall, attach insulating bushings to the brackets on the 19-inch rack mountable node interface unit so that the unit does not directly touch the wall. Insulating bushings are supplied as accessories.

## Installation Orientation

Mount the device to the DIN rail with the screws in the vertically correct orientation. Check the installation orientation in General Specifications (GS).

## 2.5.6 Example of Mounting to General Purpose Cabinet / Junction Box

This section describes examples of the maximum number of devices mounted in a general-purpose cabinet or a junction box. When mounting more devices than the number shown in the examples, or when changing the conditions explained later, please carry out thermal design for each device, and make sure it meets the temperature specifications for each device.

### Cabinet for FIO System

#### Mounting to Cabinet Using ACUKT1, A2CUKT4

The following describes how to mount the field control unit and node units to a Rettal TS8 cabinet using the Cabinet Utility Kit (ACUKT1, A2CUKT4).

**Cabinet Specification**

Cabinet Utility Kit (ACUKT1) can be used for mounting to a Rettal TS8 cabinet with the dimensions of 800 mm (W) x 800 mm (D) x 2,000 mm (+100 mm) (*1) (H).

*1: 100 mm is the height of the channel base.

**Operating Temperature**

- The ambient temperature of the cabinet should be 50°C or less.
- The field control unit and node units should meet the temperature range specified in the General Specifications (GS).

**Mounting Conditions**

- Maximum number of mounted units
  Field Control Unit (for FIO):
  One unit can be mounted either at the front or rear of the cabinet (max. one unit).

  Node unit:
  Up to 7 units can be mounted each at the front and rear of the cabinet. However, up to 6 units can be mounted on the side where the field control unit is mounted.
- Use the door fan that is included in ACUKT1, A2CUKT4.
- Do not mount a heat dissipating device (e.g., power supply) in the cabinet, with the exception of the field control unit and node units.
- Provide space for one unit between the higher-level node fan unit and the node unit beneath it.
- Mount the appropriate number of node fan units in accordance with the number of units mounted. For details, refer to GS 33J60K20-01EN.

**IMPORTANT**

The restrictions on the I/O modules installed in the FIO node units are described in the document of “FIO System Overview” (GS 33J60F10-01EN).

**Mounting Position of Devices**

- Field Control Unit (for FIO with HKU I/F): Location 38 to 42
- Node Unit : Location 4 to 34

**Mounting Position of cabinet Utility Kit (ACUKT1, A2CUKT4)**

- Node fan Unit (ANFAN): Location 34, 36
- PDB: Location 1 to 3
- Door fan unit (ADFAN): To the door
- Power Supply Bus Unit, Vertical type (AEPV7D)

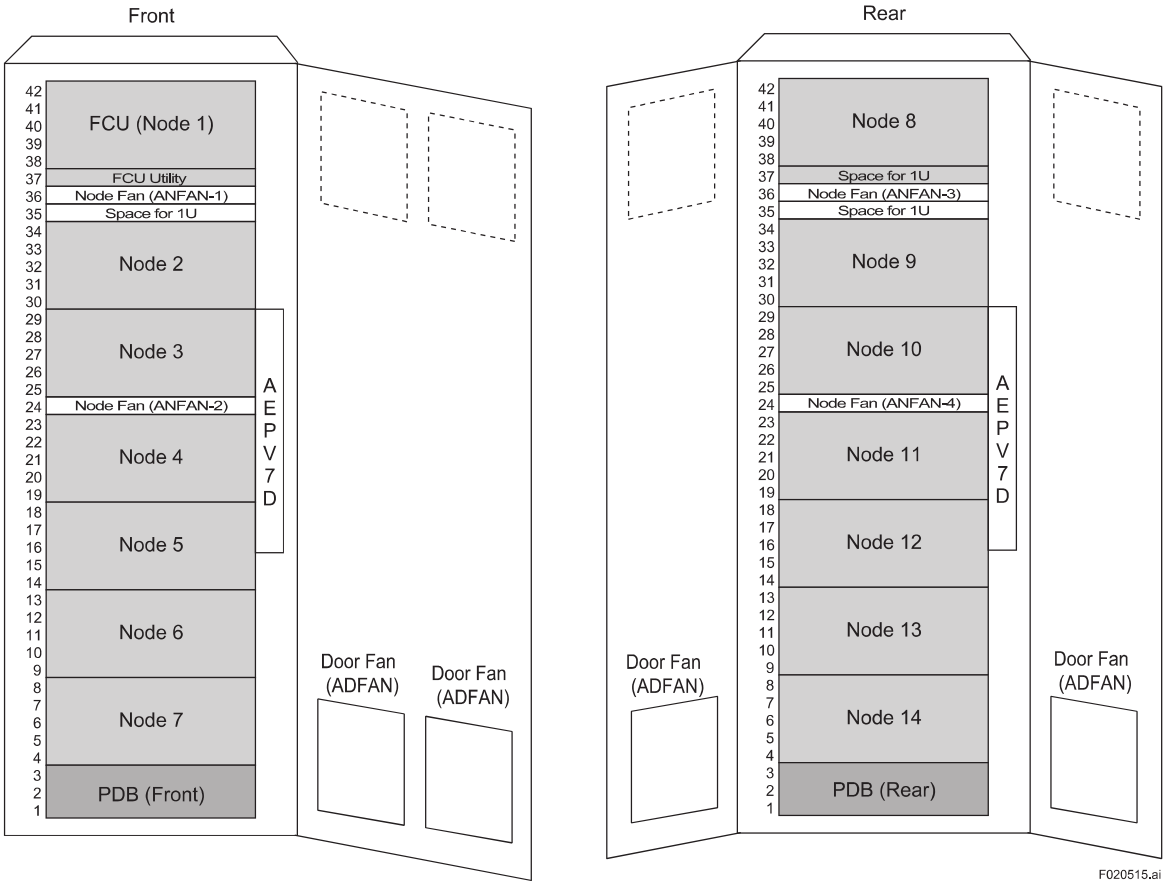



**Figure Example of Closely-installed FIO Node Units (A single door is mounted at the front, A double door is mounted at the rear)**

### Mounting of Door Fan

Mount the door fan unit using the chassis of Rittal's standard door fan unit.

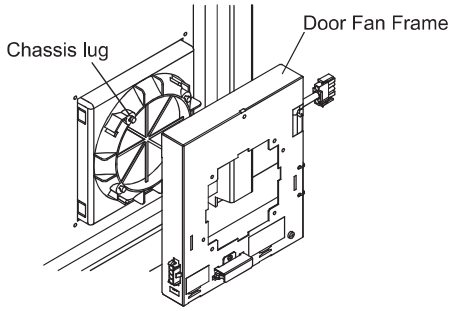



**Figure Mounting of Door Fan frame**

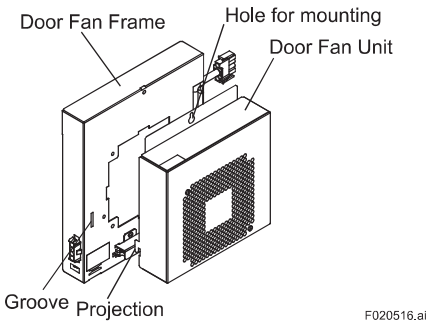



**Figure Mounting of Door Fan Unit**

## Mounting to General Purpose Cabinet without ACUKT1, A2CUKT4

The following describes how to mount the field control unit and node units to a Rittal or other general purpose cabinet without using the Cabinet Utility Kit (ACUKT1, A2CUKT4).

**Cabinet Specification Example**

- Cabinet dimensions: 800 mm (W) x 800 mm (D) x 2,000 mm (+100 mm) (*1) (H).

  *1: 100 mm is the height of the channel base.
- Door fans must be mounted on both front- and rear-door panels. (Both fans' air flow rate should be equal or greater than 230 $m^3$/h.)

**Temperature Condition**

The ambient cabinet outside a cabinet must be below 40 degree Celsius.

The ambient temperature inside a cabinet where the Field Control Unit and the FIO Node Units are installed must satisfy the conditions specified in GS (General Specification)documents of the Field Control Unit and the FIO Node Units.

**Installation Condition**

- Maximum Number of Devices
  Field Control Unit: One each can be installed in front part and rear part of a cabinet.
  Node Unit: Four each can be installed in front part and rear part of a cabinet.

  If Field Control Unit is not installed in the part of the cabinet, up to five FIO node units can be installed.
- Any heat generating device other than Field Control Unit and FIO node unit (such as a power supply) should not be installed in the cabinet.
- A three unit mounting space (one unit mounting space equals to 44.45 mm) should be kept between the highest position of the mounting frame and the highest Field Control Unit or FIO node unit in the cabinet.
- One unit mounting space (one unit mounting space equals to 44.45 mm) should be kept between an Field Control Unit and an FIO node unit.
- Up to two FIO node units can be installed close to each other in the same cabinet.

If three FIO node units need to be installed close to each other, a circulation fan unit (with 300 $m^3$/h or more airflow capability) should be placed at the top of the three FIO node units.

**IMPORTANT**

The restrictions on the I/O modules installed in the FIO node units are described in the document of "FIO System Overview" (GS 33J60A10-01EN).

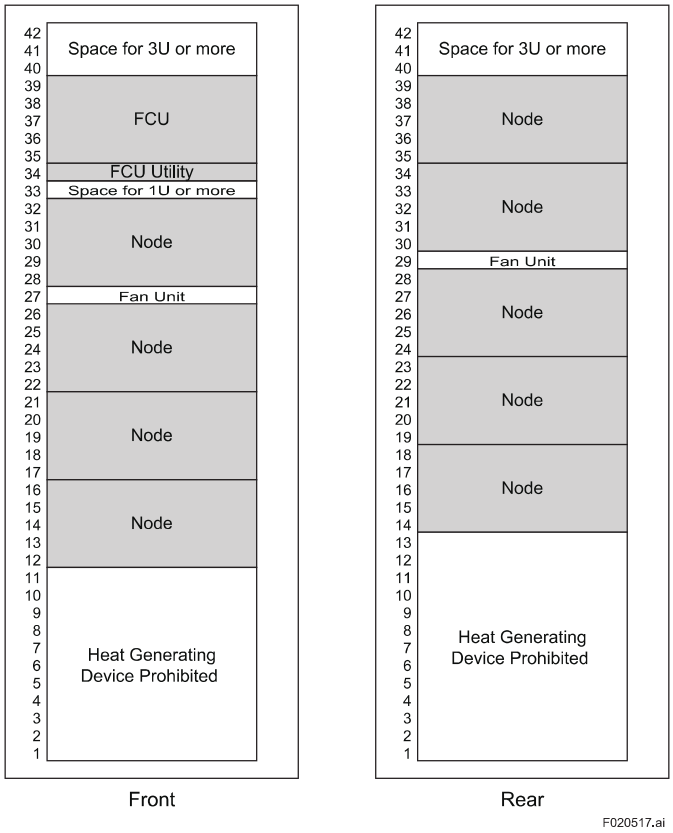



**Figure Mounting Example Using General Purpose Cabinet (Without Using ACUKT1, A2CUKT4)**

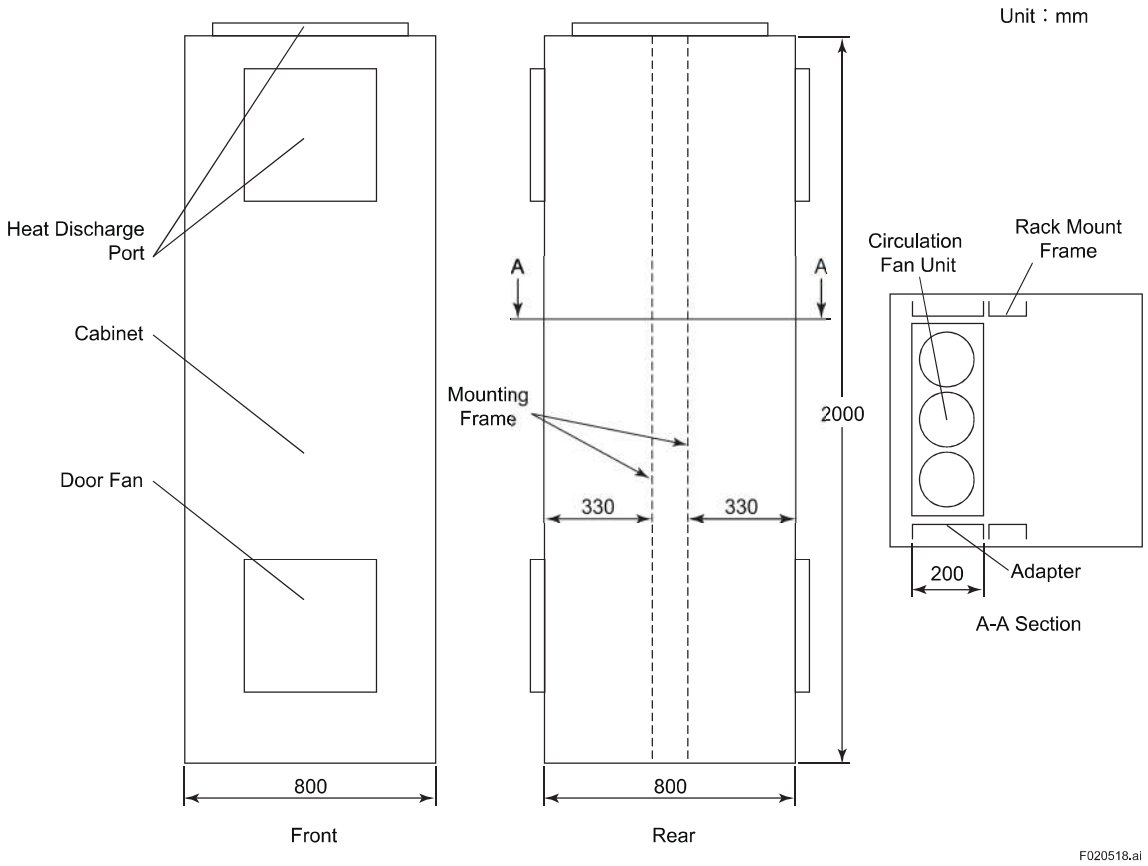



**Figure An Example of Installation in Rittal Cabinet**

## Cabinet for N-IO System

This section describes examples of the maximum number of N-IO system equipment (except for equipment for RIO System Upgrade) installed in general-purpose cabinets.

The following shows the common specifications to the examples of cabinets for N-IO system that are explained later.

### Cabinet Specifications

The following cabinet is assumed to be used.

**Table Cabinet Dimensions**

| W | D | H | Product example |
|---|---|---|---|
| 800 mm | 800 mm | 2000 mm (+100 mm) (*1) | Rittal TS8808 series |

*1: 100 mm is the height of the channel base.

**Table Specifications of a cabinet ambient temperature and an air supply / air exhaust port (In case N-IO FCU is included in a cabinet.)**

| Cabinet ambient temperature | Air supply port | Air flow | Area of an air supply/ air exhaust port (Panel cut of a cabinet) | Product example | Remarks |
|---|---|---|---|---|---|
| 40 ºC or less | Fan | Door fan 230 $m^3$/h or more<br><br>Circulation fan 230 $m^3$/h or more | Air supply port 60000 $mm^2$ or more<br><br>Air exhaust port 60000 $mm^2$ or more | Rittal SK3239 series (Fan) | • Be sure to mount two push-fit door fans on each side in case of a failure.<br>• The air flow and the area in the left show the total value on each side. |

**Table Specifications of a cabinet ambient temperature and an air supply / air exhaust port (In case only N-IO nodes (Non-Intrinsic Safety Barrier) are included in a cabinet.)**

| Cabinet ambient temperature | Air supply port | Air flow | Area of an air supply/ air exhaust port (Panel cut of a cabinet) | Product example | Remarks |
|---|---|---|---|---|---|
| 50 ºC or less | Fan | Door fan 40 $m^3$/h or more | Air supply port 16000 $mm^2$ or more<br><br>Air exhaust port 60000 $mm^2$ or more | Rittal SK3237 series (Fan) | • It is recommended to mount two push-fit door fans on each side in case of a failure.<br>• The air flow and the area in the left show the total value on each side. |
| 40 ºC or less | Outlet filter | — (*1) | Air supply port 60000 $mm^2$ or more<br><br>Air exhaust port 60000 $mm^2$ or more | Rittal SK3239.200 (Outlet filter) | • Be sure to mount two outlet filters on each side in case of a failure such as filter clogging. |

*1: When not mounting a fan, be sure to secure a ventilation path in the cabinet.

**Table Specifications of a cabinet ambient temperature and an air supply / air exhaust port (In case only N-IO nodes (Intrinsic Safety Barrier) are included in a cabinet.)**

| Cabinet ambient temperature | Air supply port | Air flow | Area of an air supply/ air exhaust port (Panel cut of a cabinet) | Product example | Remarks |
|---|---|---|---|---|---|
| 50 °C or less | Fan | Door fan 230 $m^3/h$ or more | Air supply port 60000 $mm^2$ or more<br><br>Air exhaust port 60000 $mm^2$ or more | Rittal SK3239 series (Fan) | • Be sure to mount two or more push-fit door fans on each side in case of a failure.<br>• The air flow and the area in the left show the total value on each side. |

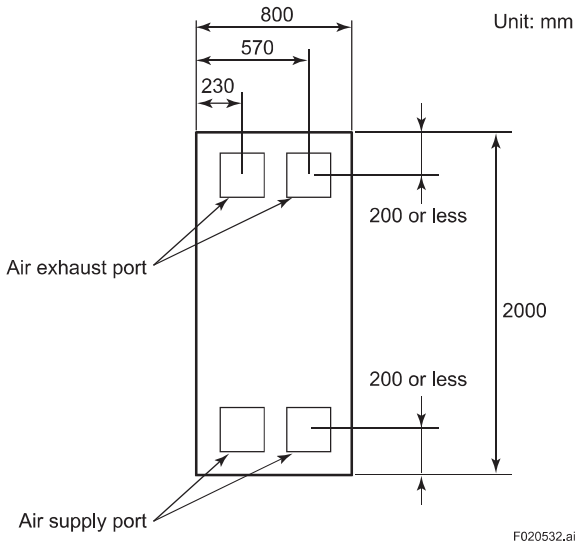
### Notes

The following shows the common notes to the examples.

- The ventilation for each system shall not be blocked.
- The mounting plate for mounting the IOBP and IOBP_IS shall be made of metal, regardless of whether DIN rail or panel mounting.
- A DIN rail shall be made of metal.
- For mounting restrictions other than the above, refer to the General Specifications (GS).

### Position of an air supply / air exhaust port

In this mounting example, arrange an air supply / air exhaust port as follows.




Note: This is the dimension from the end face of the cabinet. (Not the dimension from the end face of the cabinet door.)

**Figure Position of an air supply/ air exhaust port**

### Conventions

The following shows the common abbreviations used and their explanations.

| Abbreviations | Explanations |
|---|---|
| FCU | Field Control Unit |
| NIU | Node Interface Unit (for N-IO) |
| IOBP | I/O Base Plate |
| IOBP_IS | I/O Base Plate for Intrinsic Safety explosion protection |
| NIO node | Consists of NIU and IOBP/IOBP_IS. |
| Unit | Unit of 19 inch rack. 1 Unit = 44.45 mm |
| Side | One of the front and the back of a cabinet. (e.g., side, one side) |

## Example of Mounting Multiple FCUs for N-IO in a Cabinet

### Temperature conditions

In this example, the ambient temperature is assumed to be the following.

| | |
|---|---|
| Cabinet ambient temperature | 40 °C or less |

### Maximum numbers of units that can be mounted

| Type | Model | Number of units that can be mounted per side |
|---|---|---|
| FCU | A2FV50D<br>A2FV50S<br>A2BE1D | Up to 4 |

Heat-generating devices other than the above shall not be mounted in the cabinet.

### Mounting conditions

- FCU shall be mounted with a 3-unit or more space from the top-shelf mounting position of the cabinet.
- A 2-unit or more space shall be provided between the circulation fan unit and the FCU on the bottom shelf.
- Devices that block the convective air flow from the circulation fan unit or door fans to each module shall not be mounted.

The following shows how to mount multiple FCUs for N-IO in a cabinet:

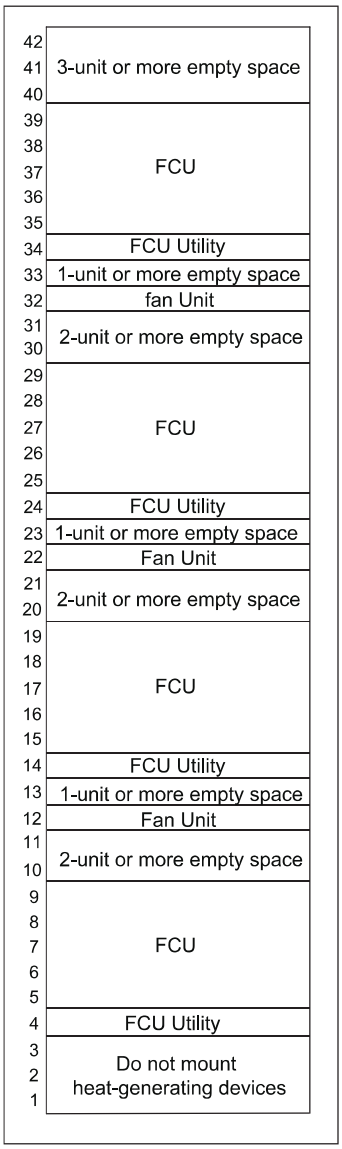



**Figure Example of Mounting Multiple FCUs for N-IO in a Cabinet**

## Example of Mounting an FCU for N-IO and N-IO Nodes in a Cabinet

### Temperature conditions

In this example, the ambient temperature is assumed to be the following.

| | |
|---|---|
| Cabinet ambient temperature | 40 °C or less |

### Maximum numbers of units that can be mounted in case of this example

| Type | Model | Number of units that can be mounted per side |
|---|---|---|
| FCU | A2FV50D/A2FV50S/ A2BE1D | Up to 1 |
| NIU | A2NN30D | Up to 1 |
| IOBP | A2BN3D | Up to 6 (2 rows × 3 shelves) |

Heat-generating devices other than the above shall not be mounted in the cabinet.

### Exception to mounting heat-generating devices

Shunt Resistor Unit : A2EXR001 for the Pulse Input Signal Adaptor (A2SAP105) can be mounted in the same cabinet under the following conditions:

- A2EXR001 shall be mounted on the side of the cabinet or under IOBP with a distance of 200 mm from NIU.
- When 5 or more A2EXR001units are mounted on a cabinet, the number of IOBP on the cabinet shall be reduced in accordance with the following table.

**Table Example of Number of A2EXR001 Mounted and Mounting Conditions**

| Number of A2EXR001 mounted | Mounting condition |
|---|---|
| 1 to 4 | Can be mounted in the same cabinet |
| 5 to 12 | Can be mounted in the same cabinet by reducing one IOBPs |
| 13 to 20 | Can be mounted in the same cabinet by reducing two IOBPs |

- Further reduce one IOBP on the cabinet per 8 A2EXR001 units when 21 or more A2EXR001 units are mounted on a cabinet.

### Mounting conditions

- The FCU on the top shelf shall be mounted with a 100-mm or more space from the cabinet ceiling.
- A 1-unit (=44.45 mm) or more space shall be provided between NIU and IOBP.
- A circulation fan unit shall be mounted on the shelf below the FCU with a 1-unit space. A 1-unit or more space shall be provided under the circulation fan unit.
- Suitable length of signal cables and power cables should be used.

The following shows how to mount an FCU for N-IO and N-IO nodes in a cabinet:

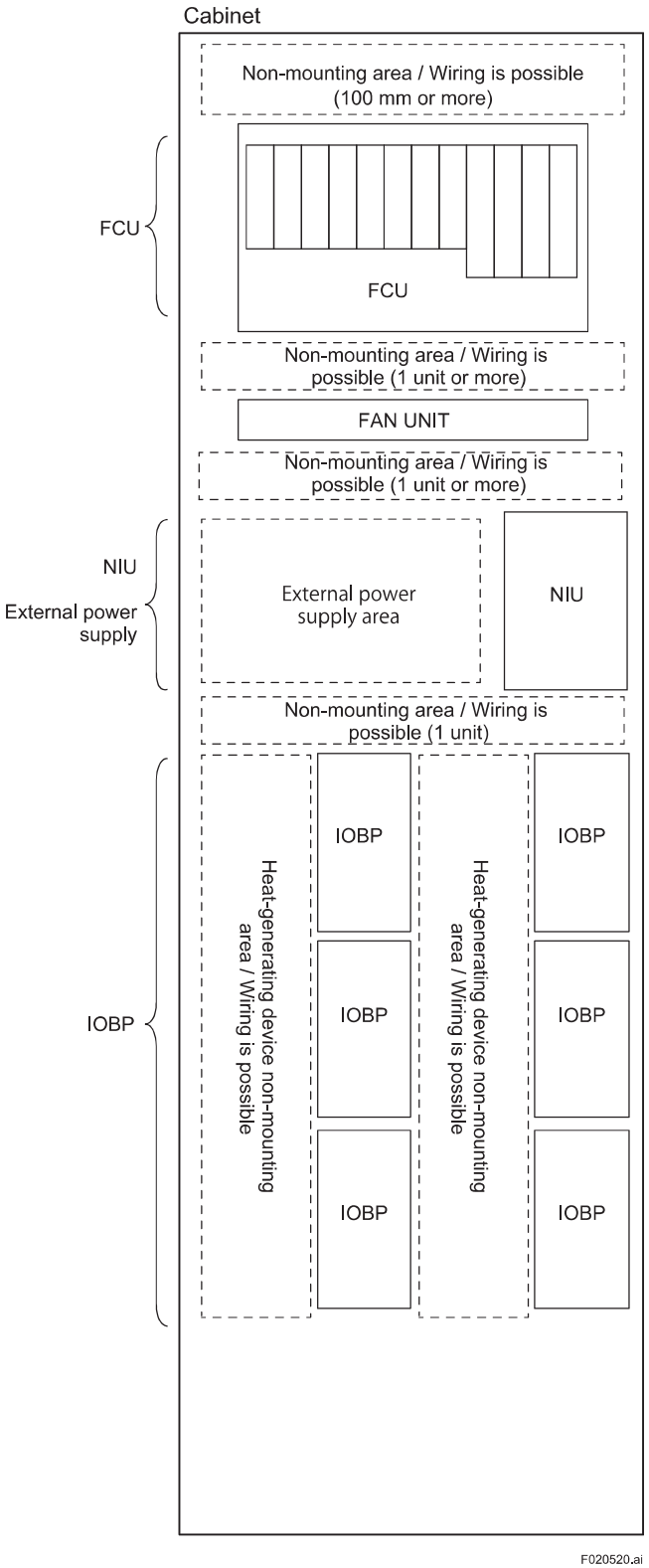



**Figure Example of Mounting an FCU for N-IO and N-IO Nodes in a Cabinet**

## Example of Mounting an FCU for N-IO and N-IO Nodes in a Cabinet (For field wiring via terminal board)

### Temperature conditions

In this example, the ambient temperature is assumed to be the followings.

| | |
|---|---|
| Cabinet ambient temperature | 40 °C or less |

### Maximum numbers of units that can be mounted in case of this example

| Type | Model | Number of units that can be mounted per side |
|---|---|---|
| FCU | A2FV50S/A2FV50D/ A2BE1D | Up to 1 |
| NIU | A2NN30D | Up to 2 |
| IOBP | A2BN3D | Up to 12 (3 rows × 4 shelves) |

Heat-generating devices other than the above shall not be mounted in the cabinet.

### Mounting conditions

- The FCU on the top shelf shall be mounted with a 100-mm or more space from the cabinet ceiling.
- A 1-unit (= 44.45 mm) or more space shall be provided between NIU and IOBP.
- A circulation fan unit shall be mounted on the shelf below the FCU with a 1-unit space.

  A 1-unit or more space shall be provided under the circulation fan unit.
- Suitable length of signal cables and power cables should be used.

The following shows how to mount an FCU for N-IO and N-IO nodes in a cabinet (IOBP×3 columns mounted).

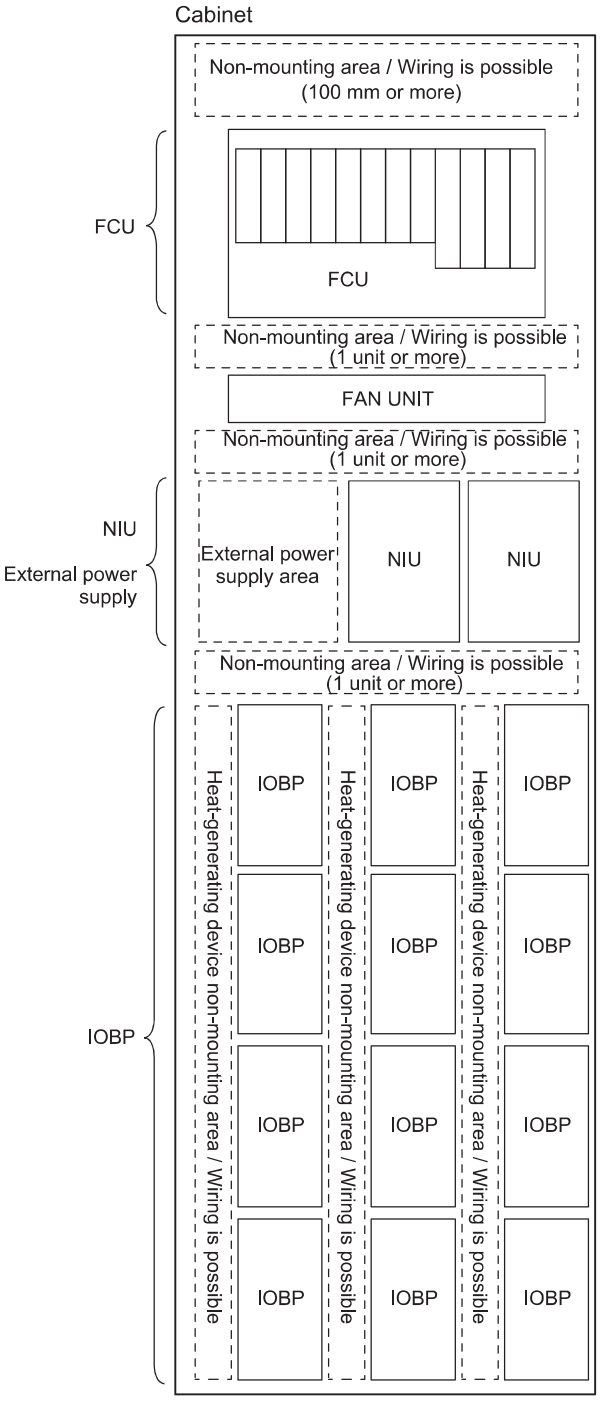



**Figure Example of Mounting an FCU for N-IO and N-IO Nodes in a Cabinet (IOBP×3 columns mounted)**

## Example of Mounting N-IO Nodes (Non-Intrinsic Safety Barrier) in a Cabinet

### Temperature conditions (For direct field wiring to IOBP)

In this example, the ambient temperature is assumed to be the followings.

| | |
|---|---|
| Cabinet ambient temperature | 50 °C or less (*1) |

*1: The cabinet ambient temperature is 40 °C or less, when the temperature option (-40 to 70 °C) of NIU and IOBP is not specified.

### Maximum numbers of units that can be mounted in case of this example

| Type | Model | Number of units that can be mounted per side |
|---|---|---|
| NIU | A2NN30D (*1) | Up to 2 |
| IOBP | A2BN3D (*1) | Up to 10 (2 rows × 5 shelves) |

*1: Specify the temperature environment option (-40 to 70 °C).

Heat-generating devices other than the above shall not be mounted in the cabinet.

### Exception to mounting heat-generating devices

Shunt Resistor Unit: A2EXR001 for the Pulse Input Signal Adaptor (A2SAP105) can be mounted in the same cabinet under the following conditions:

- A2EXR001 shall be mounted on the side of the cabinet or under IOBP with a distance of 200 mm from NIU.
- When 5 or more A2EXR001units are mounted on a cabinet, the number of IOBP on the cabinet shall be reduced in accordance with the following table.

**Table Number of Shunt Resistors Mounted and Mounting Conditions**

| Number of shunt resistors mounted | Mounting condition |
|---|---|
| 1 to 4 | Can be mounted in the same cabinet |
| 5 to 12 | Can be mounted in the same cabinet by reducing one IOBPs |
| 13 to 20 | Can be mounted in the same cabinet by reducing two IOBPs |

- Further reduce one IOBP on the cabinet per 8 A2EXR001 units when 21 or more A2EXR001 units are mounted on a cabinet.

### Mounting conditions

- The NIU shall be mounted with a 100-mm or more space from the cabinet ceiling.
- A 1-unit (=44.45 mm) or more space shall be provided between NIU and IOBP.
- Suitable length of signal cables and power cables should be used.

The following shows how to mount N-IO nodes (Non-Intrinsic Safety barrier) in a cabinet:

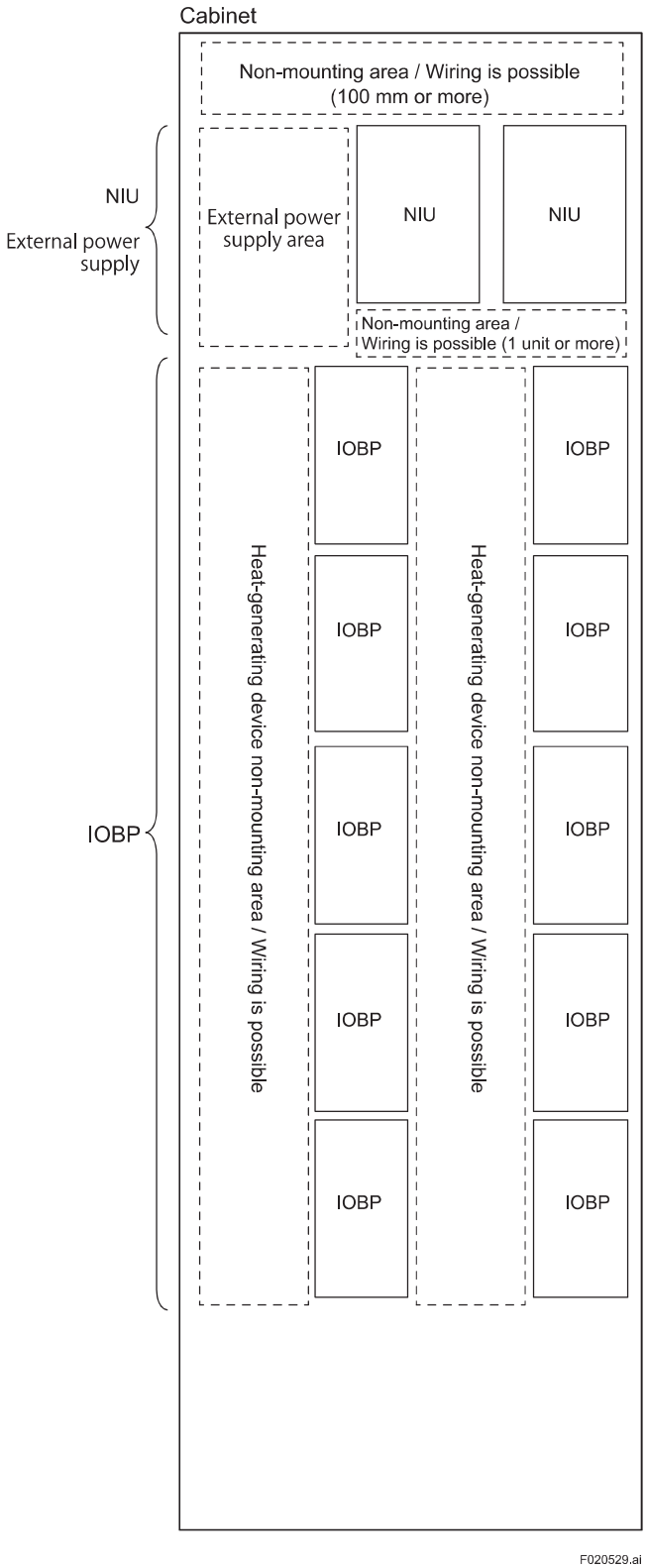



**Figure Example of Mounting N-IO Nodes (Non-Intrinsic Safety barrier) in a Cabinet**

## Example of Mounting N-IO Nodes (Non-Intrinsic Safety Barrier) in a Cabinet (For field wiring via terminal board)

### Temperature conditions

In this example, the ambient temperature is assumed to be the followings.

| | |
|---|---|
| Cabinet ambient temperature | 50 °C or less (*1) |

*1: The cabinet ambient temperature is 40 °C or less, when the temperature option (-40 to 70 °C) of NIU and IOBP is not specified.

### Maximum numbers of units that can be mounted in case of this example

Heat-generating devices other than the above shall not be mounted in the cabinet.

| Mounting surface of cabinet | Type | Model | Number of units that can be mounted per side (*2) |
|---|---|---|---|
| Mounting surface of external power supply | NIU | A2NN30D (*1) | Up to 3 |
| | IOBP | A2BN3D (*1) | Up to 15 (3 rows x 5 shelves) |
| Non-mounting surface of external power supply | NIU | A2NN30D (*1) | Up to 3 |
| | IOBP | A2BN3D (*1) | Up to 18 (3 rows x 6 shelves) |

*1: Specify the temperature environment option (-40 to 70 °C).
*2: It is subject to use of wall-mount type IOBP.

### Mounting conditions

- The NIU shall be mounted with a 100-mm or more space from the cabinet ceiling.
- A 1-unit (=44.45 mm) or more space shall be provided between NIU and IOBP.
- When using a DIN rail, be sure to install a DIN rail on the mounting plate. Fixing at the both ends of a DIN rail and not fixing at the middle.
- Suitable length of signal cables and power cables should be used.

The following shows how to mount N-IO nodes (Non-Intrinsic Safety barrier) in a cabinet:

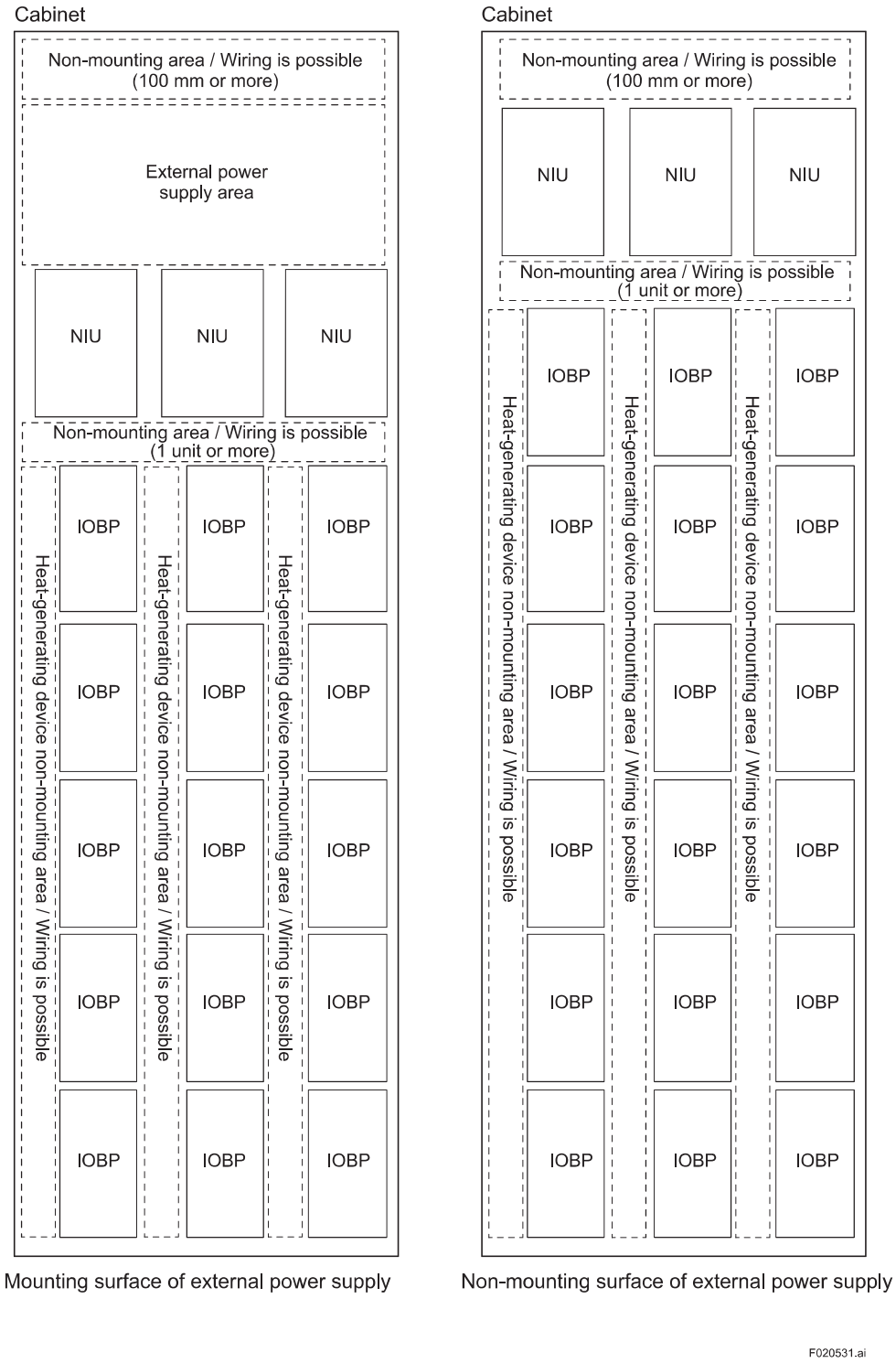



**Figure Example of Mounting N-IO Nodes (Non-Intrinsic Safety barrier) in a Cabinet**

## Example of Mounting N-IO Nodes (Intrinsic Safety Barrier) in a Cabinet

### Temperature conditions (For direct field wiring to IOBP)

In this example, the ambient temperature is assumed to be the followings.

| | |
|---|---|
| Cabinet ambient temperature | 50 °C or less |

### Maximum numbers of units that can be mounted in case of this example

| Type | Model | Number of units that can be mounted per side |
|---|---|---|
| NIU | A2NN30D (*1) | Up to 2 |
| IOBP_IS | A2BN4D | 8 (2 rows × 4 shelves) |
| | A2BN5D | 10 (2 rows × 5 shelves) |

*1: Specify the temperature environment option (-40 to 70 °C).

Heat-generating devices other than the above shall not be mounted in the cabinet.

IOBP cannot be mounted.

### Mounting conditions

- The NIU shall be mounted with a 100-mm or more space from the cabinet ceiling.
- A 1-unit (=44.45 mm) or more space shall be provided between NIU and IOBP_IS.
- Suitable length of signal cables and power cables should be used.
- Mounting the devices in the cabinet should be in line according to the intrinsic safety standard.

The following shows how to mount N-IO nodes (Intrinsic Safety barrier) in a cabinet:

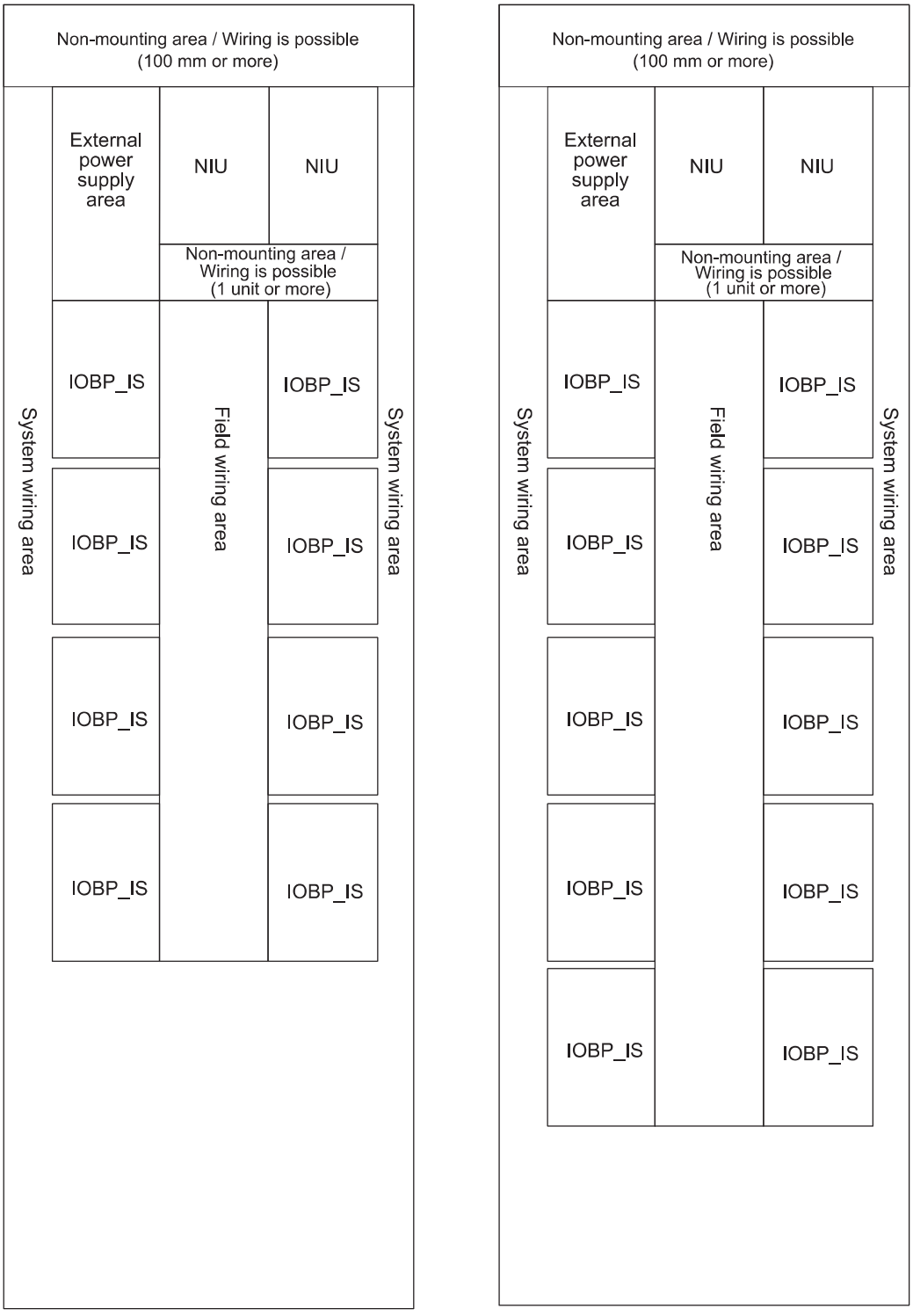



**Figure Example of Mounting N-IO Nodes (Intrinsic Safety Barrier) in a Cabinet**

# Junction Box for N-IO System

This section describes examples of the maximum number of N-IO system equipment (except for equipment for RIO System Upgrade) installed in general-purpose junction boxes.

The following shows the common specifications to the examples of junction boxes for N-IO system that are explained later.

## Junction Box Specifications

The following junction box is assumed to be used.

**Table Junction Box Dimensions**

| W | D | H |
|---|---|---|
| 800 mm | 300 mm | 1000 mm |

## Product examples

**Table Product examples**

| | Manufacturer | Model |
|---|---|---|
| Junction Box | Rittal | 1180 series |

## Notes

The following shows the common notes to the examples.

- The ventilation for each system shall not be blocked.
- The mounting plate for mounting the IOBP and IOBP_IS shall be made of metal, regardless of whether DIN rail or panel mounting.
- A DIN rail shall be made of metal.
- For mounting restrictions other than the above, refer to the General Specifications (GS).

## Conventions

The following shows the common abbreviations used and their explanations.

| Abbreviations | Explanations |
|---|---|
| NIU | Node Interface Unit or Base Plate for Node Interface Unit |
| IOBP | Base Plate |
| IOBP_IS | Base Plate Intrinsic Safety explosion protection |
| Unit | Unit of 19 inch rack. 1 Unit = 44.45 mm |

## Example of Mounting N-IO Nodes (Non-Intrinsic Safety Barrier) in a Junction Box

### Temperature conditions

In this example, the ambient temperature is assumed to be the followings.

| | |
|---|---|
| Junction Box ambient temperature | 50 °C or less |

### Maximum numbers of units that can be mounted

| | Type | Model | Number of units that can be mounted per side |
|---|---|---|---|
| Per junction box | NIU | A2NN30D (*1) | Up to 1 |
| | IOBP | A2BN3D (*1) | Up to 4 (2 rows × 2 shelves) |
| | Other | Heat-generating device (*2) | heat generation: 40 W or less |

*1: Specify the temperature environment option (-40 to 70 °C).
*2: The device to be mounted shall be selected from those that have the ambient temperature range of +15 °C or more.

Heat-generating devices other than the above shall not be mounted in the junction box.

In this example, IOBP_IS cannot be mounted.

### Mounting conditions

- Do not mount the IOBP so that its heat-generating part (adaptor or I/O) is located immediately under the N-ESB Bus module (A2EN501). The IOBP may be mounted immediately under the power supply of the NIU (A2PW50x).
- The NIU shall be mounted with a 2-unit or more space from the ceiling of the junction box.
- A 1-unit or more space shall be provided between the NIU and IOBP.
- To mount heat-generating devices other than NIU and IOBP shall be mounted with 30-mm intervals on the right of the NIU on the top shelf. The specifications of the devices shall be observed.

The following shows how to mount N-IO nodes (Non-Intrinsic Safety barrier) in a junction box:

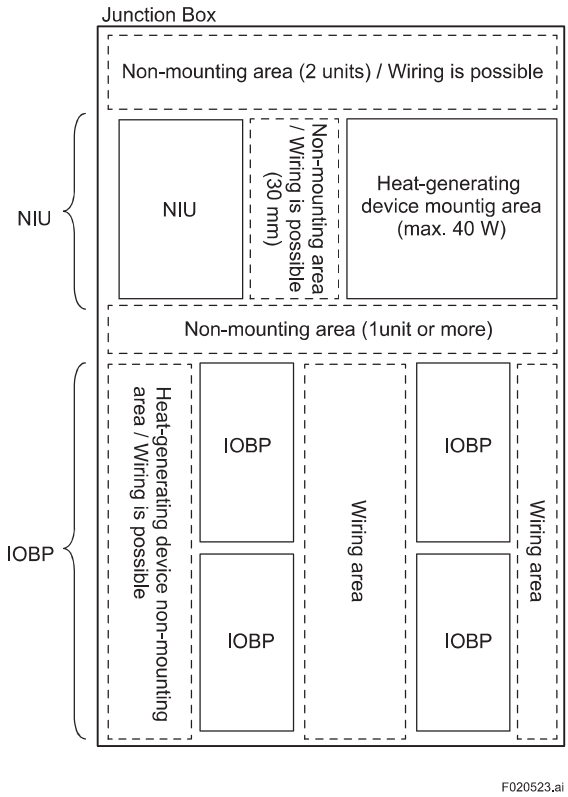



**Figure Example of Mounting N-IO Nodes (Non-Intrinsic Safety Barrier) in a Junction Box**

## Example of Mounting N-IO Nodes (Intrinsic Safety Barrier) in a Junction Box

### Temperature conditions

In this example, the ambient temperature is assumed to be the following.

| | |
|---|---|
| Junction Box ambient temperature | 50 °C or less |

### Maximum numbers of units that can be mounted

| | Type | Model | Number of units that can be mounted per side |
|---|---|---|---|
| Per junction box | NIU | A2NN30D (*1) | Up to 1 |
| | IOBP_IS | A2BN4D or A2BN5D | Up to 2 (2 rows × 1 shelf) |
| | Other | Heat-generating device (*2) | heat generation: 20 W or less |

*1: Specify the temperature environment option (-40 to 70 °C).
*2: The device to be mounted shall be selected from those that have the ambient temperature range of +15 °C or more.

Heat-generating devices other than the above shall not be mounted in the junction box.
In this example, IOBP cannot be mounted.

### Mounting conditions

- Do not mount the IOBP_IS so that its heat-generating part (Barrier or I/O) is located immediately under the N-ESB Bus module (A2EN501). The IOBP_IS may be mounted immediately under the power supply of the NIU (A2PW50x).
- The NIU shall be mounted with a 2-unit or more space from the ceiling of the junction box.
- A 1-unit or more space shall be provided between the NIU and IOBP_IS.
- To mount heat-generating devices other than NIU and IOBP_IS shall be mounted with 30-mm intervals on the right of the NIU on the top shelf. The specifications of the devices shall be observed.

The following shows how to mount N-IO nodes (Intrinsic Safety barrier) in a junction box:

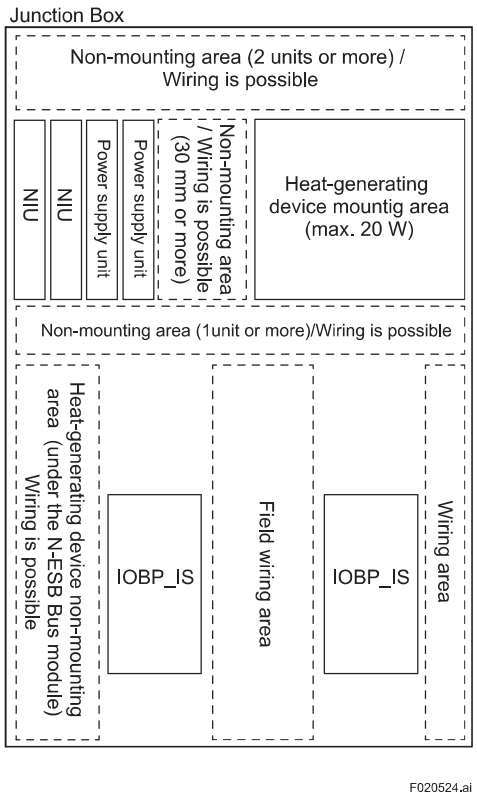



**Figure Example of Mounting N-IO Nodes (Intrinsic Safety Barrier) in a Junction Box**

## CAUTION

The wiring that will be intrinsic safety circuits must be installed so that they are electrically separated from the wiring of non-intrinsic safety circuits, including the in-cabinet wiring. Install the wiring according to the IEC 60079-14 standards or the requirements for explosion-proof wiring of the country where the system is used.

## Example of Mounting N-IO Nodes (Mixture of Intrinsic Safety Barrier and Non-Intrinsic Safety Barrier) in a Junction Box

### Temperature conditions

In this example, the ambient temperature is assumed to be the following.

| | |
|---|---|
| Junction Box ambient temperature | 50 °C or less |

### Maximum numbers of units that can be mounted

| | Type | Model | Number of units that can be mounted per side |
|---|---|---|---|
| Per junction box | NIU | A2NN30D (*1) | Up to 1 |
| | IOBP | A2BN3D (*1) | Up to 2 (1 row × 2 shelves) |
| | IOBP_IS | A2BN4D or A2BN5D | Up to 1 (1 row × 1 shelf) |
| | Other | Heat-generating device (*2) | heat generation: 20 W or less |

*1: Specify the temperature environment option (40 to 70 °C).
*2: The device to be mounted shall be selected from those that have the ambient temperature range of +15 °C or more.

Heat-generating devices other than the above shall not be mounted in the junction box.

### Mounting conditions

- Do not mount the IOBP/IOBP_IS so that its heat-generating part (Barrier or I/O) is located immediately under the N-ESB Bus module (A2EN501). The IOBP/IOBP_IS may be mounted immediately under the power supply of the NIU (A2PW50x).
- The NIU shall be mounted with a 2-unit or more space from the ceiling of the junction box.
- A 1-unit or more space shall be provided between the NIU and IOBP/IOBP_IS.
- To mount heat-generating devices other than NIU and IOBP/IOBP_IS shall be mounted with 30-mm intervals on the right of the NIU on the top shelf. The specifications of the devices shall be observed.

The following shows how to mount N-IO nodes (mixture of Intrinsic Safety barrier and Non-Intrinsic Safety barrier) in a junction box:

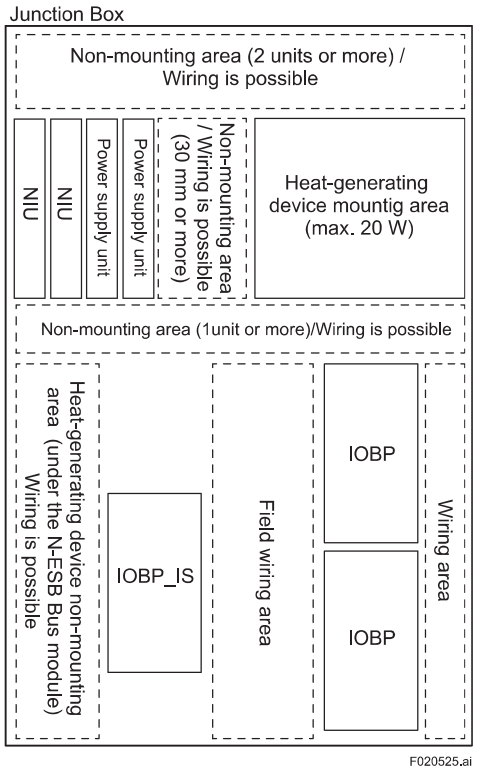



**Figure Example of Mounting N-IO Nodes (Mixture of Intrinsic Safety Barrier and Non-Intrinsic Safety Barrier) in a Junction Box**

## CAUTION

The wiring that will be intrinsic safety circuits must be installed so that they are electrically separated from the wiring of non-intrinsic safety circuits, including the in-cabinet wiring. Install the wiring according to the IEC 60079-14 standards or the requirements for explosion-proof wiring of the country where the system is used.

## 2.5.7 Desktop Equipment

**There are PCs, printers, etc. as the devices used on the desks.**

When installing any devices on the desks, take care the followings:

- It should provide a level horizontal surface for the PC or the printer.
- A work space should be preserved to connect the cables.
- Support rising cables to prevent their weight from being applied to connectors directly. Keep a space of 100 mm radius or more around the connectors.
- Do not place the desk such as to expose the PC to direct sunlight or high humidity.

## 2.5.8 Installing Control Bus Interface Card

**This section describes how to install VI702 Control Bus interface card. The card is installed in the PCI Express slot of a IBM PC/AT compatible PC to connect it to the Control Bus. The card permits you to use CENTUM VP system operation and monitoring functions on the PC when used with the dedicated software.**

**SEE ALSO**

- The steps described below are based on a common IBM PC/AT compatible machine. Refer to the manual of the PC to be used for precise instructions.
- For station address setting, refer to “Peripherals Manual (A4. Control Bus Interface Card)” (IM 33J50B10-01EN).

### Card Installation Procedure

1. Set a station address for the Control Bus interface card.
2. Turn off the computer and unplug the power cord to ensure safety.
3. Remove the PC cover.
4. Remove the slot cover.
5. Insert the Control Bus interface card in the slot. Make certain that the card is properly set in the slot.
6. Attach the PC cover.
7. Write the station address on a seal (sticker) and attach it to the front of the PC or a similar highly-visible place.

**SEE ALSO** For electrostatic protection, refer to Item 1.5.2, “Countermeasures against Static Electricity.”

# 3. Cabling

This section describes how to cable the installed system equipment.

Connecting terminals for power, grounding, and signal cables are shown in figures.

The figures also show how to connect the HIS-connected Control Bus interface card to Field Control Units, and an optical fiber cable to the optical ESB bus.

# 3.1 Cables and Terminals

**It is recommended that you use flexible, thin, easy-to-bend, twisted-pair cables to connect the terminals of the system equipment. Use solderless (crimp-on) terminals with insulating cover, which have low contact resistance little aging.**

**Rigid cables make cabling work difficult and exert unnecessary force on the terminals, which may result in system failures.**

**Cables with the temperature rating of an ambient temperature plus 10 °C or more must be used.**

**As for the following models, cables with the temperature rating as shown in the below Table must be used.**

**Table Rating temperature of Cables**

| Models | Cables | Temperature rating of Cables |
|---|---|---|
| ARS15M, ARS55M | Signal Cables | An ambient temperature plus 20 °C or more |
| AEP7D (100-120 / 220-240 V AC) | Input Power Cables | An ambient temperature plus 30 °C or more |
| AEP7D (24 VDC) | Input Power Cables | An ambient temperature plus 50 °C or more |
| AEPV7D (100-120 / 220-240 V AC) | Input Power Cables | An ambient temperature plus 30 °C or more |
| AEPV7D (24 VDC) | Input Power Cables | An ambient temperature plus 40 °C or more |
| AEP9D | Input Power Cables | An ambient temperature plus 60 °C or more |
| A2PW50□ (When /NCBL) | Input/PE Cables | An ambient temperature plus 30 °C or more |
| A2BN3D | Field Power/ Grounding Cables | An ambient temperature plus 30 °C or more |
| A2BN3D | I/O Cables | An ambient temperature plus 20 °C or more |
| A2BN4D | I/O Cables | An ambient temperature plus 20 °C or more |
| A2BN5D | I/O Cables/ Barrier Power Cables/ Grounding Cables | An ambient temperature plus 20 °C or more |
| A2BM4 | Terminal board | An ambient temperature plus 20 °C or more |
| N-IO field enclosure (A2NN70D, A2CB60) | I/O Cables | Enclosure ambient temperature plus 35 ºC or more |

## Signal Cables

Nominal conductor cross-sectional area:
For FIO Node 0.75 to 2.00 $mm^2$
For N-IO Node 0.5 to 2.50 $mm^2$ (AWG20 to 14)

Example of Suitable Cables:
600 V vinyl isolated cable (IV); JIS C 3307/IEC60227-3
Vinyl isolated wire (KIV); JIS C 3316/IEC60227-3
600 V vinyl isolated cable type 2 (HIV); JIS C 3317/IEC60227-3
Heat-proof vinyl isolated wire (UL1015/UL1007)
Vinyl isolated sheath cable for control loop (CVV); JIS C 3401

## Alarm and Control Circuit Cables

Nominal conductor cross-sectional area:
Node Inerface Unit External Alarm input terminal:
0.13 to 2.5 $mm^2$
Other than above: 0.5 to 1.25 $mm^2$

Example of Suitable Cables:
600 V vinyl isolated cable (IV); JIS C 3307/IEC60227-3
Vinyl isolated wire (KIV); JIS C 3316/IEC60227-3
Heat-proof vinyl-insulated wire (UL1007)

## Power Cables

Nominal conductor cross-sectional area
For rack-mounted AC 100-120/220-240 V-driven equipment: 1.25 to 2.0 $mm^2$
For rack-mounted DC 24 V-driven equipment: Minimum 2.0 $mm^2$
For N-IO I/O Base plates (Field Power Supply terminal): 0.5 to 1.5 $mm^2$
For N-IO Barrier Base plates (Barrier Power Supply terminal): 0.5 to 1.5 $mm^2$
For cabinets AC 100-120/220-240 V-driven: Minimum 8.0 $mm^2$
For cabinets DC 24 V-driven equipment: Minimum 14.0 $mm^2$
For Power Unit (A2PW50☐/NCBL):
1.25 $mm^2$ (AWG16) Double insulation structure

Example of suitable cables:
600 V vinyl isolated cable (IV); JIS C 3307/IEC60227-3
Vinyl isolated wire (KIV); JIS C 3316/IEC60227-3

Note: Use cables capable of supplying current required by respective pieces of equipment with low voltage drop.

## Grounding Cables

**SEE ALSO** See Section 1.4, “Grounding,” for wiring of grounding cables connecting grounding bars of different cabinets and/or panels to each other.

Nominal conductor cross-sectional area
For rack-mounted equipment: Minimum 2.0 $mm^2$
For Power Supply Unit (A2PW50☐/NCBL):
1.25 $mm^2$ (AWG16) or 2.00 $mm^2$ (AWG14)
For Node Interface Unit: Minimum 2.0 $mm^2$ (AWG14)
For N-IO I/O Base plates: Minimum 2.0 $mm^2$ (AWG14)
For N-IO Barrier Base plates: Minimum 2.0 $mm^2$ (AWG14)
Grounding cables connecting cabinets AC 100-120/220-240/V-driven
to protective grounding system: Minimum 5.5 $mm^2$
Grounding cables connecting cabinets DC 24 V-driven to protective grounding system:
Minimum 8.0 $mm^2$

Example of suitable cables:
600 V vinyl isolated cable (IV); JIS C 3307/IEC60227-3
Vinyl insulated wire (KIV); JIS C 3316/IEC60227-3

Note: Use the cable that is defind in the rules/standards of the country or the region.

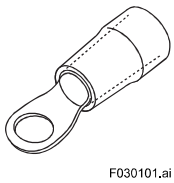
## Cable Terminals

Use the specified solderless terminals and sleeves for pressure clamp terminal on the end of terminal-connected cables, providing low contact resistance, high durability, and low aging.

### Solderless Lug

**CAUTION**

- Be sure to use solderless terminals with insulating sheath.
- Use solderless terminals and crimp tools from the same maker.
- Use different crimp tools according to cable size.



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**Figure Solderless Terminal with Insulating Sheath**

### Sleeve for pressure clamp terminal and spring clamp terminal

When connecting the process I/O signal to the pressure clamp terminal of FIO and N-IO, strip the cable coating (without a sleeve) or attach a sleeve to the cable.

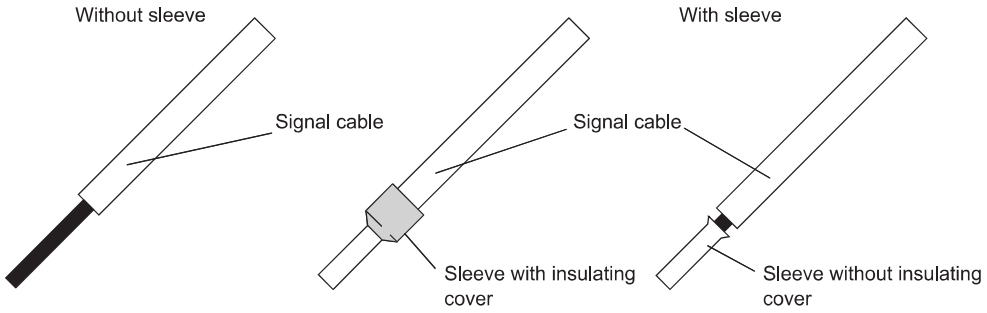



**Figure Sleeve for Pressure Clamp Terminal**

**CAUTION**

- Use a sleeve and a clamp tool from the same manufacturer.
- Use a sleeve and a clamp tool which suit the cable thickness.
- Use a sleeve which meet the following DIN standards.
  Sleeve without insulating cover (DIN 46 228/1)
  Sleeve with insulating cover (DIN 46 228/4)

## Bending radius of the cable

When connecting a cable to a system instrument, ensure to secure the minimum bending radius of the cable.
The minimum bending radius is either the value shown in the cable manufacturer's specifications or six-fold of the cable conductor diameter, whichever is bigger should be applied.

# 3.2 Connecting Power

**Power is connected either by using a grounding-type bipolar (three-pin) plug or by wiring to terminals.**

**When piece of CENTUM VP equipment has a power switch, it is recommended that you install a breaker for each piece of equipment in the same room, for maintenance and safety considerations.**

## Power Cable Termination

### Solderless (crimp-on) Lug Terminal Processing

Use solderless lugs for power cables (see Figure).

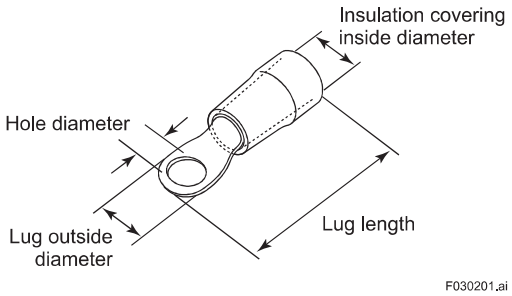



**Figure Solderless (crimp-on) Lug**

### Solderless (crimp-on) Lug Specifications

The solderless lug to use must have the dimensions given in table according to the nominal cross sectional area of the power cable for which the lug is to be used.

**Table Solderless Lug Dimensions**

| Nominal cross sectional area ($mm^2$) | Screw used (mm) | Hole diameter (mm) | Lug outside diameter (mm) | Lug length (mm) | Insulation covering inside diameter (mm) |
|---|---|---|---|---|---|
| 1.25 | 4 | 4.3 or more | 8.2 or less | approx.21 | 3.6 or more |
| 2.0 | 4 | 4.3 or more | 8.7 or less | approx.21 | 4.3 or more |
| 5.5 | 5 | 5.3 or more | 9.7 or less | approx.29 | 5.9 or more |
| 8.0 | 6 | 6.3 or more | 12.2 or less | approx.41 | 7.0 or more |
| 22.0 | 8 (hexagon head bolt) | 8.3 or more | 16.8 or less | approx.50 | 11.0 or more |

**CAUTION**

- Always use solderless lugs with insulating covering.
- Always use solderless lugs and crimp-on tool manufactured by the same manufacturer.
- The crimp-on tool must be matched to the wire thickness.

## Sleeve Terminal Processing

Perform the following terminal processing for the primary power supply input with pressure clamp terminal.

Use a sleeve with insulating cover which meet the DIN 46 228/4.

**CAUTION**

- Use sleeves and a tool that are from the same manufacturer.
- Use sleeves and a tool that are suitable for the cable thickness.
- Connect the cable properly by inserting the wires all the way into the pressure clamp terminals.

Strip the cable coating at the end of the cable and then attach a sleeve. The sleeve specifications differ depending on the cable thickness. The sleeve specifications are shown in the following table.

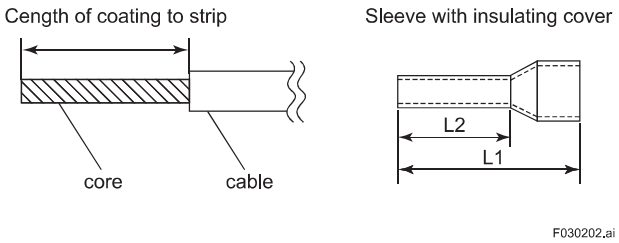



**Figure Terminal Processing**

**Table Cable termination example of Sleeve with Insulating Cover**

| Nominal cross sectional area ($mm^2$) | Length to strip (mm) | Sleeve dimensions (mm) | |
|---|---|---|---|
| | | L1 | L2 |
| 1.25 (AWG16) | 10 | 14 | 8 |

**CAUTION**

- Power cables must be laid 1 cm or further away from signal cables.
- Power and grounding cable are use power and ground cables which are in conformance with the safety standard of each country.

## Type and Maximum Length of Power Cables

Formulas are given below for determining the type and the maximum length (m) of branch cables from an indoor low-voltage main line.

- The standard type of cable used (nominal cross sectional area) is equivalent to JIS C 3312.
- Calculate the maximum power cable length from the following conditions in Figure. However, the power cable must meet the conditions described in Section “1.3 Power Supply System”, “AC Power Specification”.

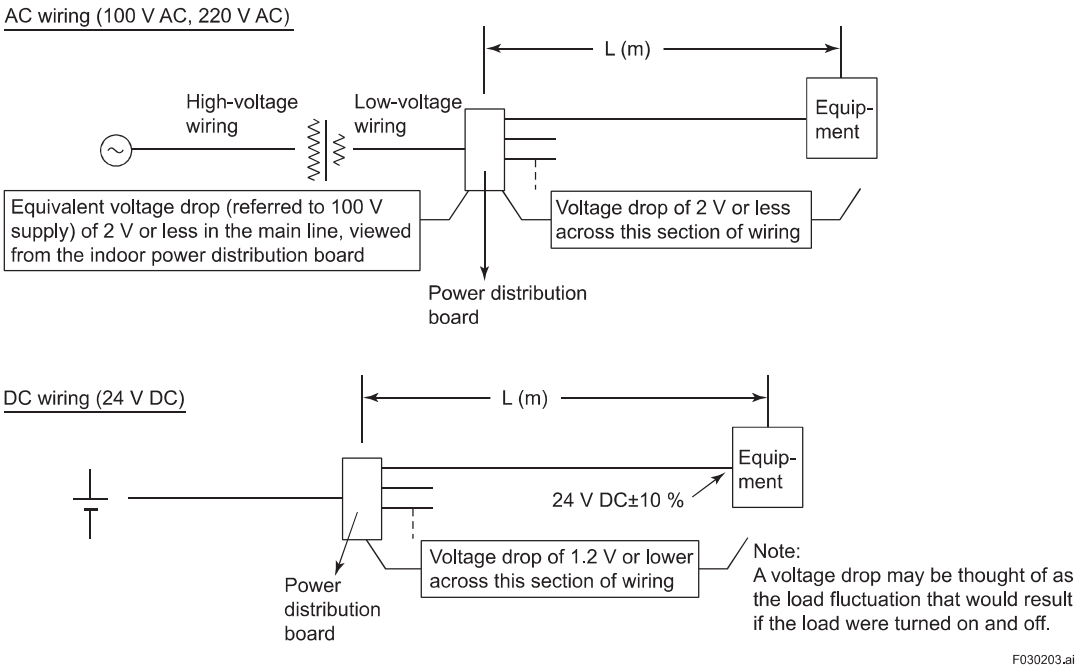



**Figure Maximum Cable Length Calculation Conditions**

[Maximum power cable length calculation conditions]

Use the following formula to calculate the maximum power cable length:

(a) 100 V AC and 220 V AC supply voltages

$$L\,(m) = \frac{\text{Voltage drop across wiring}}{\text{Conductor resistance (ohm/km)} \times \text{(Number of cores)} \times \text{Equipment current consumption}} \times 1000$$

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(b) 24 V DC supply voltage

$$L\,(m) = \frac{\text{Voltage drop across wiring}}{\text{Conductor resistance (ohm/km)} \times \text{(Number of cores)} \times \text{Equipment current consumption}} \times 1000$$

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Note: In the formulas above, the voltage drop across wiring is assumed to be 2 V for AC power supplies and 1.2 V for DC power supplies; the number of cores is two; and the conductor resistance is as specified in the table below.

**Table Wire Nominal Cross Sectional Areas and Resistances**

| **Wire nominal cross sectional area** | 5.5 $mm^2$ | 8 $mm^2$ | 14 $mm^2$ | 22 $mm^2$ |
|---|---|---|---|---|
| **Wire conductor resistance** | 3.37 ohm/km | 2.39 ohm/km | 1.36 ohm/km | 0.82 ohm/km |

# Power Distribution Boards

Power distribution boards are normally provided by the customer. Figures show examples of AC and DC power distribution boards.

## AC Power Distribution Board

The power cables is branched to each unit by way of a circuit breaker.

Each power system uses three terminals (AC and ground: ISO M4 to M6 screws).

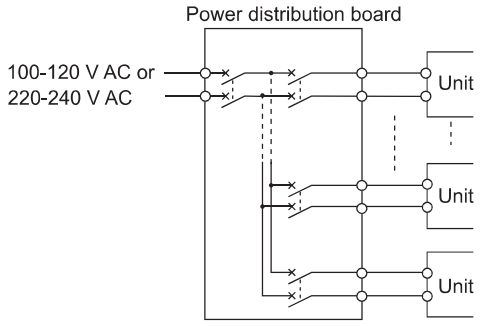



**Figure AC Power Distribution Board**

## 24 V DC Power Distribution Board

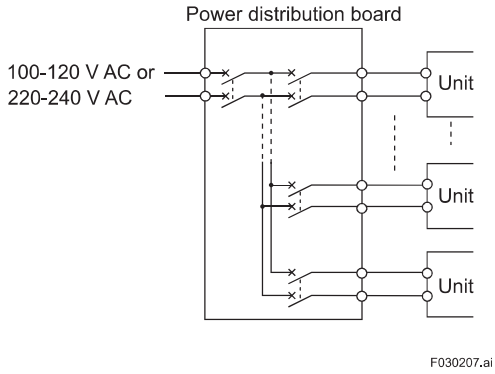



**Figure 24 V DC Power Distribution Board**

## Terminal Connection

The power supply terminals and the grounding terminals of each equipment are as follows.

**Table The power supply terminals and the grounding terminals of each equipment (1/2)**

| Category | Model | | Power supply Type | Power supply terminal | Grounding terminal | Grounding Type |
|---|---|---|---|---|---|---|
| Field Control Unit | AFV30S/AFV30D | | Power Supply Input | M4 Screw (A cable with dedicated connector is connected to a terminal by default.) | M4 Screw (A cable with dedicated connector is connected to a terminal by default.) | Functional grounding |
| | A2FV50S/A2FV50D | | Power Supply Input | | | |
| | A2FV70S/A2FV70D | | Power Supply Input | | | |
| Node unit | ANB10S/ANB10D | | Power Supply Input | | | |
| | ANB11S/ANB11D | | Power Supply Input | | | |
| Unit | ANT10U | | Power Supply Input | | | |
| Router | AVR10D | | Power Supply Input | | | |
| | AW810D | | Power Supply Input | | | |
| Cabinet | AFV40S/AFV40D | | Power Supply Input | M6 Screw | • M5 Screw (On the grounding bar) • M8 Hex bolt | Protective grounding |
| | ACB51 | | Power Supply Input | | | |
| Node Interface Unit | A2NN30D | With Power supply cable | Power Supply Input | Dedicated connector | | • Functional grounding (24 V DC) • Protective grounding (Other than 24 V DC) |
| | | Without Power supply cable (/NCBL) | Power Supply Input | Plessure clamp | M4 Screw | |
| | | | Base Plate | | M4 Screw | Functional grounding |
| | A2NN10D | | Power Supply Input | M4 Screw | M4 Screw | • Functional grounding (24 V DC) • Protective grounding (Other than 24 V DC) |
| | | | Frame | | M4 Screw | Functional grounding |
| Power Supply Unit | A2PW503 A2PW504 | With Power supply cable | Power Supply Input | Dedicated connector | | • Functional grounding (24 V DC) • Protective grounding (Other than 24 V DC) |
| | | | Power Supply Output | Dedicated connector | — | |
| | | Without Power supply cable (/NCBL) | Power Supply Input | Plessure clamp | M4 Screw | • Functional grounding (24 V DC) • Protective grounding (Other than 24 V DC) |
| | | | Power Supply Output | Dedicated connector | — | |

**Table The power supply terminals and the grounding terminals of each equipment (2/2)**

| Category | Model | Power supply Type | Power supply terminal | Grounding terminal | Grounding Type |
|---|---|---|---|---|---|
| I/O Unit | A2BN3D | Power Supply Input | Model:A2KPB00 (Dedicated connector) | M3 Screw | Functional grounding |
| | | Field Power Supply Input | Pressure Clamp | | |
| | A2BN4D | Power Supply Input | Model:A2KPB00 (Dedicated connector) | M4 Screw | Grounding for explosion protection |
| | | Barrier Power Supply Input | Pressure Clamp | | |
| | A2BN5D | Power Supply Input | Model:A2KPB00 (Dedicated connector) | M4 Screw | Grounding for explosion protection |
| | | Barrier Power Supply Input | Pressure Clamp | | |
| Power supply bus unit | AEPV7D (Style 2) AEP7D | Power Supply Input | M4 Screw | M4 Screw | • Functional grounding (24V DC)<br>• Protective grounding (Other than 24V DC) |
| | | Power Supply Output | Dedicated 5 pins connector | | |
| Power supply bus unit | AEP9D | Power Supply Input | M4 Screw | M4 Screw | Functional grounding |
| | | Power Supply Output | Dedicated Connector | | |
| Base Plate | A2BE1D A2BE2D | Power Supply Input | Dedicated connector | M4 Screw | Functional grounding |
| Power Supply Unit | PW48□ | Power Supply Input | Dedicated Connector | | Functional grounding |
| | | Power Supply Output | Dedicated Connector | — | |
| Standard Cabinet | A2CAB1 | — | | • M5 Screw (On the grounding bar)<br>• M8 Hex bolt | Protective grounding |
| Cabinet Utility Kit | ACUKT1 A2CUKT4 | Power Supply Input | M6 Screw | M4 Screw | |

## Conduit Power-cabling

Conduit cabling using cable glands is recommended to lay a power cable for the cabinet and instrumentation boards. It prevents the power cable from contacting metallic plates and putting its weight on power connection terminal.

The console type HIS, or cabinet, has a conduit hole in the bottom plate directly below the terminal box, and the hole can be exposed by removing the blank plate screwed to the bottom. See figures below for conduit cabling:

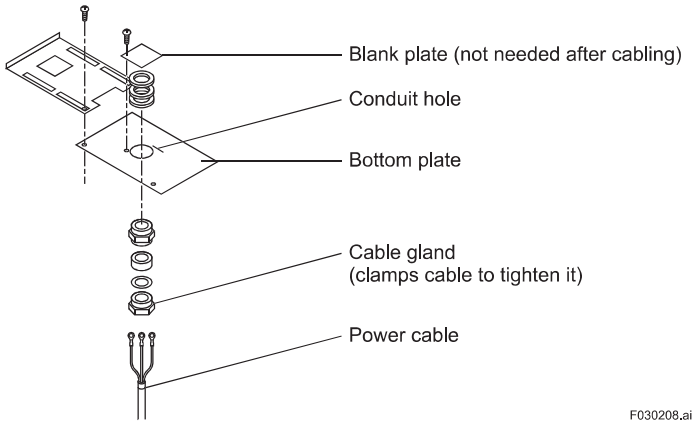



**Figure Conduit Hole & Cable Gland**

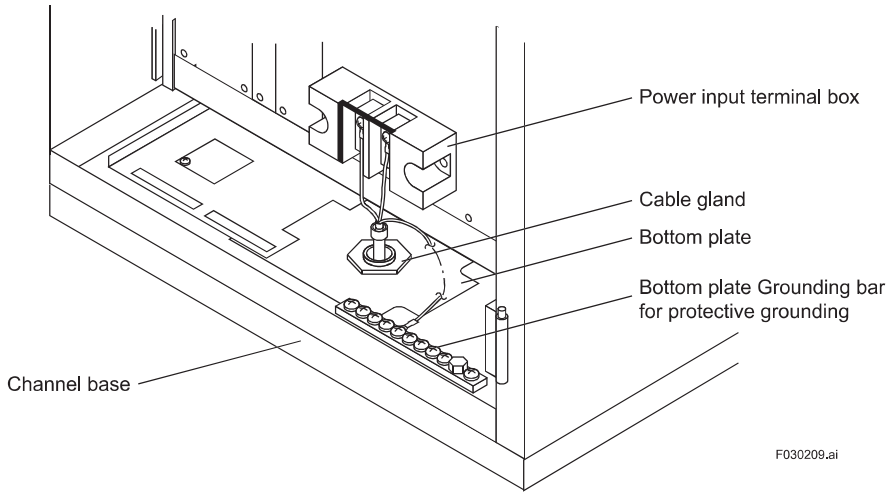



**Figure Conduit Cabling**

Conduit cabling is also recommended for the 19-inch rack-mount equipment, laying a power cable through a conduit hole where the cable enters the metallic cabinet.

# 3.3 Connecting Ground Cable

**Connect ground cables as follows:**

**CAUTION**

- Connect the terminal connection type device to the protective conductor terminal.
- Connect AFV40S/AFV40D, ACB51, and A2CAB1 to the relay terminal of the ground bar for protective grounding for connecting a ground cable with M5 screws.
- Connect a power cable of the plug-in device to a grounded socket. The cabinet is grounded when the power cable is plugged in.

# 3.4 Power and Ground Cabling

**The following figures illustrate how to connect a power and grounding cable with each system equipment.**

## A2NN30D Node Interface Unit

### Connecting Power Supply with NIU and IOU

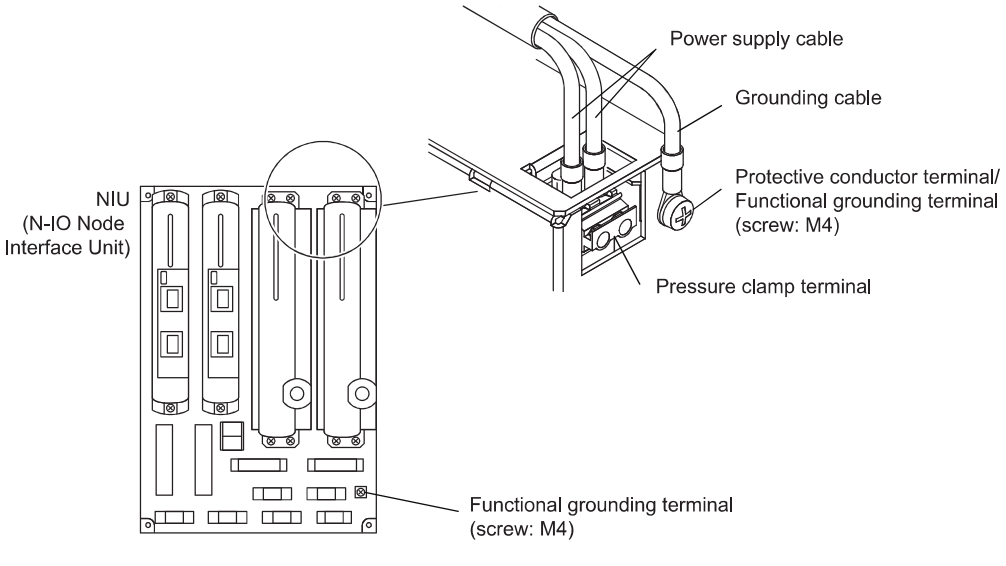
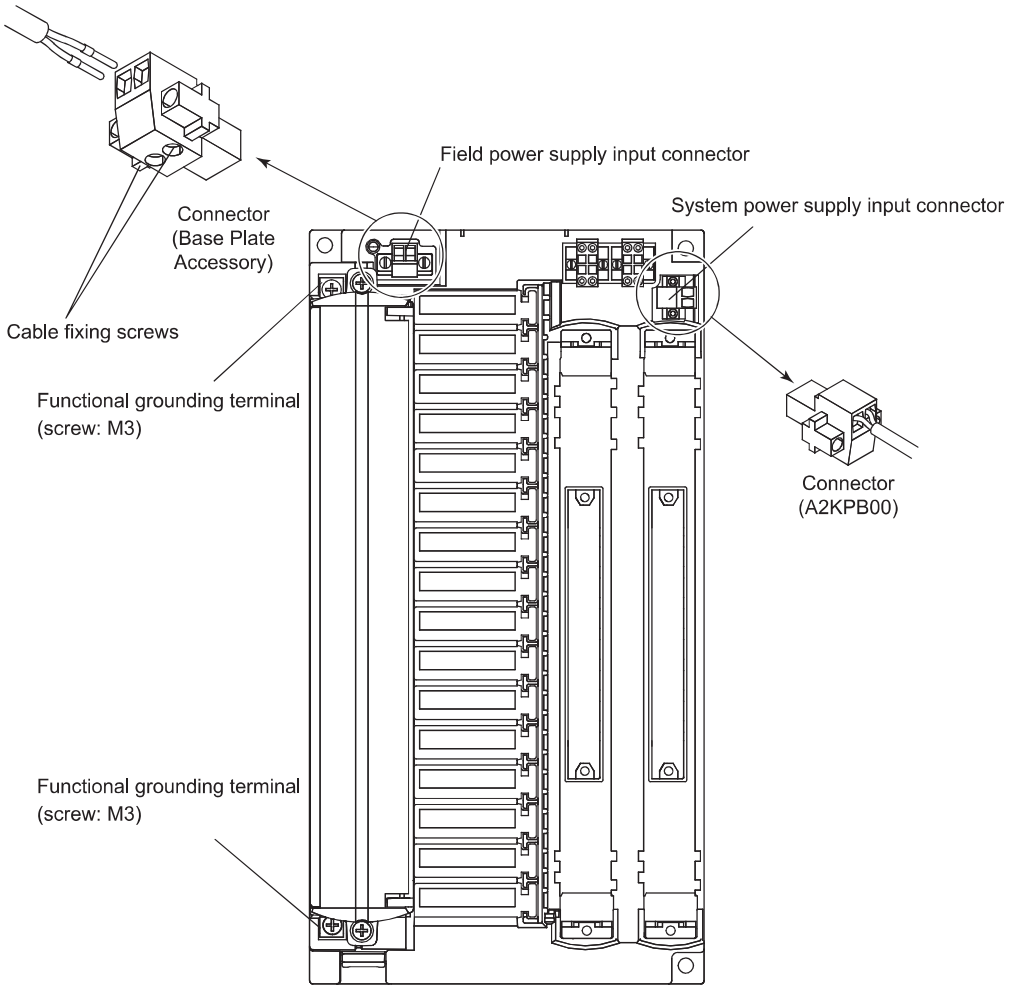


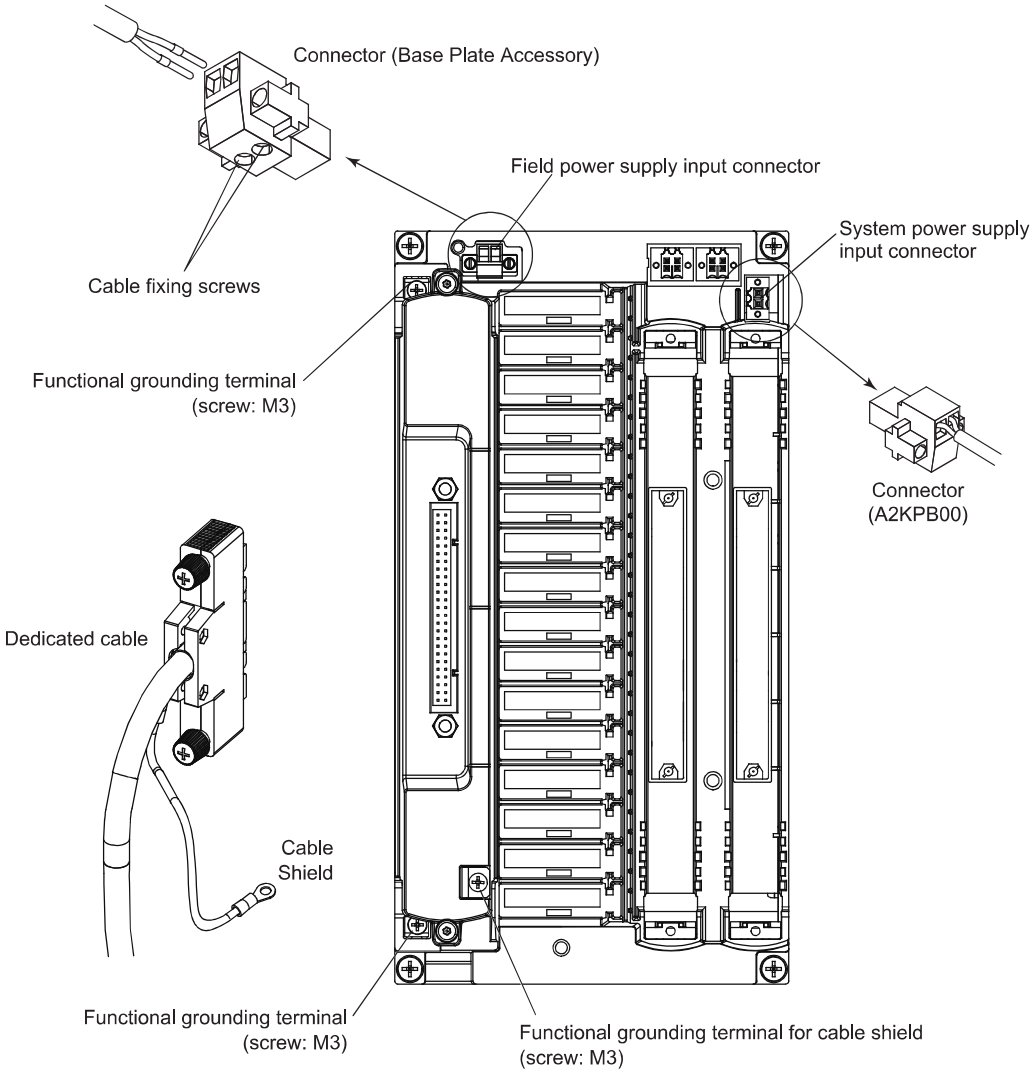

**Figure Connecting Power Supply with Node Interface Unit**

## A2BN3D Base Plate for Adaptor




A2BN3D-□1□□□,-□2□□□

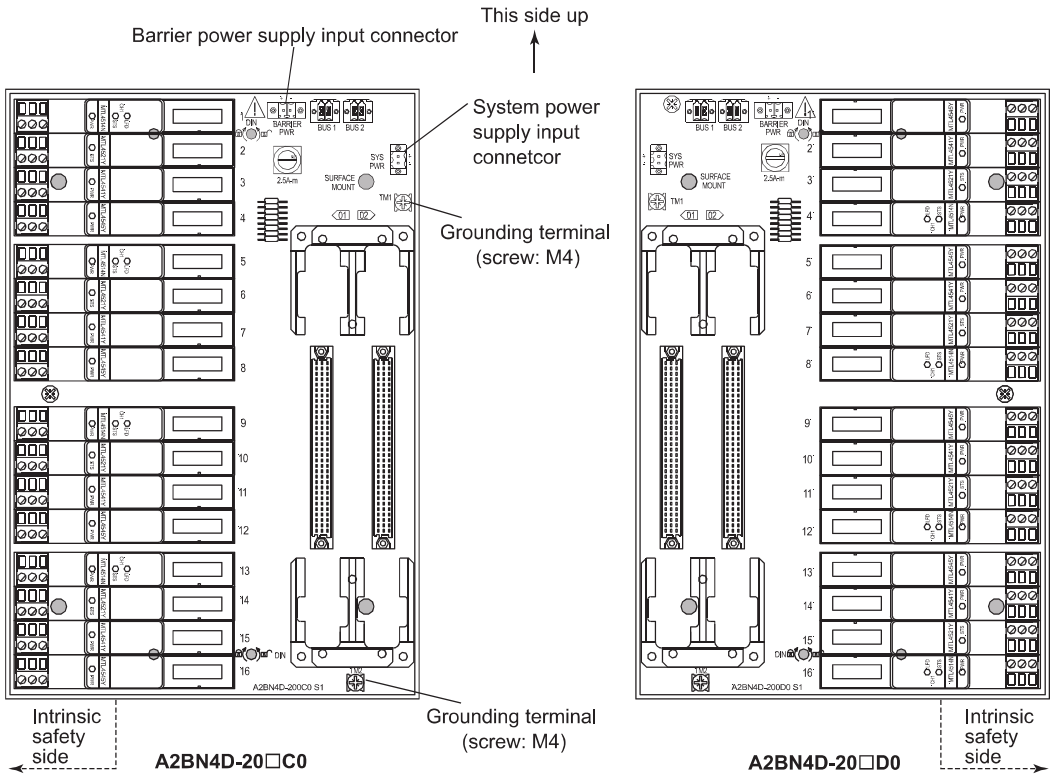
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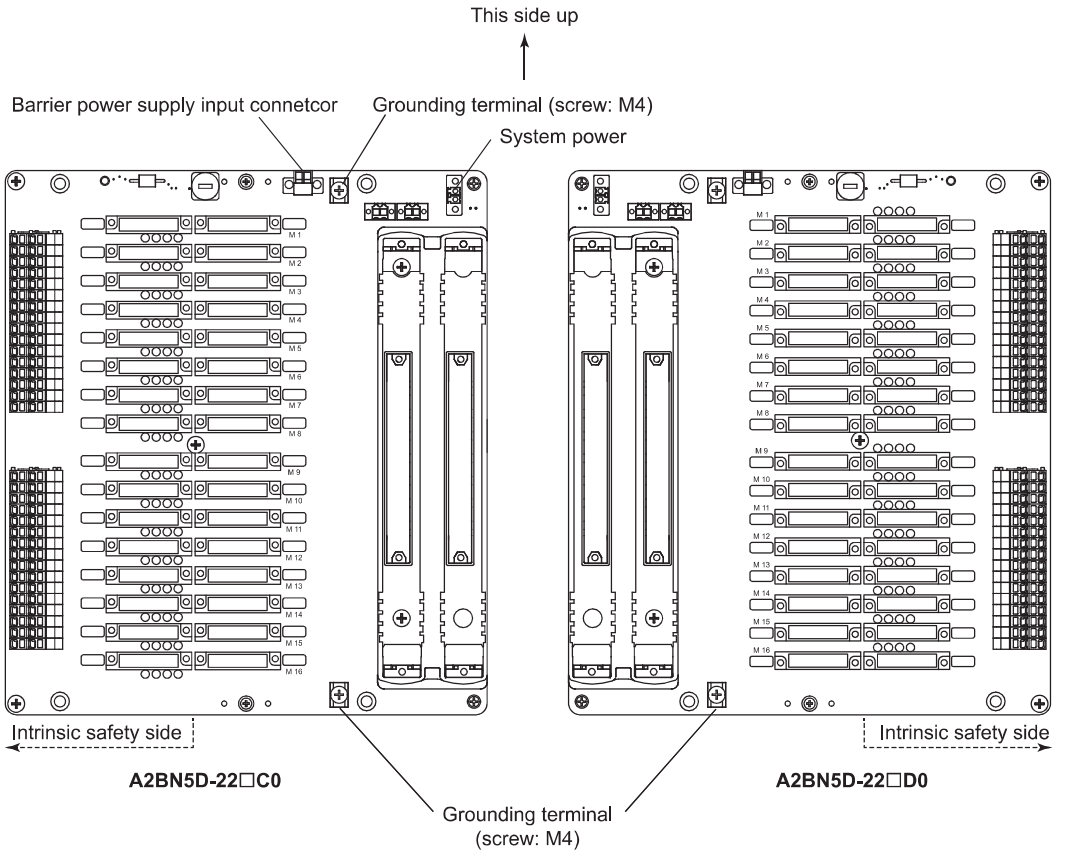

A2BN3D-□9□□□

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## A2BN4D Base Plate for Barrier (MTL)



## A2BN5D Base Plate for Barrier (P+F)




**CAUTION**

To avoid the influences of external noise, the cable length outside the cabinet connected to Barrier power supply input connector shall be less than 3 m.

## Connecting Power Supply with Node Interface Unit and I/O Units

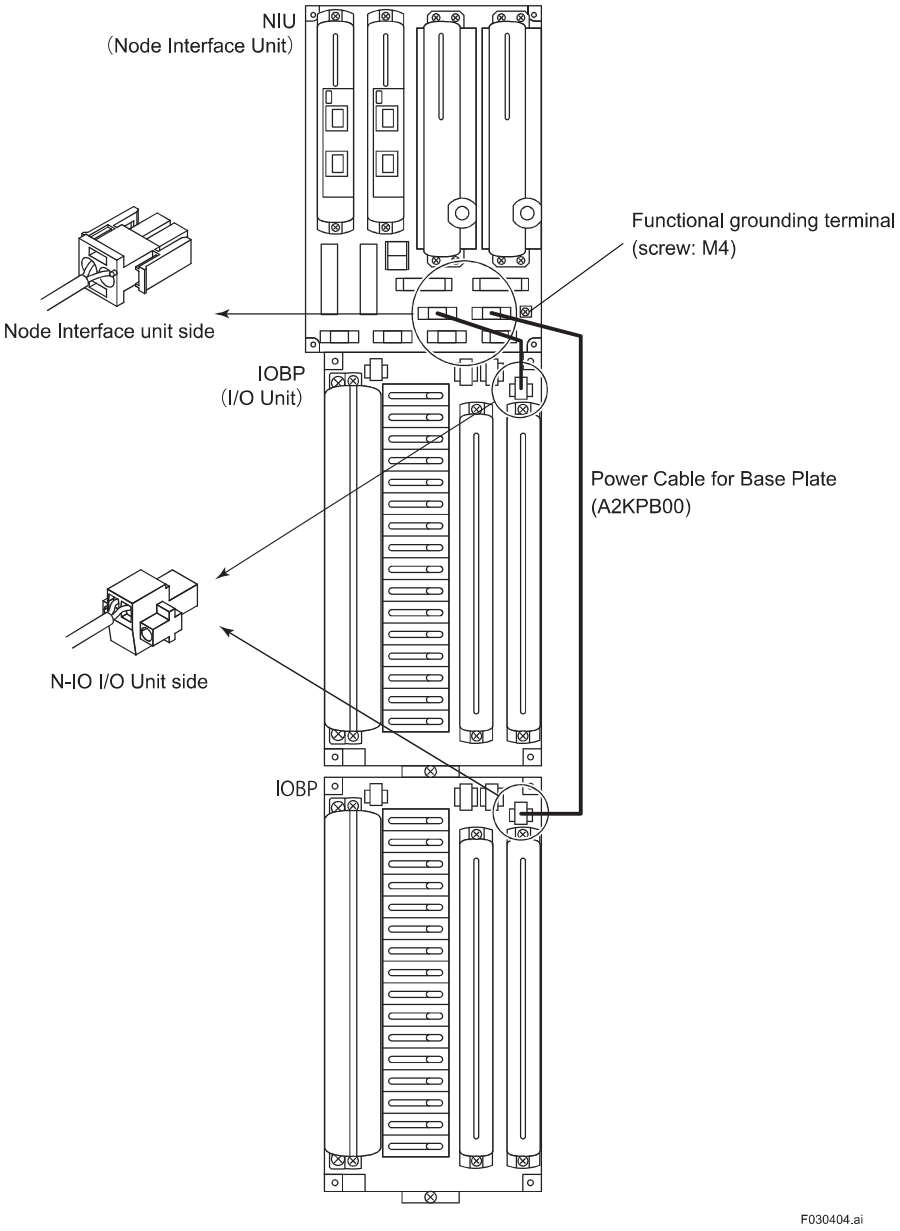



**Figure Connecting Power Supply with Node Interface Unit and I/O Units**

**CAUTION**

When connecting a Power Cable for Base Plate to a N-IO node, ensure to keep the minimum bending radius of the cable.

The minimum bending radius of the Power Cable is six-fold of the diameter of the cable.

