Base Load Power Hub (BLPH)

INSTALLATION OPERATING AND MAINTENANCE MANUAL

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BROOKS INSTRUMENT Beyond Measure

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Installation & Operation Manual

Models MT3809G and MT3810G
Metal Tube Variable Area Flowmeters

BROOKS® INSTRUMENT

Beyond Measure

Essential Instructions
Read before proceeding!

Brooks Instrument designs, manufactures and tests its products to meet many national and international standards. These products must be properly installed, operated and maintained to ensure they continue to operate within their normal specifications. The following instructions must be adhered to and integrated into your safety program when installing, operating and maintaining Brooks Instrument products.

- To ensure proper performance, use qualified personnel to install, operate, update, program and maintain the product.
- Read all instructions prior to installing, operating and servicing the product. If this instruction manual is not the correct manual, please see back cover for local sales office contact information. Save this instruction manual for future reference.

⚠ **WARNING: Do not operate this instrument in excess of the specifications listed in the Instruction and Operation Manual. Failure to heed this warning can result in serious personal injury and / or damage to the equipment.**

- If you do not understand any of the instructions, contact your Brooks Instrument representative for clarification.
- Follow all warnings, cautions and instructions marked on and supplied with the product.

⚠ **WARNING: Prior to installation ensure this instrument has the required approval ratings to meet local and national codes. Failure to heed this warning can result in serious personal injury and / or damage to the equipment.**

- Install your equipment as specified in the installation instructions of the appropriate instruction manual and per applicable local and national codes. Connect all products to the proper electrical and pressure sources.
- Operation: (1) Slowly initiate flow into the system. Open process valves slowly to avoid flow surges. (2) Check for leaks around the flow meter inlet and outlet connections. If no leaks are present, bring the system up to the operating pressure.
- Please make sure that the process line pressure is removed prior to service. When replacement parts are required, ensure that qualified people use replacement parts specified by Brooks Instrument. Unauthorized parts and procedures can affect the product's performance and place the safe operation of your process at risk. Look-alike substitutions may result in fire, electrical hazards or improper operation.
- Ensure that all equipment doors are closed and protective covers are in place to prevent electrical shock and personal injury, except when maintenance is being performed by qualified persons.

⚠ **WARNING: For liquid flow devices, if the inlet and outlet valves adjacent to the devices are to be closed for any reason, the devices must be completely drained. Failure to do so may result in thermal expansion of the liquid that can rupture the device and may cause personal injury.**

European Pressure Equipment Directive (PED)

All pressure equipment with an internal pressure greater than 0.5 bar (g) and a size larger than 25mm or 1" (inch) falls under the Pressure Equipment Directive (PED).

- The Specifications Section of this manual contains instructions related to the PED directive.
- Products described in this manual are in compliance with EN directive 2014/34/EU.
- All Brooks Instrument Flowmeters fall under fluid group 1.
- Products larger than 25mm or 1" (inch) are in compliance with PED category I, II or III.
- Products of 25mm or 1" (inch) or smaller are Sound Engineering Practice (SEP).

European Electromagnetic Compatibility (EMC)

The Brooks Instrument (electric/electronic) equipment bearing the CE mark has been successfully tested to the regulations of the Electro Magnetic Compatibility (EMC directive 2014/30/EU).
Special attention however is required when selecting the signal cable to be used with CE marked equipment.

Quality of the signal cable, cable glands and connectors:

Brooks Instrument supplies high quality cable(s) which meets the specifications for CE certification.
If you provide your own signal cable you should use a cable which is overall completely screened with a 100% shield.
"D" or "Circular" type connectors used should be shielded with a metal shield. If applicable, metal cable glands must be used providing cable screen clamping.
The cable screen should be connected to the metal shell or gland and shielded at both ends over 360 Degrees.
The shield should be terminated to an earth ground.
Card Edge Connectors are standard non-metallic. The cables used must be screened with 100% shield to comply with CE certification.
The shield should be terminated to an earth ground.
For pin configuration : Please refer to the enclosed Instruction Manual.

ESD (Electrostatic Discharge)

⚠ **CAUTION: This instrument contains electronic components that are susceptible to damage by static electricity. Proper handling procedures must be observed during the removal, installation or other handling of internal circuit boards or devices.**

Handling Procedure:

1. Power to unit must be removed.
2. Personnel must be grounded, via a wrist strap or other safe, suitable means before any printed circuit card or other internal device is installed, removed or adjusted.
3. Printed circuit cards must be transported in a conductive container. Boards must not be removed from protective enclosure until immediately before installation. Removed boards must immediately be placed in protective container for transport, storage or return to factory.

Comments

This instrument is not unique in its content of ESD (electrostatic discharge) sensitive components. Most modern electronic designs contain components that utilize metal oxide technology (NMOS, SMOS, etc.). Experience has proven that even small amounts of static electricity can damage or destroy these devices. Damaged components, even though they appear to function properly, exhibit early failure.

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Introduction

The Brooks® Models MT3809 and MT3810 are rugged, all metal flowmeters offering reliable operation based on the variable area principle. The Model MT3809 is constructed with stainless steel components for measuring a variety of liquid and gas applications while the Model MT3809 ETFE utilizes an E/TFE lining for aggressive liquid and gas applications.

Flow rate indication is provided by means of magnetic coupling where a magnet, encapsulated in the float, is coupled to a rotatable magnet located in the rear of the indicator, thus turning the dial indicator mounted on the meter.

Optional accessories available includes transmitter with 4-20 mA analog output with HART® communications or FOUNDATION™ Fieldbus communications with or without configurable alarms and pulse output for totalization. Also available are front adjustable inductive alarms, high temperature or stainless steel indicator housings, valves, flow controllers and certifications.

Design Features

The Brooks Model MT3809 has been the “go to” meter for several years and the choice of Engineering Contractor customers (EPC). Brooks is proud to raise the performance of the standard meter by adding these new features and options:

- Transmitter with 4-20mA/HART-7, or transmitter with FOUNDATION™ Fieldbus Communications
- Local Operator Interface with LCD display without removing the cover which means changes can be made even in hazardous areas
- 316SS flameproof housing
- The broadest range of operating temperatures in the industry, the perfect meter for even more applications
- Even lower flow rates with the current lay lengths which means one meter style can be used for very low to high flow rates
- The new meter is designed to ASME B31.3 and gasket sealing surface is per ASME a rugged design that does not require special gaskets at installation
- Weldneck flanges are standard which means full penetration welds that can easily be tested for integrity
- Mechanical and alarm design that meets SIL 2 requirements

Overview of Meter Specifications

⚠WARNING

Do not operate this instrument in excess of the specifications listed in Table 1-1. Failure to heed this warning can result in serious personal injury and/or damage to the equipment.

⚠ CAUTION

It is the user’s responsibility to select and approve all materials of construction. Careful attention to metallurgy, engineered materials and elastomeric materials is critical to safe operation.

Table 1-1 Meter Specifications

		MT3809	MT3809 ELF	MT3810	TFE Lined
Measuring Range		See Capacity Tables			
Rangeability		10:1 (most sizes)			
Metering Tube	Standard	316/316L (dual certified stainless steel)			Tefzel® Lined 316/316L (dual certified stainless steel)
	Premium	Alloy 625, Hastelloy® C, Titanium Gr. II	Monel® K-500, Hastelloy C	-	-
Flanges and End Fittings	Standard	316/316L (dual certified stainless steel)		316/316L (dual certified stainless steel)	Tefzel Lined 316/316L (dual certified stainless steel)
	Premium	Alloy 625, Hastelloy C, Titanium Gr. II		-	-
Accuracy		2%, 1%, VDI/VDE class 2.5, 1.6	5%, 3%, VDI/VDE class 4, 2.5	5%, VDI/VDE class 6	2%, VDI/VDE class 2.5
Repeatability		0.25% Full Scale	1% Full Scale	0.25% Full Scale	0.25% Full Scale
Scale type / material		Dark increments with white background / Aluminum			
Installation orientation and location		Vertical (within 5% of true-vertical), bottom inlet, top outlet. Do not locate in proximity of other magnetic interfering components.			
Connections	Flanged:	Weldneck flanges			Slip on flanges
	- to ANSI B16.5	ANSI 1/2" to 4" 150# RF to 600# RF	ANSI 1/2" to 1" 150# RF to 600# RF	ANSI 1/2" to 2" 150# RF to 300# RF	ANSI 1/2" to 2" 150# RF to 300# RF
	- to DIN 2527/2635	DIN PN 40			
	- Flange finish	3.2 - 6.3 Ra			
	Threaded female	1/2" to 2"NPT/Rc-Female	1/2" NPT/Rc-Female	1/2" to 2" NPT-Female	-
	Threaded male	1" to 2-1/2" NPT-Male	1" NPT-Male	-	-
O-ring material	Flanged	None	Kalrez® 4079	None	
	Threaded male	None		-	-
	Threaded female std	Viton® or Teflon®		Viton or Teflon	-
	Threaded female high pressure 2500lbs	Viton Shore 90 + Teflon back-up ring or Kalrez 3018 Shore 90 + Teflon back-up ring		-	-
Floats	Standard	316L stainless steel			Hastelloy C-276 (sizes 7,8) PVDF (sizes 10-13)
	Premium	Alloy 625, Hastelloy C, Titanium Gr. II	Monel K-500, Hastelloy C	-	-
Protection Category	Indicator only	IP67 / NEMA 4X			
	Transmitter ALU	IP64			
	Transmitter SS	IP67 / NEMA 4X			
Indicator Housing & Cover material	Indicator only ALU	Die cast Aluminum (Alloy 380), epoxy paint, glass window			
	Transm/Alarm/HiTemp ALU	Die cast Aluminum (Alloy 380), epoxy paint, glass window			
	Indicator only SS	Cast 316 stainless steel, glass window			
	Transm/Alarm/HiTemp SS	Cast 316 stainless steel, 316 stainless steel hardware, glass window			
Pressure/Temperature		See Pressure/Temperature Tables			
Maximum Fluid Temperature		420°C/788°F (Refer to Temperature Tables)		300°C/570°F	150°C/270°F
Meter Dimensions		Refer to Product Dimension Figures			
Needle Control Valves & Flow Controllers		Valves - Sizes 7 - 12 / FCA Sizes 7,8	Valve/FCA Sizes 0-5	Valves - Sizes 7 - 12 / FCA Sizes 7,8	-
Product Approvals		Refer to Product Approvals Pages			
Transmitter	Current loop 4-20mA/HART®	Refer to Transmitter Section for detailed specifications on 4-20mA/HART-7 transmitter, Hi/Lo-alarm and pulse ouput - N **ot Available 3810G**			
	FOUNDATION™ Fieldbus	Refer to FOUNDATION Fieldbus Section for detailed specifications on FOUNDATION Fieldbus transmitter, Hi/Lo-alarm and pulse ouput - **Not Available 3810G**			
Inductive Alarms		Refer to Inductive Alarm Section - **Not Available 3810G**			Refer to Inductive Alarm Section
Local Operator Interface (incl. LCD)		Refer to Temperature Tables			

Table 1-2 ELF Body/Float Stop/Float/Metering Tube Material Restrictions

ELF BODY MAT'L (#1)	METERING TUBE MAT'L (#6)	OUTLET FLOAT STOP MAT'L (#13)	FLOAT MAT'L (#14) *	INLET FLOAT STOP MAT'L (#17)
316 LSS	316SS	INCONEL 625	316SS	316SS
HASTELLOY C-276	HASTELLOY C-276	HASTELLOY C-276	HASTELLOY C-276	HASTELLOY C-276
INCONEL 625	MONEL	INCONEL 625	MONEL	MONEL
TITANIUM GR2	MONEL	INCONEL 626	TITANIUM GR2	MONEL

***Note: Size 0 float is always TITANIUM GR2 FLOAT**

Table 1-3 Flow Capacities, Pressure Drop and Viscosity Immunity Ceiling Values

Meter type	Meter size	Connection size DIN (mm)	Connection size ANSI (inch)	Float code	Float material	water[3] max volume flow	water unit	water max volume flow	water unit	air[1,2] max volume flow	air unit	air max volume flow	air unit	Pressure drop mbar	Pressure drop inches WC	VIC cSt	Max visc. cSt	PED category
MT3809 ELF	0				Titanium	0.96		0.25		1.6		44		12	5	1	5	SEP
	1					1.3		0.34		2.1		59		12	5	1	10	SEP
	2			0		3.6		0.96	gph	4.9	scfh	130	l_n/h	12	5	1	20	SEP
	3					10		2.8		12		350		12	5	1	35	SEP
	4					21		5.5		23		650		32	13	1	70	SEP
	5					42		11		53		1400		38	15	1	100	SEP
MT3809 / MT3810	7	15	1/2"	A	SS316	25	l/h	0.11	gpm	0.49	scfm	0.8	m_n^3/h	30	13	1	40	SEP
				B[4]		65		0.28		1.2		2.1		30	13	1	20	SEP
				C		130		0.59		2.4		3.9		30	13	1	120	SEP
				D[4]		200		0.88		3.7		6.1		35	15	1	20	SEP
	8			A		250		1.1		5.2		8.5		45	19	2	250	SEP
				B		400		1.7		7.7		12		55	23	1	180	SEP
				C		650		2.8		11		19		60	25	2	475	SEP
				D		1000		4.4		21		35		130	53	1.5	250	SEP
	10	25	1"	A		1200		5.2		19		31		60	25	5	300	CAT I, II or III
				B		1500		6.6		31		51		70	29	1.5	300	CAT I, II or III
				C		2400		10		41		68		85	35	7	300	CAT I, II or III
				D		3500		15		65		100		155	63	4	300	CAT I, II or III
	12	40	1-1/2"	A		4000		17		67		100		50	21	50	300	CAT I, II or III
				B		6000		26		95		150		60	25	30	300	CAT I, II or III
				C		8000		35		150		240		150	61	2	300	CAT I, II or III
				D		10000		46		210		340		300	121	2	300	CAT I, II or III
	13	50	2"	A		6500		28		100		160		50	21	50	300	CAT I, II or III
				B		9500		41		160		260		60	25	50	300	CAT I, II or III
				C		12000		55		200		330		100	41	2.5	300	CAT I, II or III
				D		20000		88		390		650		300	121	1	300	CAT I, II or III
	15	80	3"	A		20000		88		390		640		110	45	8	300	CAT I, II or III
				B		30000		130		550		900		140	57	7	300	CAT I, II or III
				C		40000		170		750		1200		280	113	5	300	CAT I, II or III
	16	100	4"	A		49000		210		N/A		N/A		160	65	15	300	CAT I, II or III
				B		70000		300		N/A		N/A		210	85	10	300	CAT I, II or III
				C		100000		440		N/A		N/A		300	121	5	300	CAT I, II or III
MT3809 TFE Lined[5]	7	15	1/2"	A	Hastel-C	110		0.48		2.2		3.7		25	11	1	2	SEP
				B		170		0.75		3.5		5.8		50	21	1	2	SEP
	8			A		250		1.1		5.1		8.3		30	13	1	2	SEP
				B		420		1.8		8.5		13		45	19	1	2	SEP
				C		500		2.2		9.9		16		40	17	1	2	SEP
				D		850		3.7		18		30		130	53	1	2	SEP
	10	25	1"	A	PVDF	1400		6.2		27		45		45	19	2	3	CAT I, II or III
				B		2000		8.8		39		63		106	43	2	3	CAT I, II or III
				C		2400		10		47		77		90	37	2	3	CAT I, II or III
				D		3000		13		58		95		130	53	2	3	CAT I, II or III
	12	40	1-1/2"	A		3000		13		58		95		50	21	2	3	CAT I, II or III
				B		4000		18		73		120		75	31	2	3	CAT I, II or III
				C		5000		22		94		150		85	35	2	3	CAT I, II or III
				D		6000		26		110		180		120	49	2	3	CAT I, II or III
	13	50	2"	A		6000		26		110		180		95	39	2	3	CAT I, II or III
				B		8000		35		150		250		125	51	2	3	CAT I, II or III
				C		12000		53		220		370		200	81	2	3	CAT I, II or III
				D		15000		66		280		470		225	91	2	3	CAT I, II or III

[1] Air flows in scfm or scfh are given at 70°F and 14.7 psia

[2] Air flows in m_n^3/h or ln/h are given at 0°C and 1,013 bar(a)

[3] Water flows in l/h, gph and gpm are given at 70°F

[4] Minimum operating pressure required 7 psig / 0.48 bar

[5] For TFE lined gas applications operating pressure must be greater than 29 psia / 2 bar(a)

Pressure Ratings

Please reference Tables 1-3, 1-4 and 1-5.

Table 1-4 Model MT3809/MT3810 Pressure Ratings, Flanged

Flanged - 150LBS, ANSI*

Temperature		316/316L		Titanium Gr.2		Alloy C-276/625	
°F	°C	psi	Bar	psi	Bar	psi	Bar
-325	-198	275	19.0			290	20.0
-75	-59	275	19.0	234	16.1	290	20.0
100	38	275	19.0	234	16.1	290	20.0
212	100	235	16.2	200	13.8	257	17.7
392	200	199	13.7	139	9.6	200	13.8
572	300	148	10.2	88	6.1	148	10.2
617	325			81	5.6		
752	400	94	6.5			94	6.5

Flanged - 300LBS, ANSI*

Temperature		316/316L		Titanium Gr.2		Alloy C-276/625	
°F	°C	psi	Bar	psi	Bar	psi	Bar
-325	-198	720	49.6			750	51.7
-75	-59	720	49.6	612	42.2	750	51.7
100	38	720	49.6	612	42.2	750	51.7
212	100	612	42.2	521	35.9	747	51.5
392	200	518	35.7	363	25.0	701	48.3
572	300	458	31.6	276	19.0	622	42.9
617	325			268	18.5		
752	400	426	29.4			529	36.5

Flanged - 600LBS, ANSI*

Temperature		316/316L		Titanium Gr.2		Alloy C-276/625	
°F	°C	psi	Bar	psi	Bar	psi	Bar
-325	-198	1440	99.3			1500	103.4
-75	-59	1440	99.3	1224	84.4	1500	103.4
100	38	1440	99.3	1224	84.4	1500	103.4
212	100	1224	84.4	1040	71.7	1494	103.0
392	200	1034	71.3	724	49.9	1403	96.7
572	300	917	63.2	550	37.9	1243	85.7
617	325			538	37.1		
752	400	854	58.9			1063	73.3

*** Meter sizes 15 and 16 have a Minimum Temperature of -150°F/-101°C**

Note: Flanged ELF O-ring is Kalrez 4079.