## Example of System Cabinet Installation and Grounding Wiring

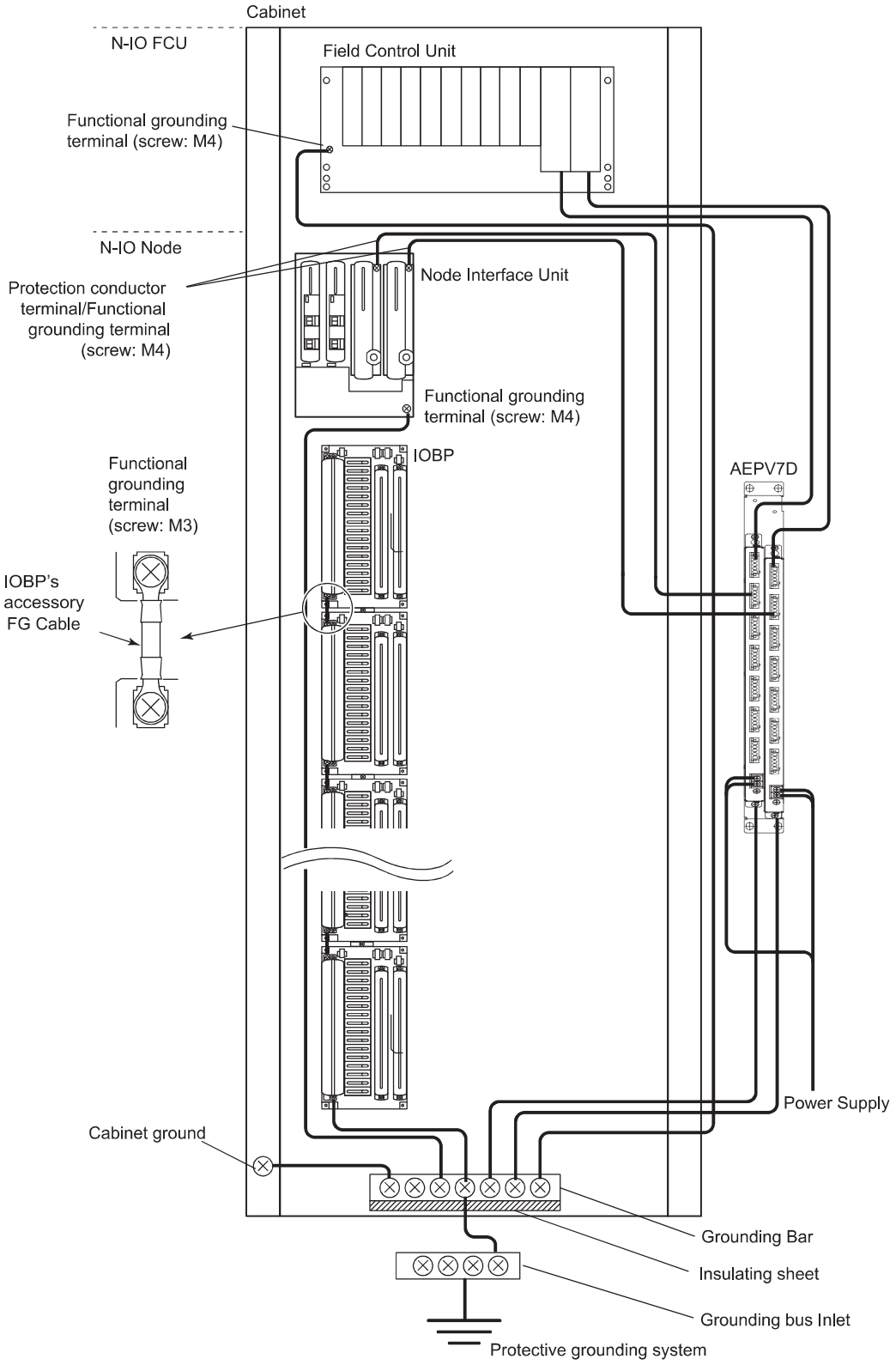



**Figure N-IO system devices installation and grounding wiring (Cabinet)**

**WARNING**

The wiring that will be intrinsic safety circuits must be installed so that they are electrically separated from the wiring of non-intrinsic safety circuits, including the in-cabinet wiring. Install the wiring according to the IEC 60079-14 standards or the requirements for explosion-proof wiring of the country where the system is used.

## Example of Node Box Installation and Grounding Wiring

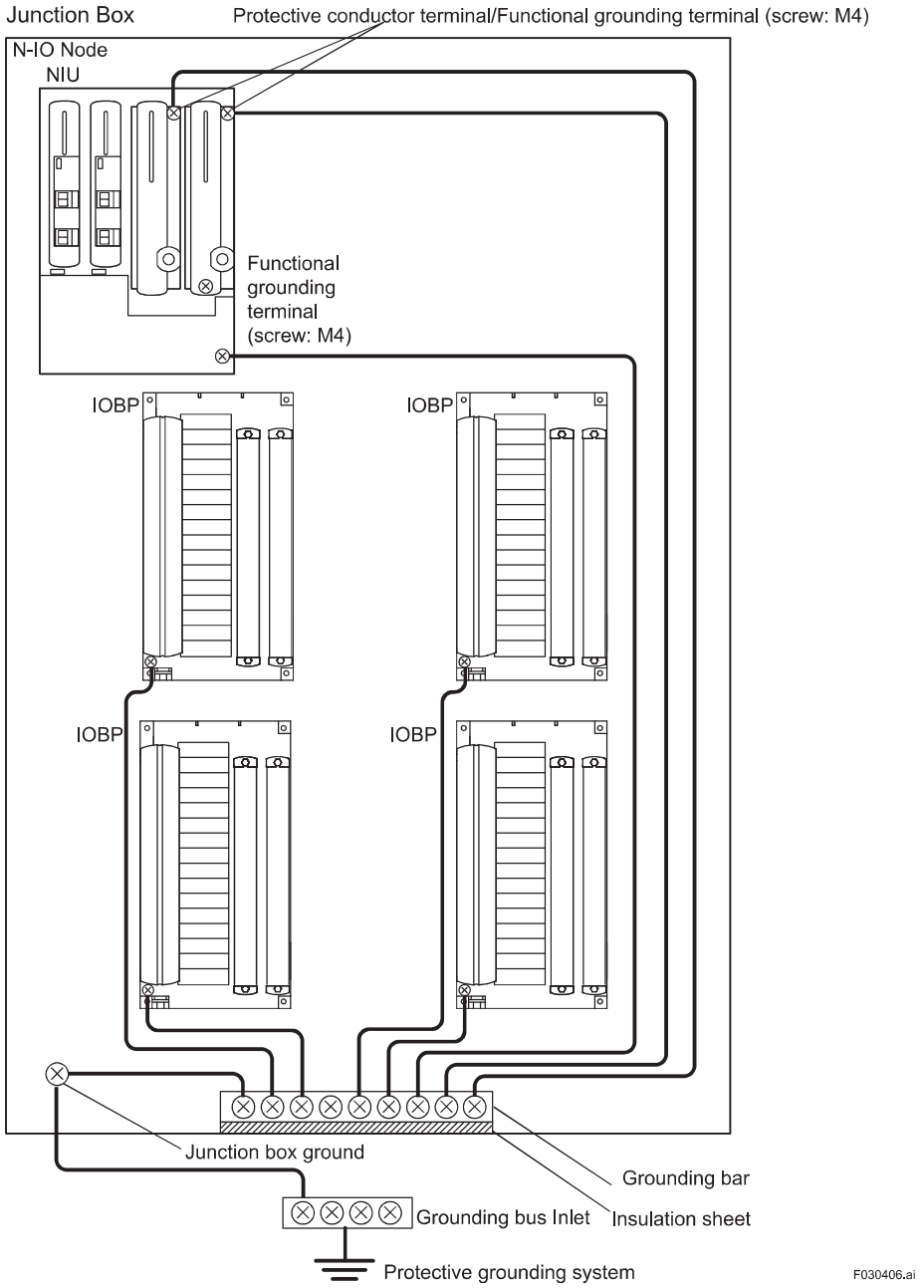



**Figure Example of N-IO Node devices Installation and grounding wiring**

**WARNING**

The wiring that will be intrinsic safety circuits must be installed so that they are electrically separated from the wiring of non-intrinsic safety circuits, including the in-cabinet wiring. Install the wiring according to the IEC 60079-14 standards or the requirements for explosion-proof wiring of the country where the system is used.

## Field Control Unit (for FIO 19-inch Rack Mountable Type) Model: AFV30S/AFV30D, FCU constructed with A2BE1D

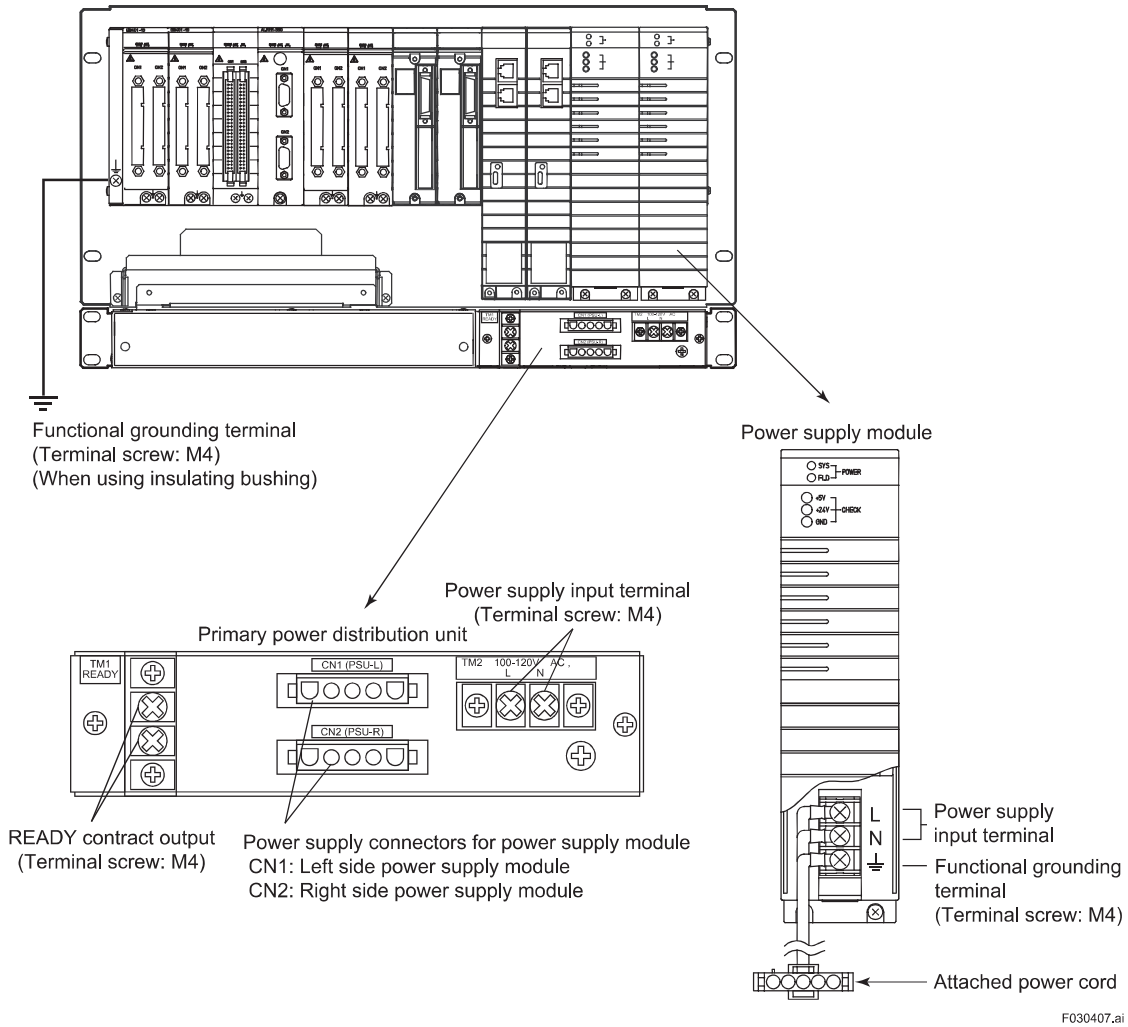



**Figure FCU (for FIO) Power Cable Connections**

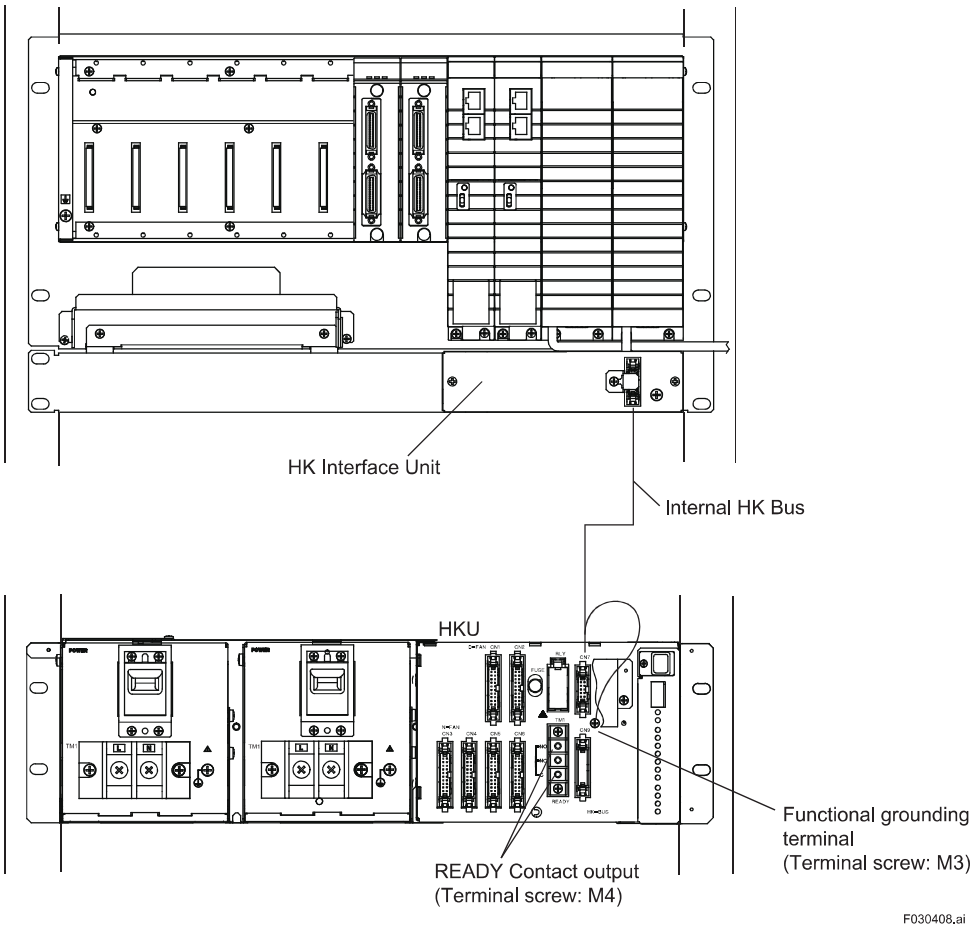



**Figure Cable connection of FCU (for FIO) (When Connecting to HKU)**

## Field Control Unit (for N-IO 19-inch Rack Mountable Type) Model: AFV50S/AFV50D, FCU constructed with A2BE1D

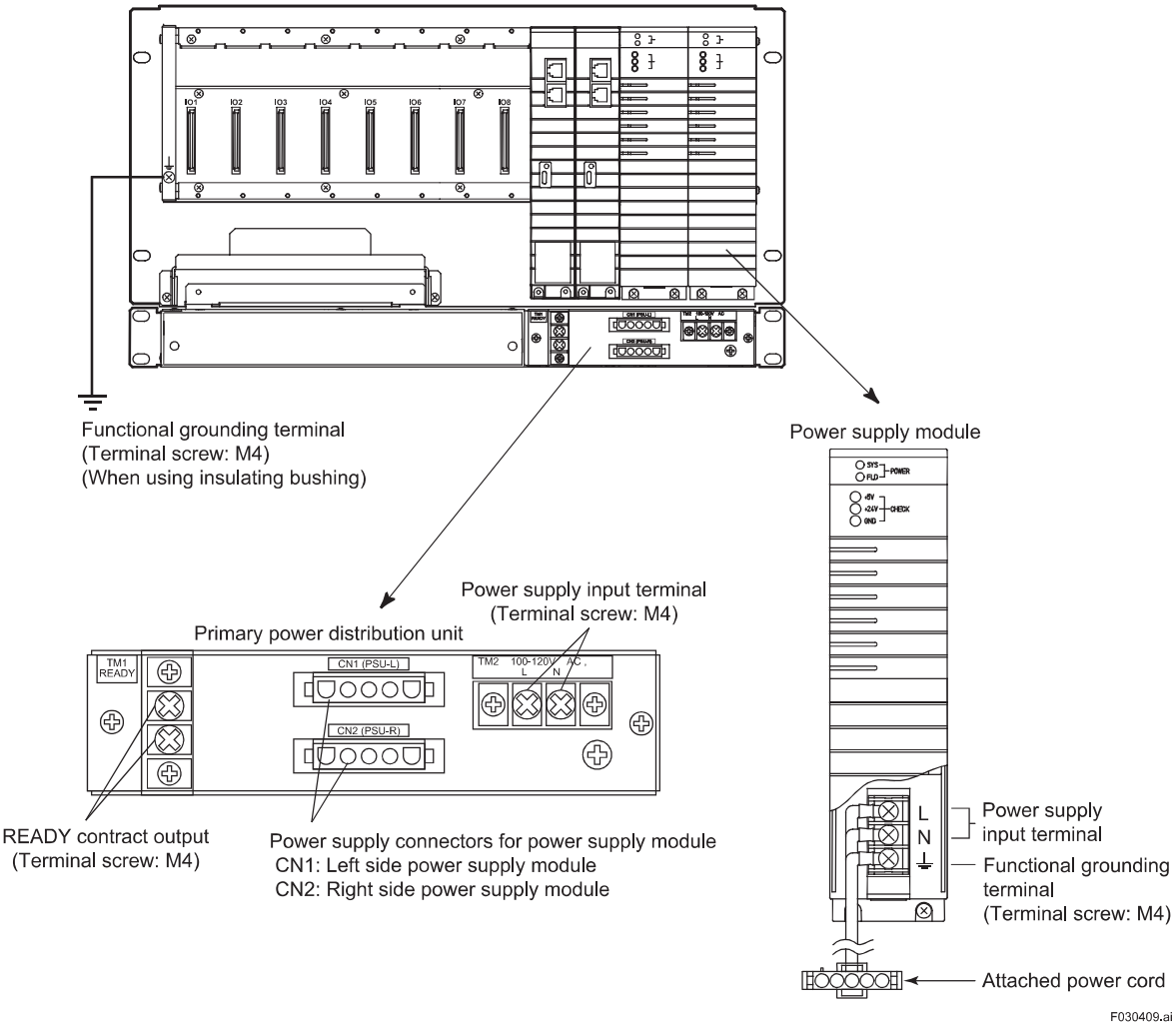



**Figure FCU (for FIO) Power Cable Connections**

## A2FV70S/A2FV70D Field Control Unit (for RIO System upgrade19-inch Rack Mountable Type)
## Model: AFV70S/AFV70D, FCU constructed with A2BE1D

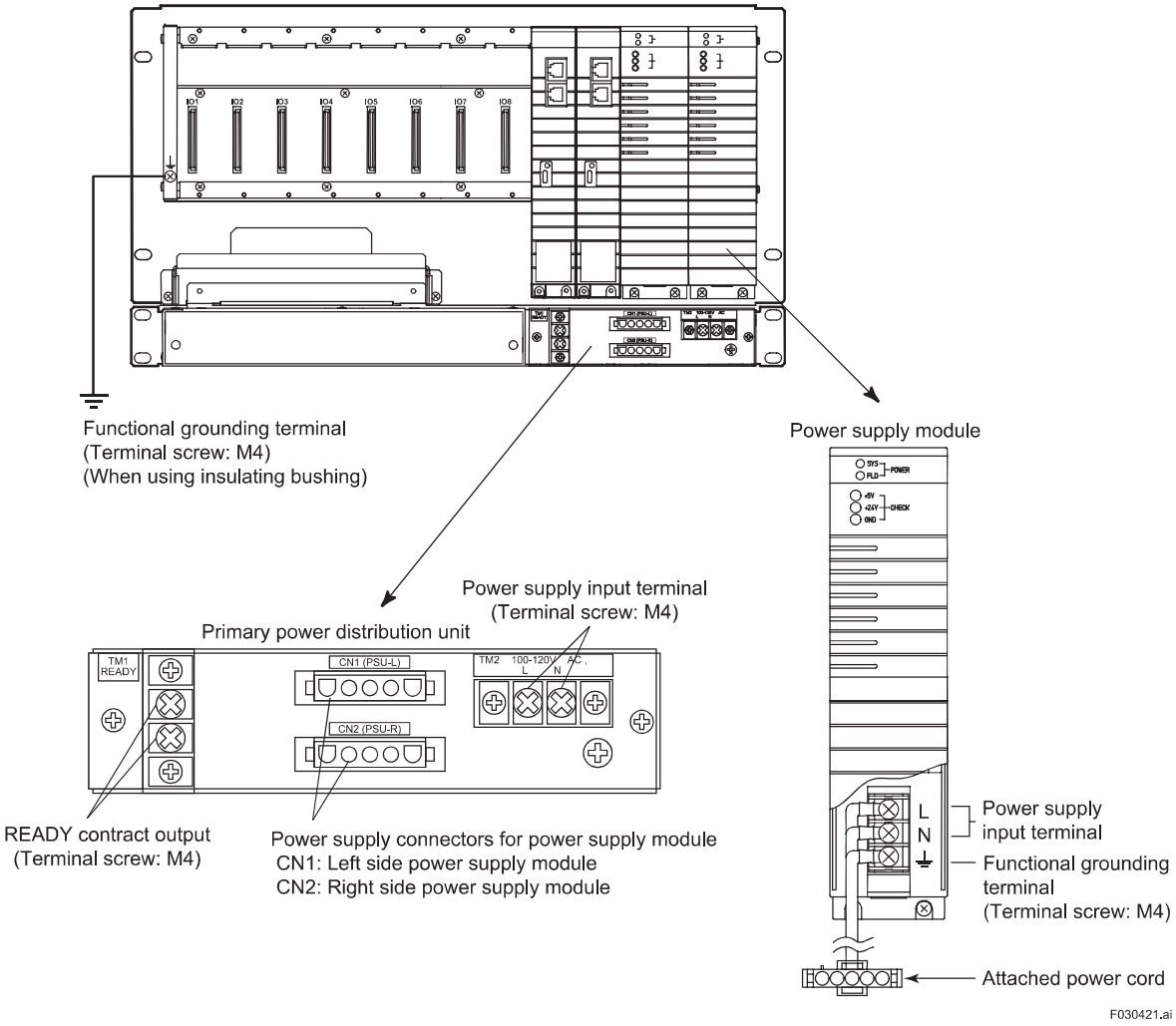
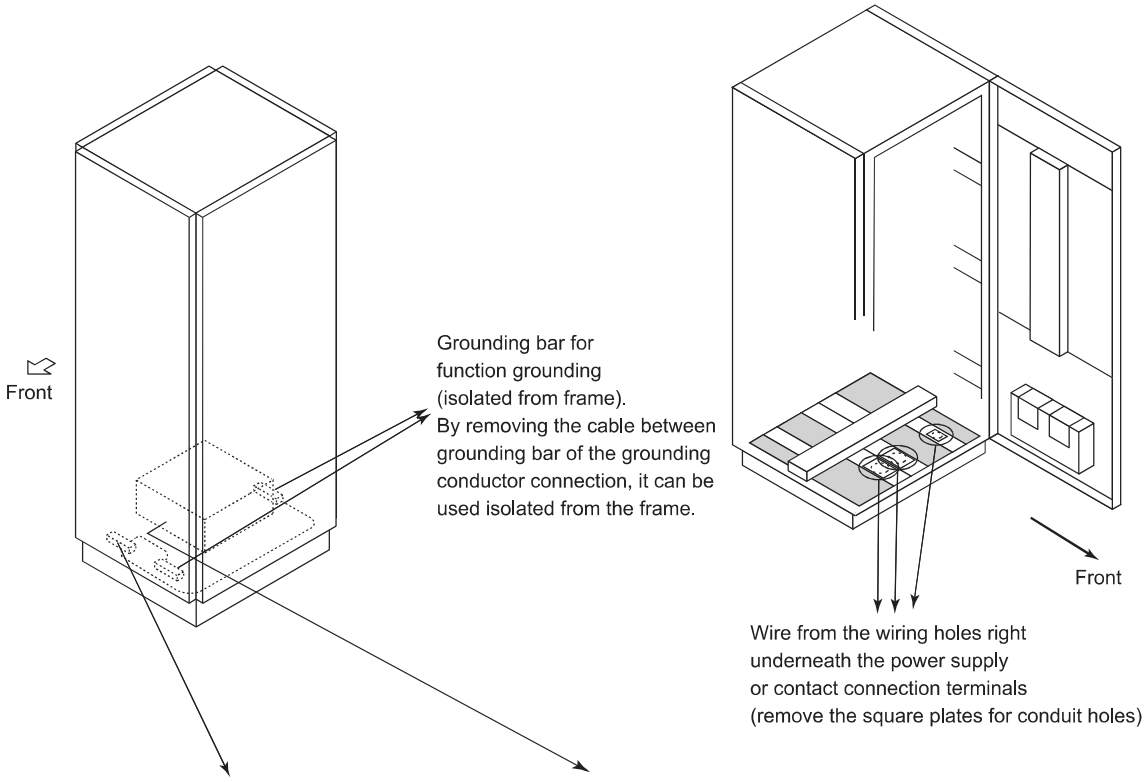



**Figure FCU (for RIO System upgrade) Power Cable Connections**

## Field Control Unit (with Cabinet), ACB51 I/O Expansion Cabinet Model: AFV40S/AFV40D, ACB51, the cabinet constructed with A2CAB1 and A2CUKT4




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## FIO Node Unit ESB Bus Node Unit (19-inch Rack Mountable Type) Model: ANB10S/ANB10D, ESB Bus Node Unit constructed with A2BE2D

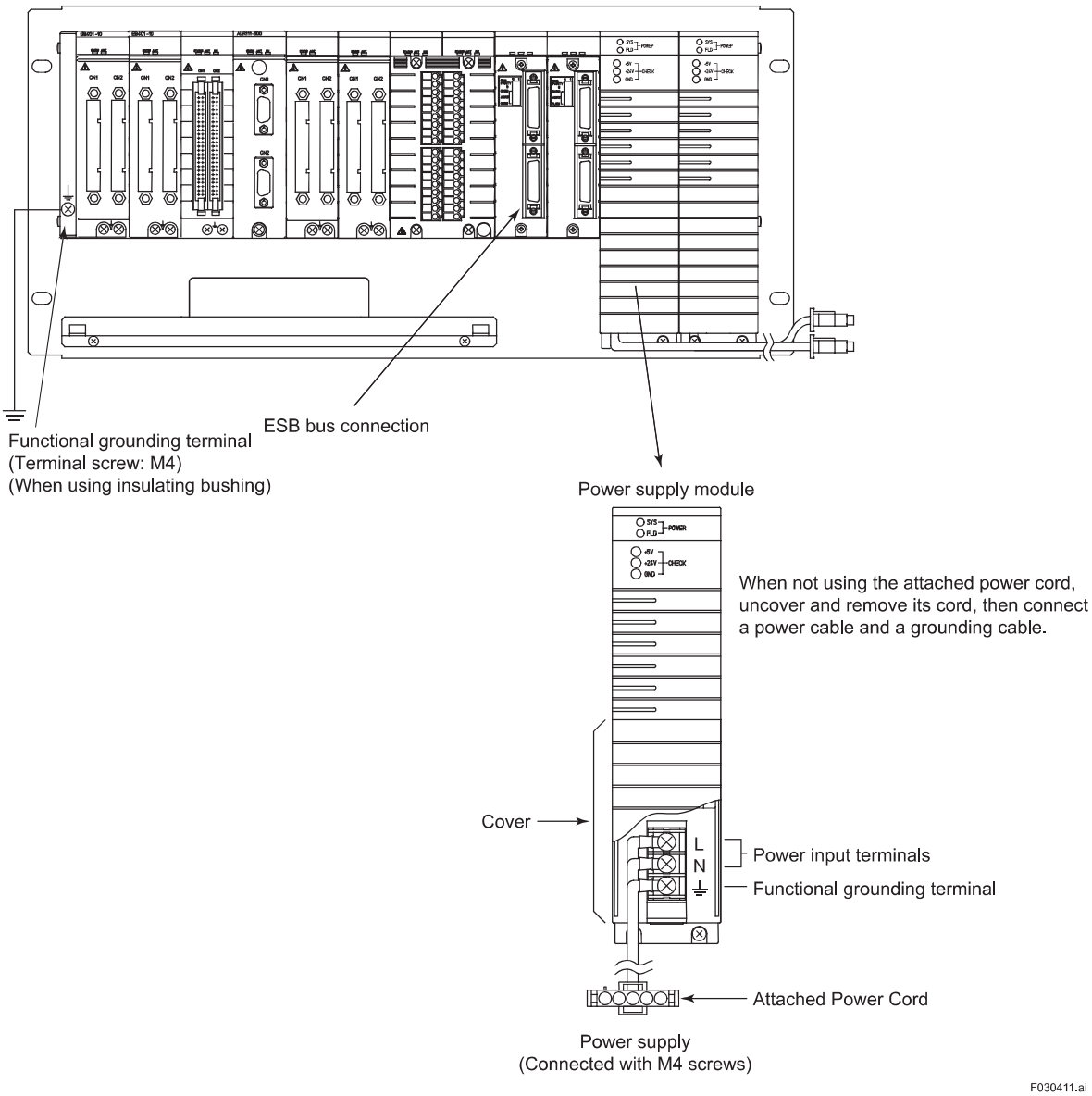



**Figure ESB Bus Node Unit Power Cable Connection**

## FIO Node Unit Optical ESB Bus Node Unit Model: ANB11S/ANB11D, Optical ESB Bus Node Unit constructed with A2BE2D

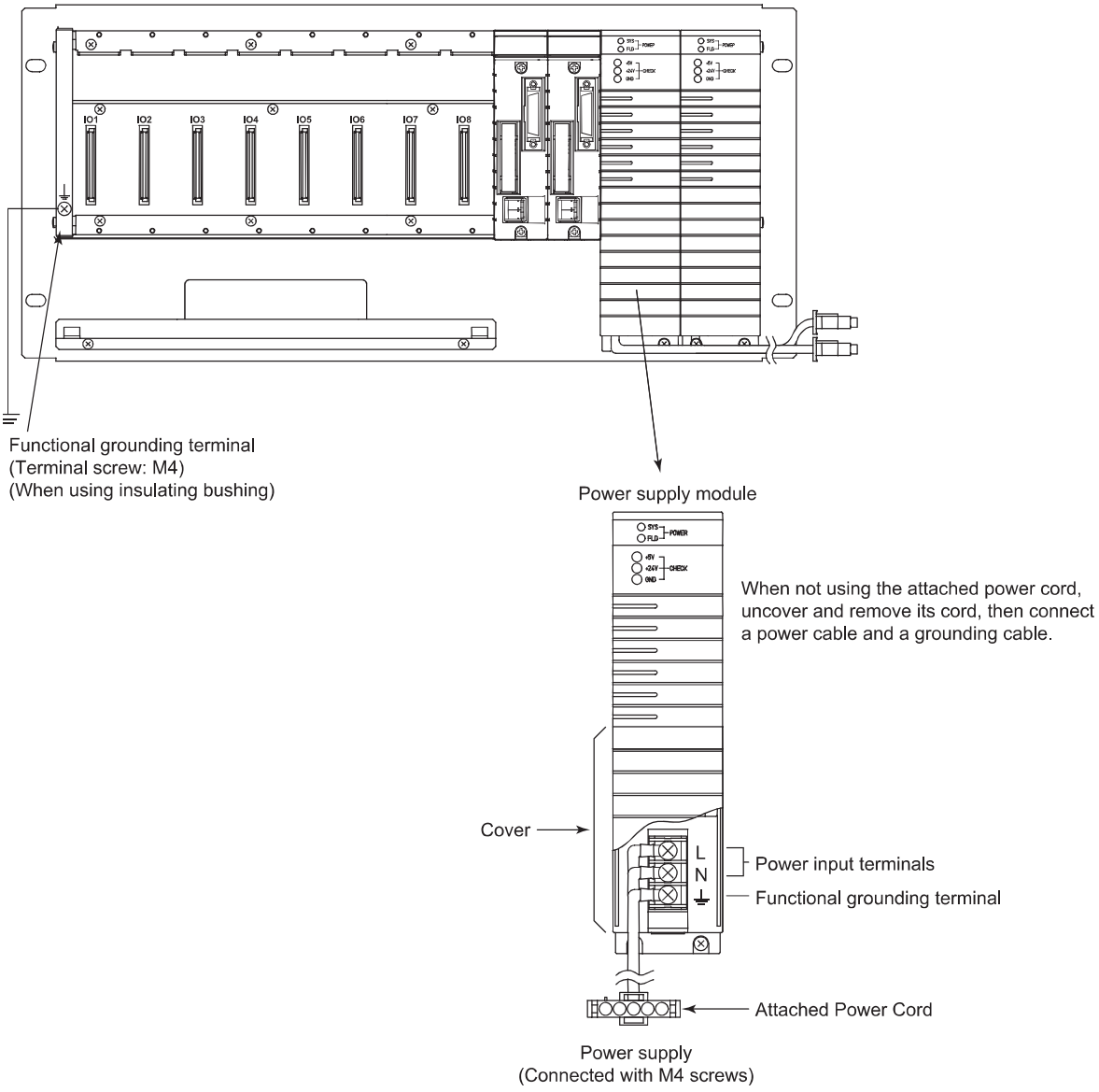



**Figure Optical ESB Bus Node Unit Power Cable Connection**

## Optical ESB Bus Repeater Unit
## Model: ANT10U, Optical ESB Bus Repeater Unit constructed with A2BE2D

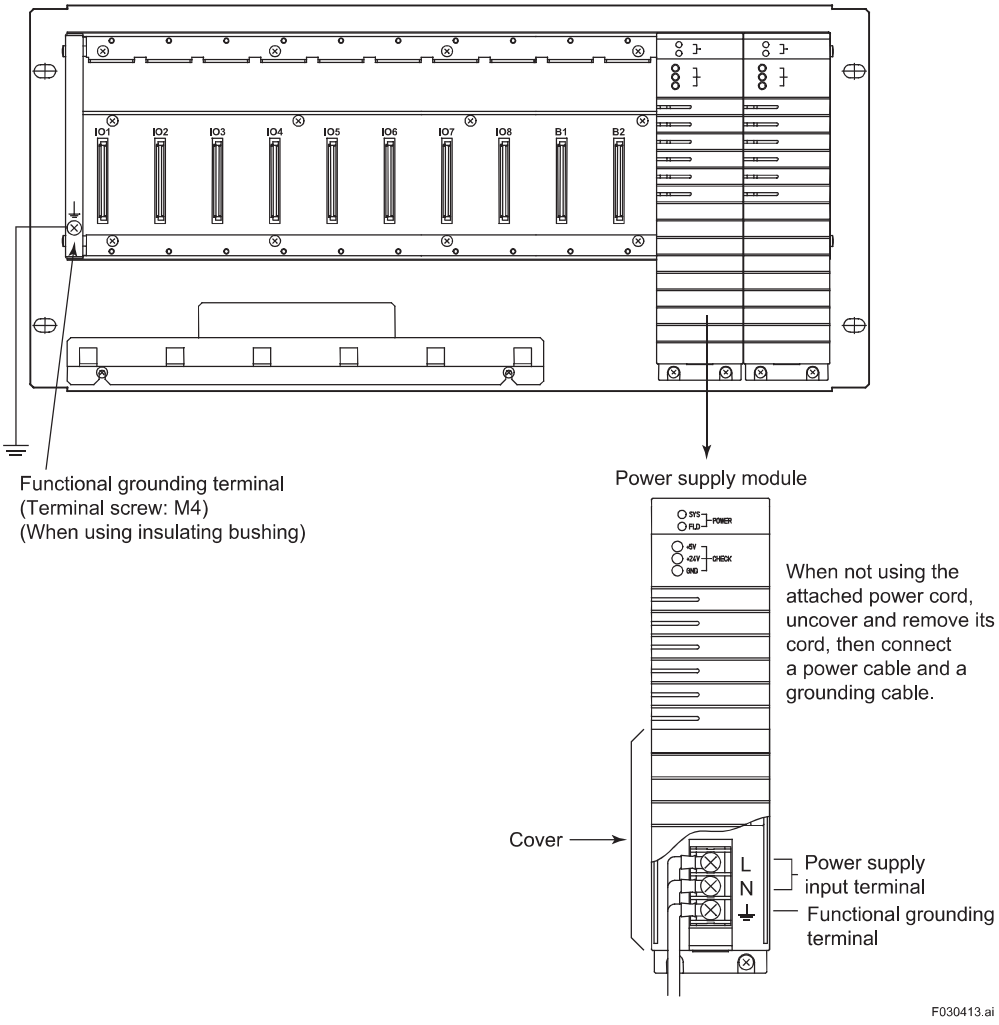



**Figure Optical ESB Bus Repeater Unit Power Cable Connection**

## AVR10D Duplexed V net Router

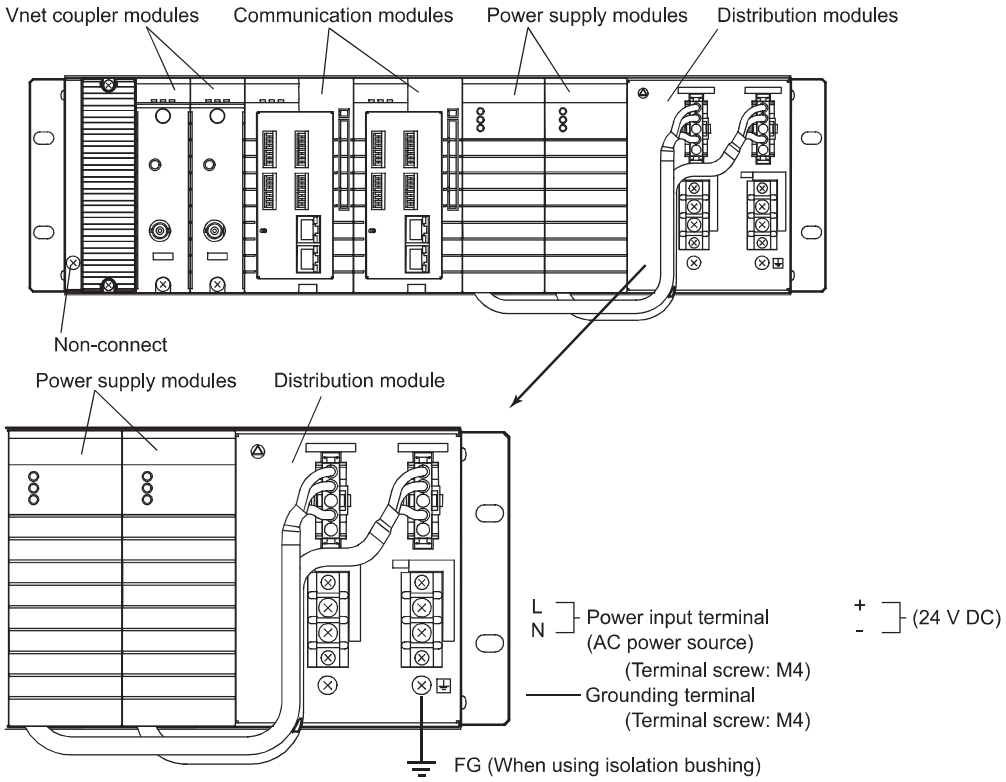



**Figure AVR10D V net Router Power Cable Connection**

## IMPORTANT

When power to the V net router is turned off, communications with the areas within the coverage of the Vnet service are disabled. The service coverage area needs to be taken into consideration when designing a system to supply power to the V net router (e.g. providing an independent power source for the V net router).

## AW810D Wide Area Communication Router

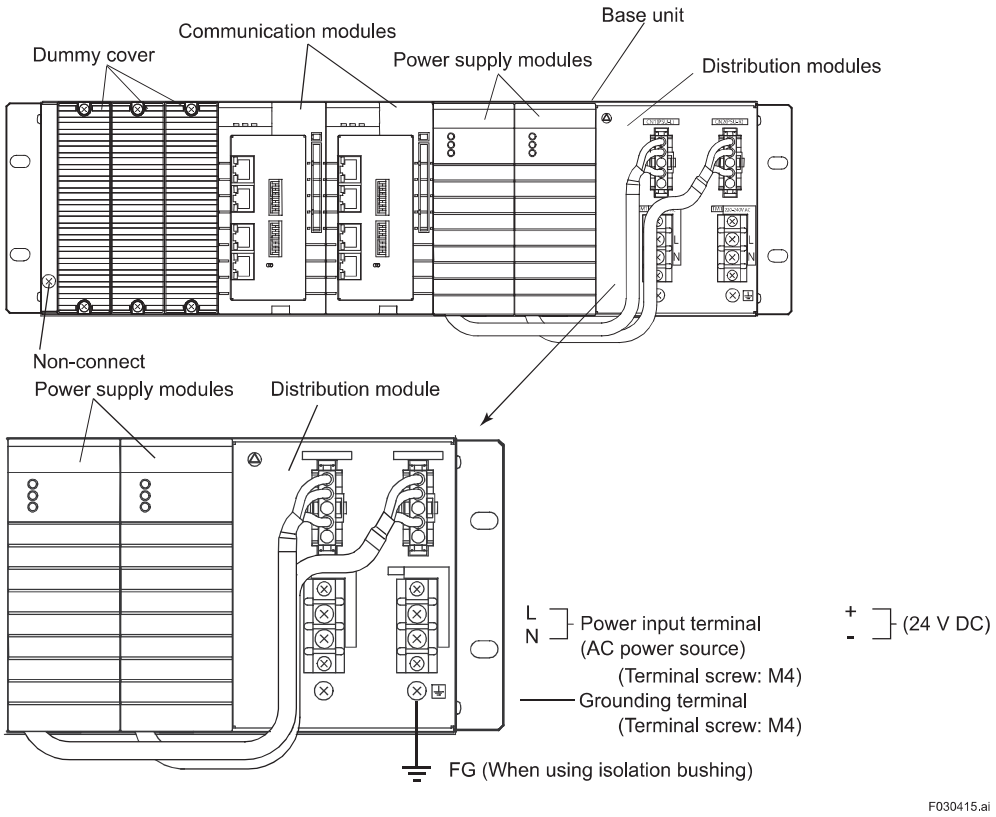



**Figure AW810D Wide Area Communication Router Power Cable Connection**

## IMPORTANT

When power to the Wide Area Communication router is turned off, communications with the areas within the coverage of the Vnet/IP service are disabled. The service coverage area needs to be taken into consideration when designing a system to supply power to the Wide Area Communication router (e.g. providing an independent power source for the Wide Area Communication router).

## A2NN10D Node Interface Unit (for RIO System Upgrade)

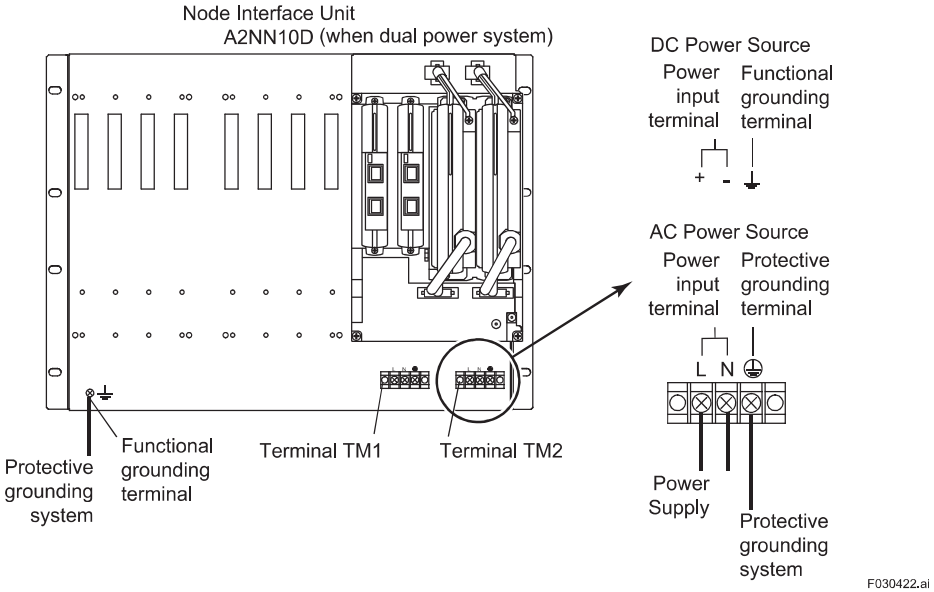
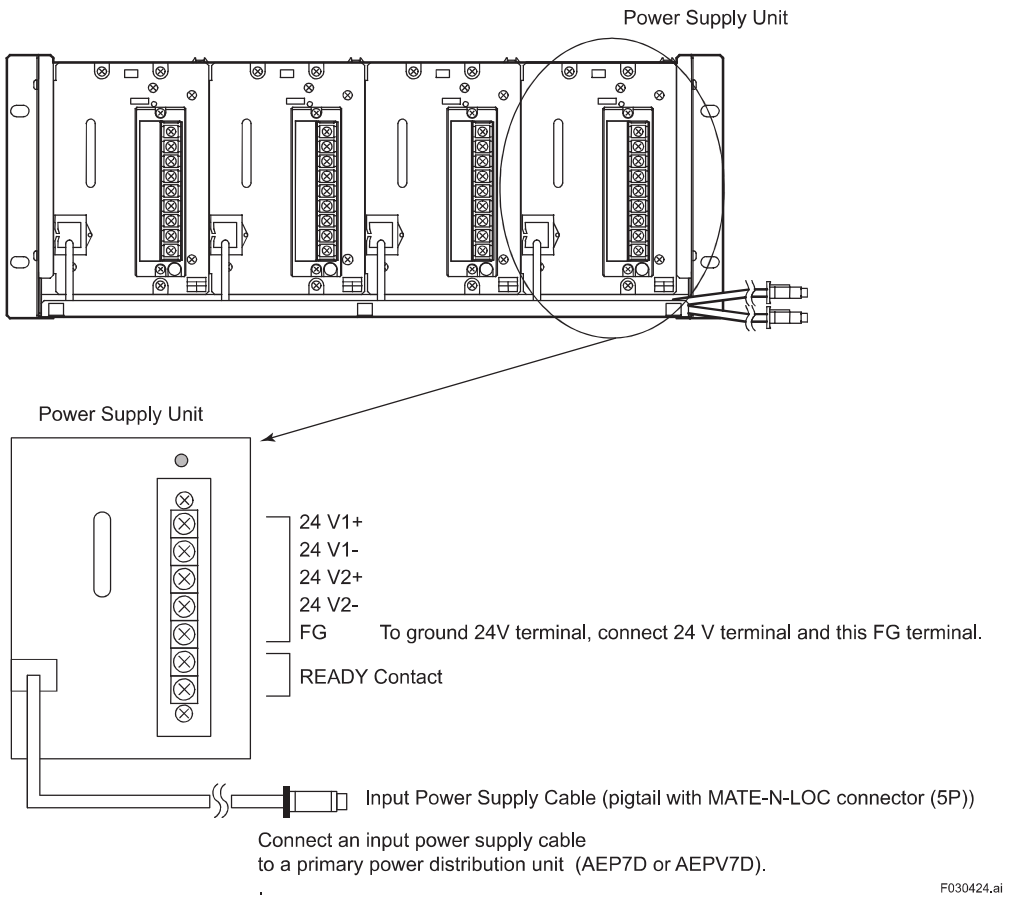


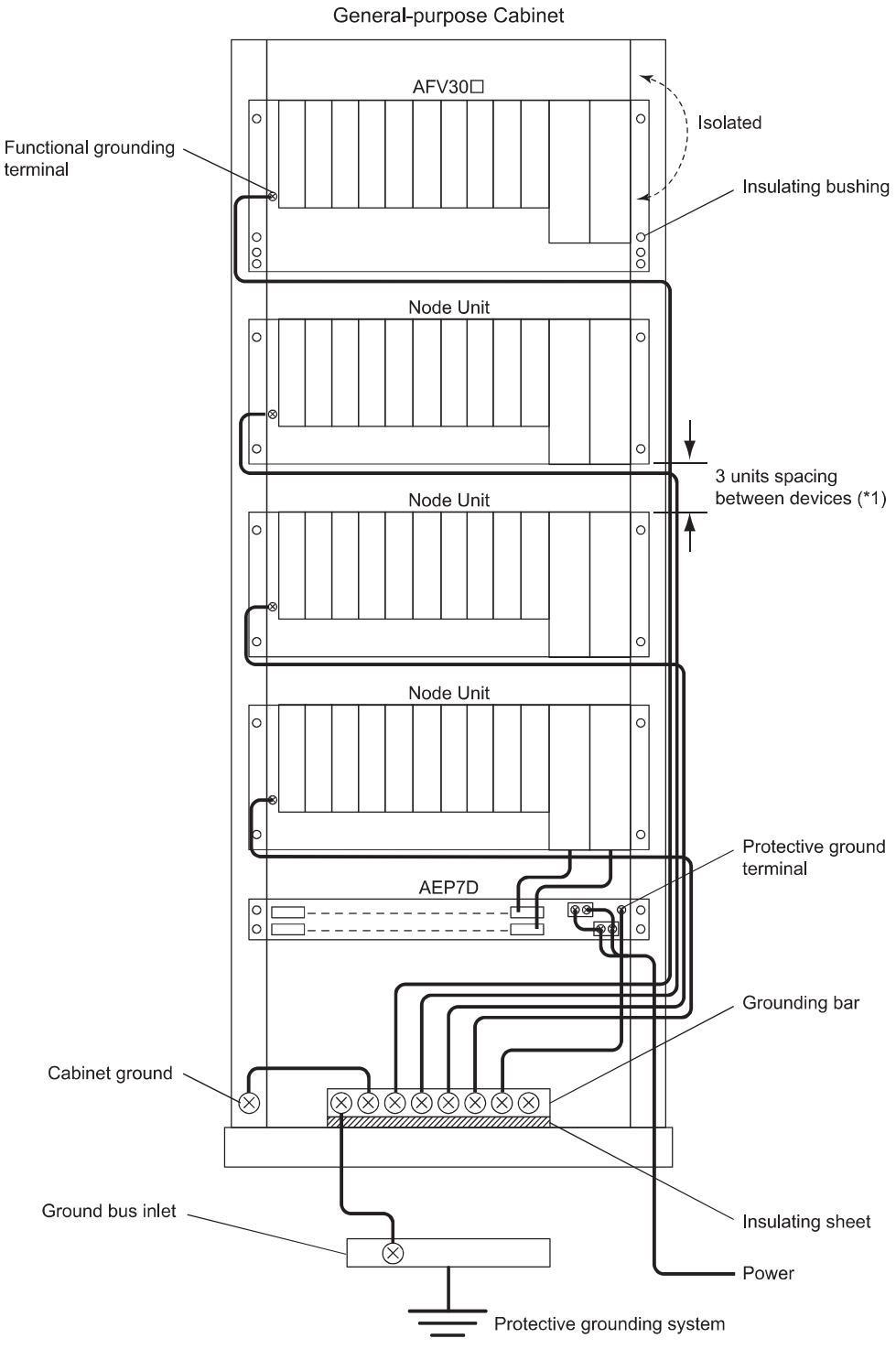

**Figure A2NN10D Node Interface Unit Power Cable Connection**

## PW601, PW602 24 V DC Output Power Supply




## 19-inch Rack-mount Devices and Wiring (For FIO System)

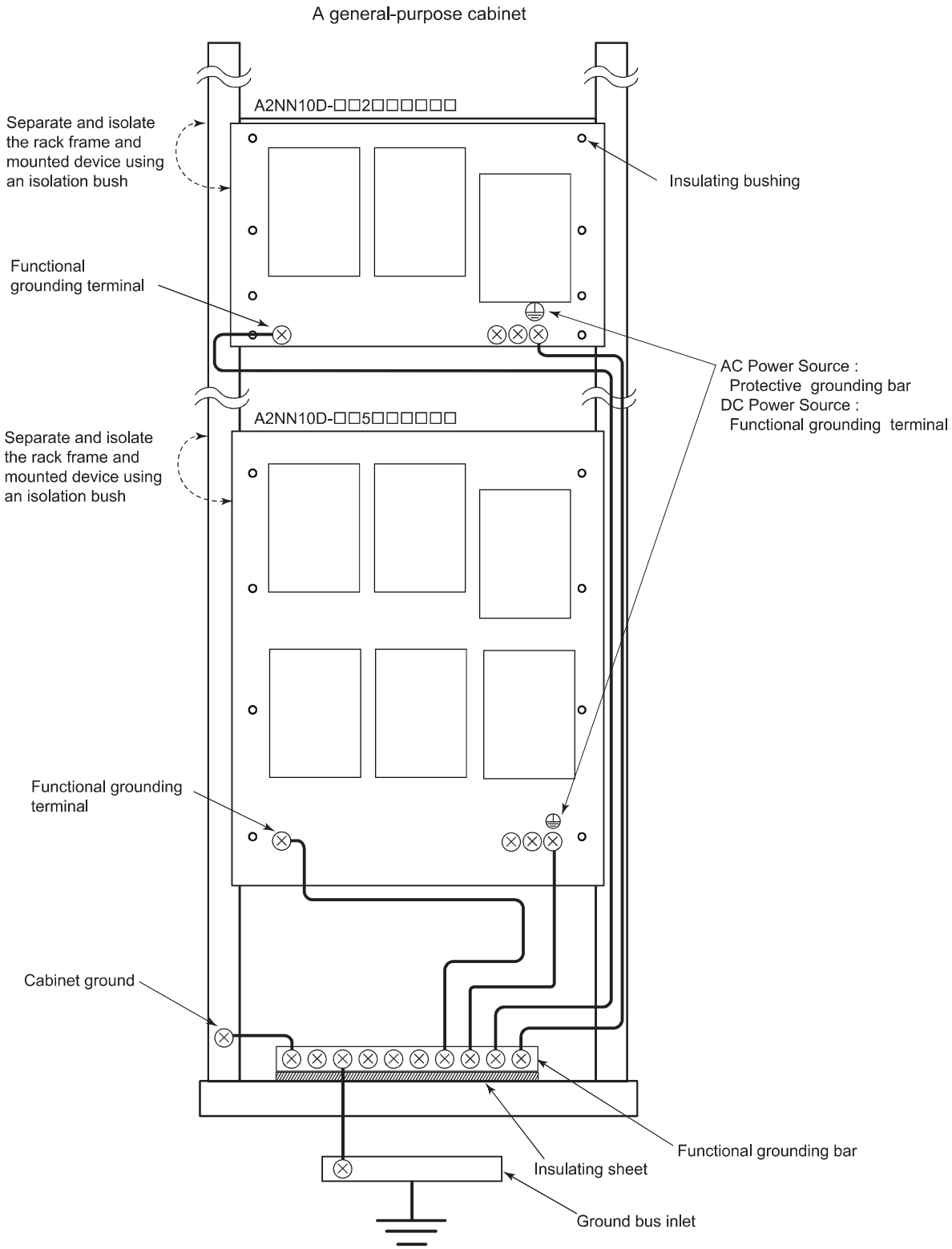
An example of wiring when AFV30□, A2FV50□, A2FV70□, ANB10□ or ANB11□ is mounted to a general-purpose cabinet in the following:




*1: Keep a space of 3 units or more for heat radiation.

**Figure 19-inch Rack-mount Devices and Wiring**

An example of wiring when A2NN10D is mounted to a general-purp cabinet in the following:



## Mounting and Wiring Example of Cabinet Utility Kit (ACUKT1)

The following shows a mounting and wiring example of ACUKT1.

In this example, a single door is mounted at the front and a double door at the rear.

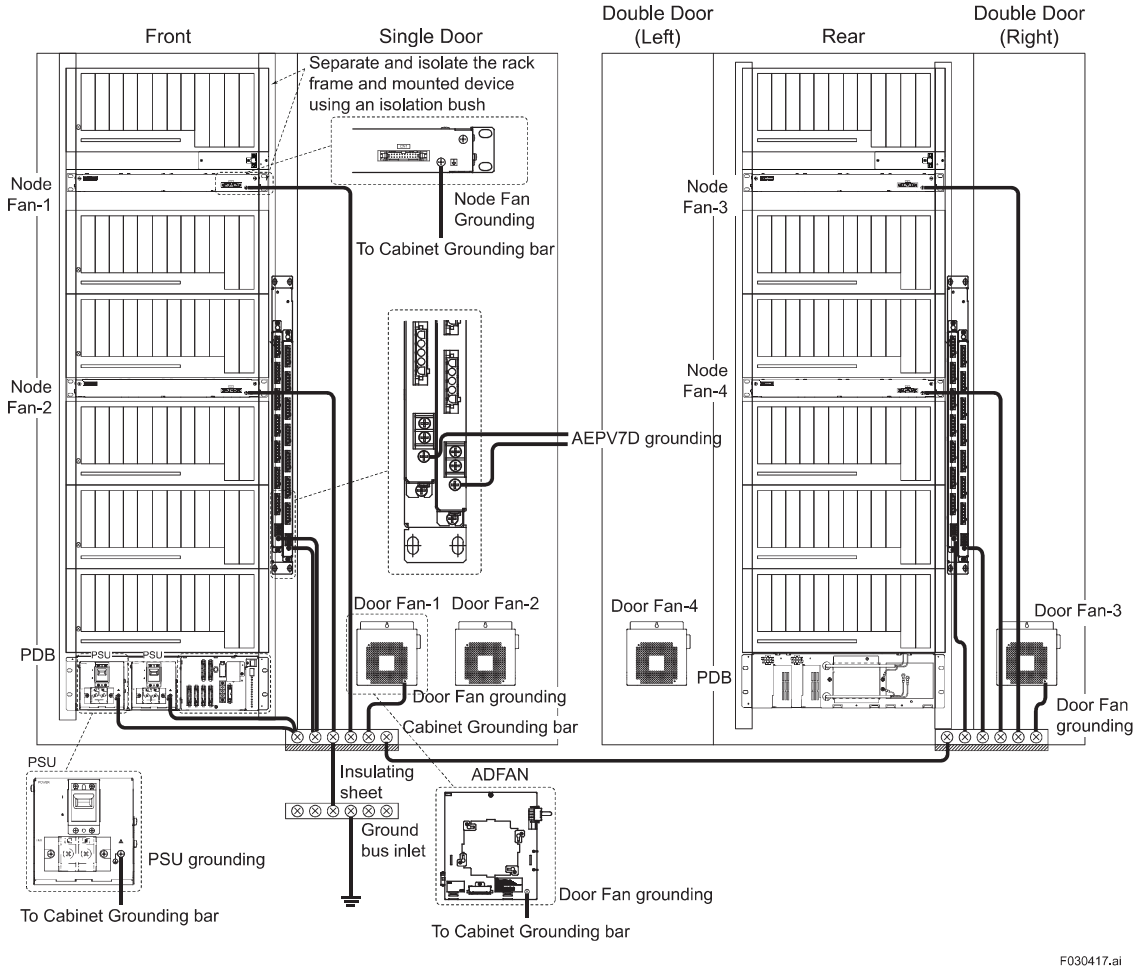



**Figure Example of ground wiring**

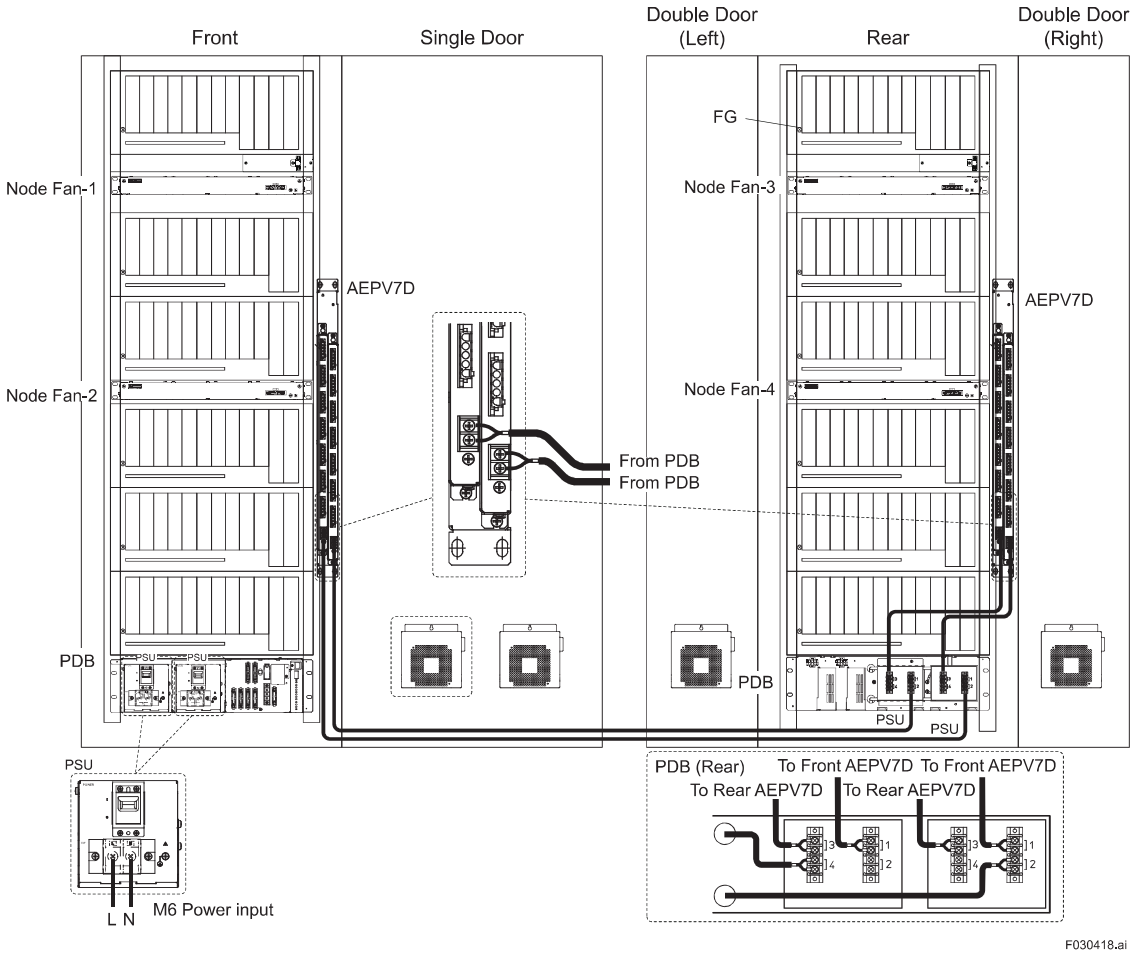



**Figure Example of Dual AC Power Supply**

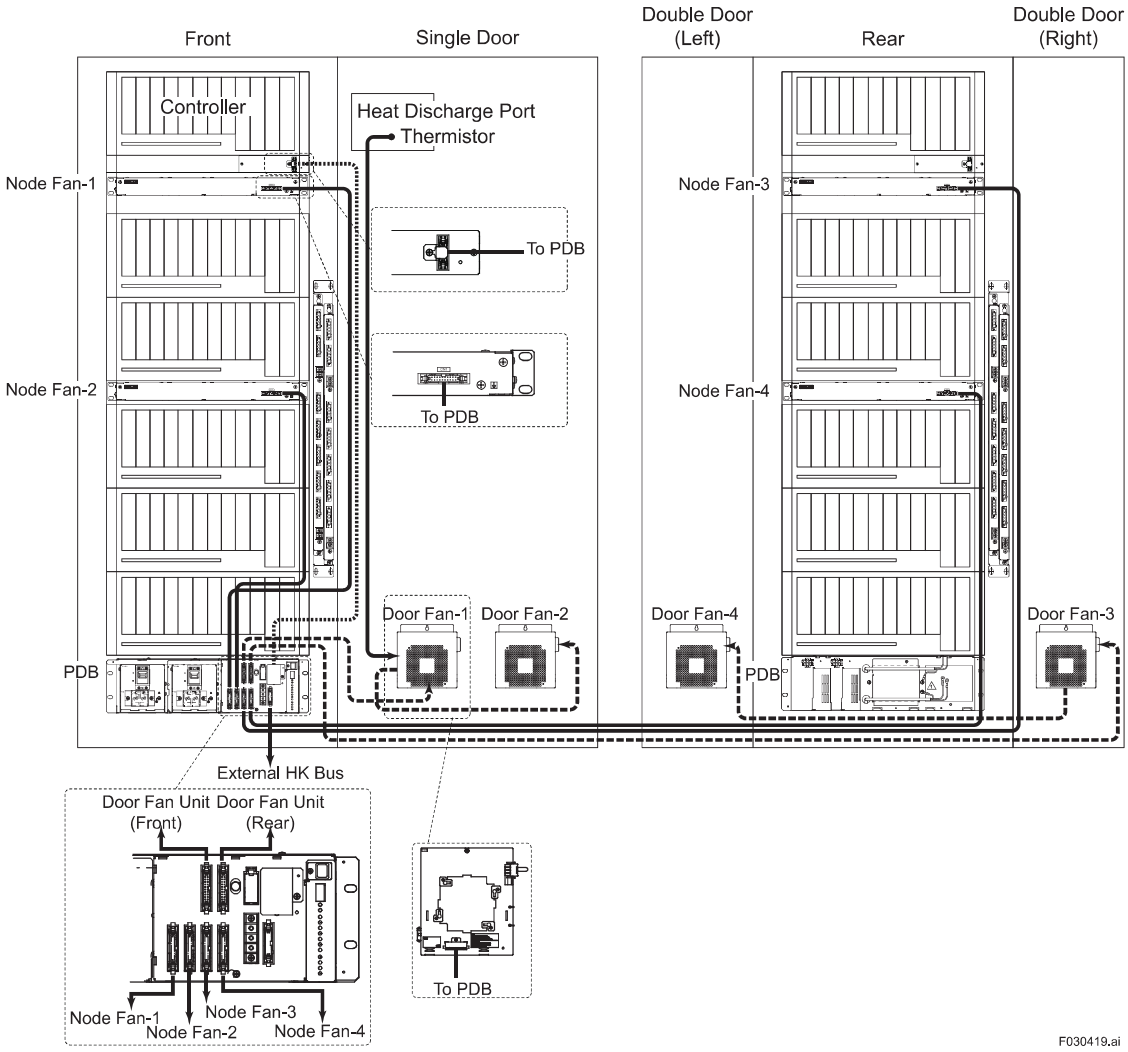



**Figure Example of signal wiring**

# 3.5 Connecting Signal Cable

**The terminal blocks or connectors of I/O modules are the interface of the field signals. When connecting the field signals to I/O modules via a dedicated cable and a terminal board, the terminal board becomes the interface of the field signals.**

## Process I/O Signal Connection

- Power, Control Bus, and signal cables must be separately laid. Avoid laying them in parallel.
- The use of group-shielded twisted-pair cables is recommended for analog signal input specifically in order to prevent induction noise. A twisted-pair cable pitch of 50 mm or less should be used and the shielded cables must be grounded.
- The use of twisted-pair cables is also recommended for digital signals.
- The twisted-pair cable has the following advantages over a solid wire:
  - More flexible for easy curving and cabling in limited spaces.
  - With good contact and durable in using a solderless contact.
- Signal cables must be clamped so that their weight does not affect terminals.
- Use solderless lug or pressure clamp terminal contact when process I/O signals are connected with terminals.

### Solderless Lug

**CAUTION**

- The CENTUM VP system uses screw terminals for signal connections.
- Use the solderless contact with an insulation covering.
- Use the solderless contact and crimp tools of the same make.
- Use correct-size crimp tools according to cable sizes.
- When the door is attached or detached for cable connection, be sure to then OFF the power of the main unit before connecting or disconnecting a cable.

### Pressure Clamp Terminal

**CAUTION**

- The CENTUM VP uses a pressure clamp terminal for signal connection of FIO and N-IO.
- For cable connection with a sleeve attached, use a sleeve and a clamp tool from the same manufacturer.
- Use a clamp tool which suits the cable thickness.
- When the door is attached or detached for cable connection, be sure to then OFF the power of the main unit before connecting or disconnecting a cable.

### Push-in terminal

**CAUTION**

- The N-IO field enclosure also uses a push-in terminal for signal connection.
- For cable connection with a sleeve attached, use a sleeve and a clamp tool from the same manufacturer.
- Use a clamp tool which suits the cable thickness.

### Spring Clamp Terminal

**CAUTION**

- The CENTUM VP uses a spring clamp terminal for signal connection of N-IO.
- For cable connection with a sleeve attached, use a sleeve and a clamp tool from the same manufacturer.
- Use a clamp tool which suits the cable thickness.
- When the door is attached or detached for cable connection, be sure to then OFF the power of the main unit before connecting or disconnecting a cable.

## Signal Cable Termination

Use the specified sleeves for pressure clamp terminal on the end of terminal - connected cables.

### Pressure Clamp Terminal (for FIO Module Pressure Clamp Terminal Block)

- Terminal processing
  When connecting the process I/O signal to the pressure clamp terminal of FIO I/O Modules or N-IO, strip the cable coating (without a sleeve) or attach a sleeve to the cable. The following shows the length of the coating stripped for cases when a sleeve is not used and when it is used.

ATA4S, ATD5S, ATI3S, ATB5S, ATF9S, A1BT4D,ATA4D, ATD5D, ATI3D, and ATB5D

**Table Without a sleeve**

| Cable thickness ($mm^2$) | Length of coating stripped (mm) | Remarks |
|---|---|---|
| 0.5 to 2 (AWG20 to 14) | 11 | — |

It is recommended to use any one of the following sleeves.

Sleeve without insulating cover (DIN 46 228/1)
Sleeve with insulating cover (DIN 46 228/4)

**Table With a sleeve**

| Nominal cross sectional area ($mm^2$) | When using a sleeve with an isolation cover | | | When using a sleeve without an isolation cover | |
|---|---|---|---|---|---|
| | Length of coating stripped (mm) | Sleeve size | | Length of coating stripped (mm) | Sleeve size |
| | | Total length (mm) | Contact section length (mm) | | Total length (mm) |
| 0.5 | 12 | 16 | 10 | 10 | 10 |
| 0.75 | 12 | 16 | 10 | 10 | 10 |
| 1 | 12 | 16 | 10 | 10 | 10 |
| 1.25 to 1.5 | 12 | 16 | 10 | 10 | 10 |

## Pressure Clamp Terminal (for ARS□□M)

For both signal line and power line of the Solid State Relay Board ARS□□M, pressure clamp terminals are used.

- Terminal processing
  When connecting the signal and power line to the pressure clamp terminal, strip the cable coating (without a sleeve) or attach a sleeve to the cable. The following shows the length of the coating stripped for cases when a sleeve is not used and when it is used.

**Table Terminal treatment for pressure clamp terminal signal line**

| | Cable thickness ($mm^2$) | Length of coating stripped (mm) | Inserting length of sleeve (mm) |
|---|---|---|---|
| Without sleeve | 0.5 to 2 (AWG20 to 14) | 8 | – |
| With sleeve | 0.5 to 2 (AWG20 to 14) | 8 | 8 |

**Table Terminal treatment for pressure clamp terminal power line**

| | Cable thickness ($mm^2$) | Length of coating stripped (mm) | Inserting length of sleeve (mm) |
|---|---|---|---|
| Without sleeve | 0.5 to 2 (AWG20 to 14) | 9 | – |
| With sleeve | 0.5 to 1.5 (AWG20 to 16) | 9 | 8 |

## Pressure Clamp Terminal, Spring Clamp Terminal (for N-IO), Push-in terminal (for N-IO field enclosure)

At the end of the signal cables to the following applicable interface, provide the following cable termination:

**Table Applicable Interface**

| Products | Models | Interface | Sleeve Normal cross sectional area ($mm^2$) |
|---|---|---|---|
| Node Interface Unit | A2NN30D | External alarm input terminal | 0.5 ~ 2.5 |
| I/O Unit | A2BN3D | I/O signal terminal (Pressure clamp terminal) | 0.5 ~ 2.5 |
| | | I/O signal terminal (Spring clamp terminal) | 0.5 ~ 1.5 |
| | | Field power supply input terminal | 0.5 ~ 1.5 |
| | A2BN5D | I/O signal terminal | 0.5 ~ 1.5 |
| | | Barrier power supply input terminal | 0.5 ~ 1.5 |
| Terminal board | A2BM4 | I/O signal terminal | 0.5 ~ 2.5 |
| Shunt resistor unit (For A2SAP105) | A2EXR001 | Input terminal | 0.5 ~ 2.5 |
| N-IO field enclosure | A2NN70D, A2CB60 | I/O signal terminal (Push-in terminal) | 0.5 ~ 2.5 |

- When using a sleeve
  At the cable end, peel off the coating and attach a sleeve. The specifications of the sleeve differ, depending on the cable thickness. Provide cable termination according to the following figure and tables:

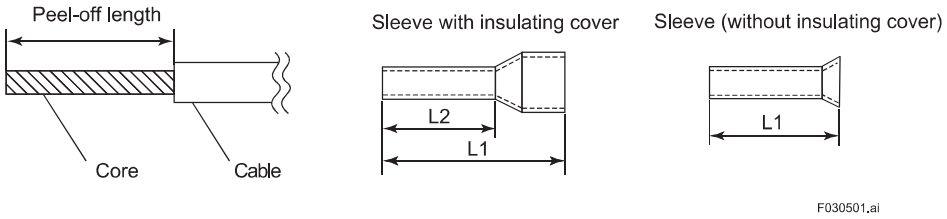



**Figure Cable termination (for pressure clamp terminals)**

It is recommended to use any one of the following sleeves.

Sleeve without insulating cover (DIN 46 228/1)
Sleeve with insulating cover (DIN 46 228/4)

**Table When sleeves with insulating cover are used**

| Nominal cross sectional area ($mm^2$) | Peel-off length (mm) | Sleeve dimensions (mm) | |
|---|---|---|---|
| | | L1 | L2 |
| 0.5 | 10 | 14 | 8 |
| 0.75 | 10 | 14 | 8 |
| 1.0 | 10 | 14 | 8 |
| 1.5 | 10 | 14 | 8 |
| 2.5 | 10 | 14 | 8 |

**Table When sleeves without insulating cover are used**

| Nominal cross sectional area ($mm^2$) | Peel-off length (mm) | Sleeve dimensions (mm) |
|---|---|---|
| | | L1 |
| 0.5 | 6 | 6 |
| 0.75 | 6 | 6 |
| 1.0 | 6 | 6 |
| 1.5 | 7 | 7 |
| 2.5 | 7 | 7 |

- When not using a sleeve
  The peel-off length should be 7 mm. (*1)
- For I/O Unit Model A2BN4D
  The pressure clamp terminal is on the MTL I.S. barrier. A cable must be prepared separately. Cable specification of field signal depends on the requirements specification of MTL's I.S. barriers. Refer to the instruction manual of I.S. barriers provided by the vendor.

*1: In case of A2EXR001, the peel-off length should be 8 mm for pressure clamp terminals and 7 mm for spring clamp terminals.

## Solderless Lug

- Solderless lug specifications

  The specifications of the solderless lug to use are determined by the nominal cross sectional area of the power cable for which the lug is to be used, the lug screw, dimensions and so on.

**Table Solderless Lug Dimensions**

| Nominal cross sectional area ($mm^2$) | Screw used (mm) | Hole diameter (mm) | Lug outside diameter (mm) | Lug length (mm) | Insulation covering inside diameter (mm) | Dimension "C" (mm) |
|---|---|---|---|---|---|---|
| 0.75 ~ 1.25 | 4 (*1) | 4.3 or more | 8.2 or less | Approx.21 | 3.6 or more | 7.0 or more |
| 2.0 | 4 (*1) | 4.3 or more | 8.7 or less | Approx.21 | 4.3 or more | 7.1 or more |

*1: Recommended tightening torque is 1.2 N•m.

**CAUTION**

- For CENTUM VP, spring lugs are used for connecting signals for equipment for RIO System Upgrade.
- Always use solderless lugs with insulated covering.
- Always use solderless lugs and crimp-on tool manufactured by the same manufacturer.
- The crimp-on tool must be matched to the wire thickness.

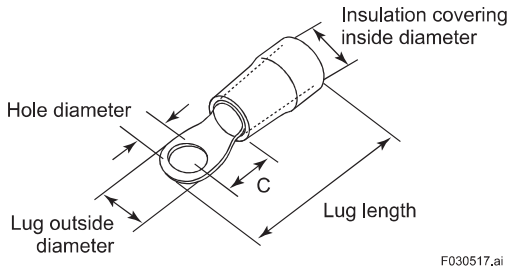



**Figure Solderless Lug**

## Connecting Signal Cables to Terminals (for FIO)

### Connecting to Pressure-clamp Terminal

1. Loosen the cable connecting terminal screw.
2. Strip the cable coating (without a sleeve) or attach a sleeve to the cable, then insert the tip of the cable into the connecting section of the pressure clamp terminal.
3. Fasten the screw using the special tool (a screw driver conforming to the DIN 5264B standard with a tip width of 0.6 mm and a shaft diameter of 3.5 mm) with a fastening torque of 0.5 N•m.

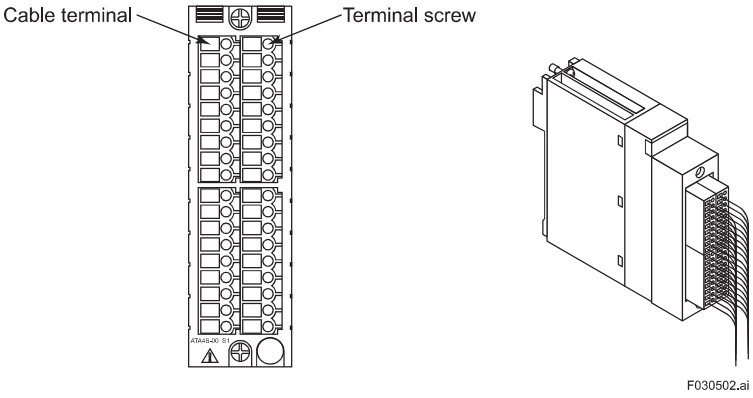



**Figure Connecting Signal Cable to Terminal (for FIO)**

**CAUTION**

Do not use non-standard signal cable or sleeve; using them could cause improper connection. Be sure to remove the cable sheath just as much as specified, fit the sleeve, and clamp the cable firmly to the terminal.

# Routing Signal Cables (for FIO)

## Areas for Signal Cables from Field

Signal cables from the field enter the FCS at the bottom and connect to individual node units in the routes shown in Figure below.

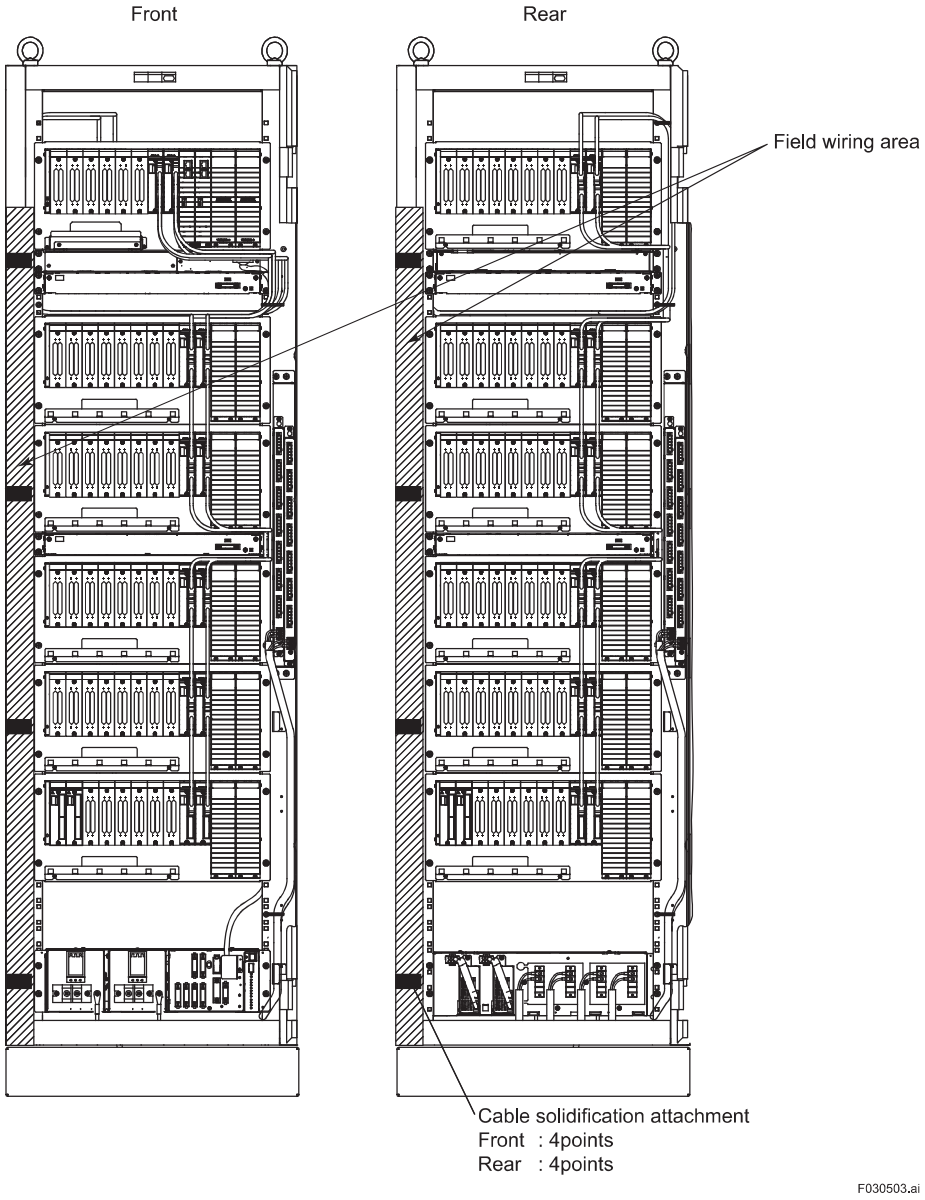



**Figure Areas for Signal Cables from Field**

## FIO Node Unit Wiring in FCU with Cabinet

**Model: AFV40S/AFV40D, the cabinet constructed with A2CAB1 and A2CUKT4**

The figure shows a dual-redundant ESB bus example.

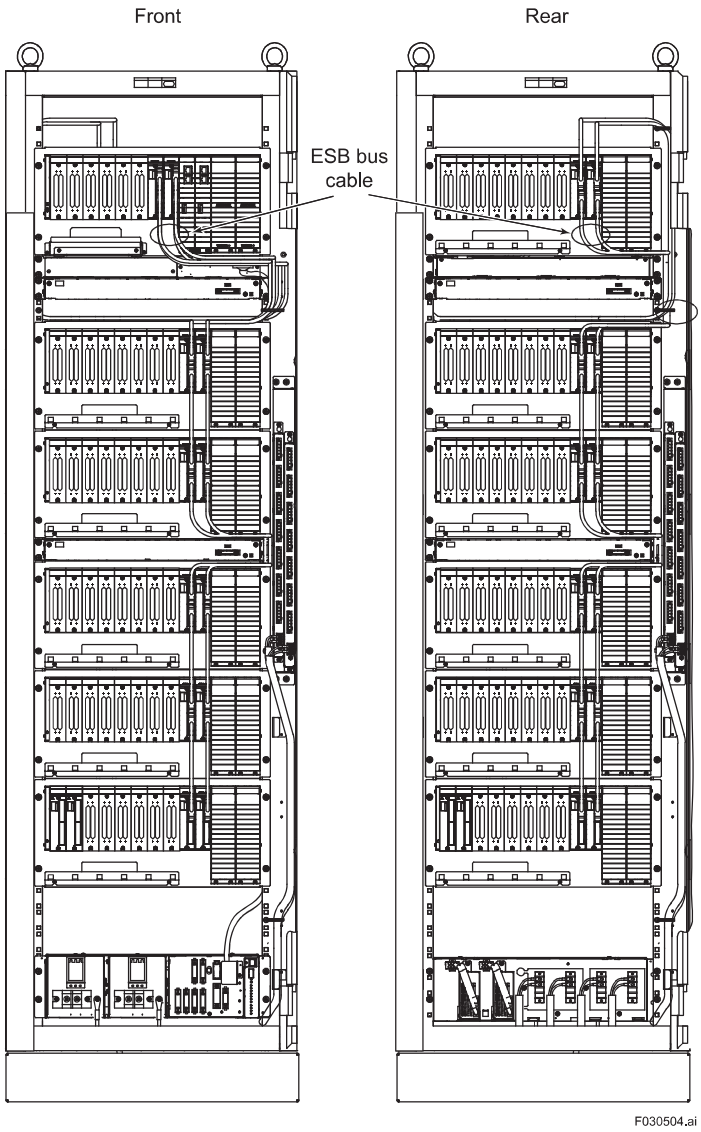



**Figure FIO Node Unit Wiring in FCU with Cabinet**

## FIO Node Unit Wiring in I/O Expansion Cabinet

**Model: ACB51, the cabinet constructed with A2CAB1 and A2CUKT4**

The figure shows a dual-redundant ESB bus example, the ESB bus node units installed in the front of the cabinet and the terminal boards in the rear.

Avoid using ESB bus cable with other cables and also avoid wiring its cable in parallel with others.

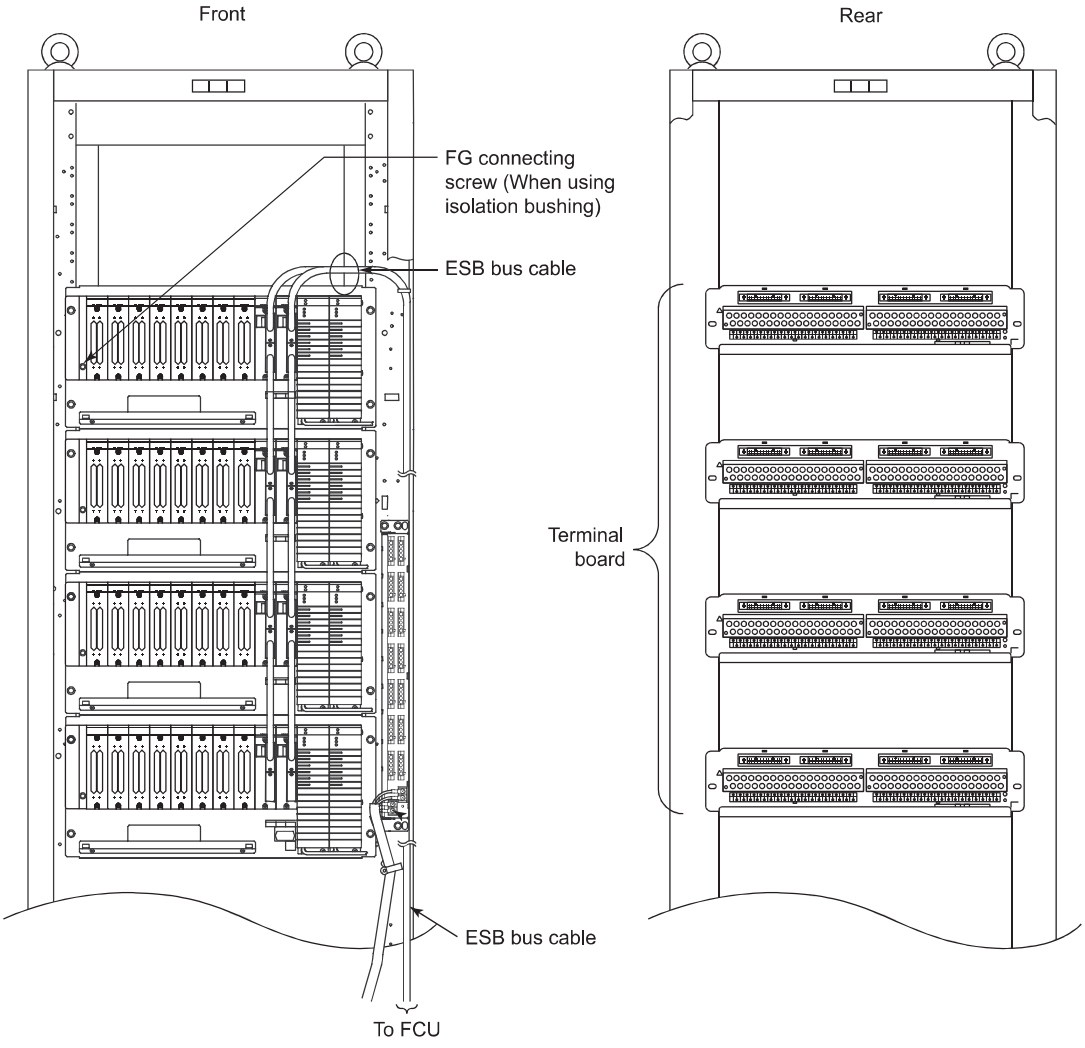



**Figure FIO Node Unit Wiring in I/O Expansion Cabinet**

## FCU (for FIO), ESB Bus Node Unit

**CAUTION**

To reserve the ventilation for I/O module, the signal cable should not exceed the separator at the center of cable tray.

The following shows a dual-redundant ESB bus example.

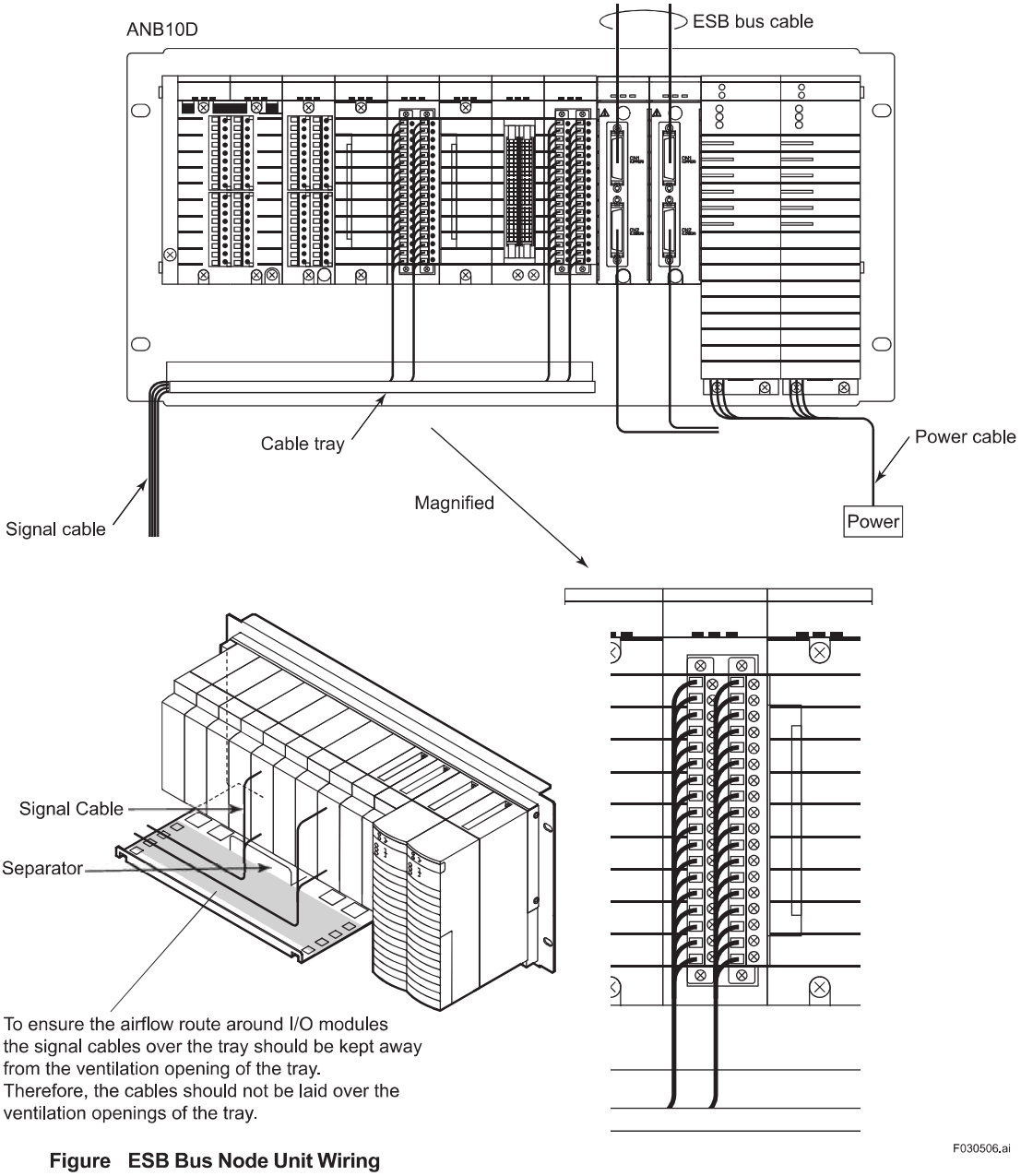



**Figure ESB Bus Node Unit Wiring**

## FIO Signal Cabling

**IMPORTANT**

The signal cable for the top node unit must be wired at the innermost part in the field control area as the figure shows.
When fixing cables to a clamp, allow enough space so that the cards can be maintained.
Bind the bottom cables to the clamp bar on the channel base.

Push in the signal cables for the top node unit as far as they will go.

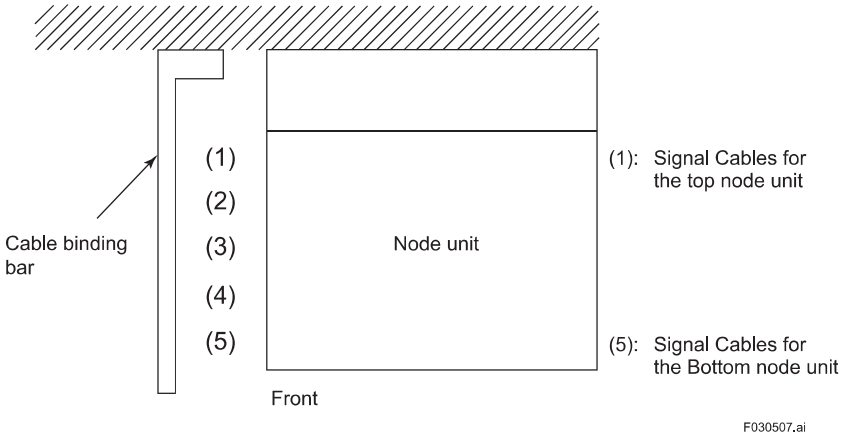



**Figure Signal Cabling**

## FIO with KS Cable Interface Adaptor Cabling

When connecting a dedicated cable to an FIO module, ensure to keep the minimum bending radius of the cable.
Place the cable in front of the separator on the cable tray for ventilation.

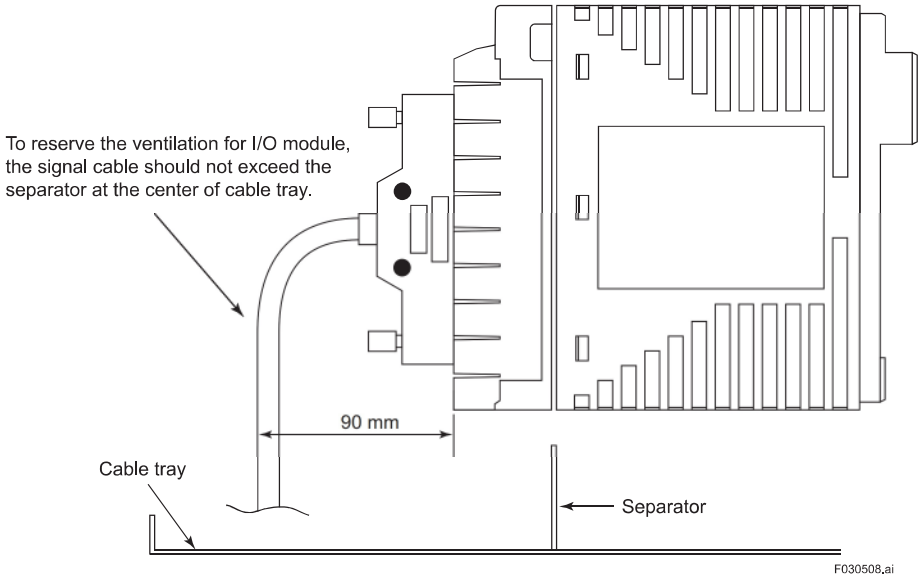



**Figure FIO with KS Cable Interface Adaptor Cabling**

## Modifying the Cabinet Bottom Plates for Cable Wiring

Cables are passed through the holes in the bottom plates of the cabinet.
The diameters of these holes can be changed to match the diameter of the cables. There are four bottom plates two each for AFV40☐/ACB51/A2CAB1 specifically for signal cable wiring.

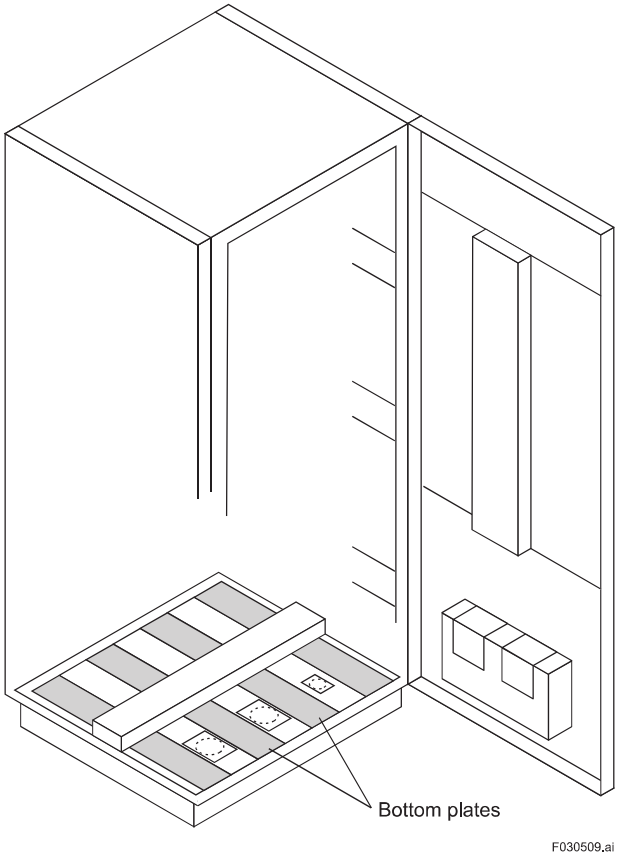



**Figure Bottom Plates of AF☐20☐/ACB21/A2CAB1**

To modify the bottom plates, follow these steps.

1. Remove the bottom plate to be modified.

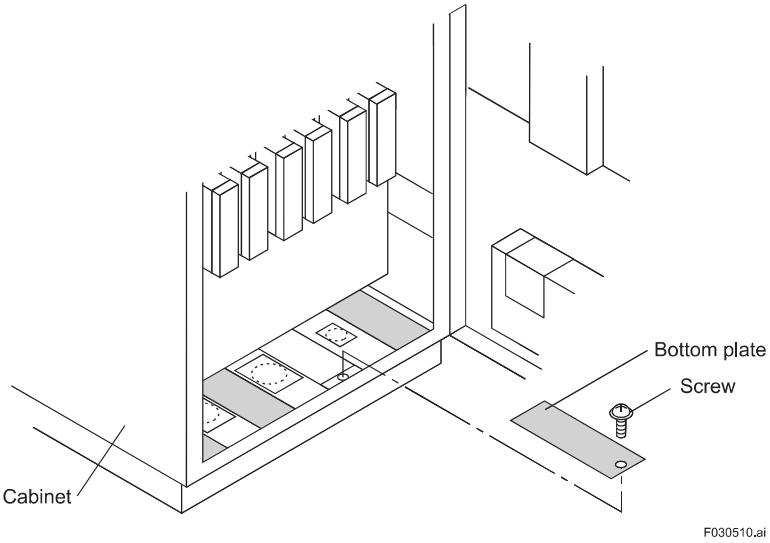



**Figure Removing the Bottom Plate**

2. Turn the bottom plate upside down so that the bottom faces upwards.
3. Use a wire cutter or another appropriate tool to remove sections of the bottom plate so that a hole large enough for the cable to pass through is made. Do not cut the sponge pad on the reverse side of the plate.
4. Cut and remove the area protective padding approximately 20 mm inside the opening made in the preceding step.
5. Turn the rim of the protective padding (width: 320 mm) inside out. This will protect the cable from the rough edges of the plate. The sponge pad has an adhesive surface. Peel the paper from the surface and stick the sponge pad to the plate.

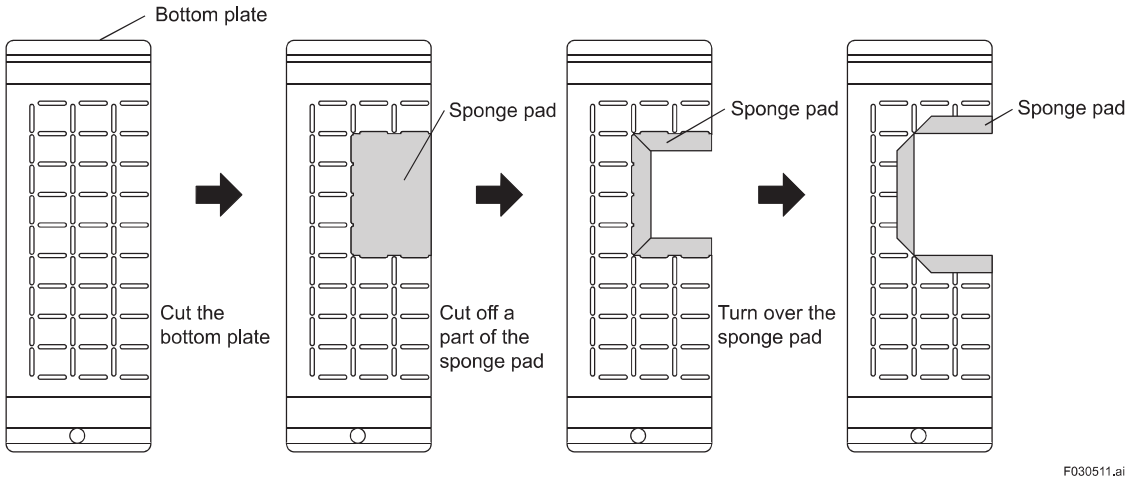


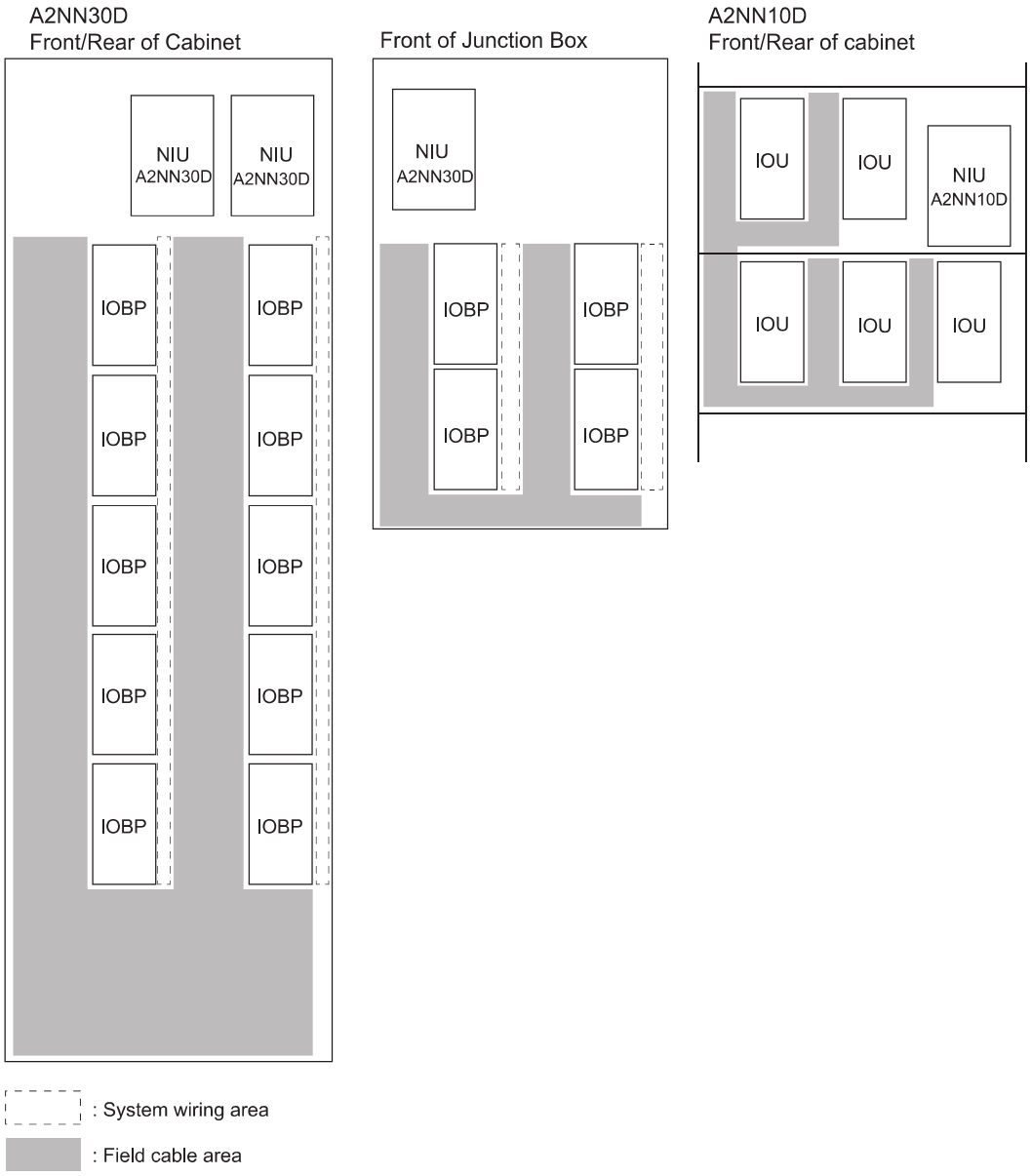

**Figure Modifying the Bottom Plate**

6. Replace the bottom plate.

# Routing Signal Cables (for N-IO)

## Field Cable Area

Signal cables from the field enter the Cabinet at the bottom and connected to individual IOBP units in the routes shown in Figure below.