Flanged - PN16, EN-1092*

Temperature		316/316L		Titanium Gr.2		Alloy C-276/625	
°F	°C	psi	Bar	psi	Bar	psi	Bar
-325	-198	232	16.0			232	16.0
-75	-59	232	16.0	197	13.6	232	16.0
100	38	232	16.0	197	13.6	232	16.0
212	100	196	13.5	167	11.5	232	16.0
392	200	160	11.0	112	7.7	232	16.0
572	300	139	9.6	84	5.8	223	15.4
752	400	129	8.9			173	11.9

Flanged - PN40, EN-1092*

Temperature		316/316L		Titanium Gr.2		Alloy C-276/625	
°F	°C	psi	Bar	psi	Bar	psi	Bar
-325	-198	580	40.0			580	40.0
-75	-59	580	40.0	493	34.0	580	40.0
100	38	580	40.0	493	34.0	580	40.0
212	100	490	33.8	416	28.7	580	40.0
392	200	400	27.6	280	19.3	580	40.0
572	300	348	24.0	209	14.4	557	38.4
752	400	322	22.2			431	29.7

Flanged - 10K, JIS B2220*

Temperature		316/316L		Titanium Gr.2		Alloy C-276/625	
°F	°C	psi	Bar	psi	Bar	psi	Bar
-325	-198	203	14.0			203	14.0
-75	-59	203	14.0	173	11.9	203	14.0
100	38	203	14.0	173	11.9	203	14.0
212	100	203	14.0	173	11.9	203	14.0
392	200	174	12.0	122	8.4	174	12.0
572	300	145	10.0	87	6.0	145	10.0

Flanged - 20K, JIS B2220*

Temperature		316/316L		Titanium Gr.2		Alloy C-276/625	
°F	°C	psi	Bar	psi	Bar	psi	Bar
-325	-198	493	34.0			493	34.0
-75	-59	493	34.0	419	28.9	493	34.0
100	38	493	34.0	419	28.9	493	34.0
212	100	493	34.0	419	28.9	493	34.0
392	200	450	31.0	315	21.7	450	31.0
572	300	421	29.0	252	17.4	421	29.0
752	400	334	23.0			334	23.0

Table 1-5 Model MT3809/MT3810 Pressure Ratings, NPT Female

NPT - Female - Standard Design (Teflon O-rings)									
316/316L									
Temperature		#7/8		#10		#12		#13	
°F	°C	psi	Bar	psi	Bar	psi	Bar	psi	Bar
-58 to 100	-50 to 38	2567	177	2321	160	1929	133	1740	120
212	100	2190	151	1973	136	1653	114	1479	102
392	200	1842	127	1668	115	1392	96	1247	86
482	250	1726	119	1552	107	1291	89	1160	80

NPT - Female - ELF - 2500LBS Design			
316/316L			
Temperature		ELF	
°F	°C	psi	Bar
-58 to 100	-50 to 38	6000	414
212	100	5100	351.6
392	200	4311	297.2
572	300	3822	263.5

NPT - Female - 7-12 - 2500LBS Design			
316/316L			
Temperature		#7-12	
°F	°C	psi	Bar
-31 to 100	-35 to 38	6000	413.7
212	100	5100	351.6
392	200	4311	297.2
550	288	3822	263.5

NPT - Female - Standard Design (Teflon O-rings)									
Titanium Gr. 2									
Temperature		#7/8		#10		#12		#13	
°F	°C	psi	Bar	psi	Bar	psi	Bar	psi	Bar
-58 to 100	-50 to 38	2147	148	1929	133	1610	111	1450	100
212	100	1813	125	1639	113	1363	94	1233	85
392	200	1334	92	1204	83	1001	69	899	62
482	250	1160	80	1044	72	870	60	783	54

NPT - Female - ELF - 2500LBS Design			
Titanium Gr. 2			
Temperature		ELF	
°F	°C	psi	Bar
-58 to 100	-50 to 38	5100	352
212	100	4335	298.9
392	200	3017	208.0
572	300	2293	158.1

NPT - Female - 7-12 - 2500LBS Design			
Titanium Gr. 2			
Temperature		#7-12	
°F	°C	psi	Bar
-31 to 100	-35 to 38	5100	351.6
212	100	4335	298.9
392	200	3017	208.0
550	288	2293	158.1

NPT - Female - Standard Design (Teflon O-rings)									
Hastelloy Alloy C-276									
Temperature		#7/8		#10		#12		#13	
°F	°C	psi	Bar	psi	Bar	psi	Bar	psi	Bar
-58 to 100	-50 to 38	3510	242	3162	218	2640	182	2379	164
212	100	3162	218	2857	197	2379	164	2147	148
392	200	2756	190	2480	171	2074	143	1871	129
482	250	2582	178	2335	161	1944	134	1755	121

NPT - Female - ELF - 2500LBS Design			
Alloy C-276/ Alloy 625			
Temperature		ELF	
°F	°C	psi	Bar
-58 to 100	-50 to 38	6250	431
212	100	6228	429.4
392	200	5842	402.8
572	300	5179	357.1

NPT - Female - 7-12 - 2500LBS Design			
Alloy C-276/ Alloy 625			
Temperature		#7-12	
°F	°C	psi	Bar
-31 to 100	-35 to 38	6250	430.9
212	100	6228	429.4
392	200	5842	402.8
550	288	5179	357.1

NPT - Female - Standard Design (Teflon O-rings)									
Inconel Alloy 625									
Temperature		#7/8		#10		#12		#13	
°F	°C	psi	Bar	psi	Bar	psi	Bar	psi	Bar
-58 to 100	-50 to 38	4047	279	3640	251	3046	210	2741	189
212	100	4047	279	3640	251	3046	210	2741	189
392	200	3902	269	3510	242	2930	202	2640	182
482	250	3800	262	3423	236	2857	197	2567	177

Female ELF - 2500LBS Design: O-ring is Kalrez 4079
Female Sizes 7-12 - 2500LBS Design: O-ring is Kalrez 3018

Table 1-6 Model MT3809/MT3810 Pressure Ratings, NPT Male

NPT - Male - Standard Design							
316/316L							
Temperature		#7/8		#10		#12	
°F	°C	psi	Bar	psi	Bar	psi	Bar
-325	-198	4699	324	3785	261	3684	254
100	38	4699	324	3785	261	3684	254
212	100	4018	277	3234	223	3147	217
392	200	3379	233	2712	187	2654	183
572	300	3002	207	2408	166	2350	162
752	400	2785	192	2248	155	2190	151

NPT - Male - Standard Design							
Hastelloy Alloy C-276							
Temperature		#7/8		#10		#12	
°F	°C	psi	Bar	psi	Bar	psi	Bar
-325	-198	4989	344	5163	356	5033	347
100	38	4989	344	5163	356	5033	347
212	100	4511	311	4670	322	4540	313
392	200	3931	271	4061	280	3960	273
572	300	3466	239	3597	248	3495	241
752	400	3176	219	3292	227	3205	221

NPT - Male - Standard Design							
Titanium Gr. 2							
Temperature		#7/8		#10		#12	
°F	°C	psi	Bar	psi	Bar	psi	Bar
-75	-59	3046	210	3147	217	3075	212
100	38	3046	210	3147	217	3075	212
212	100	2596	179	2683	185	2611	180
392	200	1900	131	1973	136	1914	132
572	300	1450	100	1494	103	1450	100
617	325	1349	93	1407	97	1363	94

NPT - Male - Standard Design							
Inconel Alloy 625							
Temperature		#7/8		#10		#12	
°F	°C	psi	Bar	psi	Bar	psi	Bar
-325	-198	5758	397	5961	411	5802	400
100	38	5758	397	5961	411	5802	400
212	100	5758	397	5961	411	5802	400
392	200	5540	382	5729	395	5584	385
572	300	5279	364	5453	376	5323	367
752	400	5062	349	5236	361	5105	352

NPT - Male - ELF - 2500LBS Design*			
316/316L			
Temperature		ELF	
°F	°C	psi	Bar
-58 to 122	-50 to 50	6000	414
212	100	5100	351.6
392	200	4311	297.2
572	300	3822	263.5

NPT - Male - ELF - 2500LBS Design*			
Titanium Gr. 2			
Temperature		ELF	
°F	°C	psi	Bar
-58 to 122	-50 to 50	5100	352
212	100	4335	298.9
392	200	3017	208.0
572	300	2293	158.1

NPT - Male - ELF - 2500LBS Design*			
Alloy C-276/ Alloy 625			
Temperature		ELF	
°F	°C	psi	Bar
-58 to 122	-50 to 50	6250	431
212	100	6228	429.4
392	200	5842	402.8
572	300	5179	357.1

* ELF 2500# Design (Kalrez 4079)

Temperature Ratings

Please reference Table 1-6.

Table 1-7 Temperature Cut-off Tables

Meter with 316 SS Mechanical Indicator

	Process Temperature		Ambient Temperature	
Connection type	°C	°F	°C	°F
Flanged / MNPT	-198 to 420	-325 to 788	-55 to 75	-67 to 167
Threaded female	-50 to 300*	-58 to 572*	-55 to 75	-67 to 167
ETFE lined	-30 to 150	-22 to 302	-30 to 40	-22 to 104

Meter with Aluminum Mechanical Indicator

	Process Temperature		Ambient Temperature	
Connection type	°C	°F	°C	°F
Flanged / MNPT	-198 to 300	-325 to 572	-55 to 75	-67 to 167
Threaded female	-50 to 300*	-58 to 572*	-55 to 75	-67 to 167
ETFE lined	-30 to 150	-22 to 302	-30 to 40	-22 to 104

Ambient Temperatures with Electrical Components

Option	°C	°F
Transmitter	-40 to 70	-40 to 158
Transmitter w/display	-20 to 70	-4 to 158
Inductive switches	-40 to 70	-40 to 158

Insulation required when process temperatures are greater than 300°C/572°F.