NIU: Node Interface Unit
IOBP: N-IO I/O Base Plate
IOU: I/O Unit (for RIO System Upgrade)

**Figure Area for Signal Cable from Field**

## Connecting Signal Cables to Terminals (for N-IO)

### Connecting cables to pressure clamp terminals (A2BN3D-□1□□□)

Follow these steps to connect cables to pressure clamp terminals:

1. Open the cover of the terminal block of the base plate for N-IO I/O.
2. Confirming the cable polarity, insert the cable to the pressure clamp terminal and tighten the screw. The tightening torque of the screws should be 0.5 to 0.6 N·m.
3. Pull the cable gently to check that it is fixed securely.
4. Close the cover of the terminal block of the base plate for N-IO I/O.

### Connecting cables to spring clamp terminals (A2BN3D-□2□□□)

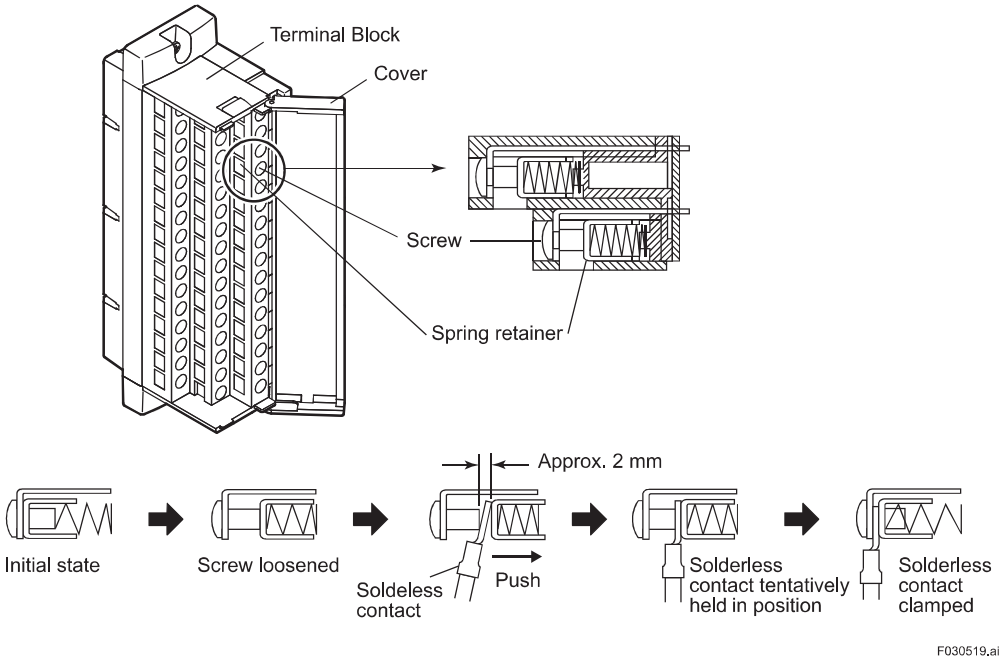
Follow these steps to connect cables to spring clamp terminals:

1. Open the cover of the terminal block of the base plate for N-IO I/O.
2. Pressingly expand the spring clamp terminal with a flat-blade screwdriver.
3. Insert a cable without pulling out the screwdriver.
4. Pull out the flat-blade screwdriver.
5. Pull the cable gently to check that it is fixed securely.
6. Close the cover of the terminal block of the base plate for N-IO I/O.

## Connecting Signal Cables to Terminals (for RIO System Upgrade)

Follow these steps to connect cables to terminanl Block for RIO System Upgrade:

1. Open the terminal block cover.
2. Loosen the terminal screws.
3. Insert the tip of the cable's solderless contact between the screw and the spring retainer, and press the retainer to make a gap of about 2 mm between them.
4. Insert the solderless contact further in the gap until the screw enters in the hole of the solderless contact.
5. Tighten the terminal screw.
6. Close the terminal block cover.




## IMPORTANT

- When connecting solderless lug, be sure to clamp its ring only.
- Using non-standard solderless lug may crush its sleeve, causing a connection failure.

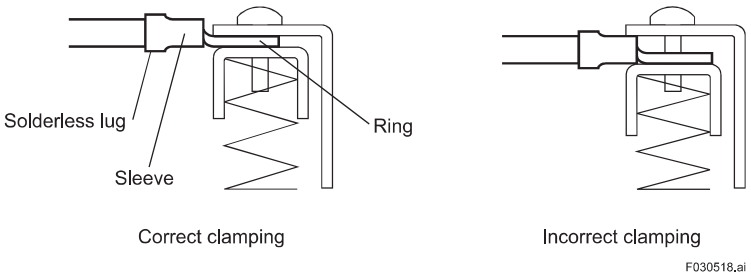



**Figure Connect Clamping of Solderless Lug**

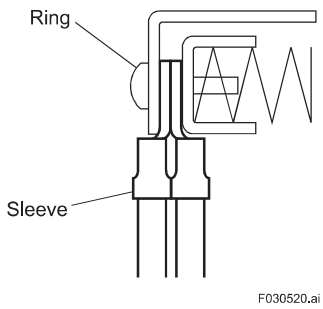



**Figure Connecting two cables with single terminal**

## N-IO Signal Cabling

**IMPORTANT**

The signal cable for the top IOBP must be wired at the innermost part in the field control area as the figure shows.
When fixing cables to a clamp, allow enough space so that the cards can be maintained.
Bind the bottom cables to the clamp bar on the channel base.

Push in the signal cables for the top IOBP as far as they will go.

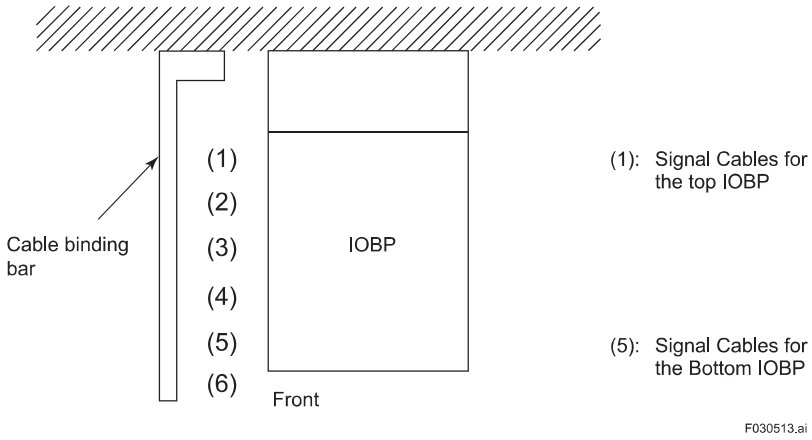



**Figure Cabling**

## Example of Node Interface Unit A2NN30D and I/O Unit cable wiring (Cabinet)

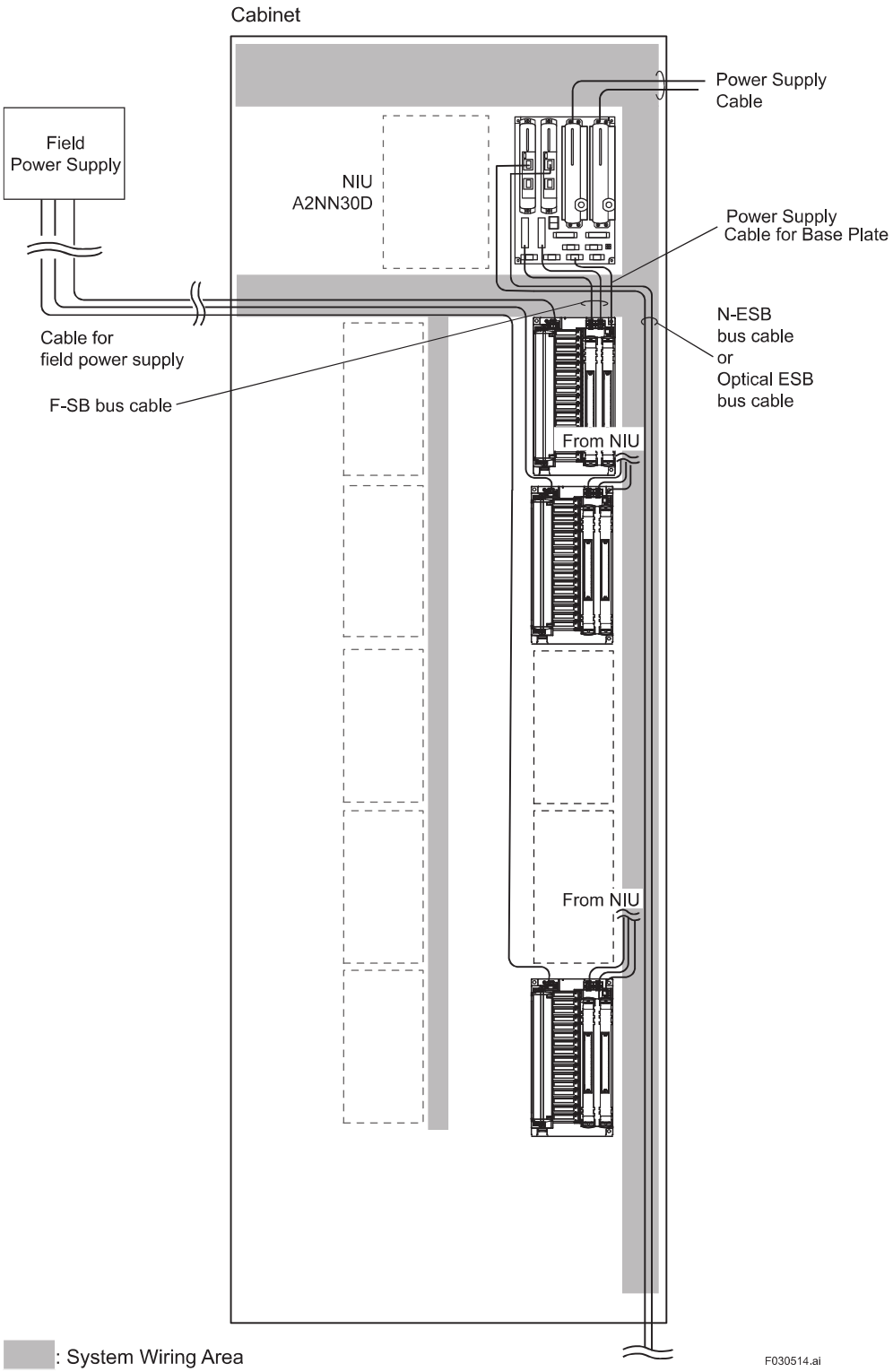
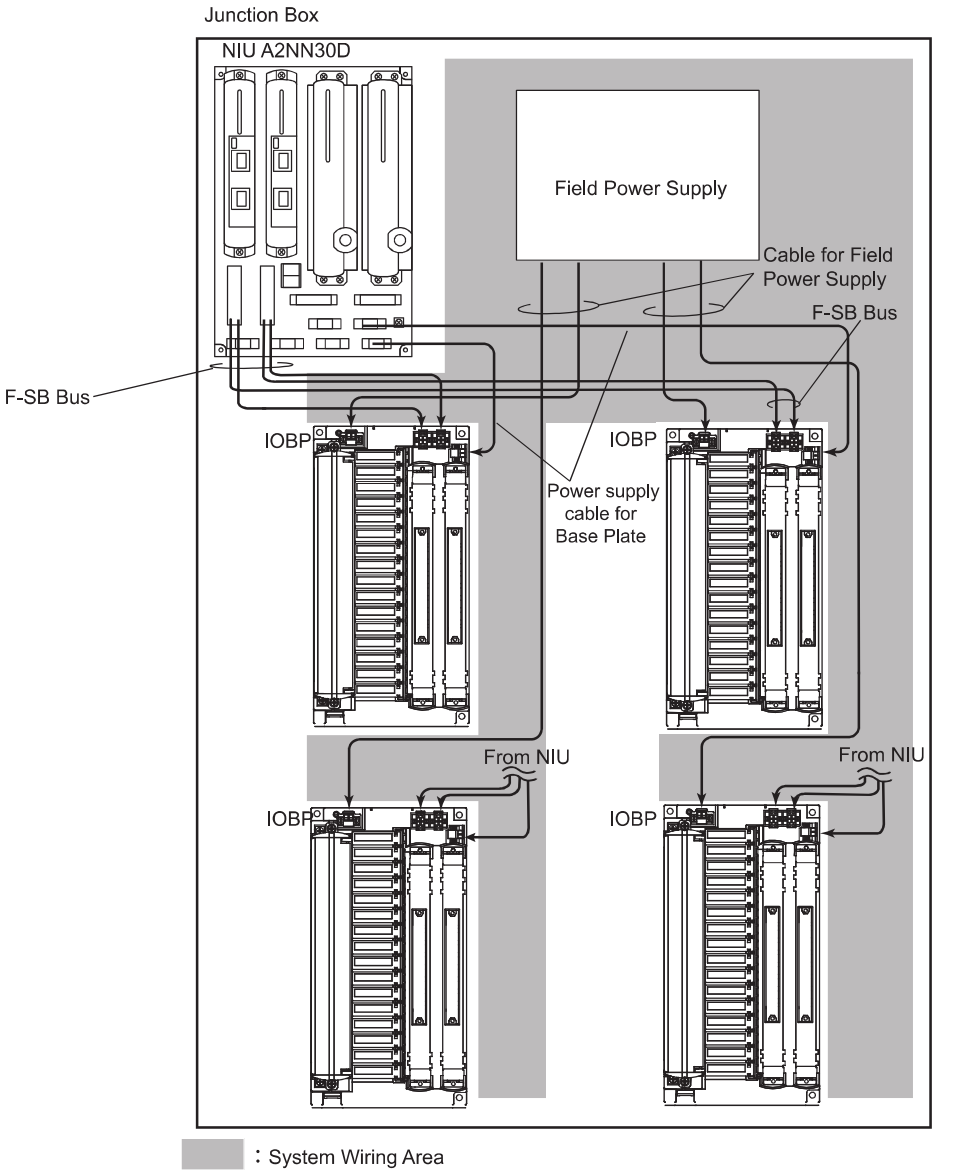



**Figure Example of Node Interface Unit and I/O Unit Cable Wiring (Cabinet)**

## Example of Node Interface Unit A2NN30D and I/O Unit Cable Wiring (Junction Box)




NIU: Node Interface Unit (A2NN30D)
IOBP: N-IO I/O Unit

**Figure Example of Node Interface Unit and I/O Unit**

**WARNING**

The wiring that will be intrinsic safety circuits must be installed so that they are electrically separated from the wiring of non-intrinsic safety circuits, including the in-cabinet wiring. Install the wiring according to the IEC 60079-14 standards or the requirements for explosion-proof wiring of the country where the system is used.

## Connecting external alarm input terminal with Node Interface Unit

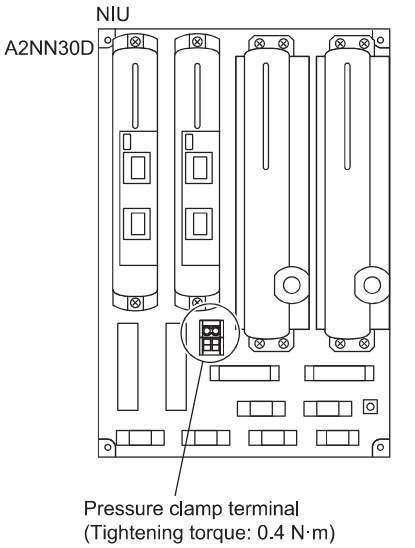



**Figure Connecting external alarm input terminal with Node Interface Unit**

# 3.6 Connecting Signal Cables with Fieldnetwork I/O (FIO)

**This section describes the signal connections with FIO.**

## 3.6.1 Combination of Fieldnetwork I/O (FIO) and Terminal Blocks

A pressure clamp terminal block or KS cable (also called a “Yokogawa-specific cable”) interface adaptor is available for field-wiring, or an MIL cable provided by the user may be used.

**SEE ALSO** For the terminal arrangement of the pressure clamp terminals and terminal board, and the pin arrangement of the MIL connector, refer to “Field Connection Specifications (for FIO)” (GS 33J60A20-01EN).

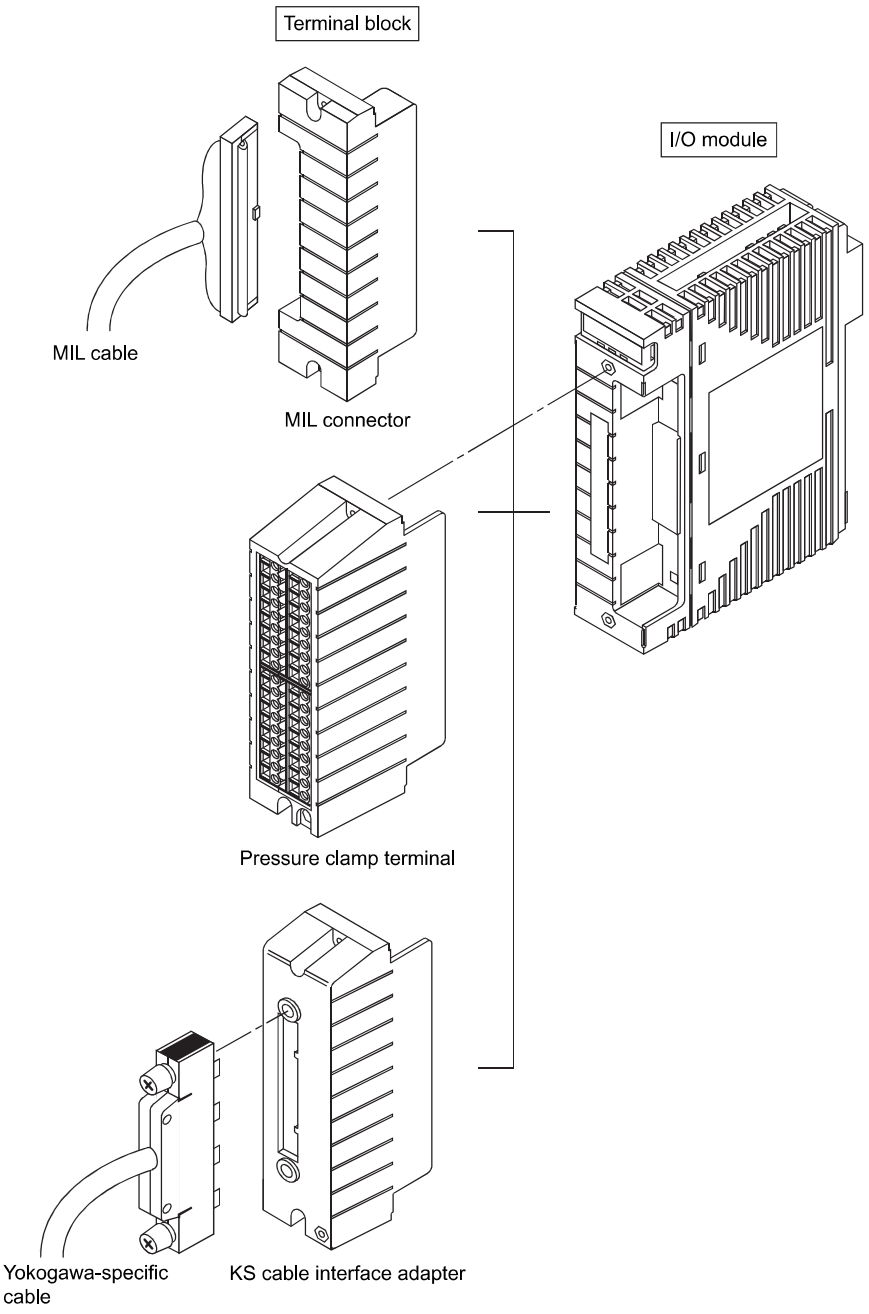



**Figure FIO Terminals**

## 3.6.2 List of Signal Cables for Connection with FIO

The following table shows the list of signal cables connections with FIO.

**Table Signal Cables for Connection with FIO (1/2)**

| Module | Name | I/O channels per Module | Connection Signal | | |
|---|---|---|---|---|---|
| | | | Pressure Clamp Terminal | Yokogawa-specific Cable (*1) | MIL Cable |
| **Analog I/O Modules** | | | | | |
| AAI141 | Analog Input Module (4 to 20 mA, Non-Isolated) | 16 | x | x | x |
| AAV141 | Analog Input Module (1 to 5 V, Non-Isolated) | 16 | x | x | x |
| AAB141 | Analog Input Module (1 to 5 V / 4 to 20 mA, Non-Isolated) | 16 | – | x | – |
| AAI841 | Analog I/O Module (4 to 20 mA Input, 4 to 20 mA Output, Non-Isolated) | 8 input/8 output | x | x | x |
| AAB841 | Analog I/O Module (1 to 5 V Input, 4 to 20 mA Output, Non-Isolated) | 8 input/8 output | x | x | x |
| AAB842 | Analog I/O Module (1 to 5 V / 4 to 20 mA Input, 4 to 20 mA Output, Non-Isolated) | 8 input/8 output | – | x | – |
| AAI143 | Analog Input Module (4 to 20 mA, Isolated) | 16 | x | x | x |
| AAI543 | Analog Output Module (4 to 20 mA, Isolated) | 16 | x | x | x |
| AAV144 | Analog Input Module (-10 to +10 V, Non-Isolated) | 16 | x | x | x |
| AAV544 | Analog Output Module (-10 to +10 V, Non-Isolated) | 16 | x | x | x |
| AAI135 | Analog Input Module (4 to 20 mA, Isolated Channels) | 8 | x | x | x |
| AAI835 | Analog I/O Module (4 to 20 mA, Isolated Channels) | 4 input/4 output | x | x | x |
| AAT145 | TC/mV Input Module (TC: R, J, K, E, T, B, S, N /mV: -100 to 150 mV, Isolated Channels) | 16 | – | x (*2) | – |
| AAR145 | RTD/POT Input Module (RTD: Pt100 Ω / POT: 0 to 10 kΩ, Isolated Channels) | 16 | – | x (*2) | – |
| AAP135 | Pulse Input Module (Pulse Count, 0 to 10 kHz, Isolated Channels) | 8 | x | x | x |
| AAP149 | Pulse Input Module for compatible PM1 (Pulse Count, 0 to 6 kHz, Non-Isolated) | 16 | – | x | – |
| AAP849 | Pulse Input/Analog Output module for compatible PAC (Pulse Count input, 4 to 20 mA output, Non-Isolated) | 8 input/8 output | – | x | – |

x : Can be connected.
– : Cannot be connected.
*1: Yokogawa-specific cable for connecting I/O Module and a terminal board, etc.
*2: Can be connected directly with a Yokogawa-specific cable, without a terminal block.

Table Signal Cables for Connection with FIO (2/2)

| Module | Name | I/O channels per Module | Connection Signal | | |
|---|---|---|---|---|---|
| | | | Pressure Clamp Terminal | Yokogawa-specific Cable (*1) | MIL Cable |
| **Digital I/O Modules** | | | | | |
| ADV151 | Digital Input Module (24 V DC, 4.1 mA) | 32 | x | x | x |
| ADV551 | Digital Output Module (24 V DC, 100 mA) | 32 | x | x | x |
| ADV161 | Digital Input Module (24 V DC, 2.5 mA) | 64 | – | x (*2) | x |
| ADV561 | Digital Output Module (24 V DC, 100 mA) | 64 | – | x (*2) | x |
| ADV859 | Digital I/O Module for Compatible ST2 (Isolated Channels) | 16 input /16 output | – | x (*2) | – |
| ADV159 | Digital Input Module for Compatible ST3 (Isolated Channels) | 32 | – | x (*2) | – |
| ADV559 | Digital Output Module for Compatible ST4 (Isolated Channels) | 32 | – | x (*2) | – |
| ADV869 | Digital I/O Module for Compatible ST5 (Common Minus Side Every 16-Channel) | 32 input /32 output | – | x (*2) | – |
| ADV169 | Digital Input Module for Compatible ST6 (Common Minus Side Every 16-Channel) | 64 | – | x (*2) | – |
| ADV569 | Digital Output Module for Compatible ST7 (Common Minus Side Every 16-Channel) | 64 | – | x (*2) | – |
| **Communication Modules** | | | | | |
| ALR111 | RS-232C Communication Module (1200 bps to 115.2 kbps) | 2 port | – | x (D-SUB9 pin) (*2) | – |
| ALR121 | RS-422/RS-485 Communication Module (1200 bps to 115.2 kbps) | 2 port | – | x (M4 terminal block 5-pole) (*2) | – |
| ALE111 | Ethernet Communication Module (10 Mbps) | 1 port | – | x (RJ-45) (*2) | – |
| ALF111 | Foundation Fieldbus (FF-H1) Communication Module (31.25 kbps) | 4 port | x | x (*2) | – |
| ALP121 | PROFIBUS-DP Communication Module (for FIO) | 1 port | – | x (*2) | – |
| A2LP131 | PROFINET Communication Module (for N-IO/FIO) | 1 port | – | X (RJ-45) (*2) | – |
| A2LP141 | PROFINET Communication Module (for N-IO/FIO) | 1 port | – | X (RJ-45) (*2) | – |
| **Turbomachinery I/O Modules** | | | | | |
| AGS813 | Servo Module (Isolated) | 12 | – | x (*3) | – |
| AGP813 | High Speed Protection Module (Isolated) | 26 | – | x (*3) | – |

x : Can be connected.
– : Cannot be connected.
*1: Yokogawa-specific cable for connecting I/O Module and a terminal board, etc.
*2: Can be connected directly with a Yokogawa-specific cable, without a terminal block.
*3: Available cables are AKB337-M005, M007 and M010.



**CAUTION**

When connecting a Yokogawa-specific cable to an FIO module, ensure to keep the minimum bending radius of the cable. The minimum bending radius of the Yokogawa specific cable is six-fold of the diameter of the cable.

## 3.6.3 Connecting Signal Cables with FIO

### Pressure Clamp Terminal

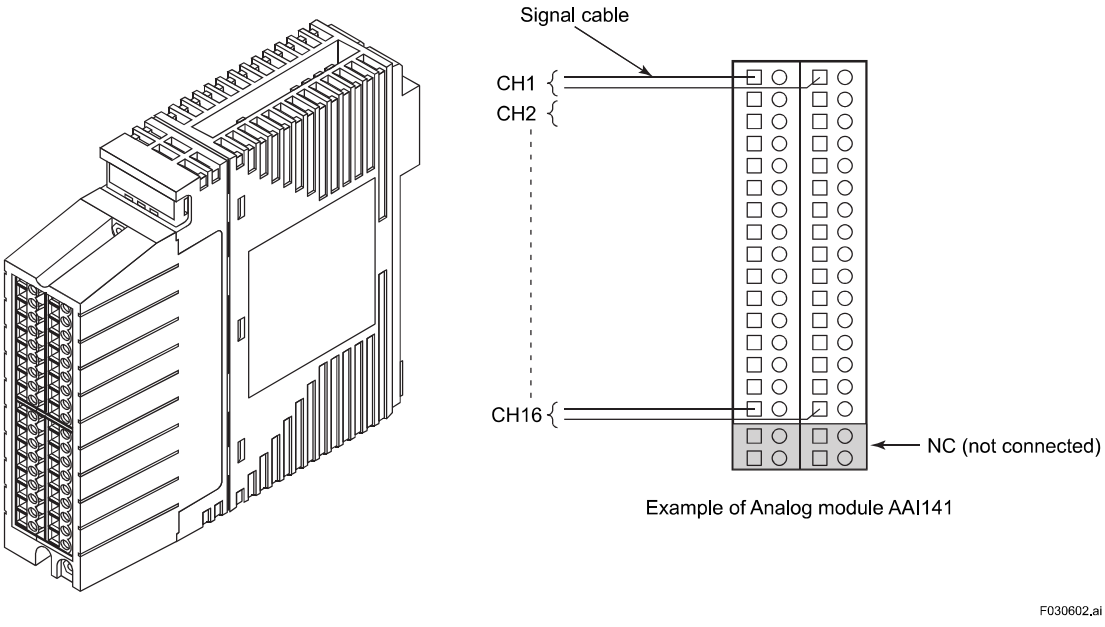



**Figure I/O Module with Pressure Clamp Terminal**

### Dual-redundant Pressure Clamp Terminal

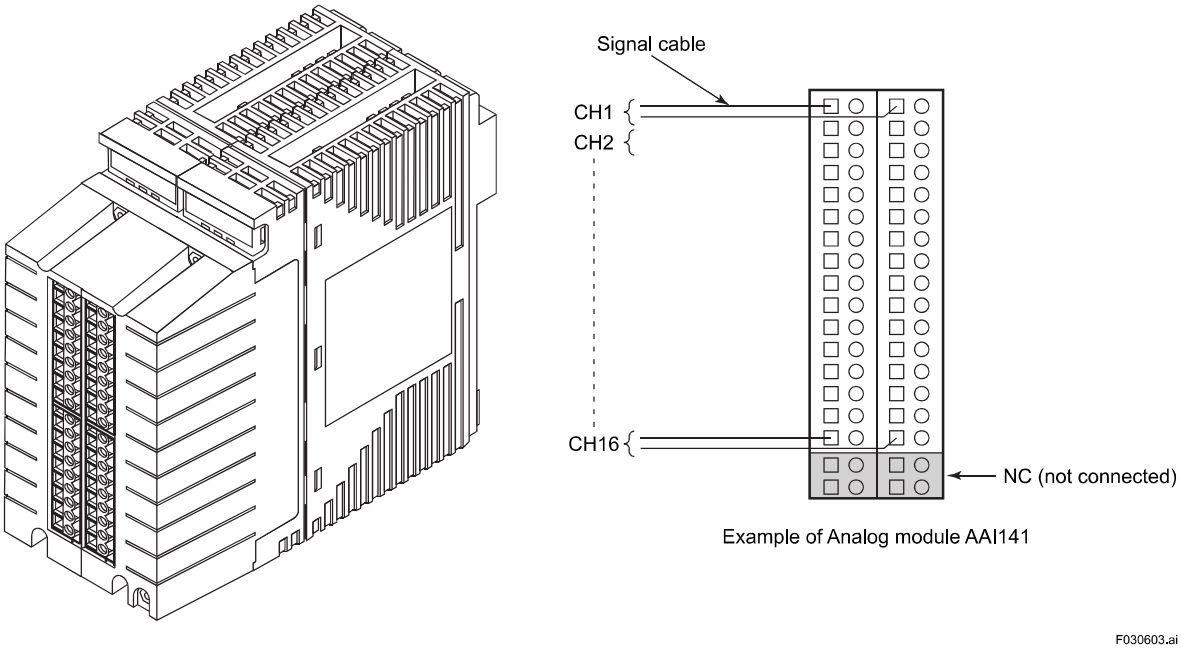



**Figure I/O Module with Dual-redundant Pressure Clamp Terminal**

## KS Cable Interface Adaptor

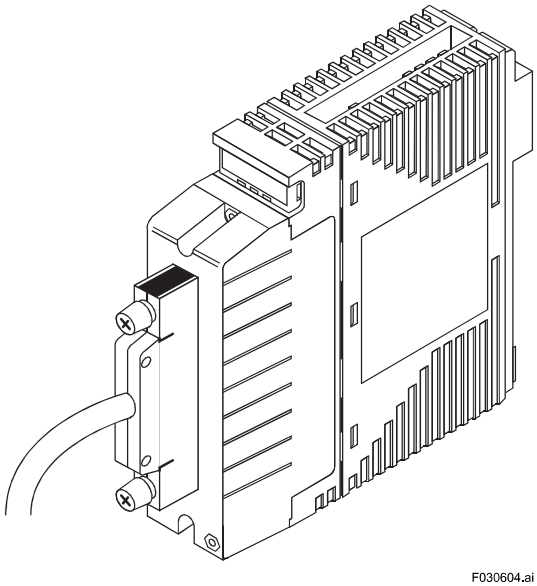



**Figure I/O Module with KS Cable Interface Adaptor**

The I/O modules are arranged in a dual-redundant configuration on the terminal board.

## Connecting Signal Cables with Analog I/O Module

Signal cables are connected to different terminals according to the devices to be connected as listed below:

**Table Signal Names and I/O Signals of Analog I/O Module**

| Model Name | Single Name | I/O Signal | | |
|---|---|---|---|---|
| AAI141<br>AAI841<br>AAI143 | IN☐A | 2-wire transmitter input + | Current input - | – |
| | IN☐B | 2-wire transmitter input - | Current input + | |
| AAI135<br>AAI835<br>(*1) | IN☐A | 2-wire transmitter input + | – | – |
| | IN☐B | 2-wire transmitter input - | Current input + | |
| | IN☐C | – | Current input - | |
| AAR145<br>(*2) | IN☐A | Resistance temperature detector input A | Potentiometer input, 100% | – |
| | IN☐B | Resistance temperature detector input B | Potentiometer input, 0% | |
| | IN☐C | Resistance temperature detector input B | Potentiometer input, variable | |
| AAP135 | IN☐A | 2-wire power supply source | – | 3-wire power supply source |
| | IN☐B | 2-wire power supply signal | 2-wire voltage, contact + | 3-wire power supply + |
| | IN☐C | – | 2-wire voltage, contact - | 3-wire power supply - |

☐ is channel number.
*1: If the power to models AAI141, AAI841, AAI135 and AAI835 is off or abnormal, the current input loop is in the open state. Do not use current signals with other receiving devices. When in use, also use an external receiver resistance in the voltage mode (Shunt resistor module part no. A1080RZ 250 ohm).
*2: Wiring resistance for the signal cables of IN☐A and IN☐B must be identical.

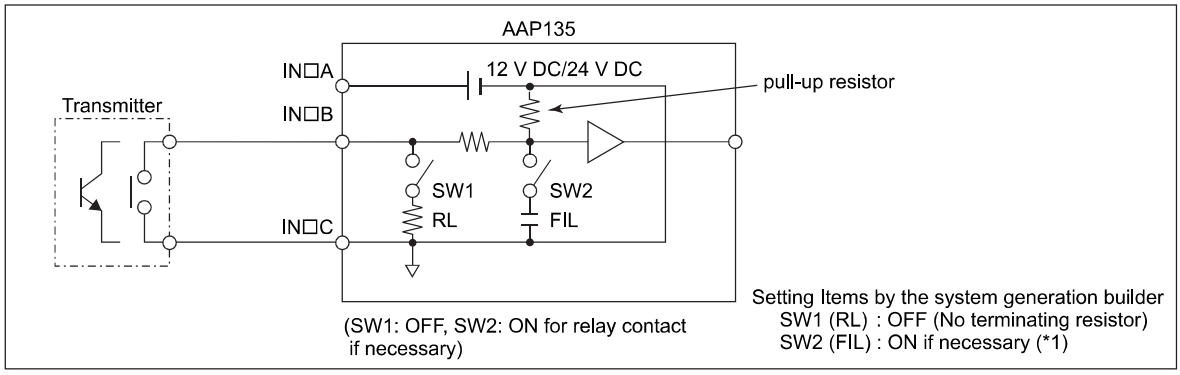
## Connecting Signal Cables with Pulse Input Module AAP135

The AAP135 receives contact ON/OFF, voltage pulse and current pulse. Refer to the figures below for details on how to connect signal cables since the items to be set by the system generation builder depend on the input pulse types.

### When Receiving No-Voltage Contact Signals (1)

For the relay contacts or transistor contacts, connect as follows.

Pulse input frequency should be 0 to 800 Hz. Max. frequency differs due to the wiring effect, etc.




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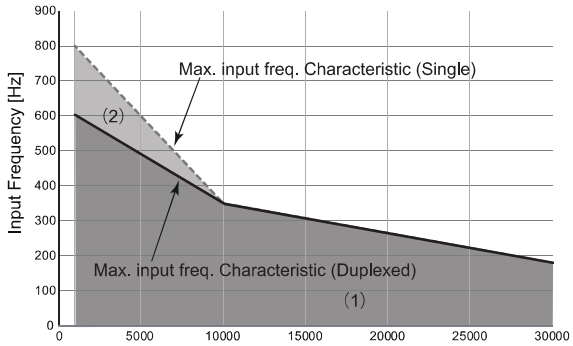
*1: When there is a chattering noise at a mechanical relay, set the SW2 to ON to eliminate the noise.

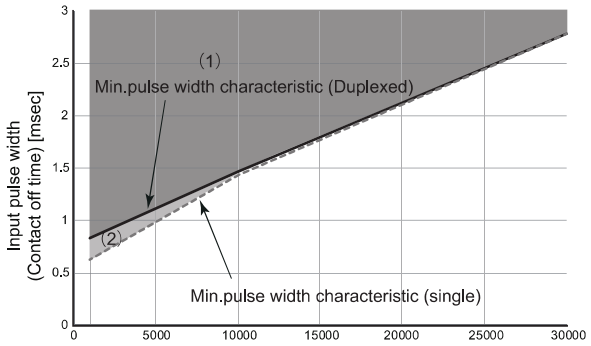
**Figure No-Voltage contact Input (1)**

A receivable maximum frequency and minimum pulse width of AAP135 depend on redundancy configuration of AAP135.

**Table Receivable minimum pulse width (when synthetic capacity of connected wiring and transmitter is less or equal than 1000 pF)**

| I/O module redundancy | Input frequency | Minimum input pulse width (Contact off time) |
|---|---|---|
| Single | 0 to 800 Hz | 625 µs |
| Duplexed | 0 to 600 Hz | 833 µs |




| | I/O module redundancy | |
|---|---|---|
| Area | Single | Duplexed |
| (1) | Receivable | Receivable |
| (2) | Receivable | Not receivable |

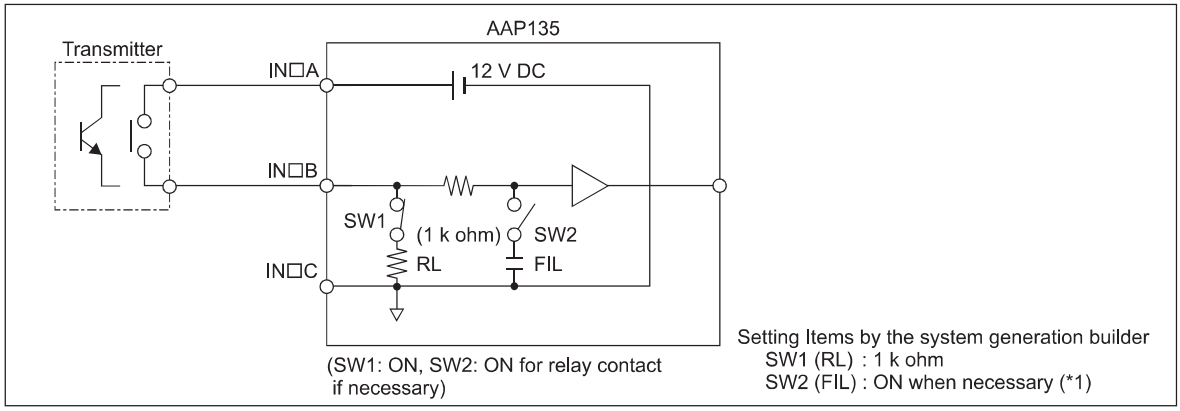
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**Figure Receivable minimum pulse width (when synthetic capacity of connected wiring and transmitter is more than 1000pF)**

## When Receiving No-Voltage Contact Signals (2)

Carry out connection as follows if a current is needed to flow to the relay contacts or transistor contacts.

When receiving transistor contact signal of more than 800 Hz frequency, connect as follows.

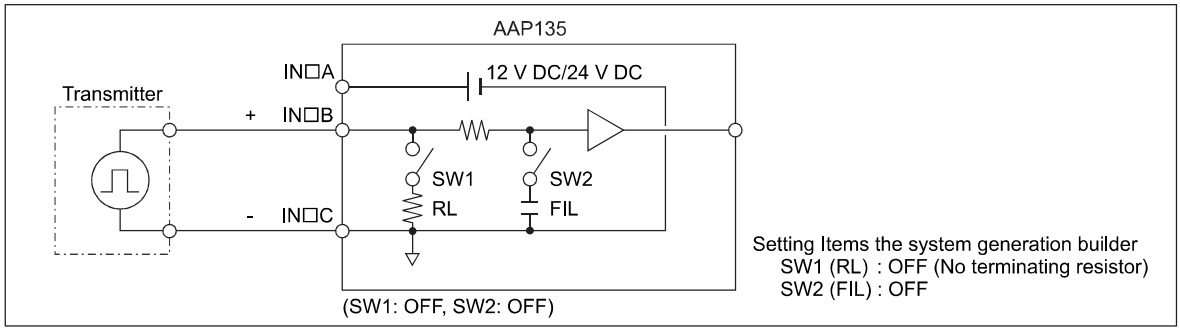



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*1: When there is a chattering noise at a mechanical relay, set the SW2 to ON to eliminate the noise.

**Figure No-Voltage contact Input (2)**

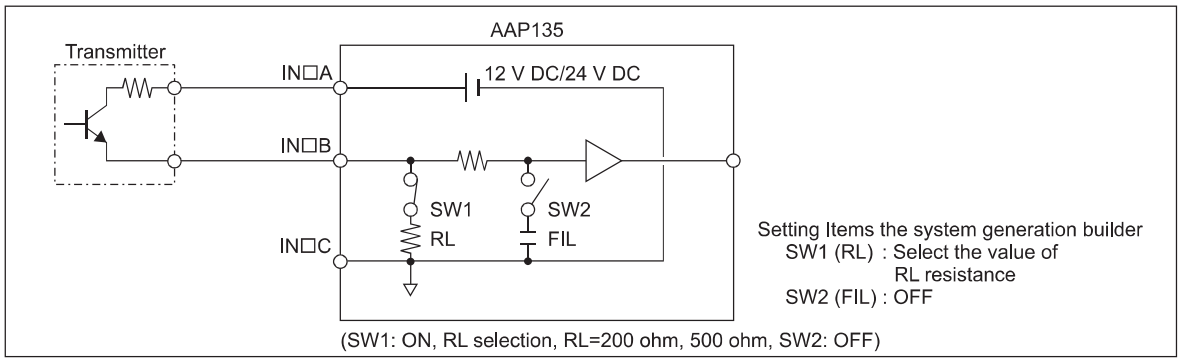
## When Receiving Voltage Pulse Signals




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**Figure Voltage Pulse Input**

## When Receiving Current Pulse By Using the Internal Power to Drive the Transmitter (2-wire power supply type)

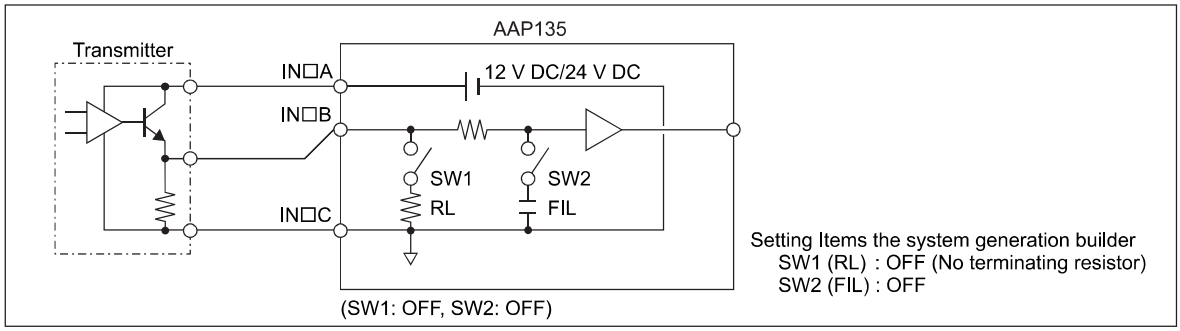



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**Figure 2-Wire Power Supply Type**

This method supplies power to the transmitter, and receives the transmitter output signals as the current pulse signals. By using the input load resistance (select from None, 200 ohm, 500 ohm), the current signal is converted to the voltage level pulse and receives it.

## When Receiving Voltage Pulse By Using the Internal Power to Drive the Transmitter (3-wire power supply type)




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**Figure 3-Wire Power Supply Type**

## Connecting Terminal Board with FIO

The I/O module equipped with a KS cable interface adaptor can be connected to the terminal board using a Yokogawa-specific cable. Field signals are connected using the terminal board.

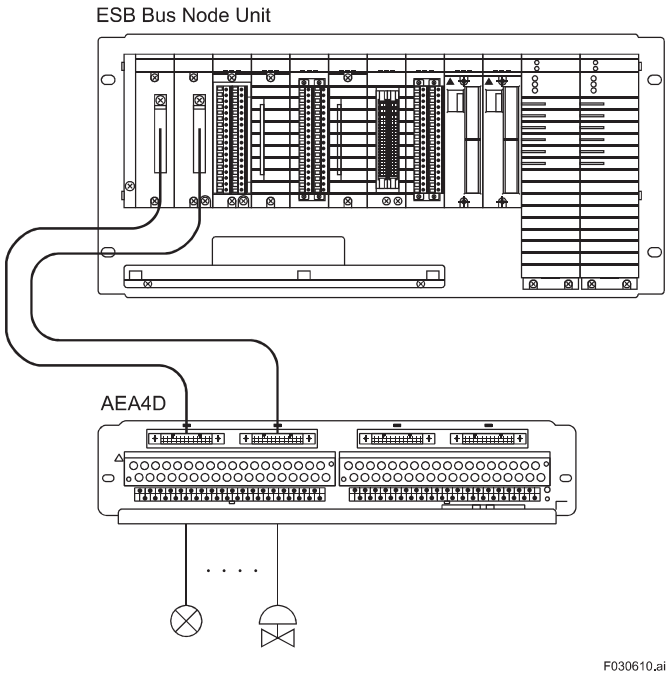



**Figure Example of Terminal Board Connection with Dual-redundant I/O Module**

**SEE ALSO** For details of the KS cable interface adaptor model and the cable model, refer to “Field Connection Specifications (for FIO)” (GS 33M50H10-40E).

## Connecting Relay Board with Digital I/O Module

An example of the connection of the mechanical relay board ARM55D with the Digital I/O Module ADV551 is shown below.

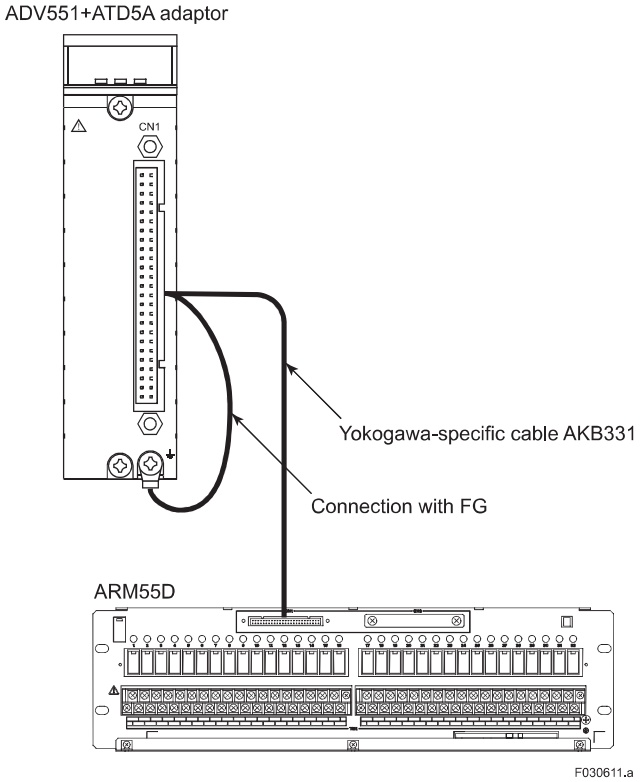



**Figure Example of Relay Board Connection with Digital I/O Module**

# 3.6.4 Implementation and Cable Connection of Fieldbus Communication Module ALF111

This section describes the implementation and cable connection of the Foundation Fieldbus Communication Module ALF111.

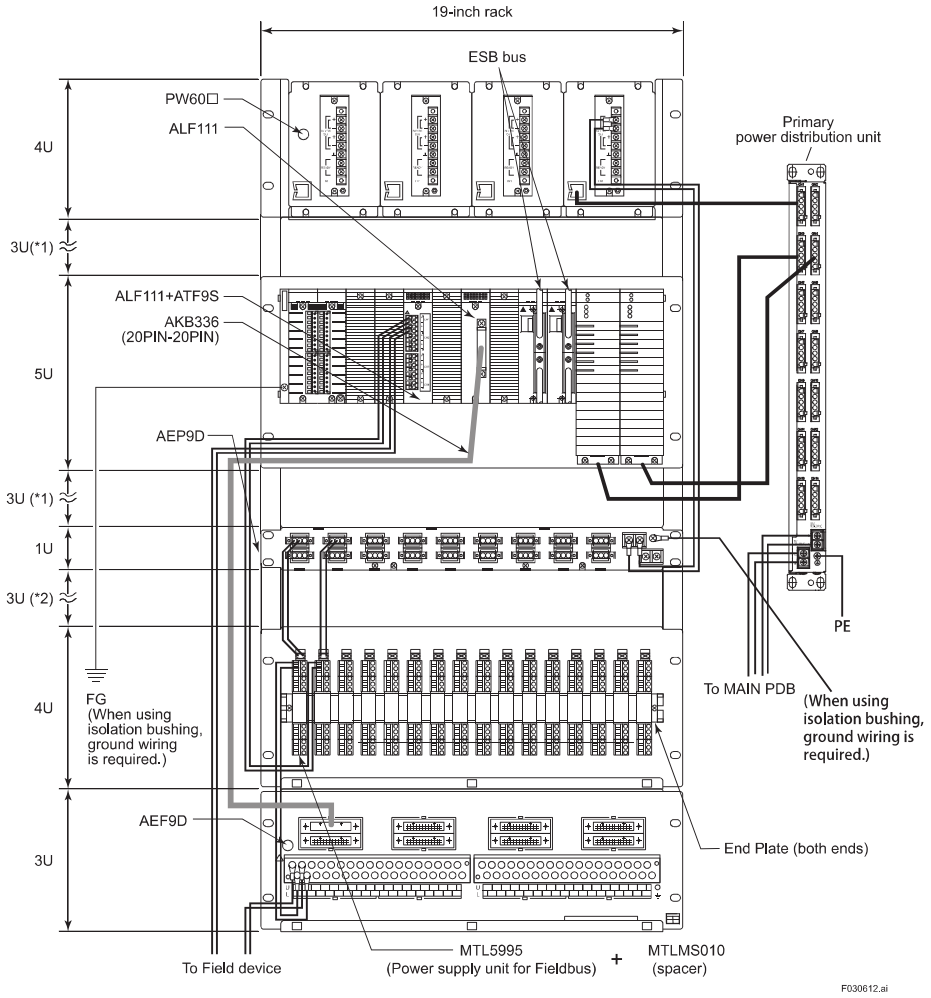
Foundation fieldbus H1 (Low Speed Voltage Mode) is called Foundation fieldbus, Fieldbus, H1 Fieldbus, FF, or FF-H1 in this manual.

## Example of Implementation of Fieldbus Communication Module ALF111

To connect Fieldbus using the ALF111, the power supply unit for the Fieldbus must be prepared as shown below.

The example of the implementation and the wiring of the ALF111 is shown below.

For the implementation of the ALF111 and the relevant devices, follow the implementation conditions for the devices. 1 U (unit) = 44.45 mm.

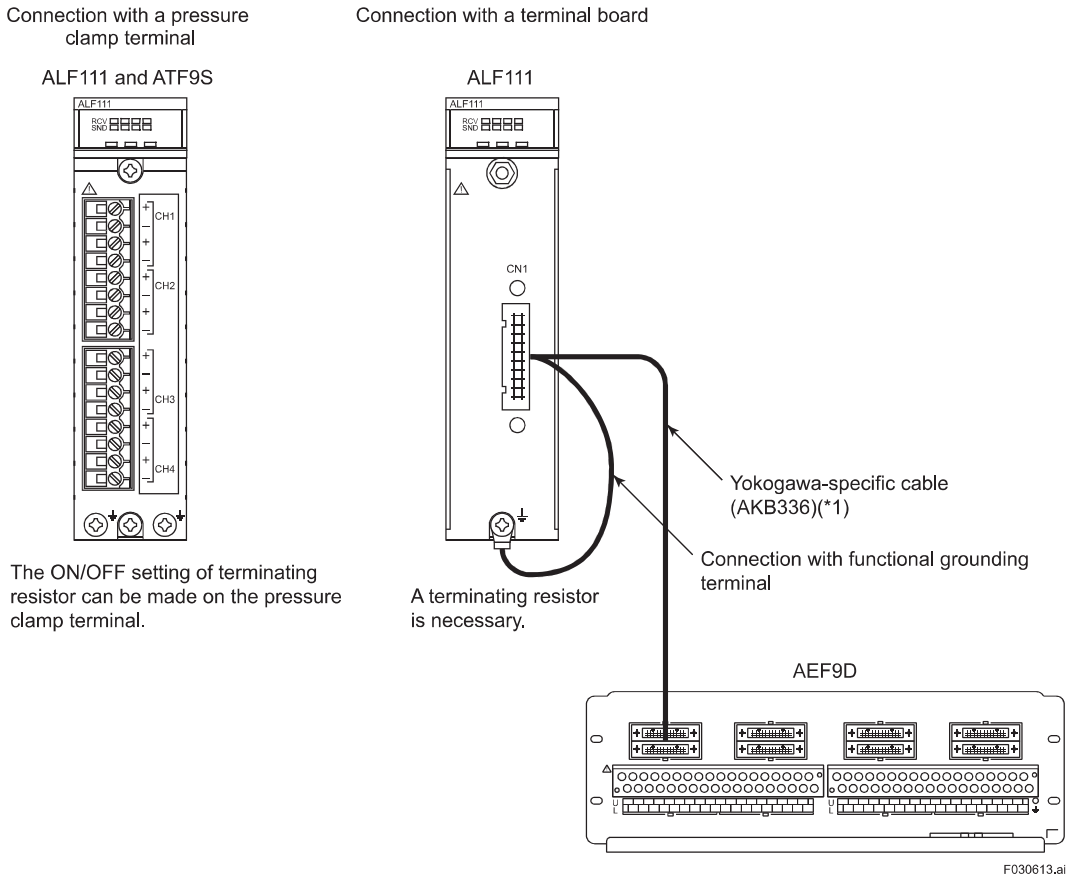



*1: Reserve a space of 3U for heat radiation.
*2: Reserve a space of 3U for heat radiation and wiring.

**Figure Example of ALF111 Implementation**

## Connection of Fieldbus Communication Module ALF111

The Fieldbus can be connected by attaching a pressure clamp terminal block or by using a Yokogawa-specific cable for connection to the terminal board (M4 screw).




*1: If Type A cables are used for Fieldbus wiring, double the length of the AKB336 cable and include its length in with the total length of the branch cables. Keep the trunk cable length (trunk line cable length) within 1900 m (total branch length).

**Figure Fieldbus Wiring for ALF111**

**SEE ALSO** For details of the Fieldbus connection and wiring work, refer to “Fieldbus Technical Information” (TI 38K03A01-01E).

## Fieldbus Wiring for ALF111 with Pressure Clamp Terminal Block

The signal cables from the field device should be connected to the + and - terminals of the pressure clamp terminal block (ATF9S). (*1)

*1: Tightening torque: 0.4 (N•m)

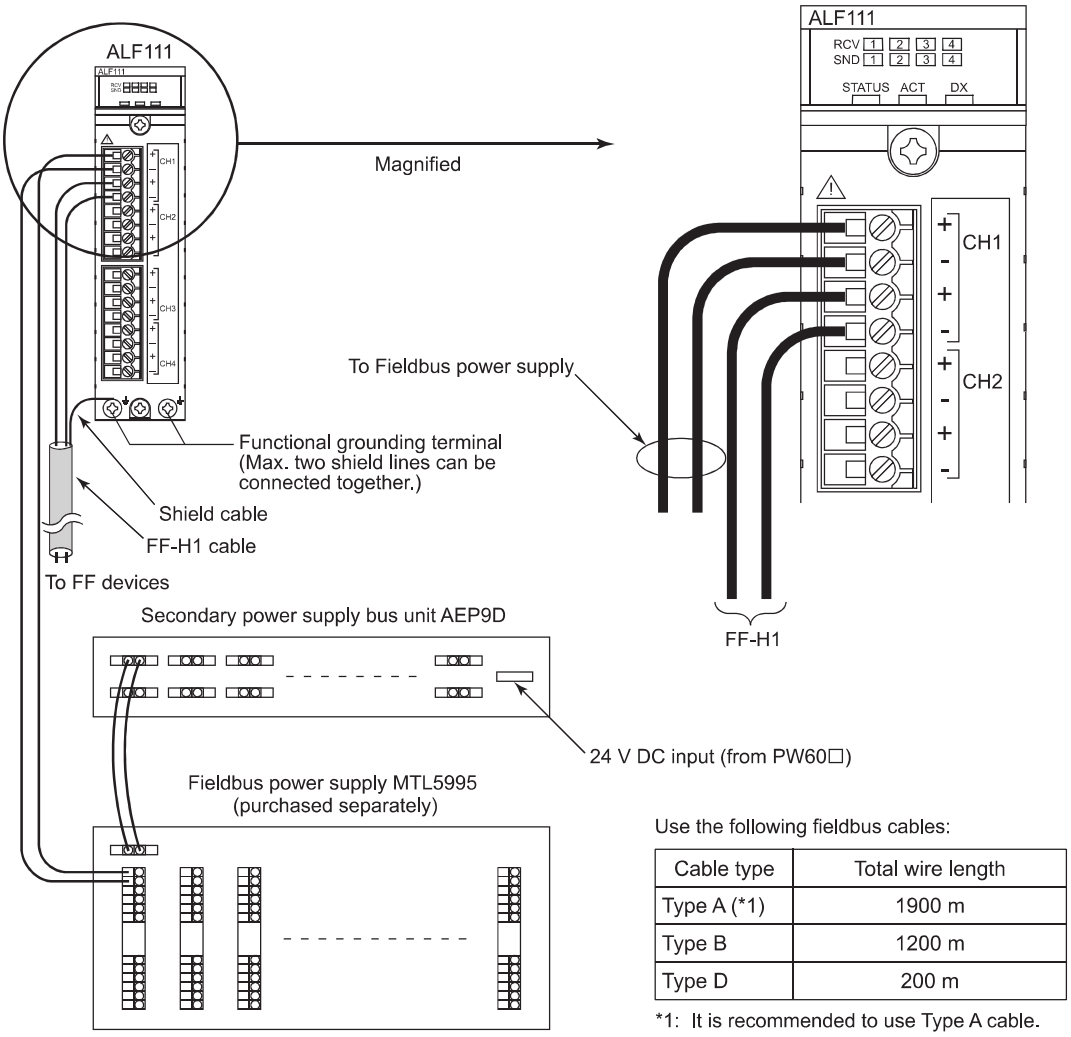
Do not connect anything to the terminals of channels that are not used.

When installing the node unit mounted with the ALF111 on the 19-inch rack, connect the shield lines of Fieldbus cables from the field devices to the Functional grounding terminal of the ATF9S. If two or more channels are used, no more than two shield lines can be connected to one Functional grounding terminal.

When installing the node unit mounted with the ALF111 in the control station cabinet, connect the shield lines of Fieldbus cables to the shield ground bar within the cabinet (insulated from the cabinet itself), not to the Functional grounding terminal of the ATF9S.

The length of the connection cable between the power supply unit and the ALF111 should be less than one meter. Use a type A cable and connect the cable shield to the same potential as the Functional grounding terminal of the node if the cable length exceeds one meter.

Note that, when installing wiring within the cabinet, the shield line should be connected to the shield ground bar within the cabinet as well. For details about example of wiring, see section 3.7.11.




Use the following fieldbus cables:

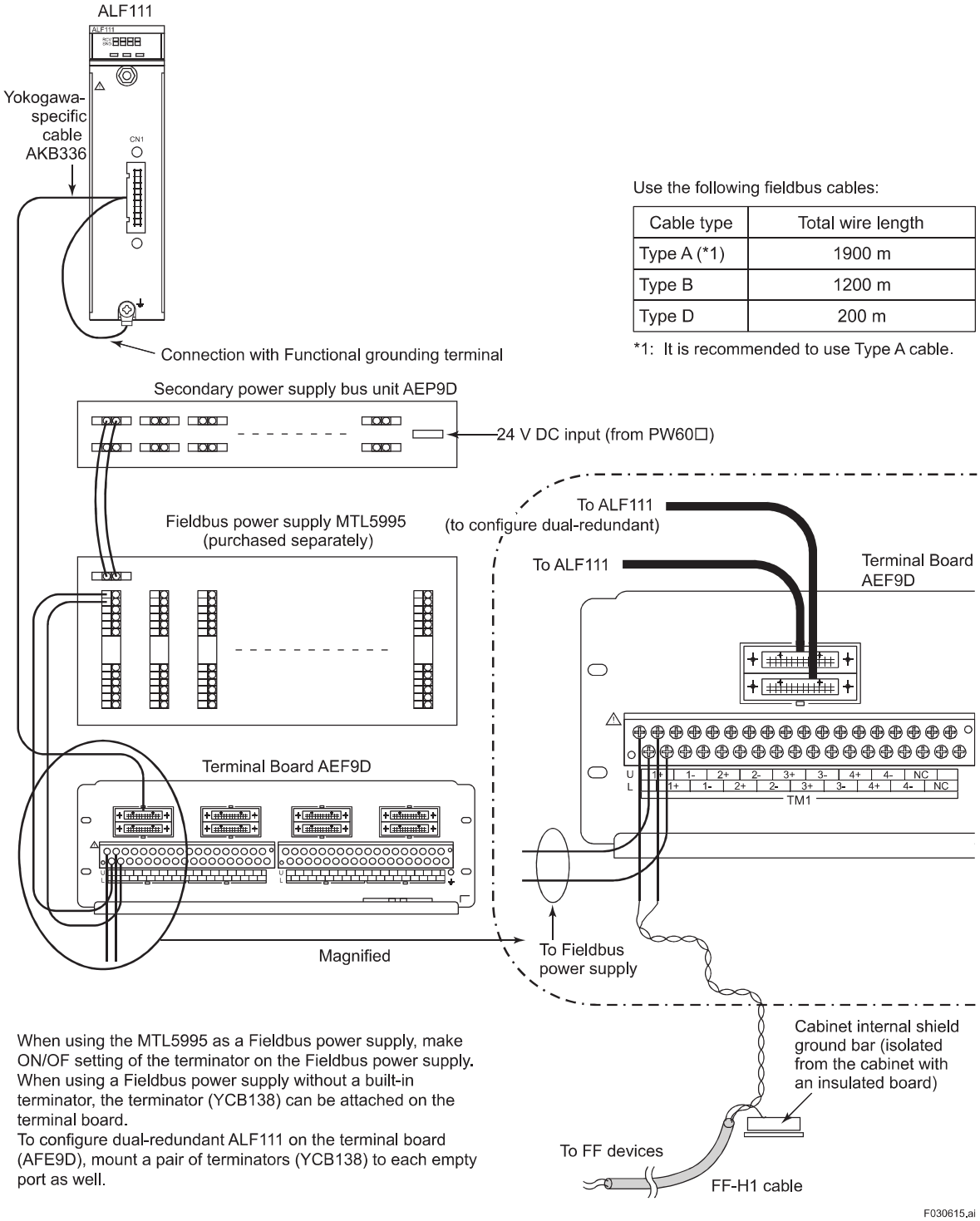
| Cable type | Total wire length |
|---|---|
| Type A (*1) | 1900 m |
| Type B | 1200 m |
| Type D | 200 m |

*1: It is recommended to use Type A cable.

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**Figure Fieldbus Wiring for ALF111 with Pressure Clamp Terminal**

## Fieldbus Wiring for ALF111 with Terminal Board




Use the following fieldbus cables:

| Cable type | Total wire length |
|---|---|
| Type A (*1) | 1900 m |
| Type B | 1200 m |
| Type D | 200 m |

*1: It is recommended to use Type A cable.

When using the MTL5995 as a Fieldbus power supply, make ON/OF setting of the terminator on the Fieldbus power supply. When using a Fieldbus power supply without a built-in terminator, the terminator (YCB138) can be attached on the terminal board.
To configure dual-redundant ALF111 on the terminal board (AFE9D), mount a pair of terminators (YCB138) to each empty port as well.

**Figure Fieldbus Wiring for ALF111 with Terminal Board**

## Installation of Terminator to Terminal Board AEF9D

Make sure to install a terminator (YCB138) if the ALF111 (terminal board AEF9D) terminates the network, in other words, if the network is not terminated by a terminator in the power supply unit.

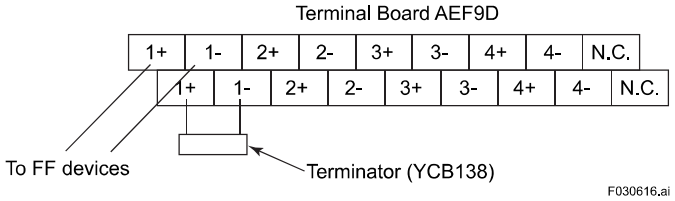



**Figure Installation of Terminator to Terminal Board AEF9D**

## IMPORTANT

In the following condition, the vacant port should be terminated with a pair of terminators: The AEF9D terminal board is used, the ALF111 is in a dual-redundant configuration, and any of the four ports is vacant.

# 3.7 Signal Connections of N-IO I/O Unit

**This section describes connecting to the N-IO I/O unit.**

## 3.7.1 N-IO I/O Unit Types

### I/O Modules that can be used with Base Plate

The following table shows I/O Modules installable with Base Plate.

**Table I/O Modules Installable with Base Plate**

| Base plate model | Description | I/O module model |
|---|---|---|
| A2BN3D | Base Plate for Adaptor | A2MMM843 Analog Digital I/O Module |
| A2BN4D | Base Plate for Barrier (MTL) | |
| A2BN5D | Base Plate for Barrier (P+F) | |
| A2BN3D | Base Plate for Adaptor | A2MDV843 Digital I/O Module |
| A2BN4D | Base Plate for Barrier (MTL) | |
| A2BN5D | Base Plate for Barrier (P+F) | |

## 3.7.2 Base Plate for Adaptor

### Adaptors Installable with Base Plate for Adaptor

The following table shows adaptors installable with A2BN3D Base Plate for Adaptor.

**Table Adaptors Installable with A2BN3D Base Plate for Adaptor**

| Base plate model | Compatible adaptor models |
|---|---|
| A2BN3D (Base Plate for Adaptor) | A2SAP105 Pulse Input Signal Adaptor |
| | A2SDV105 Digital Input Adaptor |
| | A2SDV505 Digital Output Adaptor |
| | A2SDV506 Relay Output Adaptor |
| | A2SMX801 Pass-through I/O signal Adaptor |
| | A2SAM105 Current Input/Voltage Input Adaptor |
| | A2SAM505 Current Output/Voltage Output Adaptor |
| | A2SAT105 mV/TC/RTD input Adaptor |
| | A2SMX802 Pass-through I/O Signal Adaptor |

### Terminal type that can be select with Base Plate for Adaptor

The following table shows terminal types can be select with A2BN3D Base Plate for Adaptor.

**Table Terminal type Compatible with A2BN3D Base Plate for Adaptor**

| Base plate model | Suffix code | Terminal type |
|---|---|---|
| A2BN3D (Base Plate for Adaptor) | -□1□□□ | Pressure clamp terminal |
| | -□2□□□ | Spring clamp terminal |
| | -□9□□□ | Cable connector interface (*1) |

*1: Connect the field from the A2BN3D to the pressure cramp terminal on the terminal board (A2BM4) via a dedicated cable.

## Base Plate for Adaptor Terminal Numbers (Spring Clamp Terminals)

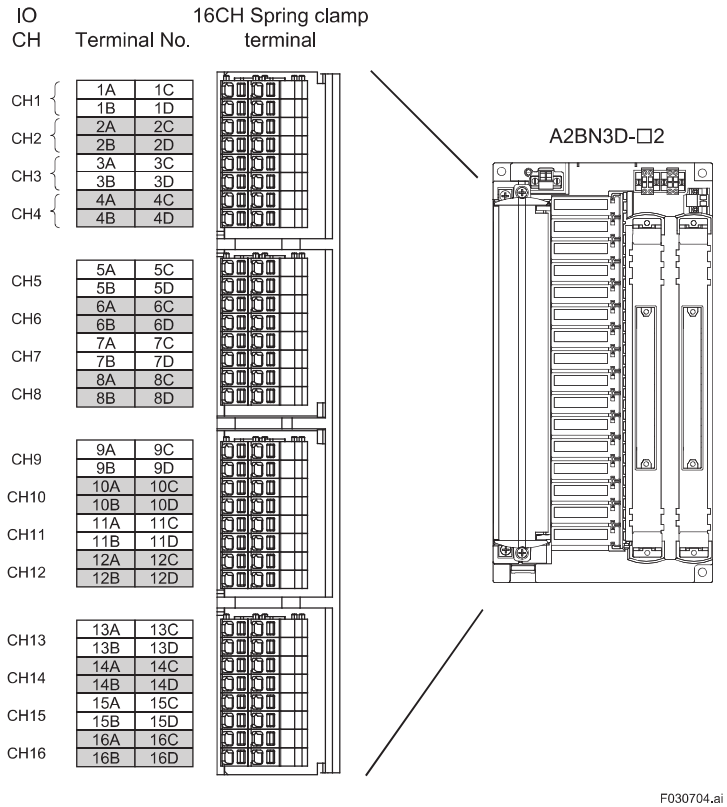



**Figure A2BN3D-□2 Base Plate for Adaptor**

## Base Plate for Adaptor Terminal Numbers (Pressure Clamp Terminals)

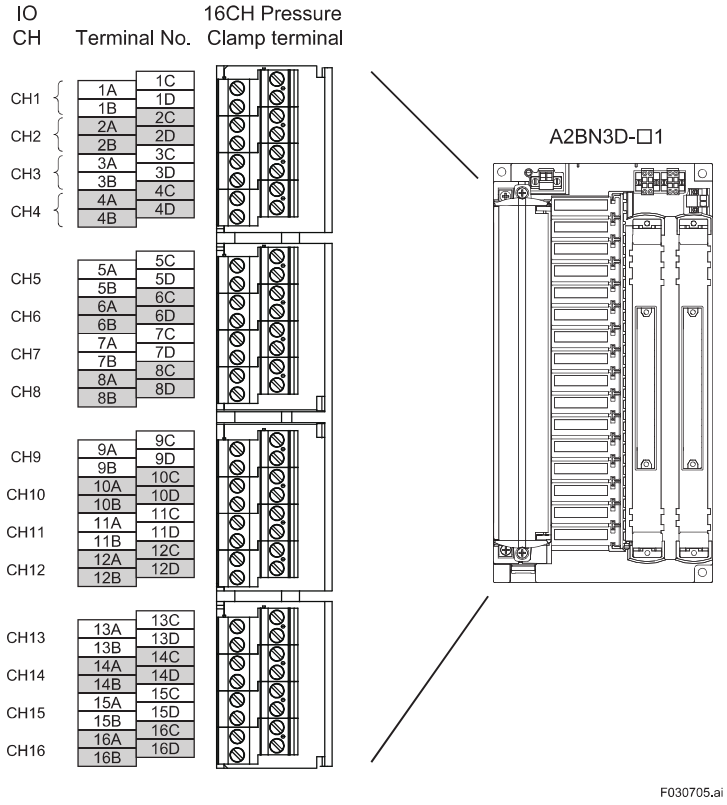
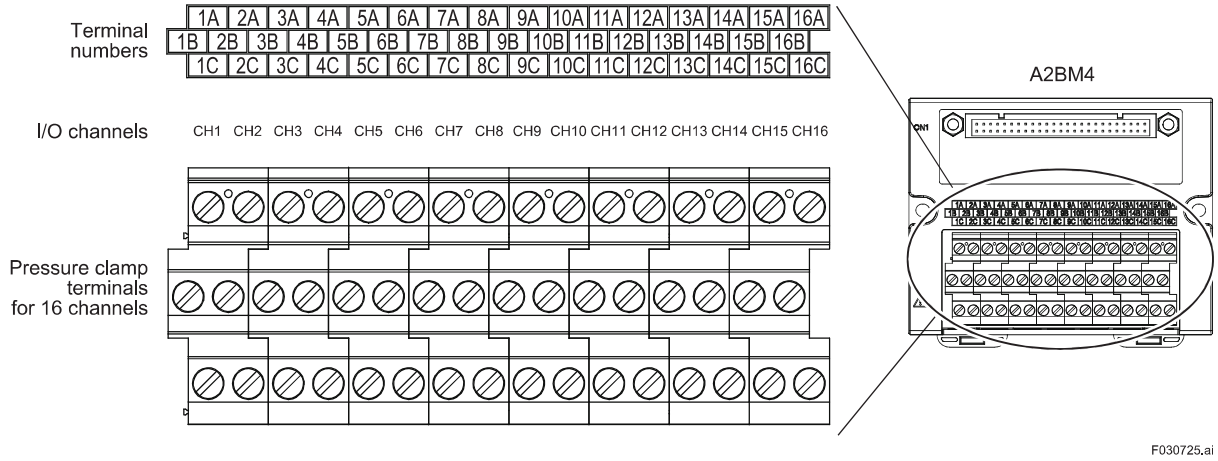



**Figure A2BN3D-□1 Base Plate for Adaptor**

## Terminal board for analog digital I/O (Pressure Clamp Terminals)



## Connecting Signal Cables with A2BN3D

The signal connections of the base plate for adaptor (model: A2BN3D) differ depending on the signal type. There are two ways of the direct field wiring to the terminal block on A2BN3D and the field wiring via the dedicated cable and terminal board (A2BM4).The following table shows the terminal numbers and signal types.

**Table Terminal Numbers and Signal Types (A2BN3D) (1/2)**

| Adaptor Name (Model) | Signal Name (*1) | IO Signal (*2) | | | | |
|---|---|---|---|---|---|---|
| | | Case 1 | Case 2 | Case 3 | Case 4 | Case 5 |
| Pulse Inpu Signal Adaptor (A2SAP105) (*3) | □A | — | Power Supply type 2-wire power supply | Power Supply type 3-wire power supply | Dry contact input + (*5) (*6) | — |
| | □B | 2-wire (voltage) + | Power Supply type 2-wire signal | Power supply type 3-wire + | Dry contact input − (*5) (*6) | Dry contact input + (*7) |
| | □C | 2-wire (voltage) − | Connect to A2EXR001 | Power supply type 3-wire − | Connect to A2EXR001 (*6) | Dry contact input − (*7) |
| | □D | — | Connect to A2EXR001 | — | Connect to A2EXR001 (*6) | — |
| Current input/ voltage input Adaptor (A2SAM105) (*3) (*4) | □A | 2-wire transmitter input + | 4-wire transmitter current input + | Voltage input + | — | — |
| | □B | 2-wire transmitter input - | 4-wire transmitter current input - | Voltage input - | — | — |
| | □C | — | — | — | — | — |
| | □D | — | — | — | — | — |
| Current output/ voltage output Adaptorr (A2SAM505) (*3) | □A | Current output + | Voltage output + | — | — | — |
| | □B | Current output - | Voltage output - | — | — | — |
| | □C | — | — | — | — | — |
| | □D | — | — | — | — | — |
| mV/TC/RTD input Adaptor (A2SAT105) (*3) (*13) | □A | TC/mV input + | RTD input A (*8) | Potentiometer input 100 % (*8) | — | — |
| | □B | TC/mV input - | RTD input B | Potentiometer input variable | — | — |
| | □C | — | RTD input B (*8) | Potentiometer input 0 % (*8) | — | — |
| | □D | — | — | — | — | — |
| Digital Input Adaptor (A2SDV105) | □A | Voltage input + | — | — | — | — |
| | □B | Voltage input − | — | — | — | — |
| | □C | — | Dry contact input + (*9) | — | — | — |
| | □D | — | Dry contact input − (*9) | — | — | — |

**Table Terminal Numbers and Signal Types (A2BN3D) (2/2)**

| Adaptor Name (Model) | Signal Name (*1) | IO Signal (*2) | | | | |
|---|---|---|---|---|---|---|
| | | Case 1 | Case 2 | Case 3 | Case 4 | Case 5 |
| Digital Output Adaptor (A2SDV505) | □A | Digital output + (*9) | — | — | — | — |
| | □B | Digital output - (*9) | — | — | — | — |
| | □C | — | — | — | — | — |
| | □D | — | — | — | — | — |
| Relay Output Adaptor (A2SDV506) | □A | Digital output (NO) + (*10) | — | — | — | — |
| | □B | Digital output (COM) − | Digital output (COM) − | — | — | — |
| | □C | — | Digital output (NC) + (*10) | — | — | — |
| | □D | — | — | — | — | — |
| Pass-through I/O signal Adaptor (A2SMX801) | □A | Signal + (*11) | — | — | — | — |
| | □B | Signal − (*11) | — | — | — | — |
| | □C | — | — | — | — | — |
| | □D | — | — | — | — | — |
| Pass-through I/O signal adaptor (A2SMX802) | □A | 3-wire transmitter current input + (*3) | 4-wire transmitter current input + (*3) | Open drain (DO sink) | — | — |
| | □B | 3-wire transmitter current input - (*3) (*9) | 4-wire transmitter current input - (*3) (*12) | — | — | — |
| | □C | Field power supply + (*3) (*9) | Field power supply + (*3) (*9) | Field power supply + (*9) | — | — |
| | □D | — | Field power supply - (*3) (*9) (*12) | — | — | — |

*1: □ = 1 to 16
Terminal-A, B, C, and D are for A2BN3D-□1□□□,-□2□□□.
Terminal-A, B, and C are for A2BN3D-□9□□□. (Terminal-D is unused for A2BN3D-□9□□□.)
*2: "—" denotes that the terminal is not used. Do not connect any signal because the terminal is connected to internal circuits.
*3: This adaptor can be used in combination with the A2MMM843 only.
*4: When the power supply is turned off or overcurrent is detected, the current input loop enters a high impedance state.
*5: Used when the input frequency is 0 to 5 kHz.
*6: Used when the input frequency is 0 to 10 kHz.
*7: Used when the input frequency is 0 to 800 Hz.
*8: The resistance values of the connecting cables must match.
*9: Connect the field power supply to the base plate.
*10: Normal state, the status output is OFF.
*11: The signal type is set by software.
*12: In the internal circuit, terminals B and D have a common potential.
*13: A2SAT105 is available for A2BN3D-□1□□□,-□2□□□. (Unavailable for A2BN3D-□9□□□)

## IMPORTANT

The pass-through I/O signals adaptor A2SMX802 is not isolated from the pass-through I/O signal adaptor A2SMX801,digital output adaptor that are mounted on the same base plate for adaptor.

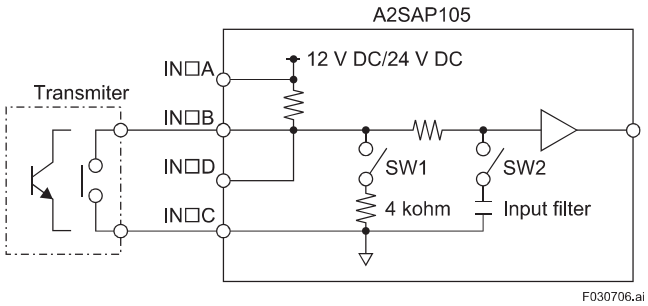
## 3.7.3 Adaptors (for A2BN3D)

### A2SAP105 Pulse Input Signal Adaptor

When the pulse input signal adaptor is used, signal connections to the base plate and shunt resistor usage depend on the type of the pulse signal that is input. When receiving dry contact signals, you can remove mechanical chattering noise by selecting the pulse input filtering option in the IOM builder. However, the input filter passes a limited range of frequencies.
When connecting the field signal via the terminal board (A2BM4), the terminal-A, B, and C can be used for the following circuit diagrams but the terminal-D cannot be used.

#### When receiving dry contact signals (Input frequency: 0 to 800 Hz)

Select “Without Shunt Resistor” (SW1: OFF) in the IOM builder.
The following figure shows the circuit diagram.

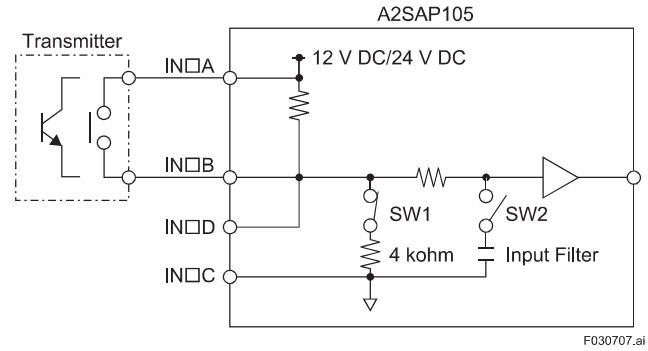



□: 1 to 16

**Figure When receiving dry contact signals (Input frequency: 0 to 800 Hz)**

#### When receiving dry contact signals (Input frequency: 0 to 5 kHz)

Select “Shunt Resistor 4000 ohm” (SW1: ON) in the IOM builder.
The following figure shows the circuit diagram.



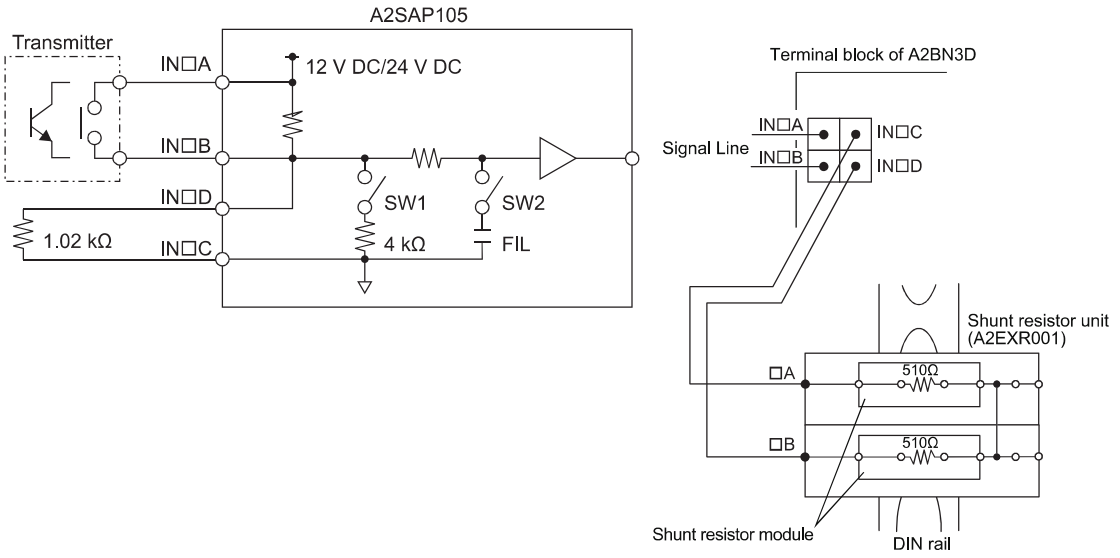

□: 1 to 16

**Figure When receiving dry contact signals (Input frequency: 0 to 5 kHz)**

## When receiving dry contact signals (Input frequency: 0 to 10 kHz)

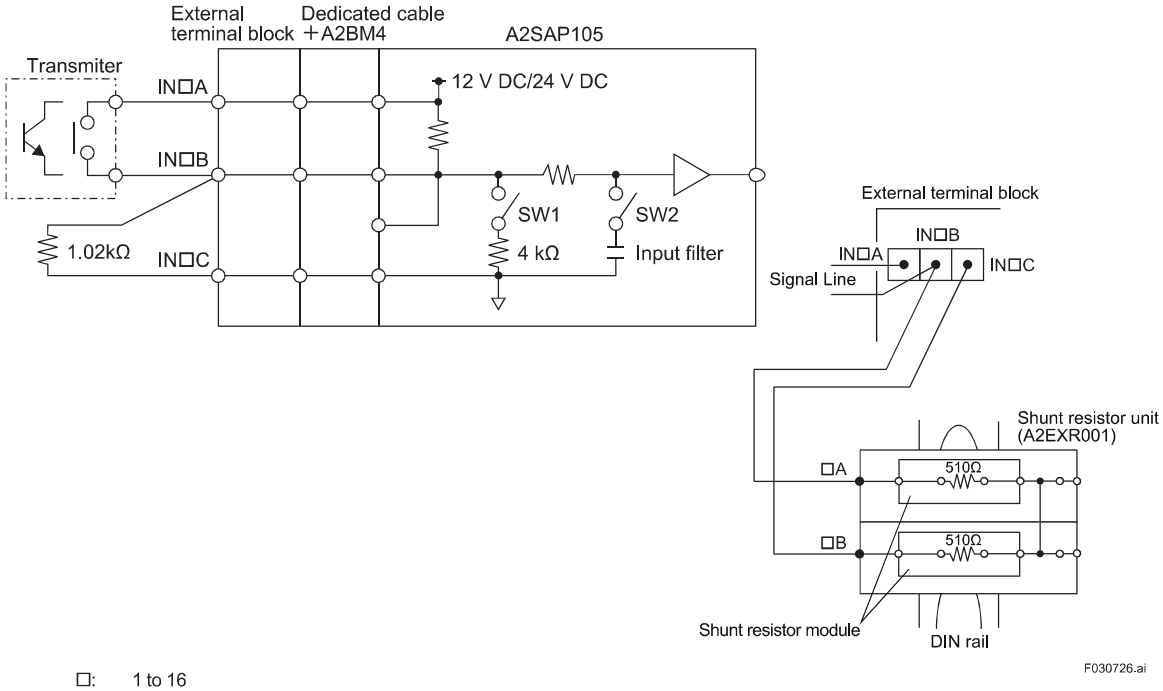
Select “Without Shunt Resistor” (SW1: OFF) in the IOM builder. Also install two 510 Ω shunt resistor modules on the shunt resistor unit (Model:A2EXR001). The total resistance value will be 1.02 kΩ.
When connecting the field signal via the terminal board (A2BM4), it can be substituted by connecting a shunt resistor unit between terminal-B and C of the external terminal block.
The following figure shows the circuit diagram.

Direct field wiring to base plate




□: 1 to 16

Field wiring via terminal board




□: 1 to 16

**Figure When receiving dry contact signals (Input frequency: 0 to 10 kHz)**

## • Shunt Resistor Unit (A2EXR001)

**SEE ALSO** For more information about the specifications of A2EXR001, refer to :I/O Adaptors (for N-IO) (GS 33J62F30-01EN)

The shunt resistor unit (Model: A2EXR001) converts the current signals of the internal circuit of the pulse input signal adaptor into voltage signals and is capable of converting four points of signals. It is used when receiving dry contact signal inputs with 0 to 10 kHz input frequencies or current pulse signal inputs.

**Structure and parts of the shunt resistor unit**

The shunt resistor unit has terminal blocks with either pressure clamp terminals or spring clamp terminals.

The following figure shows the structure and parts of the shunt resistor unit, using an example of the model with pressure clamp terminal-type terminal blocks.

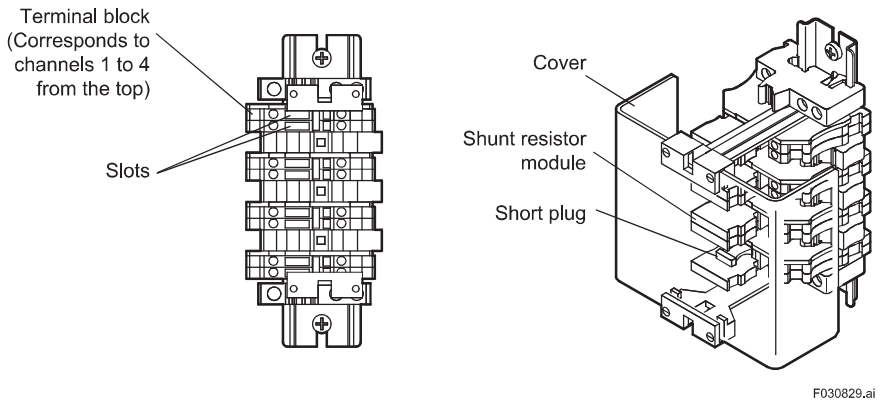



**Figure Shunt resistor unit**

The shunt resistor unit has terminal blocks for channel numbers 1 to 4. Each terminal block is provided with two slots that are used to install a shunt resistor module or a short plug. Short plugs are installed on these slots when the unit is shipped from the factory. The shunt resistor modules are accessories.

### Installation and wiring for the shunt resistor unit

Install A2EXR001 at least 200 mm away from edge of the IOBP.
A2EXR001 should be installed with the distance of 30mm or more from other heat source.

**CAUTION**

Handle an shunt resistor module in A2EXR001 with care as it may become high in temperature. Use a cover to prevent from touching the resistor directly to avoid being burned.

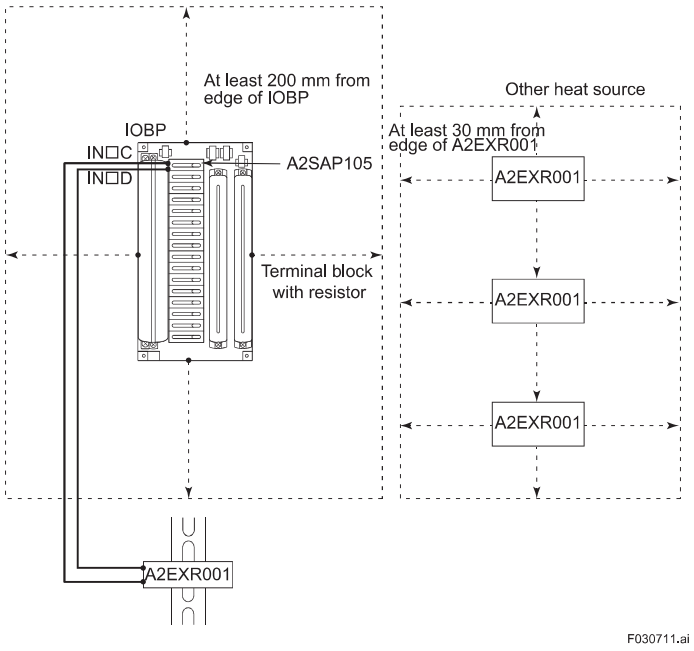



**Figure Distance to Separate A2EXR001 and IOBP**

### Installing the shunt resistor unit

The following figure shows how to install the shunt resistor unit on the inner wall surface of the cabinet.

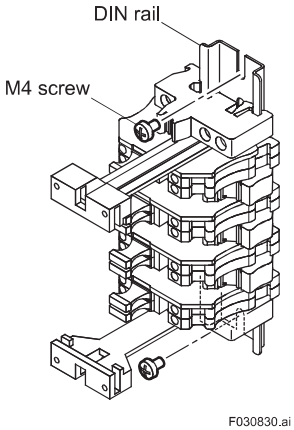



**Figure Installing the shunt resistor unit on the wall**

Using two M4 screws, fix the DIN rail of the shunt resistor unit on the wall.
The M4 screws are accessories.

### Wiring for the shunt resistor unit

Connect the signal cables to the shunt resistor unit for the required number of signals.
The following figure shows the cable connections to the shunt resistor unit.

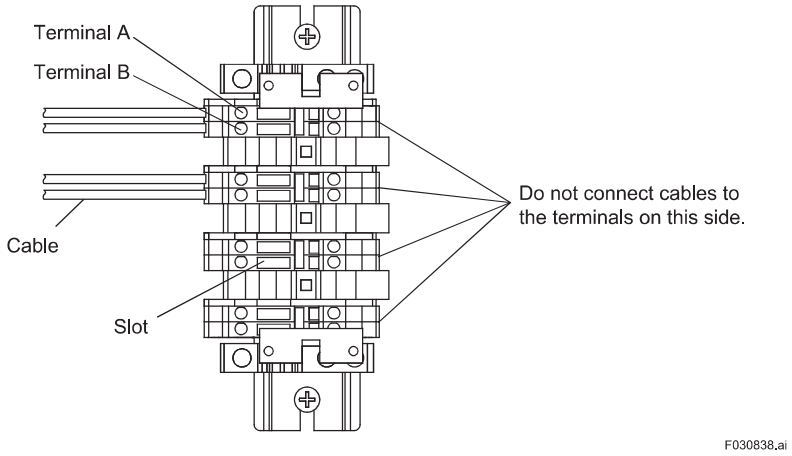
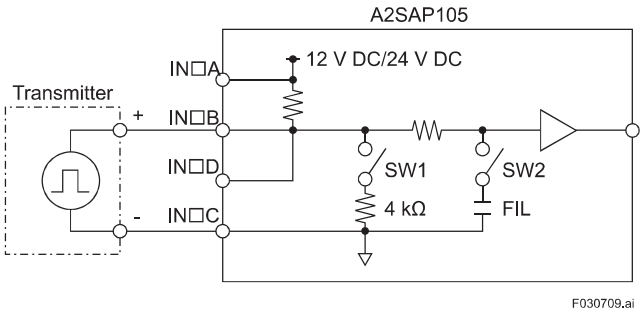



**Figure Cable connections to the shunt resistor unit**

## When receiving voltage pulse signals

In the IOM builder, select “Without Shunt Resistor” (SW1: OFF) and clear the “Input Filtering” (SW2: OFF) option.

The following figure shows the circuit diagram.




□: 1 to 16

**Figure When Receiving Voltage Pulse Signals**

## When receiving current pulse signals (2-wire power supply type)

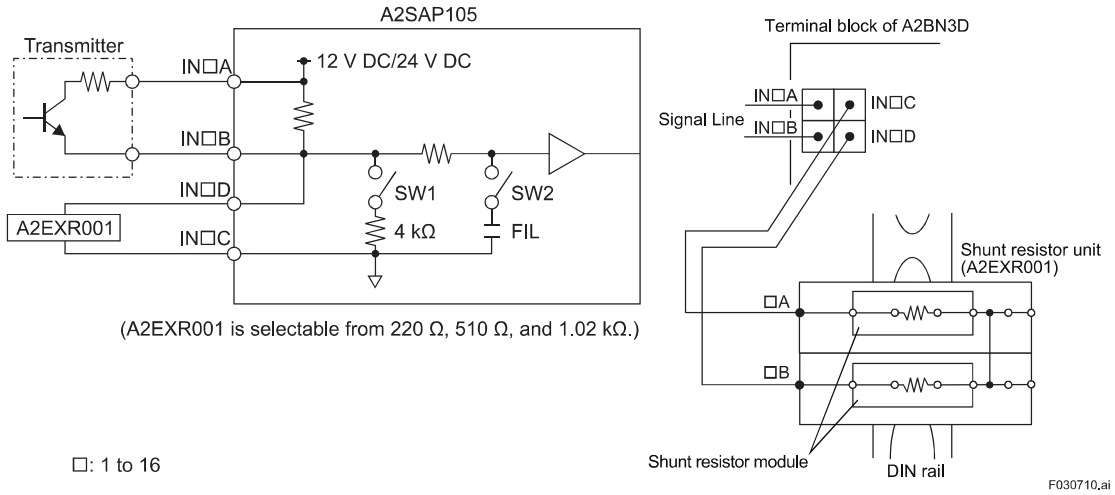
According to the input signal level, connect the shunt resistor unit (A2EXR001) of which resistor value is selected by the combination of the shunt resistor module and short plug. The resistor value of A2EXR001 can be selected to the following values.

- 220 Ω
- 510 Ω
- 1.02 kΩ

In the IOM builder, select "Without Shunt Resistor" (SW1: OFF) and clear the "Input Filtering" (SW2: OFF) option.When connecting the field via the terminal board (A2BM4), it can be substituted by connecting a shunt resistor unit between terminal-B and C on the external terminal block.

The following figure shows the circuit diagram.

Direct field wiring to base plate




Field wiring via terminal board

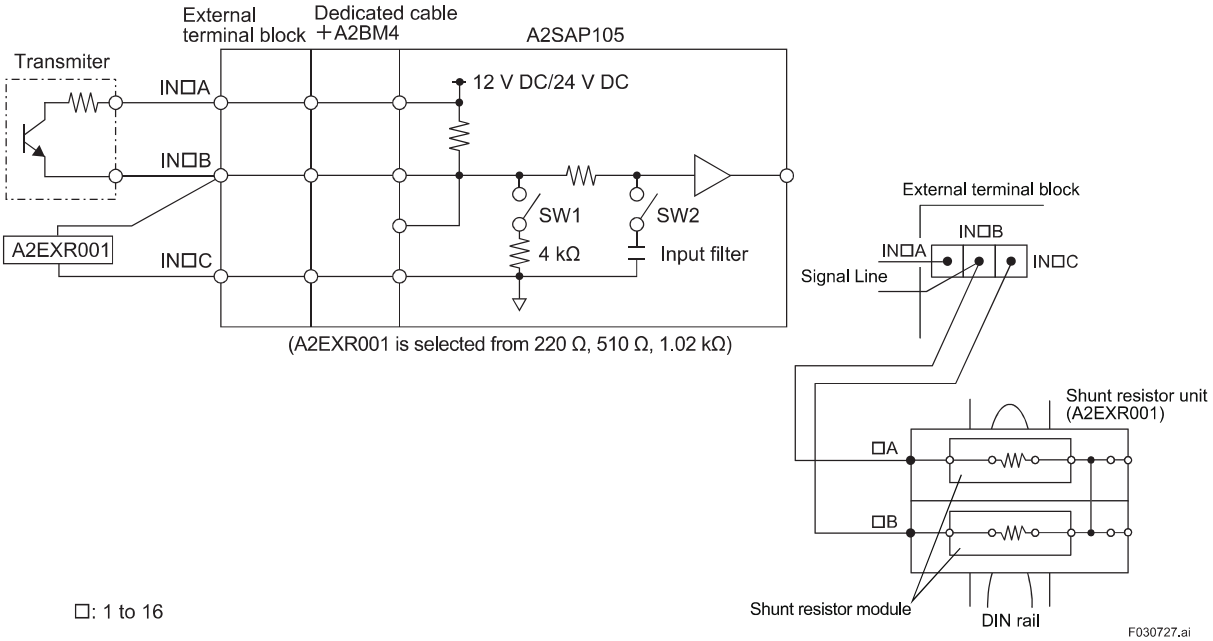
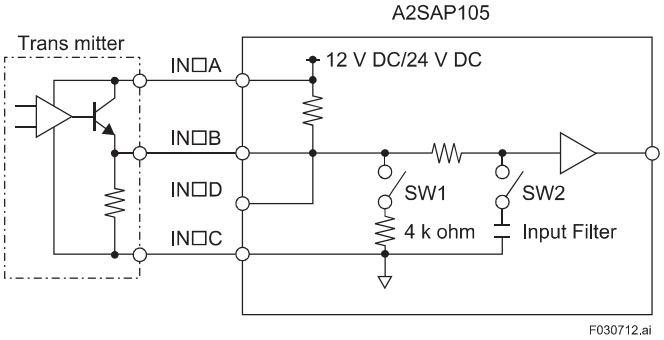



**Figure When receiving current pulse signals (2-wire power supply type)**

### When receiving voltage pulse signals by using the internal power to drive the transmitter (3-wire power supply type)

In the IOM builder, select “Without Shunt Resistor” (SW1: OFF) and clear the “Input Filtering” (SW2: OFF) option.

The following figure shows the circuit diagram.

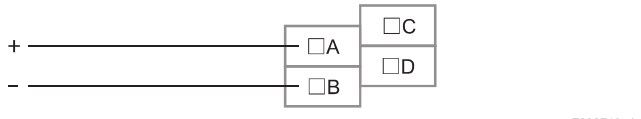



□: 1 to 16

**Figure When receiving voltage pulse signals by using the internal power to drive the transmitter (3-wire power supply type)**

## A2SAM105 Current input/voltage input adaptor

The following figure shows the signal wiring when using the current input/voltage input adaptor

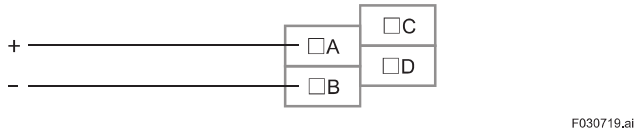



□: 1 to 16

**Figure When using the current output/voltage output adaptor**

## A2SAM505 Current output/voltage output adaptor

The following figure shows the signal wiring when using the current output/voltage output adaptor




□: 1 to 16

**Figure when using the current input/voltage input adaptor**

## A2SAT105 mV/TC/RTD input adaptor

The following figure shows the signal wiring when using the mV/TC/RTD input adaptor A2SAT105 is unavailable for A2BN3D-□9□□□.

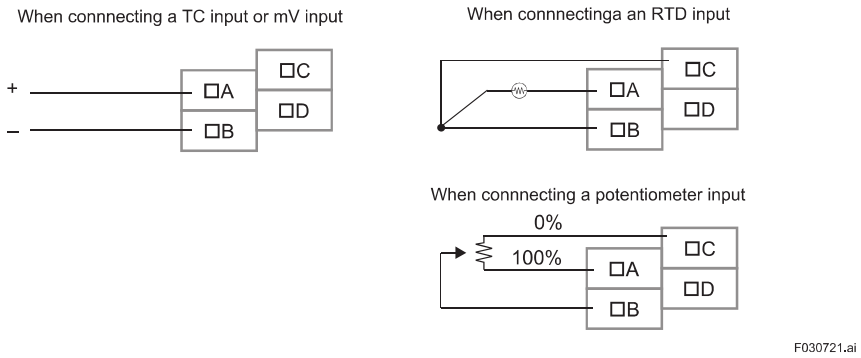



**Figure When using the mv/TC/RTD input adaptor**

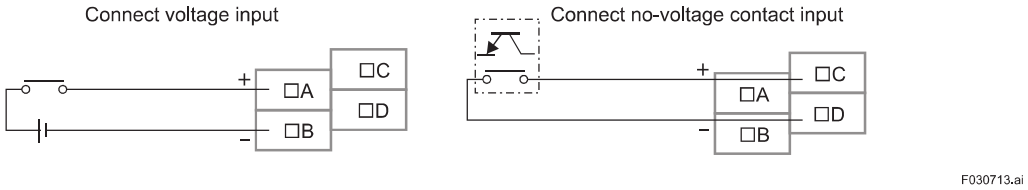
For thermocouple signalinput,mountthemV/TC/RTD input adaptor on the base plate for adaptor with RJC.

**SEE ALSO** For more information about the types of TC and RTD that can be connected to the mV/TC/RTD input adaptor and the standards they must conform to, refer to:
"I/O Adaptors (for N-IO)" (GS 33J62F30-01EN).

## A2SDV105 Digital input adaptor

The following figure shows the signal wiring for the base plate when you use the digital input adaptor. The dry contact input is not supported for A2BN3D-□9□□□. For the dry contact input, it is necessary to change the adaptor to A2SMX801 and set the DI mode by software for the connection between terminal-A and B. In that case, it becomes non-isolated from an I/O module.

If you connect a dry contact input, connect the field power supply to the base plate.



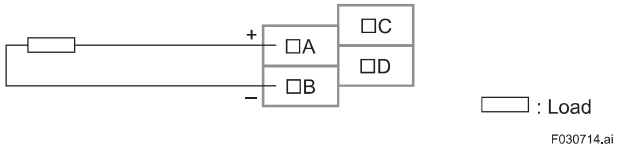

□: 1 to 16

**Figure When Using the digital Input Adaptor**

## A2SDV505 Digital output adaptor

The following figure shows the signal wiring to the base plate when you use the digital output adaptor.

When you use the digital output adaptor, connect the field power supply to the base plate.




□: 1 to 16

**Figure When Using the digital output adaptor**

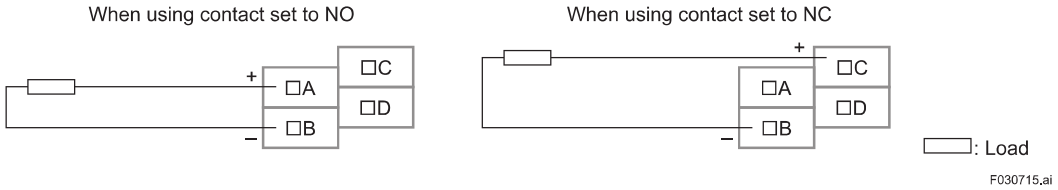
**IMPORTANT**

When you connect an inductive load, connect a diode in parallel with the load.

## A2SDV506 Relay output adaptor

When you use the relay output adaptor, signal connections to the base plate differ, depending on whether the contact output is NC or NO.

The following figure shows the signal connection to the base plate.




□: 1 to 16

**Figure When using the relay output adaptor**

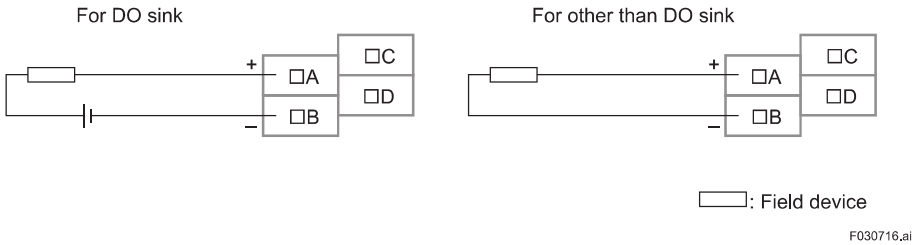
**IMPORTANT**

When you connect an inductive load, connect a diode in parallel with the load.

## A2SMX801 Pass-through I/O signal adaptor

When you use the pass-through I/O signal adaptor, you need to set the signal type by software.

The following figure shows the signal wiring to the base plate.




□: 1 to 16

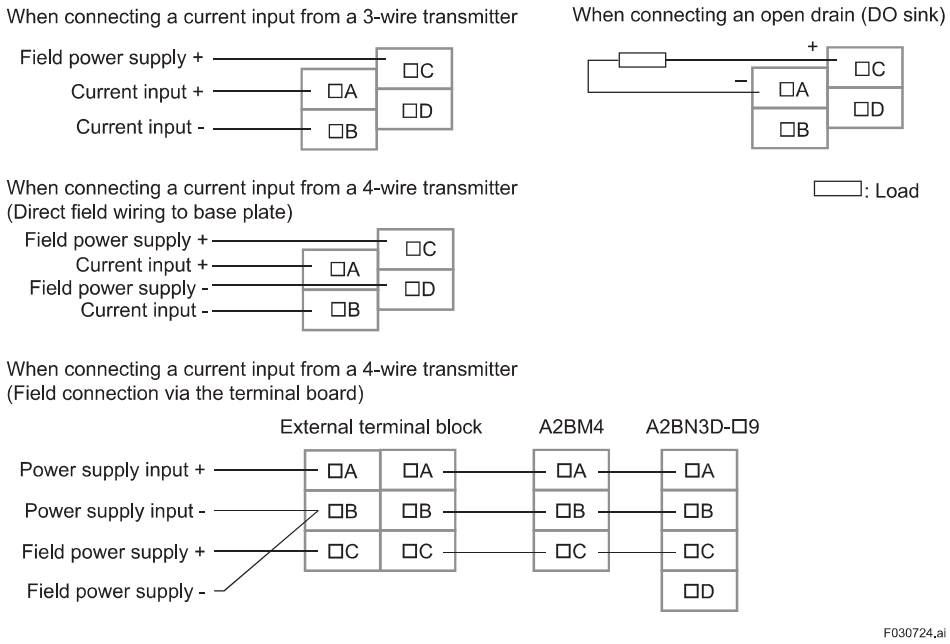
**Figure When using the pass-through I/O signal adaptor**

## A2SMX802 Pass-through I/O signal adaptor

**CAUTION**

When you connect an inductive load, connect a diode in parallel with the load.

For current input from a 4-wire transmitter, when connecting the field signals via the terminal board, it is necessary to connect the field power supply - to the terminal-B on the external terminal block.
The following figure shows the signal wiring to the base plate when you use the pass-through I/O signal adaptor




☐: 1 to 16

**Figure When using the pass -through i/o signal adaptor A2SMX 802**

**TIP**

When using A2SMX802, connect the field power supply to the base plate.
When mounting A2SMX802 to the base plate, each channel between A2SDV105, A2SDV505, and A2SMX801 is not insulated.
For details of the Fieldbus connection and wiring work, refer to “Fieldbus Technical Information” (TI 38K03A01-01E).

# 3.7.4 Base Plate for Barrier

## Base Plate for Barrier Types and Terminal Types

The following table shows relation between Base Plate for Barrier Types and Terminal Types.

**Table Base Plate for Barrier Types and Terminal Types**

| Base plate model | Suffix code | Field wiring orientation | Terminal type | Terminal position |
|---|---|---|---|---|
| A2BN4D Base Plate for Barrier (MTL) | -□□□C□ | Left | Pressure clamp terminal | On barrier module |
| | -□□□D□ | Right | | |
| A2BN5D Base Plate for Barrier (P+F) | -□□□C□ | Left | Spring clamp terminal | On base plate |
| | -□□□D□ | Right | | |

## Modules Installable with Base Plate for Barrier

The following table shows Modules installable with Base Plate for Barrier.

**Table Modules Installable with Base Plate for Barrier**

| Base plate model | Model of installable barrier |
|---|---|
| A2BN4D Base Plate for Barrier (MTL) | Refer to the General Specifications (GS). |
| A2BN5D Base Plate for Barrier (P+F) | Refer to the General Specifications (GS). |

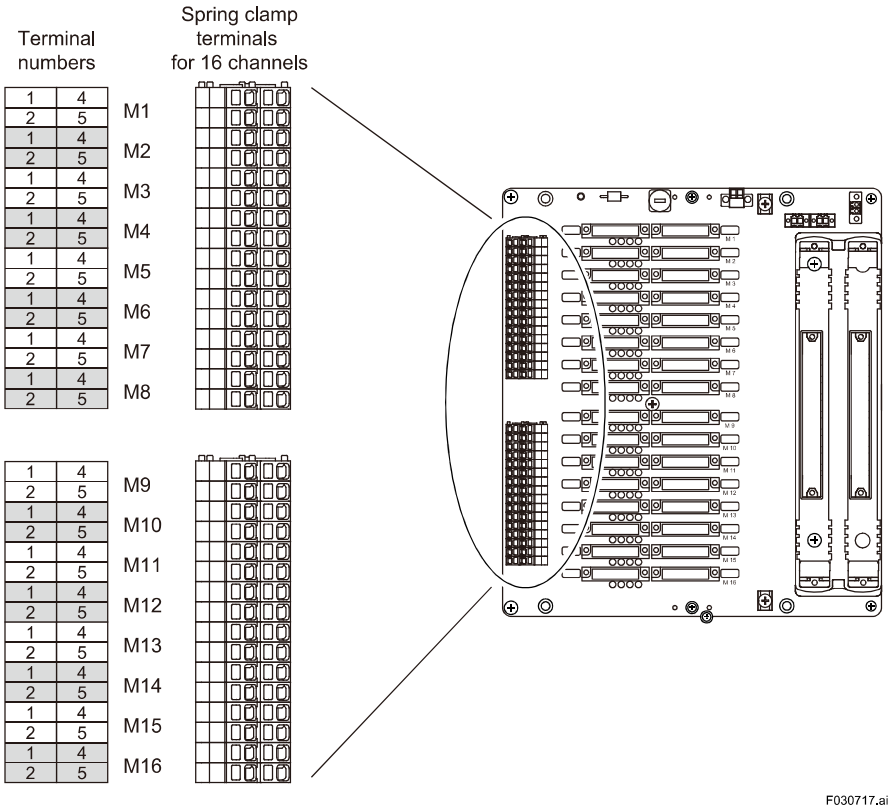
## Base Plate for Barrier Terminal Numbers

### A2BN4D (Pressure Clamp Terminals)

The A2BN4D Base Plate for Barrier do not have signal terminals because signal terminals are provided on intrinsic safety barriers.

Information about the terminal numbers of the signal terminals provided on the intrinsic safety barriers, refer to the manufacture's catalog.

## A2BN5D (Spring Clamp Terminals)



## Connecting Signal Cables with Base Plate for Barrier (A2BN5D)

The signal connections of the base blate for barrier (model:A2BN5D) differ depending on the signal type. The following table shows the terminal numbers and signal types.

**Table Terminal Numbers and Signal Types (A2BN5D)**

| Intrinsic safety barriers | Terminal number (*1) | IO Signal | | | | | |
|---|---|---|---|---|---|---|---|
| | | Case 1 | Case 2 | Case 3 | Case 4 | Case 5 | Case 6 |
| Analog Input (*3) | M□1 | 2-wire transmitter input + | Current input + | — | — | — | — |
| | M□2 | — | — | — | — | — | — |
| | M□4 | 2-wire transmitter input − | — | — | — | — | — |
| | M□5 | — | Current input − | — | — | — | — |
| Analog Output (*3) | M□1 | Analog output + | — | — | — | — | — |
| | M□2 | — | — | — | — | — | — |
| | M□4 | Analog output − | — | — | — | — | — |
| | M□5 | — | — | — | — | — | — |
| Digital Input | M□1 | Digital input+ | — | — | — | — | — |
| | M□2 | — | — | — | — | — | — |
| | M□4 | Digital input − | — | — | — | — | — |
| | M□5 | — | — | — | — | — | — |
| Digital Output | M□1 | Digital output + | — | — | — | — | — |
| | M□2 | — | — | — | — | — | — |
| | M□4 | Digital output − | — | — | — | — | — |
| | M□5 | — | — | — | — | — | — |
| Temperature Input (*3) | M□1 | RJC | — | RTD 4-wire source + | RTD 3-wire source + | RTD 2-wire source + | Potentiometer source + |
| | M□2 | Thermocouple input + | Voltage input + | RTD 4-wire input + | — | — | — |
| | M□4 | RJC | — | RTD 4-wire source - | RTD 3-wire source - | RTD 2-wire source - | Potentiometer source - |
| | M□5 | Thermocouple input - | Voltage input - | RTD 4-wire input - | RTD 3-wire input - | — | Potentiometer input - |

*1: □ = 1 to 16
*2: "—" is a terminal that is not used. Do not connect anything to it.
*3: This barrier can be used in combination with the A2MMM843 only.

# 3.8 Signal Connections of N-IO I/O Unit (For RIO System Upgrade)

**This section describes the signal connection with the N-IO I/O units for RIO System Upgrade.**

## 3.8.1 N-IO I/O Unit Types

### I/O Modules installed into the Nest for I/O Adaptor

The following table shows the I/O Modules installed into the A2BA3D Nest for I/O Adaptor.

**Table I/O Modules installed into the A2BA3D Nest for I/O Adaptor**

| Nest for I/O Adaptor model | I/O module model |
|---|---|
| A2BA3D (Nest for I/O Adaptor) | A2MME041 |

Note: A2BA3D (Nest for I/O Adaptor) inclules the A2MME041 (Redundant I/O Module for A2BA3D).

## 3.8.2 Nest for I/O Adaptor

### Adaptors installed into the Nest for I/O Adaptor

**Table Adaptors installed into the A2BA3D Nest for I/O Adaptor**

| Nest for I/O Adaptor model | Adaptor model |
|---|---|
| A2BA3D (Nest for I/O Adaptor) | A2SAP105 Pulse Input Signal Adaptor |
| | A2SAM105 Current Input/Voltage Input Adaptor |
| | A2SAM505 Current Output/Voltage Output Adaptor |
| | A2SAT105 mV/TC/RTD Input Adaptor |

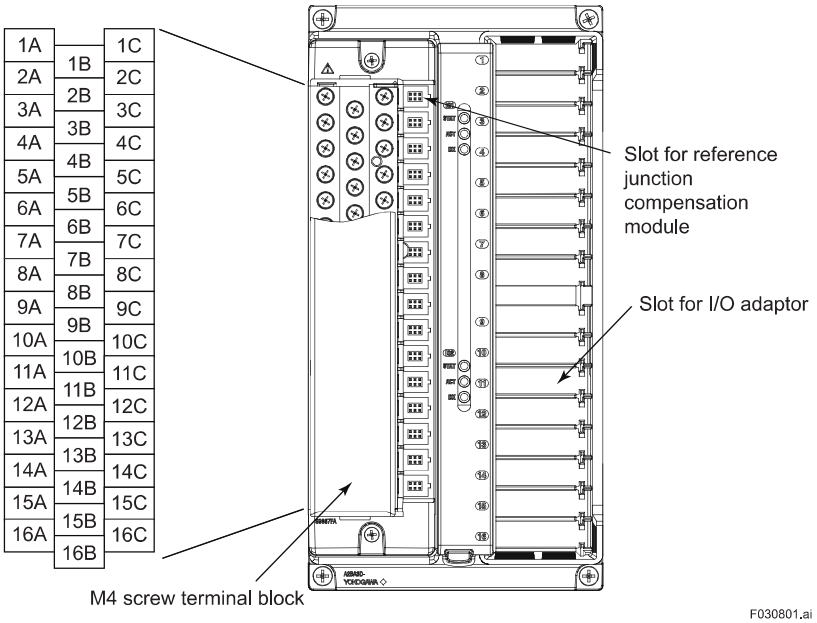
### Terminal type that can be select with Nest for I/O Adaptor

**Table Terminal type Compatible with A2BA3D Nest for I/O Adaptor**

| Model | Suffix code | Terminal type |
|---|---|---|
| A2BA3D (Nest for I/O Adaptor) | –□3□□□ | M4 Screw |
| | –□4□□□ | ELCO Connector |

## A2BA3D Terminal assignment of M4 screw terminal block

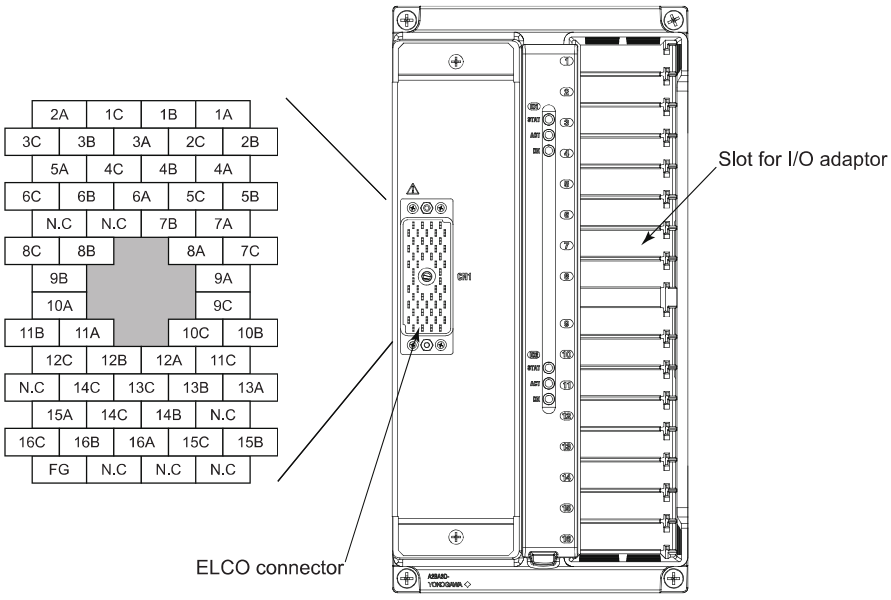
**A2BA3D-□3□□□**




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## A2BA3D Pin assignment of ELCO connector

**A2BA3D-□4□□□**




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## Signal connection of the terminal block of the nest for I/O adaptor A2BA3D

The signal cables of the field devices to the terminal block that is mounted on the nest for I/O adaptor must be connected to different terminals depending on the types of signals. To prevent damage to the devices, connect signal cables to the appropriate terminals according to the type of signals.

The following table shows the relationship between signal types and terminal numbers of channels.

**Table Terminal numbers and signal types**

| Adaptor (model) | Terminal number (*1) | Signal type (*2) | | | | |
|---|---|---|---|---|---|---|
| | | Case 1 | Case 2 | Case 3 | Case 4 | Case 5 |
| Current input/ voltage input adaptor (A2SAM105) (*3) | ☐A (*4) | 2-wire transmitter input + | — | — | — | — |
| | ☐B | 2-wire transmitter input - | 4-wire transmitter current input + | Voltage input + | — | — |
| | ☐C | — | 4-wire transmitter current input - | Voltage input - | — | — |
| Current output/voltage output adaptor (A2SAM505) | ☐A | Current output + | Voltage output + | — | — | — |
| | ☐B | — | — | — | — | — |
| | ☐C | Current output - | Voltage output - | — | — | — |
| mV/TC/RTD input adaptor (A2SAT105) | ☐A | — | RTD input A (*5) | Potentiometer input, 100% (*5) | — | — |
| | ☐B | TC/mV input + | RTD input B | Potentiometer input, variable | — | — |
| | ☐C | TC/mV input - | RTD input B (*5) | Potentiometer input, 0% (*5) | — | — |
| Pulse input signal adaptor (A2SAP105) (*6) | ☐A | — | Dry contact input + (*7) (*8) | — | 2-wire power supply type, power | 3-wire power supply type, power |
| | ☐B | 2-wire contact + (*9) | Dry contact input - (*7) (*8) | 2-wire, voltage + | 2-wire power supply type, signal | 3-wire power supply type + |
| | | | Connect to A2EXR001 (*8) | | Connect to A2EXR001 | |
| | ☐C | 2-wire contact - (*9) | Connect to A2EXR001 (*8) | 2-wire, voltage - | Connect to A2EXR001 | 3-wire power supply type - |

*1: ☐: 1 to 16
*2: "—" denotes that the terminal is not used. Do not connect any signal because the terminal is connected to internal circuits.
*3: When the power supply is turned off or overcurrent is detected, the current input loop enters a high impedance state. Do not share the current signal with other receiving devices. If the signals are shared, you must convert the signals into voltage signals by using an external shunt resistor or shunt resistor module (Part:A1080RZ) to receive the signals.
*4: Power for transmitter is supplied from the A terminal. If an overcurrent is detected, the A terminal enters an open state.
*5: The resistance values of the connecting cables must match.
*6: When the power supply is turned off or overcurrent is detected, the transmitter power supply terminal enters an open state.
*7: Used when the input frequency is 0 to 5 kHz.
*8: Used when the input frequency is 0 to 10 kHz.
*9: Used when the input frequency is 0 to 800 Hz.

# 3.8.3 Adaptors (for A2BA3D)

## A2SAP105 Pulse input signal adaptor

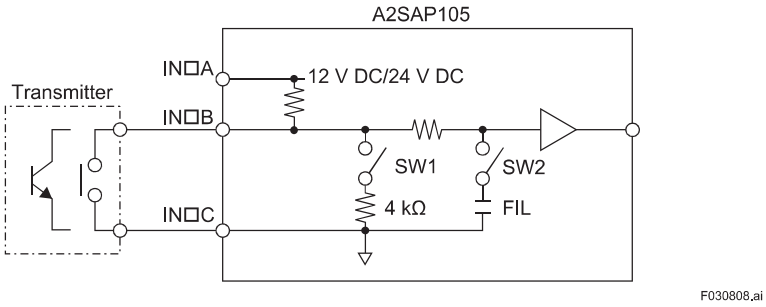
When the pulse input signal adaptor (Model: A2SAP105) is used, signal connections and shunt resistor usage depend on the type of the pulse signal that is input.

When receiving dry contact signals, you can remove mechanical chattering noise by selecting the pulse input filtering option in the IOM builder. However, the input filter passes a limited range of frequencies.

**SEE ALSO** For more information about removing the mechanical chattering noise, refer to:
N-IO Node (for RIO System Upgrade) (GS 33J64F10-01EN)

### When receiving dry contact signals (Input frequency: 0 to 800 Hz)

Select "Without Shunt Resistor" (SW1: OFF) in the IOM builder.
The following figure shows the circuit diagram.

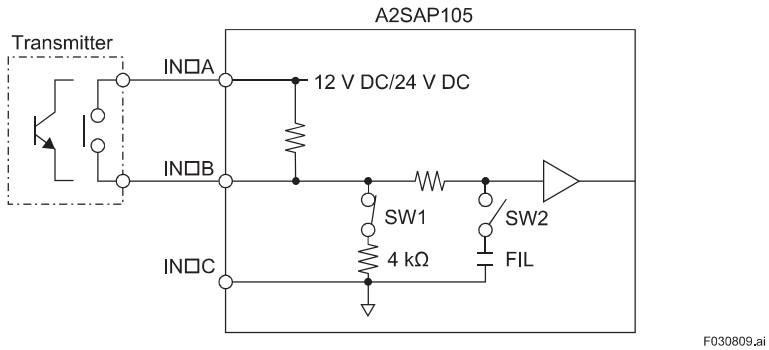



□: 1 to 16

**Figure When receiving dry contact signals (Input frequency: 0 to 800 Hz)**

### When receiving dry contact signals (Input frequency: 0 to 5 kHz)

Select "Shunt Resistor 4000 ohm" (SW1: ON) in the IOM builder.
The following figure shows the circuit diagram.

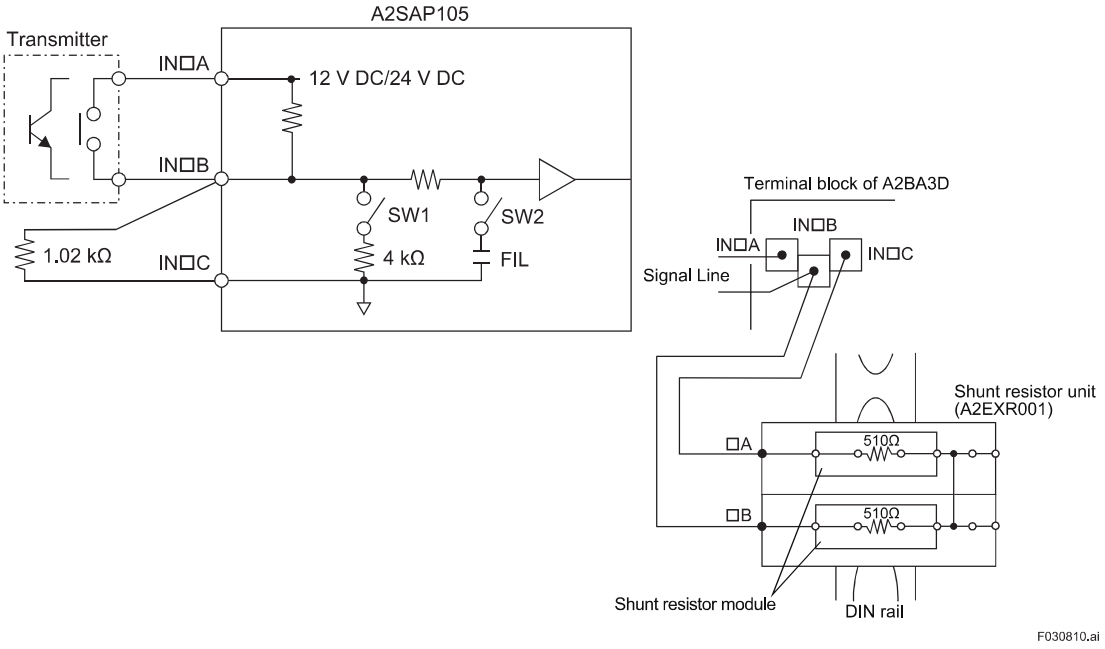



□: 1 to 16

**Figure When receiving dry contact signals (Input frequency: 0 to 5 kHz)**

## When receiving dry contact signals (Input frequency: 0 to 10 kHz)

Select "Without Shunt Resistor" (SW1: OFF) in the IOM builder. Also install two 510 Ω shunt resistor modules on the shunt resistor unit. The total resistance value will be 1.02 kΩ.
The following figure shows the circuit diagram.




□: 1 to 16

**Figure When receiving dry contact signals (Input frequency: 0 to 10 kHz)**

### • Shunt Resistor Unit (A2EXR001)

**SEE ALSO** For the General specifications of A2EXR001, refer to N-IO Node (For RIO System Upgrade ) (GS 33J64F10-01EN)

The shunt resistor unit (Model: A2EXR001-S000030/KFR) converts the current signals of the internal circuit of the pulse input signal adaptor into voltage signals and is capable of converting four points of signals. It is used when receiving dry contact signal inputs with 0 to 10 kHz input frequencies or current pulse signal inputs.

### Elements of the shunt resistor unit

The following figure shows the elements of the shunt resistor unit.

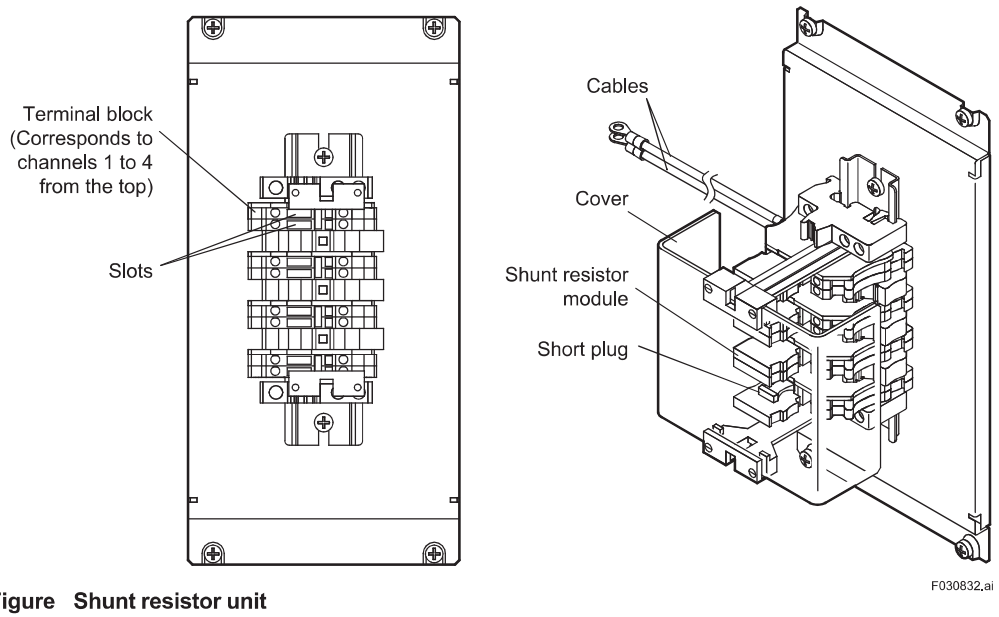



**Figure Shunt resistor unit**

The shunt resistor unit has terminal blocks for channel numbers 1 to 4. Each terminal block is provided with two slots that are used to install a shunt resistor module or a short plug. Short plugs are installed on these slots when the unit is shipped from the factory. The shunt resistor unit comes with shunt resistor modules and cables for connecting the shunt resistor unit and the nest for I/O adaptor as accessories.

### Installation and wiring for the shunt resistor unit

**CAUTION**

Handle shunt resistor module in A2EXR001 with care as it may become high in temperature. Use a cover to prevent from touching the resistor directly to avoid being burned.

### Installing the shunt resistor unit

The following figure shows how to install the shunt resistor unit.

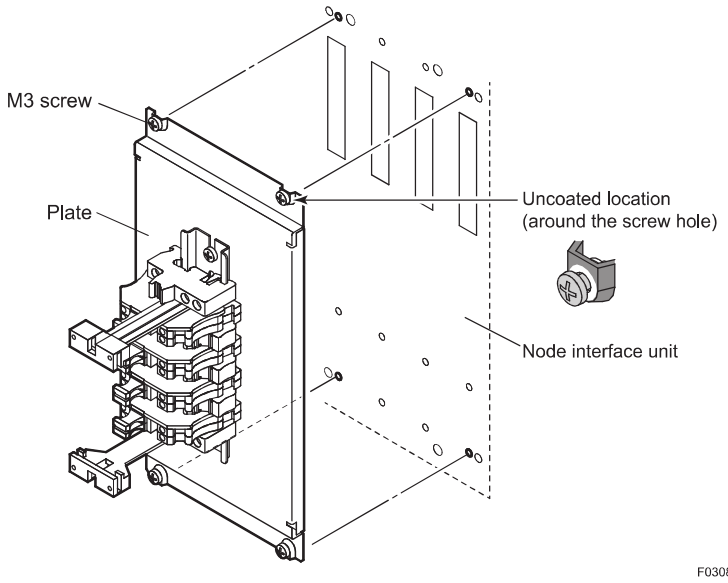



**Figure Installing the shunt resistor unit**

Install the shunt resistor unit onto the node interface unit securely by tightening the four M3 screws.

When there is no empty space in the node interface unit and the shunt resistor unit (Model: A2EXR001) cannot be mounted, Multiple shunt resistor units can be installed in the empty space on the back of the FCU (Model: A2FV70☐) or Base Plate (Model: A2BE1D) by using shunt resistor unit fixing plate. For details of the Shunt resistor unit fixing plate, Refer to the figure below.

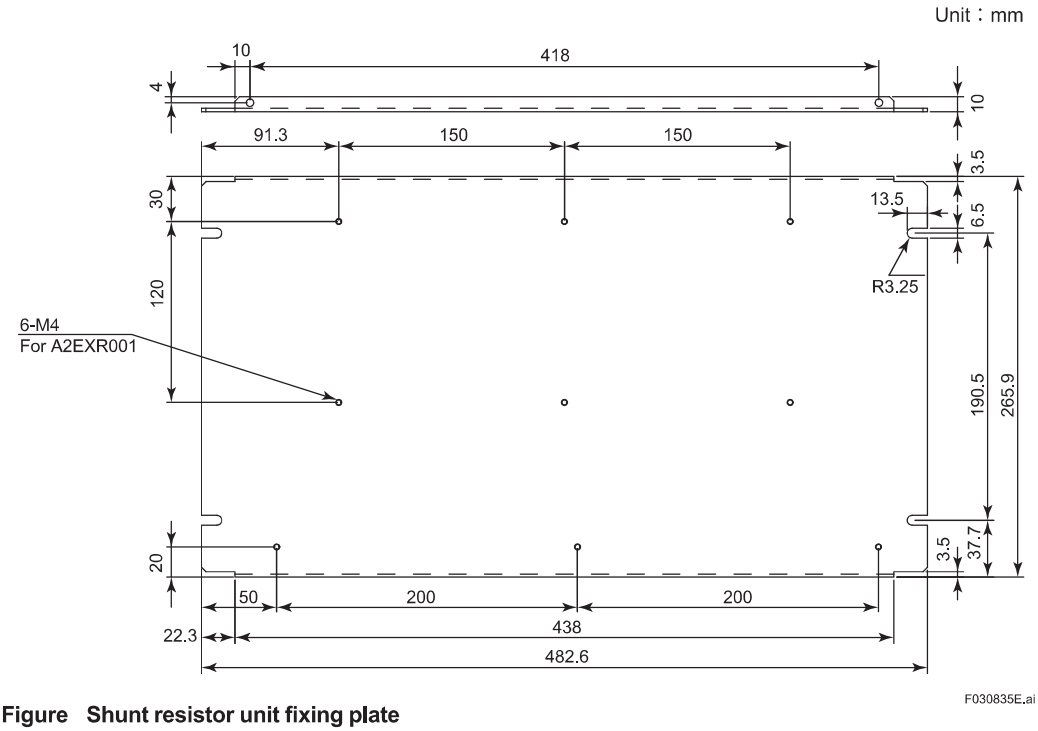



**Figure Shunt resistor unit fixing plate**

The shunt resistor unit fixing plate can be mounted on the upper rear of the RIO system upgrade application cabinet.

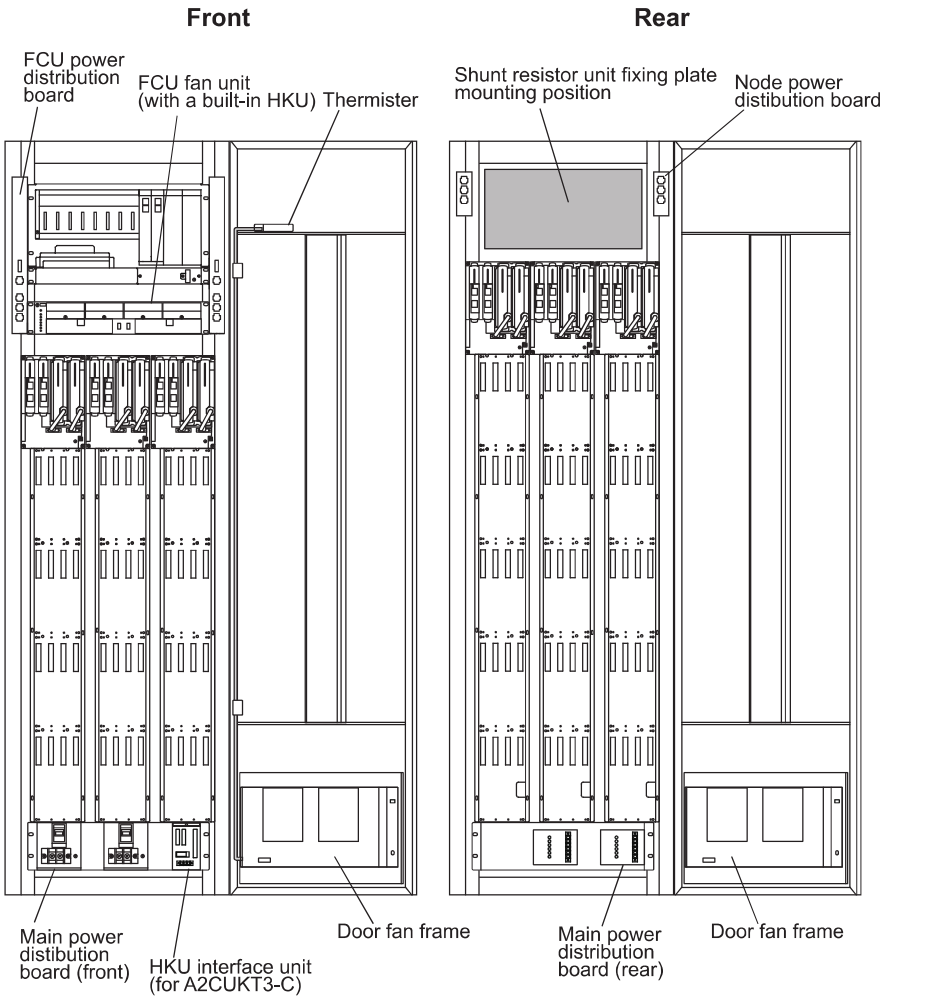



**Figure Shunt resistor unit fixing plate mounting position**

### Wiring for the shunt resistor unit

For the wiring between the shunt resistor unit and the nest for I/O adaptor, use the cables that are provided as accessories of the shunt resistor unit. The cables have a sleeve at one and for connection to the shunt resistor unit and a ring terminal for M4 screw at the other and for connection to the nest for I/O adaptor.
Connect the cables to the shunt resistor unit for the required number of signals.
The following figure shows the cable connections to the shunt resistor unit.

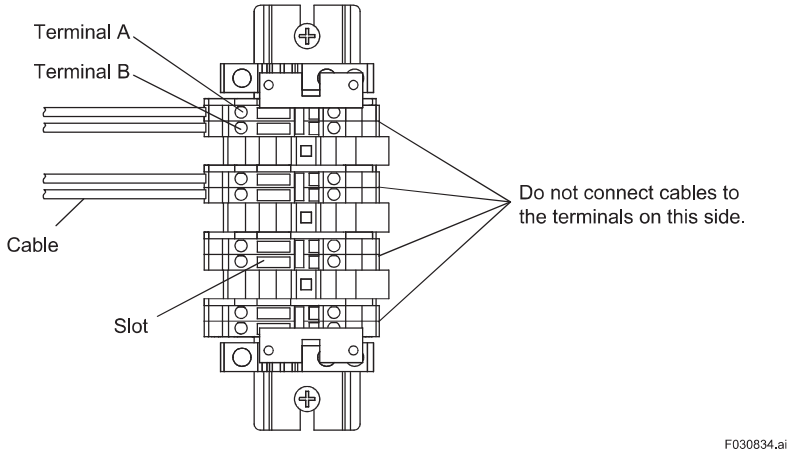
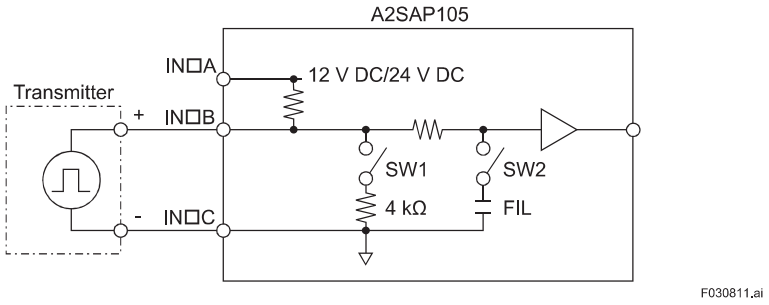



**Figure Cable connections to the shunt resistor unit**

## When receiving voltage pulse signals

In the IOM builder, select "Without Shunt Resistor" (SW1: OFF) and clear the "Input Filtering" (SW2: OFF) option.
The following figure shows the circuit diagram.




□: 1 to 16

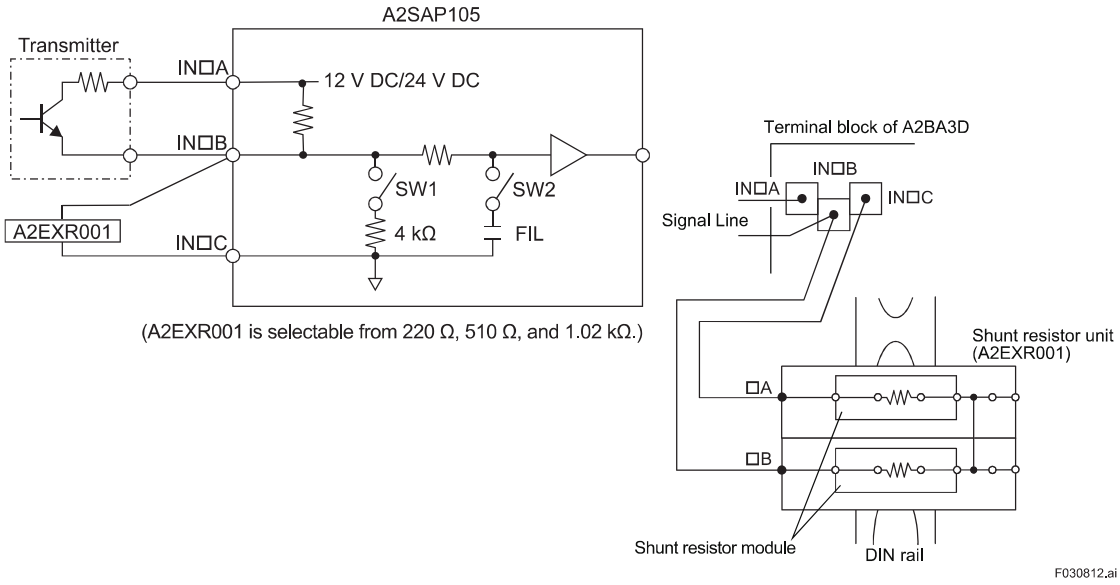
**Figure When receiving voltage pulse signals**

## When receiving current pulse signals (2-wire power supply type)

According to the input signal level, install the shunt resistor module and short plug onto the shunt resistor unit so that the total resistance value becomes one of the following values:

- 220 Ω
- 510 Ω
- 1.02 kΩ

In the IOM builder, select "Without Shunt Resistor" (SW1: OFF) and clear the "Input Filtering" (SW2: OFF) option.
The following figure shows the circuit diagram.

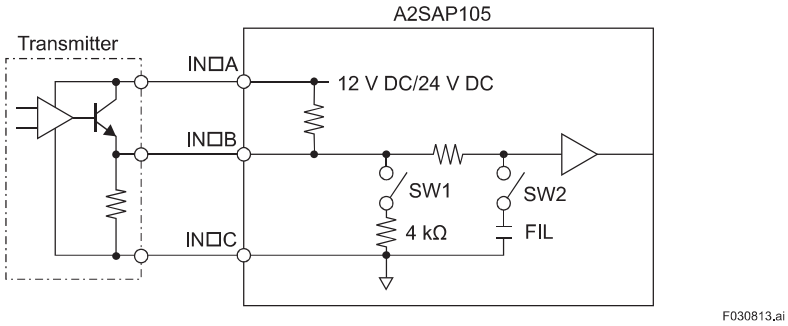



□: 1 to 16

**Figure When receiving current pulse signals (2-wire power supply type)**

## When receiving voltage pulse signals by using the internal power to drive the transmitter (3-wire power supply type)

In the IOM builder, select "Without Shunt Resistor" (SW1: OFF) and clear the "Input Filtering" (SW2: OFF) option.
The following figure shows the circuit diagram.




□: 1 to 16

**Figure When receiving voltage pulse signals by using the internal power to drive the transmitter (3-wire power supply type)**

## When attaching a shunt resistor to the M4 screw terminal block of A2BA3D

If there is no empty space in the node interface unit and it is difficult to install the shunt resistor unit (Model: A2EXR001) in the cabinet, it is possible to prepare the shunt resistor separately and attach it to the M4 screw terminal block of the nest for I/O adaptor (Model: A2BA3D). However, the following (1) to (4) implementation conditions must be met.

### (1) Cabinet ambient Temperature Conditions

Check the cabinet ambient temperature considering the temperature rise in the cabinet caused by the shunt resistor. Check that the cabinet is installed in an air-conditioned control room and that the operating cabinet ambient temperature is 30 °C or less.

### (2) Protection from the heat generated by the shunt resistor

Select a shunt resistor from 220 Ω, 510 Ω, 1.0 kΩ (accuracy ± 5 %, rated 2 W) according to the type of signal, and install it between the B and C terminals of the M4 screw terminal block. At this time, terminal B is tightened together with the input signal. The shunt resistor generates heat depending on the operating conditions, so protect it with a heat resistant tube etc. and use it. The following figure shows the connection diagram and example of the shunt resistor assembly.

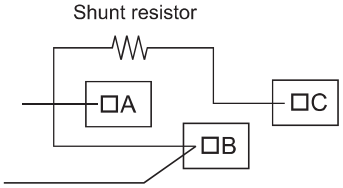



Figure Shunt resistor connection diagram

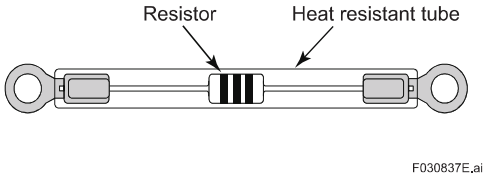



Figure Example of shunt resistor assembly

### (3) Signal cable temperature rating conditions

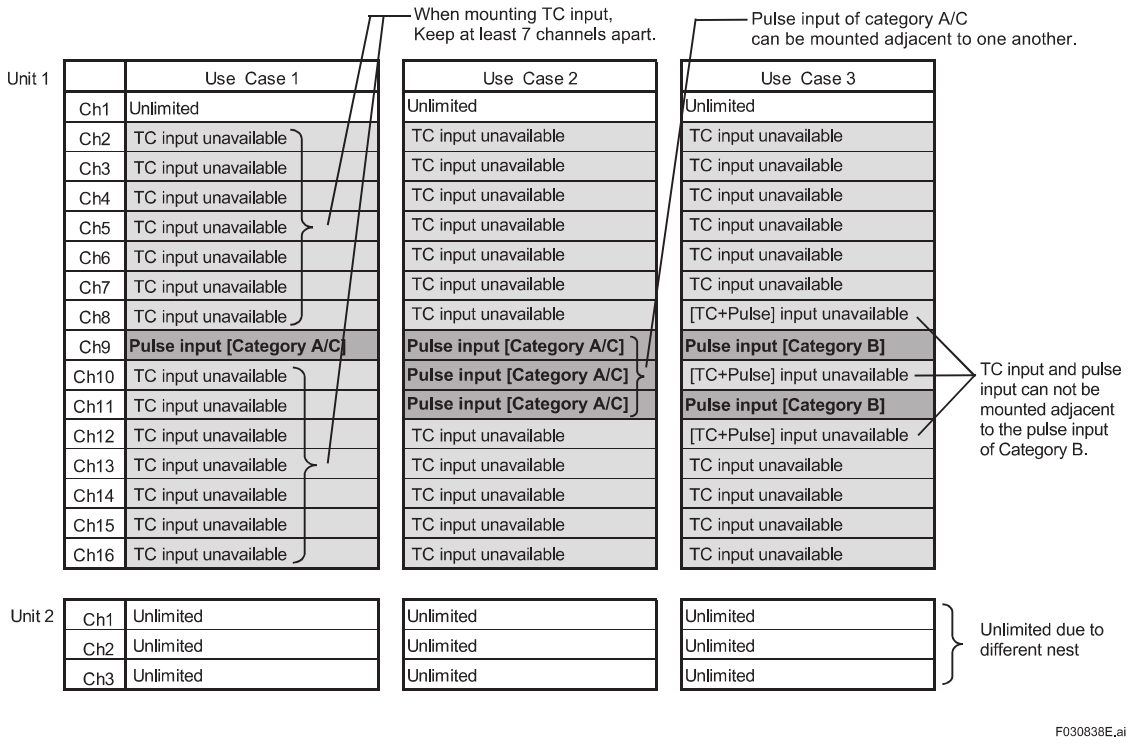
The heat generated by the shunt resistor affects to the insulation performance of the signal cable coating. Especially when operating under conditions of large heat generation (Category B and Category C in the table below), please check the temperature rating of the signal cable. If the temperature rating of the signal cable is less than 75 °C (Category B in the table below), avoid using it on adjacent channels to prevent the heat generated by the shunt resister.
Keep one or more channels apart from the channels where resistors are installed. If an adjacent installation is unavoidable, add 1m of signal cables with a temperature rating of 75 °C or higher to the existing signal cables before connecting them (Category C in the table below).

Table Signal cable temperature rating classification

| | | Transmitter power supply | Shunt resistor value | Signal cable temperature rating | Installation on adjacent channel |
|---|---|---|---|---|---|
| Category A | Current pulse | 12 V or 24 V | 220 Ω | 60 °C or less | available |
| | | | 510 Ω | | |
| | Dry contact pulse | 12 V | 510 Ω | | |
| | | | 1.0 KΩ | | |
| Category B | Current pulse | 24 V | 1.0 KΩ | Less than 75 °C | not available (At least one channel away) |
| | Dry contact pulse | | | | |
| Category C | Current pulse | 24 V | 1.0 KΩ | 75 °C or higher | available |
| | Dry contact pulse | | | | |

### (4) A2SAT105 (TC input) mounting conditions

The heat generated by the shunt resistor affects the TC input measurement accuracy of the mV/TC/RTD input adaptor (Model: A2SAT105). When attaching a shunt resistor to an M4 screw terminal block, do not mix it with the TC input in “Nest for I/O adaptor” (Model: A2BA3D). If mixing is happened, mount the TC input channel more than 7 channels away from the pulse input channel connected with the shunt resistor. Other input signals such as mV input and RTD input can be used in the adjacent channel of pulse input.




| | | Use Case 1 | Use Case 2 | Use Case 3 |
|---|---|---|---|---|
| Unit 1 | Ch1 | Unlimited | Unlimited | Unlimited |
| | Ch2 | TC input unavailable | TC input unavailable | TC input unavailable |
| | Ch3 | TC input unavailable | TC input unavailable | TC input unavailable |
| | Ch4 | TC input unavailable | TC input unavailable | TC input unavailable |
| | Ch5 | TC input unavailable | TC input unavailable | TC input unavailable |
| | Ch6 | TC input unavailable | TC input unavailable | TC input unavailable |
| | Ch7 | TC input unavailable | TC input unavailable | TC input unavailable |
| | Ch8 | TC input unavailable | TC input unavailable | [TC+Pulse] input unavailable |
| | Ch9 | **Pulse input [Category A/C]** | **Pulse input [Category A/C]** | **Pulse input [Category B]** |
| | Ch10 | TC input unavailable | **Pulse input [Category A/C]** | [TC+Pulse] input unavailable |
| | Ch11 | TC input unavailable | **Pulse input [Category A/C]** | **Pulse input [Category B]** |
| | Ch12 | TC input unavailable | TC input unavailable | [TC+Pulse] input unavailable |
| | Ch13 | TC input unavailable | TC input unavailable | TC input unavailable |
| | Ch14 | TC input unavailable | TC input unavailable | TC input unavailable |
| | Ch15 | TC input unavailable | TC input unavailable | TC input unavailable |
| | Ch16 | TC input unavailable | TC input unavailable | TC input unavailable |
| Unit 2 | Ch1 | Unlimited | Unlimited | Unlimited |
| | Ch2 | Unlimited | Unlimited | Unlimited |
| | Ch3 | Unlimited | Unlimited | Unlimited |

**Figure I/O Adaptor Implementation Example 1**

| | | Use Case 1 | Use Case 2 | Use Case 3 | |
|---|---|---|---|---|---|
| Unit 1 | Ch1 | Unlimited | Unlimited | Unlimited | |
| | Ch2 | Unlimited | Unlimited | Unlimited | |
| | Ch3 | Unlimited | Unlimited | Unlimited | |
| | Ch4 | Unlimited | Unlimited | TC input unavailable | |
| | Ch5 | Unlimited | Unlimited | TC input unavailable | |
| | Ch6 | Unlimited | Unlimited | TC input unavailable | |
| | Ch7 | Unlimited | TC input unavailable | TC input unavailable | |
| | Ch8 | Unlimited | TC input unavailable | TC input unavailable | |
| | Ch9 | TC input unavailable | TC input unavailable | TC input unavailable | |
| | Ch10 | TC input unavailable | TC input unavailable | TC input unavailable | |
| | Ch11 | TC input unavailable | TC input unavailable | **Pulse input [Category A/C]** | Pulse input of category A/C can be mounted adjacent to one another. |
| | Ch12 | TC input unavailable | TC input unavailable | **Pulse input [Category A/C]** | |
| | Ch13 | TC input unavailable | [TC+Pulse] input unavailable | [TC+Pulse] input unavailable | TC input and pulse input can not be mounted adjacent to the pulse input of Category B. |
| | Ch14 | TC input unavailable | **Pulse input [Category B]** | **Pulse input [Category B]** | |
| | Ch15 | TC input unavailable | [TC+Pulse] input unavailable | [TC+Pulse] input unavailable | |
| | Ch16 | **Pulse input [Category A/C]** | **Pulse input [Category B]** | **Pulse input [Category B]** | |
| Unit 2 | Ch1 | Unlimited | Unlimited | Unlimited | Unlimited due to different nest |
| | Ch2 | Unlimited | Unlimited | Unlimited | |
| | Ch3 | Unlimited | Unlimited | Unlimited | |

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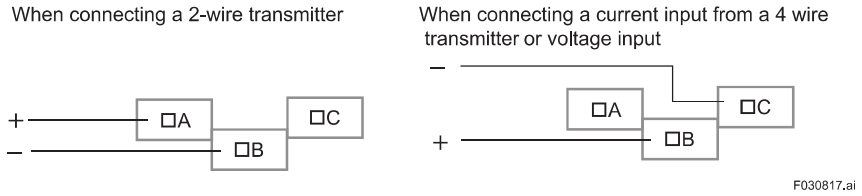
**Figure I/O Adaptor Implementation Example 2**

## A2SAM105 Current input/voltage input adaptor

**IMPORTANT**

Do not share the current signal with other receiving devices. If the signals are shared, you must convert the signals into voltage signals by using an external shunt resistor or shunt resistor module to receive the signals.

The following figure shows the signal wiring when using the current input/voltage input adaptor (Model: A2SAM105).



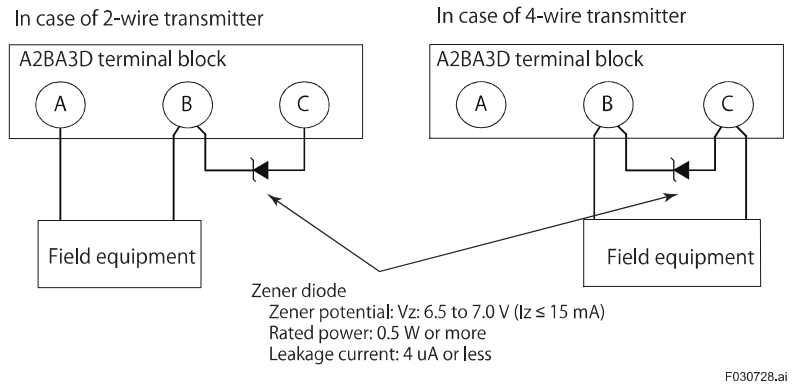

□: 1 to 16

**Figure When using the current input/voltage input adaptor**

## When the input current value exceeds 25 m A

When the input current exceeds 25 mA due to the inrush current of the connected equipment etc. (eg, NOHKEN ultrasonic level meter, etc.), the inrush current exceeds the allowable input current of the adapter, so startup failure of the connected equipment may occurs. As a measure, by connecting a zener diode for bypassing the inrush current to the B - C terminal of the A2BA3D, the input current value can be used from 25 to 40 m A.

Connection example




## When sharing the current signal with another receiving device

When receiving 4-20 mA current signals from the four-wire transmitter by converting them into 1-5 V DC voltage signals, you must install the shunt resistor module (Part: A1080RZ, 250 Ω) on the receiving terminals of the terminal block.

**IMPORTANT**

Do not share the current signal with other receiving devices. If the signals are shared, you must convert the signals into voltage signals by using an external shunt resistor or shunt resistor module to receive the signals.

The following figure shows how to install the shunt resistor module.

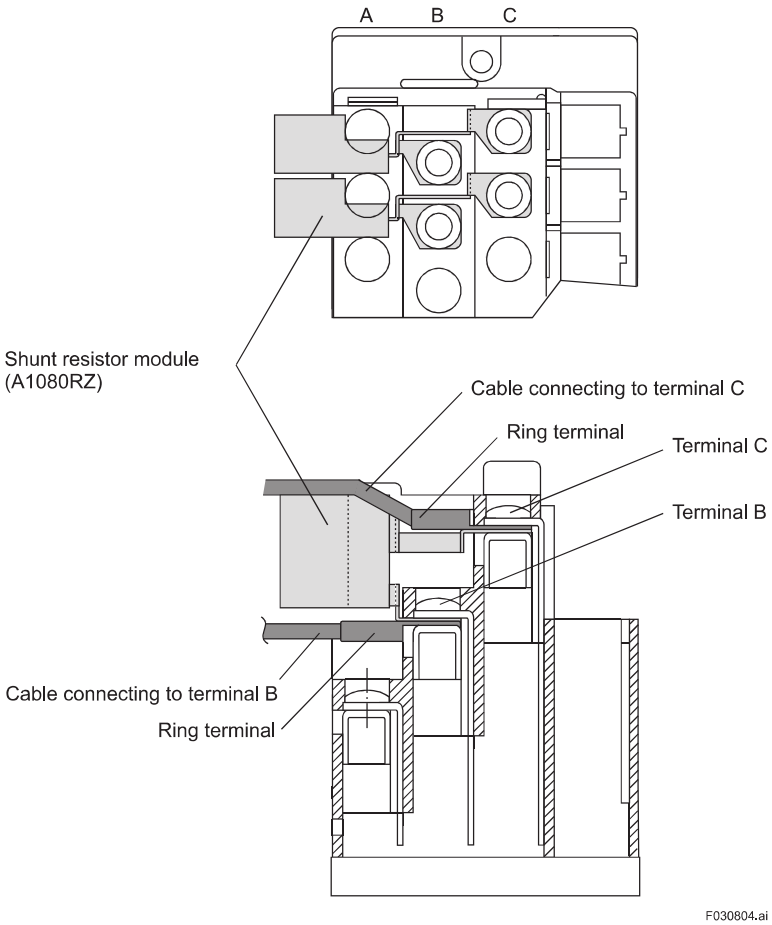


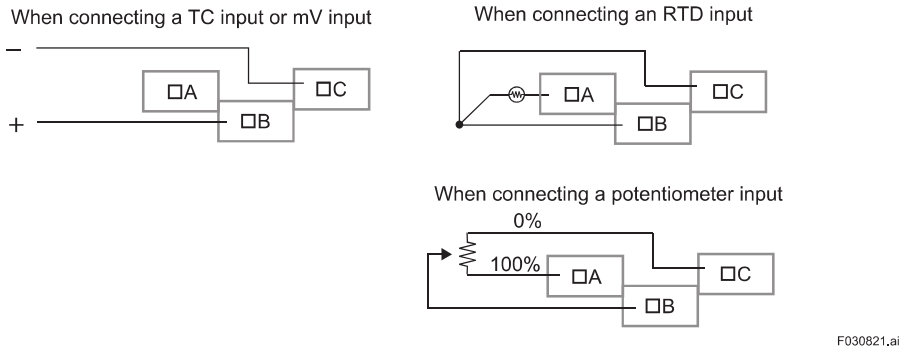

**Figure Installing the shunt resistor module**

Follow these steps to install the shunt resistor module on the terminal block:

1. Open the cover of the terminal block.
2. Loosen the M4 screws of terminals B and C.
3. Insert the ring of the ring terminal of the cable that connects to terminal B into the gap. Be sure to insert it with the convex side of the crimping part of the ring terminal being oriented to the terminal block side.
4. Orient the shunt resistor module as shown in the figure and insert it into each gap of terminals B and C.
   The screw goes into the screw hole of the ring terminal and is secured temporarily.
5. Insert the ring of the ring terminal of the cable that connects to terminal C into the gap. Be sure to insert it with the convex side of the crimping part of the ring terminal being oriented in the opposite orientation of the shunt resistor module.
6. Tighten the M4 screws on terminals B and C.
7. Close the cover of the terminal block.

## A2SAT105 mV/TC/RTD input adaptor

The following figure shows the signal wiring when using the mV/TC/RTD input adaptor (Model: A2SAT105).




□: 1 to 16

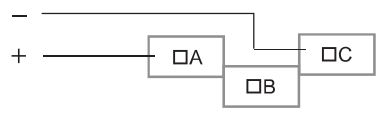
**Figure When using the mV/TC/RTD input adaptor**

For thermocouple signal input, mount the reference junction compensation module (Part number: S9393UK) on the terminal block.

**SEE ALSO** For more information about the types of TC and RTD that can be connected to the mV/TC/RTD input adaptor and the standards they must conform to, refer to:
"N-IO Node (for RIO System Upgrade)" (GS 33J64F10-01EN)

## A2SAM505 Current output/voltage output adaptor

The following figure shows the signal wiring when using the current output/voltage output adaptor (Model: A2SAM505).




□: 1 to 16

**Figure When using the current output/voltage output adaptor**

### Dual-redundant current output

For current signal output, adaptors can be configured for redundancy. Mount the adaptors in the slots that are vertically next to one another, and set the signal setting of the adaptors in the odd-numbered slot and the even-numbered slot to dual-redundant.

To also match the output, connect terminal A to terminal A, and terminal C to terminal C on the terminal blocks by using short-bars (Part number: A1534JT).

The following figure shows how to attach short-bars by using an example of a dual-redundant configuration of adaptors in slots 3 and 4.

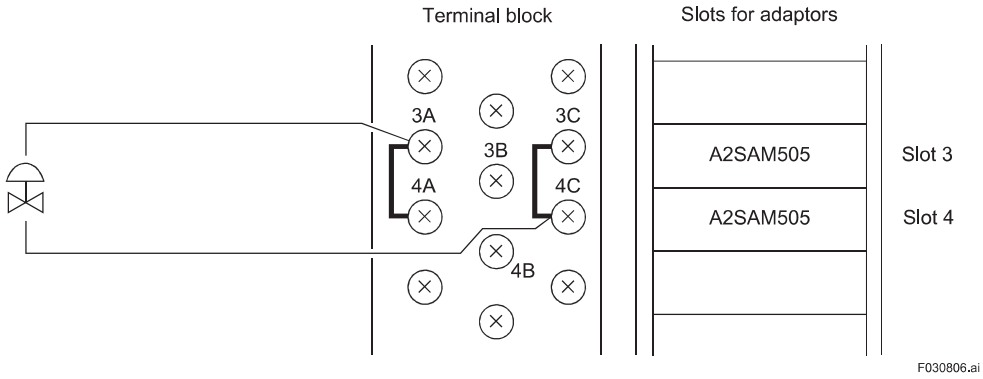



**Figure Example of attaching short-bars**

**TIP**

When using the ELCO connector, short the pins that correspond to terminal A on a terminal block, and the pins that correspond to terminal C.

**SEE ALSO**

For more information about the ELCO connector pin assignment, refer to:
"N-IO Node (for RIO System Upgrade)" (GS 33J64F10-01EN)

## Signal connection of a terminal block for the multichannel I/O module

The signal cables of the field devices to the terminal blocks for the multi-channel I/O module must be connected to different terminals depending on the types of signals. To prevent damage to devices, connect signal cables to the appropriate terminals according to the type of signals. The following table shows the relationship between signal types and terminal numbers of channels.

**Table Terminal numbers and signal types - Analog I/O module**

| I/O modules | | Terminal number (*1) | Signal types |
|---|---|---|---|
| Device | Model and suffix code | | |
| Analog input module | AAI143-HM☐ | ☐A | Current input + |
| | | ☐B | Current input - |
| Analog output module | AAI543-HM☐ | ☐A | Current output + |
| | | ☐B | Current output - |
| RTD/POT input module(*2) | AAR145-SM☐ | ☐A | RTD input A (*3) |
| | | ☐B | RTD input B |
| | | ☐B | RTD input B (*3) |
| TC/mV input module | AAT145-SM☐ | ☐A | TC/mV input + |
| | | ☐B | TC/mV input - |
| Analog input module | AAV144-SM☐ | ☐A | Voltage input + |
| | | ☐B | Voltage input - |

*1: ☐: 1 to 16
*2: POT input is not supported.
*3: The resistance values of the connecting cables must match.

**Table Terminal numbers and signal types - Digital I/O module**

| I/O modules | | Terminal number (*1) | Signal types | |
|---|---|---|---|---|
| Device | Model and suffix code | | | |
| ST3-compatible digital input module | ADV159-PM☐ | ☐A | Status input + | Push button input + |
| | | ☐B | Status input - | Push button input - |
| | ADV159-PY☐ | ☐A | Relay status input + | Relay push button input + |
| | | ☐B | Relay status input - | Relay push button input - |
| | | ☐C | — | — |
| ST6-compatible digital input module | ADV169-PM☐ | ☐A | Status input + | Push button input + |
| | | ☐B | Status input - | Push button input - |

| I/O modules | | Terminal number (*1) | Signal types | |
|---|---|---|---|---|
| Device | Model and suffix code | | | |
| ST4-compatible digital input module | ADV559-PM☐ | ☐A | Status output + | Pulse width output + |
| | | ☐B | Status output - | Pulse width output - |
| | ADV559-PY☐ | ☐A | Relay status output Contact closed when energized | Relay pulse width output Contact closed when energized |
| | | ☐B | Relay status output Contact close when not energized | Relay pulse width output Contact close when not energized |
| | | ☐C | Relay status output Common | Relay pulse width output Common |
| ST7-compatible digital input module | ADV569-PM☐ | ☐A | Status output + | Pulse width output + |
| | | ☐B | Status output - | Pulse width output - |

*1: For ADV169-PM☐ and ADV569-PM☐, ☐ ranges from 1 to 32, for all others, ☐ ranges from 1 to 16.
*2: "—" denotes that the terminal is not used. Do not connect any signal to it.

Connect the signal cables to the terminal blocks.

## Analog I/O

This section describes the signal wiring when the following signals are received or sent:

- Voltage signals are received on AAV144-SM☐.
- Thermocouple or mV signals are received on AAT145-SM☐.
- Signals from the 2-wire transmitter are received on AAI143-HM☐.
- Current signals are sent by AAI543-HM☐.

The following figure shows the signal wiring for the preceding signals.

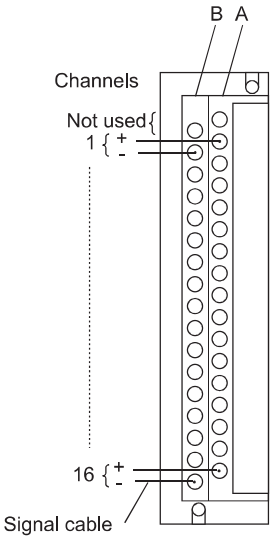



**Figure For voltage input, thermocouple input, mV input, 2-wire transmitter input, or current output**

**IMPORTANT**

When using I/O module AAI143-HM☐, do not share the current signals with other receiving devices.

## RTD input

The following figure shows the signal wiring when receiving RTD signal input on AAR145- SM☐.

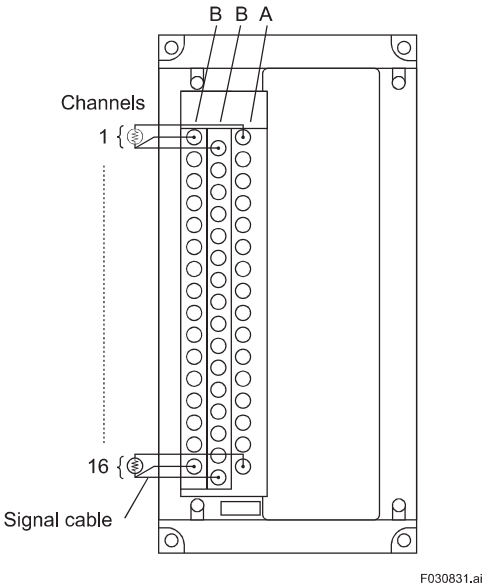



**Figure For RTD Input**

**SEE ALSO** For more information about the types of RTD that can be connected to AAR145-SM☐ and the standards the RTD must conform to, refer to:
"N-IO Node (for RIO System Upgrade)" (GS 33J64F10-01EN)

## Contact input or output of isolated channels

This section describes the signal wiring when the following signals are received or sent:

- When receiving contact signals on ADV159-PM□
- When sending contact signals by ADV559-PM□

The following figure shows the wiring for the preceding cases.

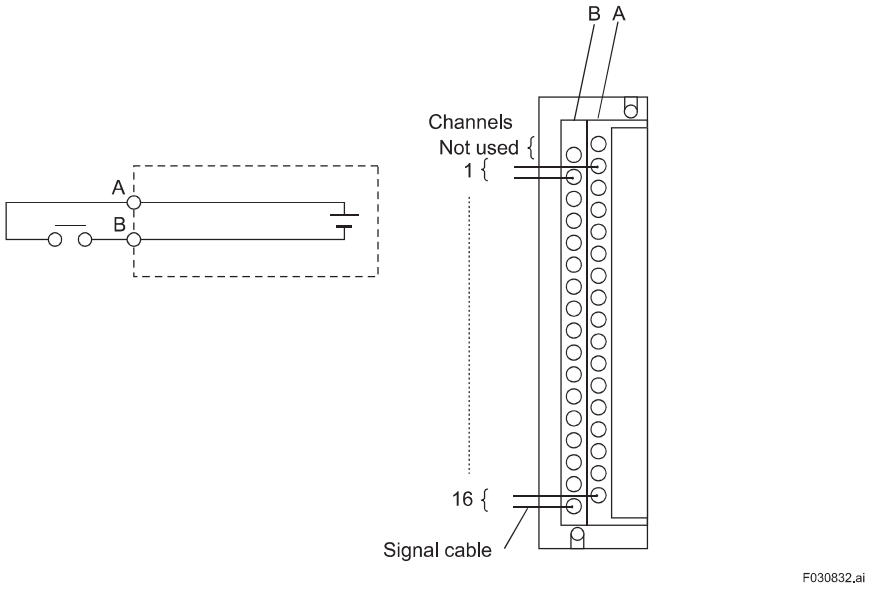



**Figure For contact input or output of isolated channels**

## Isolated contact input or output

This section describes the signal wiring when the following signals are received or sent:

- When receiving contact signals on ADV169-PM☐
- When sending contact signals by ADV569-PM☐

The following figure shows the signal wiring for the preceding signals.

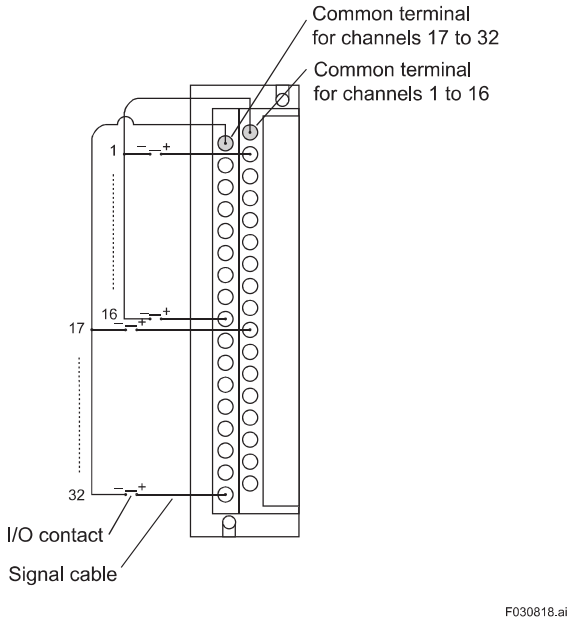



**Figure For isolated contact input or output**

## Relay input

The following figure shows the signal wiring when receiving relay signal input on ADV159-PY☐.

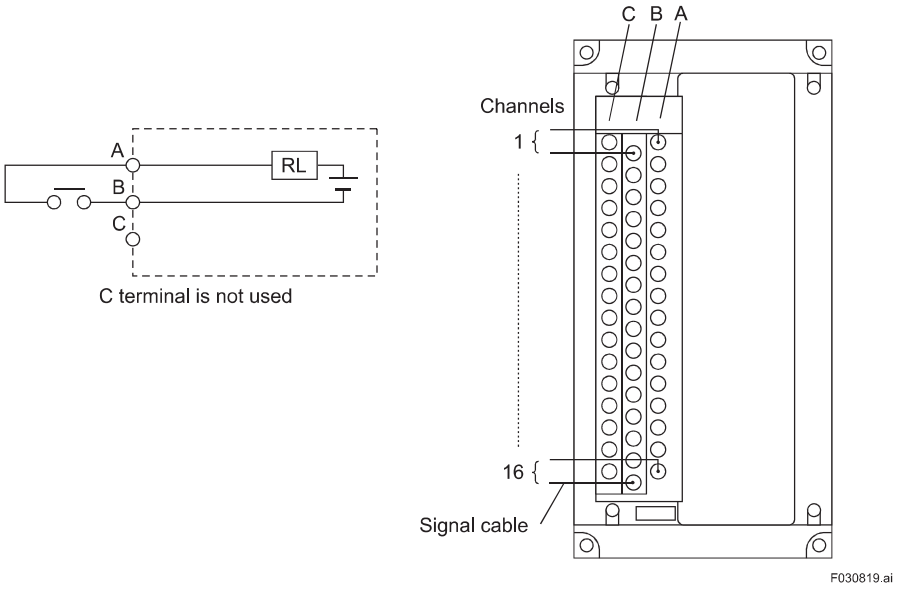



**Figure For relay input**

## Relay output

The following figure shows the signal wiring when sending relay signal output by ADV559-PY☐.

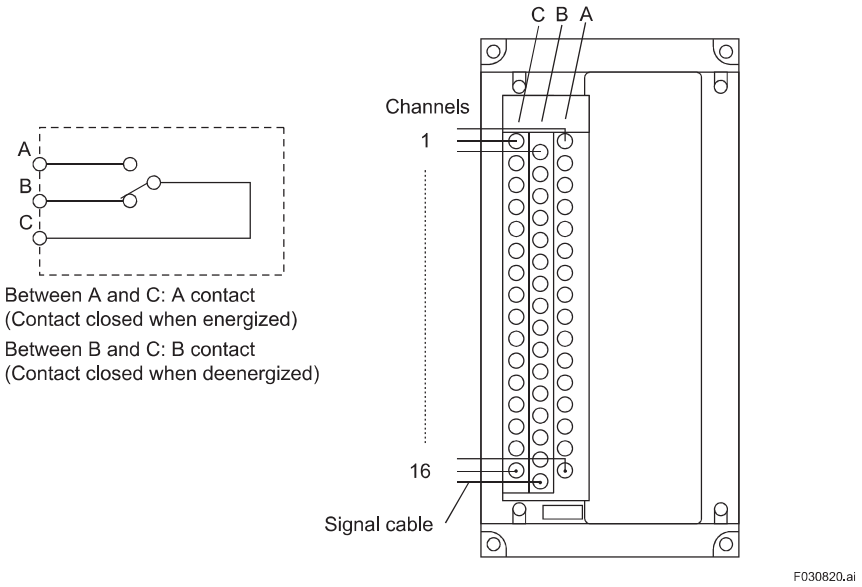



**Figure For relay output**

**CAUTION**

High voltage signals can be connected to ADV559-PY☐.
To prevent electrical shock, shut off the power to the field devices before you install wiring for ADV559-PY☐.

**SEE ALSO**

For more information about the output rating of ADV559-PY☐, refer to:
"N-IO Node (for RIO System Upgrade)" (GS 33J64F10-01EN)

# 3.9 Connecting Bus Cable

## Control Bus (Vnet/IP)

Information on Vnet/IP interface connection and an example of Human Interface Station (HIS) and AFV30D connection are shown below:

### Vnet/IP Interface

- Topology : tree connection
- Configuration : dual redundancy only
- Connector : RJ45 connector
- Intra-domain connection : Layer 2 switch (L2SW) used
- Inter-domain connection : Layer 3 switch (L3SW) used
- Recommended cable : UTP cable of CAT5e or above (optical cable for outdoor use)

### HIS and FCU Connection

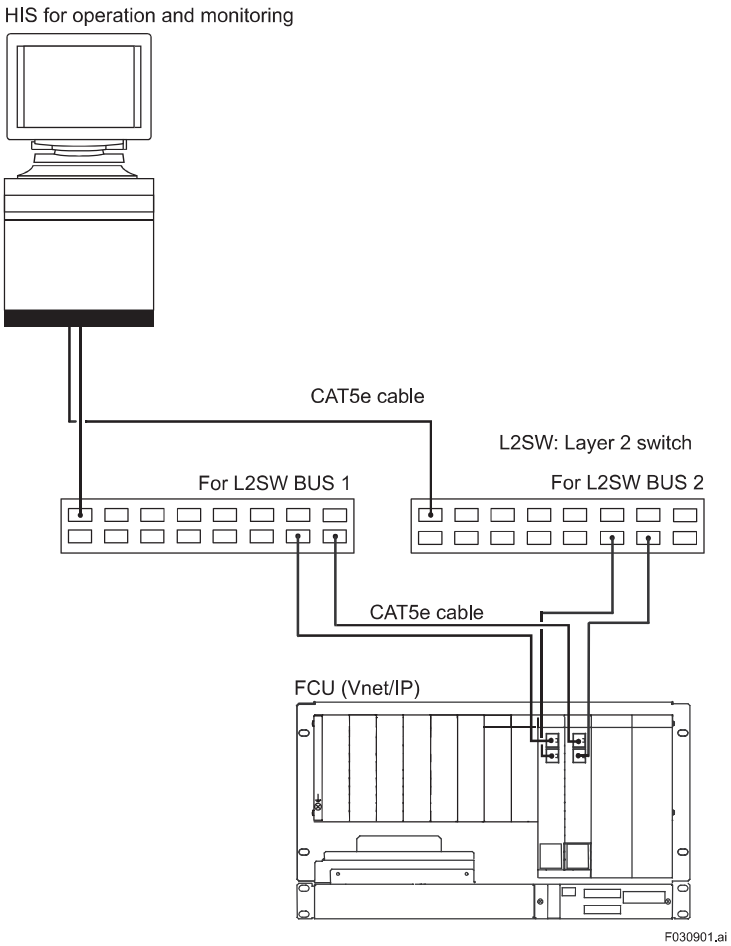



**Figure Example of HIS and FCU Connection**

## Example of Connection between AVR10D and FCU

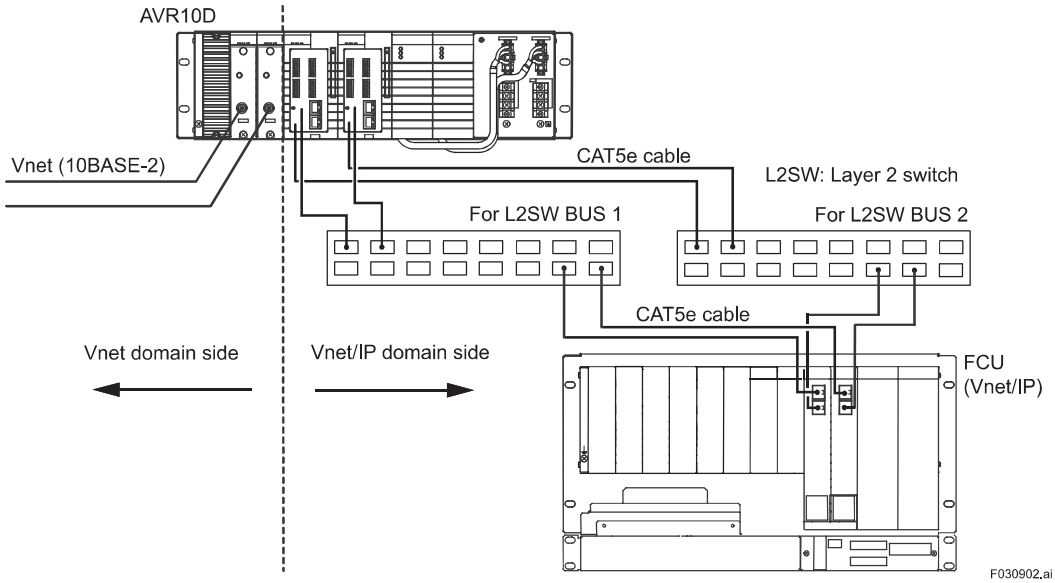



**Figure Example of Connection between AVR10D and FCU**

## Example of Connection between AW810D and FCU

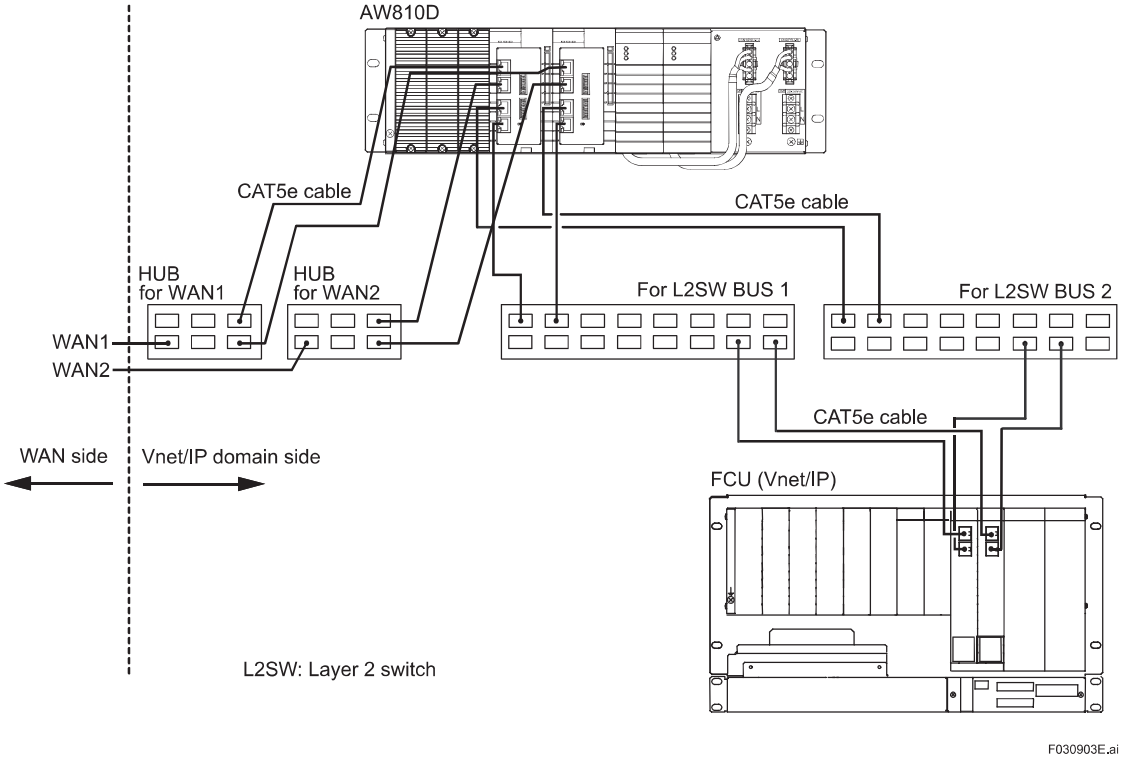



**Figure Example of Connection between AW810D and FCU**

## Differentiation between BUS 1 and BUS 2 (WAN 1 and WAN 2)

Use different colors, etc., to differentiate between BUS 1 and BUS 2 (WAN 1 and WAN 2).

## Destination Display

Attach a display tag at the tip of cables to indicate the station number, switch number, and port number of the destination.

## Cable Fixing

Fix cables securely so that their connectors are not exposed to undue stress.

## Handling of Vnet/IP Cables Connected to the Processor Module (CP461 or CP471)

- Turn the power on after connecting the cables to the CP4☐1.
- When removing the CP4☐1 on-line, remove it with the cable connected to it.
- Before installing the CP4☐1 on-line, connect a cable to it.

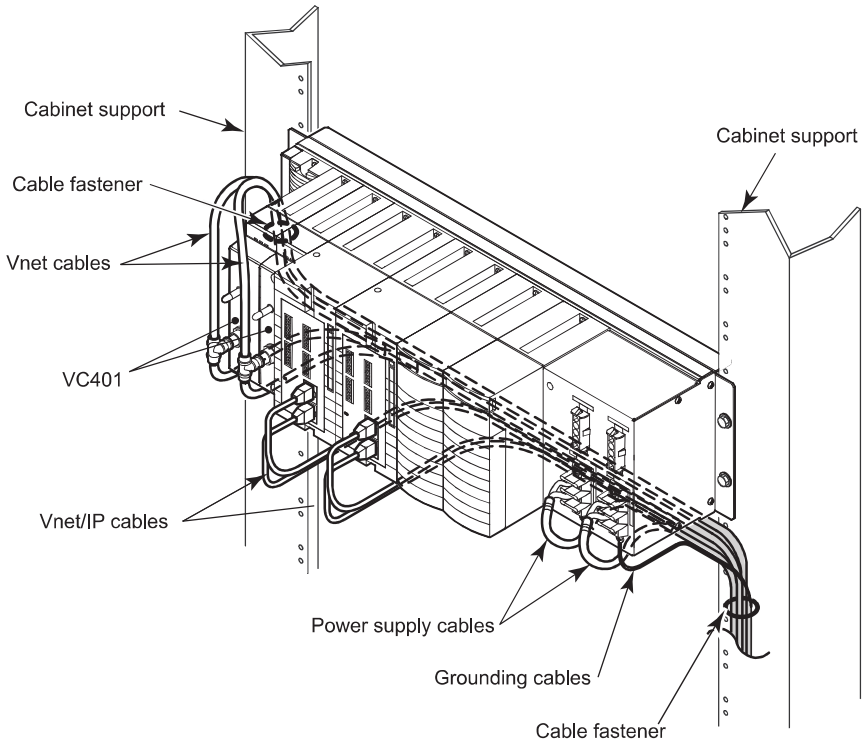
## Handling of Cables Connected to the AVR10D/AW810D

- The power supply should not be turned on unless the cables are connected.
- When online removing the module, the module should be removed together with the connected cables.
- When online installing the module, the cable should be connected to the module first.

## Handling of Cables Connected to the VI702

- The power of the PC should not be turned on until the cables are connected.
- When disconnecting the cables, the power of the PC must be turned off.

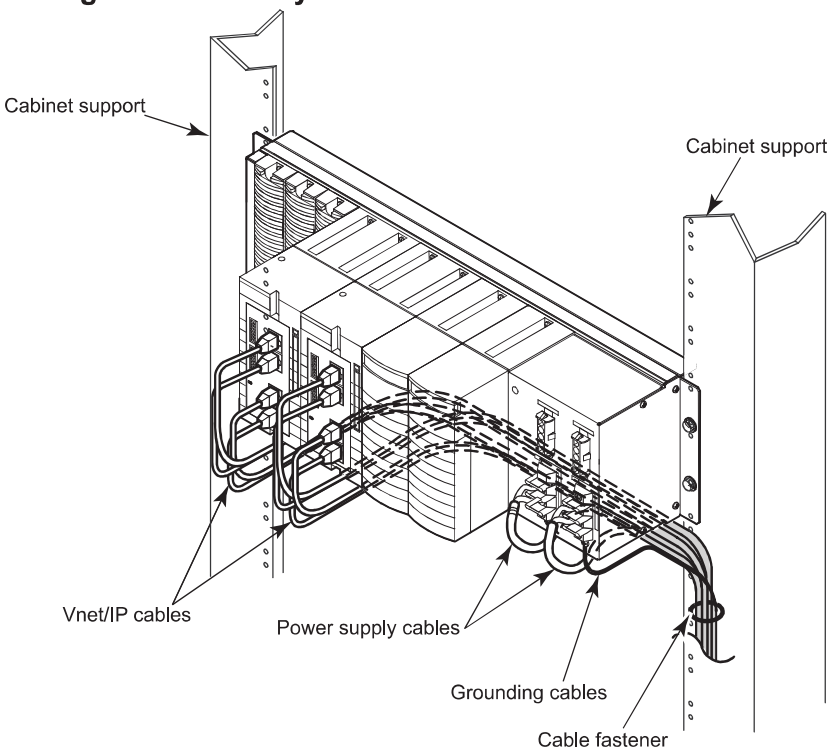
## Cabling for AVR10D System




Use a cable fastener to fix the Vnet cable onto the support on the left side of the VC401. F030904.ai

**Figure Cabling Diagram of the AVR10D System**

## Cabling for AW810D System

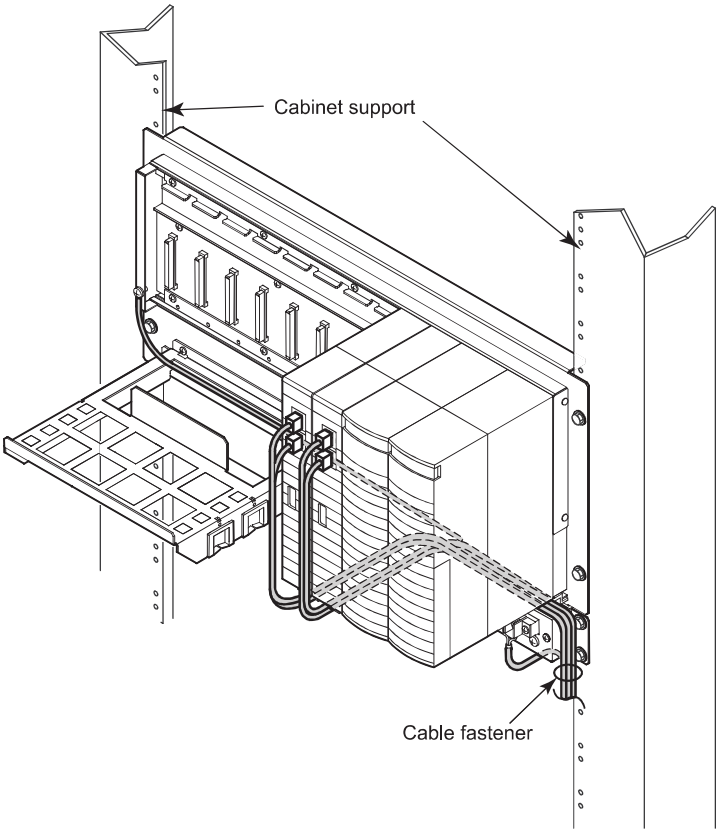



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**Figure Cabling Diagram of the AW810D System**

## Cabling for FCU

**Model: AFV30S/AFV30D, A2FV50S/A2FV50D, A2FV70S/A2FV70D and FCU constructed with A2BE1D**

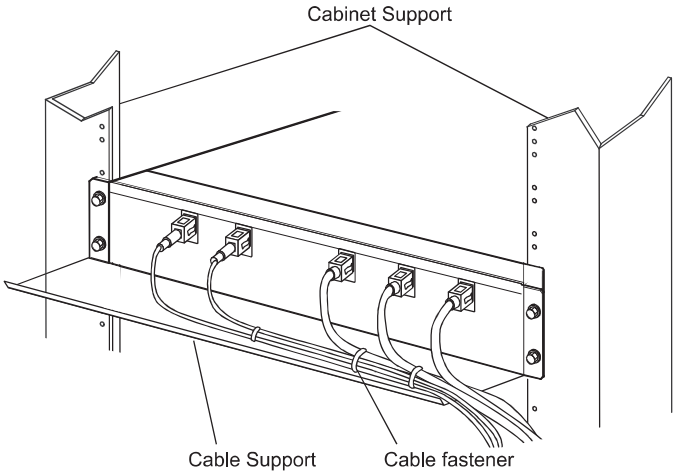



Use a cable fastener to fix cables onto the support.

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**Figure Cabling Diagram for FCU**

## Cabling for L2SW/L3SW




Fix cables to cable support by using cable fastener so that their connectors are not exposed to undue stress.

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**Figure Vnet/IP Cabling Diagram for the L2SW/L3SW**

## N-ESB Bus (N-IO System)

The following figure shows a connection example of the N-ESB bus.

Connect UTP Cable of Cat5e (two) from N-ESB Bus Coupler Module (A2EN402, A2EN404) to N-ESB Bus Module (A2EN501).

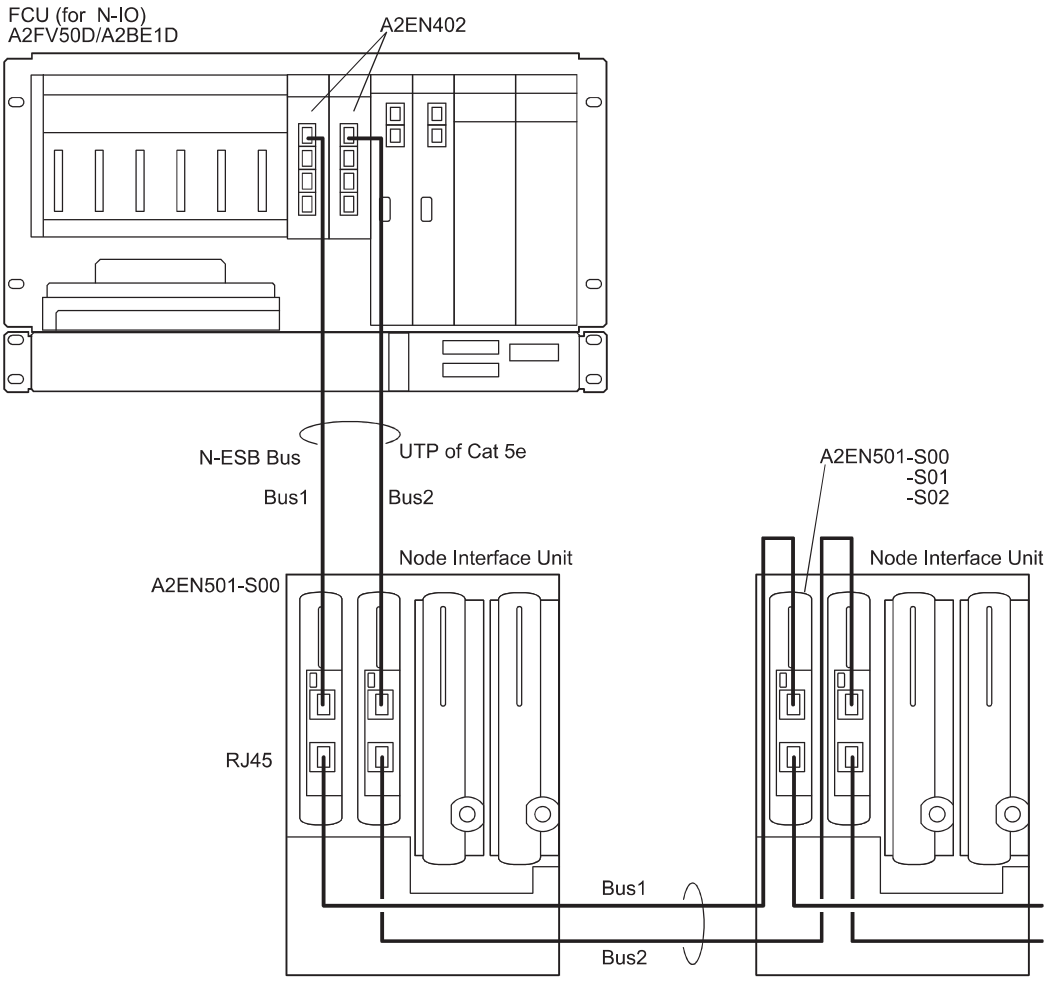
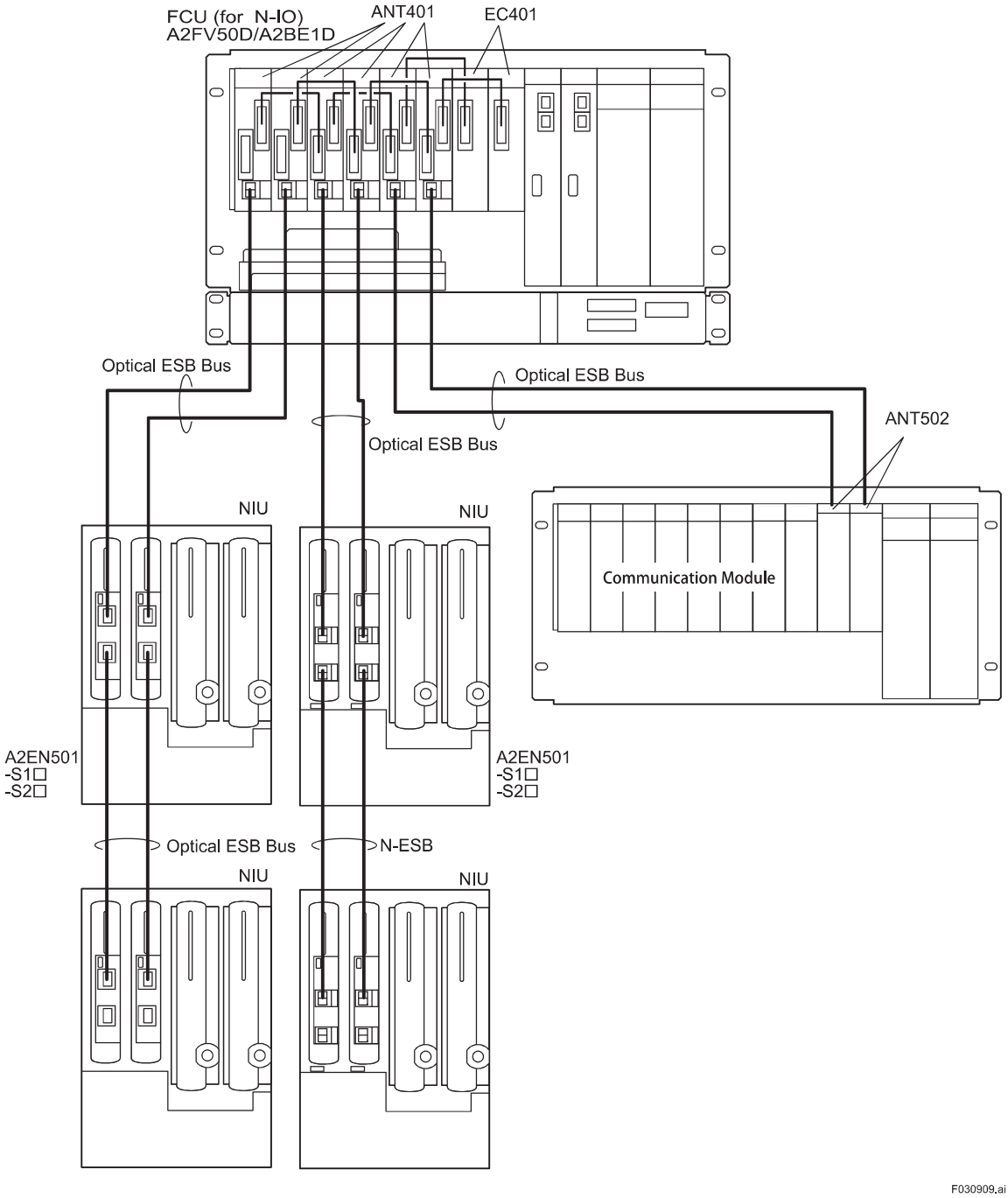



**Figure Example of N-ESB Bus Connection**


FCU (for N-IO)
A2FV50D/A2BE1D
ANT401
EC401
Optical ESB Bus
Optical ESB Bus
Optical ESB Bus
ANT502
NIU
NIU
Communication Module
A2EN501
-S1□
-S2□
A2EN501
-S1□
-S2□
Optical ESB Bus
N-ESB
NIU
NIU
F030909.ai

## ESB Bus

The following is an example of connecting an ESB bus.
Either ESB Bus Adapter (Connector unit for ESB Bus) A2EE1A-N or ESB Bus Adapter (Connector unit with terminator for ESB Bus) A2EE1A-T must be mounted to SB401 installed in ESB bus node unit. If a node unit is connected next, select ESB Bus Adapter (Connector unit for ESB Bus) A2EE1A-N. If the node unit is the last one, select ESB Bus Adapter (Connector unit with terminator for ESB Bus) A2EE1A-T.