Meter with Electrical Components - Ambient Temperature 30°C / 86°F

	Process Temperature	
Connection type	°C	°F
Transmitter	-198 to 420	-325 to 788
Transmitter w/display	-198 to 420	-325 to 788
Inductive switches	-198 to 420	-325 to 788

Meter with Electrical Components - Ambient Temperature 60°C / 140°F

	Process Temperature	
Connection type	°C	°F
Transmitter	-198 to 200	-325 to 392
Transmitter w/display	-198 to 175	-325 to 350
Inductive switches	-198 to 200	-325 to 392

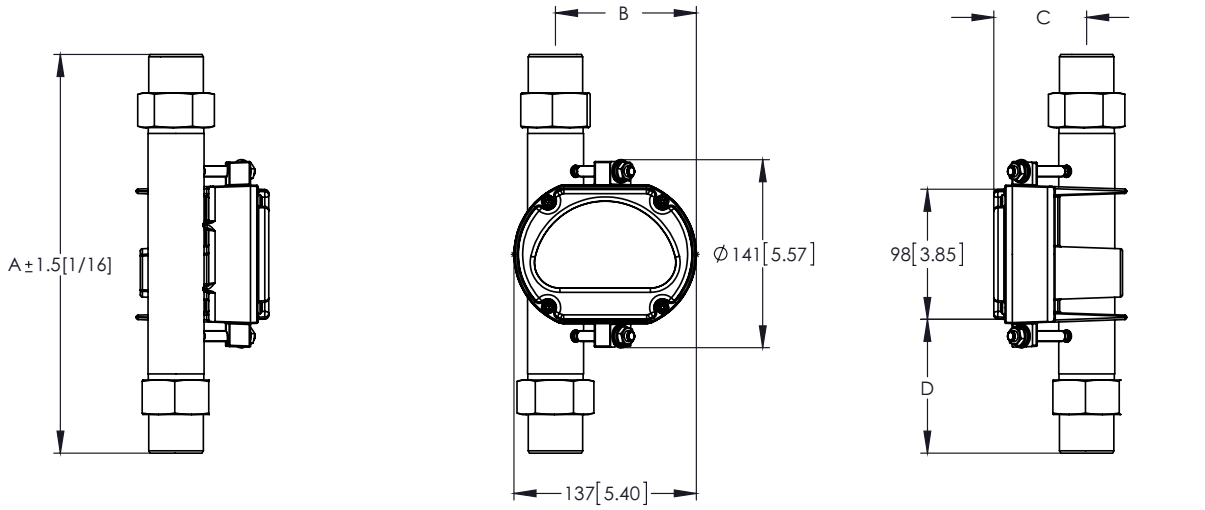
*

Elastomer Materials	Minimum Temperature °F	Minimum Temperature °C	Maximum Temperature °F	Maximum Temperature °C
Kalrez 4079	-58	-50	572	300
Kalrez 3018	-31	-35	550	288
Teflon PTFE	-58	-50	482	250
Viton A	5	-15	400	204
Teflex (Viton core, FEP jacket)	5	-15	400	204

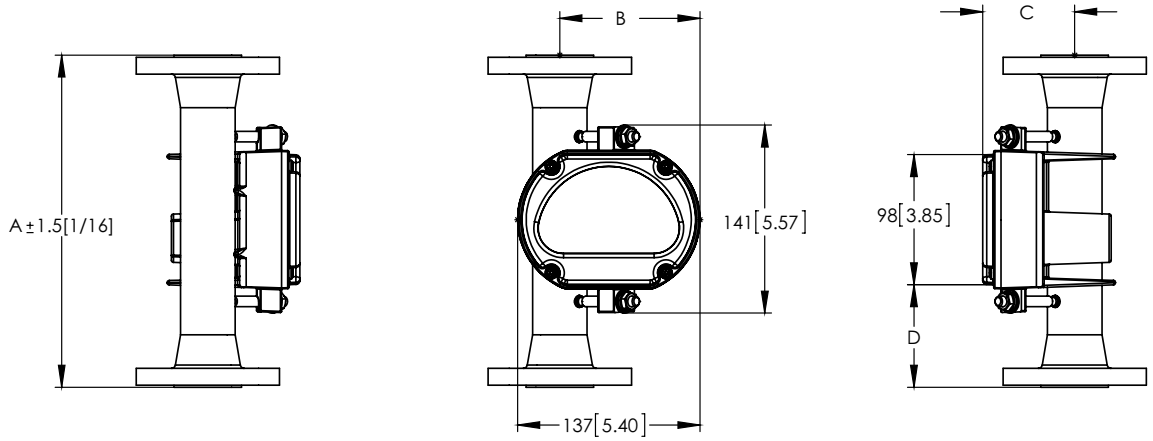
Outline and Dimensions

Please reference Figures 1-1, 1-2 and 1-3 on the following pages.

Model 3809 & 3810 General Purpose Indicator Housing with Threaded Female Connections mm [inches]



Model 3809 & 3810 General Purpose Indicator Housing with Flanged Connections mm [inches]

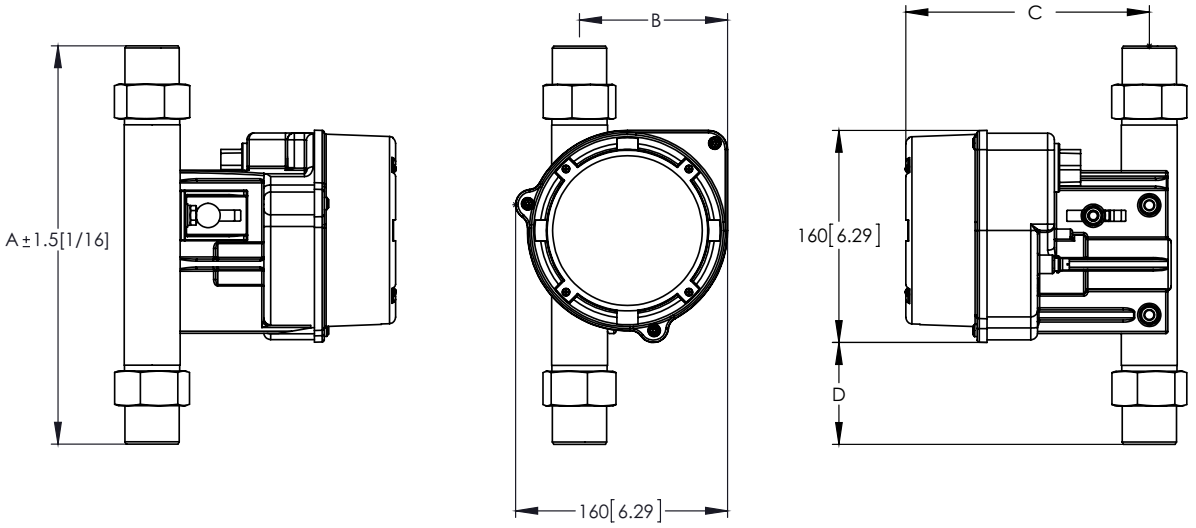


Meter Size	Connection	A	B	C	D	Weight (Approx.)*
0-5	1/2" Threaded Female	225 [8.85]	99 [3.90]	63 [2.56]	61 [2.40]	2.7 kg [6 lbs.]
	1" Threaded Male	200 [7.87]	100 [3.94]	65 [2.56]	48 [1.89]	2.7 kg [6 lbs.]
7 & 8	1/2" Threaded Female	225 [8.85]	99 [3.90]	63 [2.56]	61 [2.40]	2.7 kg [6 lbs.]
	3/4" Threaded Female	225 [8.85]	99 [3.90]	63 [2.56]	61 [2.40]	2.7 kg [6 lbs.]
	1" Threaded Male	200 [7.87]	100 [3.94]	65 [2.56]	48 [1.89]	2.7 kg [6 lbs.]
10	1" Threaded Female	300 [11.81]	107 [4.21]	71 [2.80]	98 [3.86]	4.5 kg [10 lbs.]
	1-1/2" Threaded Male	250 [9.84]	108 [4.25]	72 [2.83]	73 [2.87]	4.5 kg [10 lbs.]
12	1-1/2" Threaded Female	300 [11.81]	116 [4.57]	80 [3.15]	98 [3.86]	6.8 kg [15 lbs.]
	2-1/2" Threaded Male	250 [9.84]	118 [4.65]	83 [3.27]	73 [2.87]	6.8 kg [15 lbs.]
13	2" Threaded Female	300 [11.81]	122 [4.78]	86 [3.39]	98 [3.86]	7.7 kg [17 lbs.]
0-5	Flanged (ANSL DIN and JIS)	250 [9.84]	99 [3.90]	63 [2.48]	73 [2.87]	4.1 kg [9 lbs.] - 6.5 kg [14 lbs.]
7 & 8		250 [9.84]	99 [3.90]	63 [2.48]	73 [2.87]	4.1 kg [9 lbs.] - 11.9 kg [26 lbs.]
10		250 [9.84]	106 [4.13]	70 [2.76]	73 [2.87]	7.7 kg [17 lbs.] - 14.5 kg [32 lbs.]
12		250 [9.84]	115 [4.53]	79 [3.11]	73 [2.87]	12.2 kg [27 lbs.] - 17.7 kg [39 lbs.]
13		250 [9.84]	122 [4.80]	85 [3.35]	73 [2.87]	14.1 kg [31 lbs.] - 28 kg [62 lbs.]
15		250 [9.84]	139 [5.47]	103 [4.06]	73 [2.87]	20.0 kg [44 lbs.] - 45 kg [99 lbs.]
16		350 [13.78]	154 [6.06]	118 [4.65]	123 [4.84]	37.6 kg [83 lbs.] - 58.6 kg [129 lbs.]

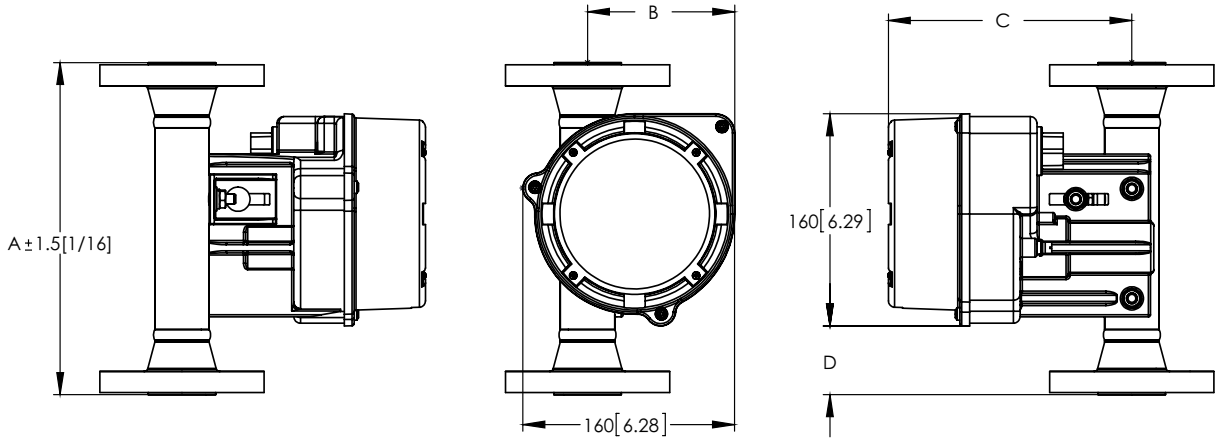
*Weights shown for aluminum indicator. Add 1.8 [4 lbs.] for steel indicator housing.

Figure 1-1 Model MT3809 and MT3810 Dimensional Drawings (mm/in) and Weights (kg/lbs) - General Purpose Housing

Model 3809 Intrinsically Safe Indicator Housing with Threaded Female Connections mm [inches]



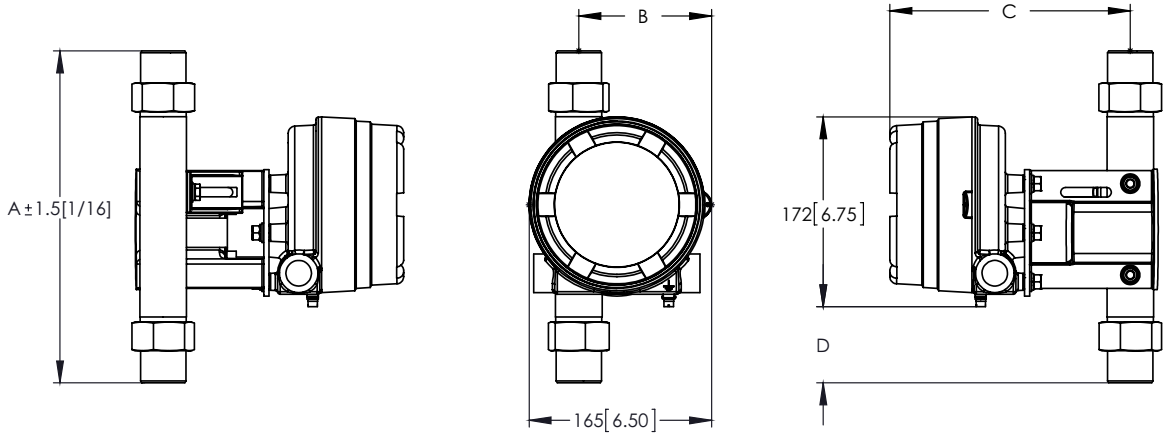
Model 3809 Intrinsically Safe Indicator Housing with Flanged Connections mm [inches]



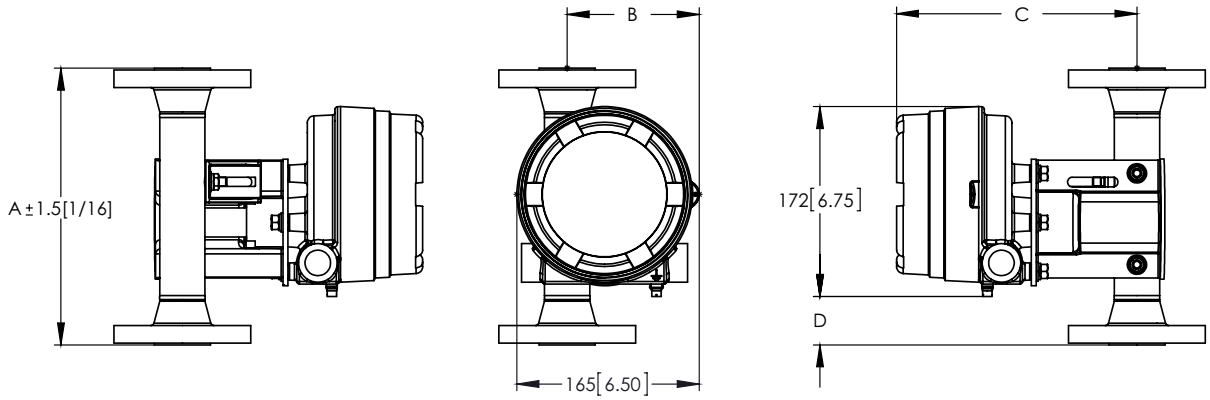
Meter Size	Connection	A	B	C	D	Weight (Approx.)*
0-5	1/2" Threaded Female	225 [8.85]	104 [4.10]	183 [7.20]	40 [1.57]	5.4 kg [12 lbs.]
	1" Threaded Male	200 [7.87]	105 [4.13]	183 [7.20]	27 [1.06]	5.4 kg [12 lbs.]
7 & 8	1/2" Threaded Female	225 [8.85]	104 [4.10]	183 [7.20]	40 [1.57]	5.4 kg [12 lbs.]
	3/4" Threaded Female	225 [8.85]	104 [4.10]	183 [7.20]	40 [1.57]	5.4 kg [12 lbs.]
	1" Threaded Male	200 [7.87]	105 [4.13]	183 [7.20]	27 [1.06]	5.4 kg [12 lbs.]
10	1" Threaded Female	300 [11.81]	121 [4.76]	183 [7.20]	77 [3.03]	7.3 kg [16 lbs.]
	1-1/2" Threaded Male	250 [9.84]	113 [4.45]	183 [7.20]	52 [2.05]	7.3 kg [16 lbs.]
12	1-1/2" Threaded Female	300 [11.81]	121 [4.76]	183 [7.20]	77 [3.03]	9.5 kg [21 lbs.]
	2-1/2" Threaded Male	250 [9.84]	120 [4.72]	183 [7.20]	52 [2.05]	9.5 kg [21 lbs.]
13	2" Threaded Female	300 [11.81]	127 [5.00]	183 [7.20]	77 [3.03]	10.4kg [23 lbs.]
0-5	Flanged (ANSI, DIN and JIS)	250 [9.84]	104 [4.10]	183 [7.20]	52 [2.05]	6.8 kg [15 lbs.] - 9.2 kg [20 lbs.]
7 & 8		250 [9.84]	104 [4.10]	183 [7.20]	52 [2.05]	6.8 kg [15 lbs.] - 14.6 kg [32 lbs.]
10		250 [9.84]	111 [4.37]	183 [7.20]	53 [2.05]	10.4 kg [23 lbs.] - 17.2 kg [38 lbs.]
12		250 [9.84]	120 [4.72]	183 [7.20]	54 [2.05]	15 kg [33 lbs.] - 20.5 kg [45 lbs.]
13		250 [9.84]	126 [4.96]	183 [7.20]	55 [2.05]	16.8 kg [37 lbs.] - 30.7 kg [68 lbs.]
15		250 [9.84]	144 [5.67]	183 [7.20]	56 [2.05]	22.7 kg [50 lbs.] - 47.7 kg [105 lbs.]
16		350 [13.78]	159 [6.26]	183 [7.20]	57 [2.05]	40.4 kg [89 lbs.] - 61.4 kg [135 lbs.]

Figure 1-2 Model MT3809 and MT3810 Dimensional Drawings (mm/in) and Weights (kg/lbs) - Intrinsically Safe Housing

Model 3809 Explosion Proof Indicator Housing with Threaded Female Connections mm [inches]



Model 3809 Explosion Proof Indicator Housing with Flanged Connections mm [inches]



Meter Size	Connection	A	B	C	D	Weight (Approx.)*
0-5	1/2" Threaded Female	225 [8.85]	113 [4.45]	218 [8.58]	41 [1.61]	11.8 kg [26 lbs.]
	1" Threaded Male	200 [7.87]	114 [4.49]	218 [8.58]	28 [1.10]	11.8 kg [26 lbs.]
7 & 8	1/2" Threaded Female	225 [8.85]	113 [4.45]	218 [8.58]	41 [1.61]	11.8 kg [26 lbs.]
	3/4" Threaded Female	225 [8.85]	113 [4.45]	218 [8.58]	41 [1.61]	11.8 kg [26 lbs.]
	1" Threaded Male	200 [7.87]	114 [4.49]	218 [8.58]	28 [1.10]	11.8 kg [26 lbs.]
10	1" Threaded Female	300 [11.81]	120 [4.72]	218 [8.58]	78 [3.07]	13.6 kg [30 lbs.]
	1-1/2" Threaded Male	250 [9.84]	121 [4.76]	218 [8.58]	53 [2.09]	13.6 kg [30 lbs.]
12	1-1/2" Threaded Female	300 [11.81]	129 [5.08]	218 [8.58]	78 [3.07]	15.9 kg [35 lbs.]
	2-1/2" Threaded Male	250 [9.84]	131 [5.16]	218 [8.58]	53 [2.09]	15.9 kg [35 lbs.]
13	2" Threaded Female	300 [11.81]	135 [5.31]	218 [8.58]	78 [3.07]	16.8 kg [37 lbs.]
0-5	Flanged (ANSL DIN and JIS)	250 [9.84]	113 [4.45]	218 [8.58]	53 [2.09]	13.2 kg [29 lbs.] - 15.6 kg [34 lbs.]
7 & 8		250 [9.84]	113 [4.45]	218 [8.58]	53 [2.09]	13.2 kg [29 lbs.] - 21 kg [46 lbs.]
10		250 [9.84]	120 [4.72]	218 [8.58]	53 [2.09]	16.8 kg [37 lbs.] - 23.6 kg [52 lbs.]
12		250 [9.84]	129 [5.08]	218 [8.58]	53 [2.09]	21.3 kg [47 lbs.] - 26.8 kg [59 lbs.]
13		250 [9.84]	135 [5.31]	218 [8.58]	53 [2.09]	23.1 kg [51 lbs.] - 37 kg [81 lbs.]
15		250 [9.84]	153 [6.02]	218 [8.58]	53 [2.09]	29 kg [64 lbs.] - 54 kg [119 lbs.]
16		350 [13.78]	168 [6.61]	218 [8.58]	103 [4.06]	46.7 kg [103 lbs.] - 67.7 kg [149 lbs.]