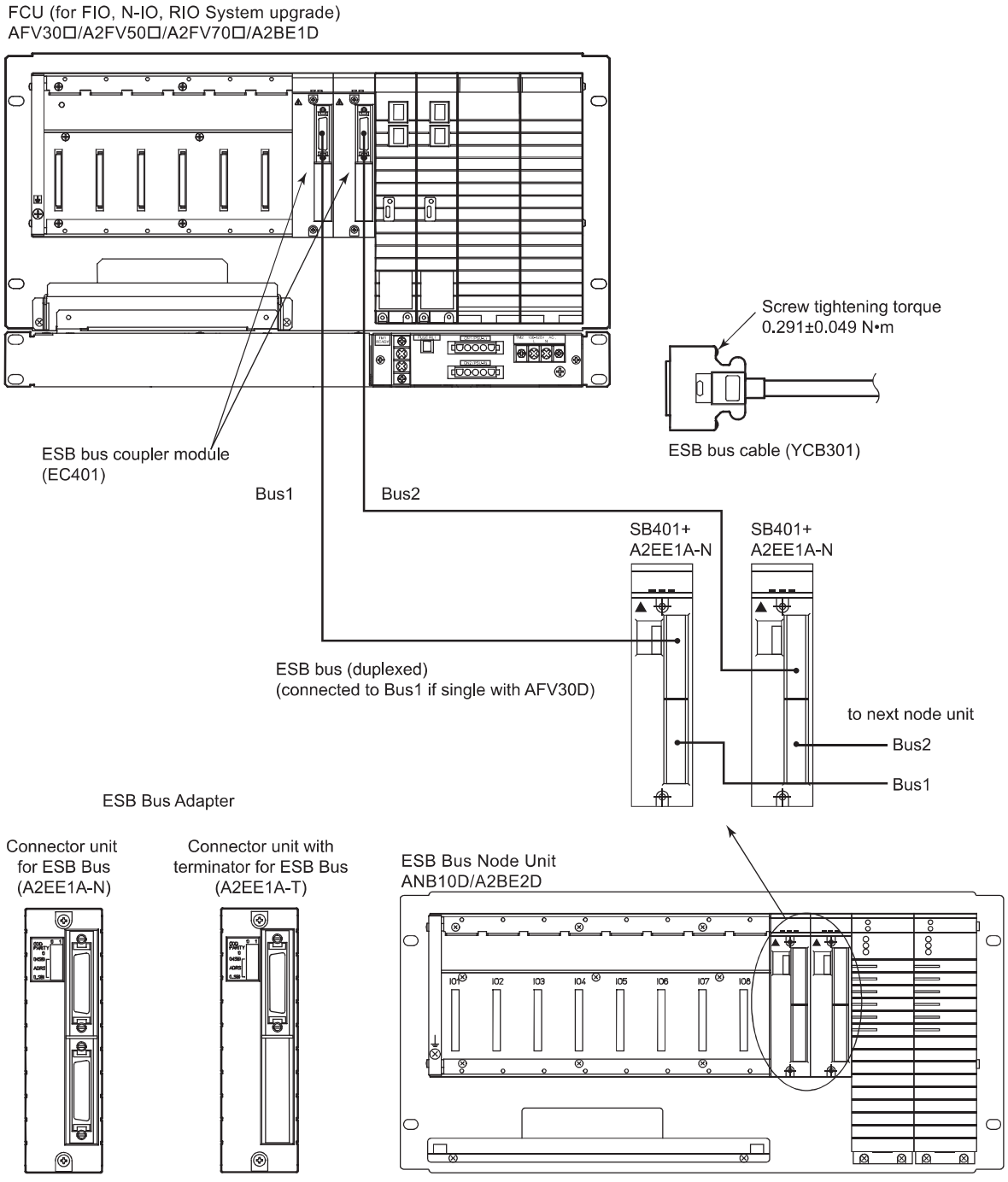



**Figure ESB bus Connection (Example of FIO Node Expansion /N-IO Communication Node Expansion)**

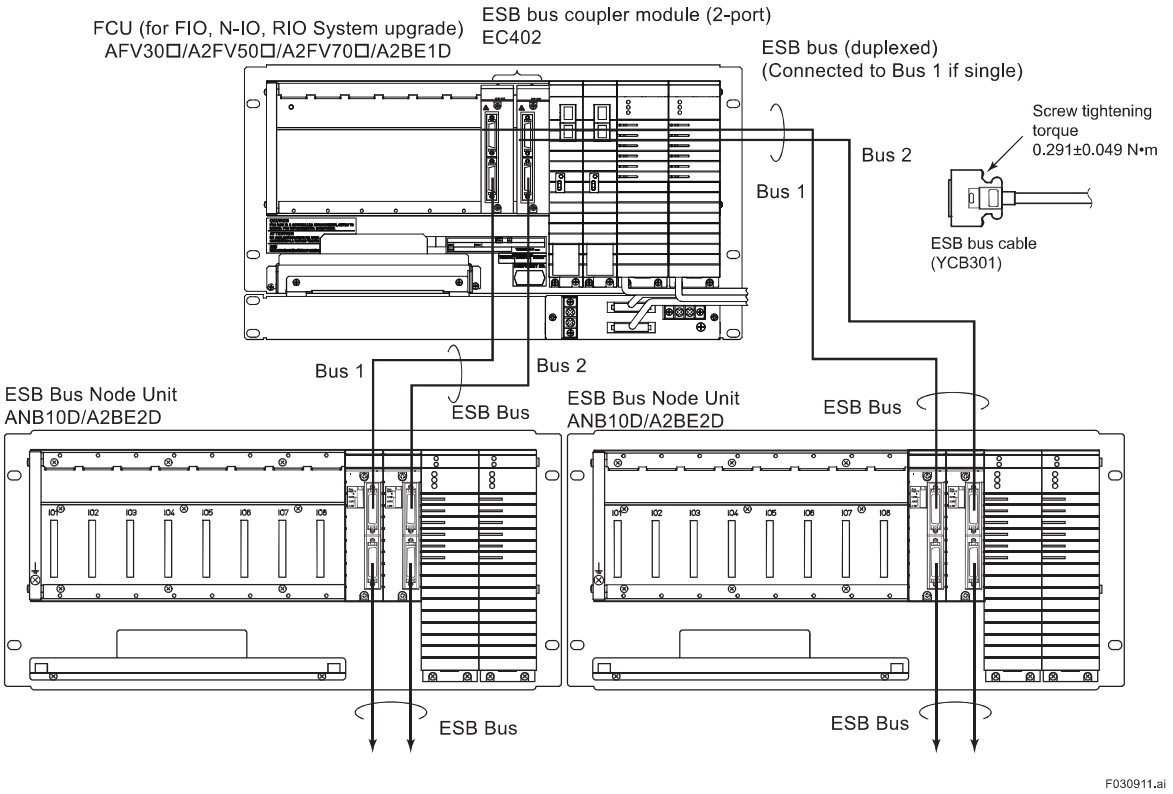



**Figure ESB bus connection (When FIO Node Expansion N-IO Communication Node Expansion)**

## Optical ESB Bus (N-IO System )

The following figure shows a connection example of the optical ESB Bus of the N-IO system.

Use a N-ESB Bus Module (A2EN501) equipped with an optical module to connect between an NIU and NIU

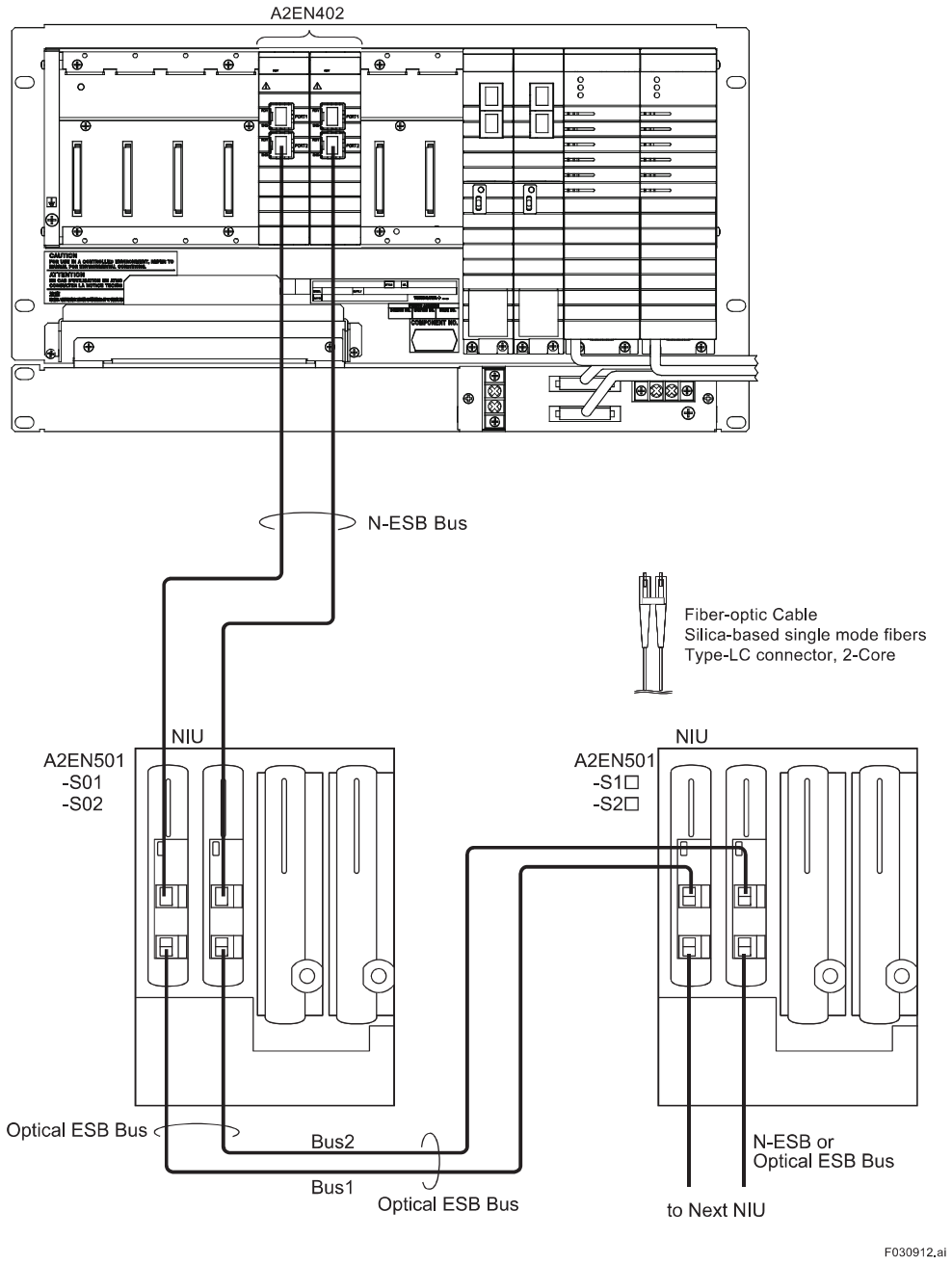



**Figure Optical ESB Bus (N-IO) Connection (When Chain Connection)**

## Optical ESB Bus (FIO system)

The following figure shows a connection example of the optical ESB bus repeater. The optical ESB bus repeater master module (ANT401/ANT411) is connected to the optical ESB bus repeater slave module (ANT502/ANT512) using a 2-core optical fiber cable. Two 2-core cables are used for dual redundancy.

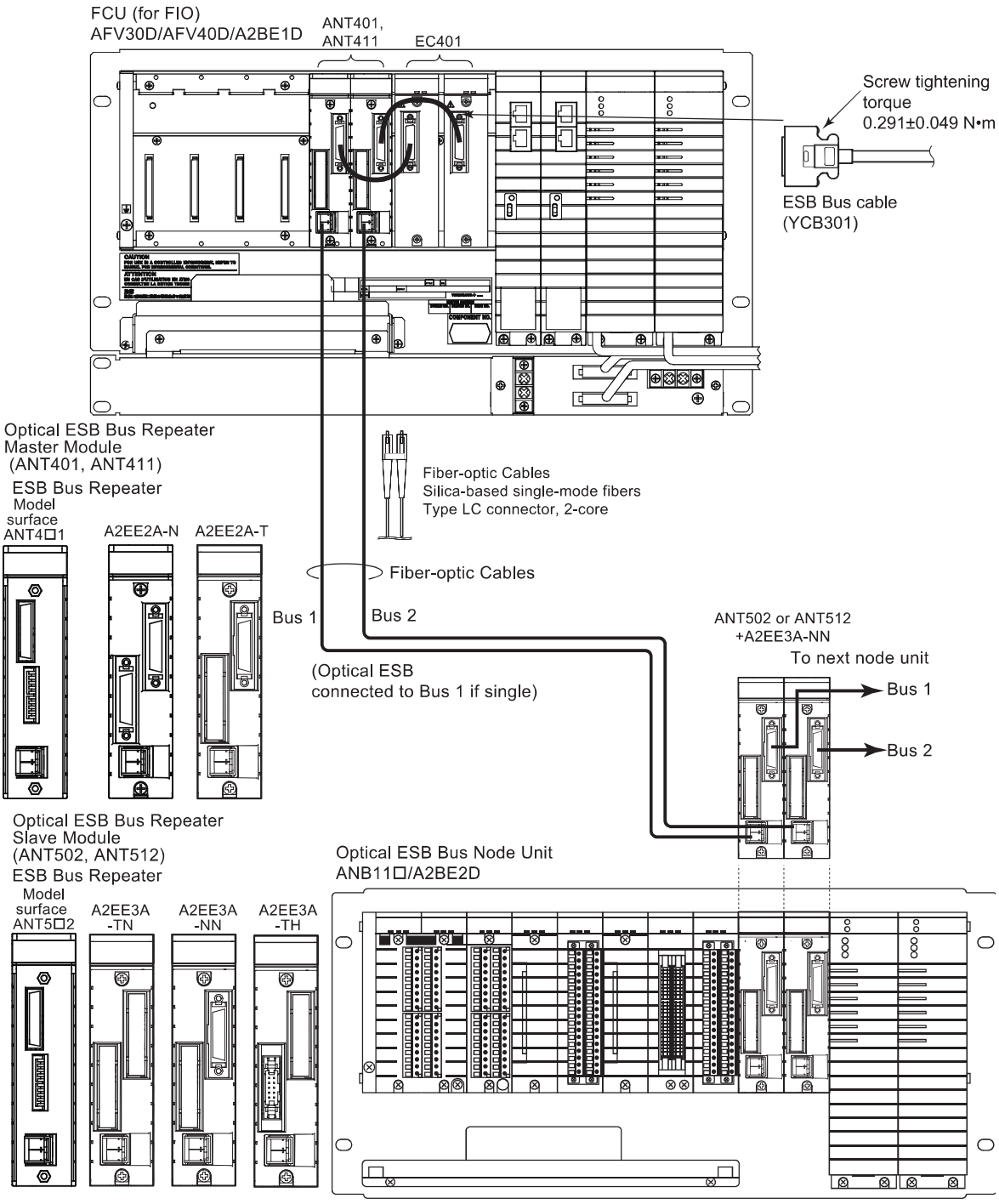



**Figure Optical ESB bus repeater connection (FIO system)**

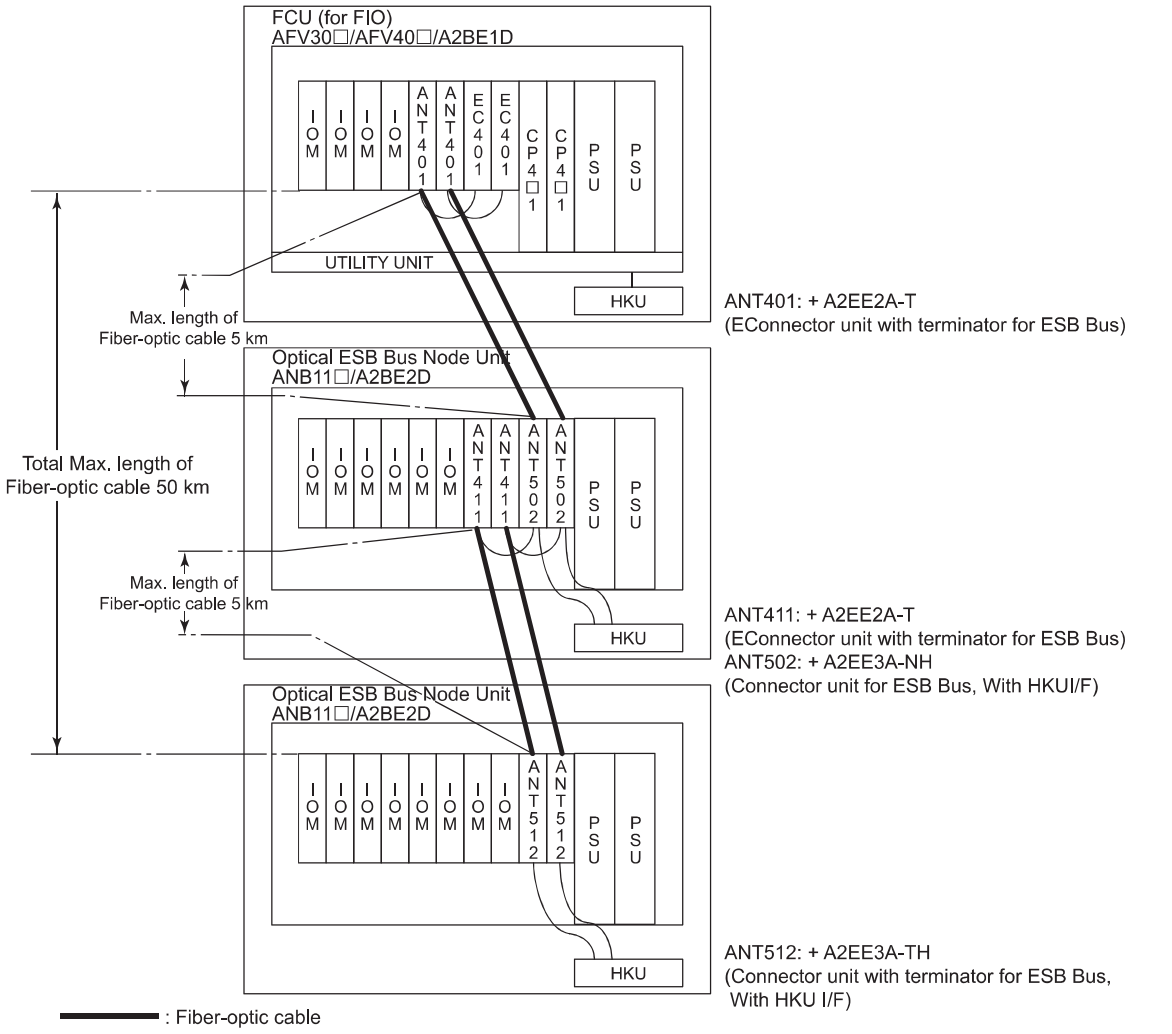



**Figure Example of Optical ESB Bus Chain Connection Using HK Function**

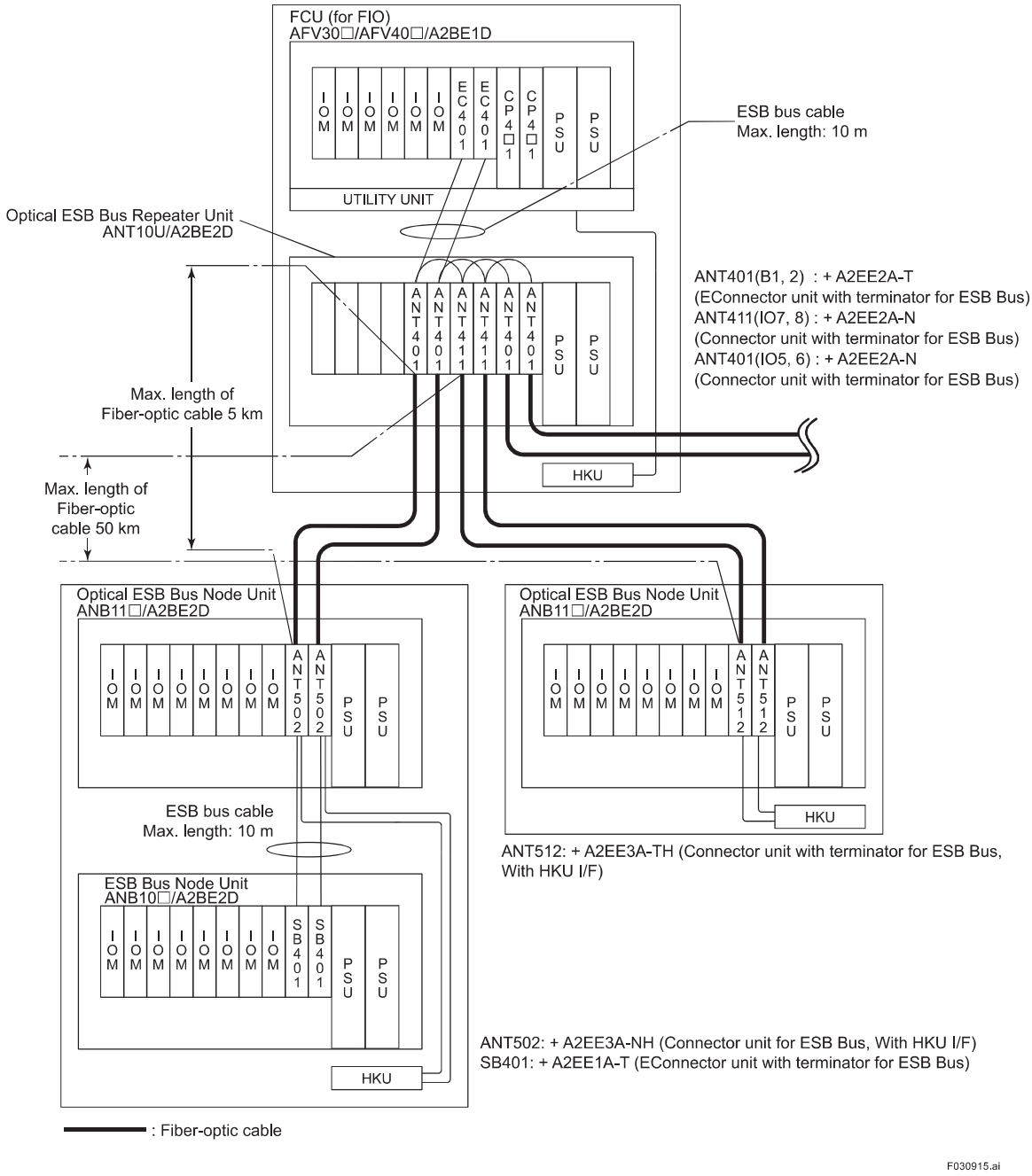



**Figure Example of Optical ESB Bus Star Connection Using HK Function**

## Specifications of Fiber-optic Cables Used in Optical ESB Bus Repeater Modules

The table below shows the specifications of the fiber-optic cables used in optical ESB bus repeater modules.

**Table Specifications of Fiber-optic Cables Used in Optical ESB Bus Repeater Modules**

| Item | Specification |
|---|---|
| Connector | Type LC connector (IEC 61754-20-compliant product) |
| Cable | Silica-based single-mode fibers (JIS C6835 SSMA-9.3/125, IEC 60793-2-50B1.1) |
| Number of cores used | Two |

Note: If light attenuation between ANT411 and ANT512 is less than 3 dB, increase attenuation by 3 dB using an attenuator.

The fiber-optic cables should be selected what the rating temperature is the ambient temperature plus 20 °C or more.

Lay fiber-optic cables according to the manufacturer's cable handling precautions such as allowable bending radius.

Secure and wire the fiber-optic cables so as not to put extra stress on the cable trays in the units listed below:

- Field control unit
- Node Unit
- Unit for optical bus repeater module

## F-SB Bus (for N-IO Node)

The following figure shows a conne

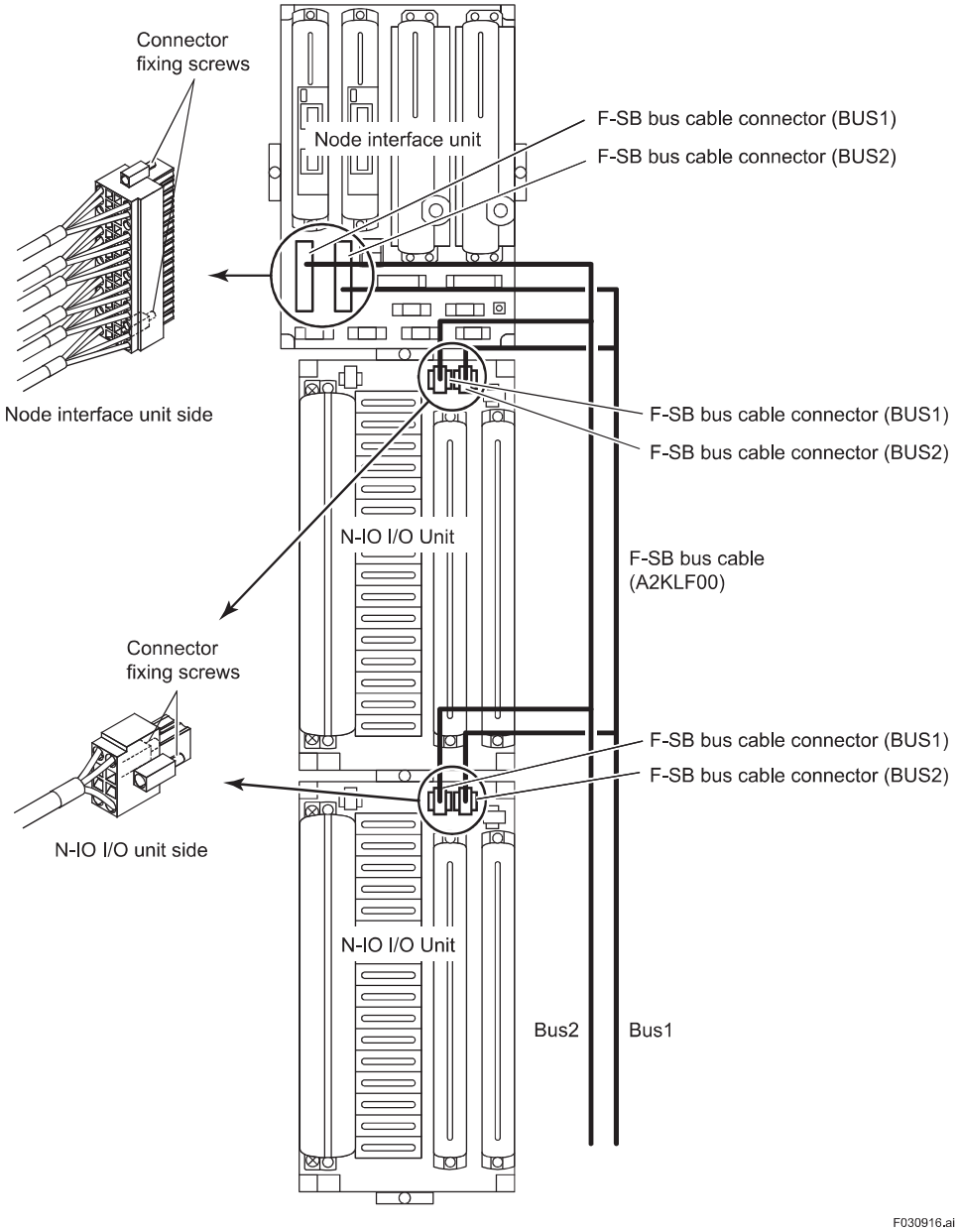



**Figure F-SB Bus Connection**

## IMPORTANT

When connecting a F-SB bus cable to N-IO node, ensure to keep the minimum bending radius of the cable.

The minimum bending radius of the F-SB bus cable is six-fold of the diameter of the cable.

# 3.10 House Keeping Unit Connection (FIO system)

## Cabinet Utility Kit (ACUKT1/A2CUKT4)

The following shows an HKU wiring example of the Cabinet Utility Kit (ACUKT1/A2CUKT4).

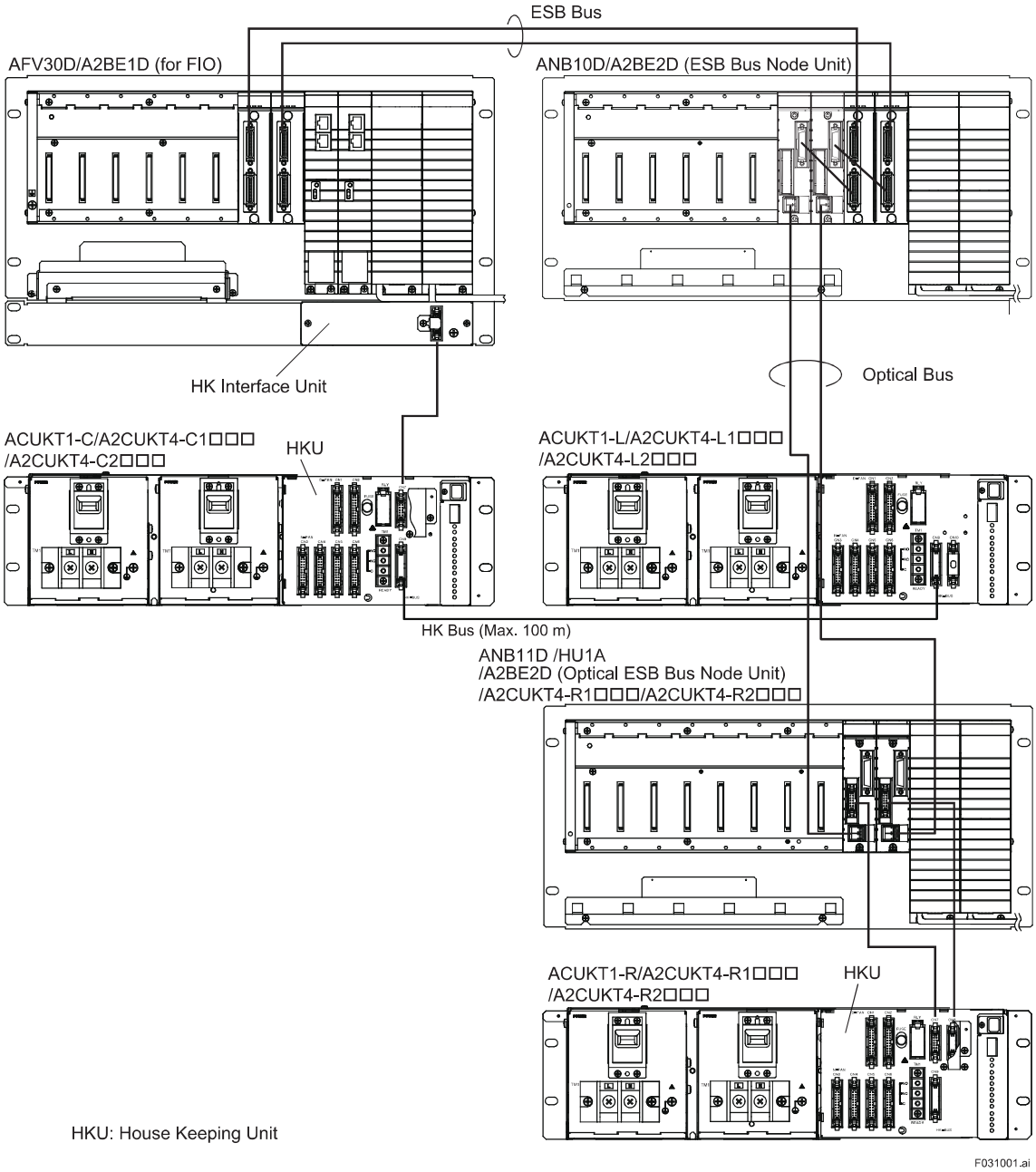



**Figure HKU Connection of ACUKT1/A2CUKT4**

# 3.11 Alarm and Contact Output Cabling

**IMPORTANT**

To ensure this system compliance with the CSA safety standards, all devices connected to this system shall be CSA certified devices.

## Status Contact Output Connection

Each CENTUM VP device is provided with a terminal which makes contact output to external if a power failure or processor failure is detected. The output contact rating of each device is shown below.

**Table Status Contact Output**

| Device | Status Contact Output | Contact Rating |
|---|---|---|
| AFV30S/AFV30D (19-inch Rock Mountable Type) | Power and processor failure | 30 V DC, 0.3 A |
| AFV40S/AFV40D (with Cabinet) | Power and processor failure | 250 V AC/30 V DC, 2 A, 125 VA |
| A2FV50S/A2FV50D | Power and processor failure | 30 V DC, 0.3 A |
| A2FV70S/A2FV70D | Power and processor failure | 30 V DC, 0.3 A |
| MHM/MHC | Power | 30 V DC, 0.3 A |
| ACB51 | Fan, fan power supply or cabinet temperature fault | 250 V AC/30 V DC, 2 A, 125 VA |
| ACUKT1 (with AFV30□) | Power and processor failure | 250 V AC/30 V DC, 2 A, 125 VA |
| ACUKT1 (without AFV30□) | Fan, fan power supply or cabinet temperature fault | |
| A2FU2 | Power and processor failure | 30 V DC, 0.3A |
| A2CUKT4-C□□□□ | Power and processor failure | 250 V AC/30 V DC, 2A, 125 VA |
| A2CUKT4-L□□□□/A2CUKT4-R□□□□ | Fan, fan power supply or cabinet temperature fault | 250 V AC/30 V DC, 2A, 125 VA |

## Use of Lamps

When you want to turn on lamps using contacts, use the following lamps:

- The rated voltage of lamp does not exceed the rated contact voltage.
- When using incandescent lamps, their rush current does not exceed the rated contact current. It is considered to be 10 to 15 times the rated current. If the rush current exceed the rated contact current, use a dim lamp resister or a rush current preventing resistor. It is recommended to use a dim lamp resistor using 40 to 50 % of the lamp current rating, or a rush current preventing resistor using 80 to 90 % of the lamp current rating. A dim lamp resistor permits detection of lamp failure.

Be sure to test the lamp before installation.

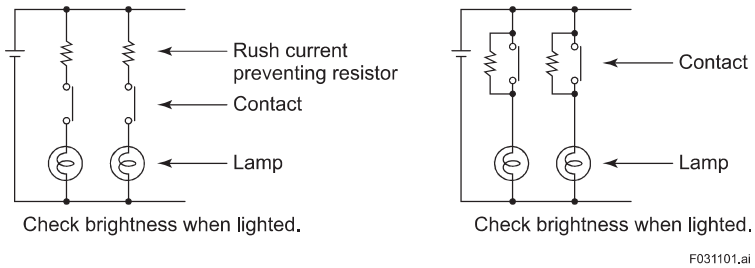



**Figure Examples of Using Lamps**

## Use of Relays

Contact protection and surge absorption can be provided in various manners. When using contacts output to drive relays and solenoids, the following precautions should be taken:

- Install a diode in parallel to induction load for noise prevention and contact protection.
- Use a relay circuit with voltage rating as low as possible for increased reliability.
- Select a diode having a reverse withstand voltage which is 10 times or larger than a circuit voltage and a forward current which exceeds a load current.

**IMPORTANT**

Relays and solenoids cause reverse electromotive voltages at both coil ends due to inductive load. This phenomenon causes contact damage or noise, leading to device errors and adversely affecting the entire system.

### When a DC Power Supply Is Used

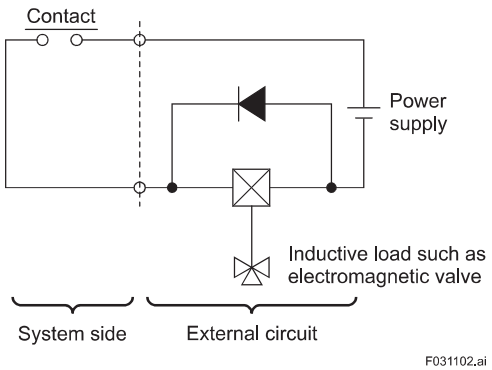
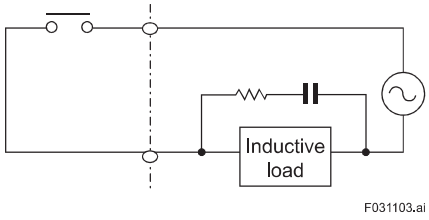



**Figure Example of Using Diode for Contact Protection**

### When a AC (or DC) Power Supply Is Used

- Shunt the load with a resistor (R) and a capacitor (C).
- The recovery time increases when using relays or solenoid valves.




Note: Avoid direct AC voltage input to the contact output terminal on 19-inch rack mountable type.

**Figure Example of Capacitor/Resistor-protected Circuit**

# 3.12 Connecting input devices such as operation keyboard

When connecting the input devices such as an operation keyboard, a mouse, or a keyboard, please note the following instructions for wiring.

- Keep signal cables of the input devices and power cables of PCs or LCD monitors physically segregated (do not bundle cables together).
- Do not pull the unlocked type connector with excess strength, or it may get loose.
- When the connector is pulled off for cleaning or something, put it back in to the same port.
- Pulling off an USB connector while it is powered on for replacing the operation keyboard, please note that the system operation and monitoring functions may be interrupted.

# 4. Installation Specifications

**This section summarizes power consumption, in-rush current, breaker ratings, parts durability and other data for the installation of CENTUM VP system.**

## Electrical Specifications

Power consumption (current) and other electrical data are shown below:

**Table Electrical Specifications (1/3)**

| Equipment | Input-voltage range | | Max. power consumption (VA, A, W) (*1) | Heating value J/h (*2) |
|---|---|---|---|---|
| | Voltage (V AC) | Frequency (Hz) | | |
| AFV30S Field Control Unit | 100-120 | 50/60±3 | 200 VA | $432 \times 10^3$ (120 W) |
| | 220-240 | | 230 VA | |
| | 24 V DC | | 5.5 A | |
| AFV30D Duplexed Field Control Unit | 100-120 | 50/60±3 | 200 VA | $432 \times 10^3$ (120 W) |
| | 220-240 | | 230 VA | |
| | 24 V DC | | 5.5 A | |
| AFV40S Field Control Unit (at maximum installation of FIO) | 100-120 | 50/60±3 | 2500 VA | $5400 \times 10^3$ (1500 W) |
| | 220-240 | | 2860 VA | |
| | 24 V DC | | 71 A | |
| AFV40D Duplexed Field Control Unit (at maximum installation of FIO) | 100-120 | 50/60±3 | 2500 VA | $5400 \times 10^3$ (1500 W) |
| | 220-240 | | 2860 VA | |
| | 24 V DC | | 71 A | |
| A2FV50S 19-inch Rack Mountable Type Field Control Unit for FIO (at maximum installation of FIO) | 100-120 | 50/60±3 | 200 VA | $432 \times 10^3$ (120 W) |
| | 220-240 | | 230 VA | |
| | 24 V DC | | 5.5 A | |
| A2FV50D 19-inch Rack Mountable Type Duplexed Field Control Unit for FIO (at maximum installation of FIO) | 100-120 | 50/60±3 | 200 VA | $432 \times 10^3$ (120 W) |
| | 220-240 | | 230 VA | |
| | 24 V DC | | 5.5 A | |
| A2FV70S Field Control Unit (at maximum installation of FIO) | 100-120 | 50/60±3 | 200 VA | $432 \times 10^3$ (120 W) |
| | 220-240 | | 230 VA | |
| | 24 V DC | | 5.5 A | |
| A2FV70D Field Control Unit (at maximum installation of FIO) | 100-120 | 50/60±3 | 200 VA | $432 \times 10^3$ (120 W) |
| | 220-240 | | 230 VA | |
| | 24 V DC | | 5.5 A | |
| ANB10S ESB Bus Node Unit (at maximum installation of FIO) | 100-120 | 50/60±3 | 200 VA | $432 \times 10^3$ (120 W) |
| | 220-240 | | 230 VA | |
| | 24 V DC | | 5.5 A | |
| ANB10D Duplexed ESB Bus Node Unit (at maximum installation of FIO) | 100-120 | 50/60±3 | 200 VA | $432 \times 10^3$ (120 W) |
| | 220-240 | | 230 VA | |
| | 24 V DC | | 5.5 A | |
| ANB11S Node Unit for Single ESB Bus with Optical Repeater (at maximum installation of FIO) | 100-120 | 50/60±3 | 200 VA | $432 \times 10^3$ (120 W) |
| | 220-240 | | 230 VA | |
| | 24 V DC | | 5.5 A | |

*1: Power consumption in steady operation is indicated in VA (AC), A (DC) or W (DC). When power consumption varies according to the installed number of equipment, power consumption by the maximum number of units installed is listed.

*2: Heating value in steady operation is indicated in Joule/hour. When heating value varies according to the installed number of equipment, heating value by the maximum number of units installed is listed.

**Table Electrical Specifications (2/3)**

| Equipment | Input-voltage range | | Max. power consumption (VA, A, W) (*1) | Heating value J/h (*2) |
|---|---|---|---|---|
| | Voltage (V AC) | Frequency (Hz) | | |
| ANB11D Node Unit for Dual-Redundant ESB Bus with Optical Repeater (at maximum installation of FIO) | 100-120 | 50/60±3 | 200 VA | $432 \times 10^3$ (120 W) |
| | 220-240 | | 230 VA | |
| | 24 V DC | | 5.5 A | |
| ANT10U Unit for Optical ESB Bus Repeater Module (at maximum installation of FIO) | 100-120 | 50/60±3 | 200 VA | $432 \times 10^3$ (120 W) |
| | 220-240 | | 230 VA | |
| | 24 V DC | | 5.5 A | |
| ACB51 I/O Expansion Cabinet (at maximum installation of FIO) | 100-120 | 50/60±3 | 2500 VA | $5400 \times 10^3$ (1500 W) |
| | 220-240 | | 2860 VA | |
| | 24 V DC | | 71 A | |
| AVR10D Duplexed Vnet Router | 100-120 | 50/60±3 | 80 VA | $158 \times 10^3$ (44 W) |
| | 220-240 | | 110 VA | |
| | 24 V DC | | 1.7 A | |
| ACUKT1 Cabinet Utility Kit (at maximum installation of FIO) | 100-120 | 50/60±3 | 2900 VA | $6264 \times 10^3$ (1740 W) |
| | 220-240 | | 3320 VA | |
| | 24 V DC | | 82 A | |
| ACUKT1 Cabinet Utility Kit (excluding node) | 100-120 | 50/60±3 | 100 VA | $216 \times 10^3$ (60 W) |
| | 220-240 | | 100 VA | |
| | 24 V DC | | 5 A | |
| AW810D Wide Area Communication Router | 100-120 | 50/60±3 | 80 VA | $158 \times 10^3$ (44 W) |
| | 220-240 | | 110 VA | |
| | 24 V DC | | 1.7 A | |
| A2NN10D Node Interface Unit | 100-240 | 50/60±3 | 320 VA | $540 \times 10^3$ (150 W) |
| | 24 V DC | | 180 W | |
| A2NN30D Node Interface Unit | 100-240 | 50/60±3 | 190 VA | $98 \times 10^3$ (150 W) |
| | 24 V DC | | 150 W | |
| A2BE1D (Installing CP471, PW48☐ and FIO) Field Control Unit (at maximum installation of module) | 24 V DC | | 28.8 W | $58 \times 10^3$ (16 W) |
| A2BE2D (Installing PW48☐ and FIO) FIO Node Unit (at maximum installation of module) | 100-120 | 50/60±3 | 200 VA | $432 \times 10^3$ (120 W) |
| | 220-240 | | 230 VA | |
| | 24 V DC | | 5.5 A | |
| A2BE2D (Installing PW48☐ and Optical ESB Bus repeater module) Optical ESB Bus Repeater Unit (at maximum installation of module) | 100-120 | 50/60±3 | 200 VA | $432 \times 10^3$ (120 W) |
| | 220-240 | | 230 VA | |
| | 24 V DC | | 5.5 A | |
| A2BE2D (Installing PW48☐ and Optical ESB Bus repeater module) Optical ESB Bus Repeater Unit (at maximum installation of module) | 100-120 | 50/60±3 | 200 VA | $432 \times 10^3$ (120 W) |
| | 220-240 | | 230 VA | |
| | 24 V DC | | 5.5 A | |
| A2CUKT4-☐3☐☐☐ Cabinet Utility Kit (at maximum installation of module, for Standard Cabinet A2CAB1) | 100-120 | 50/60±3 | 2500 VA | $5400 \times 10^3$ (1500 W) |
| | 220-240 | | 2860 VA | |
| | 24 V DC | | 71 A | |

*1: Power consumption in steady operation is indicated in VA (AC), A (DC) or W (DC). When power consumption varies according to the installed number of equipment, power consumption by the maximum number of units installed is listed.

*2: Heating value in steady operation is indicated in Joule/hour. When heating value varies according to the installed number of equipment, heating value by the maximum number of units installed is listed.

**Table Electrical Specifications (3/3)**

| Equipment | Input-voltage range | | Max. power consumption (VA, A, W) (*1) | Heating value J/h (*2) |
|---|---|---|---|---|
| | Voltage (V AC) | Frequency (Hz) | | |
| A2CUKT4-□1□□□, A2CUKT4-□2□□□ Cabinet Utility Kit (at maximum installation of module, for Rittal Cabinet) | 100-120 | 50/60±3 | 2900 VA | $6264 \times 10^3$ (1740 W) |
| | 220-240 | | 3320 VA | |
| | 24 V DC | | 82 A | |
| A2CUKT4 Cabinet Utility Kit (excluding node) | 100-120 | 50/60±3 | 100 VA | $216 \times 10^3$ (60 W) |
| | 220-240 | | 100 VA | |
| | 24 V DC | | 5 A | |

*1: Power consumption in steady operation is indicated in VA (AC), A (DC) or W (DC). When power consumption varies according to the installed number of equipment, power consumption by the maximum number of units installed is listed.

*2: Heating value in steady operation is indicated in Joule/hour. When heating value varies according to the installed number of equipment, heating value by the maximum number of units installed is listed.

## Actual Power-On In-Rush Current of Each Component

Actual in-rush current data measured for each component is listed below:

**Table System Equipment Power-On In-Rush Current**

| Model | | In-Rush current (A) | | In-Rush current (A) | | In-Rush current (A) | |
|---|---|---|---|---|---|---|---|
| | | 100 V AC | | 220 V AC | | 24 V DC | |
| | | Primary | Secondary | Primary | Secondary | Primary | Secondary |
| AFV30S | FCU (rack mountable type) | 62 | 5 | 124 | 5 | 30 | 23 |
| AFV30D | Duplexed FCU (rack mountable type) | 62 | 5 | 124 | 5 | 30 | 23 |
| AFV40S | FCU with Cabinet (with Maximum no. of node units installed) | 344 | 180 | 540 | 132 | 120 | 170 |
| AFV40D | FCU with Cabinet (with Maximum no. of node units installed) | 344 | 180 | 540 | 132 | 120 | 170 |
| A2FV50S | FCU (19-inch rack mountable type) | 62 | 5 | 124 | 5 | 30 | 23 |
| A2FV50D | Duplexed FCU (19-inch rack mountable type) | 62 | 5 | 124 | 5 | 30 | 23 |
| A2FV70S/D | FCU (rack mountable type) | 62 | 5 | 124 | 5 | 30 | 23 |
| AVR10D | Duplexed V net router | 47 | 1 | 48 | 0.5 | 10 | 2 |
| ACB51 | I/O Expansion Cabinet (With maximum no. of node units installed) | 344 | 180 | 540 | 132 | 120 | 170 |
| ANB10S/D | Node Unit for ESB Bus | 62 | 5 | 124 | 5 | 30 | 23 |
| ANB11S/D | Optical ESB Bus Node Unit | 62 | 5 | 124 | 5 | 30 | 23 |
| AVR10D | Duplexed V net Router | 47 | 1 | 48 | 0.5 | 10 | 2 |
| AW810D | Wide Area Communication Router | 47 | 1 | 48 | 0.5 | 10 | 2 |
| A2NN10D | Node Interface Unit | 40 | — | 80 | — | 60 | — |
| A2NN30D | Node Interface Unit | 40 | — | 80 | — | 60 | — |
| A2PW503 | Power Supply Unit (100-240 V AC) | 20 | — | 40 | — | — | — |
| A2PW504 | Power Supply Unit (24 V DC) | — | — | — | — | 30 | — |
| A2BE1D | Field Control Unit (Installing CP471, PW48□ and FIO) | 62 | 5 | 124 | 5 | 30 | 23 |
| A2BE2D | FIO Node Unit (Installing PW48□ and FIO) | 62 | 5 | 124 | 5 | 30 | 23 |
| A2BE2D | Optical ESB Bus Repeater Unit (Installing PW48□ and Optical ESB Bus repeater module) | 62 | 5 | 124 | 5 | 30 | 23 |

—: There are no specifications.

Input current peak values and waveforms, influenced by input impedance, varies with system configurations, line sharing with other systems, and other factors. The rush current data shown above were measured under predetermined conditions (see below). Please note that the values are subject to change.

The power input circuit, with an in-rush current limiting circuit, restrains primary in-rush current, turning any current exceeding the limit to secondary and successive rush current.

### Measurement Conditions

Input voltage: 132/264 V AC, 50 Hz, and 24 V DC

Power line impedance: Approx. 0.4 ohms (external line and internal impedance)

Turn-on timing: At 50 Hz, 90° or 5 ms after the AC zero-crossing point

(60 Hz data are almost identical to the 50 Hz data shown above.)

Measurement: The primary peak and secondary peak are measured after turn-on.

## Note

- The timing of the maximum primary/secondary in-rush current varies with devices.
- The restart in-rush current after a momentary power failure exceeds the above data and its timing is also different.
- For a system composed of multiple pieces of equipment, the in-rush current is normally smaller than the total of the in-rush currents by individual pieces of equipment.

## Maximum Power Consumption of FIO

Table Maximum Power Consumption of FIO (1/3)

| Model name | Name | Max. current consumption 5 V DC (mA) | Max. current consumption 24 V DC (mA) |
|---|---|---|---|
| **Bus Interface Module (FIO system ) (N-IO system)** | | | |
| EC401 | ESB Bus Coupler Module | 500 | – |
| EC402 | ESB Bus Coupler Module (for AFV30☐/AFV40☐, 2-Port) | 500 | – |
| A2EN402 | N-ESB Bus Coupler Module (for N-IO, 2-Port) | 500 | – |
| A2EN404 | N-ESB Bus Coupler Module (for N-IO, 4-Port) | 500 | – |
| ANT401 | Optical ESB Bus Repeater Master Module 5 km (for AFV30☐/AFV40☐) | 500 | – |
| ANT411 | Optical ESB Bus Repeater Master Module 5 - 50 km (for AFV30☐/AFV40☐) | 500 | – |
| ANT502 | Optical ESB Bus Repeater Slave Module 5 km (for AFV30☐/AFV40☐) | 500 | – |
| ANT512 | Optical ESB Bus Repeater Slave Module 5 - 50 km (for AFV30☐/AFV40☐) | 500 | – |
| **Analog I/O Modules (FIO system) (*1)** | | | |
| AAI141 | Analog Input Module (4 to 20 mA, 16-channel, Non-Isolated) | 310 | 450 |
| AAV141 | Analog Input Module (1 to 5 V, 16-channel, Non-Isolated) | 350 | – |
| AAB141 | Analog Input Module (1 to 5 V / 4 to 20 mA, 16-channel, Non-Isolated) | 480 | 120 |
| AAI841 | Analog I/O Module (4 to 20 mA, 8-channel Input / 8-channel Output, Non-Isolated) | 310 | 500 |
| AAB841 | Analog I/O Module (1 to 5 V Input, 4 to 20 mA Output, 8-channel Input / 8-channel Output, Non-Isolated) | 310 | 250 |
| AAB842 | Analog I/O Module (1 to 5 V / 4 to 20 mA Input, 4 to 20 mA Output, 8-channel Input / 8-channel Output, Non-Isolated) | 410 | 290 |
| AAI143 | Analog Input Module (4 to 20 mA, 16-channel, Isolated) | 230 | 540 |
| AAI543 | Analog Output Module (4 to 20 mA, 16-channel, Isolated) | 230 | 540 |
| AAV144 | Analog Input Module (-10 to +10 V, 16-channel, Isolated) | 500 | – |
| AAV544 | Analog Output Module (-10 to +10 V, 16-channel, Isolated) | 860 | – |
| AAI135 | Analog Input Module (4 to 20 mA, 8-channel, Isolated Channels) | 360 | 450 |
| AAI835 | Analog I/O Module (4 to 20 mA, 4-channel Input/4-channel Output, Isolated Channels) | 360 | 450 |
| AAT145 | TC/mV Input Module (TC: R, J, K, E, T, B, S, N/mV: -100 to 150 mV, 16-channel, Isolated Channels) | 350 | – |
| AAR145 | RTD/POT Input Module (RTD: Pt100 ohm/POT: 0 to 10 kohm, 16-channel, Isolated Channels) | 350 | – |
| AAP135 | Pulse Input Module (8-channel, Pulse Count, 0 to 10 kHz, Isolated Channels) | 300 | 400 |
| AAP149 | Pulse Input Module for Compatible PM1 (16-channel, Pulse Count, 0 to 6 kHz, Non-Isolated) | 400 | – |
| AAP849 | Pulse Input/Analog Output Module for compatible PAC (Pulse count Input, 4 to 20mA Output, 8-channel Input/8-channel Output, Non-Isolated) | 310 | 250 |

*1: Except for suffix code of -☐K☐, and -☐M☐.

**Table Maximum Power Consumption of FIO (2/3)**

| Model name | Name | Max. current consumption 5 V DC (mA) | Max. current consumption 24 V DC (mA) |
|---|---|---|---|
| **Digital I/O Modules (FIO system) (*1)** | | | |
| ADV151 | Digital Input Module (32-channel, 24 V DC) | 500 | – |
| ADV551 | Digital Output Module (32-channel, 24 V DC) | 700 | – |
| ADV161 | Digital Input Module (64-channel, 24 V DC) | 550 | – |
| ADV561 | Digital Output Module (64-channel, 24 V DC) | 780 | – |
| ADV859 | Digital I/O Module for Compatible ST2 (16-channel Input/16-channel Output, Isolated Channels) | 450 | – |
| ADV159 | Digital Input Module for Compatible ST3 (32-channel Input, Isolated Channels) | 330 | – |
| ADV559 | Digital Output Module for Compatible ST4 (32-channel Output, Isolated Channels) | 570 | – |
| ADV869 | Digital I/O Module for Compatible ST5 (32-channel Input/32-channel Output, Common Minus Side Every 16-channel) | 800 | – |
| ADV169 | Digital Input Module for Compatible ST6 (64-channel Input, Common Minus Side Every 16-channel) | 800 | – |
| ADV569 | Digital Output Module for Compatible ST7 (64-channel Output, Common Minus Side Every 16-channel) | 800 | – |
| **Communication Modules (FIO system) (N-IO system)** | | | |
| ALR111 | RS-232C Communication Module (2-Port, 1200 bps to 115.2 kbps) | 500 | – |
| ALR121 | RS-422/RS-485 Communication Module (2-Port, 1200 bps to 115.2 kbps) | 500 | – |
| ALE111 | Ethernet Communication Module (1-Port, 10 Mbps) | 500 | – |
| ALF111 | Foundation Fieldbus (FF-H1) Communication Module (4-Ports, 31.25 kbps) | 500 | – |
| ALP121 | PROFIBUS-DP Communication Module (1-Port, 9600 bps to 12 Mbps) | 700 | – |
| A2LP131 | PROFINET Communication Module (1-Port, 100 Mbps) | 800 | – |
| A2LP141 | PROFINET Communication Module (1-Port, 100 Mbps) | 800 | – |
| **Turbomachinery I/O Modules** | | | |
| AGS813 | Servo Module (Isolated) | 500 | – |
| AGP813 | High Speed Protection Module (Isolated) | 900 | – |

*1: Except for suffix code of -□K□, -□M□, and -□Y□.

**Table Maximum Power Consumption of FIO (3/3)**

| Model name | | Name | Max. current consumption 5 V DC (mA) | Max. current consumption 24 V DC (mA) |
|---|---|---|---|---|
| **Analog I/O Modules (for RIO System Upgrade)** | | | | |
| AAB841 | -☐K☐ | Analog I/O Module (1 to 5 V Input, 4 to 20 mA Output, 8-channel Input / 8-channel Output, Non-Isolated) | – | 330 |
| AAI143 | -☐M☐ | Analog Input Module (4 to 20 mA, 16-channel, Isolated) | – | 600 |
| AAI543 | -☐M☐ | Analog Output Module (4 to 20 mA, 16-channel, Isolated) | – | 680 |
| AAV144 | -☐K☐<br>-☐M☐ | Analog Input Module (-10 to +10 V, 16-channel, Isolated) | – | 130 |
| AAT145 | -☐K☐<br>-☐M☐ | Analog Input Module (-10 to +10 V, 16-channel, Isolated) | – | 130 |
| AAR145 | -☐K☐<br>-☐M☐ | RTD/POT Input Module (RTD: Pt100 ohm/POT: 0 to 10 kohm, 16-channel, Isolated Channels) | – | 120 |
| **Digital I/O Modules (for RIO System Upgrade)** | | | | |
| ADV159 | -☐K☐<br>-☐M☐ | Digital Input Module for Compatible ST3 (16-channel Input, Isolated Channels) | – | 120 |
| | -☐Y☐ | | – | 300 |
| ADV559 | -☐K☐<br>-☐M☐ | Digital Output Module for Compatible ST4 (32-channel Output, Isolated Channels) | – | 130 |
| | -☐Y☐ | | – | 410 |
| ADV169 | -☐K☐<br>-☐M☐ | Digital Input Module for Compatible ST6 (32-channel Input, Common Minus Side Every 16-channel) | – | 170 |
| ADV569 | -☐K☐<br>-☐M☐ | Digital Output Module for Compatible ST7 (64-channel Output, Common Minus Side Every 16-channel) | – | 190 |

## Maximum Power Consumption of N-IO

| Mode | Name | Max current cosumption 24 V DC (A) |
|---|---|---|
| A2BN3D | Base Plate for Adaptor (Field Power Supply) | 8 A |
| A2BN4D | Base Plate for Barrier (Barrier Power Supply) | 1.6 A |
| A2BN5D | Base Plate for Barrier (Barrier Power Supply) | 1.2 A |

## Breaker Specifications

Breaker ratings are listed below:

**Table Breaker Ratings (1/2)**

| Equipment | Built-in breaker rating (A/V) | External breaker rating (Recommend) (A/V) (*1) |
|---|---|---|
| A2FV50S/A2FV50D field control unit (100 V AC, 220 V AC) | 6.3/250 (fuse) | 15/250 |
| A2FV50S/A2FV50D field control unit (24 V DC) | 10/250 (fuse) | 20/250 |
| A2FV70S/A2FV70D field control unit (100 V AC, 220 V AC) | 6.3/250 (fuse) | 15/250 |
| A2FV70S/A2FV70D field control unit (24 V DC) | 10/250 (fuse) | 20/250 |
| ANB10S/10D ESB bus node unit (100 V,220 V AC) | 6.3/250 (fuse) | 15/250 |
| ANB10S/10D ESB bus node unit (24 V DC) | 10/250 (fuse) | 20/250 |
| AFV30S/D field control unit (100 V AC system) | 6.3/250 (fuse) | 15/250 |
| AFV30S/D field control unit (220 V AC system) | 6.3/250 (fuse) | 15/250 |
| AFV30S/D field control unit (24 V DC) | 10/250 (fuse) | 20/250 |
| AFV40S/D field control unit (100 V AC system) | 20/250 (two) | 50/250 |
| AFV40S/D field control unit (220 V AC system) | 20/250 (two) | 50/250 |

**Table Breaker Ratings (2/2)**

| Equipment | Built-in breaker rating (A/V) | External breaker rating (Recommend) (A/V) (*1) |
|---|---|---|
| AFV40S/D field control unit (24 V DC) | 30/24 (three) | 100/24 |
| ACB51 I/O expansion cabinet (100 V AC system) | 20/250 (two) | 50/250 |
| ACB51 I/O expansion cabinet (220 V AC system) | 20/250 (two) | 50/250 |
| ACB51 I/O expansion cabinet (24 V DC) | 30/24 (three) | 100/24 |
| ANB11S/D Optical ESB bus node unit (100 V AC system) | 6.3/250 (fuse) | 15/250 |
| ANB11S/D Optical ESB bus node unit (220 V AC system) | 6.3/250 (fuse) | 15/250 |
| ANB11S/D Optical ESB bus node unit (24 V DC) | 10/250 (fuse) | 20/250 |
| ANT10U Unit for optical ESB bus repeater module (100 V AC system) | 6.3/250 (fuse) | 15/250 |
| ANT10U Unit for optical ESB bus repeater module (220 V AC system) | 6.3/250 (fuse) | 15/250 |
| ANT10U Unit for optical ESB bus repeater module (24 V DC) | 10/250 (fuse) | 20/250 |
| ACUKT1 Cabinet utility kit (100 V AC system) | 20/250 (fuse) | 50/250 |
| ACUKT1 Cabinet utility kit (220 V AC system) | 20/250 (fuse) | 50/250 |
| ACUKT1 Cabinet utility kit (24 V DC) | 30/24 (three) | 100/24 |
| AVR10D Duplexed V net router (100 V AC system) | 3.15/250 (fuse) | 10/250 |
| AVR10D Duplexed V net router (220 V AC system) | 3.15/250 (fuse) | 10/250 |
| AVR10D Duplexed V net router (24 V DC) | 6.3/250 (fuse) | 15/250 |
| AW810D Wide Area Communication Router (100 V AC system) | 3.15/250 (fuse) | 10/250 |
| AW810D Wide Area Communication Router (220 V AC system) | 3.15/250 (fuse) | 10/250 |
| AW810D Wide Area Communication Router (24 V DC) | 6.3/250 (fuse) | 15/250 |
| A2NN10D Node Interface Unit (100-240 V AC system) | 5/250 (fuse) | 15/250 |
| A2NN10D Node interface Unit (24 V DC) | 12/250 (fuse) | 30/24 |
| A2NN30D Node Interface Unit (100-240 V AC system) | 5/250 (fuse) | 15/250 |
| A2NN30D Node interface Unit (24 V DC) | 12/250 (fuse) | 30/24 |
| A2PW503 Power Supply Unit (100-240 V AC system ) | 5/250 | 15/250 |
| A2PW504 Power Supply Unit (24 V DC) | 12/250 | 30/24 |
| A2BN4D Base Plate for Barrier (MTL): Barrier Power Input (24 V DC) | 2.5/250 (fuse) | — |
| A2BN5D Base Plate for Barrier (P+F): Barrier Power Input (24 V DC) | 2/250 (fuse) | — |
| A2BE1D Field Control Unit (Installing CP471, PW48☐ and FIO) (100 V AC) | 6.3/250 (fuse) | 15/250 |
| A2BE1D Field Control Unit (Installing CP471, PW48☐ and FIO) (220 V AC) | 6.3/250 (fuse) | 15/250 |
| A2BE1D Field Control Unit (Installing CP471, PW48☐ and FIO) (24 V DC) | 10/250 (fuse) | 20/250 |
| A2BE2D FIO Node Unit (Installing PW48☐ and FIO) (100VAC) | 6.3/250 (fuse) | 15/250 |
| A2BE2D FIO Node Unit (Installing PW48☐ and FIO) (220VAC) | 6.3/250 (fuse) | 15/250 |
| A2BE2D FIO Node Unit (Installing PW48☐ and FIO) (24 V DC) | 10/250 (fuse) | 20/250 |
| A2BE2D Optical ESB Bus Repeater Unit (Installing PW48☐ and Optical ESB Bus repeater module) (100VAC) | 6.3/250 (fuse) | 15/250 |
| A2BE2D Optical ESB Bus Repeater Unit (Installing PW48☐ and Optical ESB Bus repeater module) (220VAC) | 6.3/250 (fuse) | 15/250 |
| A2BE2D Optical ESB Bus Repeater Unit (Installing PW48☐ and Optical ESB Bus repeater module) (24 V DC) | 10/250 (fuse) | 20/250 |
| A2CUKT4-☐3☐☐ Cabinet Utility Kit (for Standard Cabinet A2CAB1) (100 V AC) | 20/250 (two) | 50/250 |
| A2CUKT4-☐3☐☐ Cabinet Utility Kit (for Standard Cabinet A2CAB1) (220 V AC) | 20/250 (two) | 50/250 |
| A2CUKT4-☐3☐☐ Cabinet Utility Kit (for Standard Cabinet A2CAB1) (24 V DC) | 30/24 (three) | 100/24 |

| Equipment | Built-in breaker rating (A/V) | External breaker rating (Recommend) (A/V) (*1) |
|---|---|---|
| A2CUKT4-□1□□/A2CUKT4-□2□□ Cabinet Utility Kit (for Rittal Cabinet) (100VAC) | 20/250 (two) | 50/250 |
| A2CUKT4-□1□□/A2CUKT4-□2□□ Cabinet Utility Kit (for Rittal Cabinet) (220VAC) | 20/250 (two) | 50/250 |
| A2CUKT4-□1□□/A2CUKT4-□2□□ Cabinet Utility Kit (for Rittal Cabinet) (24 V DC) | 30/24 (three) | 100/24 |

*1: Recommended.

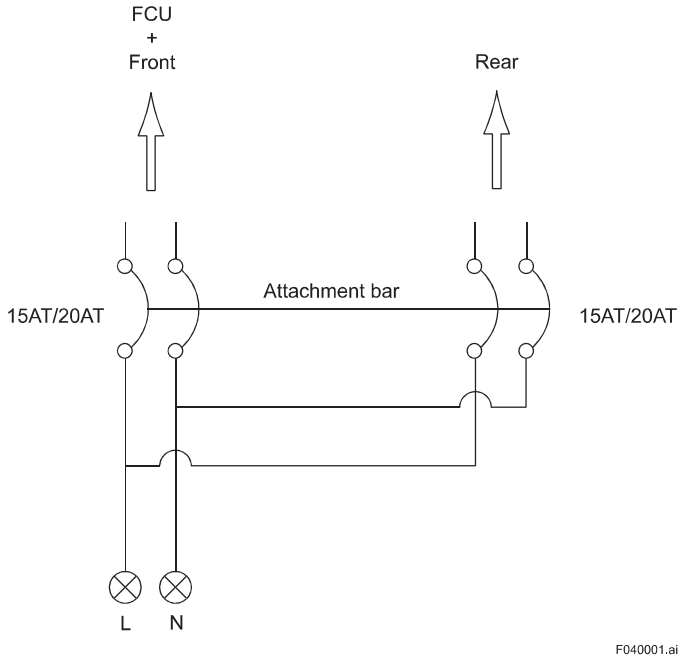



**Figure Breaker**

## Durability of Parts

Some hardware components require periodical replacement. As a guideline to the intervals between preventive maintenance checks, the following table lists components with life span of less than 10 years.

Users can replace parts indicated by “Yes” in the “user replacement”. For other components, users should not attempt to replace them; contact Yokogawa for replacement.

There can be some parts having defined life spans in resale material mounted to a console kit. If that is the case, replace the parts according to a manual of resale material.

The average ambient temperature shown in the table is the average temperature surrounding the corresponding parts.

When the parts are installed in a cabinet of Yokogawa product, though varies with actual installations, in general, the temperature inside of the cabinet is about 10 °C higher than the temperature outside the cabinet.

Note: Random failures within the recommended replacement intervals may occur in some parts.

**IMPORTANT**

The reliability and life span of electronic equipment greatly depend on the operating environment. It is essential for ensuring reliable operation and prolonged life span that the equipment is used not only within the range of environment resistance standards but also in a more satisfactory environment. For instance, if a piece of equipment is always used at 35 °C when its operating temperature ranges from 5 to 40 °C, generally its resulting in a reduced life span compared with operation at 25 °C.

If corrosive gas is present in the environment, the corrosion of the equipment’s contacts and printed circuit boards is accelerated more than in a cleaner environment, resulting in a reduced life span. Moreover, if dust can be easily generated in the environment, filters must be cleaned and replaced more often.

### AIP830, AIP831

| Part names | Part numbers | Recommended replacement cycle | Replacement by user | Remarks |
|---|---|---|---|---|
| AIP830 | AIP830 | – | Yes | Depends on frequency of use. |
| AIP831 | AIP831 | – | Yes | Depends on frequency of use. |

## ● AFV30☐

| Part names | Part numbers | Recommended replacement cycle | Replacement by user | Remarks |
|---|---|---|---|---|
| Power supply module | PW481 | 8 years | Yes | 100-120 V AC: Average ambient temperature 40 °C or less<br>Including built-in Aluminium Electrolytic Capacitor and built-in power fuse (Not user replaceable) |
| | PW482 | 8 years | Yes | 220-240 V AC: Average ambient temperature 40 °C or less<br>Including built-in Aluminium Electrolytic Capacitor and built-in power fuse (Not user replaceable) |
| | PW484 | 8 years | Yes | 24 V DC: Average ambient temperature 40 °C or less<br>Including built-in Aluminium Electrolytic Capacitor and built-in power fuse (Not user replaceable) |
| Battery Pack | S9548FA | 3 years | Yes | Average ambient temperature 30 °C or less |
| | | 1.5 years | Yes | Average ambient temperature 40 °C or less |
| | | 9 months | Yes | Average ambient temperature 50 °C or less |

## ● A2FV50☐

| Part names | Part numbers | Recommended replacement cycle | Replacement by user | Remarks |
|---|---|---|---|---|
| Power supply module | PW481 | 8 years | Yes | 100-120 V AC: Average ambient temperature 40 °C or less<br>Including built-in Aluminium Electrolytic Capacitor and built-in power fuse (Not user replaceable) |
| | PW482 | 8 years | Yes | 220-240 V AC: Average ambient temperature 40 °C or less<br>Including built-in Aluminium Electrolytic Capacitor and built-in power fuse (Not user replaceable) |
| | PW484 | 8 years | Yes | 24 V DC: Average ambient temperature 40 °C or less<br>Including built-in Aluminium Electrolytic Capacitor and built-in power fuse (Not user replaceable) |
| Battery Pack | S9548FA | 3 years | Yes | Average ambient temperature 30 °C or less |
| | | 1.5 years | Yes | Average ambient temperature 40 °C or less |
| | | 9 months | Yes | Average ambient temperature 50 °C or less |

## ● A2FV70□

| Part names | Part numbers | Recommended replacement cycle | Replacement by user | Remarks |
|---|---|---|---|---|
| Power supply module | PW481 | 8 years | Yes | 100-120 V AC: Average ambient temperature 40 °C or less<br>Including built-in Aluminium Electrolytic Capacitor and built-in power fuse (Not user replaceable) |
| | PW482 | 8 years | Yes | 100-120 V AC: Average ambient temperature 40 °C or less<br>Including built-in Aluminium Electrolytic Capacitor and built-in power fuse (Not user replaceable) |
| | PW484 | 8 years | Yes | 100-120 V AC: Average ambient temperature 40 °C or less<br>Including built-in Aluminium Electrolytic Capacitor and built-in power fuse (Not user replaceable) |
| Battery Pack | S9548FA | 3 years | Yes | Average ambient temperature 30 °C or less |
| | | 1.5 years | Yes | Average ambient temperature 40 °C or less |
| | | 9 months | Yes | Average ambient temperature 50 °C or less |

## ● AVR10D, AW810D

| Part names | Part numbers | Recommended replacement cycle | Replacement by user | Remarks |
|---|---|---|---|---|
| Power supply module | PW441 | 8 years | Yes | 100-120 V AC: Average ambient temperature 40 °C or less<br>Including built-in Aluminium Electrolytic Capacitor and built-in power fuse (Not user replaceable) |
| | PW442 | 8 years | Yes | 220-240 V AC: Average ambient temperature 40 °C or less<br>Including built-in Aluminium Electrolytic Capacitor and built-in power fuse (Not user replaceable) |
| | PW444 | 8 years | Yes | 24 V DC: Average ambient temperature 40 °C or less<br>Including built-in Aluminium Electrolytic Capacitor and built-in power fuse (Not user replaceable) |

## AFV40☐, ACB51

| Part names | Part numbers | Recommended replacement cycle | Used in: AFV40☐ | Used in: ACB51 | Replacement by user | Remarks |
|---|---|---|---|---|---|---|
| Power Supply Module (100-120 V AC) | PW481 | 8 years | x | x | Yes | 100-120 V AC: Average ambient temperature 40 °C or less Including built-in Aluminium Electrolytic Capacitor and built-in power fuse (Not user replaceable) |
| Power Supply Module (220-240 V AC) | PW482 | 8 years | x | x | Yes | 220-240 V AC: Average ambient temperature 40 °C or less Including built-in Aluminium Electrolytic Capacitor and built-in power fuse (Not user replaceable) |
| Power Supply Module (24 V DC) | PW484 | 8 years | x | x | Yes | 24 V DC: Average ambient temperature 40 °C or less Including built-in Aluminium Electrolytic Capacitor and built-in power fuse (Not user replaceable) |
| Power Supply Unit for Fan (100-120 V AC, 220-240 V AC) | S9618FA | 8 years | x | x | Yes | Average ambient temperature 40°C or less |
| Power Supply Unit for Fan (24 V DC) | S9619FA | 8 years | x | x | Yes | Average ambient temperature 40°C or less |
| Battery Pack | S9548FA | 3 years | x | | Yes | Average ambient temperature 30°C or less |
| | | 1.5 years | x | | Yes | Average ambient temperature 40°C or less |
| | | 9 months | x | | Yes | Average ambient temperature 50°C or less |
| Air Filter | T9070CB | 1 years | x | x | Yes | For Door fan unit |
| Fan Unit | AIP601 | 4 years | x | x | Yes | For Door fan unit |
| | AIP611 | 4 years | x | x | Yes | For Node fan unit |

## ANB10☐

| Part names | Part numbers | Recommended replacement cycle | Replacement by user | Remarks |
|---|---|---|---|---|
| Power Supply Module (100-120 V AC) | PW481 | 8 years | Yes | 100-120 V AC: Average ambient temperature 40 °C or less Including built-in Aluminium Electrolytic Capacitor and built-in power fuse (Not user replaceable) |
| Power Supply Module (220-240 V AC) | PW482 | 8 years | Yes | 220-240 V AC: Average ambient temperature 40 °C or less Including built-in Aluminium Electrolytic Capacitor and built-in power fuse (Not user replaceable) |
| Power Supply Module (24 V DC) | PW484 | 8 years | Yes | 24 V DC: Average ambient temperature 40 °C or less Including built-in Aluminium Electrolytic Capacitor and built-in power fuse (Not user replaceable) |

## ANB11□, ANT10U

| Part names | Part numbers | Recommended replacement cycle | Replacement by user | Remarks |
|---|---|---|---|---|
| Power Supply Module (100-120 V AC) | PW481 | 8 years | Yes | 100-120 V AC: Average ambient temperature 40 °C or less Including built-in Aluminium Electrolytic Capacitor and built-in power fuse (Not user replaceable) |
| Power Supply Module (220-240 V AC) | PW482 | 8 years | Yes | 220-240 V AC: Average ambient temperature 40 °C or less Including built-in Aluminium Electrolytic Capacitor and built-in power fuse (Not user replaceable) |
| Power Supply Module (24 V DC) | PW484 | 8 years | Yes | 24 V DC: Average ambient temperature 40 °C or less Including built-in Aluminium Electrolytic Capacitor and built-in power fuse (Not user replaceable) |
| Optical ESB Bus Repeater Module | ANT502 (*1) | 4 years | No | In the G3 environment |
| | ANT512 (*1) | 4 years | No | |

*1: Style S1 only. Not applicable for styles S2 and later.

## ANT401, ANT411, ANT502, ANT512

| Part names | Part numbers | Recommended replacement cycle | Replacement by user | Remarks |
|---|---|---|---|---|
| Optical ESB Bus Repeater Module | ANT401 ANT411 ANT502 ANT512 (*1) | 4 years | Yes | In the G3 environment |

## ACUKT1, A2CUKT4-□1□□□,A2CUKT4-□2□□ (for Rittal Cabinet)

| Part names | Part numbers | Recommended replacement cycle | Replacement by user | Remarks |
|---|---|---|---|---|
| Power Supply Unit for Fan (100-120 V AC, 220-240 V AC) | S9618FA | 8 years | Yes | Average ambient temperature 40°C or less |
| Power Supply Unit for Fan (24 V DC) | S9619FA | 8 years | Yes | Average ambient temperature 40°C or less |
| Fan Unit | ADFAN | 4 years | Yes | For Door fan unit |

## A2NN10D, A2NN20D, A2NN30D

| Part names | Part numbers | Recommended Replacement cycle | Replacement by user | Remarks |
|---|---|---|---|---|
| Power Supply Unit (100-120 V AC) | A2PW503-S□□□1 | 8 years | Yes | Average ambient temperature 40 °C or less |
| Power Supply Unit (24 V DC) | A2PW504-S□□□1 | 8 years | Yes | Average ambient temperature 40 °C or less |
| Bus Module | A2EN501-S1□□□□<br>A2EN501-S2□□□□<br>A2EN501-S□1□□□<br>A2EN501-S□2□□□<br>(*1) | 4 years | Yes | In the G3 environment |

*1: Style S1 only. Not applicable for styles S2 and later.

## A2SDV506

| Part names | Part numbers | Recommended Replacement cycle | Replacement by user | Remarks |
|---|---|---|---|---|
| Built-in relay | (A2SDV506) | $10^5$ times | Yes | A2SDV506 is the unit of the replacement. |

## PW601, PW602

| Part names | Part numbers | Recommended Replacement cycle | Replacement by user | Remarks |
|---|---|---|---|---|
| Power Supply Unit for PW601 (100-120 V AC) | S9889UK | 8 years | Yes | Average ambient temperature 40 °C or less |
| Power Supply Unit for PW602 (220-240 V AC) | S9890UK | 8 years | Yes | Average ambient temperature 40 °C or less |

## PW481, PW482, PW484

| Part names | Part numbers | Recommended Replacement cycle | Replacement by user | Remarks |
|---|---|---|---|---|
| Power Supply Module (100-120 V AC) | PW481 | 8 years | Yes | 100-120 V AC:Average ambient temperature 40 °C or less<br>Including built-in Aluminium Electrolytic Capacitor and built-in power fuse (Not user replaceable) |
| Power Supply Module (220-240 V AC) | PW482 | 8 years | Yes | 220-240 V AC: Average ambient temperature 40 °C or less<br>Including built-in Aluminium Electrolytic Capacitor and built-in power fuse (Not user replaceable) |
| Power Supply Module (24 V DC) | PW484 | 8 years | Yes | 24 V DC:Average ambient temperature 40 °C or less<br>Including built-in Aluminium Electrolytic Capacitor and built-in power fuse (Not user replaceable) |

### CP471

| Part names | Part numbers | Recommended Replacement cycle | Replacement by user | Remarks |
|---|---|---|---|---|
| Battery Pack | S9548FA | 3 years | Yes | Average ambient temperature 30 °C or less |
| | | 1.5 years | Yes | Average ambient temperature 40 °C or less |
| | | 9 months | Yes | Average ambient temperature 50 °C or less |

### A2CUKT4-□3□□□ (for Standard Cabinet A2CAB1)

| Part names | Part numbers | Recommended Replacement cycle | Replacement by user | Remarks |
|---|---|---|---|---|
| Power Supply Unit for Fan (100-120 V AC, 220-240 V AC) | S9618FA | 8 years | Yes | Average ambient temperature 40 °C or less |
| Power Supply Unit for Fan (24 V DC) | S9619FA | 8 years | Yes | Average ambient temperature 40 °C or less |
| Air Filter | T9070CB | 1 year | Yes | For Door fan unit |
| Fan Unit | AIP601 | 4 years | Yes | For Door fan unit |

### ANFAN

| Part names | Part numbers | Recommended Replacement cycle | Replacement by user | Remarks |
|---|---|---|---|---|
| Fan Unit | AIP611 | 4 years | Yes | For Node fan unit |

## Paint Colors

**Table Paint Colors**

| Painted section | Paint color (Reference Munsell values in parentheses) | Major unit types |
|---|---|---|
| Basic color | Frosty white (2.5Y8.4/1.2) | LPCKIT, YPCKIT, AFV40S/AFV40D, YAX801, AFS20S/AFS20D, AFS40S/AFS40D, AFG20S/AFG20D, AFG40S/AFG40D |
| Channel base | Spring Black (3.3PB2.5/0.5) | LPCKIT, YPCKIT, AFV40S/AFV40D, YAX801, AFS20S/AFS20D, AFS40S/AFS40D, AFG20S/AFG20D, AFG40S/AFG40D |

# 5. Post-installation Inspection and Environmental Preservation

## Post-installation Inspection

Upon the completion of installation of instrumentation, before turning on the power inspect the following items in the list below to avoid system contamination by dust and moisture dust and condensation.

**Table Inspection before Power On**

| | Inspection items (daily inspection/maintenance items) |
|---|---|
| **Environment** | ☐ No water intrusion from cable ducts.<br>☐ No wind/rain blow-in<br>☐ Air-conditioned<br>☐ Cable ducts and cabinet bottoms covered to prevent entry of wind, dust, moisture<br>☐ Cabinets and surroundings cleaned<br>☐ No dust entering from air vents<br>☐ Free of salty, ferrous, corrosive gas<br>☐ No direct sunlight on equipment |
| **Equipment** | ☐ No condensation or traces on cabinet interior/exterior<br>☐ No discoloration or rust on cabinet interior/exterior<br>☐ No condensation or traces on cards (disconnect cards on the upper, middle, and lower stands, and left and right sides of the cabinet to check that there is no condensation on the cards or defects anywhere in the cabinet.)<br>☐ No dust remaining inside cabinet |

It is recommended that you turn on the power in the presence of Yokogawa when turning it on first.

## Post-installation Environment Preservation

The following precautions should be taken to preserve the proper operating environment after the system has been installed:

- Seal the pits if they are shared by equipment in other rooms, preventing entry of dust and moisture from the other rooms.
- Seal all cable ducts of equipment and building with putty upon completion of cabling.
- Always turn on air conditioner. Turning it on/off may cause condensation inside equipment. If you turn on the power of an air conditioner after a long stop, turn on the air conditioner first and the system. Otherwise condensation may occur.
- Monitor and record ambient temperature and humidity. To maintain the reliability of the equipment be sure to remove the cause if they fluctuate violently.
- Note that leaving exits and entrances open during installation, or leaving open cable ducts whiles pulling cables, may result in condensation.

# Revision Information

- Title : CENTUM VP Installation Guidance
- Manual No. : TI 33J01J10-01EN

**Apr. 2024/26th Edition**
1.2 ■ Electric field strength (Electric wave condition) [completely revised]
1.2 Table Equipment Installation Specifications (1/2) [remark *3 was revised]
1.7 Table G3 Environment-compatible Products (2/3) [A2LP141 was added]
3.6.2 Table Signal Cables for Connection with FIO (2/2) [A2LP141 was added]
4. Table Maximum Power Consumption of FIO (2/3) [A2LP141 was added]

**Dec. 2023/25th Edition**
1.5.1 Noise Sources and Noise Countermeasures
Table Noise Sources & Countermeasures [Spark Killer Terminology was corrected.]
■ Examples ofinstalling protection circuit for noise caused by inductive load [Title and content were corrected.]

**Nov. 2023/24th Edition**
1.2 Control Room Environment
Table Measurement category [Applicable Standard was revised.]
3.1 Cables and Terminals
Table Rating temperature of Cables [N-IO field enclosure was added.]
3.5 Connecting Signal Cable
■ Process I/O Signal Connection [● Push-in terminal was added.]
■ Signal Cable Termination [● Push-in terminal was added.]

**Aug. 2023/23rd Edition**
1.2 Control Room Environment
■ Measurement Categories [Applicable standard was changed. Correction of errors.]
■ Applied Standards [Applicable standard was changed.]
4. Installation specifications
■ Durability of Parts [The recommended replacement cycle for ANT401, ANT411, ANT502, ANT512, and A2EN501are changed.]

**Apr. 2023/22nd Edition**
1.2 Control Room Environment
■ Conformity Standards
● Standard for Hazardous (Classified) Locations [Notation review and revision]
■ Installation Environment Specifications
Table Equipment Installation Specifications (1/2) [Correction of clerical error]

**June 2022/21st Edition**
3.6.2 List of Signal Cables for Connection with FIO [I/O Modules with Built-in Barrier (for FIO) are deleted.]
4. Installation Specifications [I/O Modules with Built-in Barrier (for FIO) are deleted.]

**Apr. 2022/20th Edition**
1.2 Control Room Environment
■ Applied Standards
[Notes of CENTUM manufacturer and official representative in EEA related to CE marking was deleted.]
■ Installation Ebvironment Specifications [Corrected Note]
1.6 Cabling Requirements
■ Ambient Temperature [Changed description]
2.5.6 Example of Mounting to General Purpose Cabinet/Junction Box
● Example of Mounting N-IO Nodes (Intrinsic Safety Barrier) in a Cabinet
Table Maximum numbers of units that can be mounted in case of this example [Note was revised]
● Example of Mounting N-IO Nodes (Intrinsic Safety Barrier) in a Junction Box
Table Maximum numbers of units that can be mounted [Note was revised]
● Example of Mounting N-IO Nodes (Mixture of Intrinsic Safety Barrier and Non-Intrinsic Safety

Barrier) in a Junction Box
Table Maximum numbers of units that can be mounted [Note was revised]

**Dec. 2021/19th Edition**
1.1 Control Room Design
■ Floor Strength and Space [Change reference documents to GS from SD]
1.2 Control Room Environment
■ Applied Standards [Added Ex "ec"] [Added UKCA Marking] [Changed CSA number] [Change "DNV GL" to "DNV"]
1.8 Compliance with Marine Standards [Change "DNV GL" to "DNV"]
2.4 Servicing Area[Add the figure of servicing area] [Deleted External Dimensions (SD)]
2.5.1 Installation on Floor
■ Size of Cabling Holes in Floor [Deleted External Dimensions (SD)]
2.5.3 19-inch Rack Mount Devices
■ Notes on Installation [Deleted External Dimensions (SD)]
3.2 Connecting Power
■ Terminal Connection [Add AEP7D and AEP9D]
3.6.4 Implementation and Cable Connection of Fieldbus Communication Module ALF111
■ Fieldbus Wiring for ALF111 with Pressure Clamp Terminal Block[Add an annotation]

**May 2021/18th Edition**
1.2 Control Room Environment
■ Installation Specification[The voltage of Category I and Category II was changed.]
■ Applied Standards[CE Marking Low Voltage Directive Number was changed. The describe about the breakers was delete.]

**Jan. 2021/17th Edition**
Summary: Correspondence to CENTUM VP R6.08
All Chapter
Added the configurations with Base Plate (for FCU) A2BE1D, HKU Interface Unit A2FU1, Primary Power Distribution Unit (for FCU) A2FU2, Base Plate (for FIO) A2BE2D, , ESB Bus Adapter (for SB401) A2EE1A, ESB Bus Adapter (for ANT4□1) A2EE2A, ESB Bus Adapter (for ANT5□2) A2EE3A, Cabinet Utility Kit A2CUKT4, and Standard Cabinet A2CAB1.

**Mar. 2020 /16th Edition**
3.2 Connecting Power
● Sleeve Terminal Processing [Table for sleeves was revised.]
3.5 Connecting Signal Cable
● Pressure Clamp Terminal (for FIO Module Pressure Clamp Terminal Block) [Table for sleeves was revised.]
● Pressure Clamp Terminal, Spring Clamp Terminal (for N-IO) [Table for sleeves was revised. Description for A2BN4D was added.]

**Jan. 2020 /15th Edition**
Introduction Updated descriptions of trademark.
1.2 Control Room Environment
■ Applied Standards[Added $C_{\mathfrak{P}}$ Marking]

**Aug. 2019 /14th Edition**
1.7 Corrosive-gas Environment Compatibility
Table G3 Environment-compatible Products [Added A2MDV843, A2NN20D, A2SMX802]
3.4 Power and Ground Cabling
■ A2BN5D Base Plate for Barrier (P+F) [Added CAUTION]
3.8.3 Adaptors (for A2BA3D) [Added shunt resistor unit fixing plate mounting specifications]
● When attaching a shunt resistor to the M4 screw terminal block of A2BA3D [Added newly]

**July 2019 /13th Edition**
1.2 Table Equipment Installation Specifications (1/2) [remark *2 was revised]
1.7 Table G3 Environment-compatible Products (2/3) [ALP111 was deleted, A2LP131 was added]
3.4 Power and Ground Cabling
■ A2BN4D Base Plate for Barrier (MTL) [CAUTION was deleted]
■ A2BN5D Base Plate for Barrier (P+F) [CAUTION was deleted]

3.6.2 Table Signal Cables for Connection with FIO (2/3) [ALP111 was deleted, A2LP131 was added]
4. Table Maximum Power Consumption of FIO (2/3) [ALP111 was deleted, A2LP131 was added]
Installation Specifications ■ Parts Durability [Revised the description of IMPORTANT]

**Mar. 2019 /12th Edition**
1.2 ■ Measurement Categories [Updated the description of safety standard.]
■ Applied Standards [Updated the description of safety standard.]
2.5.6 ■ Cabinet for N-IO System [Updated the specification for cabinet.]
4. Table Breaker Ratings [Correction of clerical error]

**Jan. 2019 /11th Edition**
1.1 Control Room Design
■ Side-by-Side Cabinet Installation [Contact information was changed]
1.2 Control Room Environment [Contact information was changed]
■ Vibration [Contact information was changed]
1.5.2 Countermeasures against Static Electricity [Arrangement Information of wrist straps and conductive sheets were deleted]
2.2 Unpacking
Caution [Contact information for Condensation was deleted]
Caution [Contact information at product fall was changed]
2.3 Storage [Contact information was changed]

**Oct. 2018 /10th Edition**
Front page Changed logo mark
Safety Precautions Changed symbol mark description
1.2 ■ Applied Standards [Corrected the target GS]
Table Equipment Installation Specifications [Added the note of temperature specification]
1.4 Grounding Table [Corrected the target grounding]
1.6 ■ Measures against EMI [Added the note for ambient temperature]
1.7 ■ Table G3 Environment-compatible Products [Added terminal boards]
2.3 ■ Storage of Unpacked Equipment [Added the note for desiccating agent or corrosion inhibitor]
2.5.4 DIN Rail Mountable Devices [Added A2BM4]
■ Notes on Installation [Revised the terms, Added notes for A2BM4]
2.5.5 Wall Mountable Devices [Added the notes for mounting A2BM4]
2.5.6 Example of Mounting to General Purpose Cabinet / Junction Box
Table Cabinet Dimensions [Changed the dimension]
[Added “Example of Mounting an FCU for N-IO and N-IO Nodes in a Cabinet (For field wiring via terminal board)”]
[Added the notes of cabinet ambient temperature for mounting N-IO nodes]
[Added “Example of Mounting N-IO Nodes (Non-Intrinsic Safety Barrier) in a Cabinet (For field wiring via terminal board)”]
3.1 Table Rating temperature of Cables [Added A2BM4]
3.4 ■ A2BN3D Base Plate for Adaptor [Added figure of power and ground cabling for A2BN3D]
■ Example of System Cabinet Installation and Grounding Wiring [Clerical corrections]
3.5 Connecting Signal Cable [Revised the description]
Table Applicable Interface [Added A2BM4]
■ Connecting Signal Cables to Terminals (for N-IO) [Added supplementary information]
3.7.2 Table Terminal type Compatible with A2BN3D Base Plate for Adaptor [Added new suffix code and note]
[Added “■ Terminal board for analog digital I/O (Pressure Clamp Terminals)”]
■ Connecting Signal Cables with A2BN3D [Added description]
Table Terminal Numbers and Signal Types (A2BN3D) [Added notes]
3.7.3 ■ A2SAP105 Pulse Input Signal Adaptor [Added description for connecting field signals to A2BM4]
[Added the figure for connecting field signals to A2SAP105 via A2BM4]
● When receiving dry contact signals (Input frequency: 0 to 10 kHz) [Figure were added]
■ A2EXR001 Shunt Resistor Unit [Changing position described]
■ A2SAT105 mV/TC/RTD input adaptor [Added notes for using A2SAT105]
■ A2SDV105 Digital input adaptor [Added description for A2SDV105]
■ A2SMX802 Pass-through I/O signal adaptor [Added description for A2SMX802]
3.8.2 Table Terminal numbers and signal types [revised]
3.8.3 ● When receiving dry contact signals (Input frequency: 0 to 10 kHz) [Figure were added]
■ A2EXR001 Shunt Resistor Unit [Changing position described]
■ A2SAM105 Current input/voltage input adaptor [Revised description for installing the shunt resistor

module]
● When the input current value exceeds 25 m A [Added]
● When sharing the current signal with another receiving device. [Title added]

**June 2018 /9th Edition**
3.1 Cables and Terminals
Table Rating temperature of Cables [Revised A2BN5D cable requirements]
3.7.1 N-IO I/O Unit Types
■ I/O Modules that can be used with Base Plate
Table I/O Modules Installable with Base Plate [Correction of clerical error]
3.7.3 Table Terminal Numbers and Signal Types (A2BN5D) [P+F I.S. barrier models are deleted]

**Mar. 2018 /8th Edition**
1.3 Notes for the field power supply unit of N-IO is added.
1.5.1 Examples of Spark-Killer and Diode Installation [Title is changed.]
2.5.4 Figure Mounting stopper to the DIN rail is revised.
2.5.6 Example of Mounting an FCU for N-IO and N-IO Nodes in a Cabinet
[Mounting conditions are corrected.]
Example of Mounting N-IO Nodes (Non-Intrinsic Safety Barrier) in a Cabinet
[Mounting conditions are corrected.]
Example of Mounting N-IO Nodes (Intrinsic Safety Barrier) in a Cabinet
[Mounting conditions are corrected.]
3.5 Figure Area for Signal Cable from Field is revised.
Figure Example of Node Interface Unit and I/O Unit Cable Wiring (Cabinet) is revised.
Figure Example of Node Interface Unit and I/O Unit Cable Wiring (Junction Box) is revised
3.7.3 ■ A2SDV505, ■ A2SDV506, ■ A2SMX802, [Errors in writing are corrected]

**Jan. 2018 /7th Edition**
- N-IO product A2EXR001 was added.
1. System Installation Requirements
1.7 Corrosive-gas Environment Compatibility [A2EXR001 was added]
2. Transportation, Storage and Installation
2.5 Installation
2.5.6 Example of Mounting to General Purpose Cabinet/Junction Box
Example of Mounting an FCU for N-IO and N-IO Nodes in a Cabinet [A2EXR001 was added]
Example of Mounting N-IO Nodes (Non-Intrinsic Safety Barrier) in a Cabinet [A2EXR001 was added]
Figure Example of Mounting an FCU for N-IO Nodes in a Cabinet [CP461 is changed to CP4□1]
3. Cabling
3.7.2 Base Plate for Adaptor
Connecting Signal Cables with A2BN3D [A2EXR001 was added]
3.7.3 Adaptor (for A2BN3D)
A2SAP105 Pulse Input Signal Adaptor [A2EXR001 was added]
3.8.2 Nest for I/O Adaptor
Signal connection of the terminal block of the nest for I/O adaptor A2BA3D [A2EXR001 was added]
3.8.3 Adaptor (for A2BA3D)
A2SAP105 Pulse Input Signal Adaptor [A2EXR001 was added]
3.9 Connecting Bus Cable
Handling of Vnet/IP cables Connected to the Processor Module [CP471 was added]

**June 2017/6th Edition**
1. System Installation Requirements
1.2 Control Room Environment
■ Applied Standards [Remark *6 was added]
● Safety Standards [CSA standard number was added]
● EMC Conformity Standards [Position of remark *5 was changed]
■ Installation Environment Specifications
Table Equipment Installation Specifications (1/2) (2/2) [ANR10□ was deleted]
3. Cabling
3.4 Power and Ground Cabling

■ A2FV50S/A2FV50D Field Control Unit (19-inch Rack Mountable Type) [Correction of clerical errors]
■ A2FV70S/A2FV70D Field Control Unit (19-inch Rack Mountable Type) [Correction of clerical errors]

**Apr. 2017/5th Edition**
Summery
-N-IO product line-ups A2SAM105, A2SAM505, A2SAT105, A2SMX802, and A2MDV843 were added.
-FIO product line-ups ADR541, ADV141, ADV142, ADV157, ADV557, and ADV851 were deleted.
Safety Precautions [Symbol definitions were revised]
Symbol Marks of this Technical Information [Symbol marks were changed]
1. System Installation Requirements
1.2 Control Room Environment
■ Applied Standards
● EMC Conformity Standards EN61000-6-2 [Note was revised]
2. Transportation, Storage and Installation
2.5 Installation
2.5.6 Example of Mounting to General Purpose Cabinet/Junction Box [Note was added]
■ Cabinet for N-IO System
● Example of Mounting N-IO Nodes (Non-Intrinsic Safety Barrier) in a Cabinet [Note was added]
● Example of Mounting N-IO Nodes (Intrinsic Safety Barrier) in a Cabinet [Note was added]
■ Junction Box for N-IO System
● Example of Mounting N-IO Nodes (Non-Intrinsic Safety Barrier) in a Junction Box [Note was added]
● Example of Mounting N-IO Nodes (Intrinsic Safety Barrier) in a Junction Box [Note was added]
● Example of Mounting N-IO Nodes (Mixture of Intrinsic Safety Barrier and Non-Intrinsic Safety Barrier) in a Junction Box [Note was added]
3. Cabling
3.1 Cables and Terminals
3.4 Power and Ground Cabling
■ A2NN10D
● 19-inch Rack-mount Devices and Wiring (For A2NN10D) [Figure was revised]
● PW601, PW602 [Figure was added]
3.6 Connecting Signal Cables with Fieldnetwork I/O (FIO)
3.6.3 Connecting Signal Cables with FIO
■Connecting Signal Cables with Pulse Input Module AAP135
● When Receiving No-Voltage Contact Signals (1) [Table and figure were added]
3.7.3 Adaptors (for A2BN3D)
■ A2SAP105
● When receiving current pulse signals (2-wire power supply type)
Table useable external resistors [Description was revised]
Table Recommended terminal blocks [WAGO was deleted]
Figure Distance to Separate External Receiving Resistor and IOBP [Figure was revised]
3.8 Signal Connections of N-IO I/O Unit (For RIO System Upgrade)
3.8.3 Adaptors (for A2BA3D)
● Specifications and installation of external shunt resistors
Table useable external resistors [Description was revised]
Table Recommended terminal blocks [WAGO was deleted]
Figure The external shunt resistors should not be located into this area [Figure was revised]
3.9 Connecting Bus Cable
Figure Example of Optical ESB Bus Chain Connection Using HK Function [A2FV50☐ and A2FV70☐ were deleted]
Figure Example of Optical ESB Bus Star Connection Using HK Function [A2FV50☐ and A2FV70☐ were deleted]
4. Installation Specifications
■ Parts Durability [PW601 and PW602 were added]

**June 2016/4th Edition**
Summery - NIU (A2NN10D) and I/O Unit for RIO System Upgrade were added.
3. Cabling
3.6 Connecting Signal Cables with Field network I/O (FIO)
3.6.3 Connecting Signal Cables with FIO
Connecting Signal Cables with Pulse Input Module AAP135
When Receiving No-Voltage Contact Signals (2)
Figure No-Voltage contact Input (2) [24 V DC was deleted]
Connecting Signal Cables with Pulse Input Module AAP135
When Receiving Current Pulse By Using the Internal Power to Drive the Transmitter (2-wire power supply type) [1k ohm was deleted]
3.7 Signal Connections of N-IO I/O Unit
3.7.2 Base Plate for Adaptor
■ Connecting Signal Cables with A2BN3D
Table Terminal Numbers and Signal Types (A2BN3D) [(*4) were added to A2SAP105 and Case 4]
3.7.3 Adaptors
● When receiving current pulse signals (2-wire power supply type)
Figure Distance to Separate External Receiving Resistor and A2SAP105 [Area was revised]
4. Installation Specifications
■ Parts Durability[ANB10□ was added]

**Dec. 2015/3rd Edition**
1. System Installation Requirements
1.2 Control Room Environment
■ Applied Standards
● EMC Conformity Standards [EAC Marking] [Standard No. was corrected]
● Standards for Hazardus Location Equipment [Standard Nos. were deleted]
● Marine Standards [Added newly]
1.7 Corrosive-gas Environment-Compatibility
■ G3 Environment-compatible Prducts
Table G3 Environment-compatible Products [An error was corrected]
1.8 Compliance with Marine Standards [DNV GL was added]
■ Marine Standard-compliant CENTUM VP (Vnet/IP) Components
Table Marine Standard-compliant CENTUM VP (Vnet/IP) Components [Tables are deleted]
3. Cabling
3.5 Connecting Signal cable
Connecting Signal Cable to Terminals(for FIO)
● Connecting to Pressure-clamp Terminal [The standard number of the screwdriver was corrected.]
4. Installation Specifications
■ Parts Durability [Part No. of the built-in power fuses are deleted]
● AFV30□
● A2FV50□
● AVR10D,AW810D
● AFV40□, ACB51
● ANB11□,ANT10U

**June 2015/2nd Edition**
Summery - A2BN5D was added.
- Requirements of EN61010-2-201 were reflected.
- Errata was corrected.
- Descriptions were revised.
1. System Installation Requirements
■ Installation Specification [Description was revised] [A2BN5D was added]
[Temperature Transportation/storage of N-IO node was corrected]
1.2 Control Room Environment
■ Applied Standards
● Safety Standards [EN 61010-2-201 and EN 61326-1 were added] [Note was revised]
● EMC Conformity Standards [EN 61326-1 was added][Note was revised]

● Standards for Hazardous Location Equipment [ATEX Typei and IECEx were added]
■ Installation Environment Specifications
Table Equipment Installation Specifications [A2BN5D was added] [Electric field of N-IO was corrected]
1.6 Cabling Requirements
■ Ambient Temperature [A2BN5D was added]
1.7 Corrosive-gas Environment Compatibility
Table G3 Environment-compatible Products [A2BN5D was added]
2. Transportation, Storage and Installation
2.5 Installation
2.5.3 19-inch Rack Mount Devices [CAUTION was revised]
2.5.4 DIN Rail Mountable Devices [A2BN5D was added]
2.5.5 Wall Mountable Devices [A2BN5D was added]
2.5.6 Example of Mounting to General Purpose Cabinet/Junction Box [A2BN5D was added]
3. Cabling
3.1 Cables and Terminals [A2BN5D was added] [■ Bending radius of cable was added]
■ Signal Cables [An error of “For N-IO Node” was corrected]
■ Power Cables [Barrier for Base Plates were added][Value was corrected]
■ Grounding Cables [Barrier Base Plates were added]
3.2 Connecting Power
■ Terminal Connection [A2BN5D was added] [Base Plate of A2BN3D was revised]
3.4 Power and Ground Cabling [A2BN5D was added]
■ A2NN30D Node Interface Unit
Figure Connecting Power Supply with Node Interface Unit [An error of the size of the screw was corrected] [A2BN5D was added]
■ A2BN3D Base Plate for Adaptor [The caption was added]
■ A2BN4D Base Plate for Barrier [The cable length restriction was added]
■ Connecting Power Supply with Node Interface Unit and I/O Units
[A Screw size of NIU was corrected] [Important information was added]
■ Example of Sytem Cabinet Installation and Grounding Wiring
Figure N-IO system devices installation and grounding wiring (Cabinet) [A Screw size of NIU was added]
3.5 Connecting Signal Cable
■ Process I/O Signal Connection
● Pressure Clamp Terminal, Spring Clamp Terminal (for N-IO Node)
Table Applicable Interface [A2BN5D was added]
■ Connecting Signal Cables to Terminals (for N-IO)
Figure Example of Node Interface Unit and I/O Unit Cable Wiring (Cabinet)
[The caption was revised]
Figure Example of Node Interface Unit and I/O Unit
[The leader line was corrected
■ Routing Signal Cables (for FIO)
●FIO with KS Cable Interface Adaptor Cabling [Minimun bending radius was added]
3.6 Connecting Signal Cables with Fieldnetwork I/O (FIO)
3.6.2 List of Signal Cables for Connection with FIO[Important information was added]
3.7 Signal Connections of N-IO I/O Unit
3.7.1 N-IO I/O Unit Types [A2BN5D was added]
3.7.2 Base Plate for Adaptor
■ Connecting Signal Cables with N-IO I/O Unit
Table Terminal Numbers and Signal Types (A2BN3D) [An error of A2SDV506 was corrected]
3.7.4 Base Plate for Barrier [A2BN5D was added]
3.8 Connecting Bus Cable
■ F-SB Bus (for N-IO Node) [Important information was added]
4. Installation Specifications
■ Electrical Specifications
Table Electrical Specifications [A2BN4D and A2BN5D were added]
■ Maximum Power Consumption of FIO [A2EN402 and A2EN404 were added]
■ Maximum Power Consumption of N-IO [A2BN5D was added]
■ Breaker Specifications [A2BN4D and A2BN5D were added]

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Subject to change without notice.

# Veeam Backup & Replication

# Deployment

To start working with Veeam Backup & Replication, you must configure a backup server — install Veeam Backup & Replication on a machine that meets the system requirements. To do this, you can use the setup wizard or install the product in the unattended mode.

When you install Veeam Backup & Replication, the Veeam Backup & Replication console is automatically installed on the backup server. If you want to access Veeam Backup & Replication remotely, you can install the Veeam Backup & Replication console on a dedicated machine.

# Installing Veeam Backup & Replication

Before you install Veeam Backup & Replication, check prerequisites. Then use the Veeam Backup & Replication setup wizard to install the product.

# Before You Begin

Before you install Veeam Backup & Replication, check the following prerequisites:

- A machine on which you plan to install Veeam Backup & Replication must meet the system requirements. For more information, see System Requirements.
- A user account that you plan to use for installation must have sufficient permissions. For more information, see Permissions.
- Backup infrastructure components communicate with each other over specific ports. These ports must be open. For more information, see Ports.
- You must remove Veeam Backup & Replication components of versions that are not supported by the upgrade procedure from the target machine. You may also need to remove earlier versions of other Veeam products and components.
- Before deploying Veeam Backup & Replication, define where the Veeam Backup & Replication server will be located. Depending on what kind of protection are you planning to use, the
  Veeam Backup & Replication server should be located on the source site or the Disaster Recovery site.
  - When replication or CDP is used: If you plan to use replication or Continuous Data Protection (CDP), the Veeam Backup & Replication server should be deployed in the disaster recovery site. In this case, if the production host crashes, Veeam Backup & Replication will automatically fail over to the replica without any manual operations. The source backup infrastructure still can be managed with the same Veeam Backup & Replication server with the help of backup proxies deployed in the source site.
  - When only backup features are used: If you plan to use Veeam Backup & Replication for backup jobs only, the backup server should be placed in the production site.

## Configuration Database

Before deploying Veeam Backup & Replication, decide which database engine and version you need to use:

- If you do not prepare a database engine in advance, Veeam Backup & Replication will automatically install PostgreSQL 15.1 locally on the backup server.
- Decide if you need the database engine installed on the same server as Veeam Backup & Replication or on a remote server. Veeam Backup & Replication requires a database engine deployed either locally on the backup server or remotely.

  It is recommended to run the database engine instance locally to eliminate latency issues. However, in some scenarios a remote instance can be the better choice:
  - High Availability. SQL Clustering and Always On Availability Group on external SQL Servers can be used for high availability of the configuration database. To learn about the configuration details, see this Veeam KB article.
  - Licensing. Some enterprises have dedicated virtual clusters for SQL Servers due to licensing constraints. In such cases, you can place the Veeam configuration database on an existing instance to lower the total cost of ownership.
- If you prefer to use an Express Edition of Microsoft SQL Server as your database engine, note that its usage is limited by 10 GB of configuration database. The Express Edition is enough for evaluation purposes and not very large environments (<500 VMs). If your infrastructure is large (more than 500 VMs), you may consider to install a Microsoft SQL Server in advance.
- If Microsoft SQL Server is installed by the previous product version, Veeam Backup & Replication will connect to the existing configuration database, upgrade it (if necessary) and use it for work.

### Step 1. Start Setup Wizard

To start the setup wizard:

1. Download the latest version of the Veeam Backup & Replication installation image from the Download Veeam Products page.
2. Mount the installation image to the machine on which you plan to install Veeam Backup & Replication or burn the image file to a flash drive or other removable storage device. If you plan to install Veeam Backup & Replication on a VM, use built-in tools of the virtualization management software to mount the installation image to the VM.

   To extract the content of the ISO, you can also use the latest versions of utilities that can properly extract data from ISOs of large size and can properly work with long file paths.
3. After you mount the image or insert the disk, Autorun will open a splash screen. If Autorun is not available or disabled, run the `Setup.exe` file from the image or disk.
4. In the splash screen, click Install.

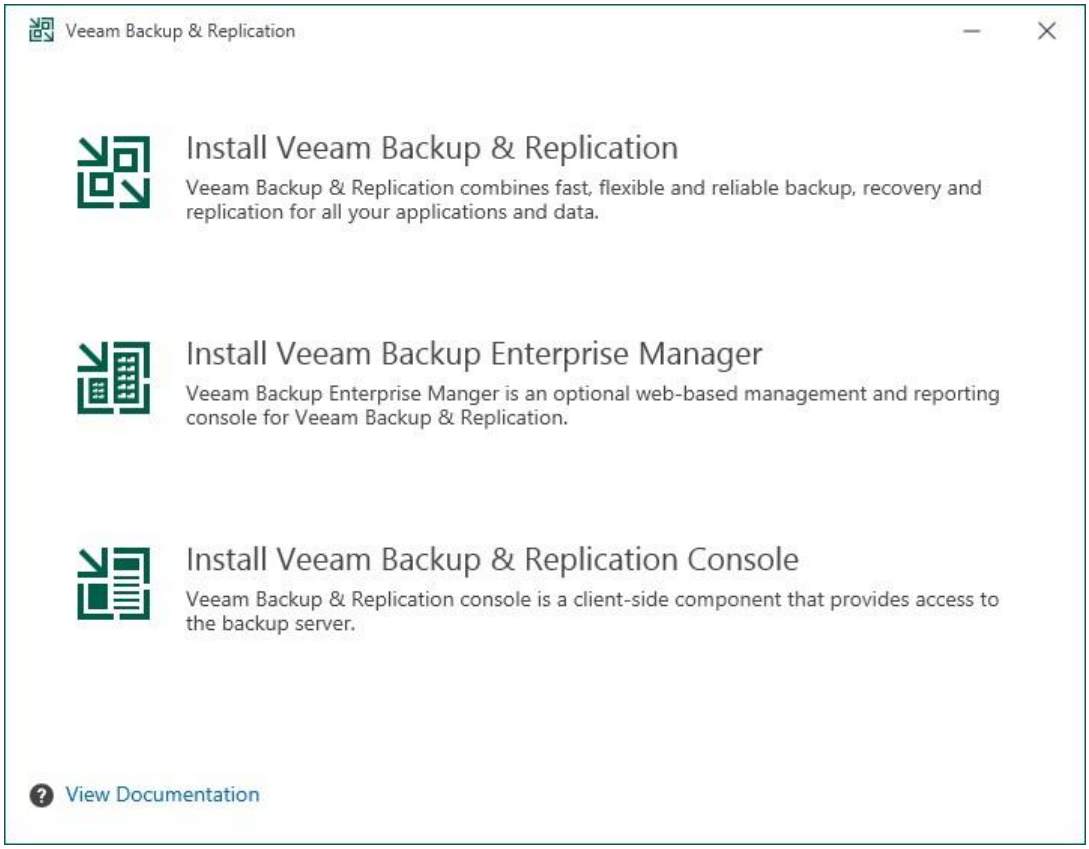
> IMPORTANT
>
> It is strongly recommended that you install Veeam Backup & Replication using Autorun or the Setup.exe file. If you run other installation files from the ISO folders, you may miss some components that need to be installed, and Veeam Backup & Replication may not work as expected.




### Step 2. Select Component

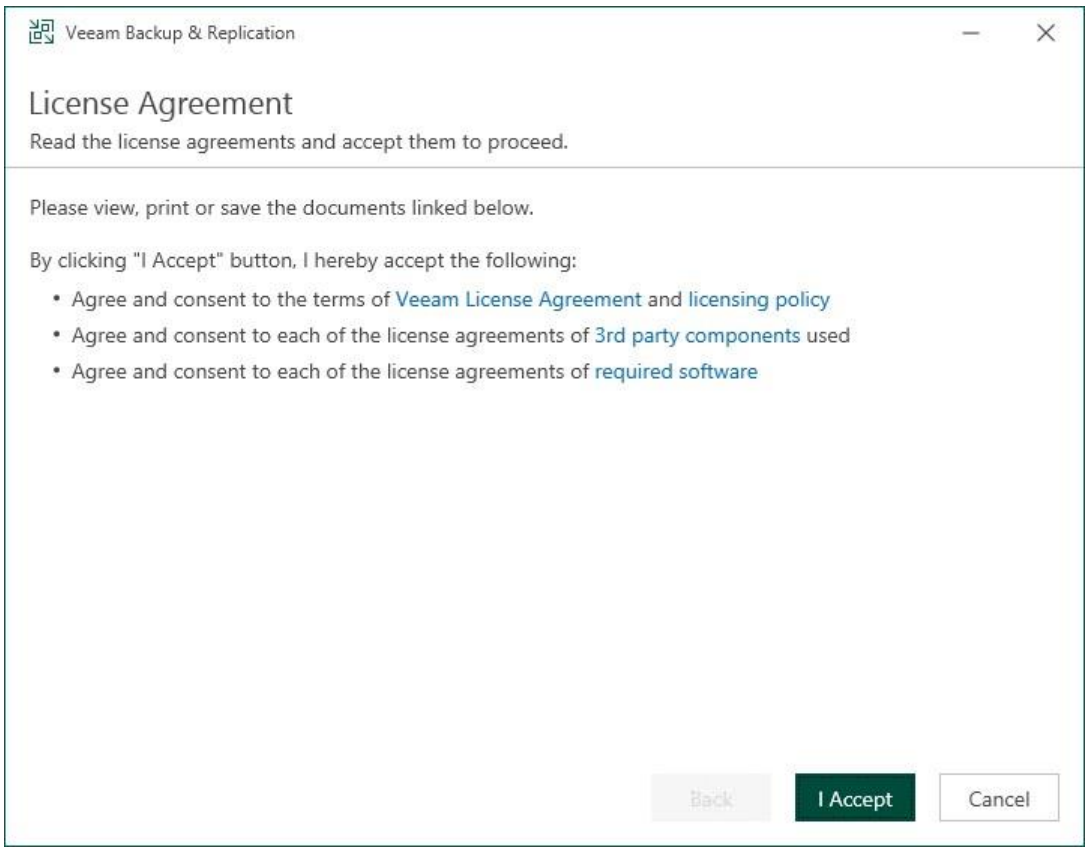
At the Select Veeam Backup & Replication Component step of the wizard, select Install Veeam Backup & Replication.

To open Veeam Help Center from the setup wizard, click View Documentation.


Veeam Backup & Replication
Install Veeam Backup & Replication
Veeam Backup & Replication combines fast, flexible and reliable backup, recovery and replication for all your applications and data.
Install Veeam Backup Enterprise Manager
Veeam Backup Enterprise Manger is an optional web-based management and reporting console for Veeam Backup & Replication.
Install Veeam Backup & Replication Console
Veeam Backup & Replication console is a client-side component that provides access to the backup server.
View Documentation

### Step 3. Read and Accept License Agreement

At the License Agreement step of the wizard, read Veeam License Agreement and licensing policy as well as license agreements of 3rd party components that Veeam incorporates and license agreements of required software. To accept the license agreements and continue installing Veeam Backup & Replication, click I Accept.



### Step 4. Provide License File

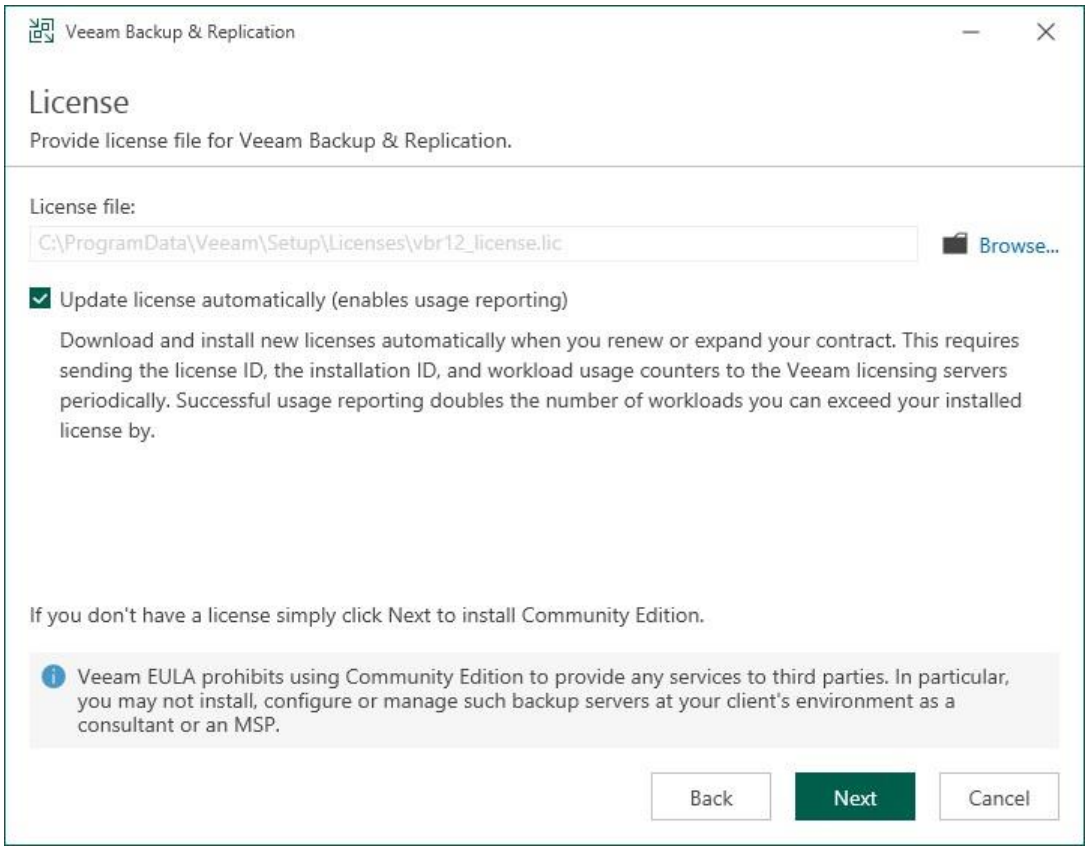
At the Provide License step of the wizard, specify what license you want to install for Veeam Backup & Replication. For more information, see Licensing.

If a valid license is already installed on the machine, the setup wizard will inform you about it. In this case, you can skip the Provide License step and move to the next step of the wizard.

If you do not install a license, the product will operate in the Veeam Backup & Replication Community (free) Edition. For more information, see Veeam Backup & Replication Community Edition.

To install a license:

1. Next to the License file field, click Browse.
2. Select a valid license file for Veeam Backup & Replication.
3. To install new licenses automatically when you renew or expand your contract, select the Update license automatically check box. If you enable the automatic license update, and therefore enable usage reporting, you will double the number of workloads by which you can exceed your installed license. For more information, see Exceeding License Limit.

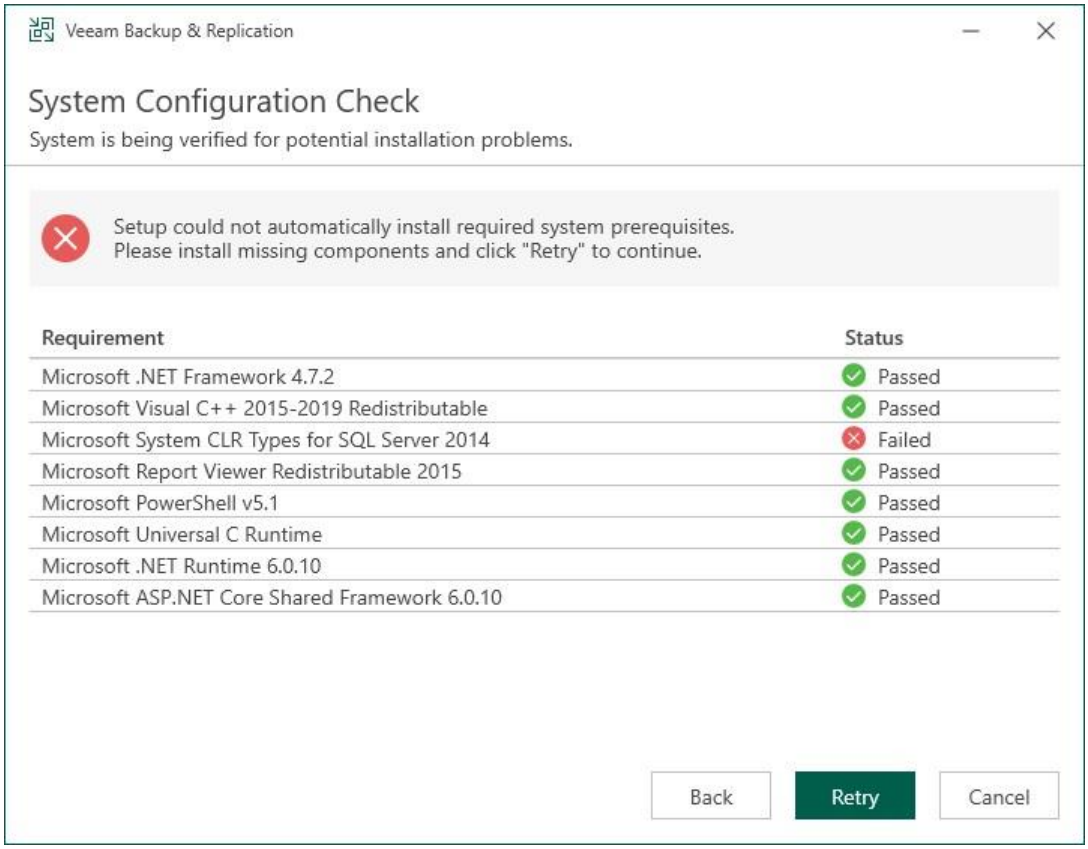


### Step 5. Install Missing Software

At the System Configuration Check step of the wizard, the setup wizard checks if the required software is installed on the machine. If some of the required components are missing, the setup will try to install them automatically. After the components are successfully installed, reboot is required. To reboot the machine, click Reboot.

If the setup wizard cannot install some of the required software components automatically, install them manually and click Retry.

> NOTE
>
> If all required software is already installed on the machine, the System Configuration Check step will be skipped. For more information on the necessary software, see System Requirements.



### Step 6. Review Default Installation Settings

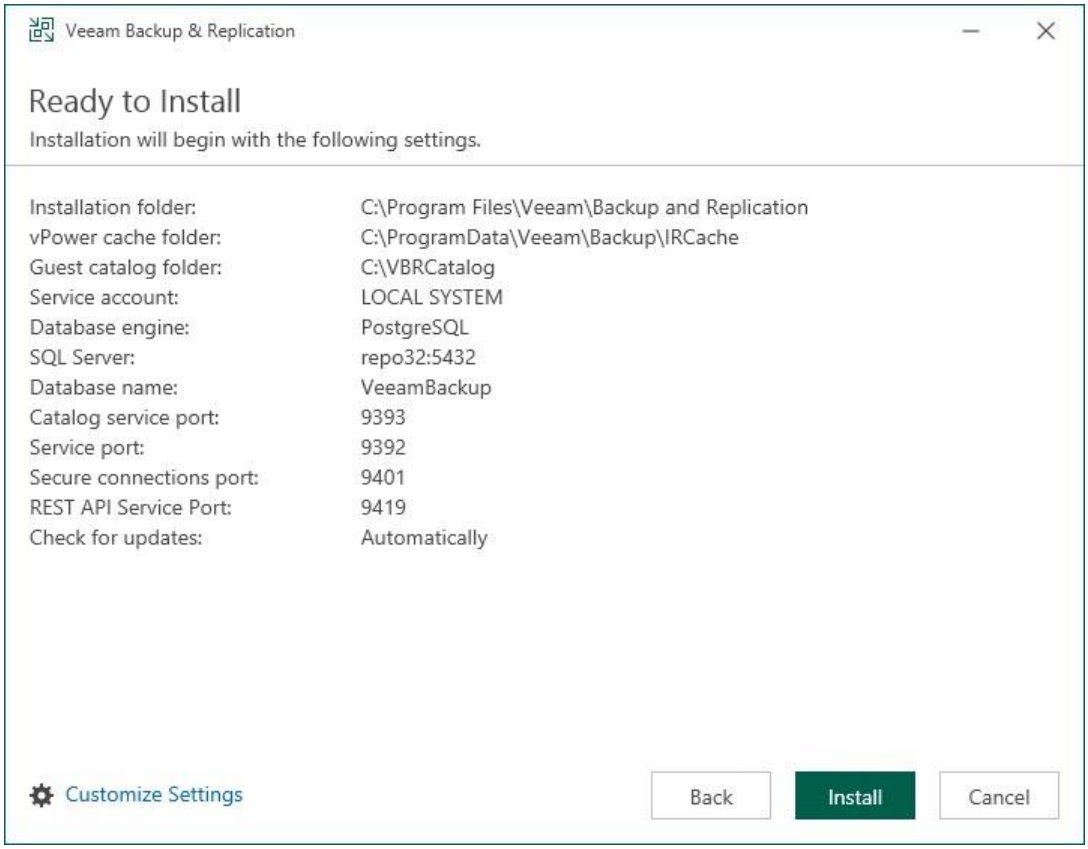
At the Ready to Install step of the wizard, you can select to install Veeam Backup & Replication with default installation settings or specify custom installation settings.

- To use the default installation settings, click Install.
- To use custom installation settings, click Customize Settings. The setup wizard will include additional steps that will let you configure installation settings.

The table below lists the default installation settings.

| Setting | Default Value | Description |
|---|---|---|
| Installation folder | C:\Program Files\Veeam\Backup and Replication | Folder where Veeam Backup & Replication will be installed. |
| vPower cache folder | C:\ProgramData\Veeam\Backup\IRCache | The `IRCache` folder on a volume with the maximum amount of free space. The IR cache folder stores the write cache for machines that are started from backups during recovery verification or restore operations. Make sure that you have at least 10 GB of free disk space to store the write cache. |
| Guest catalog folder | C:\VBRCatalog | The `VBRCatalog` folder on a volume with the maximum amount of free space.<br>The guest catalog folder stores indexing data for VM guest OS files. Indexing data is required for browsing and searching for VM guest OS files inside backups and performing 1-click restore. |
| Service account | LOCAL SYSTEM | Account under which the Veeam Backup Service runs. |
| Database engine | PostgreSQL | The setup wizard installs PostgreSQL 15.1 as a database engine locally on the Veeam Backup & Replication server. |
| SQL server | <host_name>:5432 | The local host name and port number to be used by SQL server. |

| | | |
|---|---|---|
| Database name | VeeamBackup | The setup deploys the Veeam Backup & Replication configuration database on the locally installed instance of PostgreSQL. |
| Catalog service port | 9393 | The catalog service port is used by the Veeam Guest Catalog Service to replicate catalog data from backup servers to Veeam Backup Enterprise Manager. |
| Service port | 9392 | The service port is used by Veeam Backup Enterprise Manager to collect data from backup servers. In addition to it, the Veeam Backup & Replication console uses this service port to connect to the backup server. |
| Secure connections port | 9401 | The secure connections port is used by the mount server to communicate with the backup server. |
| REST API service port | 9419 | This service port is used to access the Veeam Backup & Replication REST API. |
| Check for updates | Automatically | Veeam Backup & Replication will check for product updates weekly. When a new product build is published on the Veeam update server, a notification is displayed in the Windows Action Center. |


Veeam Backup & Replication
Ready to Install
Installation will begin with the following settings.
Installation folder: C:\Program Files\Veeam\Backup and Replication
vPower cache folder: C:\ProgramData\Veeam\Backup\IRCache
Guest catalog folder: C:\VBRCatalog
Service account: LOCAL SYSTEM
Database engine: PostgreSQL
SQL Server: repo32:5432
Database name: VeeamBackup
Catalog service port: 9393
Service port: 9392
Secure connections port: 9401
REST API Service Port: 9419
Check for updates: Automatically
Customize Settings
Back
Install
Cancel

### Step 7. Specify Service Account Settings

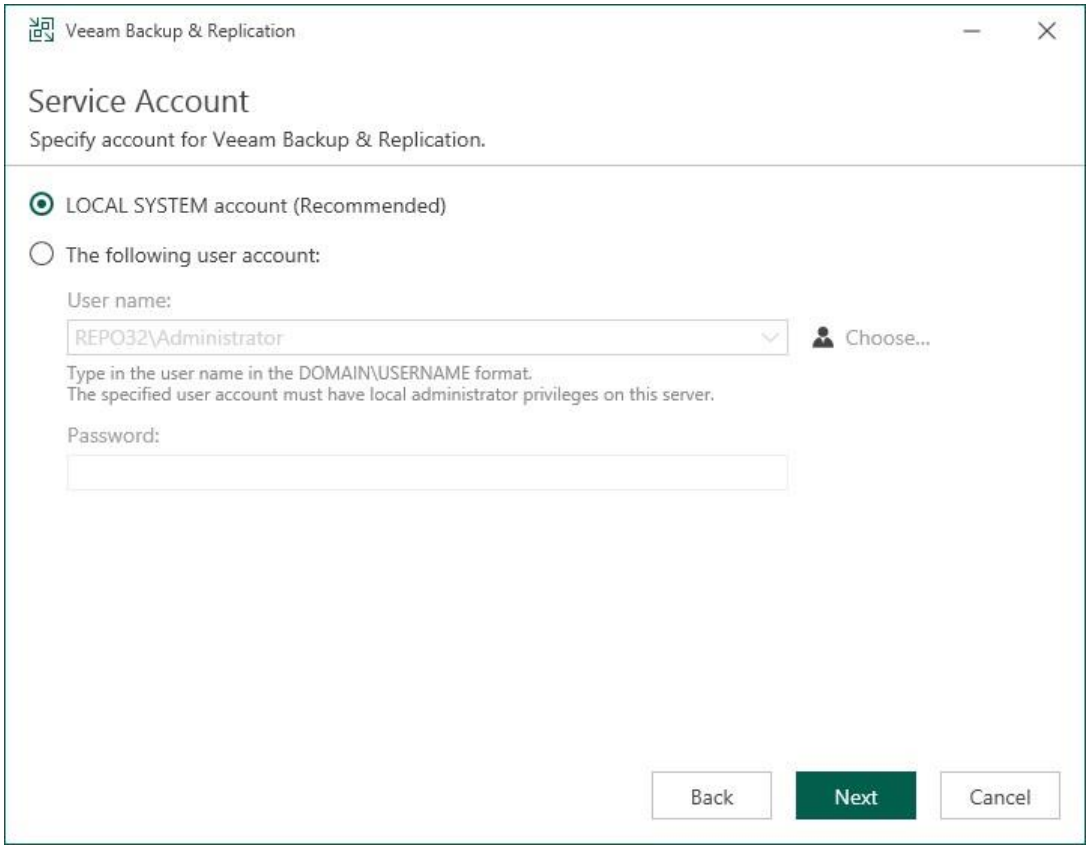
The Service Account step of the wizard is available if you have selected to configure installation settings manually.

You can select an account under which you want to run the Veeam Backup Service:

- LOCAL SYSTEM account (recommended, used by default)
- Another user account

The user name of the custom account must be specified in the DOMAIN\USERNAME format.

> NOTE
>
> The user account must have the following rights and permissions:
>
> - The account must be a member of the Administrators group on the machine where Veeam Backup & Replication is installed.
> - The account must have db_owner rights for the configuration database.
>
> Veeam Backup & Replication automatically grants the Logonasservice right to the specified user account.



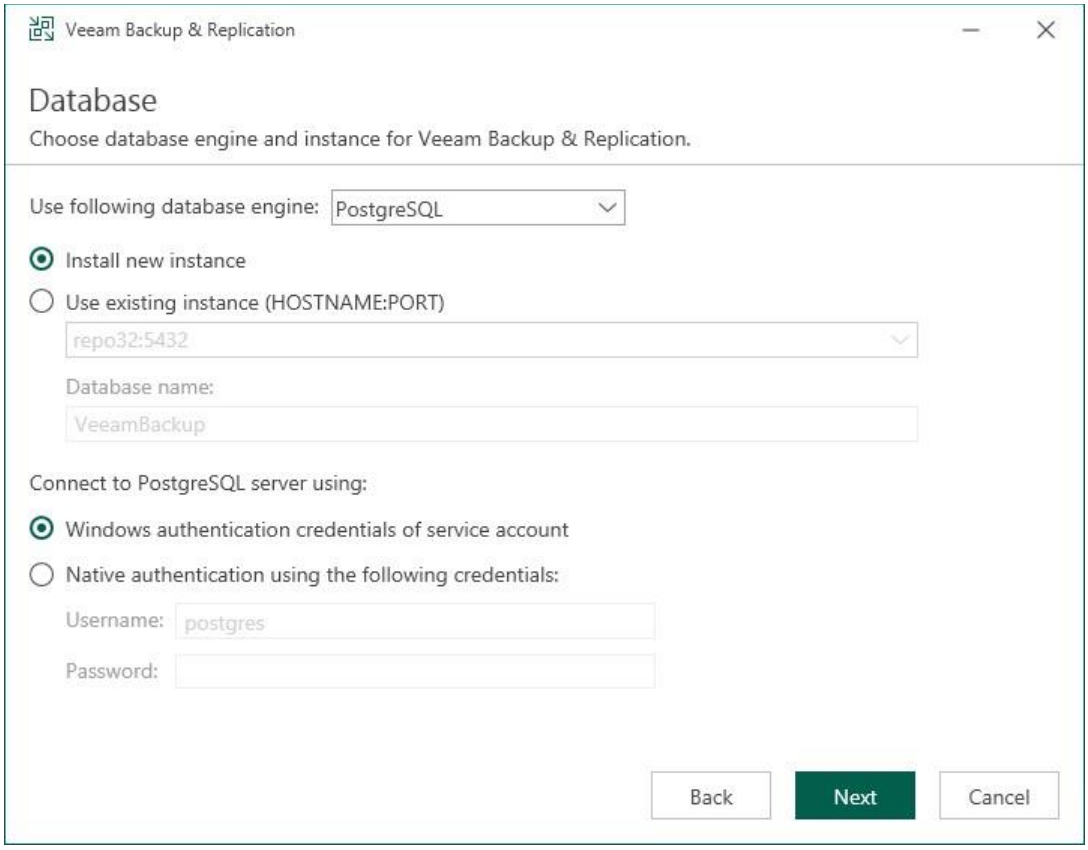
### Step 8. Specify Database Engine and Instance

The Database step of the wizard is available if you have selected to configure installation settings manually.

At this step of the wizard, you can choose a database engine (PostgreSQL or Microsoft SQL Server) for the Veeam Backup & Replication configuration database, specify a new or existing instance where you want to deploy the configuration database, and specify the authentication mode.

1. Select one of the following database engines that you want to use for the configuration database:
   - PostgreSQL
   - Microsoft SQL Server
2. Specify instance settings:
   - [For PostgreSQL] You can use an already installed PostgreSQL instance or install a new one.
     - ✦ To install a new PostgreSQL instance, select the Install a new instance option. The setup will install PostgreSQL 15.1 on the Veeam Backup & Replication server and create a database with the VeeamBackup name.
     - ✦ To use an already installed PostgreSQL instance, select the Use the existing instance option. Enter the instance name in the HOSTNAME:PORT format. In the Database name field, specify a name for the Veeam Backup & Replication configuration database.

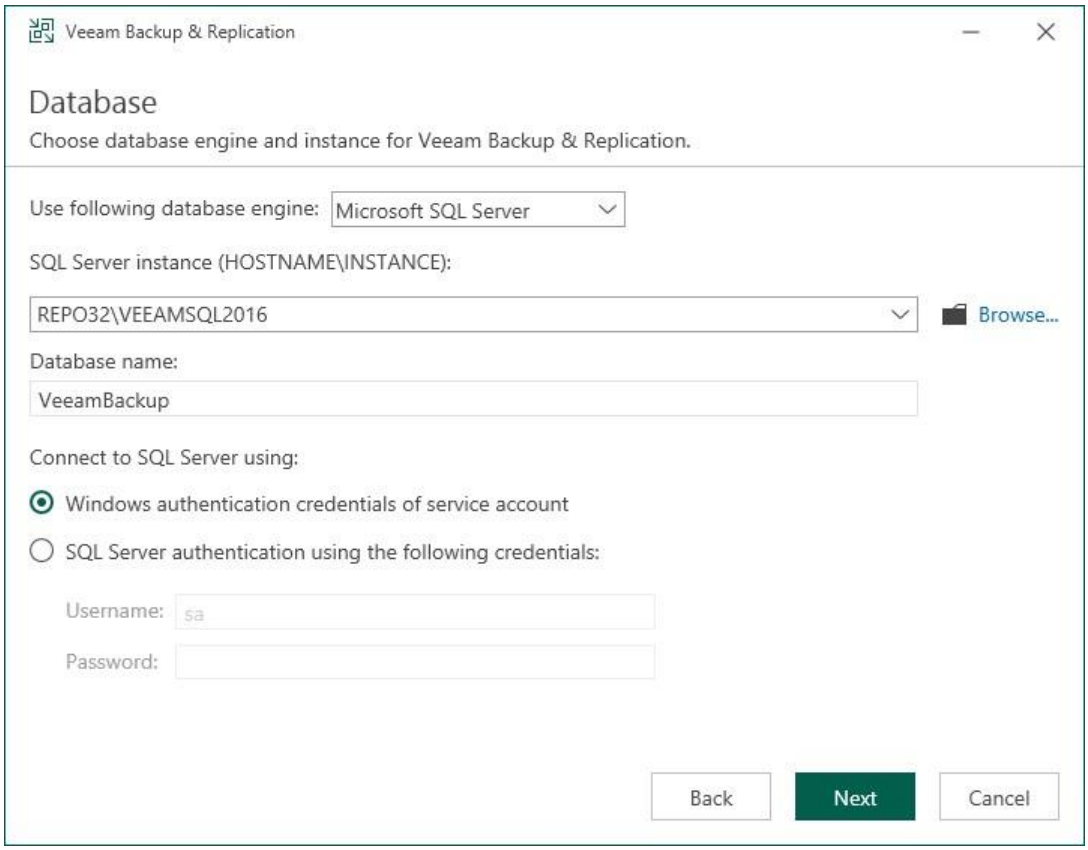
> IMPORTANT
>
> If you use the already installed PostgreSQL instance or make any changes in the machine hardware, perform the additional configuration of the PostgreSQL instance. To do that:
>
> 1. Run the Set-VBRPSQLDatabaseServerLimits cmdlet in the automatic mode.
> 2. Restart the PostgreSQL service.




   - [For Microsoft SQL Server] You can use an already installed Microsoft SQL Server database only.

i. In the SQL Server instance field, enter the instance name in the HOSTNAME\INSTANCE format or select an instance from the drop-down list. You can also click Browse to choose a Microsoft SQL Server on a remote machine.

ii. In the Database name field, specify a name for the Veeam Backup & Replication configuration database.




3. Select an authentication mode to connect to the database server instance: Microsoft Windows authentication or native database server authentication. If you select the native authentication, enter credentials of the database account.

If a configuration database with the specified name already exists (for example, it was created by a previous installation of Veeam Backup & Replication), the setup wizard will notify about it. To connect to the detected database, click Yes. If necessary, Veeam Backup Enterprise Manager will automatically upgrade the database to the latest version.

### Step 9. Specify Data Locations

The Data Locations step is available if you have selected to configure installation settings manually and to install a new instance of the database server.

At this step of the wizard, you can specify the installation folder and where the write cache and indexing data must be stored.

1. To change the default installation folder, click Browse next to the Installation path field.

   By default, the setup wizard uses the following installation folder: `C:\Program Files\Veeam\Backup and Replication`.

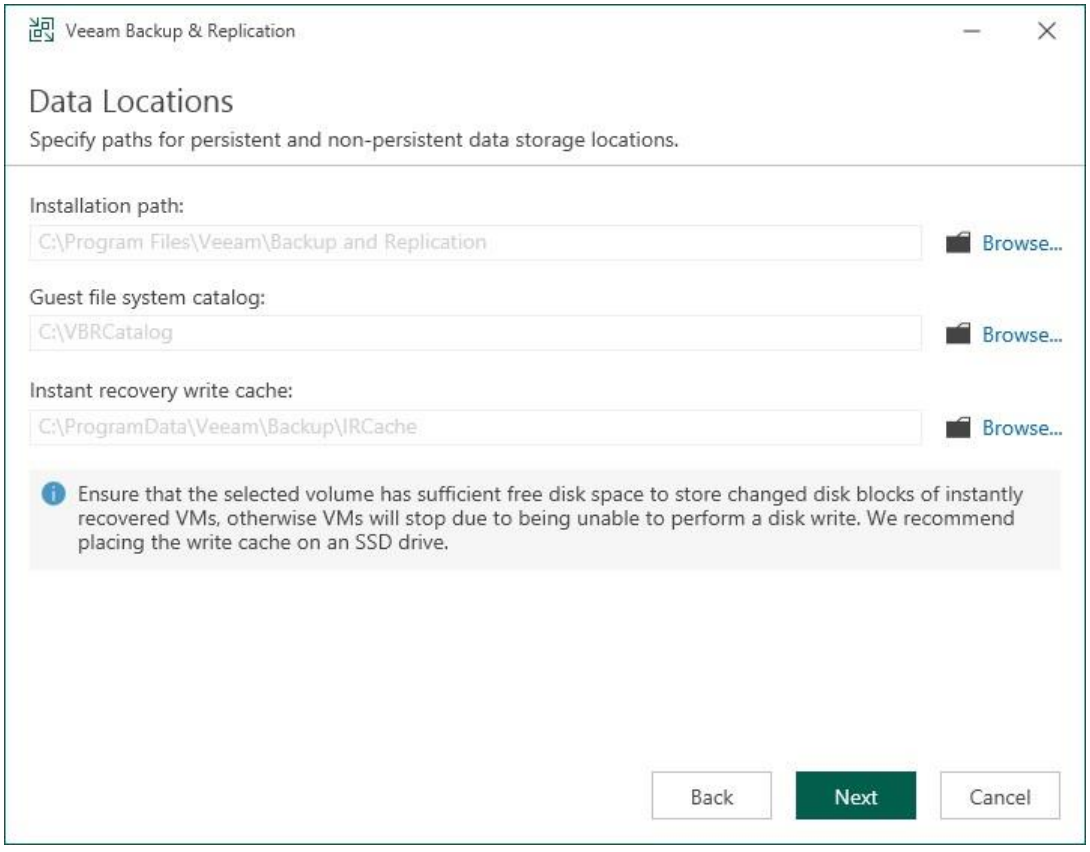
2. To change the path to the folder where index files will be stored, click Browse next to the Guest file system catalog field.

   By default, the setup wizard creates the VBRCatalog folder on a volume with the maximum amount of free space, for example: `C:\VBRCatalog`.

3. [For VMware environments] The instant recovery cache folder stores the write cache for machines that are started from backups during recovery verification or restore operations. To change the path to the IR cache folder, click Browse next to the Instant recovery write cache field. Make sure that you have at least 10 GB of free disk space to store the write cache.

   By default, the setup wizard creates the IR cache folder on a volume with the maximum amount of free space, for example: `C:\ProgramData\Veeam\Backup\IRCache`.

   You do not need to configure this data location for Microsoft Hyper-V environments.



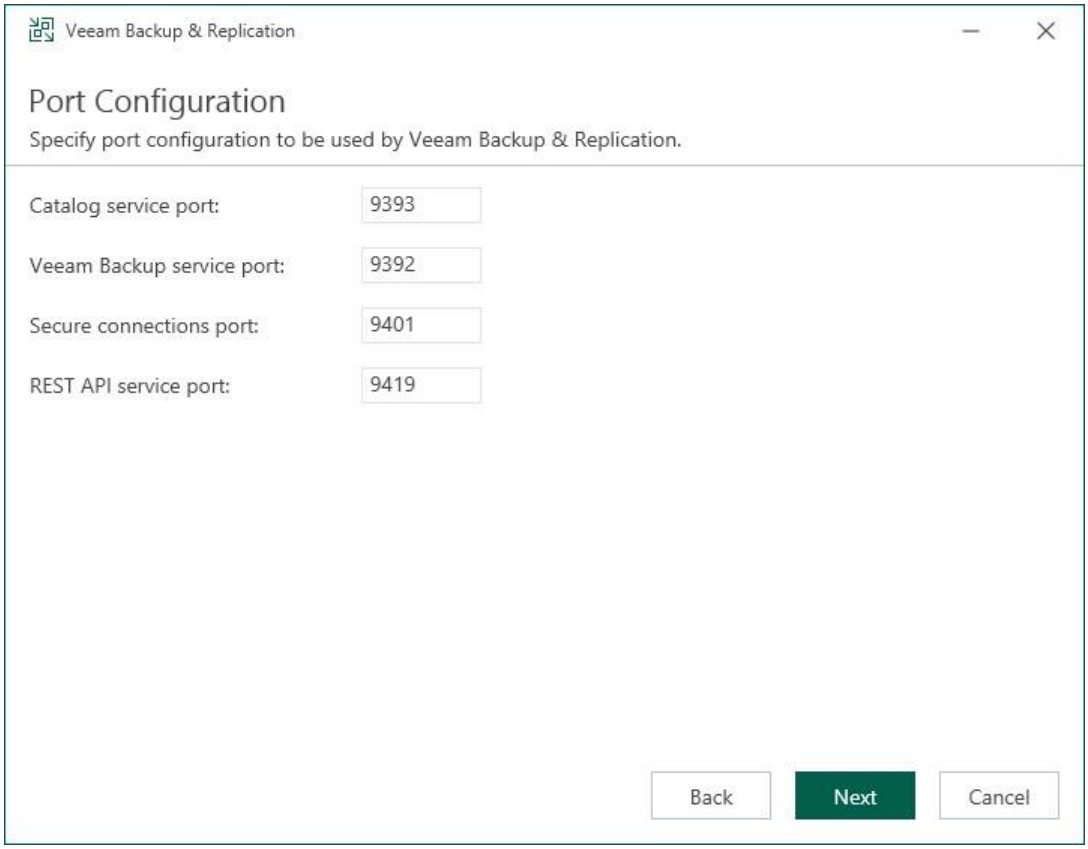

### Step 10. Specify Service Ports

The Port Configuration step of the wizard is available if you have selected to configure installation settings manually.

At this step of the wizard, you can customize port number values that will be used for communication between backup infrastructure components. For more information about Veeam Backup & Replication ports, see Ports.

- Catalog service port. This port is used by the Veeam Guest Catalog Service to replicate catalog data from backup servers to Veeam Backup Enterprise Manager. By default, port 9393 is used.

- Veeam Backup service port. This port is used by Veeam Backup Enterprise Manager to collect data from backup servers. In addition to it, the Veeam Backup & Replication console uses this service port to connect to the backup server. By default, port 9392 is used.
- Secure connections port. This port is used by the mount server to communicate with the backup server. By default, port 9401 is used.
- REST API service port. This port is used to communicate with the Veeam Backup & Replication REST API. By default, port 9419 is used.

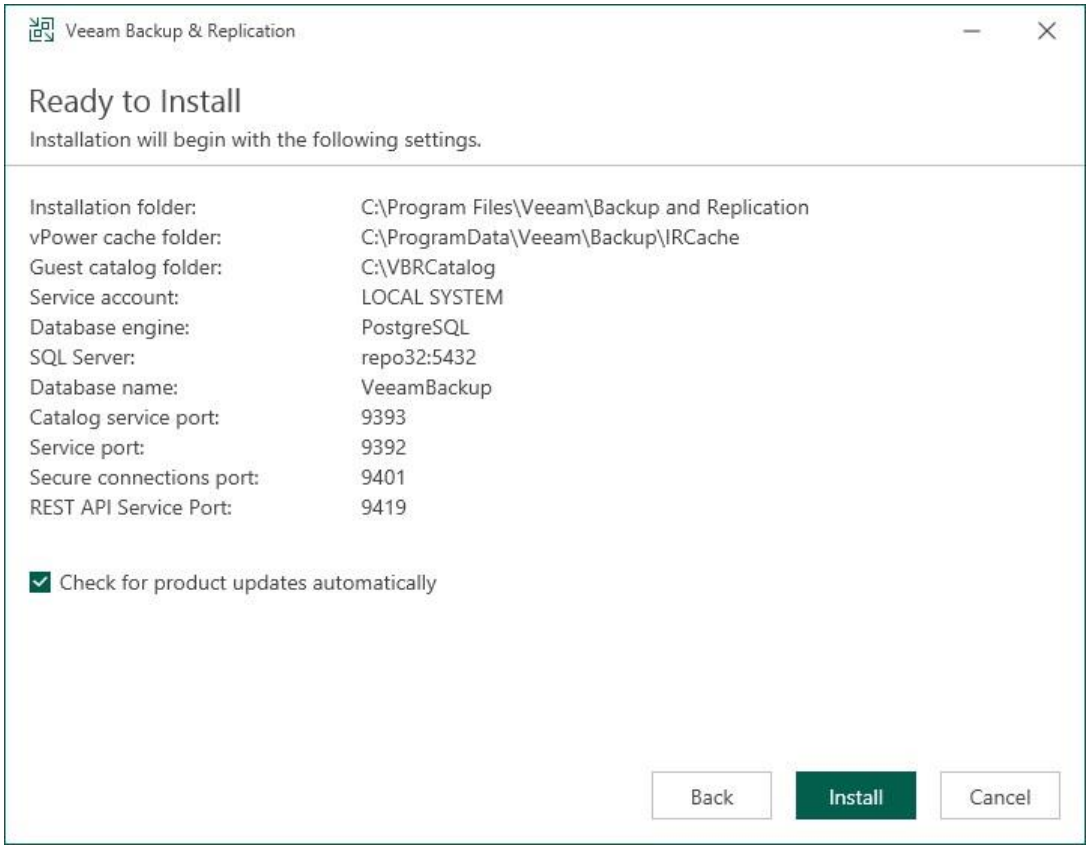


### Step 11. Begin Installation

The Ready to Install step of the wizard is available if you have selected to configure installation settings manually.

At this step of the wizard, you can review the Veeam Backup & Replication installation settings and start the installation process:

1. If you want Veeam Backup & Replication to check for product updates weekly, select the Check for product updates automatically check box. When a new product build is published on the Veeam update server, a notification will be displayed in the Windows Action Center.
2. Click Install to begin the installation.
3. Wait for the installation process to complete and click Finish to exit the setup wizard.



# Backup Infrastructure

Veeam Backup & Replication is a modular solution that lets you build a scalable backup infrastructure for environments of different sizes and configuration. The installation package of Veeam Backup & Replication includes a set of components that you can use to configure the backup infrastructure. Some components are mandatory and provide core functionality; some components are optional and can be installed to provide additional functionality for your business and deployment needs. You can co-install Veeam Backup & Replication components on the same machine, physical or virtual, or you can set them up separately for a more scalable approach.

# Backup Infrastructure Components

The Veeam backup infrastructure comprises a set of components. Some components can be deployed with the help of the setup file. Other components can be deployed using the Veeam Backup & Replication console.

# Backup Server

The backup server is a Windows-based physical or virtual machine on which Veeam Backup & Replication is installed. It is the core component in the backup infrastructure that fills the role of the "configuration and control center". The backup server performs all types of administrative activities:

- Coordinates backup, replication, recovery verification and restore tasks
- Controls job scheduling and resource allocation
- Is used to set up and manage backup infrastructure components as well as specify global settings for the backup infrastructure

In addition to its primary functions, a newly deployed backup server also performs the roles of the default VMware backup proxy and the backup repository (it manages data handling and data storing tasks).

## Backup Server Services and Components

The backup server uses the following services and components:

- Veeam Backup Service is a Windows service that coordinates all operations performed by Veeam Backup & Replication such as backup, replication, recovery verification and restore tasks. The Veeam Backup Service runs under the LocalSystem account or account that has the local Administrator permissions on the backup server.
- Veeam Broker Service interacts with the virtual infrastructure to collect and cache the virtual infrastructure topology. Jobs and tasks query information about the virtual infrastructure topology from the broker service, which accelerates job and task performance.
- Veeam Guest Catalog Service manages guest OS file system indexing for VMs and replicates system index data files to enable search through guest OS files. Index data is stored in the Veeam Backup Catalog — a folder on the backup server. The Veeam Guest Catalog Service running on the backup server works in conjunction with search components installed on Veeam Backup Enterprise Manager and (optionally) a dedicated Microsoft Search Server.
- Mount Service mounts backups and replicas for file-level access, browsing the VM guest file system and restoring VM guest OS files and application items to the original location.
- VMware Backup Proxy Services In addition to dedicated services, the backup server runs a set of Veeam Data Movers. For details, see VMware Backup Proxy.
- Veeam CDP Coordinator Service communicates with vCenter, assigns continuous data protection (CDP) tasks and manages the infrastructure components involved in CDP. For more information on CDP, see Continuous Data Protection (CDP).
- Veeam Backup & Replication Configuration Database stores data about the backup infrastructure, jobs, sessions and other configuration data. The database instance can be located on a SQL Server installed either locally (on the same machine where the backup server is running) or remotely. For more information, see the following guidelines: Veeam Backup & Replication Best Practices.

  Veeam Backup & Replication maintains the configuration database. Veeam Backup & Replication runs the DatabaseMaintenance system job once a week and when the Veeam Backup Service is restarted. The job updates the database internal statistics, defragments indexes and clears unused data. For details, see the `Job.DatabaseMaintenance` log file in the `%ProgramData%\Veeam\Backup` folder.
- Veeam Backup & Replication Console provides the application user interface and allows user access to the application functionality.
- Veeam Backup PowerShell Module is an extension for Microsoft Windows PowerShell that adds a set of cmdlets to allow users to perform backup, replication and recovery tasks through the command-line interface of PowerShell or run

custom scripts to fully automate operation of Veeam Backup & Replication. For more information on the Microsoft Windows PowerShell module, see the Getting Started section of Veeam PowerShell Reference.

# Credentials Manager

You can use the Credentials Manager to create and maintain a list of credentials records that you plan to use to connect to components in the backup infrastructure.

The Credentials Manager lets you create the following types of credentials records:

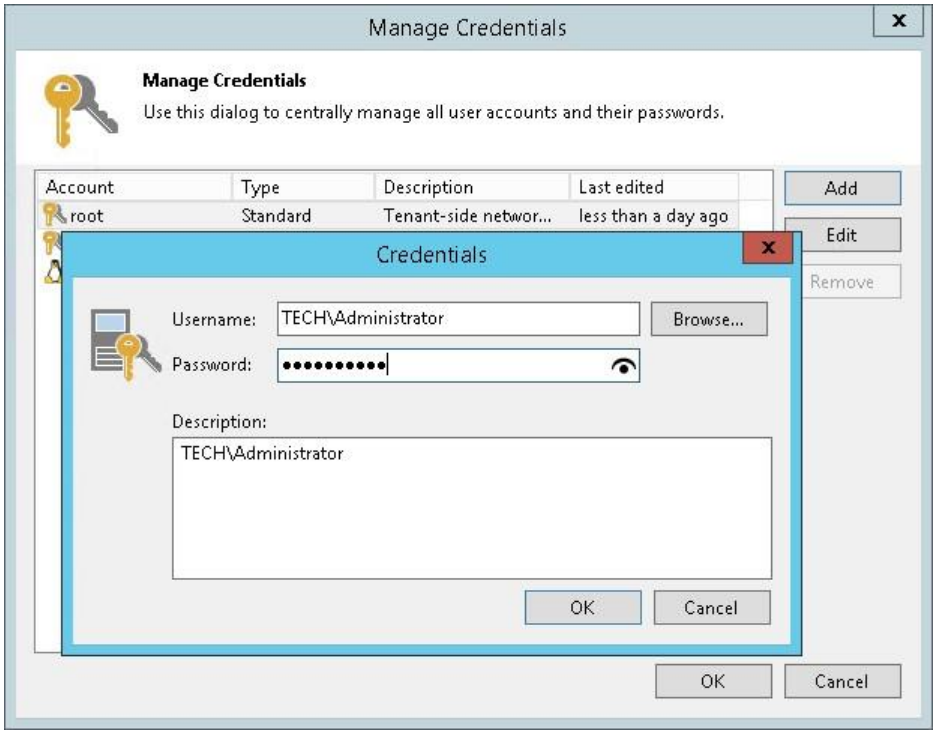
- Standard account
- Group Managed Service Accounts
- Linux account (user name and password)
- Linux private key (Identity/Pubkey)

## Standard Accounts

You can create a credentials record for an account that you plan to use to connect to a Microsoft Windows server, a VM running Microsoft Windows OS or a storage system.

To create a new standard credentials record:

1. From the main menu, select Credentials and Passwords > Datacenter Credentials.
2. Click Add > Standard account.
3. In the Username field, enter a user name for the account that you want to add. You can also click Browse to select an existing user account.
4. In the Password field, enter a password for the account that you want to add. To view the entered password, click and hold the eye icon on the right of the field.
5. In the Description field, enter a description for the created credentials record. As there can be a number of similar account names, for example, Administrator, it is recommended that you provide a meaningful unique description for the credentials record so that you can distinguish it in the list. The description is shown in brackets, following the user name.

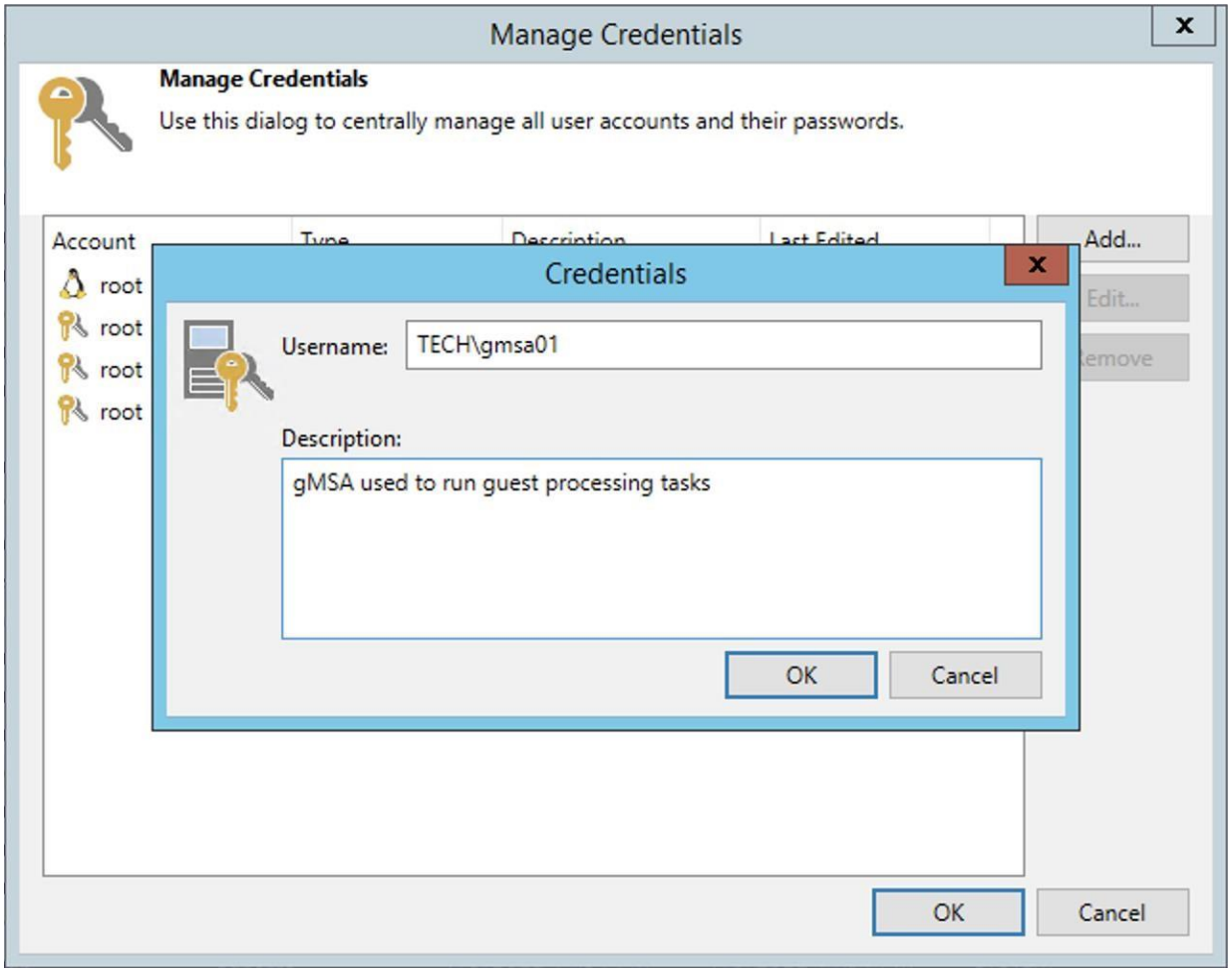



### Group Managed Service Accounts

You can add a credentials record for a Group Managed Service Account (gMSA) that you plan to use to run guest processing tasks. Note that before you add a record you should check requirements and limitations and perform actions described in the Using Group Managed Service Accounts section.

To add a new credentials record with the gMSA:

1. From the main menu, select Credentials and Passwords > Datacenter Credentials.
2. Click Add > Managed service account.
3. In the Username field, enter a gMSA that you want to add. Note that the name of the account must be specified in the following format: DOMAIN\User or user@domain.xxx.
4. In the Description field, enter a description for the created credentials record. As there can be a number of similar account names, for example, gmsa01, it is recommended that you provide a meaningful unique description for the credentials record so that you can distinguish it in the list. The description is shown in brackets, following the user name.




## Editing and Deleting Credentials Records

You can edit or delete credentials records that you have created.

To edit a credentials record:

1. From the main menu, select Credentials and Passwords > Datacenter Credentials.
2. Select the credentials record in the list and click Edit.
3. If the credentials record is already used for any component in the backup infrastructure, Veeam Backup & Replication will display a warning. Click Yes to confirm your intention.
4. Edit settings of the credentials record as required.

To delete a credentials record:

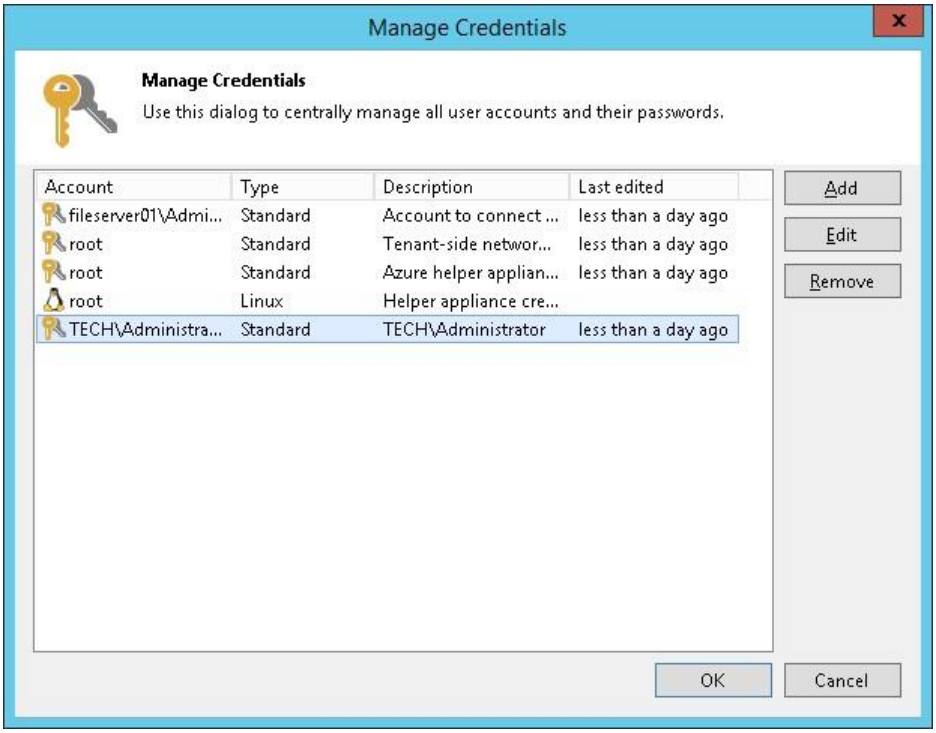
1. From the main menu, select Credentials and Passwords > Datacenter Credentials.
2. Select the credentials record in the list and click Remove. You cannot delete a record that is already used for any component in the backup infrastructure.

NOTE

The Credentials Manager contains 3system credentials records:

- A credentials record for the Veeam FLR appliance
- A credentials record for the tenant-side network extension appliance
- A credentials record for Microsoft Azure restore proxy appliance (former Azure proxy).

You cannot delete these credentials records. However, you can edit them: change a password and record description.



# Backup Proxies & Agents

## Veeam Agent for Microsoft Windows

To deploy Veeam Agent for Microsoft Windows using setup files generated by Veeam Backup & Replication, perform the following operations:

- Installation
- Configuration

> TIP
>
> You can also find detailed instructions on the Veeam Agent deployment in the `readme.txt` file that is available among the setup files generated by Veeam Backup & Replication.

# Configuration

To configure Veeam Agent for Microsoft Windows, you must apply connection settings from the configuration file. You obtained this file together with other setup files when the protection group for pre-installed Veeam Agents was created. To do configure Veeam Agent, execute the following command from the folder where Veeam Agent setup files are located:

```
"C:\Program Files\Veeam\Endpoint Backup\Veeam.Agent.Configurator.exe" -setVBRse
ttings /p:"<protection_group_name>.xml"
```

where `<protection_group_name>` is a name of the protection group for pre-installed Veeam Agents. Alternatively, you can specify the full path to the configuration file passed with the `/p` option.

Mind that the connection between Veeam Backup & Replication and Veeam Agent is not persistent. Veeam Agent synchronizes with Veeam Backup & Replication every 6 hours. After you apply new backup policy settings in the Veeam Backup & Replication console, Veeam Agent will get these settings during the next synchronization.

To synchronize Veeam Agent immediately, run the following command on the Veeam Agent computer:

```
"C:\Program Files\Veeam\Endpoint Backup\Veeam.Agent.Configurator.exe" -syncnow
```

# Backup Jobs

# Microsoft Windows – Host Server Backup

To back up data of a computer protected with Veeam Agent for Microsoft Windows, you must configure a Veeam Agent backup job in Veeam Backup & Replication.

# Before You Begin

Before you create a Veeam Agent backup job in the Veeam Backup & Replication console, check the following prerequisites:

- The Veeam Backup & Replication license must have a sufficient number of instances to process servers and/or workstations that you plan to add to the Veeam Agent backup job.
- The target location where you plan to store backup files must have enough free space.
- Protection groups that you want to add to the job must be configured in advance.
- [For backup jobs targeted at the cloud repository] The Veeam Cloud Connect service provider must be added in the Veeam backup console.

Veeam Agent backup jobs have the following limitations:

- For Veeam Agent backup job managed by backup server, you can create Veeam Agent backups in a Veeam backup repository and Veeam Cloud Connect repository. If you want to save backups in other target locations, you must configure a Veeam Agent backup job managed by Veeam Agent (backup policy). To learn more, see Veeam Agent Backup Jobs and Policies.
- [For Veeam Agent backup job managed by Veeam Agent] You cannot save the backup of entire computer on the local computer disk. Use an external hard drive or USB drive, network shared folder or backup repository as a target location.
- Veeam Agent for Microsoft Windows does not support file-level backup for backup jobs that include failover clusters.
- Veeam Agent for Microsoft Windows does not back up data to which symbolic links are targeted. It only backs up the path information that the symbolic links contain. After restore, identical symbolic links are created in the restore destination.
- After you start managing a Veeam Agent computer with Veeam Backup & Replication, data backup for this computer is performed by a backup job configured in Veeam Backup & Replication. Veeam Agent running on the computer starts a new backup chain in a target location specified in the backup job settings. You cannot continue the existing backup chain that was created by Veeam Agent operating in the standalone mode.
- You cannot map a Veeam Agent backup job configured in Veeam Backup & Replication to a Veeam Agent backup chain created by a standalone Veeam Agent in a backup repository.
- The backup cache is supported only for Veeam Agent backup jobs managed by Veeam Agent.
- Veeam Agent does not support creating transaction log backups in a cloud repository. You cannot enable transaction log backup options in the properties of the backup job targeted at a cloud repository.

## Step 1. Launch New Agent Backup Job Wizard

You can create a Veeam Agent backup job for protected computers that run a Microsoft Windows OS in one of the following ways:

- Create a new backup job — in this case, Veeam Backup & Replication will launch the New Agent Backup Job wizard. You will be able to specify protection groups, individual Active Directory objects and/or Veeam Agent computers to which the backup job settings must apply at the Computers step of the wizard.
- Add a protection group to a new backup job — in this case, Veeam Backup & Replication will launch the New Agent Backup Job wizard and add the selected protection group to the backup job. You will also be able to change the list of Veeam Agent computers to which the backup job settings must apply at the Computers step of the wizard.
- Add individual computers to a new backup job — in this case, Veeam Backup & Replication will launch the New Agent Backup Job wizard and add the selected computers to the backup job. You will also be able to change the list of Veeam Agent computers to which the backup job settings must apply at the Computers step of the wizard.

## Launching Backup Job Wizard

To launch the New Agent Backup Job wizard, do either of the following:

On the Home tab, click Backup Job > Windows computer.

Open the Home view. Select the Jobs node and click Backup Job > Windows computer on the ribbon.

Open the Home view. Right-click the Jobs node and select Backup > Windows computer.

## Adding Protection Group to New Backup Job

To add a protection group to a new Veeam Agent backup job, do either of the following:

- Open the Inventory view. In the Physical Infrastructure node, right-click the protection group that you want to add to the backup job and select Add to backup job > Windows > New job.
- Open the Inventory view. In the Physical Infrastructure node, select the protection group that you want to add to the backup job and click Add to Backup > Windows > New job on the ribbon.

Veeam Backup & Replication will start the New Agent Backup Job wizard and add the protection group to the job. You can add other protection groups and (or) individual computers to the job later on, when you pass through the wizard steps.

## Adding Computers to New Backup Job

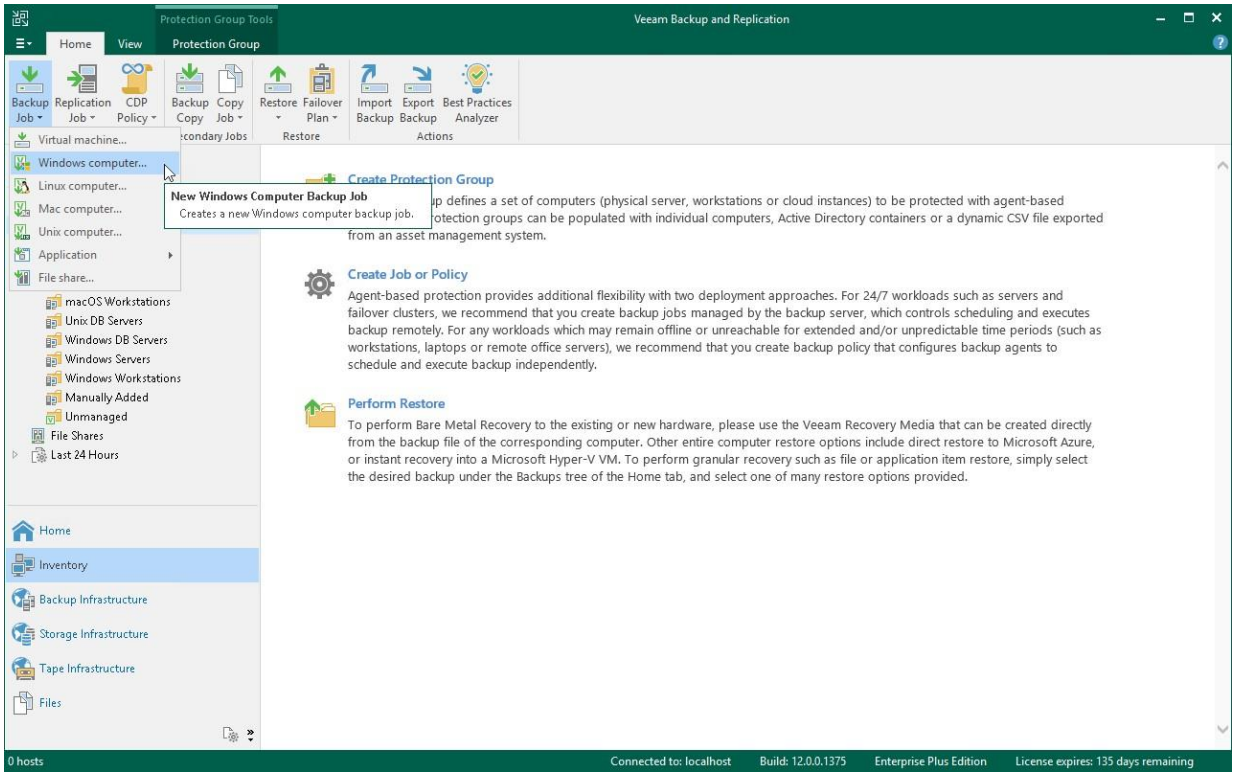
To add specific computers to a new Veeam Agent backup job, do either of the following:

Open the Inventory view. In the Physical Infrastructure node, click the protection group whose computers you want to add to the backup job. In the working area, select one or more computers that you want to add to the job, right-click the selected computer and select Add to backup job > New job.

Open the Inventory view. In the Physical Infrastructure node, click the protection group whose computers you want to add to the backup job. In the working area, select one or more computers that you want to add to the job and click Add to Backup > New job on the ribbon.

Veeam Backup & Replication will start the New Agent Backup Job wizard and add the selected computers to the job. You can add other computers and (or) protection groups to the job later on, when you pass through the wizard steps.

> TIP
>
> Consider the following:
>
> - You can press and hold [CTRL] to select multiple computers at once.
> - You can add an individual computer or protection group to a Veeam Agent backup job that is already configured in Veeam Backup & Replication. To learn more, see Adding Computers to Backup Job and Adding Protection Group to Backup Job.




### Step 2. Select Job Mode

At the Job Mode step of the wizard, specify protection settings for the backup job:

Select the type of protected computers whose data you want to back up with Veeam Agents.

If you choose to back up data pertaining to servers, select the job mode.

The job mode defines the type of the created Veeam Agent backup job: the backup job (backup job managed by the backup server) or backup policy (backup job managed by Veeam Agent).

## Selecting Protected Computer Type

At the Job Mode step of the wizard, in the Type field, select the type of protected computers whose data you want to back up with Veeam Agents. The selected type defines what modes will be available for the configured backup job and what job settings will be available at subsequent steps of the wizard. You can select one of the following computer types:

Workstation — select this option if you want to back up data pertaining to workstations or laptops. This option is suitable for computers that reside in a remote location and may have limited connection to the backup server.

For backup jobs that process workstations, Veeam Backup & Replication offers settings similar to the settings of the backup job available in the Workstation edition of Veeam Agent for Microsoft Windows. To learn more, see Veeam Agent for Microsoft Windows User Guide.

With this option selected, the backup job will be managed by Veeam Agent installed on the protected computer — you do not need to select the job mode.

Server — select this option if you want to back up data pertaining to standalone servers. This option is suitable for computers that have permanent connection to the backup server.

For backup jobs that process servers, Veeam Backup & Replication offers settings similar to the settings of the backup job available in the Server edition of Veeam Agent for Microsoft Windows. To learn more, see Veeam Agent for Microsoft Windows User Guide.

With this option selected, you can also select the job mode. To learn more, see Selecting Job Mode.

Failover cluster — select this option if you want to back up data pertaining to a failover cluster.

For backup jobs that process failover clusters, Veeam Backup & Replication offers practically the same backup job settings as for servers.

With this option selected, the backup job will be managed by the Veeam backup server — you do not need to select the job mode.

## Selecting Job Mode

If you selected the Server computer type in the Type field, in the Mode field, select the job mode. You can select one of the following modes:

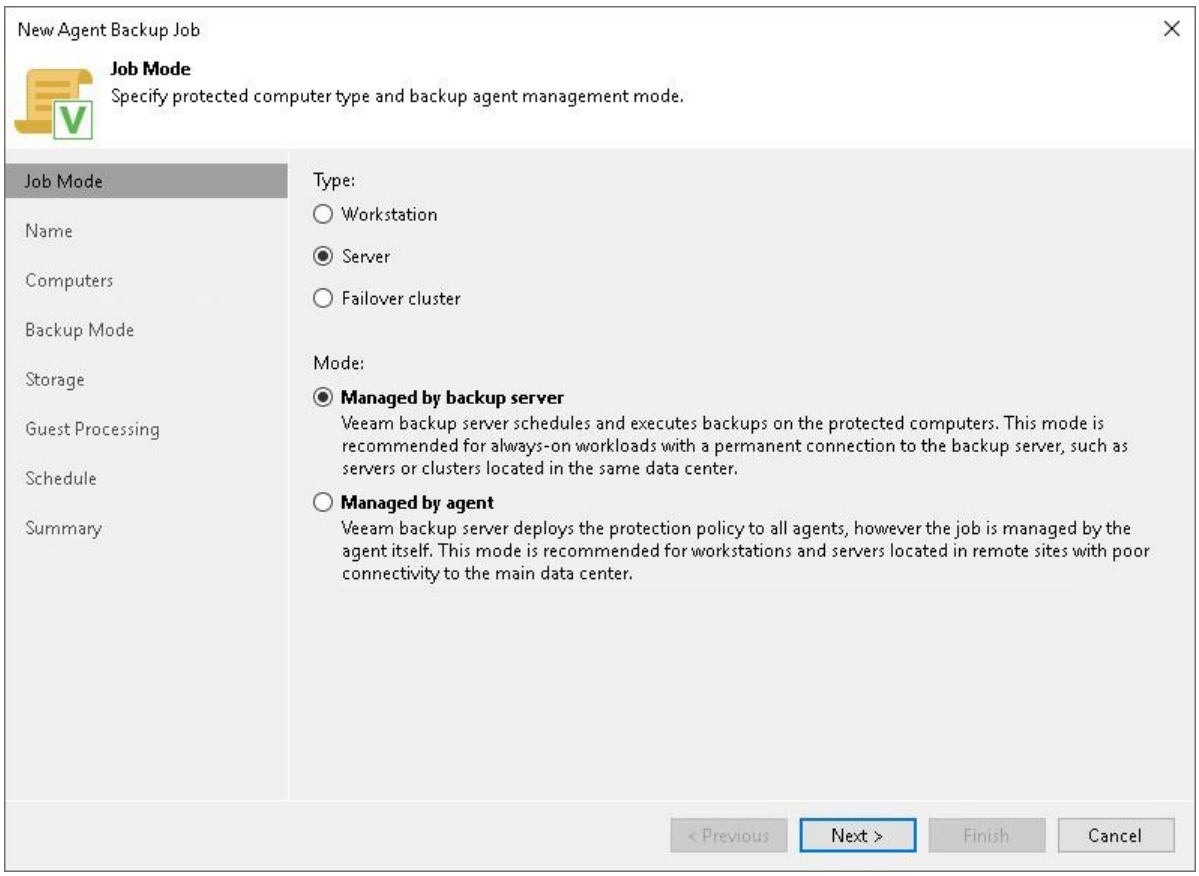
Managed by backup server — select this option if you want to configure the Veeam Agent backup job. With this option selected, you will be able to add one or more individual computers and/or protection groups to the job and instruct Veeam Backup & Replication to create Veeam Agent backups in a Veeam backup repository or Veeam Cloud Connect repository. The Veeam Agent backup job will run on the backup server in the similar way as a regular job for VM data backup. To learn more, see Backup Job.

> NOTE
>
> The Managed by backup server option is available for the Server and Failover cluster computer types. For Failover cluster, this is the only available option. This option is not available for the Workstation computer type.
>
> You must select the Managed by backup server option if you want to use the backup job to protect cloud machines. To learn more, see Select Protection Group Type.

Managed by agent — select this option if you want to configure the backup policy. The backup policy describes configuration of individual Veeam Agent backup jobs that run on protected computers, and acts as a saved template. With this option selected, you will be able to add one or more individual computers and/or protection groups to the backup policy, and instruct Veeam Agent to create backups on a local disk of a protected computer, in a network shared folder, in a Veeam backup repository or in a Veeam Cloud Connect repository. To learn more, see Backup Policy.

NOTE

- The Managed by agent option is available for the Workstation and Server computer types. For Workstation, this is the only available option. This option is not available for the Failover cluster computer type.
- You must select the Managed by agent option if you want to use the backup job to protect computers with pre-installed Veeam Agents. To learn more, see Select Protection Group Type.



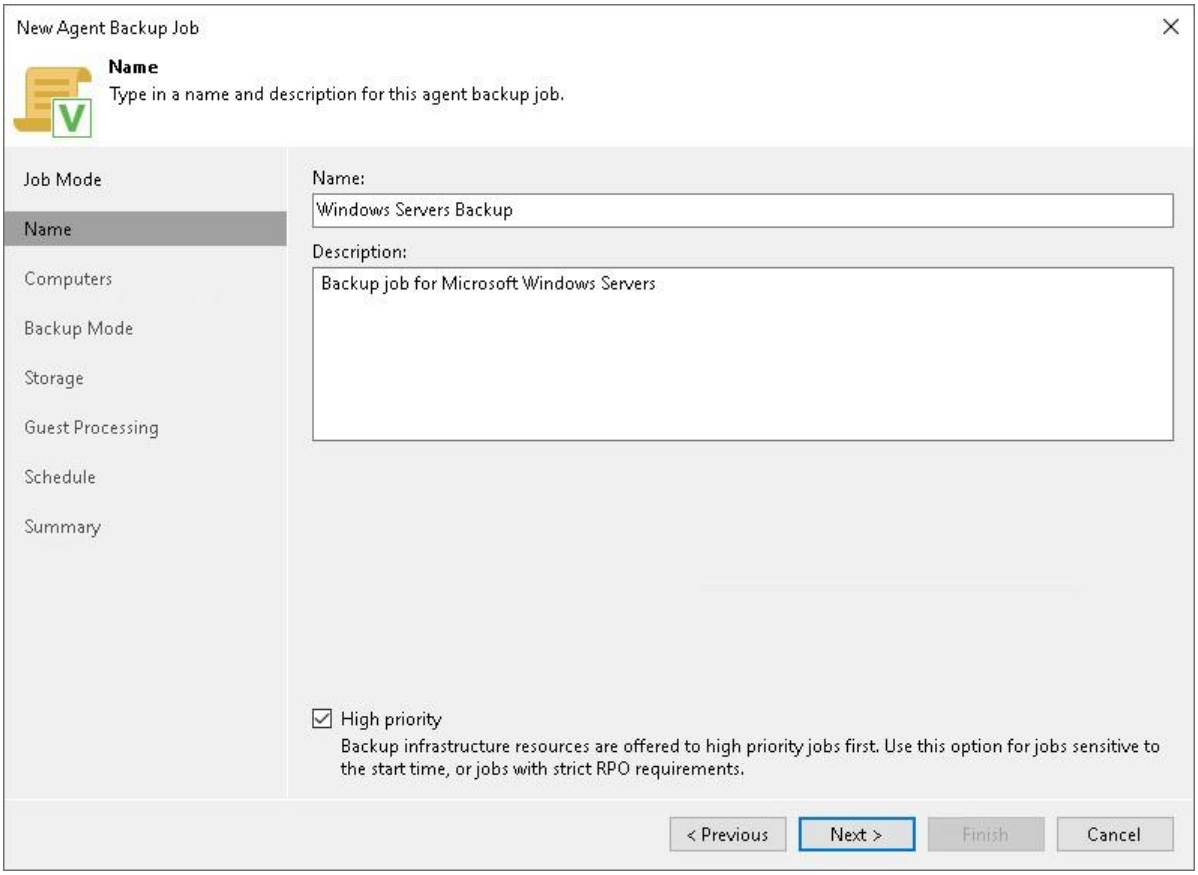

### Step 3. Specify Job Name and Description

At the Name step of the wizard, specify a name and description for the backup job.

In the Name field, enter a name for the backup job.

In the Description field, provide a description for future reference. The default description contains information about the user who created the job, date and time when the job was created.

[For backup job managed by backup server] Select the High priority check box if you want the resource scheduler of Veeam Backup & Replication to prioritize this job higher than other similar jobs and to allocate resources to it in the first place. To learn more, see the Job Priorities section in the Veeam Backup & Replication User Guide.




### Step 4. Select Computers to Back Up

At the Computers step of the wizard, select protection groups and/or individual computers whose data you want to back up.

You can add to the Veeam Agent backup job one or more protection groups and/or individual computers added to inventory in the Veeam Backup & Replication console. You can also add to the job computers that are not added to inventory yet. Veeam Backup & Replication will add such computers to the job and also add them to the Manually Added protection group.

Jobs with protection groups are dynamic in their nature. If Veeam Backup & Replication discovers a new computer in a protection group after the Veeam Agent backup job is created, Veeam Backup & Replication will automatically update the job settings to include the added computer.

NOTE

If you used the Add to backup job > Windows > New job option to launch the New Agent Backup Job wizard, the Protected computers list will already contain computers that you have selected to add to the job. You can remove some computers from the job or add new computers to the job, if necessary.

Veeam Backup & Replication displays protection groups for pre-installed Veeam Agents and their members only if you selected the Managed by agent option at the Job Mode step of the wizard. You cannot add protection groups for pre-installed Veeam Agents to backup jobs managed by backup server. To learn more, see Selecting Job Mode.

Veeam Backup & Replication displays protection groups for cloud machines and their members only if you selected the Managed by backup server option at the Job Mode step of the wizard. You cannot add protection groups for cloud machines to backup policies (backup jobs managed by backup Veeam Agent). To learn more, see Selecting Job Mode.

### Adding Protection Groups and Computers from Inventory

To add protection groups and/or individual computers to the Veeam Agent backup job:

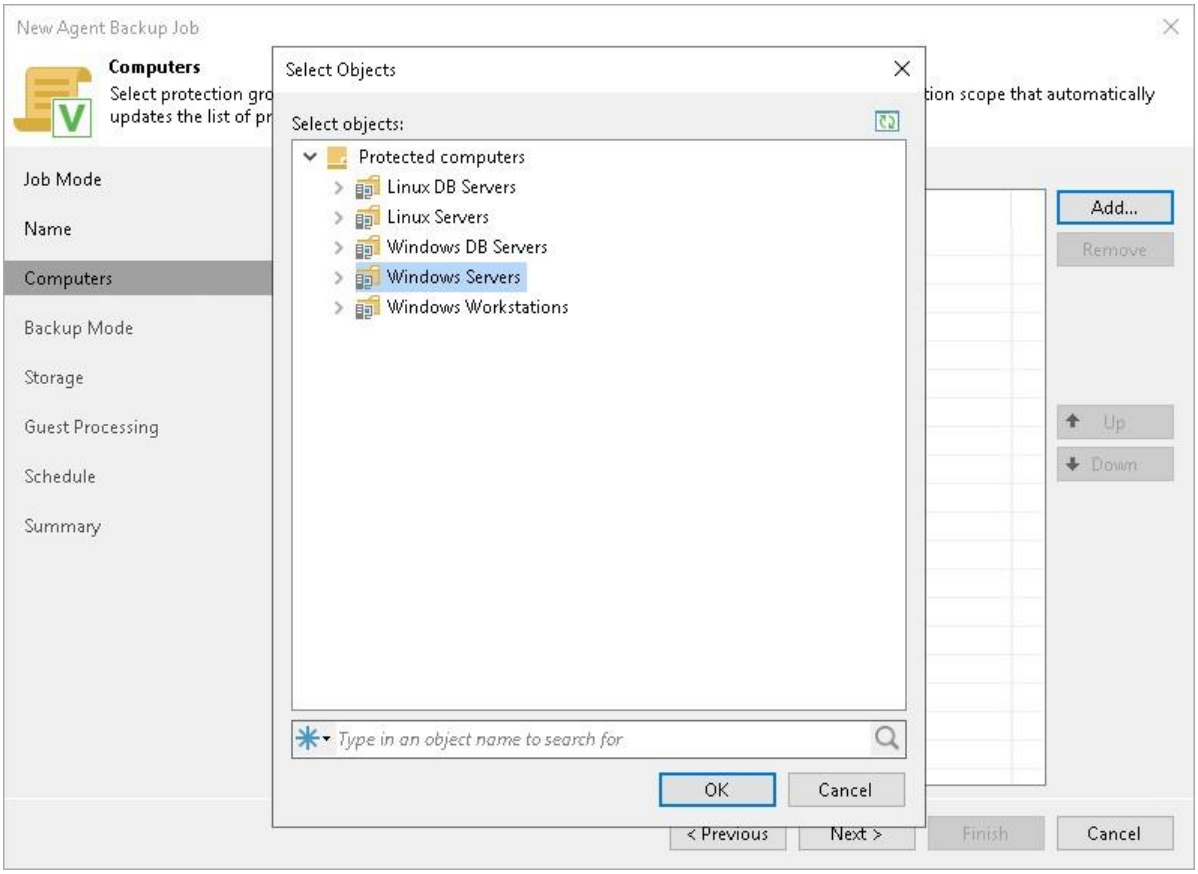
Click Add > Protection group.

In the Select Objects window, select one or more protection groups and/or computers in the list and click OK. You can press and hold [CTRL] to select multiple objects at once.

To quickly find the necessary object, use the search field at the bottom of the Select Objects window.

Enter the object name or a part of it in the search field.

Click the Start search button on the right or press [ENTER].



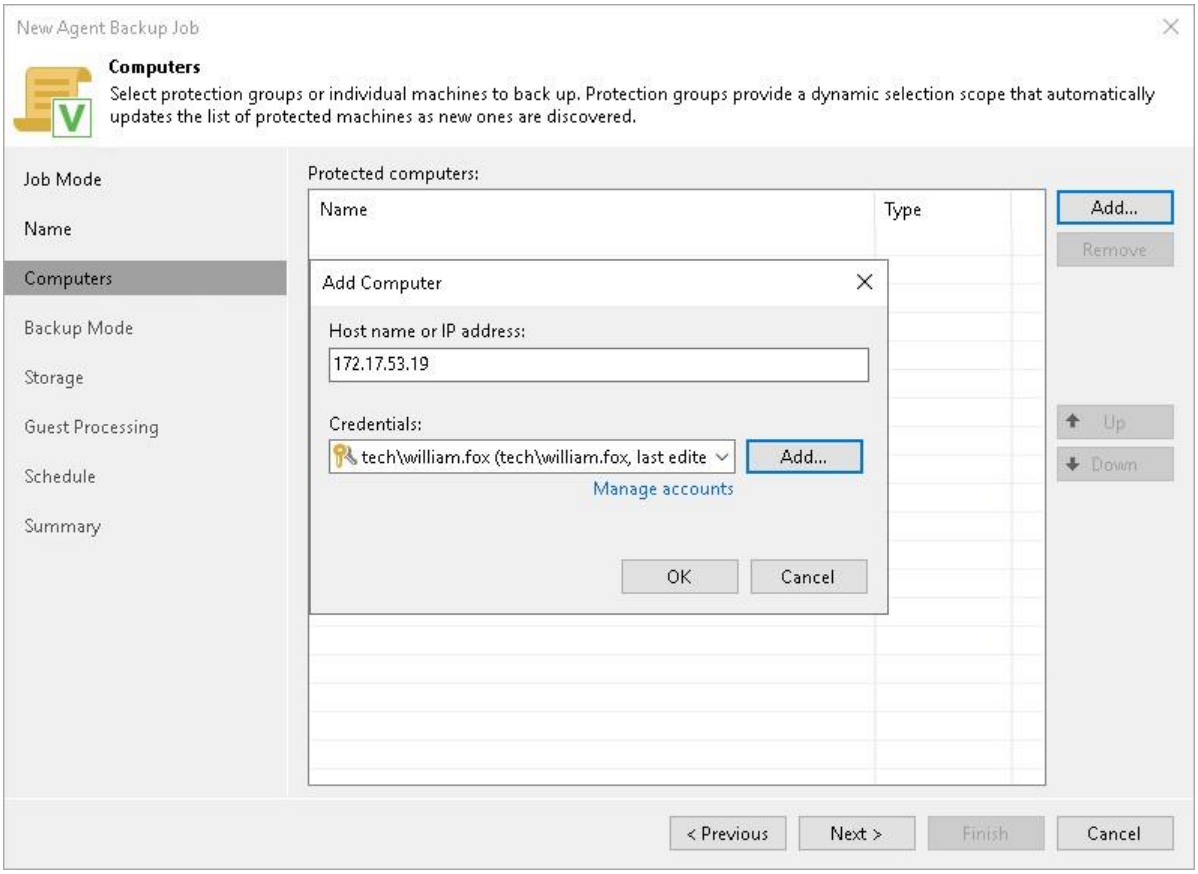

### Adding New Computers

To add to the Veeam Agent backup job new computers that do not exist in the inventory:

Click Add > Individual computer.

In the Add Computer window, in the Host name or IP address field, enter a full DNS name or IP address of the computer that you want to add to the job.

From the Credentials list, select a user account that has administrative permissions on the computer that you want to add to the job. If you have not set up credentials beforehand, click the Manage accounts link or click Add on the right to add credentials. For more information, see the Credentials Manager section in the Veeam Backup & Replication User Guide.




## Step 5. Select Backup Mode

At the Backup Mode step of the wizard, select the mode in which you want to create a backup.

In the Backup mode section, select the backup mode. You can select one of the following options:

Entire computer — select this option if you want to create a backup of the entire computer image. When you restore data from such backup, you will be able to recover the entire computer image as well as data on specific computer volumes: files, folders, application data and so on. With this option selected, you will pass to one of the following steps of the wizard:

Storage — if you have selected the Managed by backup server option at the Job Mode step of the wizard.

Destination — if you have selected the Managed by agent option at the Job Mode step of the wizard.

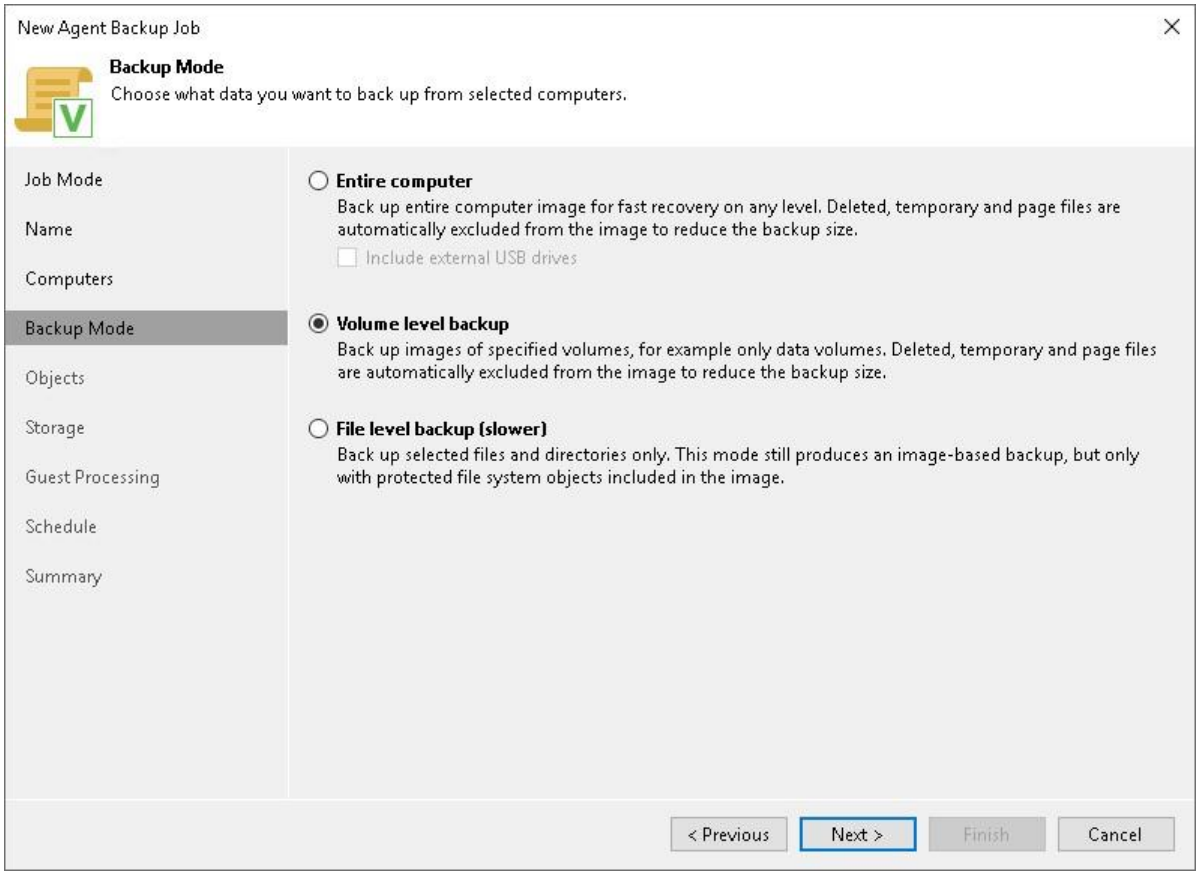
Volume level backup — select this option if you want to create a backup of specific computer volumes, for example, all volumes except the system one. When you restore data from such backup, you will be able to recover data on these volumes only: files, folders, application data and so on. With this option selected, you will pass to the Objects step of the wizard.

File level backup — select this option if you want to create a backup of individual folders on your computer. With this option selected, you will pass to the Objects step of the wizard.

[For entire computer backup] If you want to include in the backup one or more external USB drives, select the Include external USB drives check box. With this option selected, Veeam Agent will include in the backup all external USB drives that are connected to the Veeam Agent computer at the time when the backup job starts. To learn more, see the Backup of External Drives section in the Veeam Agent for Microsoft Windows User Guide.

NOTE

- The File level backup option is not available if you have selected theFailover cluster option at the Job Mode step of the wizard.
- File-level backup is typically slower than volume-level backup. Depending on the performance capabilities of your computer and backup environment, the difference between file-level and volume-level backup job performance may increase significantly. If you plan to back up all folders with files on a specific volume or back up large amount of data, it is recommended that you configure volume-level backup instead of file-level backup.




### Step 6. Specify Backup Scope Settings

The Objects step of the wizard is available if you chose to create volume-level or file-level Veeam Agent backups. Specify backup scope for the Veeam Agent backup job:

Specify volumes to back up — if you have selected the Volume level backup option at the Backup Mode step of the wizard.

Specify folders to back up — if you have selected the File level backup option at the Backup Mode step of the wizard.

## Specifying Volumes to Back Up

The Objects step of the wizard is available if you have selected the Volume level backup option at the Backup Mode step of the wizard.

At this step of the wizard, you must specify the backup scope — define what volumes you want to include in the backup. The specified backup scope settings will apply to all computers that are added to the backup job. If a specified volume does not exist on one or more computers in the job, the job will skip such volume on those computers and back up only existing ones.

To specify the backup scope, you can select the Backup the following volumes only option and add necessary objects.

Alternatively, you can back up the whole Veeam Agent computer. To do this, select the Backup all volumes except the following option. With this option selected, you can exclude objects that you do not need from the backup scope.

You can include or exclude the following objects:

- OS volume — data pertaining to the OS installed on a protected computer. This object includes the Microsoft Windows system partition and boot partition of your computer. For GPT disks on Microsoft Windows 8.1, 10, 11, 2012, 2012 R2, 2016, 2019, and 2022, the object additionally includes the recovery partition. To learn more, see the System State Data Backup section in the Veeam Agent for Microsoft Windows User Guide.

  To include or exclude the OS volume, in the necessary wizard section, click Add and select the OS volume option.

- Individual volumes.

  To include or exclude individual volumes:

  a. In the necessary wizard section, click Add and select the Volume name option.

  b. In the Add Object window, type the drive letter of a volume that you want to back up, for example, `C:\`, and click OK.

  c. Repeat steps a–b for all volumes that you want to back up.

- Individual mount points.

  To include or exclude individual mount points:

  a. In the necessary wizard section, click Add and select the Volume name option.

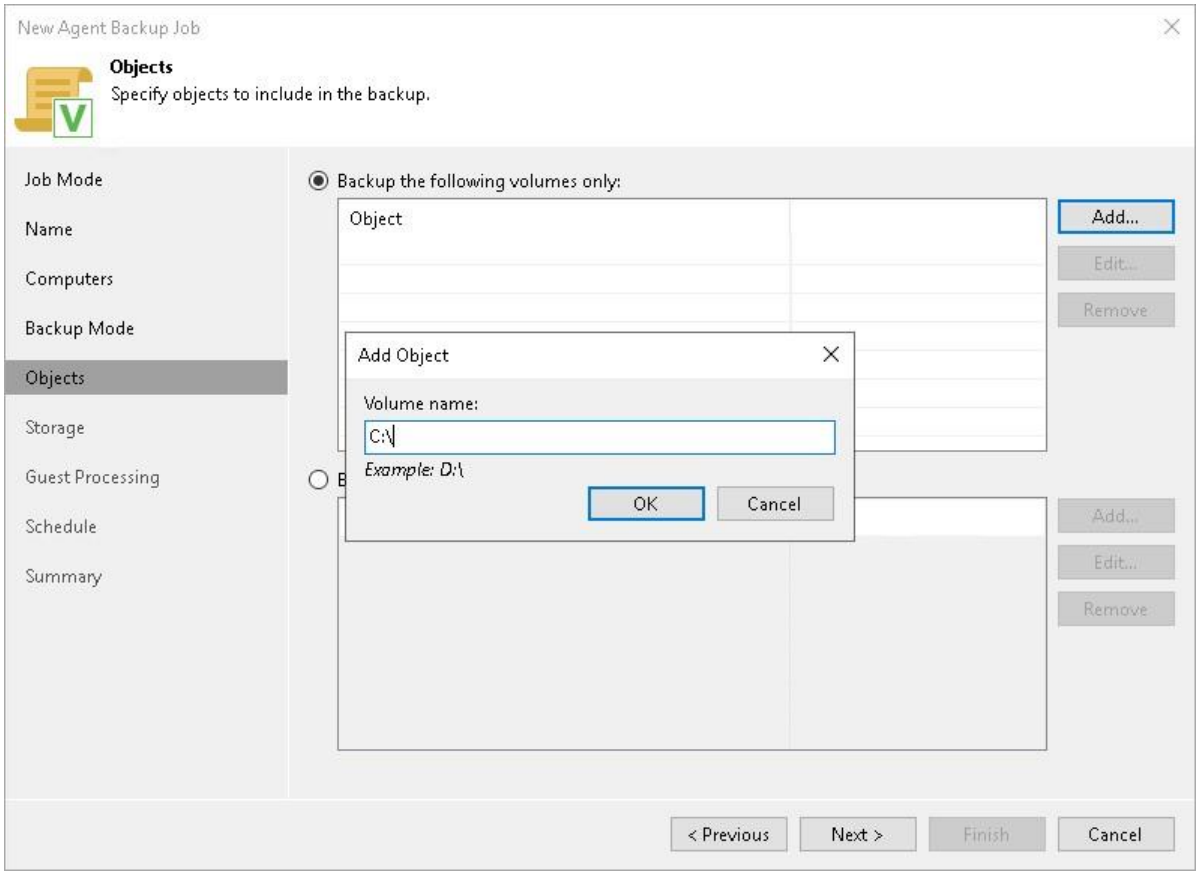
  b. In the Add Object window, type the path to a folder that is an entry point to the mounted volume you want to back up, for example, `C:\Data`, and click OK.

  c. Repeat steps a–b for all mount points that you want to back up.

NOTE

Mind the following:

- If you include a system volume in the volume-level backup, Veeam Agent for Microsoft Windows automatically includes the System Reserved/UEFI or other system partitions in the backup too.
- You cannot include volumes located on virtual hard disks (VHD or VHDX) in the volume-level backup.
- Veeam Agent for Microsoft Windows automatically adds to the list of exclusions the following Microsoft Windows objects for all computer users: temporary files folder, Recycle Bin, Microsoft Windows pagefile, hibernate file and VSS snapshot files from the System Volume Information folder.




## Specifying Folders to Back Up

The Objects step of the wizard is available if you have selected the File level backup option at the Backup Mode step of the wizard.

In the file-level backup mode, you can create two types of backups:

File-level backup that includes individual folders on your computer.

Hybrid backup that contains individual folders and specific volumes of your computer.

At this step of the wizard, you must specify the backup scope — define what folders with files or entire volumes you want to include in the backup. The specified backup scope settings will apply to all computers that are added to the backup job. If a specified object does not exist on one or more computers in the job, the job will skip such object on those computers and back up existing ones.

To specify the backup scope, in the Objects to backup list, select check boxes next to necessary objects. You can include the following data in the backup:

Operating system — data related to the OS installed on a protected computer. To learn more, see the System State Data Backup section in the Veeam Agent for Microsoft Windows User Guide.

Personal files — data related to user profiles. With this option enabled, Veeam Backup & Replication will include in the backup scope settings and data related to Veeam Agent computer user profiles. To learn more, see the Personal Data Backup section in the Veeam Agent for Microsoft Windows User Guide.

Individual file system objects — folders, mount points, and volumes of a protected computer.

To specify individual folders to back up:

Select the The following file system objects check box and click Add.

In the Add Object window, type the path to a folder, mount point folder, or volume that you want to back up, for example, `D:\Reports` or `D:\`, and click OK.

To specify the backup scope, you can use system environment variables such as %ProgramFiles% or %WinDir%. This may be useful, for example, in case computers added to the backup job run different versions of Microsoft Windows OSes, and actual paths to directories that contain data of the same type differ on these computers.

Consider the following:

You can use only system environment variables — variables defined for the Local System account on computers added to the backup job. User-dependent environment variables are not supported.

Environment variables that contain multiple values (such as the %PATH% variable) are not supported.