Figure 1-3 Model MT3809 and MT3810 Dimensional Drawings (mm/in) and Weights (kg/lbs) - Explosion Proof Housing

Optional Valves and Flow Controllers

Needle valves and flow controllers may be externally piped into the inlet or outlet side of the instrument. Needle valves can be supplied up to size 12 1-1/2" maximum 10000 l/hr / 46 gpm water equivalent. Needle valves and flow controllers will be supplied separately with the flanged meter.

Optional Electronic Features

Electronic equipment available with the Model MT3809 includes:

- Current loop 4-20mA/HART Transmitter with Alarms and Pulse Output
- FOUNDATION Fieldbus Transmitter with Alarms and Pulse Output
- Inductive Alarms; stand-alone or in combination with above transmitters

Refer to the table below for the model code nomenclature for the electronics options. All models are designed to be either intrinsically safe or explosion proof.

Nomenclature and Type Designation

MT3809 … B …
I-IV XV

XV	Electronics configuration	B, C	Indicator with inductive alarm, 1 or 2 switches
		D … L	Transmitter, 4 – 20 mA / Hart, with optionally: - pulse output - inductive alarm contact(s) - LOI or combinations thereof.
		M … U	Transmitter, FOUNDATION Fieldbus, with optionally: - pulse output - inductive alarm contact(s) - LOI or combinations thereof.

Current Loop 4-20 mA with HART Transmitter, with Alarms, Display and Pulse Output

Design Features

• 4-20 mA analog output for flowrate
• Bell-202 modulated HART digital communication over the 4-20 mA signal
• Current loop powered 2-wire connection
• User selectable 0% and 100% analog output ranges with optional smoothing
• Flexible (mix & match) units of measure for flowrates, totals, temperatures, densities, etc.
• Two flow totalizers: Resettable and inventory totalization
• User configurable, scalable pulse output for various engineering units
• Hi- and Lo-flow alarm output

Description

The 4-20 mA with HART transmitter is a compact microprocessor device designed to interface directly with the Model MT3809. This transmitter includes a Hi- and Lo alarm switch output and a pulse output.

The HART digital communication signals are superimposed on top of the 4-20 mA signal, allowing communication of more than just the process variable.

The transmitter is HART-programmable or for numerous variables such as flow rate, totalization, calibration factors, and high-low alarm parameters. It is programmable with easy-to-use hand held configurators. Prior to shipment, commonly used default values are programmed by Brooks to ensure ease of operation and quick startup. However, parameters may be reprogrammed by the user if needed. Flow rate information may be viewed locally at the meter scale, LCD display or displayed remotely.

Table 1-8 4-20 mA with HART Transmitter Description Table

Power supply voltage	21 to 30 Vdc: (2-wire current loop transmitter)
Loop current / current consumption range	3.8 to 22.0 mA.
Hi- and Lo-alarm outputs	Open collector alarm output Optically isolated outputs assignable to alarms. • Max. off-state voltage: 30 Vdc • Max. off-state current: 0,05 mA • Max. on-state voltage: 1.2 Vdc • Max. on-state current: 20 mA
Pulse Output	Optically isolated. Scalable to a variety of engineering unit systems (pulses per liter, gallons, etc.). • Range: 1 Hz to 1 kHz • Max. off-state voltage: 30 Vdc • Max. off-state current: 0.05 mA • Max. on-state voltage: 1.2 Vdc • Max. on-state current: 20 mA
Temperature Specification	See Temperature Cut-off Table
Electrical Connector	M20 x 1,5 according to ISO (1/2" NPT, 3/4” NPT (F) or cable gland optional) • Brass/Nickel plated cable gland cable diameter range 8-11 mm (Aluminum housing) • Stainless steel cable gland cable diameter range 7-10.5 mm (SS housing)
Linearity	Less than 1% at max. current.
Temperature influence	Less than 0.04% per °C.
Voltage influence	Less than 0.002% / Vdc.
Load resistance influence	± 0.1% full scale.
HART Revision	HART-7

FOUNDATION Fieldbus Transmitter, with Alarms and Pulse Output

Design Features

• FOUNDATION™ Fieldbus digital communication network interface
• Ease of wiring and installation with a single 2-wire bus connection
• Powered over 2-wire FOUNDATION™ Fieldbus connection
• Flexible (mix & match) units of measure for flowrates, totals, temperatures, densities, etc.
• Two flow totalizers: Resettable and inventory totalization
• User configurable, scalable pulse output for various engineering units
• Hi- and Lo-flow alarm output

Description

The FOUNDATION™ Fieldbus transmitter is a compact microprocessor device designed to interface directly with the Model MT3809.

The transmitter communicates over the 2-wire network per the international FOUNDATION™ Fieldbus standard for access to numerous variables such as flow rate, totalization, calibration factors, and high-low alarm parameters.

Table 1-9 FOUNDATION Fieldbus Transmitter Description Table

Power supply voltage	9-32Vdc
Power supply protection	Protected against reverse polarity
Current consumption	12 mA Entire transmitter is powered from 2-wire bus
Hi- and Lo-alarm outputs	Open collector alarm output Optically isolated outputs assignable to alarms. • Max. off-state voltage: 30 Vdc • Max. off-state current: 0,05 mA • Max. on-state voltage: 1.2 Vdc • Max. on-state current: 20 mA
Pulse Output	Optically isolated. Scalable to a variety of engineering unit systems (pulses per liter, gallons, etc.). • Range: 1 Hz to 1 kHz • Max. off-state voltage: 30 Vdc • Max. off-state current: 0.05 mA • Max. on-state voltage: 1.2 Vdc • Max. on-state current: 20 mA
Temperature Specification	See Temperature Cut-off Table
Electrical Connector	M20 x 1,5 according to ISO (1/2" NPT, 3/4” NPT (F) or cable gland optional) • Brass/Nickel plated cable gland cable diameter range 8-11 mm (Aluminum housing) • Stainless steel cable gland cable diameter range 7-10.5 mm (SS housing)
Linearity	Less than 1%
Temperature Influence	Less than 0.04% per °C
Voltage influence	Less than 0.002% / Vdc
FOUNDATION Fieldbus Revision	ITK6

Inductive Alarms

Design Features

- 1 or 2 normally open inductive limit switches
- Optional intrinsically safe power supply/amplifier/relay unit
- For low or high limit signaling/switching
- Front adjustable
- Optional Relay Power Supply – recommended

Description

One or two electronic limit switches can be installed in the indicator housing to allow signaling or switching functions on a preset flow value. The limit switch operates as a slot initiator that is inductively actuated by a disc mounted on the pointer shaft. Any flow value can be used for setting the limit value by sliding the initiator along the indicator scale. Minimum setting distance between two limit switches is approximately 40% full scale. The position of the initiator also serves to visually indicate the signaling set value. Settings can be adjusted by removing the indicator cover, loosening, moving and retightening of the alarm indication needle, and replacement of the indicator front cover. Refer to Section 2-5-1.

Table 1-10 Inductive Alarms Description Table

Power supply voltage	5 - 25 Vdc: (8 Vdc nominal)
Impedance	- Approximately 1 kohm with cam absent - Approximately 8 kohm with cam present
Ambient and process temperature	See Temperature Cut-off Table
Electrical Connector	M20 x 1,5 according to ISO (1/2" NPT, 3/4” NPT (F) or cable gland optional) • Brass/Nickel plated cable gland cable diameter range 8-11 mm (Aluminum housing) • Stainless steel cable gland cable diameter range 7-10.5 mm (SS housing)

Product Approvals Overview

Table 1-11 Product Approvals

Declarations	Mark	Meter Options				Standards/Directives/Marking	Declaration/ Certificate
		Mechanical	HART Transmitter	Foundation Fieldbus Transmitter	Inductive Alarm		
EU Declaration of Conformity	CE		✓	✓	✓	EMC Directive (2014/30/EU)	Declaration
		✓	✓	✓	✓	RoHS Directive (2011/65/EU)	Declaration
		✓	✓	✓	✓	Pressure Equipment Directive (2014/68/EU)	Declaration
SIL Declaration					✓	IEC 61508-2: 2010	Declaration
NAMUR Declaration			✓			NAMUR NE21, NE43	Declaration
IP66/67			✓	✓	✓	IEC 60529 (Stainless Steel Enclosure)	DEKRA Certificate
IP64			✓	✓	✓	IEC 60529 (Aluminum Enclosure)	DEKRA Certificate
IP66/67		✓				IEC 60529 (Stainless Steel or Aluminum Enclosure)	DEKRA Certificate
Explosion Safety "Flame Proof" For temperature limits, see Table: Process and ambient temperature limits Flame Proof / Ex-d	ATEX Ex		✓	✓	✓	II 2 G Ex db IIC T6...T1 Gb II 2 D Ex tb IIIC T85°C...T450°C Db	DEKRA 13ATEX0086X
						Ex db IIC T6...T1 Gb Ex tb IIIC T85°C...T450°C Db	IECEx DEK13.0027X
						Standards used for evaluation: (13ATEX0086X and IECEx DEK13.0027X) EN 60079-0:2012+A11:2013, EN 60079-1:2014, EN 60079-31:2014 IEC 60079-0:2011 mod + Cor.:2012 + Cor.:2013, IEC 60079-1:2014, IEC 60079-31:2013 **Special conditions for safe use:** For information regarding the dimension of the flameproof joints the manufacturer shall be contacted. **Electrical connections conditions:** For application in environments requiring EPL Gb the threaded entries of the enclosure shall be sealed with plugs, cable entry devices such as glands or conduit entry devices which are Ex db IIC Gb approved. For application in environments requiring EPL Db the threaded entries of the enclosure shall be sealed with plugs, cable entry devices such as glandsor conduit entry devices which are Ex tb IIIC Db approved. For application in environments requiring EPL Gb or EPL Db, in case the optional surge protector is used, the surge protector shall be installed with a high strength locking compound on the mounting thread.	
Explosion Safety "Constructional Safety (c)" Non-Electrical / Mechanical ATEX	ATEX Ex	✓				II2G Ex h IIC T6...T3 Gb II2D Ex h IIIC T200°C Db -20°C ≤ Ta ≤ 70°C	MBID 022
						Special conditions for safe use: Enclosure contains glass & painted aluminum parts. If it is mounted in an area where the use of category 2G or 2D apparatus is required, it must be installed such that ignition source due to propagating brush discharge sparks are excluded. The actual maximum surface temperature of the equipment depends not on the equipment itself, but on operating conditions of the process fluid/gas flowing through the equipment. The equipment by itself does not generate heat. Due to this reason the temperature class is marked as a range. The maximum permitted ambient and process temperature limits can be found in the operating instructions. At start up especially for gas applications, ensure that the pressure is gradually increased through the piping system. A sudden pressure spike situation may result in a fast movement of the float within the VA flowmeter & the float may hit hard against the float stop. Supply grounding connection by the process connections or earthing terminal.	

Table continued on next page

Table 1-11 Product Approvals (Continued)

Declarations	Mark	Meter Options: Mechanical	Meter Options: HART Transmitter	Meter Options: Foundation Field Bus Transmitter	Meter Options: Inductive Alarm	Standards/Directives/Marking	Declaration/Certificate
Explosion safety "Intrinsic Safety (ia)" "Increased safety (ec)" "Enclosure Dust (tc)" For temperature limits, see Table: Process and ambient temperature limits Intrinsic Safety / Increased Safety/ Enclosure dust	ATEX IECEX		✓	✓	✓		DEKRA 13ATEX0086X (ia) DEKRA 21ATEX0326X (ec & tc) IECEx DEK13.0027X

Option	Enclosure Type	M1	M2	M1 = Apparatus with Transmitter only M2 = Apparatus with Inductive Alarm
Unit without Digital Display	Aluminum	✓ ✓	✓ ✓	II 2 G Ex ia IIC T6…T4 Gb II 2 D Ex ia IIIC T85 °C…T135 °C Db II 3 G Ex ec IIC T6…T4 Gc II 3 D Ex tc IIIC T85 °C…T135 °C Dc II 3 G Ex ic IIC T6…T4 Gc II 3 D Ex ic IIIC T85 °C…T135 °C Dc
	Stainless Steel	✓ ✓	✓ ✓	II 1 G Ex ia IIC T6…T3 Ga II 2 D Ex ia IIIC T85 °C…T200 °C Db II 3 G Ex ec IIC T6…T3 Gc II 3 D Ex tc IIIC T85 °C…T200 °C Dc II 3 G Ex ic IIC T6…T3 Gc II 3 D Ex ic IIIC T85 °C…T200 °C Dc
	Stainless Steel High Temperature	✓ ✓	✓ ✓	II 1 G Ex ia IIC T6…T2 Ga II 2 D Ex ia IIIC T85 °C…T300 °C Db II 3 G Ex ec IIC T6…T2 Gc II 3 D Ex tc IIIC T85 °C…T300 °C Dc II 3 G Ex ic IIC T6…T2 Gc II 3 D Ex ic IIIC T85 °C…T300 °C Dc
Unit with Digital Display	Aluminum	✓ ✓	✓ ✓	II 2 G Ex ia IIC T4 Gb II 2 D Ex ia IIIC T135 °C Db II 3 G Ex ec IIC T4 Gc II 3 D Ex tc IIIC T135 °C Dc II 3 G Ex ic IIC T4 Gc II 3 D Ex ic IIIC T135 °C Dc
	Stainless Steel	✓ ✓	✓ ✓	II 1 G Ex ia IIC T4…T3 Ga II 2 D Ex ia IIIC T135 °C…T200 °C Db II 3 G Ex ec IIC T4…T3 Gc II 3 D Ex tc IIIC T135 °C…T200 °C Dc II 3 G Ex ic IIC T4…T3 Gc II 3 D Ex ic IIIC T135 °C…T200 °C Dc
	Stainless Steel High Temperature	✓ ✓	✓ ✓	II 1 G Ex ia IIC T4…T2 Ga II 2 D Ex ia IIIC T135 °C…T300 °C Db II 3 G Ex ec IIC T4…T2 Gc II 3 D Ex tc IIIC T135 °C…T300 °C Dc II 3 G Ex ic IIC T4…T2 Gc II 3 D Ex ic IIIC T135 °C…T300 °C Dc

Standards used for evaluation: (13ATEX0086X, 21ATEX0326X and IECEx DEK13.0027X)
EN 60079-0:2018, EN 60079-11:2012, EN 60079-7:2015, EN 60079-31:2014
IEC 60079-0:2017, IEC 60079-11:2011 + Cor.:2012, IEC 60079-7:2015, IEC 60079-31:2013

Special conditions for safe use:

• For models marked with material code M, Titanium Grade II, the installation instructions contain the specification of the alloy, allowing the user determine the suitability of the equipment for the particular application.

• From the safety point of view the circuits shall be assumed to be connected to earth.

• On units with digital display the programming function through the LCD display shall only be done outside the hazardous area.

Table continued on next page

Table 1-11 Product Approvals (Continued)

Declarations	Mark	Mechanical	HART Transmitter	Foundation Field Bus Transmitter	Inductive Alarm	Standards/Directives/Marking	Status/Certificate
Explosion safety "Intrinsic Safety (ia)" "Non-sparking (nA)" "Enclosure Dust (tc)"	UL c UL us LISTED		✓		✓	Class I, Division 1, Groups A, B, C, and D; Class II, Division 1, Groups E, F, and G; Class III Hazardous Locations Class I, Division 2, Groups A, B, C, and D; Class II, Division 2, Groups F and G; Class III Hazardous Locations Class I, Zone 1, AEx ia IIC T2/T3/T4/T5/T6 Gb Zone 21, AEx ia IIIC T85°C/T100°C/T135°C/T200°C/T300°C Db Class I, Zone 2, AEx nA IIC T2/T3/T4/T5/T6 Gc Zone 22, AEx tc IIIC T85°C/T100°C/T135°C/T200°C/T300°C Dc For temperature limits, see Table: Process and ambient temperature limits Intrinsic Safety / Non-Sparking / Enclosure dust	E73889
Explosion safety "Flame Proof"	CSA c SP us		✓	✓	✓	Ex d IIC T6 Gb / Class I, Div.1 Group A, B, C and D Ex tb IIIC T85 Db / Class II, Div.1, Groups E, F, and G Class I, Zone 1, AEx d IIC T6 Gb / Zone 21, AEx tb IIIC T85 Db For temperature limits, see Table: Process and ambient temperature limits Flame Proof / Ex-d	14.2628516
NEMA 4X - Watertight			✓	✓	✓	NEMA 250 (Stainless Steel Enclosure)	CSA Certificate 14.2628516
NEMA 4X - Watertight		✓				NEMA 250 (Stainless Steel or Aluminum Enclosure)	DEKRA Certificate
CRN		✓	✓	✓	✓	ASME 31.3	CRN Registration Number

Declarations	Mark	Meter Options				Standards/Directives/Marking	Status/Certificate
		Mechanical	HART Transmitter	Foundation Field Bus Transmitter	Inductive Alarm		
Customs Union - Russia Declaration	EAC	✓	✓	✓	✓	TR CU 032/2013 “On safety of the equipment operating under excessive pressure”	RU Д- US.AM02.B.01243/20
Explosion safety "Flame Proof"	EAC		✓	✓	✓	Customs Union & Russia TR CU 012/2011 1 Ex d IIC «T6…T1» GbX : Ex tb IIIC «T85°C…T400°C» Db X	RU C-US.HA65.B.00647/20
Explosion safety "Intrinsic Safety (ia)" "Non-sparking (nA)" "Enclosure Dust (tc)"	EAC		✓	✓	✓	Customs Union & Russia TR CU 012/2011 Zone 1 / Zone2 - Intrinsic safety ia/ic, Zone 2 non-sparking (nA)	RU C-US.HA65.B.00647/20
Explosion safety "Flame Proof"	KOSHA		✓		✓	Exd IIC T6..T1 Gb : Ex tb IIIC T85°C…T400°C Db	15-AV4BO-0353
Explosion safety "Intrinsic Safety (ia)"	PESO		✓	✓	✓	Zone 1 - Intrinsic safety (ia), (India - Petroleum & Exposive Safety Organization PESO / CCOE)	P468175/1

Table 1-12 Process and ambient temperature limits (Document # 834Z948)

			Maximum Process Temperature (°C)					
	Temperature Class		T6	T5	T4	T3	T2	T1
Approval type	Meter type	Ambient Temperature (°C)						
Flame-proof / Ex-d CSA / ATEX/IECex	Flanged and Male Threaded versions	-40 to 32.5	85	100	135	200	300*	420*
		-40 to 47	85	100	135	200	300*	N/A
		-40 to 58	85	100	135	200	N/A	N/A
		-40 to 65	85	100	135	N/A	N/A	N/A
		-40 to 70	85	100	N/A	N/A	N/A	N/A
	ELF and Female Threaded versions	-40 to 47	85	100	135	200	300*	N/A
		-40 to 58	85	100	135	200	N/A	N/A
		-40 to 65	85	100	135	N/A	N/A	N/A
		-40 to 70	85	100	N/A	N/A	N/A	N/A
	ETFE Lines versions	-40 to 64	85	100	135	150	N/A	N/A
		-40 to 65	85	100	135	N/A	N/A	N/A
		-40 to 70	85	100	N/A	N/A	N/A	N/A
	NOTE	* For application with process temperature equal to or greater than +300 °C heat shield and custom installation required. Refer to installation manual for details.						