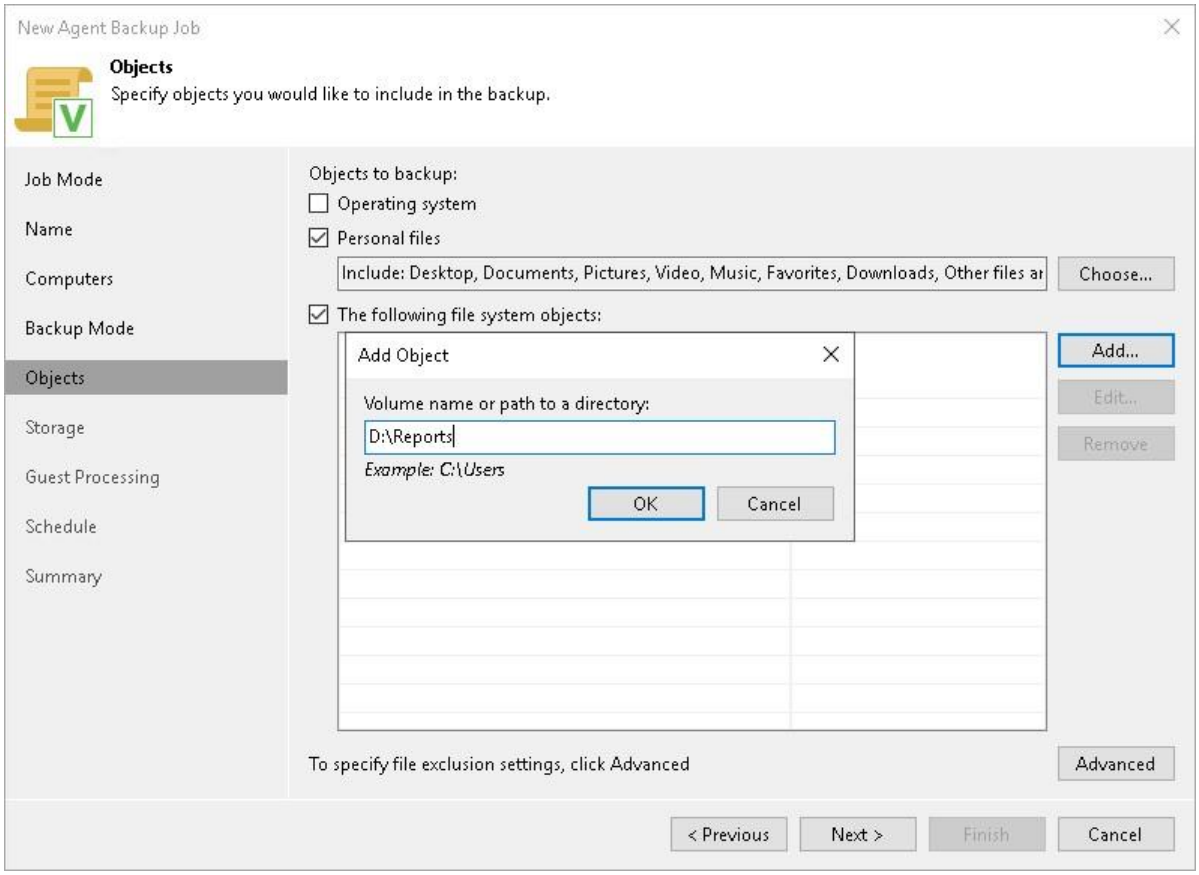
Environment variables that contain other environment variables are not supported.

Repeat steps 1–2 for all items that you want to back up.

NOTE

Mind the following:

- If you include a system volume in the file-level backup, Veeam Agent does not automatically include the System Reserved/UEFI or other system partitions in the backup. These volumes are automatically included in the backup only if you select the Entire computer option to specify the backup scope.
- Veeam Agent automatically adds to the list of exclusions the following Microsoft Windows objects for all computer users: temporary files folder, Recycle Bin, Microsoft Windows pagefile, hibernate file and VSS snapshot files from the System Volume Information folder.
- You can exclude Microsoft OneDrive folders from the backup scope in the File Filters window.



## Configuring Filters

To include or exclude folders and files of a specific type in/from the file-level backup, you can configure filters.

> NOTE
>
> Consider the following:
>
> If you include a specific folder in the file-level backup, Veeam Agent applies filters to files in specific folders that you include in the backup. Filters are not applied to computer volumes, mount points, and folders selected for backup. If you plan to create a hybrid backup that will contain volumes, mount points, and folders, filters will be applied to files in folders only.
> If you include a whole volume in the file-level backup, you cannot apply filters to include or exclude files of a specific type in/from the backup. You can only exclude specific folders that reside on the volume.
> You cannot apply filters to files and folders that reside on the mount point.

To configure a filter:

1. At the Objects step of the wizard, click Advanced.
2. Specify what files you want to back up:
   - If you include a specific folder in the file-level backup, in the Include masks field, specify file names and/or masks for file types that you want to back up, for example, `MyReport.pdf`, `*filename*`, `*.docx`. The resulting Veeam Agent backup will contain only selected files. Other files will not be backed up.

     You cannot specify include masks if you add an entire volume in the backup.
   - In the Exclude masks field, specify files that you do not want to back up in the following ways:

     If you include an entire volume in the file-level backup, in the Exclude masks field, specify paths to folders that contain files that you do not want to back up. The resulting Veeam Agent backup will contain all folders that reside on the backed-up volume except the files in the specified folders.

     For example, you include the `D:\` volume in the backup and specify the `D:\Reports\OldReports` folder in the Exclude masks field. The resulting backup will contain all folders and files that reside on the volume except files that reside in the `D:\Reports\OldReports` folder.

     If you include a specific folder in the file-level backup, in the Exclude masks field, specify file names and/or masks for file types that you do not want to back up, for example, `OldReports.rar`, `*.temp`, `*.tmp`, `*.back`. The resulting Veeam Agent backup will contain all files except files whose names match the specified names or masks.

     Keep in mind that depending on the backup type, Veeam Agent excludes files and folders from the backup scope differently:

     For the volume-level backup, content of folders you do not want to back up is excluded from the VSS snapshot with the FilesNotToSnapshot registry key.

     For the file-level backup, folders and files are excluded by Veeam Agent after the VSS snapshot is created.

     As a result, some objects may be excluded or not excluded from the backup scope depending on the type of the created backup. For example, if you configure a volume-level backup, the objects that you excluded may stay in the backup scope due to the FilesNotToSnapshot registry key limitations. To learn more, see this Microsoft article.
3. Click Add.
4. Repeat steps 2–3 for each mask that you want to add.

> TIP
>
> You can also use system environment variables to specify include and exclude masks. In this case, you must type the back slash (\) symbol in the beginning of the mask. For example: \%appdata%.
>
> Consider the following:
>
> To specify include and exclude masks, you can use only system environment variables — variables defined for the Local System account on computers added to the backup job, and cannot use user environment variables. For example, if you specify the \%appdata% exclude mask, Veeam Agent
> will exclude the `C:\Windows\system32\config\systemprofile\AppData\Roaming` folder from the backup. Application data directories for other user accounts (for example,
> `C:\Users\Administrator\AppData\Roaming`) will not be excluded from the backup.
> You cannot use environment variables that contain multiple values or other environment variables to specify include and exclude masks.

You can use a combination of include and exclude masks. Note that exclude masks have a higher priority than include masks. For example, you can specify masks in the following way:

Include mask: `*.pdf`

Exclude mask: `*draft*`

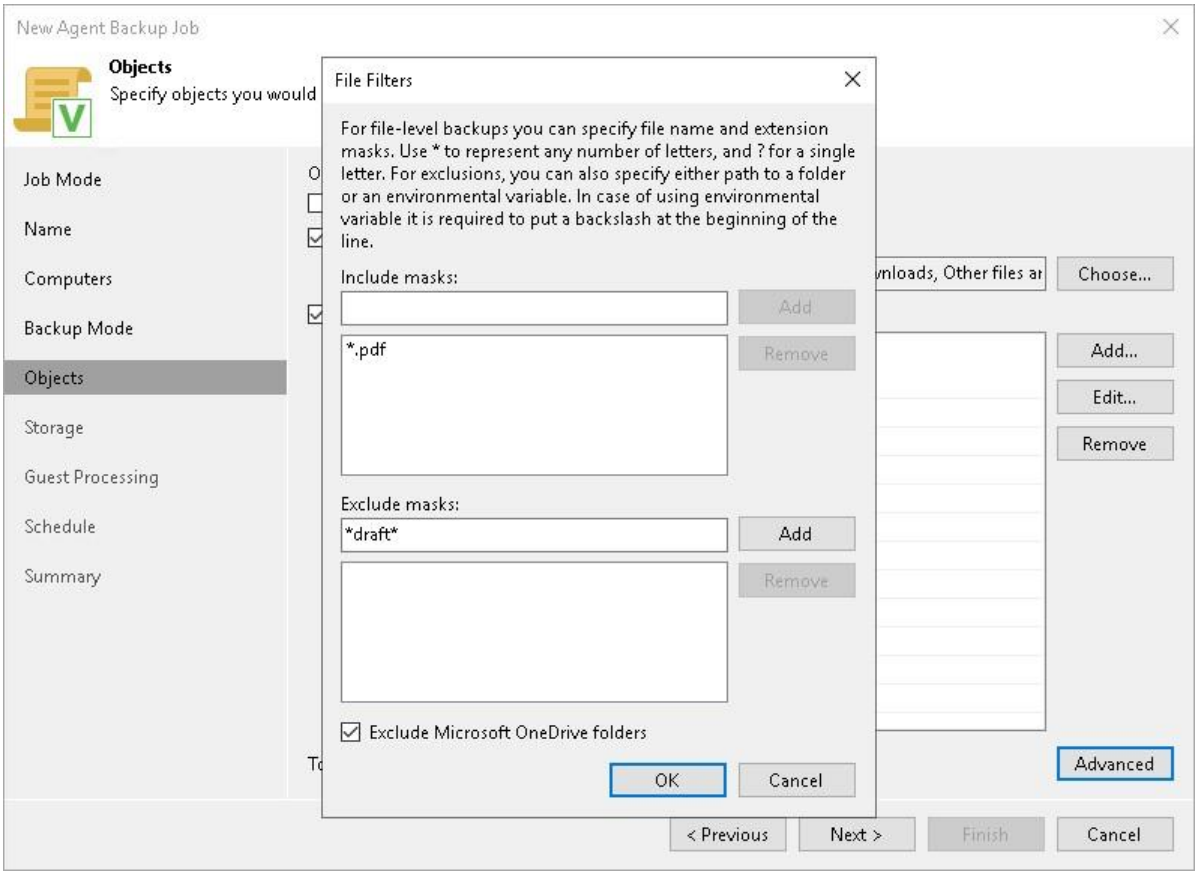
The resulting Veeam Agent backup will contain all files of the PDF format that do not contain draft in their names.

Additionally, you can specify how Veeam Agent for Microsoft Windows will process Microsoft OneDrive folders. Select the Exclude Microsoft OneDrive folders option to exclude Microsoft OneDrive folders and their content from the backup scope.

Consider the following limitation:

Veeam Agent excludes Microsoft OneDrive folders only in file-level backups. If you include an entire volume in the backup, Veeam Agent will not exclude Microsoft Onedrive folders from this volume.

Due to the OS limitations, the Exclude Microsoft OneDrive folders option behaves properly only on Veeam Agent computers running Microsoft Windows 10. If your Veeam Agent computers run other OS versions, we recommend to exclude Microsoft OneDrive folders manually.




### Step 7. Select Backup Destination

The Destination step of the wizard is available if you have selected the Managed by agent option at the Job Mode step of the wizard.

At this step of the wizard, select a target location for backups created by Veeam Agents installed on protected computers.

You can store backup files in one of the following locations:

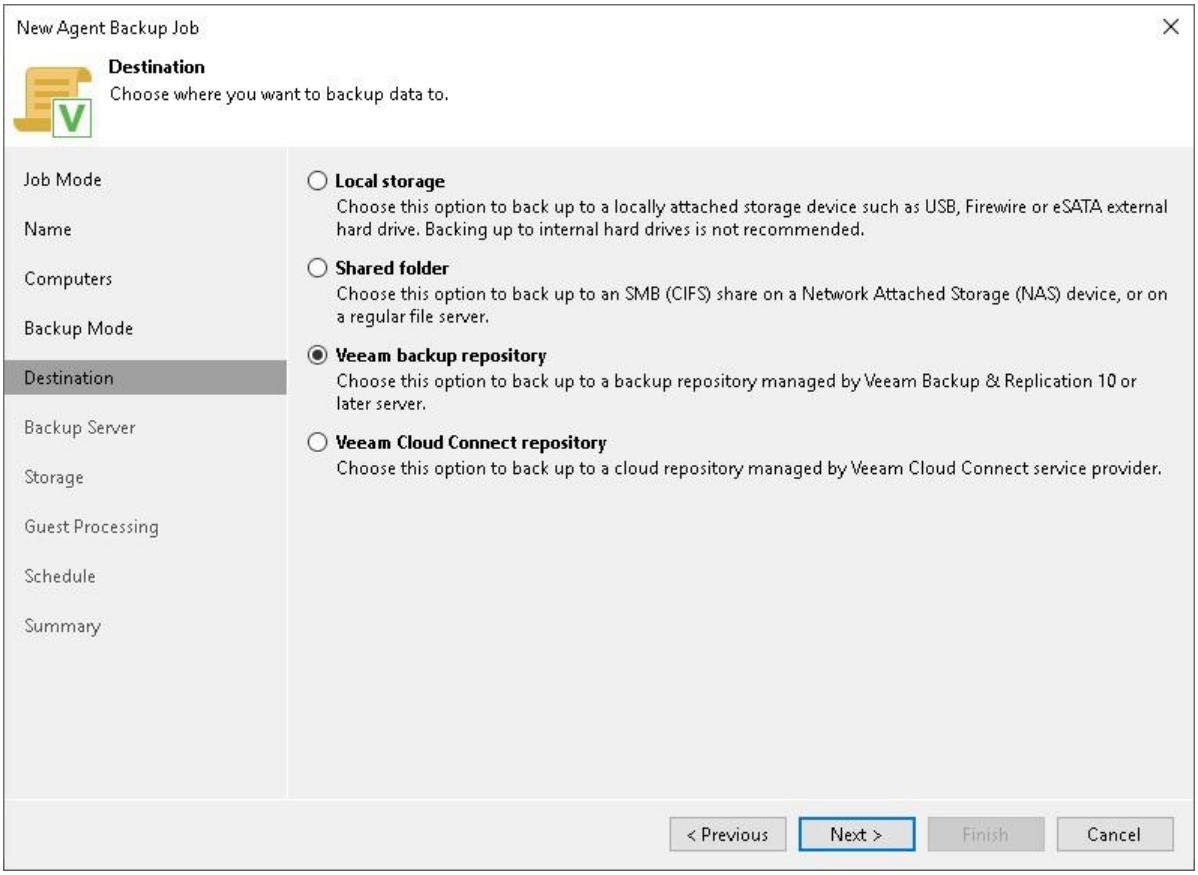
Local storage — select this option if you want to save a backup on a removable storage device attached to a protected computer or on a local drive of a protected computer. With this option selected, you will pass to the Local Storage step of the wizard.

> IMPORTANT
>
> Consider the following:
>
> It is strongly recommended that you store backups in the external location like USB storage device or shared network folder. You can also keep your backup files on the separate non-system local drive.
>
> If you select to store the backup in a local folder included in the backup scope, Veeam Agent for Microsoft Windows will automatically exclude this folder from the backup.

Shared folder — select this option if you want to save a backup in a network shared folder. With this option selected, you will pass to the Shared folder step of the wizard.

Veeam backup repository — select this option if you want to save a backup in a backup repository managed by the Veeam backup server of which the Veeam Agent backup job is configured. With this option selected, you will pass to the Backup Server step of the wizard.

Veeam Cloud Connect repository — select this option if you want to save a backup in a cloud repository exposed to you by the Veeam Cloud Connect service provider. With this option selected, you will pass to the Storage step of the wizard.




### Step 8. Specify Backup Storage Settings

Specify backup storage settings for the backup job:

If you have selected the Managed by backup server mode at the Job Mode step of the wizard, you can create Veeam Agent backups only in a backup repository managed by this Veeam backup server or in a cloud repository exposed to you by a Veeam Cloud Connect service provider. Specify backup repository settings at the Storage of the wizard.

If you have selected the Managed by agent mode at the Job Mode step of the wizard, specify backup storage settings at one of the following steps of the wizard:

- Local storage settings — if you have selected the Local storage option at the Destination step of the wizard.
- Shared folder settings — if you have selected the Shared folder option at the Destination step of the wizard.
- Veeam backup repository settings — if you have selected the Veeam backup repository option at the Destination step of the wizard.
- Cloud repository settings — if you have selected the Veeam Cloud Connect repository option at the Destination step of the wizard.

## Backup Storage Settings

The Storage step of the wizard is available if you have selected the Managed by backup server mode at the Job Mode step of the wizard.

Specify settings for the target backup repository:

From the Backup repository list, select a backup repository where you want to store Veeam Agent backups. You can select from the following types of backup repositories: ○ Veeam backup repository configured on the backup server that will manage the created backup job. ○ Cloud repository allocated to your tenant account by a Veeam Cloud Connect service provider.

When you select a backup repository, Veeam Backup & Replication automatically checks how much free space is available on the backup repository.

> NOTE
>
> Keep in mind when you work with cloud machines, Veeam Backup & Replication displays only AWS or Azure object storage repositories depending on the type of cloud machine you selected to back up.

You can map the job to a specific backup stored in the backup repository. Backup job mapping can be helpful if you have moved backup files to a new backup repository and want to point the job to existing backups in this new backup repository. You can also use backup job mapping if the configuration database got corrupted and you need to reconfigure backup jobs.

To map the job to a backup, click the Map backup link and select the backup in the backup repository. Backups can be easily identified by job names. To find the backup, you can also use the search field at the bottom of the window.

> NOTE
>
> Mind the following:
>
> The Map backup link is available only for a Veeam Agent backup job managed by the backup server. If you want to map a backup job managed by Veeam Agent, see Backup Job Mapping.
> You cannot map a Veeam Agent backup job configured in Veeam Backup & Replication to a backup chain that was created by Veeam Agent operating in the standalone mode.

Specify short-term backup retention policy settings in one of the following ways:

From the Retention policy list, select restore points and specify the number of restore points for which you want to store backup files in the target location. By default, Veeam Backup & Replication keeps backup files created for 7 latest restore points. After this number is exceeded, Veeam Backup & Replication will remove the earliest restore points from the backup chain.

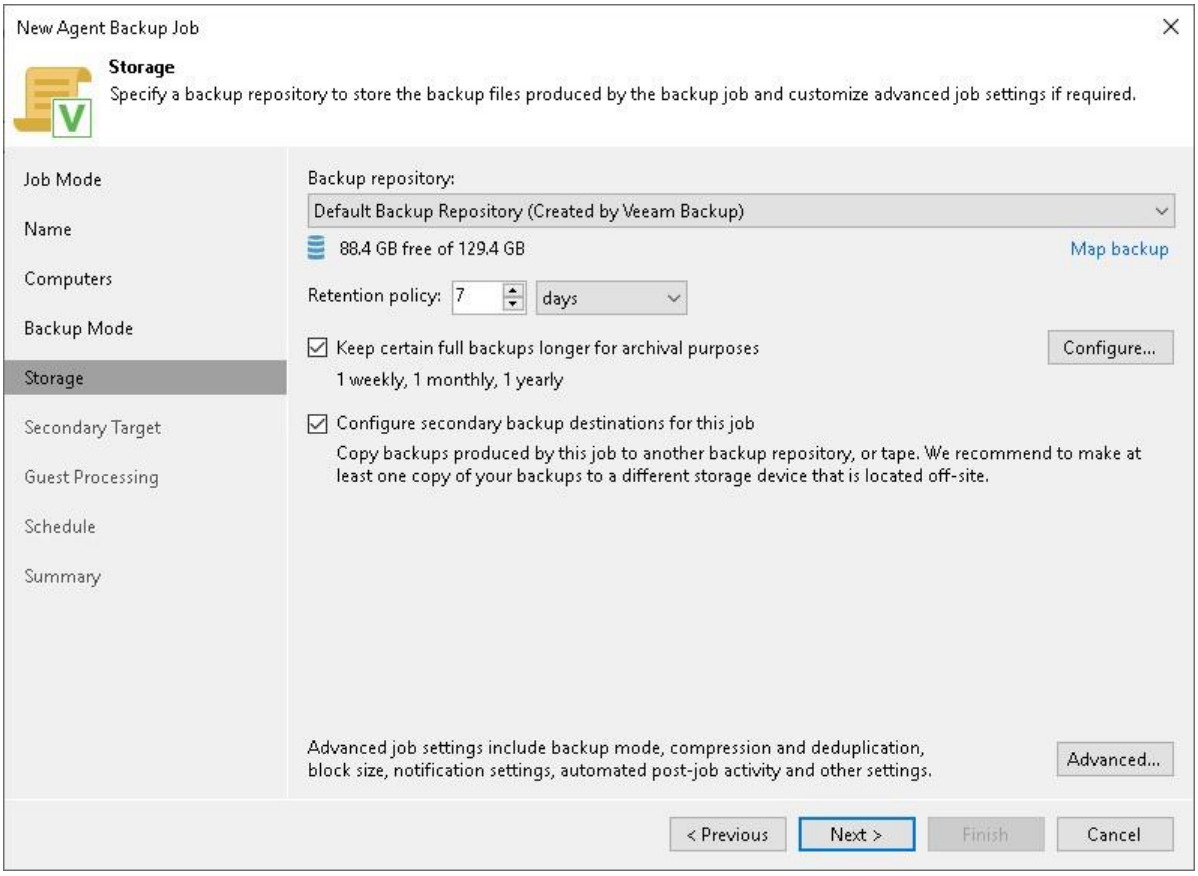
From the Retention policy list, select days and specify the number of days for which you want to store backup files in the target location. By default, Veeam Backup & Replication keeps backup files for 7 days. After this period is over, Veeam Backup & Replication will remove the earliest restore points from the backup chain.

To use the GFS (Grandfather-Father-Son) retention scheme, select the Keep certain full backups longer for archival purposes check box and click Configure. In the Configure GFS window, specify how weekly, monthly and yearly full backups must be retained. To learn more, see the Long-Term Retention Policy (GFS) section in the Veeam Backup & Replication User Guide.

If you want to archive backup files created with the backup job to a secondary destination (backup repository or tape), select the Configure secondary destinations for this job check box. With this option enabled, the New Agent Backup Job wizard will include an additional step — Secondary Target. At the Secondary Target step of the wizard, you can link the backup job to the backup copy job or backup to tape backup job.

You can enable this option only if a backup copy job or backup to tape job is already configured on the backup server.

Click Advanced to specify advanced settings for the backup job. To learn more, see Specify Advanced Backup Settings.




## Local Storage Settings

The Local Storage step of the wizard is available if you have selected the Managed by agent mode at the Job Mode step of the wizard and chosen to save the backup on a local drive of your computer.

Specify local storage settings:

In the Local folder field, type a path to a folder on a protected computer where backup files must be saved. If the specified folder does not exist in the file system of a protected computer, Veeam Agent for Microsoft Windows will create this folder and save the resulting backup file to this folder. If the volume on which the specified folder must reside does not exist on a protected computer, Veeam Backup & Replication will not apply the backup job settings to this computer.

> IMPORTANT
>
> USB storage devices formatted as FAT32 do not allow storing files larger than 4 GB in size. For this reason, it is recommended that you do not use such USB storage devices as a backup target.
>
> We do not recommend targeting a backup job at the storage device with the exFAT file system. If the protected computer runs Microsoft Windows 10 or Microsoft Windows Server 2019 and later, this configuration may lead to the backup data corruption caused by the exFAT file system issue.

Specify short-term backup retention policy settings in one of the following ways:

From the Retention policy list, select restore points and specify the number of restore points for which you want to store backup files in the target location. By default, Veeam Backup & Replication keeps backup files created for 7 latest restore points. After this number is exceeded, Veeam Backup & Replication will remove the earliest restore points from the backup chain.

From the Retention policy list, select days and specify the number of days for which you want to store backup files in the target location. By default, Veeam Backup & Replication keeps backup files for 7 days. After this period is over, Veeam Backup & Replication will remove the earliest restore points from the backup chain.

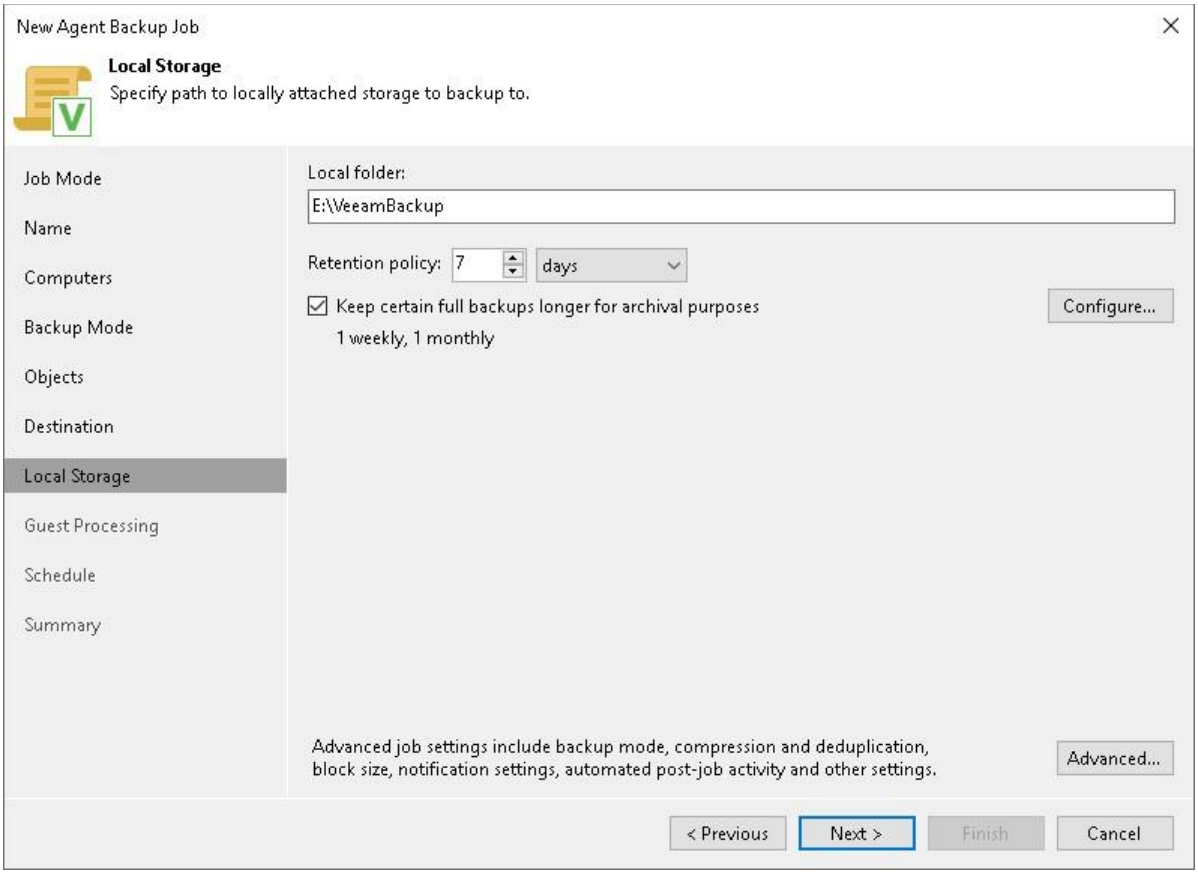
Keep in mind that if you have selected the Workstation type at the Job Mode step of the wizard, you can specify retention policy only in days.

> NOTE
> The short-term retention policies for backups of workstations and servers are the same as in Veeam Agent for Microsoft Windows operating in the standalone mode. To learn more about retention policies, see the following sections in the Veeam Agent for Microsoft Windows User Guide:
>
> - The Retention Policy in Free and Workstation Editions section about retention policy using that Veeam Agent retains restore points for a certain number of days.
> - The Retention Policy in Server Edition section about retention policy using that Veeam Agent retains restore points for a certain number of days or retains the number of latest restore points.

To use the GFS (Grandfather-Father-Son) retention scheme, select the Keep certain full backups longer for archival purposes check box and click Configure. In the Configure GFS window, specify how weekly, monthly and yearly full backups must be retained. To learn more, see the Long-Term Retention Policy (GFS) section in the Veeam Backup & Replication User Guide.

Keep in mind that to use the GFS retention policy, you must set Veeam Agent to create full backups. To learn more, see Backup Settings.

Click Advanced to specify advanced settings for the backup job. To learn more, see Specify Advanced Backup Settings.



## Shared Folder Settings

The Shared Folder step of the wizard is available if you have selected the Managed by agent mode at the Job Mode step of the wizard and chosen to save the backup in a network shared folder.

Specify shared folder settings:

In the Shared folder field, type a UNC name of the network shared folder in which you want to store backup files. Keep in mind that the UNC name always starts with two back slashes (\\).

If the network shared folder requires authentication, select the This share requires access credentials check box and select from the list a user account that has access permissions on this shared folder. If you have not set up credentials beforehand, click the Manage accounts link or click Add on the right to add credentials. The user name must be specified in the DOMAIN\USERNAME format.

If you do not select the This share requires access credentials check box, Veeam Agent for Microsoft Windows will connect to the shared folder using the NT AUTHORITY\SYSTEM account of the computer where the product is installed. You can use this scenario if the Veeam Agent computer is joined to the Active Directory domain. In this case, you can simply grant Full Control access on the shared folder and underlying file system to the computer account (DOMAIN\COMPUTERNAME$).

Specify short-term backup retention policy settings in one of the following ways:

From the Retention policy list, select restore points and specify the number of restore points for which you want to store backup files in the target location. By default, Veeam Backup & Replication keeps backup files created for 7 latest restore points. After this number is exceeded, Veeam Backup & Replication will remove the earliest restore points from the backup chain.

From the Retention policy list, select days and specify the number of days for which you want to store backup files in the target location. By default, Veeam Backup & Replication keeps backup files for 7 days. After this period is over, Veeam Backup & Replication will remove the earliest restore points from the backup chain.

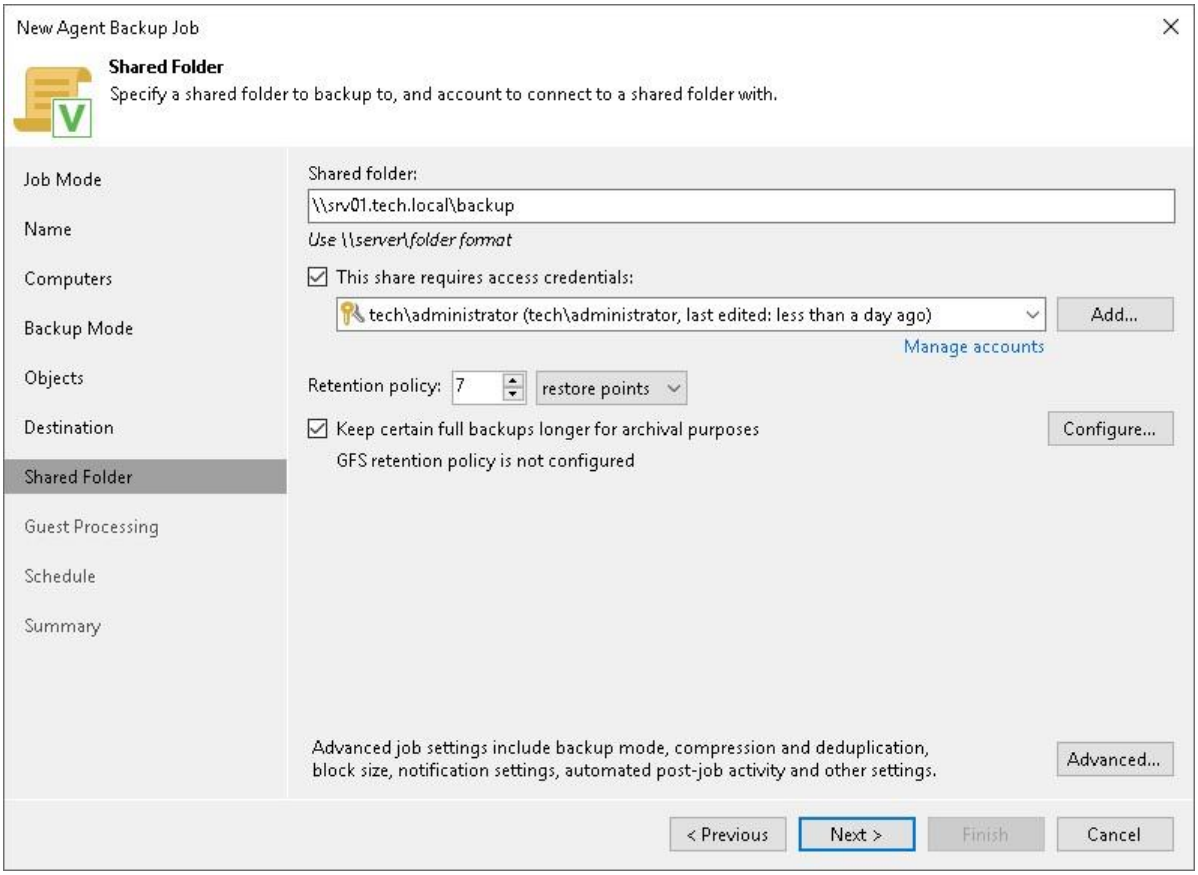
Keep in mind that if you have selected the Workstation type at the Job Mode step of the wizard, you can specify retention policy only in days.

> NOTE
>
> The short-term retention policies for backups of workstations and servers are the same as in Veeam Agent for Microsoft Windows operating in the standalone mode. To learn more about retention policies, see the following sections in the Veeam Agent for Microsoft Windows User Guide:
>
> - The Retention Policy in Free and Workstation Editions section about retention policy using that Veeam Agent retains restore points for a certain number of days.
> - The Retention Policy in Server Edition section about retention policy using that Veeam Agent retains restore points for a certain number of days or retains the number of latest restore points.

To use the GFS (Grandfather-Father-Son) retention scheme, select the Keep certain full backups longer for archival purposes check box and click Configure. In the Configure GFS window, specify how weekly, monthly and yearly full backups must be retained. To learn more, see the Long-Term Retention Policy (GFS) section in the Veeam Backup & Replication User Guide.

Keep in mind that to use the GFS retention policy, you must set Veeam Agent to create full backups. To learn more, see Backup Settings.

Click Advanced to specify advanced settings for the backup job. To learn more, see Specify Advanced Backup Settings.




## Veeam Backup Repository Settings

If you have selected the Managed by agent mode for the backup job and chosen to store backup files in a Veeam backup repository, specify settings to connect to the backup repository:

At the Backup Server step of the wizard, specify backup server settings.

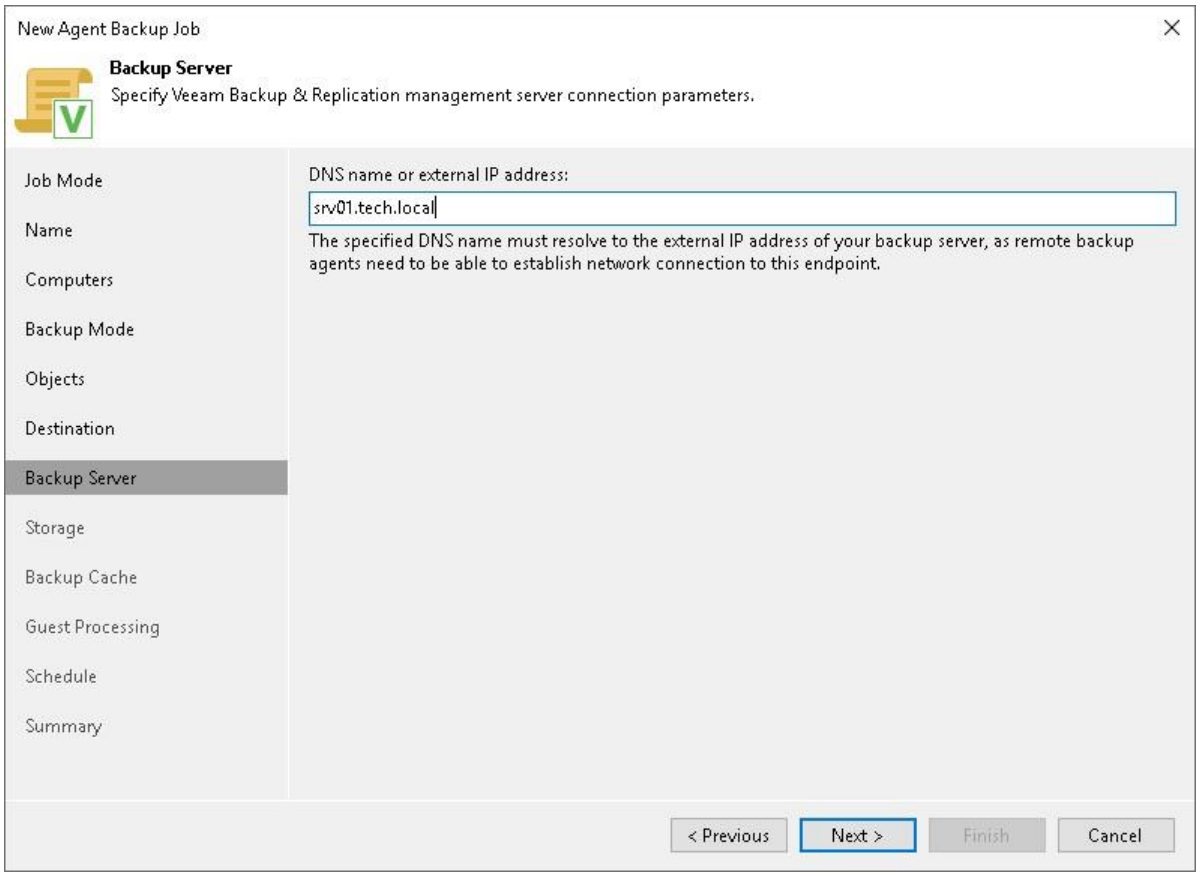
At the Storage step of the wizard, select the Veeam backup repository.

## Specifying Backup Server Settings

The Backup Server step of the wizard is available if you have selected the Managed by agent mode at the Job Mode step of the wizard and chosen to store backup files in a Veeam backup repository.

In the DNS name or external IP address field, review and change if necessary the name or IP address of the Veeam backup server on which you configure the Veeam Agent backup job. The specified DNS name or IP address must be accessible from Veeam Agent computers.

> NOTE
>
> Veeam Backup & Replication does not automatically update information about the backup server in the backup policy settings after migration of the configuration database. After you migrate configuration data to a new location, you must specify the name or IP address of the new backup server in the properties of all backup policies configured in Veeam Backup & Replication.




## Selecting Backup Repository

The Storage step of the wizard is available if you have selected the Managed by agent mode at the Job Mode step of the wizard and chosen to save backup files in a Veeam backup repository.

Specify settings for the target backup repository:

From the Backup repository list, select a backup repository where you want to store created backups. When you select a backup repository, Veeam Backup & Replication automatically checks how much free space is available on the backup repository.

Specify short-term backup retention policy settings in one of the following ways:

From the Retention policy list, select restore points and specify the number of restore points for which you want to store backup files in the target location. By default, Veeam Backup & Replication keeps backup files created for 7 latest restore points. After this number is exceeded, Veeam Backup & Replication will remove the earliest restore points from the backup chain.

From the Retention policy list, select days and specify the number of days for which you want to store backup files in the target location. By default, Veeam Backup & Replication keeps backup files for 7 days. After this period is over, Veeam Backup & Replication will remove the earliest restore points from the backup chain.

Keep in mind that if you have selected the Workstation type at the Job Mode step of the wizard, you can specify retention policy only in days.

> NOTE
> The short-term retention policies for backups of workstations and servers are the same as in Veeam Agent for Microsoft Windows operating in the standalone mode. To learn more about retention policies, see the following sections in the Veeam Agent for Microsoft Windows User Guide:
>
> - The Retention Policy in Free and Workstation Editions section about retention policy using that Veeam Agent retains restore points for a certain number of days.
> - The Retention Policy in Server Edition section about retention policy using that Veeam Agent restore points for a certain number of days or retains the number of latest restore points.

To use the GFS (Grandfather-Father-Son) retention scheme, select the Keep certain full backups longer for archival purposes check box and click Configure. In the Configure GFS window, specify how weekly, monthly and yearly full backups must be retained. To learn more, see the Long-Term Retention Policy (GFS) section in the Veeam Backup & Replication User Guide.

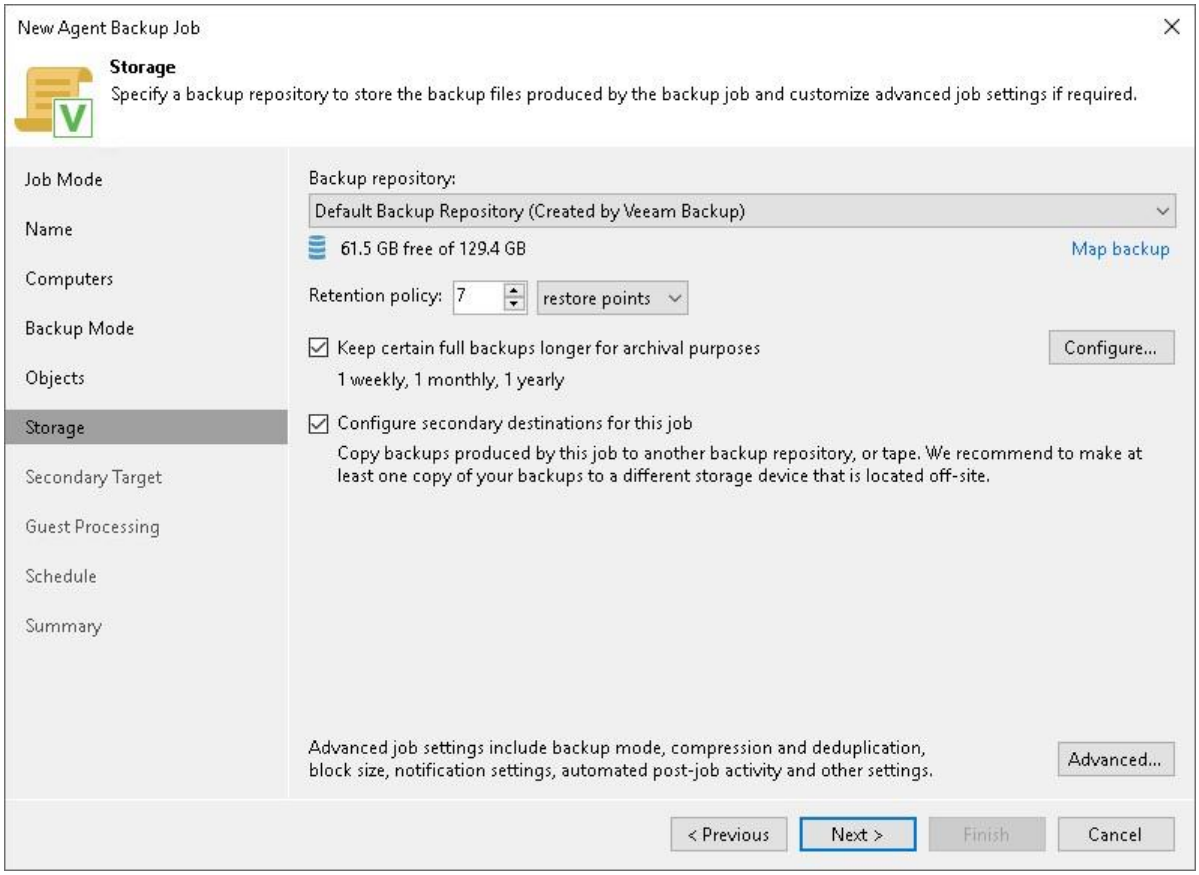
If you want to archive backup files created with the backup job to a secondary destination (backup repository or tape), select the Configure secondary destinations for this job check box. With this option enabled, the New Agent Backup Job wizard will include an additional step — Secondary Target. At the Secondary Target step of the wizard, you can link the backup job to the backup copy job or backup to tape backup job.

You can enable this option only if a backup copy job or backup to tape job is already configured on the backup server.

Click Advanced to specify advanced settings for the backup job. To learn more, see Specify Advanced Backup Settings.

TIP

You can map the job to a specific backup stored in the Veeam backup repository. Backup job mapping can be helpful if you have moved backup files to a new backup repository and want to point the job to existing backups in this new backup repository. To learn more, see Backup Job Mapping.




### Step 9. Specify Advanced Backup Settings

In the Advanced Settings window, specify advanced settings for the Veeam Agent backup job:

Backup settings

Maintenance settings

Storage settings

Notification settings

[For Veeam Agent jobs managed by the backup server] Integration settings

[For Veeam Agent jobs managed by the backup server] Script settings

TIP

After you specify necessary settings for the Veeam Agent backup job, you can save them as default settings. To do this, click Save as Default at the bottom left corner of the Advanced Settings window. When you create a new backup job, Veeam Backup & Replication will automatically apply the default settings to the new job.

## Backup Settings

To specify settings for a backup chain created with the backup job:

Click Advanced at one of the following steps of the wizard:

Storage — if you have selected to save backup files in a Veeam backup repository or cloud repository.

Local Storage — if you have selected to save backup files in a local storage of a Veeam Agent computer.

Shared Folder — if you have selected to save backup files in a network shared folder.

If you want to periodically create synthetic full backups, on the Backup tab, select the Create synthetic full backups periodically check box and click Days to schedule synthetic full backups on the necessary week days.

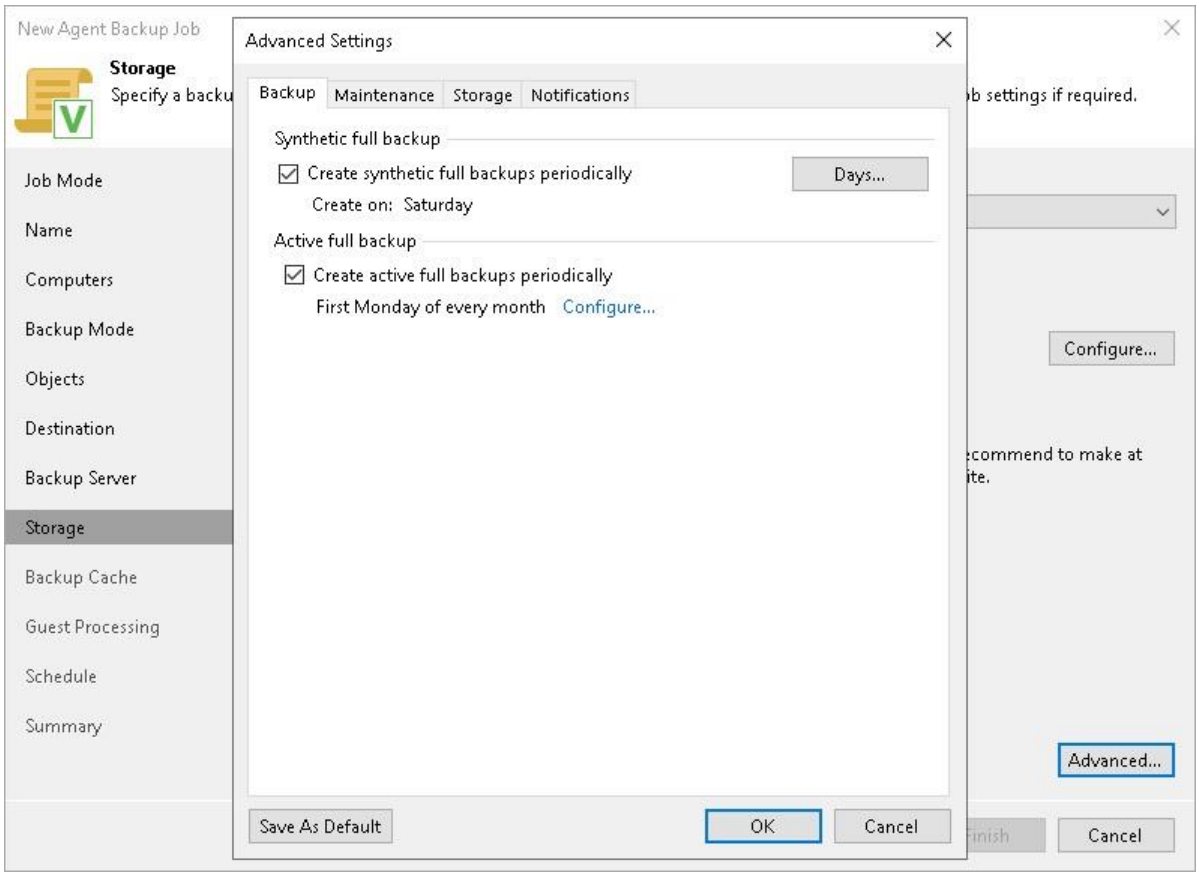
> NOTE
>
> Synthetic full backup is not available for backup jobs targeted at an object storage repository.

If you want to periodically create active full backups, select the Create active full backups periodically check box. To define scheduling settings, click Configure.

NOTE

Consider the following:

- Before scheduling periodic full backups, you must make sure that you have enough free space on the target location. For more information about periodic full backups, see the Active Full Backup and Synthetic Full Backup sections in the Veeam Agent for Microsoft Windows User Guide.
- If you schedule the active full backup and synthetic full backup on the same day, Veeam Agent for Microsoft Windows will perform only active full backup. Synthetic full backup will be skipped.




## Maintenance Settings

You can specify maintenance settings for a backup chain created with the Veeam Agent backup job. Maintenance operations help make sure that the backup chain remains valid and consistent.

Maintenance settings are available for the following types of Veeam Agent backup jobs that process Microsoft Windows computers:

Backup job managed by the backup server.

Backup job managed by Veeam Agent (backup policy).

To specify maintenance settings for the backup job:

Click Advanced at one of the following steps of the wizard:

Storage — if you have selected to save backup files in a Veeam backup repository or cloud repository.

Local Storage — if you have selected to save backup files in a local storage of a Veeam Agent computer.

Shared Folder — if you have selected to save backup files in a network shared folder.

In the Advanced Settings window, click the Maintenance tab.

To periodically perform a health check for the latest restore point in the backup chain, in the Storage-level corruption guard section, select the Perform backup files health check check box. To specify the schedule for the health check, click Configure.

An automatic health check can help you avoid a situation where a restore point gets corrupted, making all dependent restore points corrupted, too. If during the health check Veeam Agent for Microsoft Windows or Veeam Backup & Replication detect corrupted data blocks in the latest restore point in the backup chain (or the restore point before the latest one if the latest restore point is incomplete), it will start the health check retry and transport valid data blocks from the Veeam Agent computer to the target location. The transported data blocks are stored to a new backup file or the latest backup file in the backup chain, depending on the data corruption scenario.

For Veeam Agent backup jobs managed by the backup server, the health check process is similar to the one for backup jobs that process VMs. For more information, see the Health Check for Backup Files section in the Veeam Backup & Replication User Guide.

For Veeam Agent backup jobs managed by Veeam Agent, the health check process is the same as for Veeam Agent backup jobs configured directly on a Veeam Agent computer. For more information, see the Health Check for Backup Files section in the Veeam Agent for Microsoft Windows User Guide.

> NOTE
>
> For object storage, Veeam Agent offers a special health check mechanism as default. To run the health check for object storage, enable the Perform backup files health check option in the Storagelevel corruption guard section and specify the health check schedule.
>
> You can also switch from the health check for object storage to the standard health check. To do so, select the Verify content of each object in backup check box in the backup job settings. Keep in mind that enabling this setting may result in additional charges from your object storage provider.

[For backup jobs and policies targeted at a Veeam backup repository or cloud repository] Select the Remove deleted items data after check box and specify the number of days for which you want to keep the backup created with the backup job in the target location.

For backup jobs managed by the backup server, deleted items retention policy is similar to retention policy for deleted VMs. After you remove a protection group or individual computer from a Veeam Agent backup job, Veeam Backup & Replication will keep its data on the backup repository for the period that you have specified. When this period is over, backup data of this computer will be removed from the backup repository. For more information, see the Retention Policy for Deleted VMs section in the Veeam Backup & Replication User Guide.

For backup jobs managed by Veeam Agent, if Veeam Agent does not create new restore points for the backup, the backup will remain in the target location for the period that you have specified. When this period is over, the backup will be removed from the target location. For more information, see the Retention Policy for Outdated Backups section in the Veeam Agent for Microsoft Windows User Guide.

By default, the deleted items data retention period is 30 days. Do not set the deleted items retention period to 1 day or a similar short interval. In the opposite case, the backup job may work not as expected and remove data that you still require.

> NOTE
>
> The Remove deleted items data after option is not available if you configure a backup job managed by Veeam Agent (backup policy) and have selected the Local storage or Shared folder option at the Destination step of the wizard.

To periodically compact a full backup, select the Defragment and compact full backup file check box. To specify the schedule for the compact operation, click Configure. During the compact operation, data blocks from the full backup file are copied to a new empty file. As a result, the full backup file gets defragmented, and the speed of reading from and writing to the backup file increases.

NOTE

The Defragment and compact full backup file option is not available for backup jobs targeted at object storage.

The compact operation differs depending on the type of the backup job.

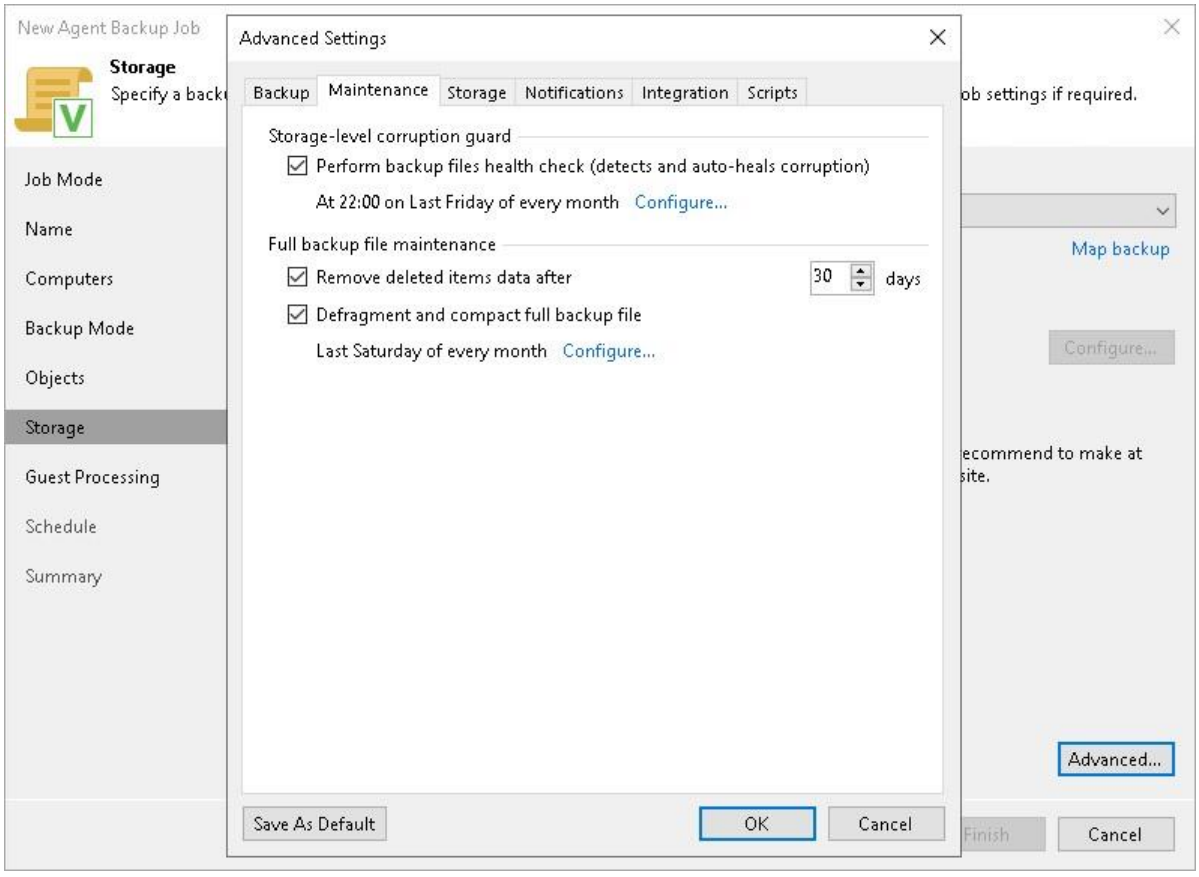
For Veeam Agent backup jobs managed by the backup server, the compact operation is similar to the compact operation performed for VM backup jobs. If the full backup file contains data blocks for deleted items (protection groups or individual computers that were removed from the backup job), Veeam Backup & Replication will remove these data blocks. For more information, see the Compact of Full Backup File section in the Veeam Backup & Replication User Guide.

For Veeam Agent backup jobs managed by Veeam Agent, if the full backup file contains data blocks for deleted drives, Veeam Agent for Microsoft Windows will remove these data blocks. For more information, see the Compact of Full Backup File section in the Veeam Agent for Microsoft Windows User Guide.

NOTE

Consider the following:

- If you want to periodically compact a full backup, you must make sure that you have enough free space in the target location. For the compact operation, the amount of free space must be equal to or more that the size of the full backup file.
- In contrast to the compact operation for a VM backup, during compact of a full Veeam Agent backup file, Veeam Backup & Replication does not perform the data take out operation. If the full backup file contains data for a computer that has only one restore point and this restore point is older than 7 days, Veeam Backup & Replication will not extract data for this computer to a separate full backup file.




## Storage Settings

To specify storage settings for the backup job:

Click Advanced at one of the following steps of the wizard:

- Storage — if you have selected to save backup files in a Veeam backup repository or cloud repository.
- Local Storage — if you have selected to save backup files in a local storage of a Veeam Agent computer.
- Shared Folder — if you have selected to save backup files in a network shared folder.

Click the Storage tab.

[For a failover cluster backup job] By default, Veeam Backup & Replication deduplicates failover cluster data before storing it in the backup repository. Data deduplication provides a smaller size of the backup file but may reduce the backup job performance. You can disable data deduplication if necessary, for example, if you use a deduplication storage appliance as a backup repository. To disable data deduplication, clear the Enable inline data deduplication check box.

> NOTE
>
> The Enable inline data deduplication option is unavailable if you selected the Workstation or Server option at the Job Mode step of the wizard.

From the Compression level list, select a compression level for the backup: None, Dedupe-friendly, Optimal, High or Extreme.

In the Storage optimization section, select what size of data blocks you plan to use: 4 MB, 1 MB, 512 KB, 256 KB. Veeam Agent for Microsoft Windows will use data blocks of the chosen size to optimize the size of backup files and job performance.

To encrypt the content of backup files, select the Enable backup file encryption check box. In the Password field, select a password that you want to use for encryption. If you have not created the password beforehand, click Add or use the Manage passwords link to specify a new password. For more information, see the Password Manager section in the Veeam Backup & Replication User Guide.

If the backup server is not connected to Veeam Backup Enterprise Manager, you will not be able to restore data from encrypted backups in case you lose the password. Veeam Backup & Replication will display a warning about it. For more information, see the Decrypting Data Without Password section in the Veeam Backup & Replication User Guide.

NOTE

Consider the following:

Data encryption settings for Veeam Agent backup jobs and backup policies configured in Veeam Backup & Replication are stored to the Veeam Backup & Replication database. For backup jobs and policies targeted at a Veeam backup repository, all data encryption operations are performed in Veeam Backup & Replication, too. Encryption settings are passed to a Veeam Agent computer only in case this computer is added to a backup policy targeted at a local drive of a protected computer, at a network shared folder, or at a cloud repository. Veeam Backup & Replication performs this operation when applying the backup policy to a protected computer.

If you change a password for data encryption for an existing backup policy targeted at a Veeam backup repository without changing other backup policy settings, the process of applying the backup policy to a protected computer completes with a notification informing that the backup policy was not modified. This happens because data encryption settings for managed Veeam Agents are saved to the Veeam Backup & Replication database and are not passed to a Veeam Agent computer.

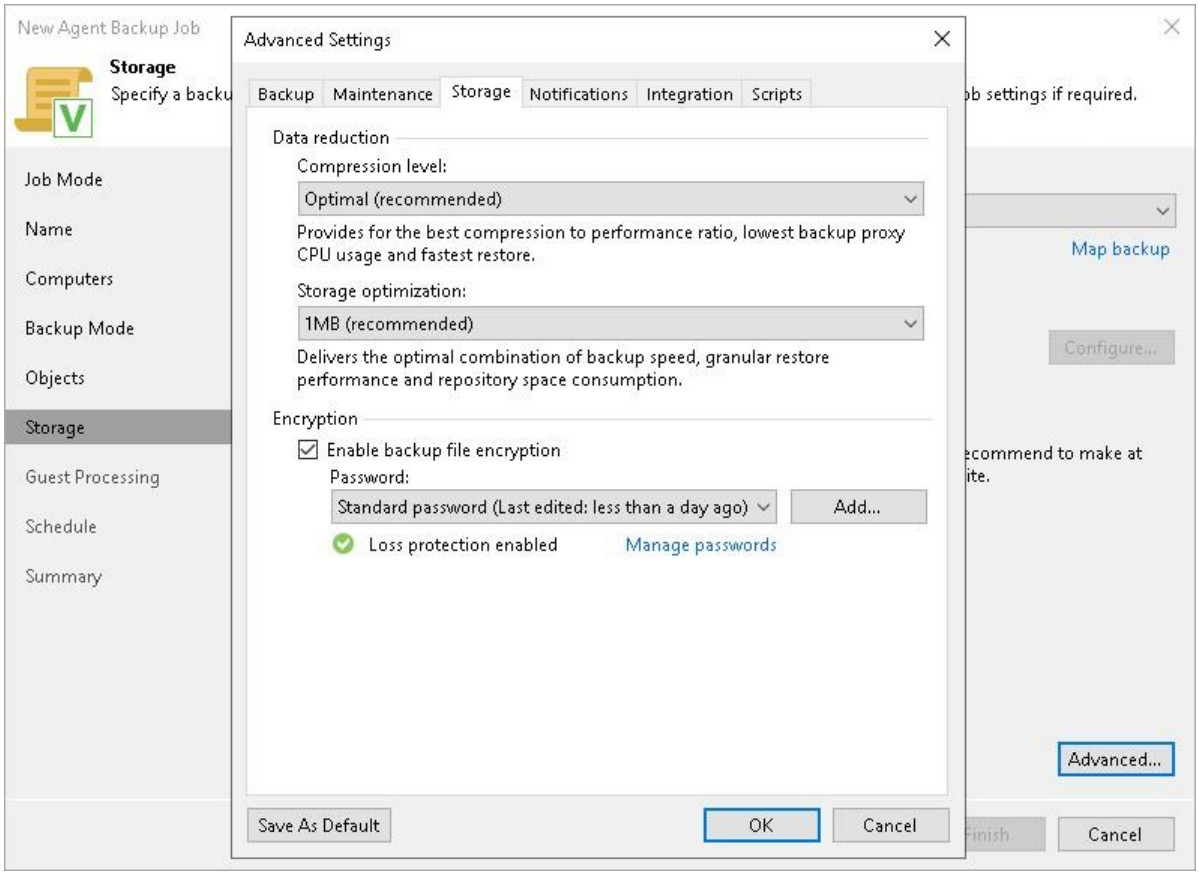
If you enable encryption for an existing Veeam Agent backup, during the next job session Veeam Agent for Microsoft Windows will create a full backup file. The created full backup file and subsequent incremental backup files in the backup chain will be encrypted with the specified password.

Encryption is not retroactive. If you enable encryption for an existing backup job, Veeam Agent for Microsoft Windows will encrypt the backup chain starting from the next restore point created with this job.

[For backup policies targeted at a local drive, network shared folder or cloud repository] When you enable data encryption for a backup policy, Veeam Backup & Replication uses the specified password to encrypt backups of all Veeam Agent computers added to the backup policy. A Veeam Agent computer user can restore data from the backup of this computer without providing a password to decrypt backup. To restore data from a backup of another computer in this backup policy, a user must provide a password specified in the backup policy settings.

This scenario differs from the same scenario in earlier versions of Veeam Backup & Replication where all backups created for Veeam Agent computers in the backup policy could be accessed from any computer in the backup policy without providing a password.

To learn more about data encryption in Veeam Backup & Replication, see the Data Encryption section in the Veeam Backup & Replication User Guide.


New Agent Backup Job
Storage
Specify a backu
Job Mode
Name
Computers
Backup Mode
Objects
Storage
Guest Processing
Schedule
Summary
Advanced Settings
Backup
Maintenance
Storage
Notifications
Integration
Scripts
Data reduction
Compression level:
Optimal (recommended)
Provides for the best compression to performance ratio, lowest backup proxy CPU usage and fastest restore.
Storage optimization:
1MB (recommended)
Delivers the optimal combination of backup speed, granular restore performance and repository space consumption.
Encryption
Enable backup file encryption
Password:
Standard password (Last edited: less than a day ago)
Add...
Loss protection enabled
Manage passwords
Save As Default
OK
Cancel
ob settings if required.
Map backup
Configure...
ecommend to make at
ite.
Advanced...
Finish
Cancel

## Notification Settings

You can specify notification settings for Veeam Agent backup jobs configured in Veeam Backup & Replication. Notification options differ depending on the job mode that you have selected at the Job Mode step of the wizard:

- Managed by backup server. To learn more, see Notification Settings for Veeam Agent Backup Job.
- Managed by agent. To learn more, see Notification Settings for Backup Policy.

## Notification Settings for Veeam Agent Backup Job

To specify notification settings for the backup job:

At the Storage step of the wizard, click Advanced.

Click the Notifications tab.

Select the Send SNMP notifications for this job check box if you want to receive SNMP traps when the job completes successfully.

SNMP traps will be sent if you specify global SNMP settings in Veeam Backup & Replication and configure software on recipient's machine to receive SNMP traps. For more information, see the Specifying SNMP Settings section in the Veeam Backup & Replication User Guide.

Select the Send e-mail notifications to the following recipients check box if you want to receive notifications about the job completion status by email. In the field below, specify a recipient's email address. You can enter several addresses separated by a semicolon.

Email notifications will be sent if you configure global email notification settings in Veeam Backup & Replication. For more information, see the Configuring Global Email Notification Settings section in Veeam Backup & Replication User Guide.

You can choose to use global notification settings or specify custom notification settings.

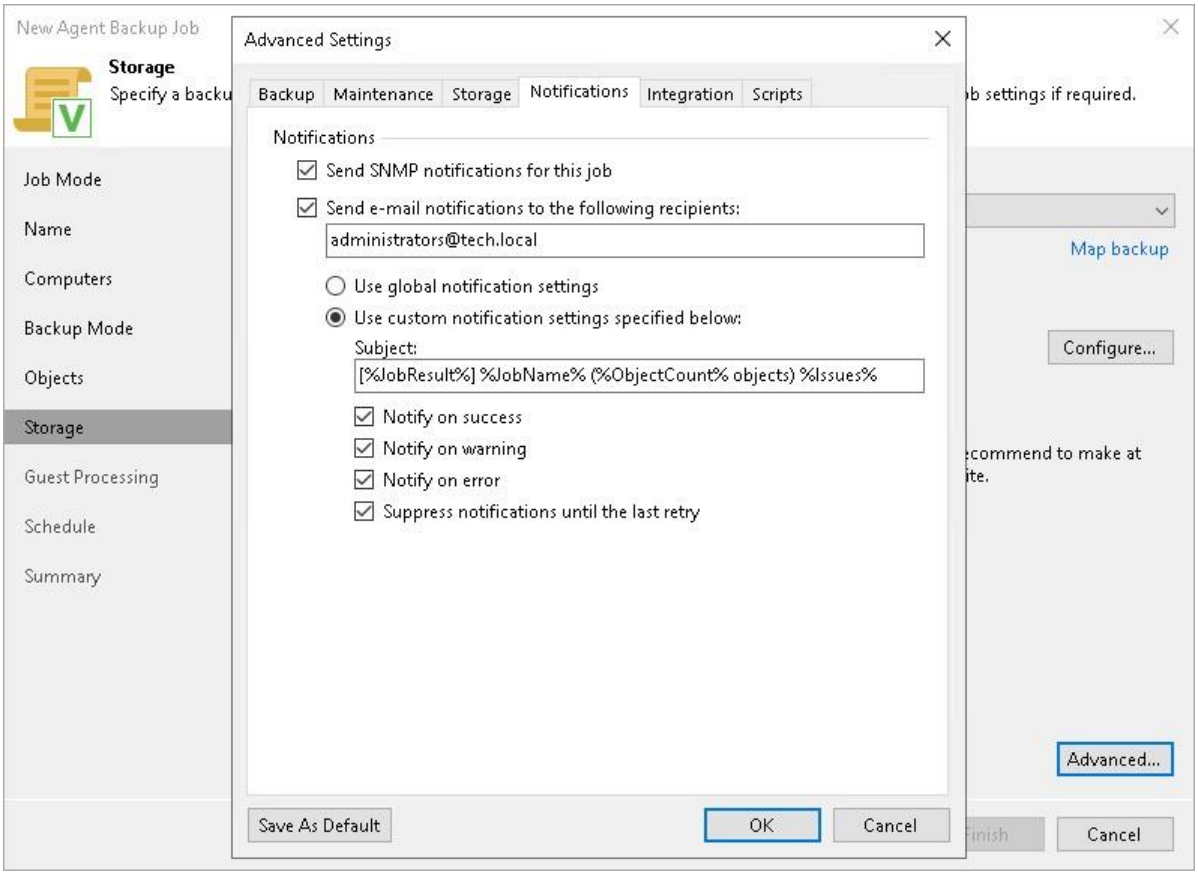
To receive a typical notification for the job, select Use global notification settings. In this case, Veeam Backup & Replication will apply to the job global email notification settings specified for the backup server.

To configure a custom notification for the job, select Use custom notification settings specified below. You can specify the following notification settings:

In the Subject field, specify a notification subject. You can use the following variables in the subject: %Time% (completion time), %JobName%, %JobResult%, %ObjectCount% (number of machines in the job) and %Issues% (number of machines in the job that have been processed with the Warning or Failed status).

Select the Notify on success, Notify on warning or Notify on error check boxes to receive email notification if the job completes successfully, completes with a warning or fails.

Select the Suppress notifications until the last retry check box to receive a notification about the final job status. If you do not enable this option, Veeam Backup & Replication will send one notification per every job retry.


New Agent Backup Job
Storage
Specify a backu
Job Mode
Name
Computers
Backup Mode
Objects
Storage
Guest Processing
Schedule
Summary
Advanced Settings
Backup
Maintenance
Storage
Notifications
Integration
Scripts
Notifications
Send SNMP notifications for this job
Send e-mail notifications to the following recipients:
administrators@tech.local
Use global notification settings
Use custom notification settings specified below:
Subject:
[%JobResult%] %JobName% (%ObjectCount% objects) %Issues%
Notify on success
Notify on warning
Notify on error
Suppress notifications until the last retry
Save As Default
OK
Cancel
ob settings if required.
Map backup
Configure...
ecommend to make at
ite.
Advanced...
Finish
Cancel

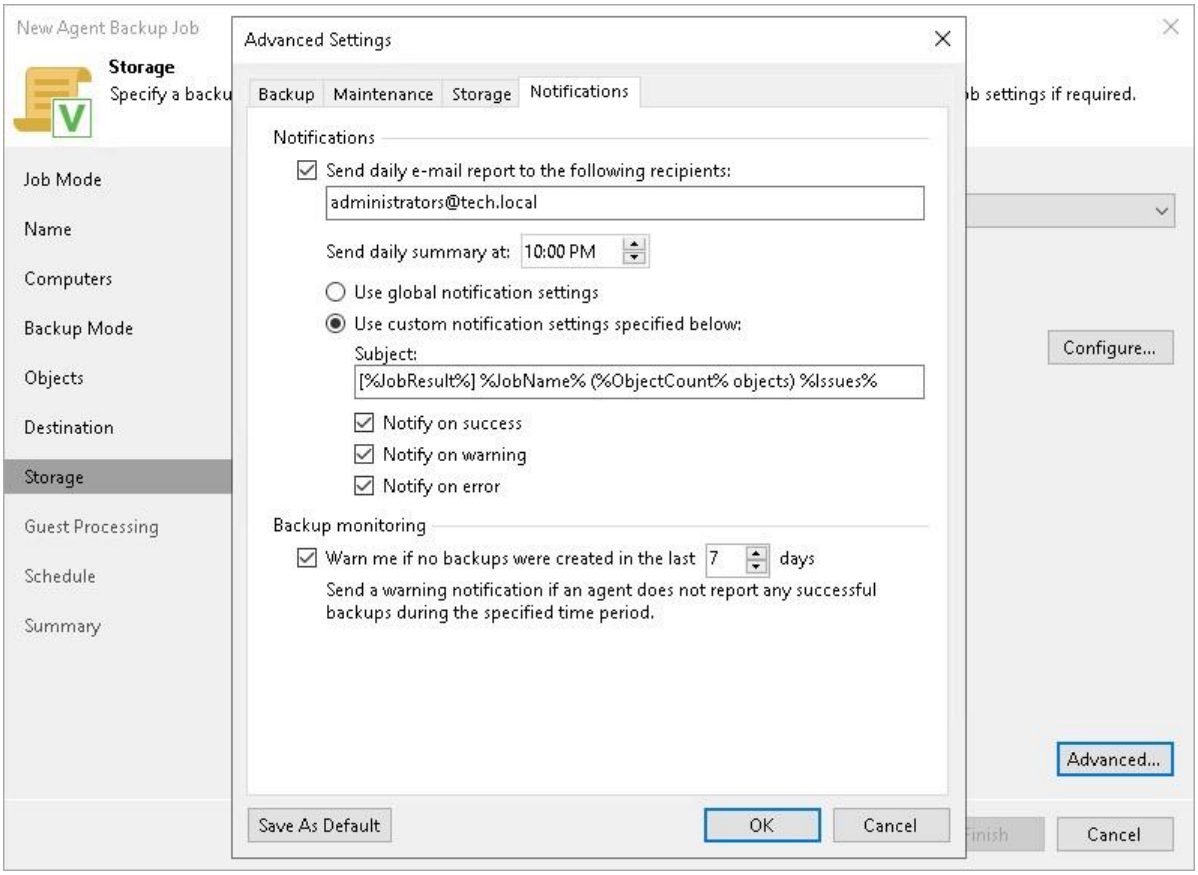
## Notification Settings for Backup Policy

You can specify email notification settings for the backup policy. If you enable notification settings, Veeam Backup & Replication will send a daily email report with backup policy statistics to a specified email address. The report contains cumulative statistics for backup job sessions performed for the last 24-hour period on computers to which the backup policy is applied.

> NOTE
>
> Email reports with backup policy statistics will be sent if you configure global email notification settings in Veeam Backup & Replication. For more information, see the Configuring Global Email Notification Settings section in the Veeam Backup & Replication User Guide.
>
> After you enable notification settings for the backup policy, Veeam Backup & Replication will send reports with the backup policy statistics to email addresses specified in global email notification settings and email addresses specified in the backup policy settings.

To specify notification settings for the backup policy:

1. Click Advanced at one of the following steps of the wizard:
   - Storage — if you have selected to save backup files in a Veeam backup repository or cloud repository.
   - Local Storage — if you have selected to save backup files in a local storage of a Veeam Agent computer.
   - Shared Folder — if you have selected to save backup files in a network shared folder.
2. Click the Notifications tab.
3. Select the Send daily e-mail report to the following recipients check box and specify a recipient's email address in the field below. You can enter several addresses separated by a semicolon.
4. In the Send daily summary at field, specify the time when Veeam Backup & Replication must send the email notification for the backup policy. Veeam Backup & Replication will send the report daily at the specified time.
5. You can choose to use global notification settings or specify custom notification settings.
   - To receive a typical notification for the backup policy, select Use global notification settings. In this case, Veeam Backup & Replication will apply to the backup policy global email notification settings specified for the backup server.
   - To configure a custom notification for the backup policy, select Use custom notification settings specified below. You can specify the following notification settings:
     - In the Subject field, specify a notification subject. You can use the following variables in the subject: %Time% (completion time), %JobName%, %JobResult%, %ObjectCount% (number of machines in the backup policy) and %Issues% (number of machines in the backup policy that have been processed with the Warning or Failed status).
     - Select the Notify on success, Notify on warning or Notify on error check boxes to receive email notification if the job completes successfully, completes with a warning or fails.
6. In the Backup monitoring section, select the Warn me if no backups were created in the last N days check box and specify a number of days. In this case, Veeam Backup & Replication will display a warning message in a backup policy session statistics in case successful backups are not created for a specified number of days.




## Integration Settings

You can specify storage integration settings for the job if you have selected the Managed by backup server mode at the Job Mode step of the wizard.

Keep in mind that storage integration settings are unavailable if you work with protection group for cloud machines.

To specify storage integration settings for the backup job:

At the Storage step of the wizard, click Advanced.

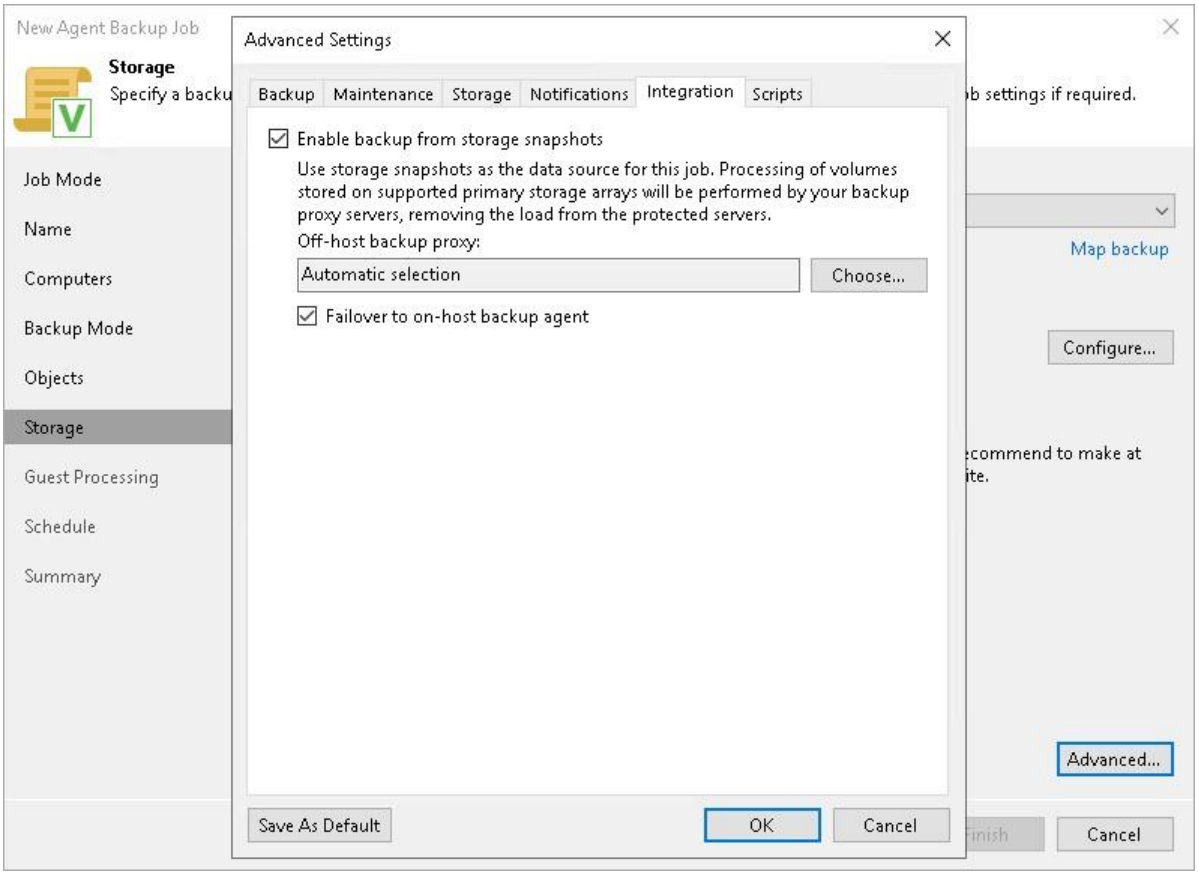
Click the Integration tab.

If you select the Enable backup from storage snapshots check box, Veeam Backup & Replication will use native storage snapshots to create Veeam Agent backups. To learn more about storage snapshots support, see Storage Snapshots Support.

To transfer a snapshot from storage to the target repository, Veeam Backup & Replication uses off-host backup proxies. You can allow Veeam Backup & Replication to use any suitable backup proxies or you can select specific backup proxies. To learn more, see Selecting Off-Host Backup Proxy.

If Veeam Backup & Replication fails to create a storage snapshot or backup proxy is unavailable, you can fail over to the regular backup scenario that uses the software VSS provider. To do this, select the Failover to on-host backup agent check box.

To learn more about regular backup scenario, see the How Backup Works section in the Veeam Agent for Microsoft Windows User Guide.




## Selecting Off-Host Backup Proxy

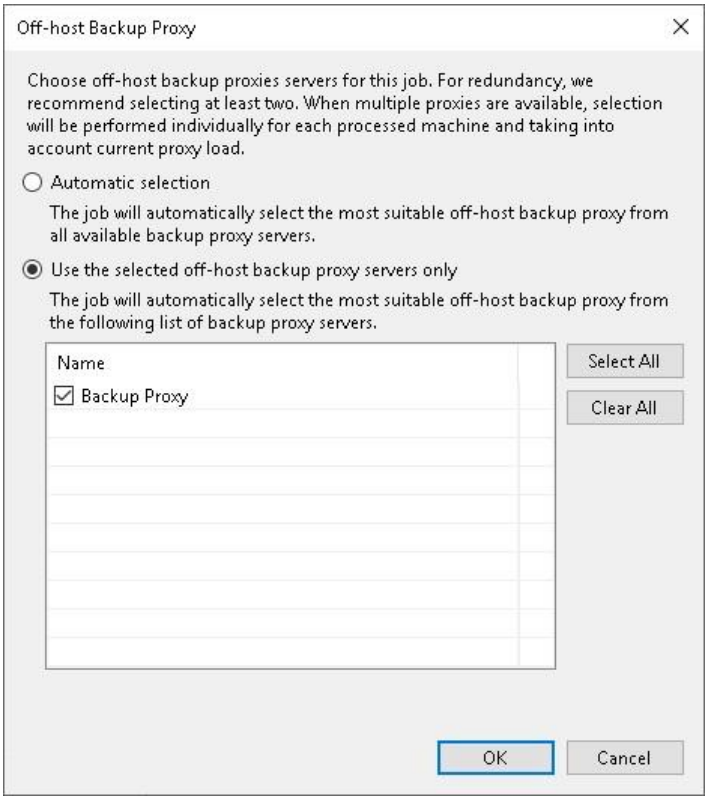
To specify what backup proxies Veeam Backup & Replication will use during the backup process, click Choose and select one of the following options in the Off-host Backup Proxy window:

If you want Veeam Backup & Replication to use any suitable backup proxies, select the Automatic selection option. In this case, the number of backup proxies that Veeam Backup & Replication uses for data transfer depends on the backup scope.

> IMPORTANT
>
> If you use the NetApp Element storage system and you have 4 or more backup proxies set in your Veeam Backup & Replication infrastructure, you cannot use automatic selection. You must manually select up to 3 backup proxies.

If you want to select backup proxies manually, select the Use the selected off-host backup proxy servers only option and select check boxes near backup proxies you plan to use.

Keep in mind that Veeam Backup & Replication displays only those backup proxies that run Microsoft Windows Server OS. For more information about backup proxy requirements, see Storage Snapshots Support.




## Script Settings

You can specify script settings for the job if you have selected the Managed by backup server mode at the Job Mode step of the wizard.

To specify script settings for the backup job:

At the Storage step of the wizard, click Advanced.

Click the Scripts tab.

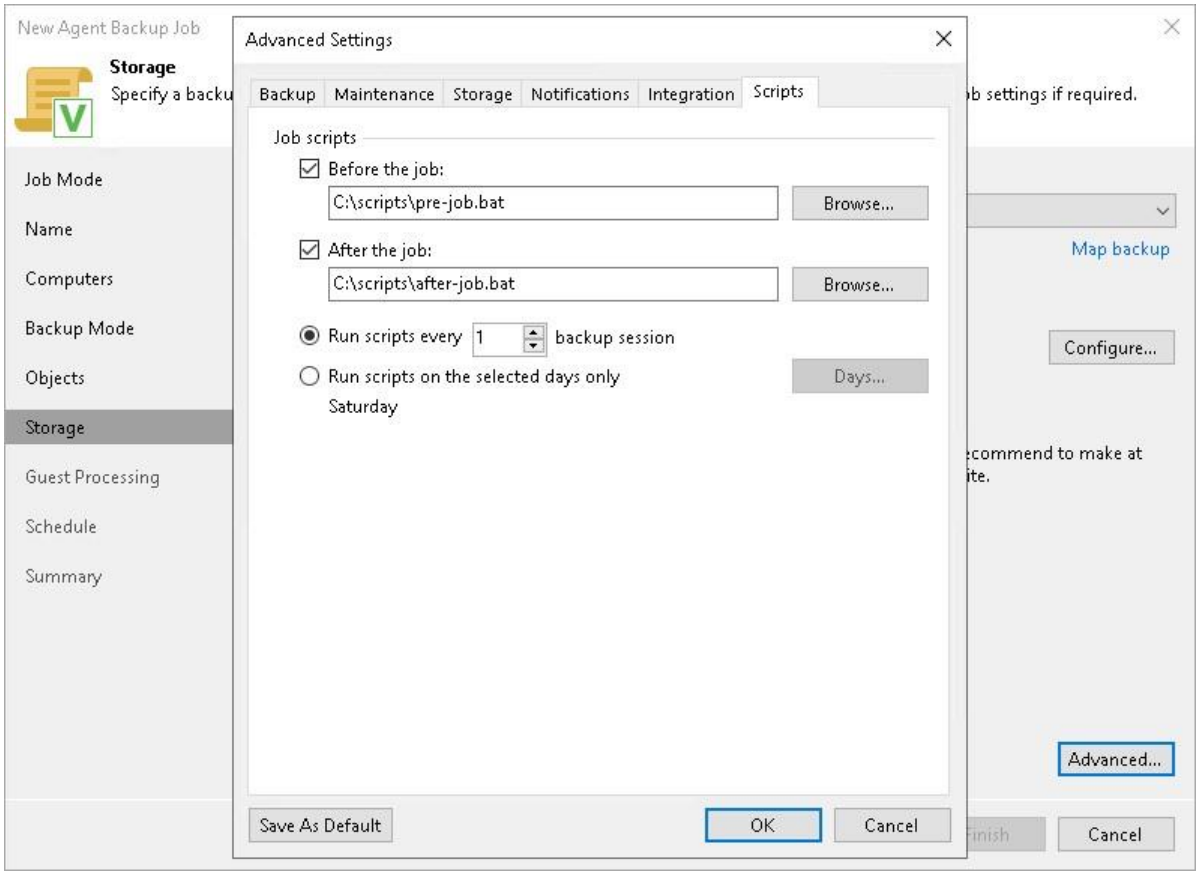
If you want to execute custom scripts before or after the backup job, select the Before the job or After the job check boxes and click Browse to choose executable files from a local folder on the backup server. The scripts are executed on the backup server.

You can select to execute pre- and post-backup actions after a number of backup sessions or on specific week days.

If you select the Run scripts every <N> backup session option, specify the number of the backup job sessions after which the scripts must be executed.

If you select the Run scripts on the selected days only option, click Days and specify week days on which the scripts must be executed.

> NOTE
>
> Custom scripts that you define in the advanced job settings relate to the backup job itself, not the OS quiescence process on protected computers. To add pre-freeze and post-thaw scripts for Veeam Agent computer OS quiescence, use the Guest Processing step of the wizard.




### Step 10. Specify Secondary Target

The Secondary Target step of the wizard is available if you have enabled the Configure secondary destinations for this job option at the Storage step of the wizard.

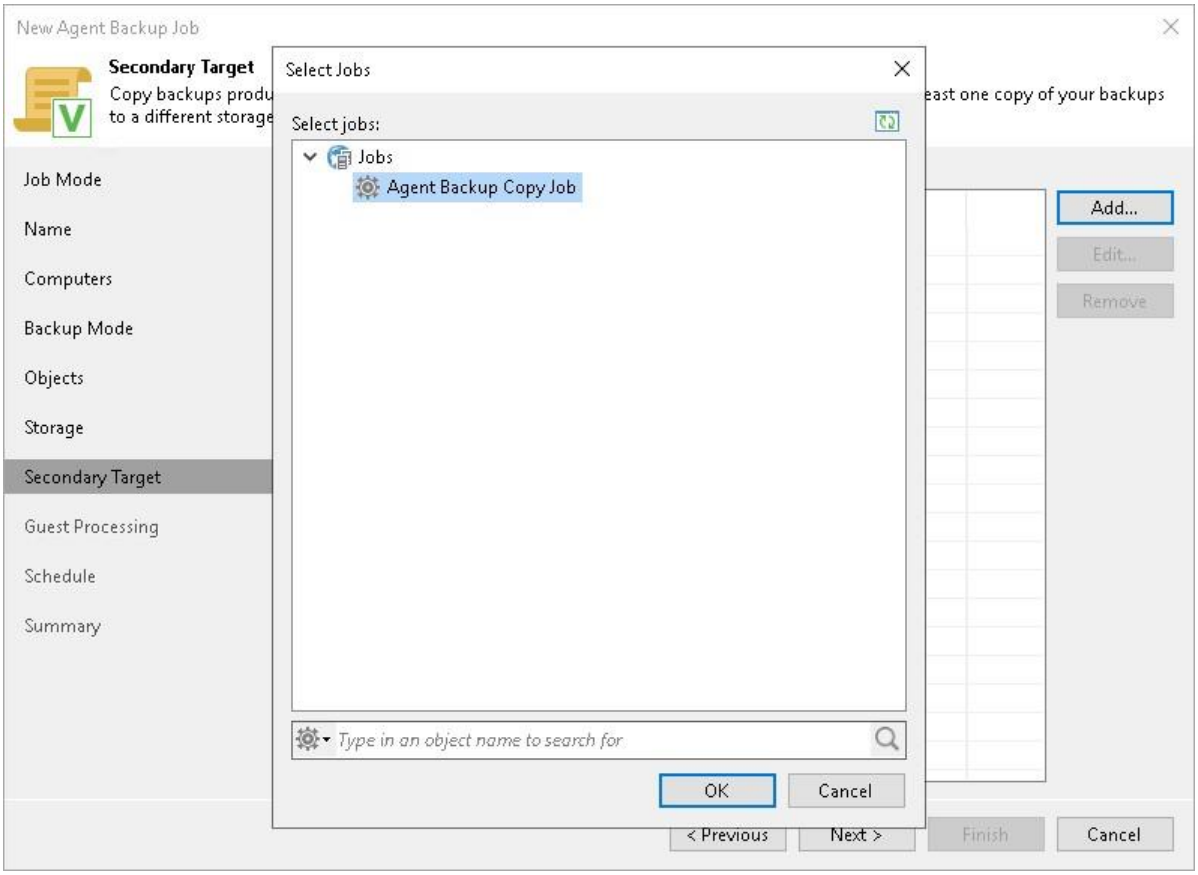
At the Secondary Target step of the wizard, you can link the Veeam Agent backup job to a backup to tape or backup copy job. As a result, the backup job will be added as a source to the backup to tape or backup copy job. Backup files created with the backup job will be archived to tape or copied to the secondary backup repository according to the secondary jobs schedule. For more information, see the Linking Backup Jobs to Backup Copy Jobs and Linking Backup Jobs to Backup to Tape Jobs sections in the Veeam Backup & Replication User Guide.

The backup to tape job or backup copy job must be configured beforehand. You can create these jobs with an empty source. When you link the Veeam Agent backup job to these jobs, Veeam Backup & Replication will automatically update the linked jobs to define the Veeam Agent backup job as a source for these jobs.

To link jobs:

Click Add.

From the jobs list, select a backup to tape or backup copy job that must be linked to the Veeam Agent backup job. You can link several jobs to the backup job, for example, one backup to tape job and one backup copy job. To quickly find the job, use the search field at the bottom of the wizard.




## Step 11. Specify Backup Cache Settings

The Backup Cache step of the wizard is available if you selected the following options at the previous steps of the wizard:

- Selected the Managed by agent mode at the Job Mode step of the wizard.
- Selected the Veeam backup repository or Veeam Cloud Connect repository option at the Destination step of the wizard.

To specify backup cache settings:

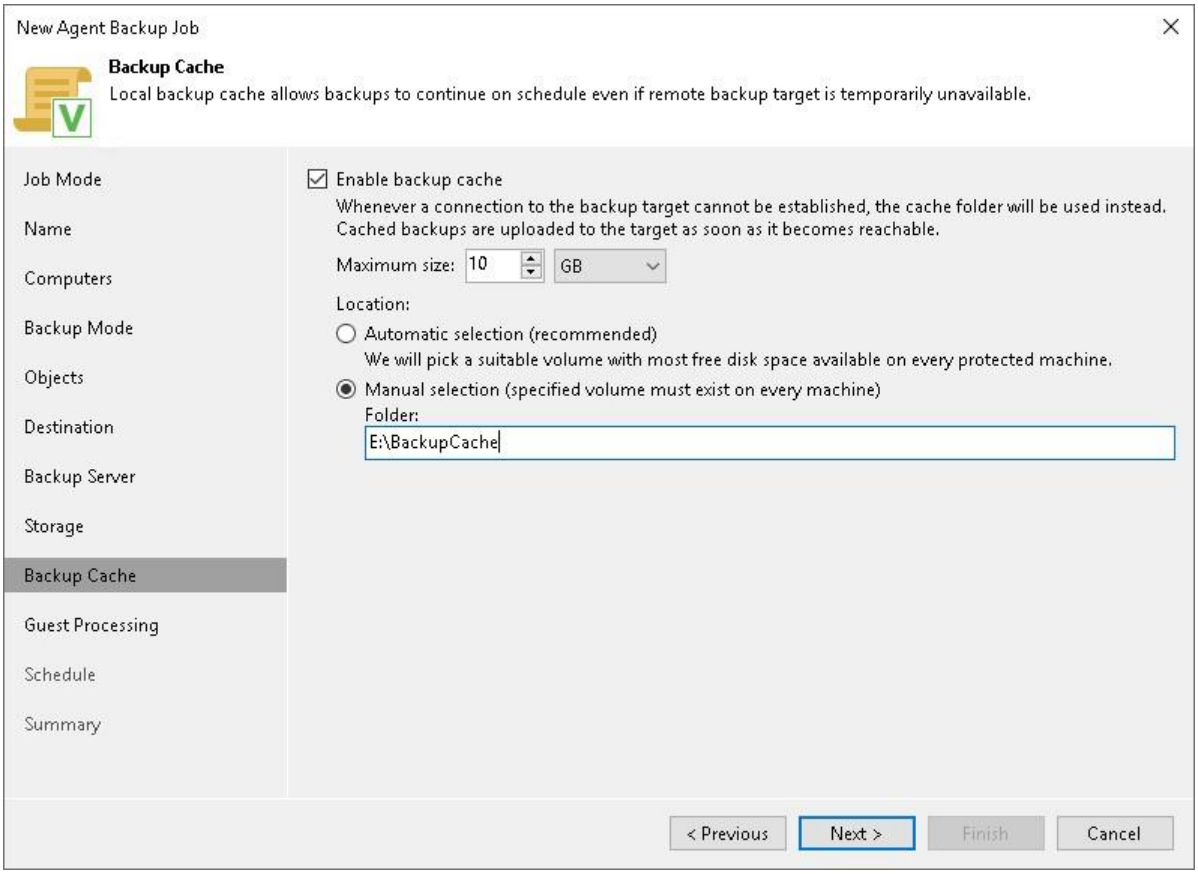
1. Select the Enable backup cache check box.
2. In the Maximum size field, specify the size for the backup cache.

   When defining the size of the backup cache, assume the following:

   - Each full backup file may consume about 50% of the backed-up data size.
   - Each incremental backup file may consume about 10% of the backed-up data size.
3. In the Location section, specify where Veeam Agent for Microsoft Windows will create the backup cache. You can select from the following options:

   - Automatic selection — select this option if you want to let Veeam Agent pick a location for the backup cache automatically. On every computer added to the backup policy, Veeam Agent will detect a volume with the largest amount of free disk space and create the backup cache in the Veeam Backup Cache folder on this volume. To learn more, see Backup Cache.

Manual selection — select this option if you want to specify a location for the backup cache manually. If you select this option, in the Folder field, specify a path to the folder on a protected computer in which backup files must be stored.

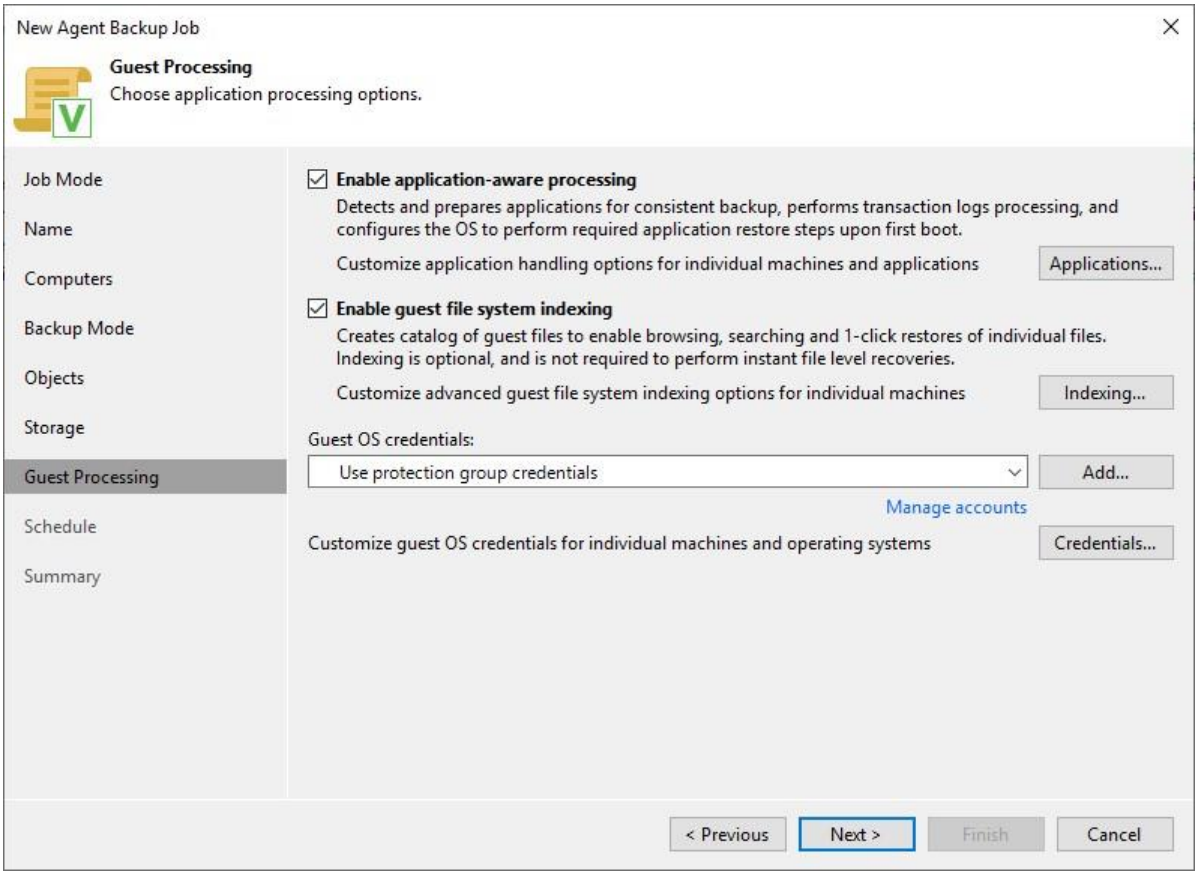



### Step 12. Specify Guest Processing Settings

The Guest Processing step of the wizard is available if you have selected the Server or Failover cluster option at the Job Mode step of the wizard.

For a Veeam Agent backup job that includes Windows-based computers, you can enable the following guest OS processing settings:

- Application-aware processing
- Transaction log handling for Microsoft SQL Server
- Archived log handling for Oracle databases
- SharePoint account settings
- Use of pre-freeze and post-thaw scripts
- File indexing




## Application-Aware Processing

If your computer runs VSS-aware applications, you can enable application-aware processing to create a transactionally consistent backup. The transactionally consistent backup guarantees proper recovery of applications without data loss.

To enable application-aware processing:

At the Guest Processing step of the wizard, make sure that the Enable application-aware processing check box is selected.

Click Applications.

In the displayed list, select a protection group or individual computer and click Edit.

To define custom settings for a computer added as a part of a protection group, you must include the computer to the list as a standalone object. To do this, click Add and choose the computer whose settings you want to customize. Then select the computer in the list and define the necessary settings.

On the General tab, in the Applications section, make sure that the Enable application-aware processing check box is selected.

You can clear this check box, for example, if you want to disable application-aware processing for a specific computer added to the backup job as a part of a protection group.

[For Microsoft SQL Server] If you disable application-aware processing, Veeam Agent will not include information about databases in the backup. However, you can use Veeam Explorer for Microsoft SQL to locate a database file in the backup and restore the database.

[For Microsoft Exchange, Microsoft SQL Server and other applications that rely on VSS] In the Microsoft VSS settings section, specify if Veeam Agent for Microsoft Windows running on a protected computer must process transaction logs or copy-only backups must be created.

Select Process transaction logs with this job if you want Veeam Agent for Microsoft Windows to process transaction logs.

[For Microsoft Exchange] With this option selected, Veeam Agent for Microsoft Windows will wait for backup to complete successfully, and then trigger truncation of transaction logs. If the backup job fails, the logs will remain untouched until the next backup job session.

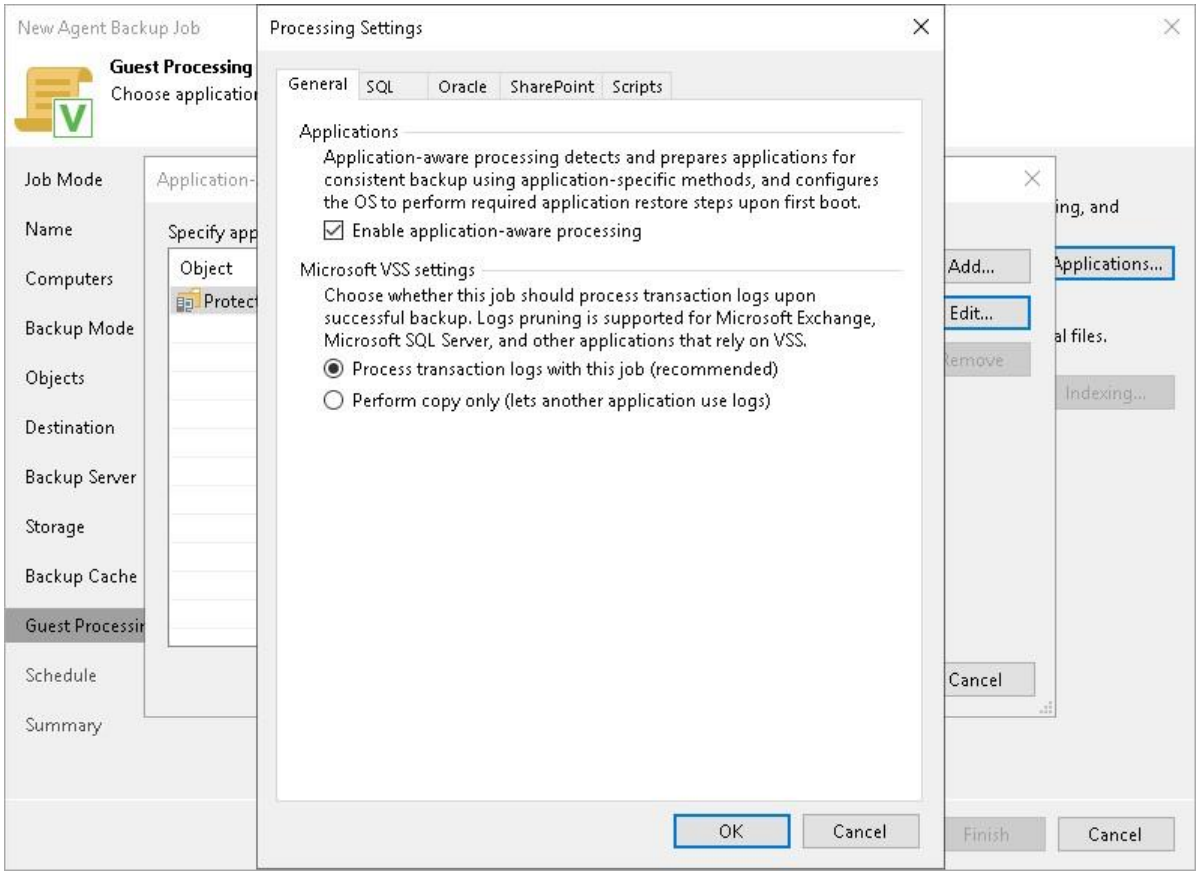
[For Microsoft SQL Server and Oracle] You will have to specify settings for database log handling on the SQL and Oracle tabs of the Processing Settings window. For more information, see Microsoft SQL Server Transaction Log Settings and Oracle Archived Log Settings.

Select Perform copy only if you use another tool to maintain consistency of the database state. Veeam Agent for Microsoft Windows will create a copy-only backup. The copy-only backup preserves the chain of full/differential backup files and transaction logs. After a copy-only backup, Veeam Agent does not trigger truncation of transaction logs. For more information, see this Microsoft article.

IMPORTANT

Consider the following:

- [For Microsoft Exchange] Veeam Agent for Microsoft Windows performs truncation of Microsoft Exchange transaction logs only if all disks that contain the Microsoft Exchange database are included in a volume-level backup job.
- [For Microsoft SQL Server and Oracle] If both Microsoft SQL Server and Oracle Server are installed on one guest OS, and log backup is enabled for both applications, Veeam Agent for Microsoft Windows will back up only Oracle transaction logs. Microsoft SQL Server transaction logs will not be processed.



check

## Microsoft SQL Server Transaction Log Settings

If you back up Microsoft SQL Server, you can specify how Veeam Agent for Microsoft Windows must process database transaction logs:

At the Guest Processing step of the wizard, make sure that the Enable application-aware processing box is selected.

Click Applications.

In the displayed list, select a protection group or individual computer and click Edit.

In the Microsoft VSS settings section, select Process transaction logs with this job.

In the Processing Settings window, click the SQL tab.

To specify a user account that Veeam Agent will use to connect to the Microsoft SQL Server, select from the Specify Windows account with sysadmin role on SQL Server list a user account that has access permissions on the database. This account must be a Microsoft Windows user account with roles and permissions as specified in the Performing Guest Processing section of the Veeam Backup & Replication User Guide. Keep in mind that you cannot use Microsoft SQL Server accounts (for example, the SA account) to connect to the database.

By default, the Use guest credentials option is selected in the list. With this option selected, Veeam Agent will connect to the Microsoft SQL Server under the account that you have specified for the protected computer in the protection group settings.

If you have not set up credentials beforehand, click the Manage accounts link or click Add on the right to add credentials.

Specify how transaction logs must be processed. You can select one of the following options:

Select Truncate logs to truncate transaction logs after successful backup. Veeam Agent will wait for the backup to complete successfully and then truncate transaction logs. If the backup job fails, the logs will remain untouched until the next backup job session.

Select Do not truncate logs to preserve transaction logs. When the backup job completes, Veeam Agent will not truncate transaction logs.

It is recommended that you enable this option for databases that use the Simple recovery model. If you enable this option for databases that use the Full or Bulk-logged recovery model, transaction logs may grow large and consume all disk space. In this case, the database administrator must take care of transaction logs him-/herself.

Select Backup logs periodically to back up transaction logs with Veeam Agent. Veeam Agent will periodically copy transaction logs to the backup location and store them together with the imagelevel backup. During the backup job session, transaction logs will be truncated.

For more information, see the Microsoft SQL Server and Oracle Logs Backup section in the Veeam Agent User Guide.

If you have selected to back up transaction logs with Veeam Agent for Microsoft Windows, you must specify settings for transaction logs backup:

In the Backup logs every <N> minutes field, specify the frequency for transaction logs backup. By default, transaction logs are backed up every 15 minutes. The maximum log backup interval is 480 minutes.

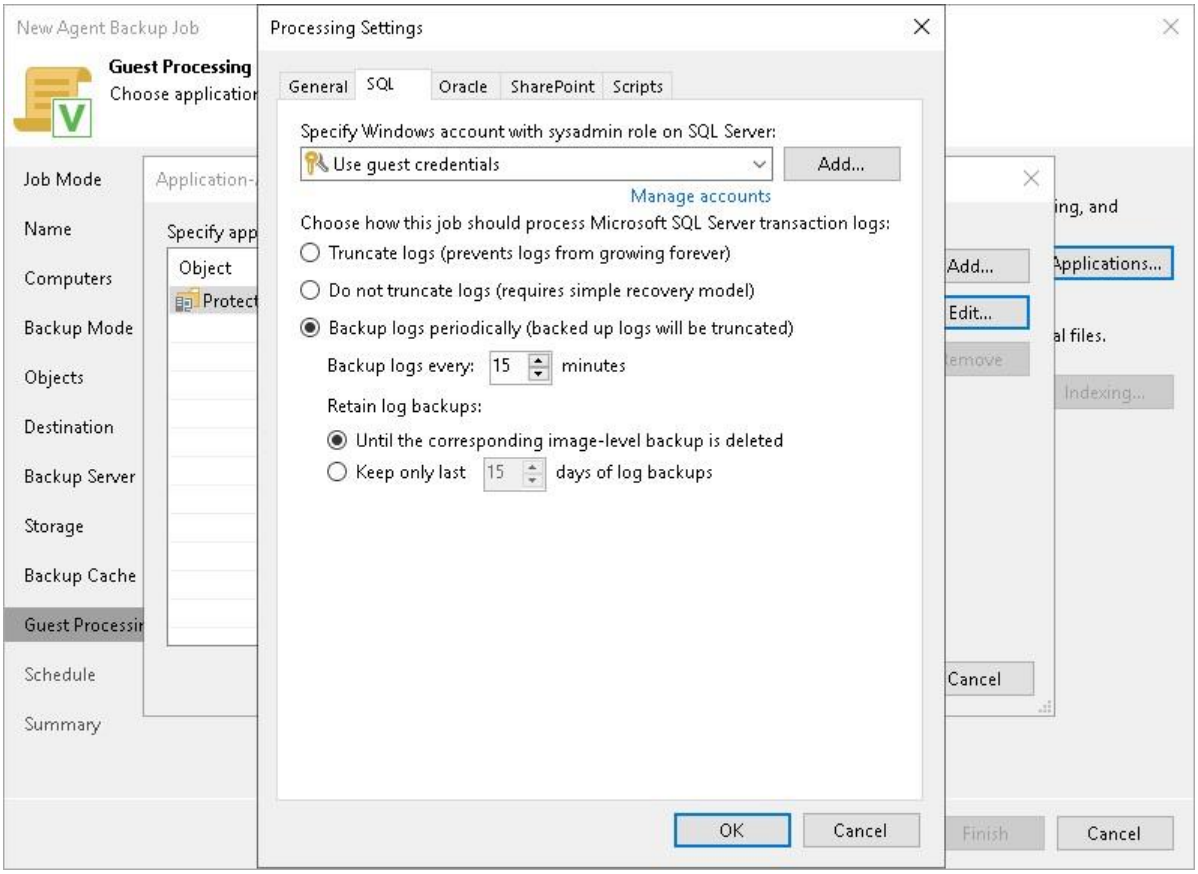
In the Retain log backups section, specify retention policy for transaction logs stored in the backup location.

check

Select Until the corresponding image-level backup is deleted to apply the same retention policy for image-level backups and transaction log backups.

Select Keep only last <N> days of log backups to keep transaction logs for a specific number of days. By default, transaction logs are kept for 15 days. If you select this option, you must make sure that retention for transaction logs is not greater than retention for the image-level backup. For more information, see the Retention for Database Log Backups section in the Veeam Agent for Microsoft Windows User Guide.

> IMPORTANT
>
> Veeam Agent for Microsoft Windows automatically excludes its configuration database from application-aware processing during backup. Transaction logs for the configuration database are not backed up.




## Oracle Archived Log Settings

If you back up an Oracle database, you can specify how Veeam Agent for Microsoft Windows must process archived logs:

At the Guest Processing step of the wizard, make sure that the Enable application-aware processing box is selected.

Click Applications.

In the displayed list, select a protection group or individual computer and click Edit.

In the Microsoft VSS settings section, select Process transaction logs with this job.

check

In the Processing Settings window, click the Oracle tab.

To specify a user account that Veeam Agent for Microsoft Windows will use to connect to the Oracle database, select from theSpecify Oracle account with SYSDBA privileges list a user account that has SYSDBA rights on the database. If you have not set up credentials beforehand, click the Manage accounts link or click Add on the right to add credentials.

By default, the Use guest OS credentials option is selected in the list. With this option selected, Veeam Agent for Microsoft Windows will connect to the Oracle database under the account that you have specified for the protected computer in the protection group settings.

In the Archived logs section, specify if Veeam Agent for Microsoft Windows must delete archived logs on the Oracle database:

Select Do not delete archived logs if you want Veeam Agent for Microsoft Windows to preserve archived logs. When the backup job completes, Veeam Agent for Microsoft Windows will not delete archived logs.

It is recommended that you select this option for databases for which the ARCHIVELOG mode is turned off. If the ARCHIVELOG mode is turned on, archived logs may grow large and consume all disk space. In this case, the database administrator must take care of archived logs him-/herself.

Select Delete logs older than <N> hours or Delete logs over <N> GB if you want Veeam Agent for Microsoft Windows to delete archived logs that are older than <N> hours or larger than <N> GB. Veeam Agent for Microsoft Windows will wait for the backup to complete successfully and then trigger archived logs truncation via Oracle Call Interface (OCI). If the backup job fails, the logs will remain untouched until the next successful backup job session.

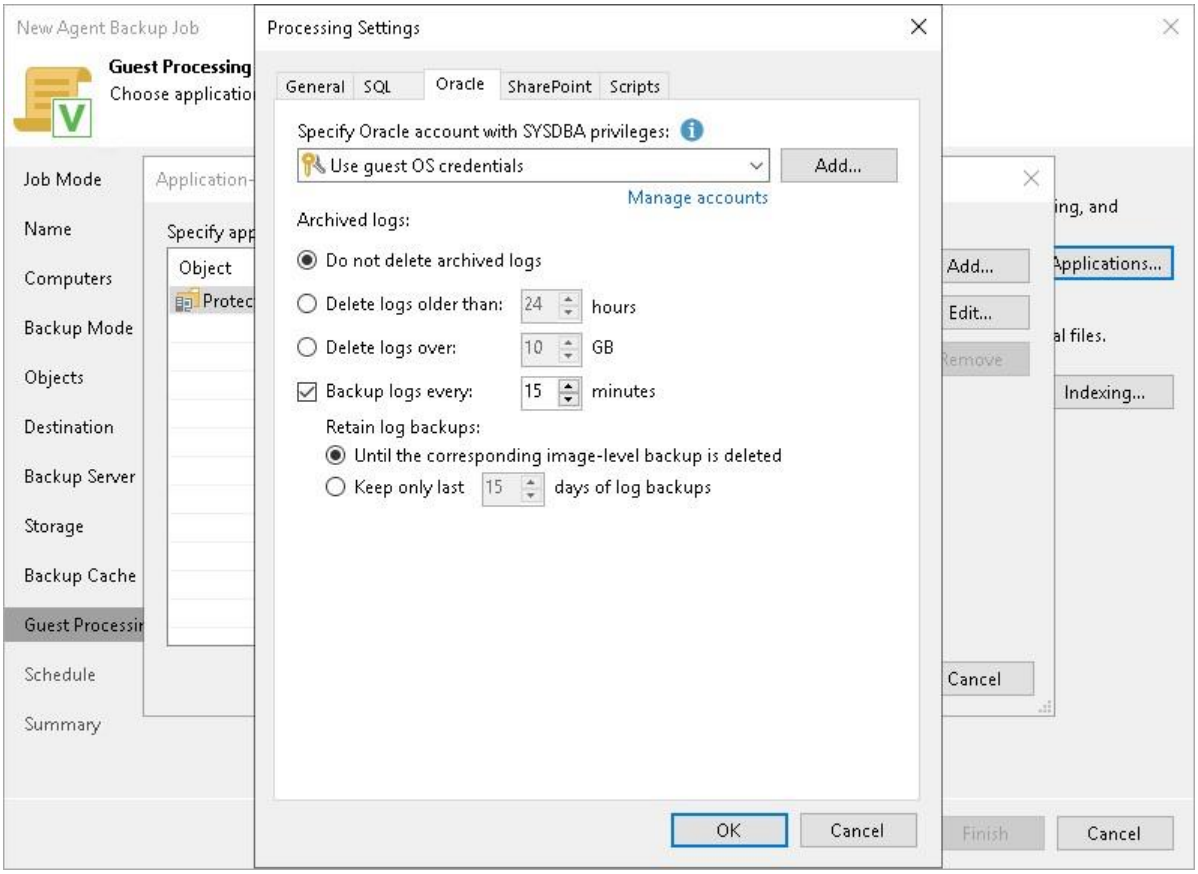
To back up Oracle archived logs with Veeam Agent for Microsoft Windows, select the Backup logs every <N> minutes check box and specify the frequency for archived logs backup. By default, archived logs are backed up every 15 minutes. The minimum log backup interval is 5 minutes. The maximum log backup interval is 480 minutes.

In the Retain log backups section, specify retention policy for archived logs stored in the backup location:

Select Until the corresponding image-level backup is deleted to apply the same retention policy for Veeam Agent backups and archived log backups.

Select Keep only last <n> days of log backups to keep archived logs for a specific number of days. By default, archived logs are kept for 15 days. If you select this option, you must make sure that retention for archived logs is not greater than retention for the Veeam Agent backups. For more information, see the Retention for Database Log Backups section in the Veeam Agent for Microsoft Windows User Guide.

check




## Microsoft SharePoint Account Settings

If you back up Microsoft SharePoint, you must specify a user account that has enough permissions on the application:

At the Guest Processing step of the wizard, make sure that the Enable application-aware processing box is selected.

Click Applications.

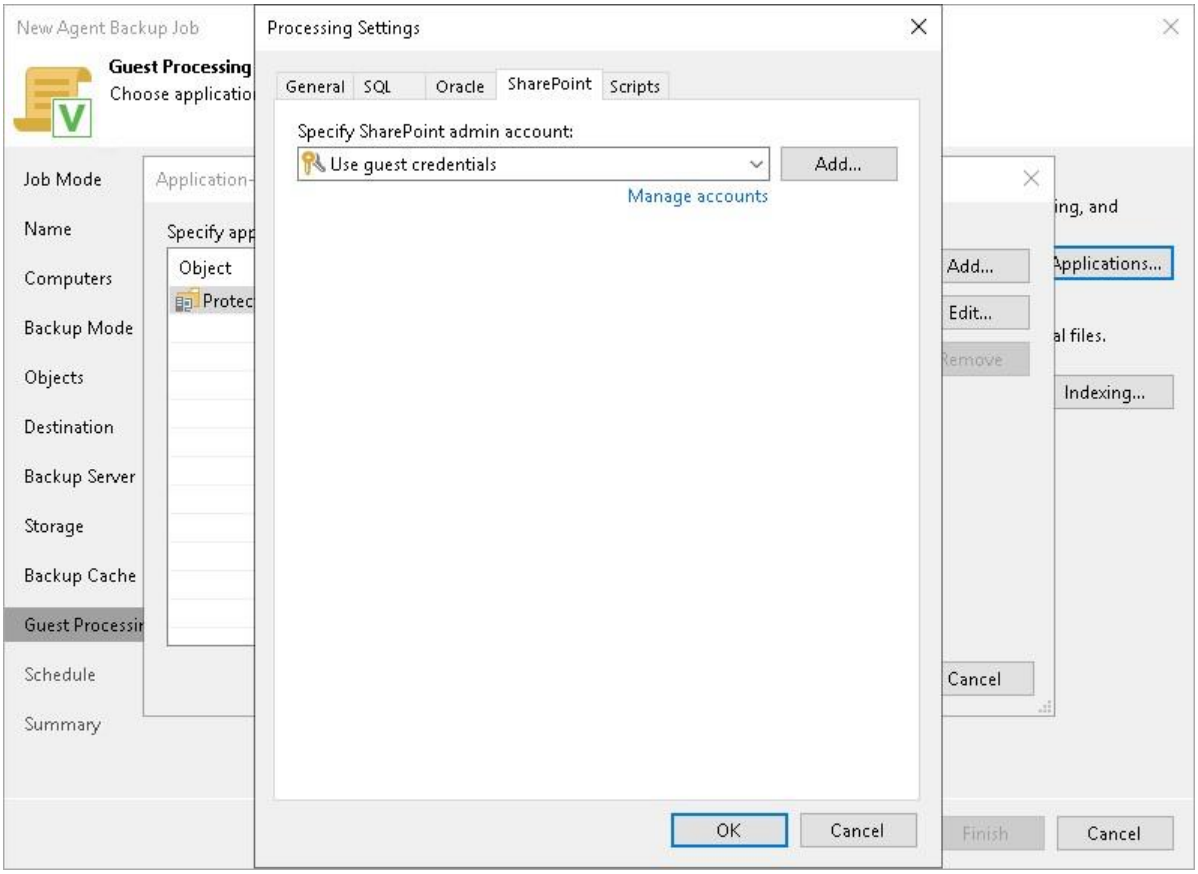
In the displayed list, select a protection group or individual computer and click Edit.

In the Processing Settings window, click the SharePoint tab.

From the Specify SharePoint admin account list, select a user account that Veeam Agent for Microsoft Windows will use to connect to the SharePoint application. If you have not set up credentials beforehand, click the Manage accounts link or click Add on the right to add credentials.

By default, the Use guest credentials option is selected in the list. With this option selected, Veeam Agent for Microsoft Windows will connect to the SharePoint application under the account that you have specified for the protected computer in the protection group settings.

check




## Pre-Freeze and Post-Thaw Scripts

If you plan to back up data of applications that do not support VSS, you can specify what scripts Veeam Agent for Microsoft Windows must use to quiesce the OS on the protected computer. The pre-freeze script quiesces the file system and application data to bring the OS to a consistent state before Veeam Agent for Microsoft Windows creates a VSS snapshot. After the VSS snapshot is created, the post-thaw script brings the file system and applications to their initial state.

To specify pre-freeze and post-thaw scripts for the job:

At the Guest Processing step, make sure that the Enable application-aware processing check box is selected.

Click Applications.

In the displayed list, select a protection group or individual computer and click Edit.

In the Processing Settings window, click the Scripts tab.

From the Specify admin account for script execution list, select a user account that Veeam Agent for Microsoft Windows will use to run pre-freeze and post-thaw scripts. If you have not set up credentials beforehand, click the Manage accounts link or click Add on the right to add credentials.

By default, the Use guest credentials option is selected in the list. With this option selected, Veeam Agent for Microsoft Windows will run pre-freeze and post-thaw scripts under the account that you have specified for the protected computer in the protection group settings.

In the Script processing mode section, specify the scenario for scripts execution:

check

Select Require successful script execution if you want Veeam Agent for Microsoft Windows to stop the backup process if the script fails.

Select Ignore script execution failures if you want to continue the backup process even if script errors occur.

Select Disable script execution if you do not want to run scripts.

3. In the working area, right-click a VM and select

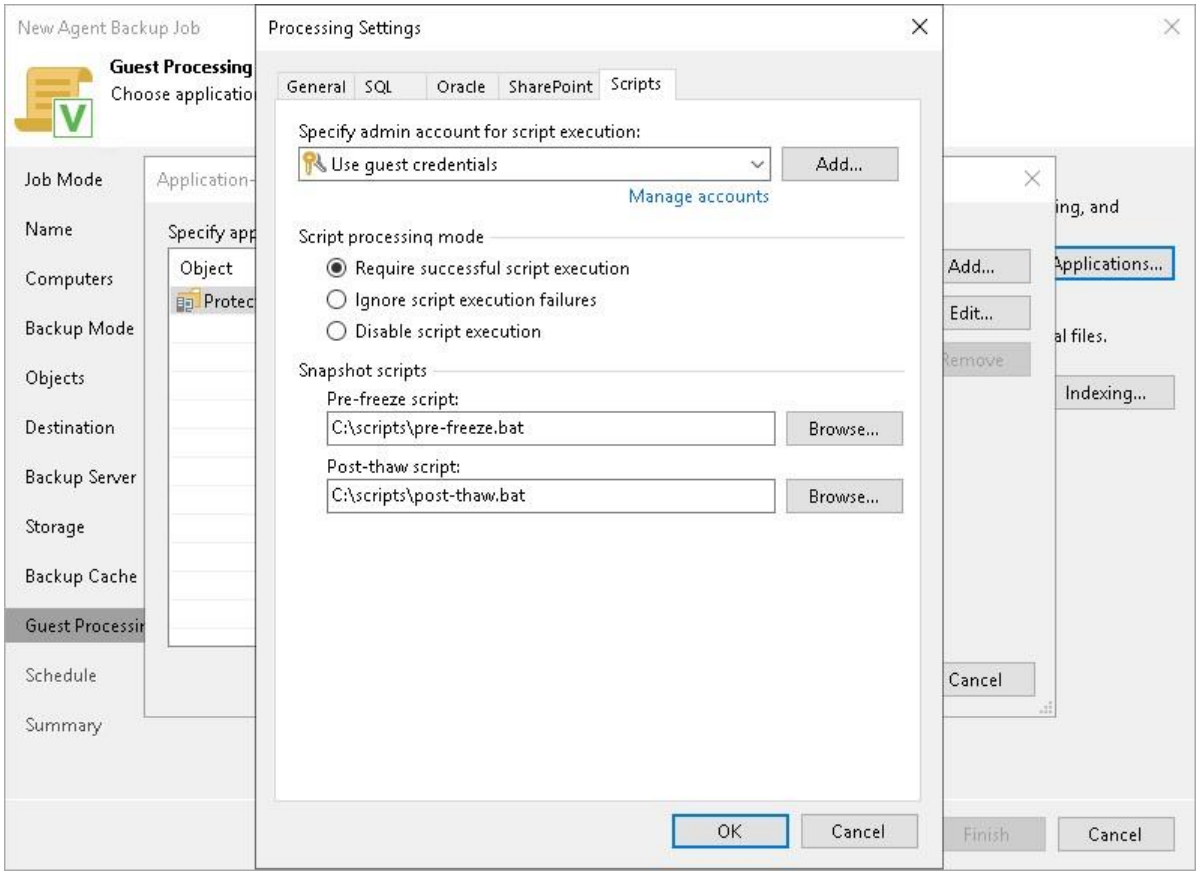
In the Snapshot scripts section, in the Pre-freeze script and Post-thaw script fields, click Browse to choose executable files from a local folder on the backup server. During the backup job session, Veeam Backup & Replication will upload the scripts to Veeam Agent computers added to the job and execute them on these computers.

Veeam Agent for Microsoft Windows supports the following types of scripts: ○

Program files in the EXE, BAT and CMD format ○ Windows script files in the JS, VBS

and WSF format ○ PowerShell script files in the PS1 format

You can use scripts of other formats as well, but we cannot guarantee correct processing of such scripts.




## File Indexing

You can instruct the backup job to create an index of files and folders on the protected computer OS during backup. If you enable the file indexing option, you will be able to search for individual files inside Veeam Agent backups and perform 1-click restore in Veeam Backup Enterprise Manager.

> NOTE
>
> File system indexing is optional. If you do not enable this option in the backup job settings, you will still be able to perform 1-click restore from the backup created with such backup job. For more information, see the Preparing for File Browsing and Restore section in the Veeam Backup Enterprise Manager User Guide.

To specify file indexing options:

At the Guest Processing step of the wizard, select the Enable guest file system indexing check box.

Click Indexing.

In the displayed list, select a protection group or individual computer and click Edit.

In the Windows indexing settings window, specify the indexing scope:

- Select Index everything if you want to index all files within the backup scope that you have specified at the Backup mode step of the wizard. Veeam Agent for Microsoft Windows will index all files that reside:

  On the protected computer OS (for entire computer backup)

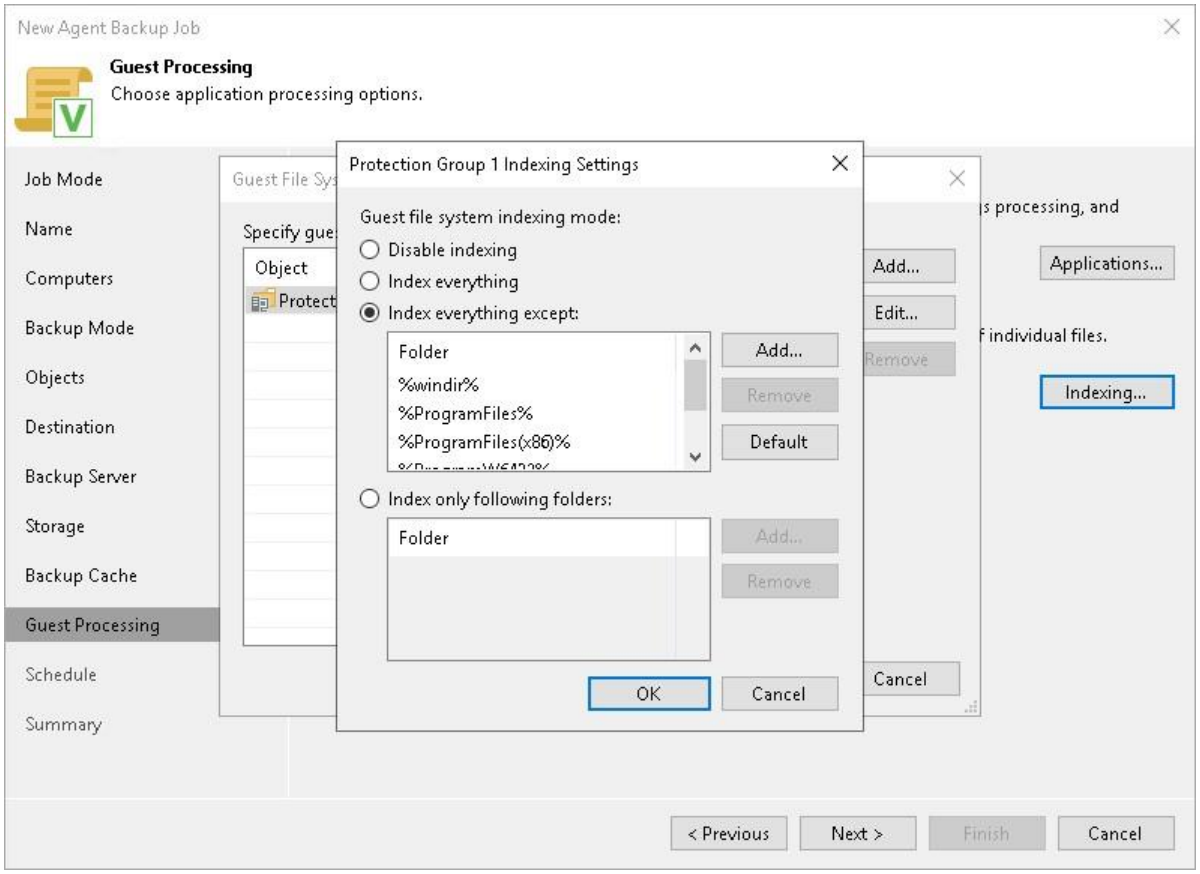
  On the volumes that you have specified for backup (for volume-level backup)

  In the folders that you have specified for backup (for file-level backup)

Select Index everything except if you want to index all files on the protected computer OS except those defined in the list. By default, system folders are excluded from indexing. You can add or delete folders using the Add and Remove buttons on the right. You can also use system environment variables to form the list, for example: %windir%, %Program Files% and %Temp%.

To reset the list of folders to its initial state, click Default.

Select Index only following folders to define folders that you want to index. You can add or delete folders to index using the Add and Remove buttons on the right. You can also use system environment variables to form the list, for example: %windir%, %Program Files% and %Temp%.




## Step 13. Specify Backup Schedule

At the Schedule step of the wizard, specify the schedule according to which you want to perform backup. Backup job scheduling options differ depending on the platform and job mode that you have selected at the Job Mode step of the wizard:

- Scheduling Settings for Workstations
- Scheduling Settings for Servers and Failover Clusters

> NOTE
>
> If you configure a backup policy, after you click Apply at the Schedule step of the wizard, Veeam Backup & Replication will immediately apply the backup policy to protected computers.

## Scheduling Settings for Workstations

At the Schedule step of the wizard, specify the schedule according to which you want to perform backup.

To specify the job schedule:

Select the Daily at check box and use the fields on the right to specify time and days when the backup job must start: ○

Everyday — select this option to start the job at specific time daily. ○ On week-days — select this option to start the job at specific time on week-days.

○ On these days — select this option to start the job at specific time on selected days.

You can leave the Daily at check box unchecked to configure the backup job without daily schedule. In this case, you will be able to use the backup job to perform backup automatically at specific events.

If you have selected the On these days option, click the Days button and clear check boxes for the days when the job must not start.

Select the action that Veeam Agent for Microsoft Windows must perform in case the protected computer is powered off at the time when the scheduled backup job must start.

Backup once powered on — select this option if you want Veeam Agent for Microsoft Windows to start the scheduled backup job when the protected computer is powered on.

Skip backup — select this option if you want Veeam Agent for Microsoft Windows not to start the scheduled backup job when the computer is powered on. Veeam Agent for Microsoft Windows will perform backup at the next scheduled time.

If you want Veeam Agent for Microsoft Windows to perform a finalizing action after the backup job completes successfully, select the necessary action: ○ Keep running — select this option if the computer must keep on working.

Sleep — select this option if you want Veeam Agent for Microsoft Windows to bring the computer to the standby mode.

Shutdown — select this option if you want Veeam Agent for Microsoft Windows to shut down the computer.

Hibernate — select this option if you want Veeam Agent for Microsoft Windows to bring the computer to the hibernate mode. This option is available if the hibernate mode is enabled on the protected computer. To learn more, see this Microsoft KB article.

When the backup job completes, Veeam Agent for Microsoft Windows will prompt a dialog with a countdown to the selected post-job action. You can select to proceed to the action immediately or to cancel the action. To learn more, see the Controlling Backup Post-Job Action section in the Veeam Agent for Microsoft Windows User Guide.

In the At the following events section, specify settings for events that trigger the backup job launch:

Select the Lock check box if you want to start the backup job when the user locks the Veeam Agent computer.

Select the Log off check box if you want to start the backup job when the user working with the computer performs a logout operation.

Select the When backup target is connected check box if you want to start the backup job when the backup storage becomes available (for example, when the computer connects to a local network and the target shared folder is accessible).

Select the Eject removable storage once backup is completed check box if you want Veeam Agent for Microsoft Windows to unmount the storage device after the backup job completes successfully. With this option selected, backup files on the removable storage will be protected from encrypting ransomware, such as CryptoLocker.

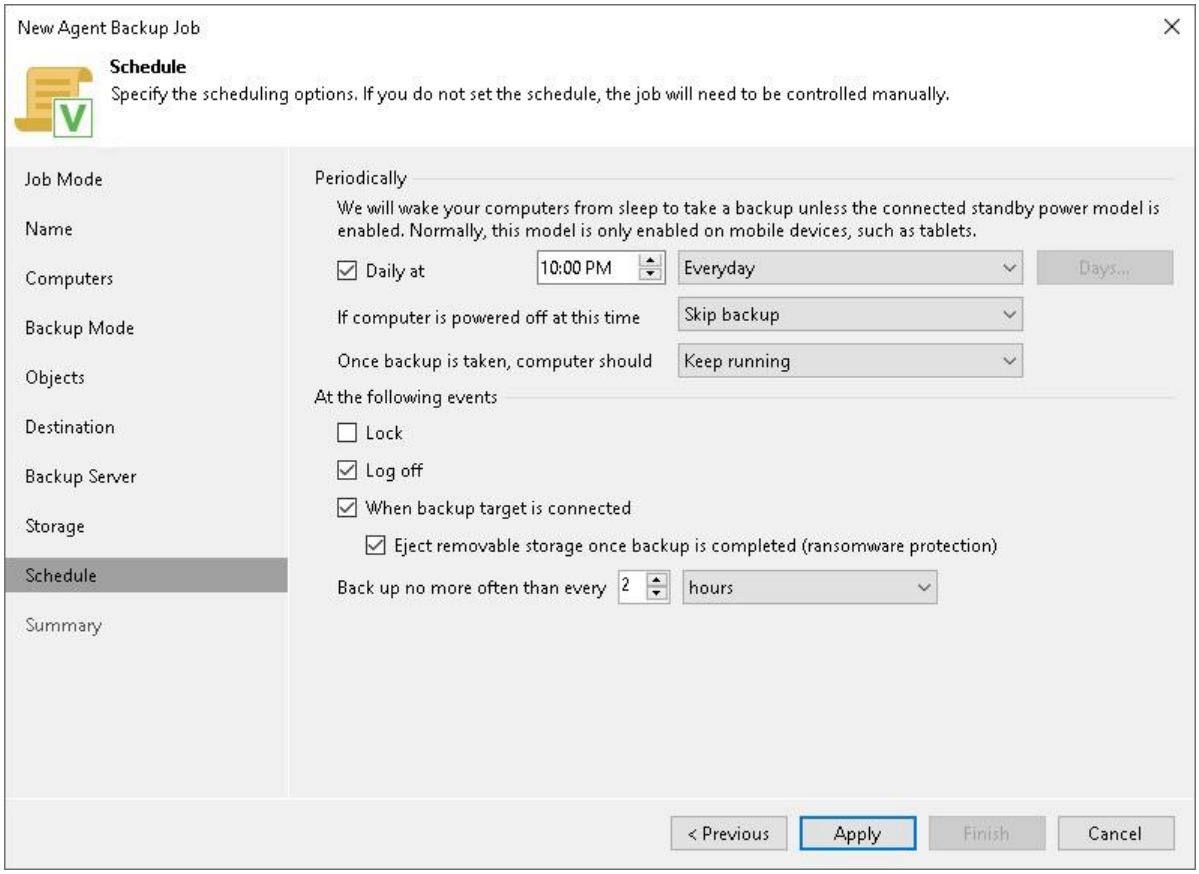
Veeam Agent applies this setting only to backup jobs triggered by the When backup target is connected event. In case of backup jobs triggered by other computer events or started periodically at specific time, Veeam Agent will ignore this setting, and the storage device will not be unmounted after the backup job completes successfully.

> IMPORTANT
>
> The Eject removable storage once backup is completed option does not guarantee a bulletproof protection against ransomware. To ensure your backups are safe, keep the OS up to date and regularly scan your backup repository for virus threats using modern antivirus software.

Use the Back up no more often than every <N> <time units> field to restrict the frequency of backup job sessions. Specify a minutely, hourly or daily interval between the backup job sessions.

The Back up no more often than every <N> <time units> option is applied only to job sessions started at specific events. Daily backups are performed according to defined schedule regardless of the time interval specified for this setting.

> IMPORTANT
>
> If the power scheme on the Veeam Agent computer does not allow using wake up timers, Veeam Agent for Microsoft Windows will not be able to wake your computer from sleep for backup. You can manually change the power scheme settings on the Veeam Agent computer. To do this, navigate to Control Panel > All Control Panel Items > Power Options > Edit Plan Settings.




## Scheduling Settings for Servers and Failover Clusters

At the Schedule step of the wizard, specify the schedule according to which you want to perform backup.

To specify the job schedule:

Select the Run the job automatically check box. If this check box is not selected, you will have to start the backup job manually to create backup.

Define scheduling settings for the job:

To run the job at specific time daily, on defined week days or with specific periodicity, select Daily at this time. Use the fields on the right to configure the necessary schedule.

To run the job once a month on specific days, select Monthly at this time. Use the fields on the right to configure the necessary schedule.

To run the job repeatedly throughout a day with a specific time interval, select Periodically every. In the field on the right, select the necessary time unit: Hours or Minutes. Click Schedule and use the time table to define the permitted time window for the job. In the Start time within an hour field, specify the exact time when the job must start.

A repeatedly run job is started by the following rules:

The defined interval always starts at 12:00 AM. For example, if you configure to run a job with a 4-hour interval, the job will start at 12:00 AM, 4:00 AM, 8:00 AM, 12:00 PM, 4:00 PM and so on.

If you define permitted hours for the job, after the denied interval is over, the job will start immediately and then run by the defined schedule.

For example, you have configured a job to run with a 2-hour interval and defined permitted hours from 9:00 AM to 5:00 PM. According to the rules above, the job will first run at 9:00 AM, when the denied period is over. After that, the job will run at 10:00 AM, 12:00 PM, 2:00 PM and 4:00 PM.

To run the job continuously, select the Periodically every option and choose Continuously from the list on the right. A new backup job session will start as soon as the previous backup job session finishes.

[For Managed by backup server mode only] To chain jobs, use the After this job field. In the common practice, jobs start one after another: when job A finishes, job B starts and so on. If you want to create a chain of jobs, you must define the time schedule for the first job in the chain. For the rest of the jobs in the chain, select the After this job option and choose the preceding job from the list.

> NOTE
>
> Mind the following:
>
> The After this job option is not available if you have selected the Managed by agent option at the Job Mode step of the wizard.
> The After this job function will automatically start a job if the first job in the chain is started automatically by schedule. If you start the first job manually, Veeam Backup & Replication will display a notification. You will be able to choose whether Veeam Backup & Replication must start the chained job as well.

In the Automatic retry section, define whether Veeam Backup & Replication or Veeam Agent for Microsoft Windows (depending on the selected job mode) must attempt to run the backup job again if the job fails for some reason. Enter the number of attempts to run the job and define time intervals between them. If you select continuous backup, Veeam Backup & Replication or Veeam Agent for Microsoft Windows retries the job for the defined number of times without any time intervals between the job runs.

[For Managed by agent mode only] If a backup policy fails and Veeam Agent retries the session, Veeam Agent does not transfer all the data again. Instead, Veeam Agent continues data transfer that was started before the backup policy fail. To do so, Veeam Agent compares hash values for data blocks on source and target. After the hash comparison, Veeam Agent also transfers only those data blocks that were not transferred before the policy fail. If data blocks on source were changed before the retry, Veeam Agent transfers these data blocks as well.

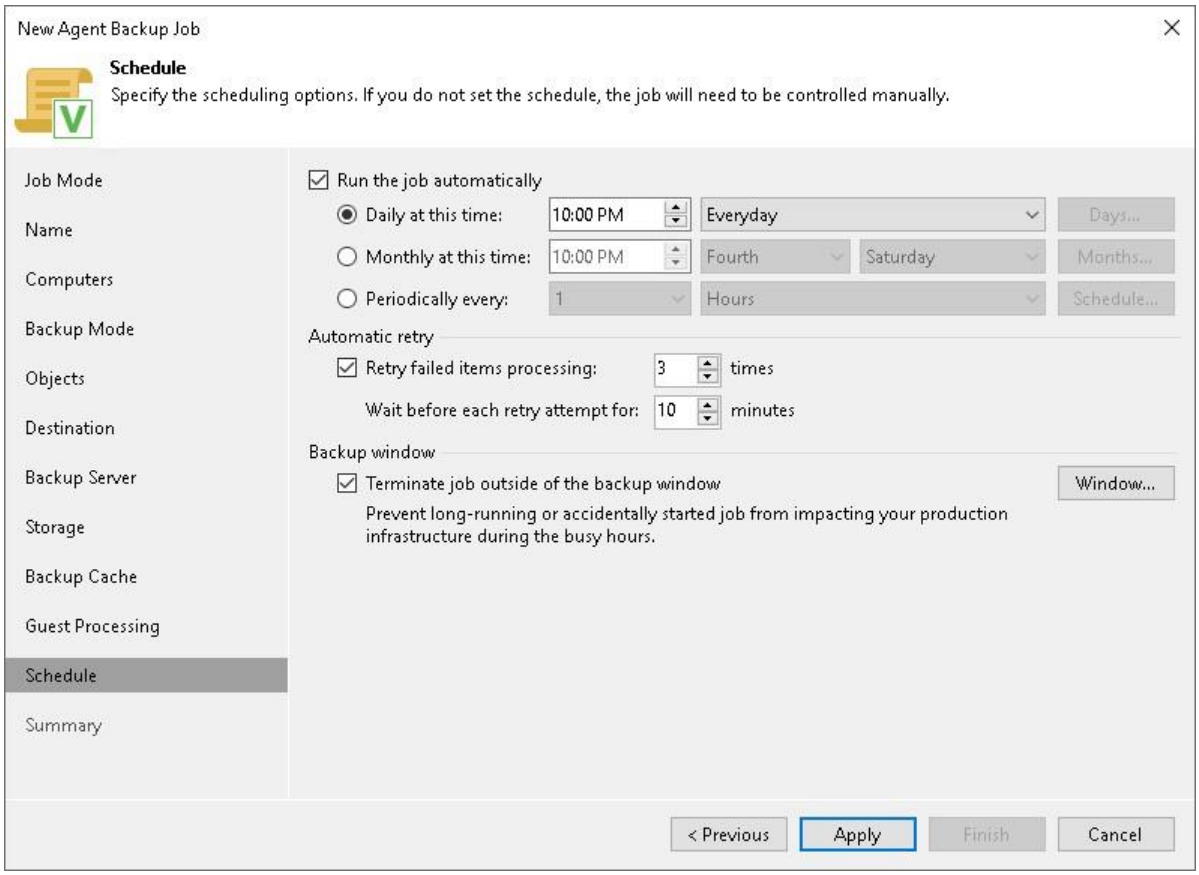
In the Backup window section, define the time interval within which the backup job must complete. The backup window prevents the job from overlapping with production hours and ensures that the job does not impact performance of your server. To set up a backup window for the job:

Select the Terminate job if it exceeds allowed backup window check box and click Window.

In the Time Periods window, define the allowed hours and prohibited hours for backup.

If the job exceeds the allowed window, it will be automatically terminated. In this case, data transport and backup chain transformation processes are stopped. Keep in mind that this behavior differs from a VM backup job where backup window affects data transport process and health check operations only.

> IMPORTANT
>
> [For backup policy] The backup window does not affect the process of uploading backup files from the backup cache to the target storage. If Veeam Agent creates one or more backup files in the backup cache, and then the backup target becomes available, Veeam Agent uploads backup files to the target location immediately, regardless of the specified backup window.




### Step 14. Review Backup Job Settings

At the Summary step of the wizard, complete the backup job configuration process.

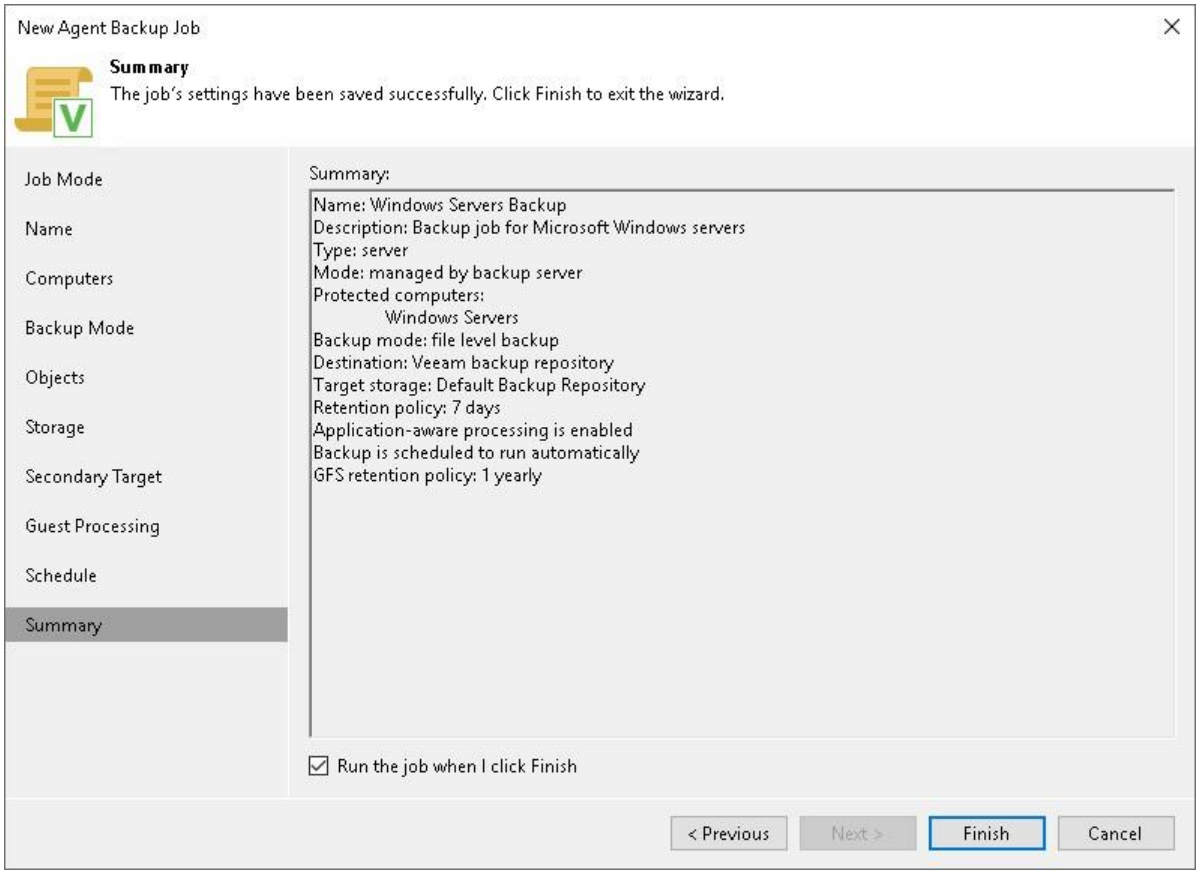
Review settings of the configured Veeam Agent backup job.

[For backup job managed by backup server] Select the Run the job when I click Finish check box if you want to start the job right after you finish working with the wizard.

Click Finish to close the wizard.

[For backup job managed by Veeam Agent] Keep in mind that Veeam Backup & Replication does not immediately apply backup policy to computers included in protection groups for pre-installed Veeam Agents. Veeam Agents installed on computers that are included in these groups connect to Veeam Backup & Replication every 6 hours and get updated backup policy settings. If you targeted a backup policy at the Veeam backup server and scheduled earlier than the next connection to Veeam Backup & Replication, this backup policy will get updated backup policy settings at the next backup policy session start. To learn more about protection groups for pre-installed Veeam Agents, see Protection Group Types.

If you want to apply backup policy immediately, you must synchronize Veeam Agent with Veeam Backup & Replication from the Veeam Agent computer side manually. To learn more, see Veeam Agent for Microsoft Windows Configuration.


New Agent Backup Job
Summary
The job's settings have been saved successfully. Click Finish to exit the wizard.
Job Mode
Name
Computers
Backup Mode
Objects
Storage
Secondary Target
Guest Processing
Schedule
Summary
Summary:
Name: Windows Servers Backup
Description: Backup job for Microsoft Windows servers
Type: server
Mode: managed by backup server
Protected computers:
Windows Servers
Backup mode: file level backup
Destination: Veeam backup repository
Target storage: Default Backup Repository
Retention policy: 7 days
Application-aware processing is enabled
Backup is scheduled to run automatically
GFS retention policy: 1 yearly
Run the job when I click Finish
< Previous
Next >
Finish
Cancel

# Recovery Jobs

# Windows Server Restoration

You can use Veeam Backup & Replication to restore a specific computer volume or all volumes from a volume level backup created with Veeam Agent for Microsoft Windows.

If data on a computer volume gets corrupted, you can restore this volume from the backup. For volume-level restore, you can use backups that were created at the volume level. File-level backups cannot be used for volume restore.

When you perform volume-level restore, Veeam Backup & Replication restores the entire content of the volume. It retrieves from the backup data blocks pertaining to a specific volume and copies them to the necessary location. Keep in mind that you cannot browse the volume in the backup and select individual application items, files and folders for restore. For granular file-level restore, you can use the Restore guest files option.

A volume can be restored to its original location or a new location. If you restore the volume to its original location, Veeam Backup & Replication overwrites data on the original volume. If you restore the volume to a new location, and the target disk contains any data, Veeam Backup & Replication overwrites data in the target location with data retrieved from the backup.

A volume can be restored to a new location that has greater or less space than the size of the volume in the backup. Depending on the amount of free disk space on target location, you can select either to shrink or to extend the volume during restore. To learn more, see the Volume Resize section in the Veeam Agent for Microsoft Windows User Guide.

# Before You Begin

Before you begin the volume-level restore process, check the following prerequisites:

- The volume-level backup from which you plan to restore data must be successfully created at least once.
- A computer on which you want to restore a volume must be added to the Veeam Backup & Replication inventory and run Veeam Agent for Microsoft Windows operating in the managed mode.

Volume-level restore has the following limitations:

- You can restore volumes only from backups created with Veeam Agent for Microsoft Windows.
- You cannot restore a system volume to a system volume of the original Veeam Agent computer or another computer with the running OS. To perform such restore, you need to boot the OS from the recovery image. For details, see Restoring Data with Veeam Recovery Media. You can also restore a system volume to a non-system volume that has enough free space.
- You cannot restore a volume to a volume on which the Microsoft Windows swap file is hosted.

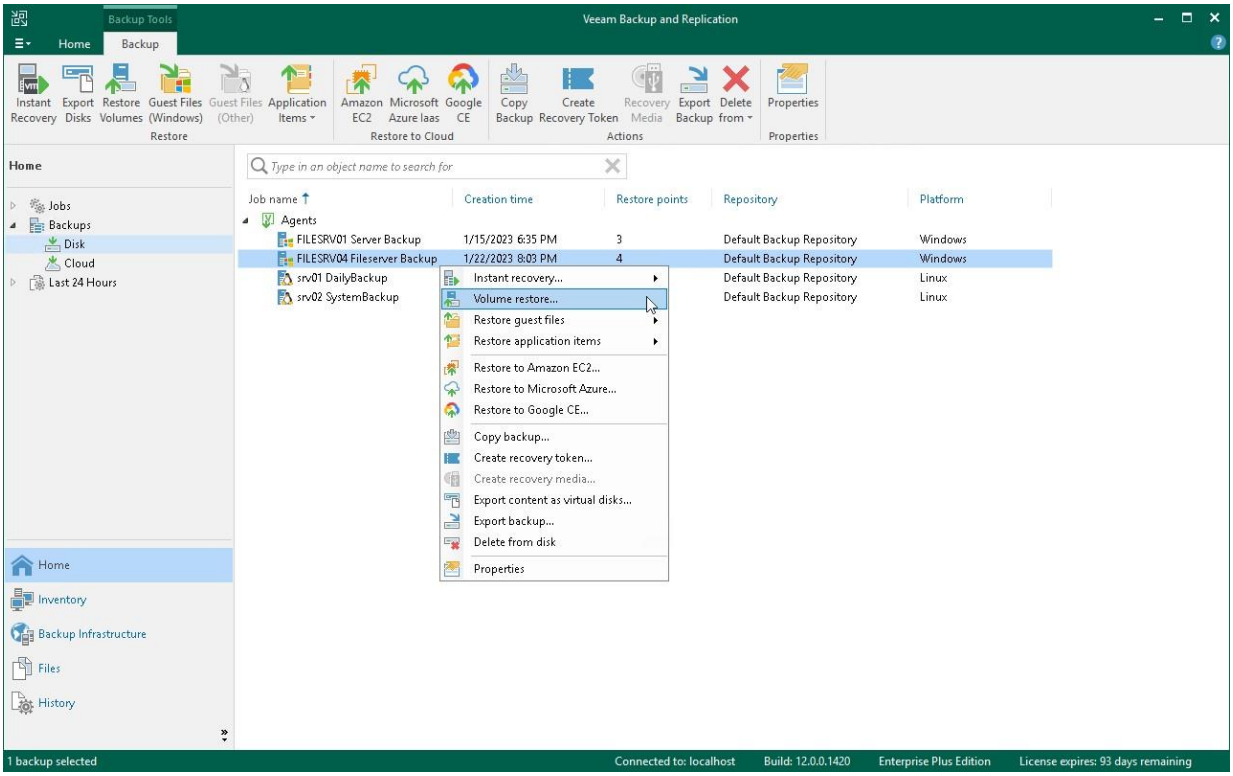
# Step 1. Launch Volume Level Restore Wizard

To launch the Volume Level Restore wizard, do either of the following:

Open the Home tab and click Restore > Agent > Disk restore > Volume restore. In this case, you will be able to select a backup of the necessary Veeam Agent computer at the Backup step of the wizard.

Open the Home view. In the inventory pane, click the Backups node. In the working area, expand the necessary Veeam Agent backup, select the necessary computer in the backup and click Restore Volumes on the ribbon or right-click the computer and select Volume restore.

In this case, you will proceed immediately to the Restore Point step of the wizard.

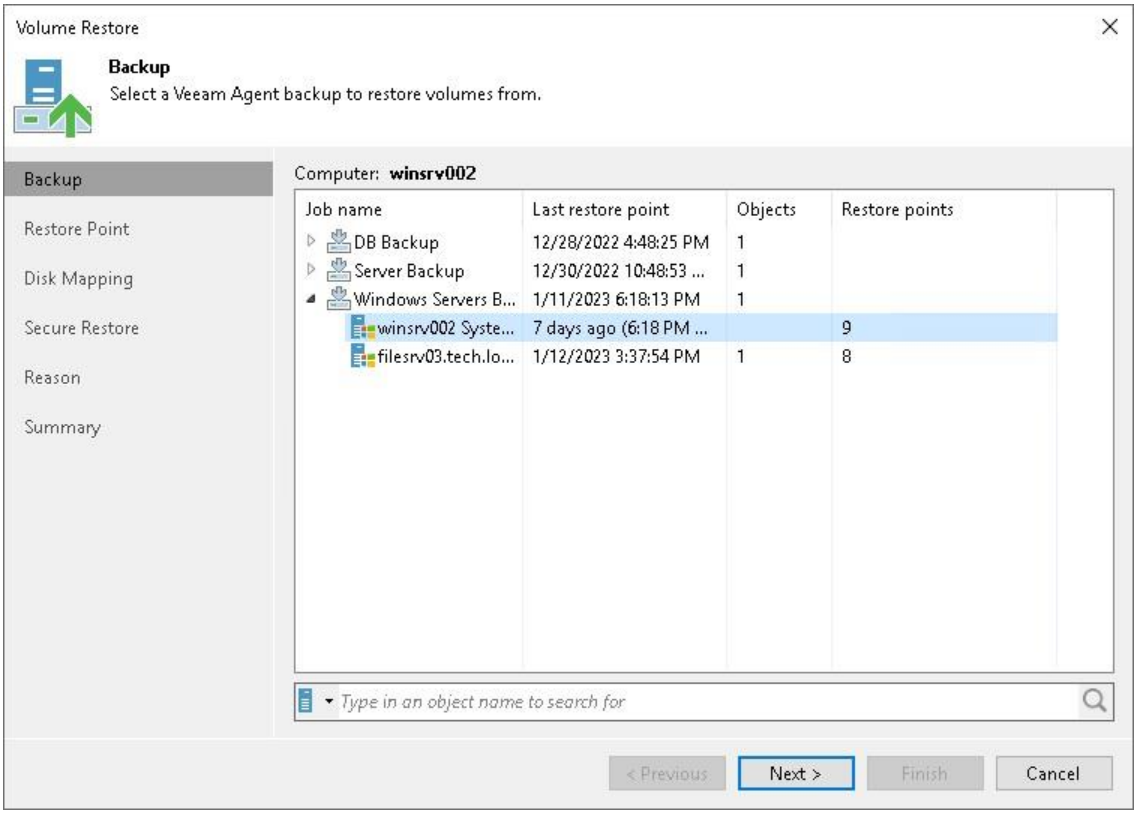



# Step 2. Select Backup

At the Backup step of the wizard, select a backup from which you want to recover data.

To quickly find the necessary backup, use the search field at the bottom of the window: enter a backup name or a part of it in the search field and click the Start search button on the right or press [ENTER].

In the list of backups, Veeam Backup & Replication displays only volume-level backups created with Veeam Agent for Microsoft Windows. File-level backups and backups created with Veeam Agent for Linux are not displayed.

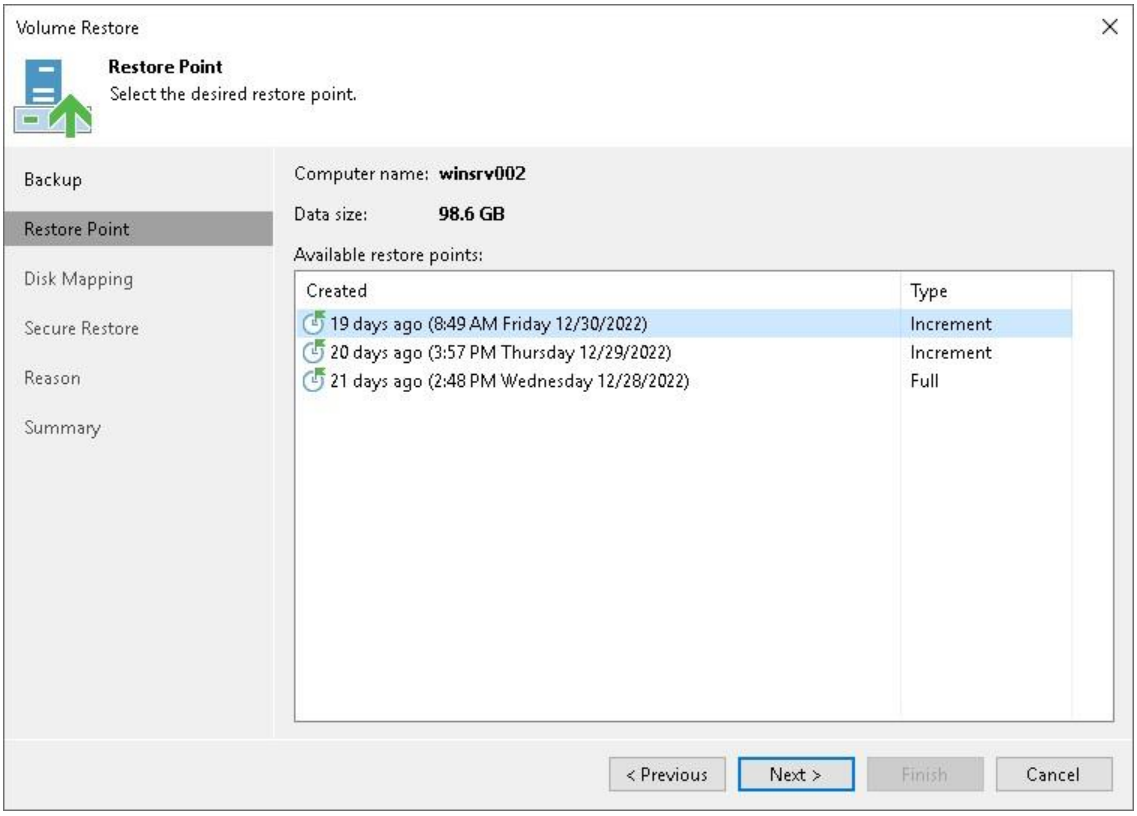



## Step 3. Select Restore Point

At the Restore Point step of the wizard, select a restore point from which you want to recover data.

By default, Veeam Backup & Replication uses the latest restore point. However, you can select any valid restore point to recover volumes to a specific point in time.

Veeam Backup & Replication displays restore points for volume-level backups only. For example, if you have run 3 job sessions to create a backup of all computer volumes and then changed the backup scope to file-level backup, Veeam Backup & Replication will display only 3 restore points in the list.



# Step 4. Map Restored Disks

At the Disk Mapping step of the wizard, select what volumes you want to restore and map volumes from the backup to volumes on the target computer.

> IMPORTANT
>
> It is strongly recommended that you change disk mapping settings only if you have experience in working with Microsoft Windows disks and partitions. If you make a mistake, your computer data may get corrupted.

To select volumes for restore:

In the Destination host field, specify the target computer where you want to restore volumes. By default, Veeam Backup & Replication restores volumes to their original location. If you want to restore volumes from the backup to another computer, click Choose and select the necessary computer. You can restore volumes only to computers that are added to the Veeam Backup & Replication inventory and run Veeam Agent for Microsoft Windows.

If you select a computer included in a protection group for pre-installed Veeam Agents, you must provide credentials of the account that has administrator permissions on the target computer. Keep in mind that Veeam Backup & Replication will keep these credentials only during the restore process and delete them after the restore process completion. To learn more about protection groups for pre-installed Veeam Agents, see Protection Group Types.

In the Disk mapping section, select check boxes next to volumes that you want to restore from the backup. By default, Veeam Backup & Replication restores volumes to their initial location and maps the restored volumes automatically. If the initial location is unavailable, a volume is restored to a disk of the same or larger size. If you want to map the restored volume to another computer disk, at the bottom of the wizard click Customize disk mapping.

> NOTE
>
> If Veeam Backup & Replication cannot map a volume automatically, Veeam Backup & Replication will prompt you to perform disk mapping manually. To proceed to the Disk Mapping window, click Yes.

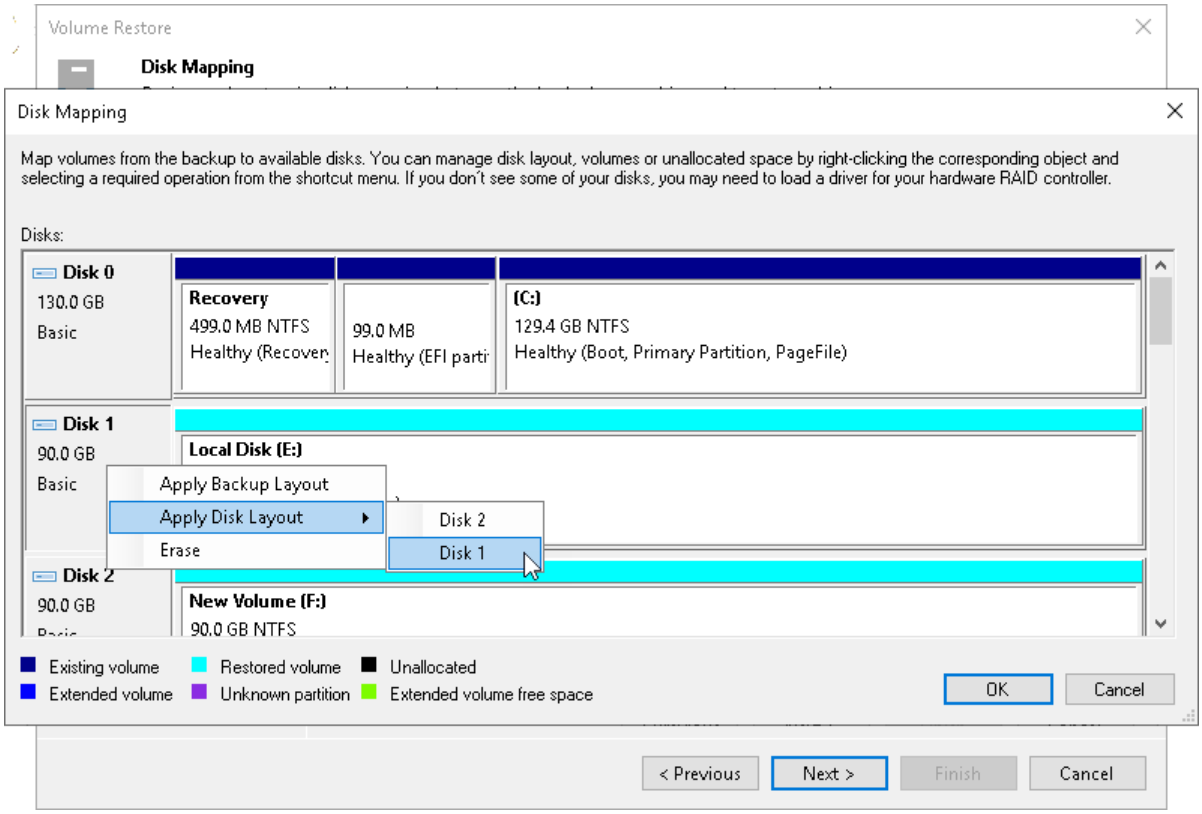
In the Disk Mapping window, specify how volumes must be restored:

Right-click the target disk on the left and select the necessary disk layout:

Apply Backup Layout — select this option if you want to apply to disk the settings that were used on your computer at the moment when you performed backup.

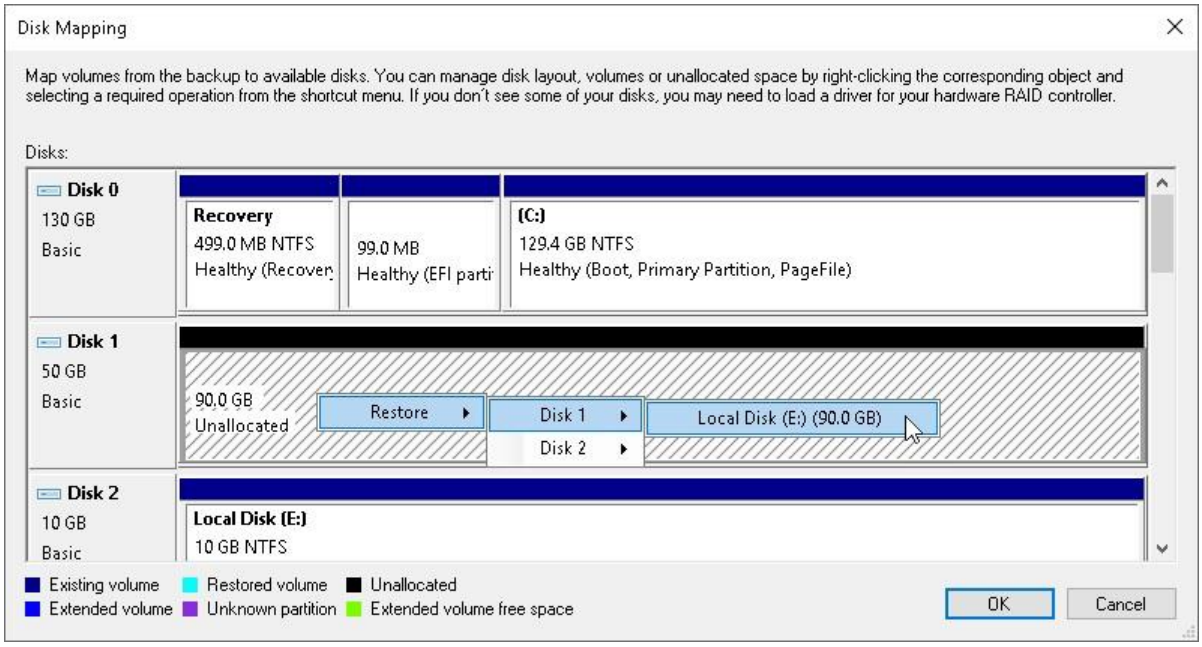
Apply Disk Layout — select this option if you want to apply to the current disk settings of another disk.

Erase — select this option if you want to discard the current disk settings.




Right-click unallocated disk space in the disk area on the right and select what volume from the backup you want to place on this computer disk.

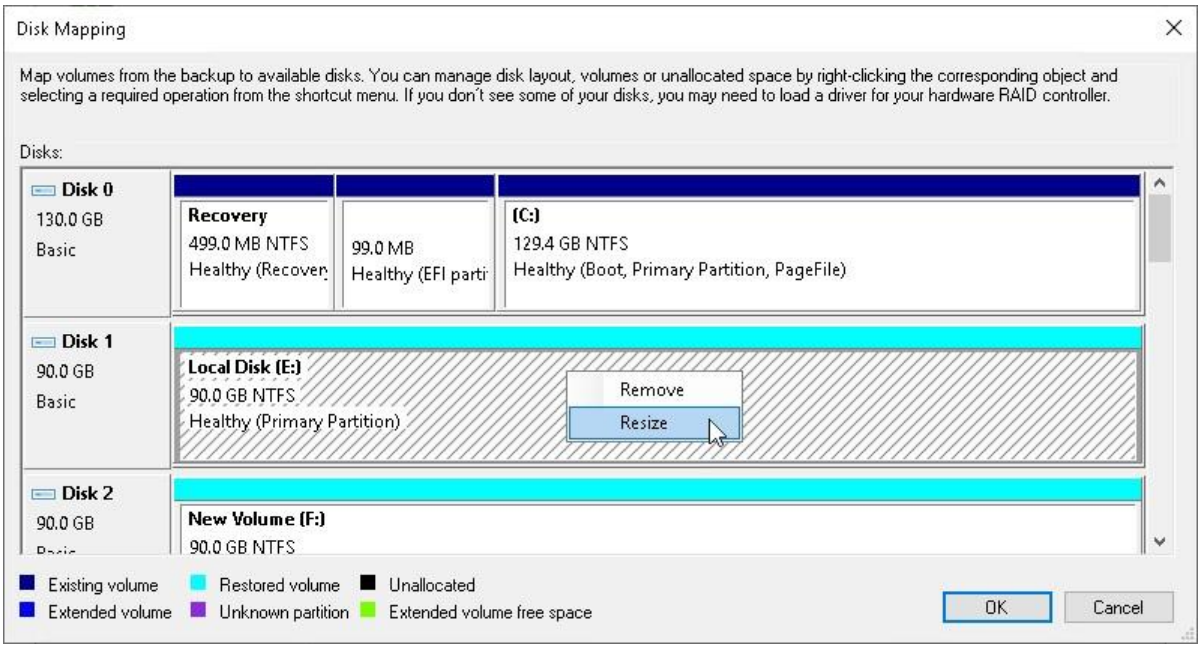
If you want to change disk layout configured by Veeam Backup & Replication, right-click an automatically mapped volume and select Remove. You will be able to use the released space for mapping volumes in your own order.




[For restore with volume resize] You can resize a volume mapped by Veeam Backup & Replication to a target computer disk. To resize a volume, right-click it in the Disk Mapping window and select Resize. With this option selected, you will pass to the Volume Resize window.

NOTE

If you map a backup volume that is larger than the amount of available space on the target disk, Veeam Backup & Replication will prompt you to shrink the restored volume. After you agree and click OK, Veeam Backup & Replication will prepare to shrink the volume to the size of available disk space.



## Step 5. Resize Restored Volumes

At the Disk Mapping step of the wizard you can set the necessary size for the restored volumes. A volume will be shrunk or extended to the specified size during the process of data restore.

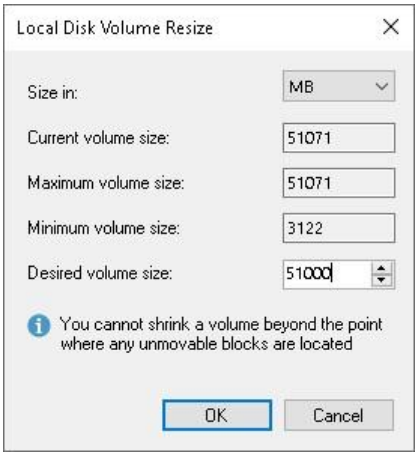
> NOTE
>
> By default, Veeam Agent for Microsoft Windows displays volume size in megabytes (MB). This allows you to specify the desired size for the volume precisely. You can also choose to display volume size in gigabytes (GB). This may be helpful when you need to resize volumes on larger computer disks and want to simplify disk size calculations.
>
> When you use GB as a volume size unit, you can specify volume size with integral numbers, for example, 1 GB, 60 GB or 200 GB, but not 0,8 GB, 60,5 GB or 200,7 GB. However, if the maximum volume size is in fact greater than the displayed value for less than 1 GB, Veeam Agent for Microsoft Windows will automatically add the exceeding amount of disk space to the extended volume. For example, if the maximum volume size is 60,2 GB, Veeam Agent for Microsoft Windows will display this size as 60 GB. When you specify 60 GB as a desired volume size, Veeam Agent for Microsoft Windows will extend the volume to 60,2 GB.

To resize a volume:

Specify a volume you want to resize:

- Right-click a restored volume mapped to a target disk and select Resize.
- [For volume shrink] Right-click unallocated disk space and select what volume from the backup you want to place on the computer disk. If the selected volume is larger than the amount of unallocated disk space, Veeam Backup & Replication will prompt you to shrink the restored volume.

In the Volume Resize window, select the volume size unit and specify the desired size for the restored volume.

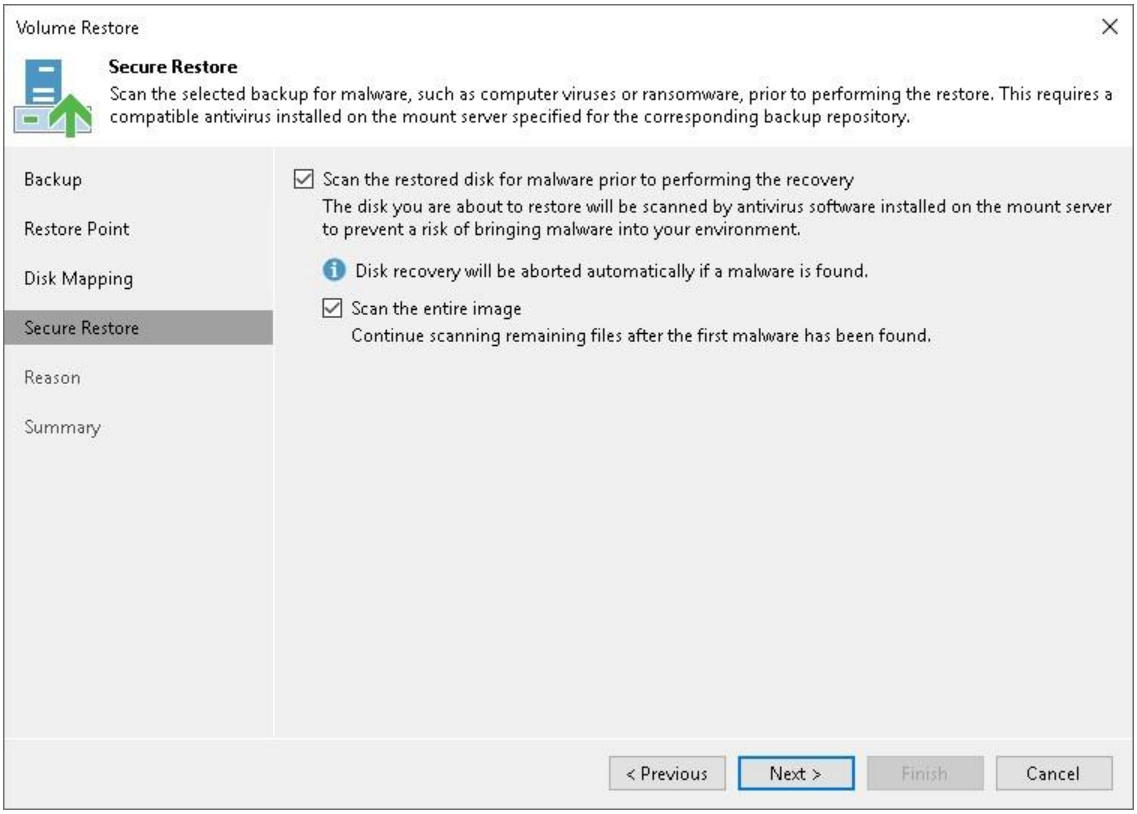



## Step 6. Specify Secure Restore Settings

At the Secure Restore step of the wizard, you can instruct Veeam Backup & Replication to perform secure restore — scan restored volume data with antivirus software before restoring the volume. To learn more about secure restore, see the Secure Restore section in the Veeam Backup & Replication User Guide.

To specify secure restore settings:

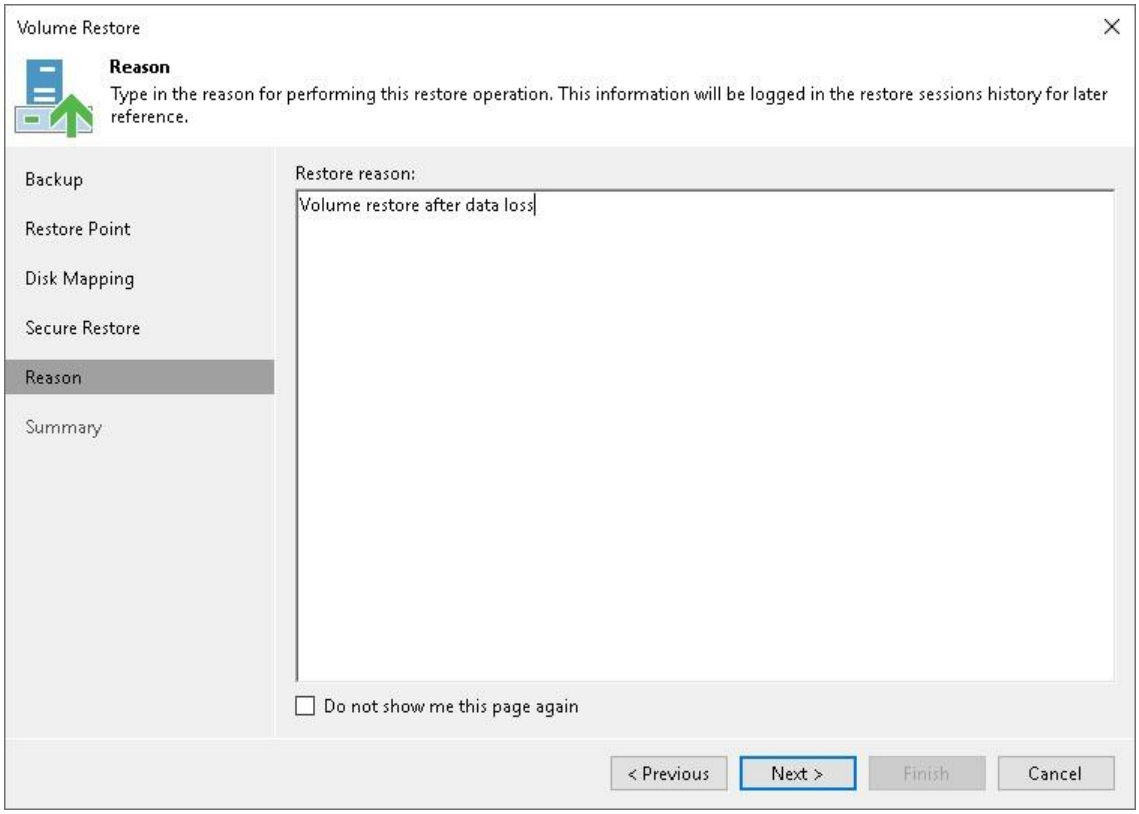
- At the Secure Restore step of the wizard, select the Scan the restored disk for malware prior to performing the recovery check box.
- Select the Scan the entire image check box if you want the antivirus software to continue volume scan after the first malware threat is found. For information on how to view results of the antivirus scan, see the Viewing Antivirus Scan Results section in the Veeam Backup & Replication User Guide.




## Step 7. Specify Restore Reason

At the Reason step of the wizard, enter a reason for restoring the computer volume.

> TIP
>
> If you do not want to display theRestore Reason step of the wizard in future, select theDo not show me this page again check box.

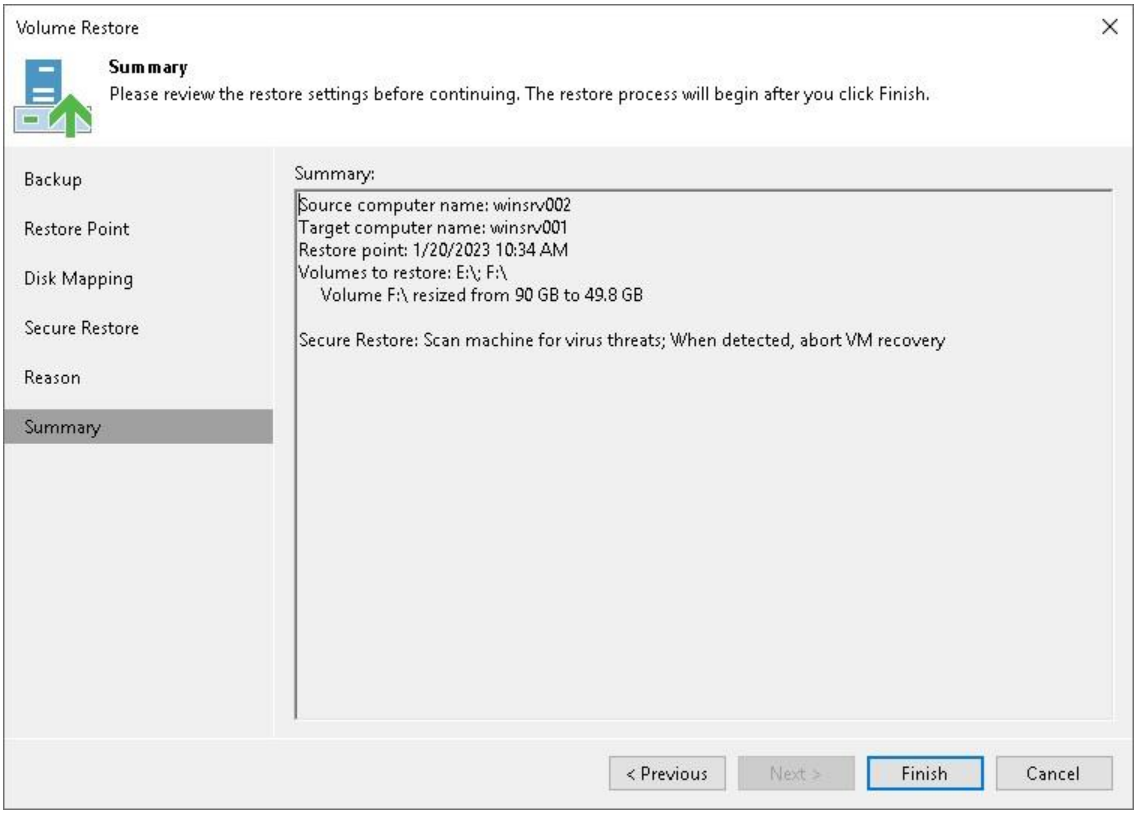



## Step 8. Complete Restore Process

At the Summary step of the wizard, complete the procedure of volume-level restore.

Review settings of the restore process.

Click Finish to start the recovery process. Veeam Backup & Replication will perform partition re-allocation operations if necessary, restore the necessary volume data from the backup and overwrite volume data on the target computer with the restored data.


Volume Restore
Summary
Please review the restore settings before continuing. The restore process will begin after you click Finish.
Backup
Restore Point
Disk Mapping
Secure Restore
Reason
Summary
Summary:
Source computer name: winsrv002
Target computer name: winsrv001
Restore point: 1/20/2023 10:34 AM
Volumes to restore: E:\; F:\
Volume F:\ resized from 90 GB to 49.8 GB
Secure Restore: Scan machine for virus threats; When detected, abort VM recovery
< Previous
Next >
Finish
Cancel

# APPENDIX

## Creating Veeam Recovery Media

You can use the backup console to create a Veeam Recovery Media for a Veeam Agent computer that you manage in Veeam Backup & Replication. The process of creating a Veeam Recovery Media in Veeam Backup & Replication practically does not differ from the same procedure performed on a Veeam Agent computer. To learn more about the Veeam Recovery Media, see the Veeam Recovery Media section in the Veeam Agent for Microsoft Windows User Guide.

Keep in mind that you can create Veeam Recovery Media in Veeam Backup & Replication only for computers that are protected with Veeam Agent for Microsoft Windows.

# Before You Begin

You can create a Veeam Recovery Media for a protected computer in Veeam Backup & Replication if the following conditions are met:

- A protected computer runs a Microsoft Windows OS.
- A full backup file of one of the following backup types was created for the protected computer on the target location by a Veeam Agent backup job:
  - Entire computer backup
  - Volume-level backup of the computer OS data (created with the Operating system option selected in the backup job settings) or computer system volume
  - File-level backup of the computer OS data created with the Operating system option selected in the backup job settings

> NOTE
>
> You can create a Veeam Recovery Media for a protected computer using a copy of a full backup file that meets all the conditions. The copy must be created by a backup copy job. To learn more, see the Backup Copy section in the Veeam Backup & Replication User Guide.
>
> By default, you cannot create a Veeam Recovery Media for a failover cluster with Cluster Shared Volumes (CSV). You can enable creation of a Veeam Recovery Media for such failover clusters with a registry value. For more information, contact Veeam Customer Support.

Removable Storage Device Scenario (USB, SD Card and Other)

- The removable storage device must be inserted into a corresponding slot on the computer or connected to the computer.
- The removable storage device must have enough capacity to store the created recovery image. On average, the size of the created recovery image without manually loaded drivers is 500 MB.
- During the recovery image creation, Veeam Agent for Microsoft Windows formats the removable storage device. If you have important information on the device, create a copy of this data in some other location.

CD/DVD/BD Scenario

- An empty or re-writable CD/DVD/BD must be inserted into a CD/DVD/BD drive on the computer.
- The CD/DVD/BD must have enough capacity to store the created recovery image. On average, the size of the created recovery image without manually loaded drivers is 500 MB.
- [For RW CD/DVD/BD] During the recovery image creation, Veeam Agent for Microsoft Windows erases information on the CD/DVD/BD. If you have important information on the CD/DVD/BD, create a copy of this data in some other location.

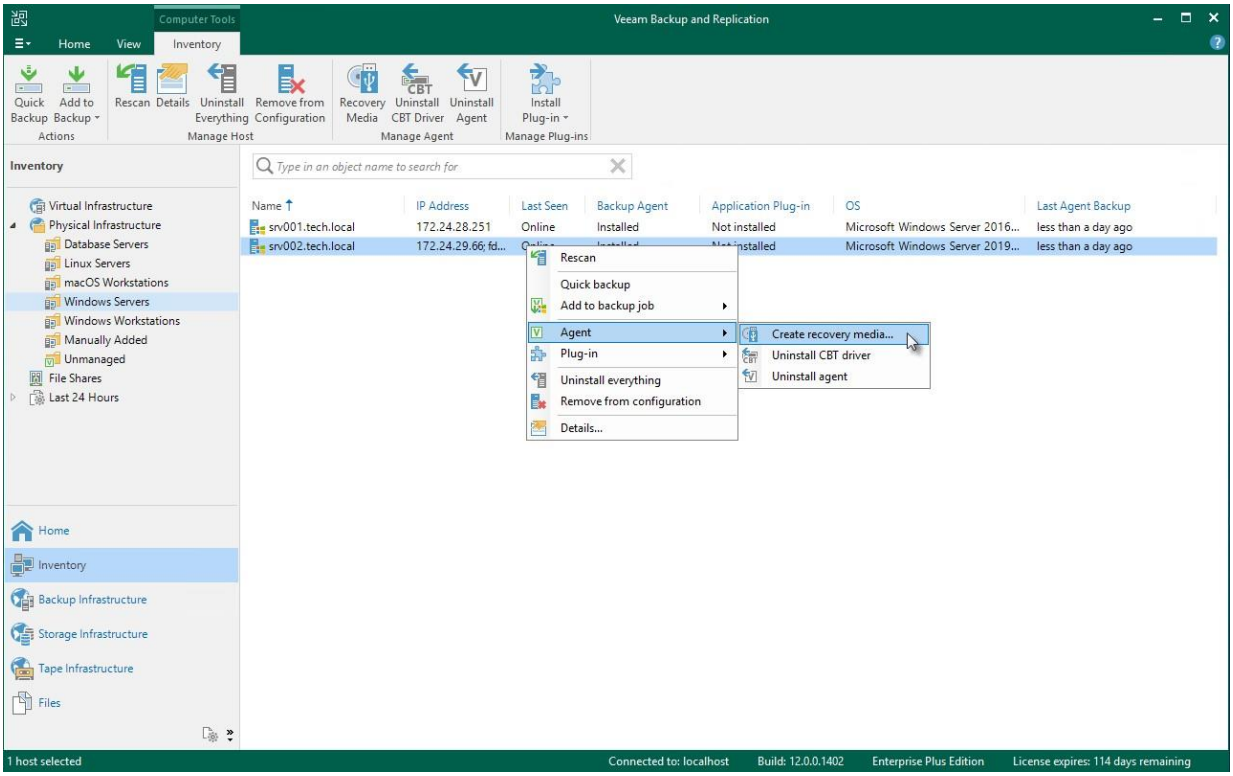
# Step 1. Launch Create Recovery Media Wizard

To launch the Create Recovery Media wizard:

- Open the Inventory view.
- In the inventory pane, expand the Physical Infrastructure node and select a protection group that contains the necessary protected computer.
- In the working area, select the computer and click Recovery Media on the ribbon or right-click the computer and select Agent > Create recovery media.

TIP

You can also launch the Create Recovery Media wizard from the Backups node in the Home view of the Veeam backup console. To learn more, see Creating Recovery Media from Backup.




# Step 2. Specify Recovery Media Options

At the Recovery Media step of the wizard, in the Available bootable media types list, specify on which type of media you want to create a recovery image. You can create the following types of recovery images:

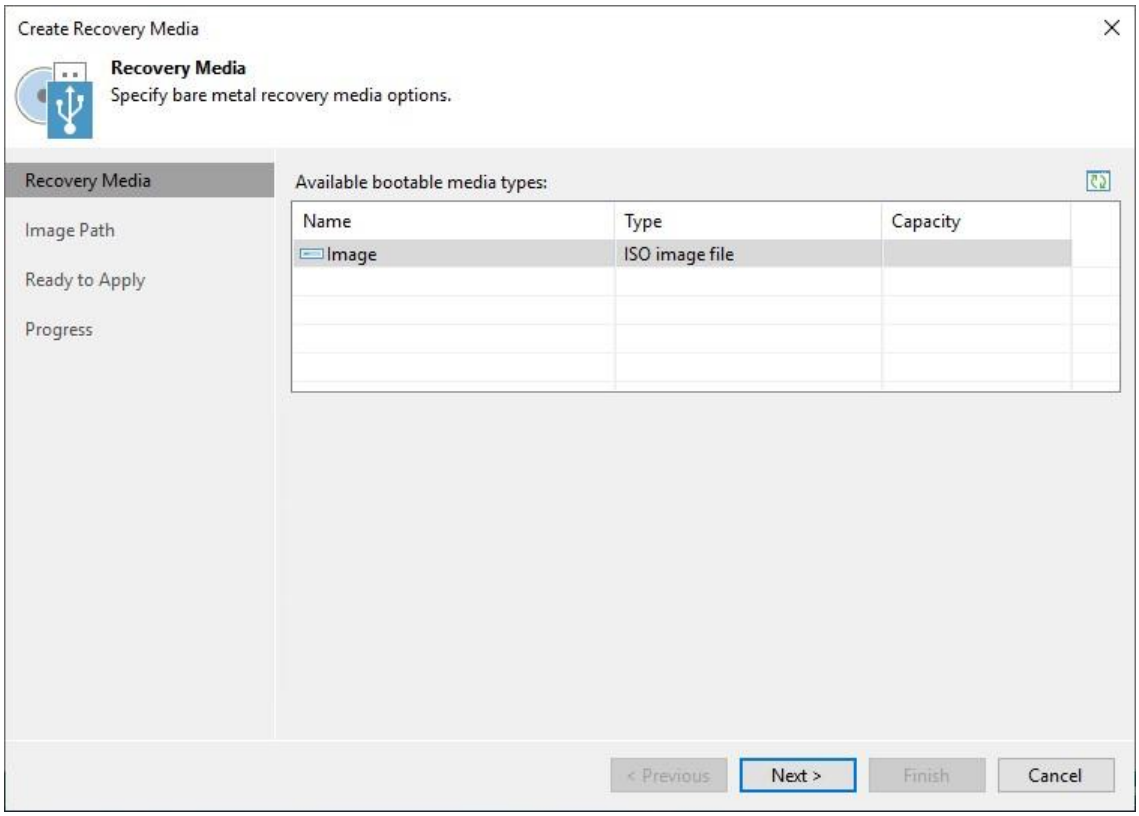
Recovery image on a removable storage device. You can create a recovery image on a USB drive, SD card and so on. Veeam Backup & Replication displays all removable storage devices currently attached to the backup server. Select the necessary one in the list.

Recovery image on an optical disk. You can create a recovery image on a CD, DVD or BD. Veeam Backup & Replication displays all CD, DVD and BD drives available on the backup server. Select the necessary one in the list.

ISO file with the recovery image. You can create a recovery image in the ISO file format and save the resulting file locally on the backup server.

NOTE

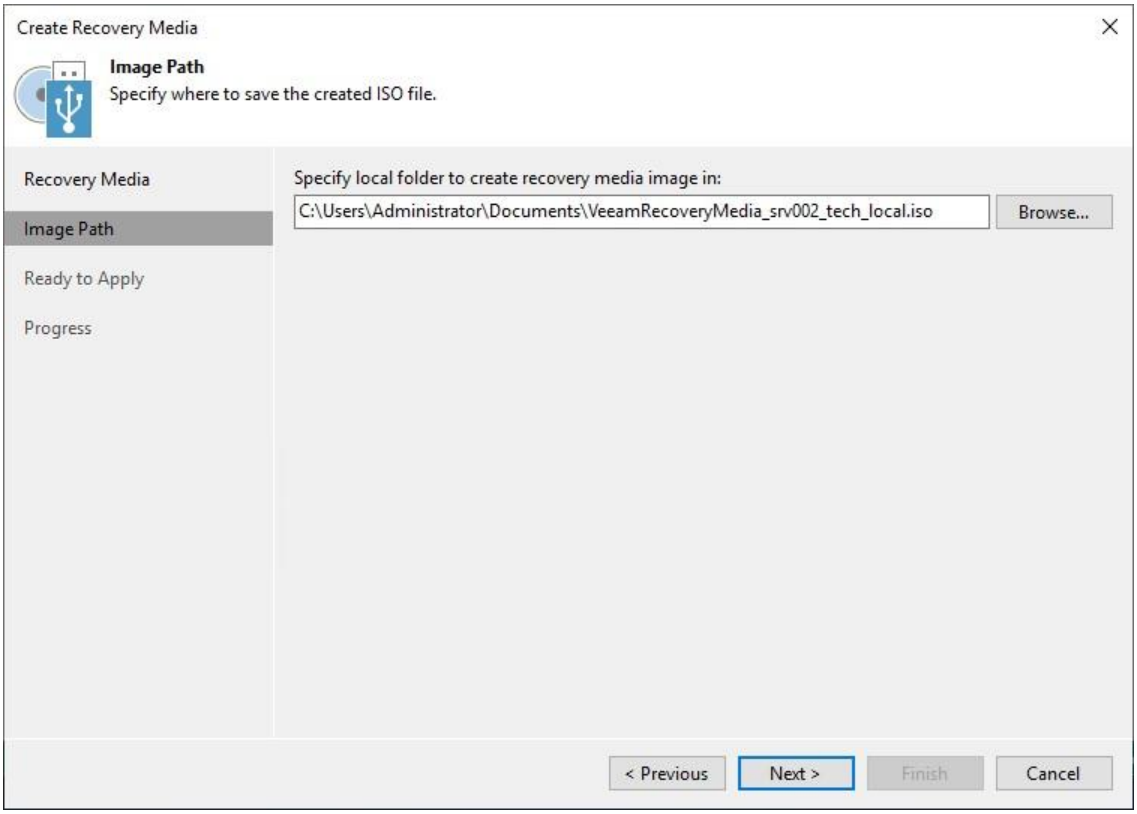
When you create a recovery image from the Veeam backup console, you cannot specify additional recovery media options in the same way as when you create a recovery image on the Veeam Agent computer. In this scenario, the recovery image is created with default settings: Veeam Backup & Replication includes network connection settings and hardware drivers installed on the Veeam Agent computer in the recovery image.




# Step 3. Specify Path to ISO

The Image Path step of the wizard is available if you have selected to create an ISO file with the recovery image.

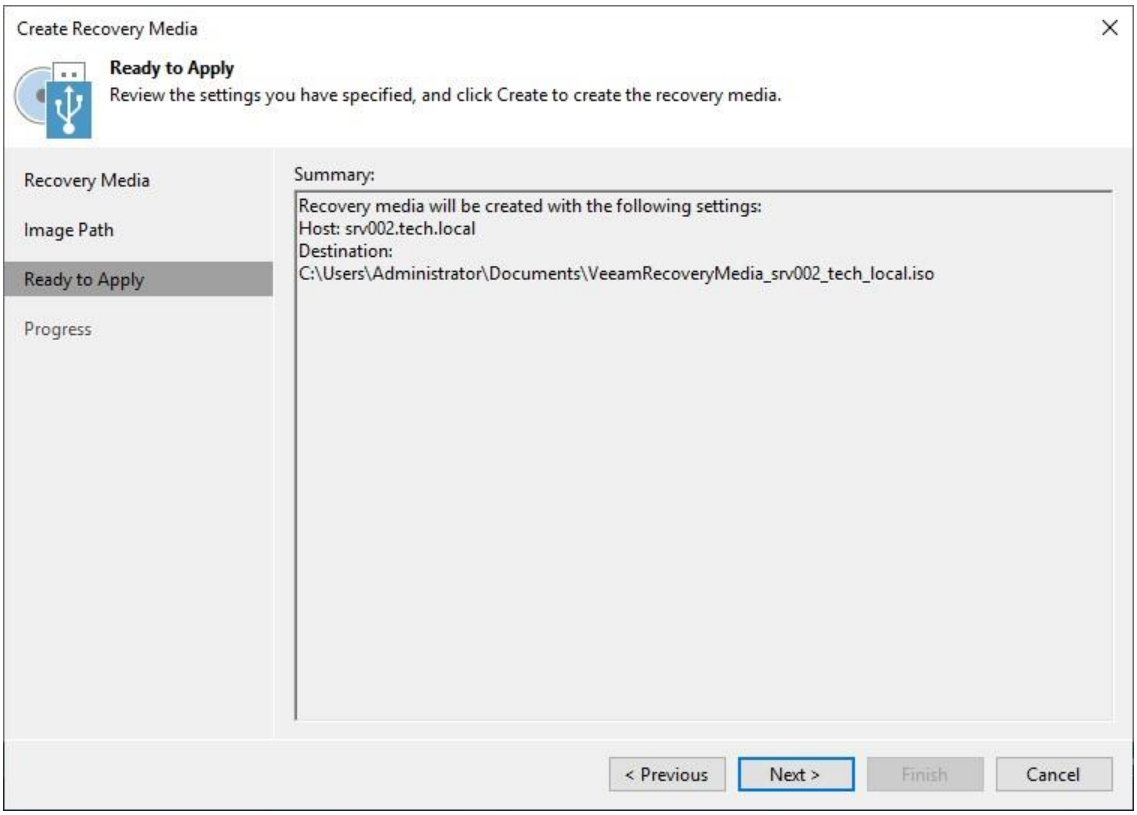
In the Specify folder to create recovery media image in field, specify a real path to the folder where you want to save the created recovery image, and the ISO file name. When you create Veeam Recovery Media using the Veeam Backup & Replication console, you can save the ISO file on the local drive of the Veeam backup server only. Thus, the recovery image will always be available should Veeam Agent computer volumes get corrupted or the computer fail to start.




# Step 4. Review Recovery Image Settings

At the Ready to Apply step of the wizard, review settings of the recovery image that you plan to create and click Create.

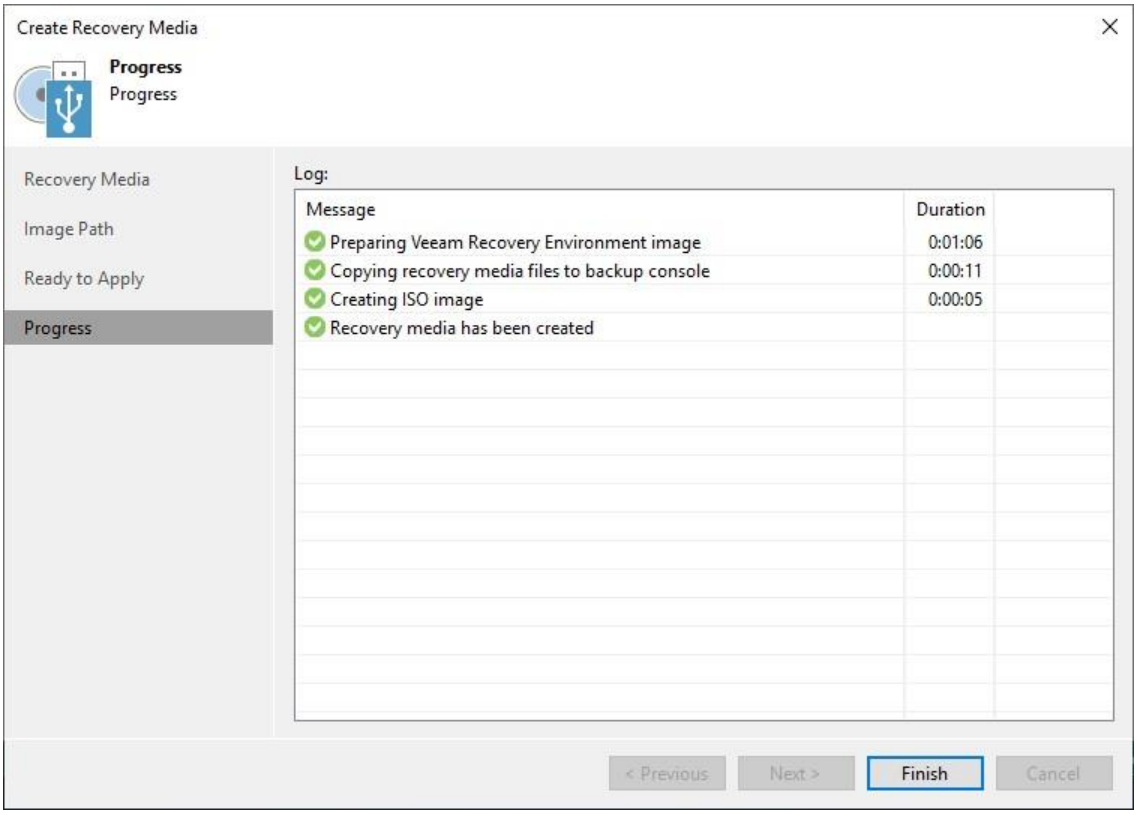
Veeam Backup & Replication will collect data necessary for recovery image creation and write the resulting recovery image to the specified target.



# Step 5. Finish Working with Wizard

The process of recovery image creation may take some time. Wait for the process to complete and click Finish to exit the wizard.

If you want to interrupt the process of recovery image creation, click Cancel or close the wizard window.




# What You Do Next

[For ISO file] After the recovery image is created, you can burn the created ISO file to a CD/DVD/BD. To do this, you can use native Microsoft Windows tools or third-party software.