			Maximum Process Temperature (°C)					
	Meter Option		Without Digital Display			With or without Digital Display		
	Temperature Class		T6	T6	T5	T4	T3	T2
Approval type	Housing type	Ambient Temperature (°C)	Without Inductive Alarm	With Inductive Alarm	With or without Inductive Alarm	With or without Inductive Alarm	With or without Inductive Alarm	With or without Inductive Alarm
Intrinsic Safety / Non-Sparking / Enclosure dust ATEX/IECex	Aluminum	-40 to +35	85	85	100	135	N/A	N/A
		-40 to +40	85	85	100	126	N/A	N/A
		-40 to +45	85	85	100	115	N/A	N/A
		-40 to +50	85	85	100	104	N/A	N/A
		-40 to +55	85	84	94	94	N/A	N/A
		-40 to +60	84	76	84	84	N/A	N/A
		-40 to +65	76 **	69 **	76	76	N/A	N/A
		-40 to +70 *	69 **	N/A	69	69	N/A	N/A
	Stainless Steel	-40 to +40	85	85	100	135	200	N/A
		-40 to +45	85	85	100	135	194	N/A
		-40 to +50	85	85	100	135	167	N/A
		-40 to +55	85	85	100	135	138	N/A
		-40 to +60	85	85	100	110	110	N/A
		-40 to +65	85 **	69 **	86	86	86	N/A
		-40 to +70 *	69 **	N/A	69	69	69	N/A
	Stainless Steel High Temp	-40 to +35	85	85	100	135	200	300
		-40 to +40	85	85	100	135	200	267
		-40 to +45	85	85	100	135	200	221
		-40 to +50	85	85	100	135	182	182
		-40 to +55	85	85	100	135	149	149
		-40 to +60	85	85	100	119	119	119
		-40 to +65	85 **	69 **	91	91	91	91
		-40 to +70 *	69 **	N/A	69	69	69	69
	NOTE	* Maximum Ambient Temperature for Inductive alarm = +66 °C ** Not Applicable/Available for Foundation Field Transmitter. (Model code XV = M...U)						

Table continued on next page

Table 1-12 Process and Ambient Temperature Limits (Document # 834Z948) (continued)

			Maximum Process Temperature (°C)					
	Meter Option		Without Digital Display			With or Without Digital Display		
	Temperature Class		T6	T6	T5	T4	T3	T2
Approval Type	Housing Type	Ambient Temperature (°C)	Without Inductive Alarm	With Inductive Alarm	With or Without Inductive Alarm	With or Without Inductive Alarm	With or Without Inductive Alarm	With or Without Inductive Alarm
Intrinsic Safety / Non-Speaking / Enclosure dust cULus	Aluminum	-40 to 40	85	85	100	126	N/A	N/A
		-40 to 45	85	85	100	115	N/A	N/A
		-40 to 50	85	85	100	104	N/A	N/A
		-40 to 55	85	84	94	94	N/A	N/A
		-40 to 60	84	76	84	84	N/A	N/A
		-40 to +65	76	69	76	76	N/A	N/A
		-50 to +70*	69	N/A	69	69	N/A	N/A
	Stainless Steel	-40 to 40	85	85	100	135	200	N/A
		-40 to 45	85	85	100	135	194	N/A
		-40 to 50	85	85	100	135	167	N/A
		-40 to 55	85	85	100	135	138	N/A
		-40 to 60	85	85	100	110	110	N/A
		-40 to +65	85	69	86	86	86	N/A
		-40 to +70*	69	N/A	69	69	69	N/A
	Stainless Steel High Temp	-40 to 40	85	85	100	135	200	267
		-40 to 45	85	85	100	135	200	221
		-40 to 50	85	85	100	135	182	182
		-40 to 55	85	85	100	135	149	149
		-40 to 60	85	85	100	119	119	119
		-40 to +65	85	69	91	91	91	91
		-40 to +70*	69	N/A	69	69	69	69
	NOTE *Maximum Ambient Temperature for Inductive alarm = +66 °C							

Approval Type	Housing Type	Ambient Temperature (°C)
ATEX - Zone 1 / Zone 2, Non-Electrical	Aluminum	-20 to 70
	Stainless Steel	-20 to 70

Table 1-13 Electrical Data Intrinsic Safety (Document # 834Z948)

Electronics configuration	Function / signal	Ui,V	Ii, mA	Pi, mW	Ci, nF	Li, µH	Recommended Barrier #
4-20mA / HART	Signal 4-20mA (J1 terminals 12+ and 13-)	28	96	605	2,2	0.365	Stahl Type: 9260-13-11-10S Stahl Type : 9001/01-280-075-101
	Pulse output (J1 terminals 7+ and 8-)	10,6	19,1	51	≈0	≈0	Pepperl & Fuchs: KFA5-SR2-EX2.W KFA6-SR2-EX2.W
		10,5	13	34	≈0	≈0	Pepperl & Fuchs: KFD2-SR2-EX2.W
	Alarm circuits A (J1 terminals 1+ and 2-)	10,6	19,1	51	≈0	≈0	Pepperl & Fuchs: KFA5-SR2-EX2.W KFA6-SR2-EX2.W
		10,5	13	34	≈0	≈0	Pepperl & Fuchs: KFD2-SR2-EX2.W
	Alarm circuits B (J1 terminals 4+ and 5-)	10,6	19,1	51	≈0	≈0	Pepperl & Fuchs: KFA5-SR2-EX2.W KFA6-SR2-EX2.W
		10,5	13	34	≈0	≈0	Pepperl & Fuchs: KFD2-SR2-EX2.W
		Uo,V	**Io, mA**	**Po, mW**	**Co, µF**	**Lo, mH**	**Notes**
	Remote zero loop signal (J1 terminals 10+ and 11-)	28	2,83	80	0.083	44	

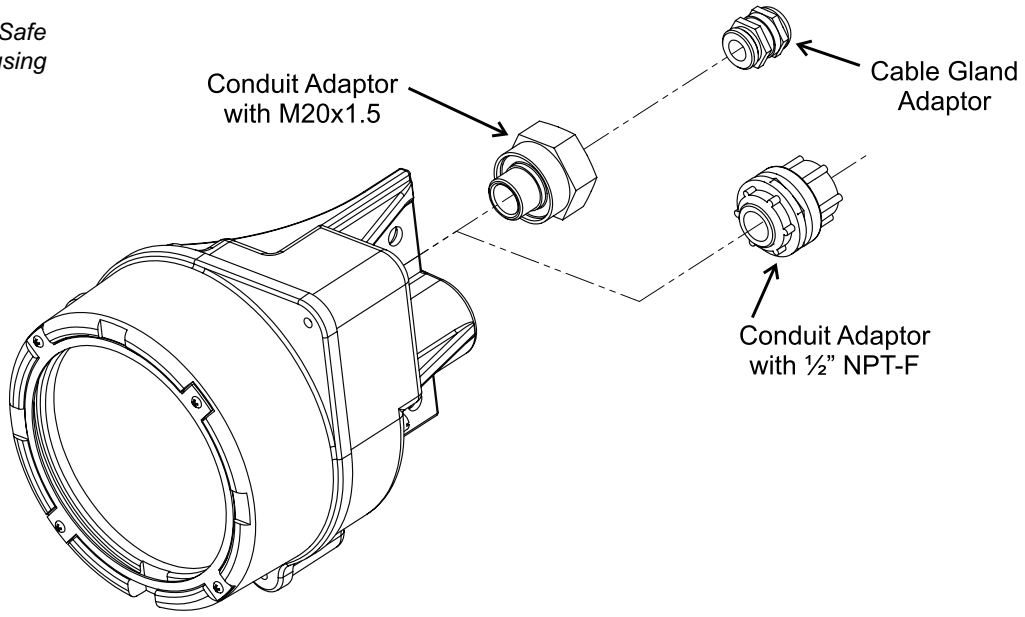
		Ui,V	Ii, mA	Pi, mW	Ci, nF	Li, mH	Recommended Barrier #
Foundation Fieldbus	FOUNDATION Fieldbus loop (J1 terminals 10+/11+ and 12-/13-)	24	380	5320	0	0	FISCO barrier
	Pulse output (J1 terminals 5+ and 6-)	10,6	19,1	51	≈0	≈0	Pepperl & Fuchs: KFA5-SR2-EX2.W KFA6-SR2-EX2.W
		10,5	13	34	≈0	≈0	Pepperl & Fuchs: KFD2-SR2-EX2.W
	Alarm circuits A (J1 terminals 1+ and 2-)	10,6	19,1	51	≈0	≈0	Pepperl & Fuchs: KFA5-SR2-EX2.W KFA6-SR2-EX2.W
	Alarm circuits B (J1 terminals 3+ and 4-)	10,6	19,1	51	≈0	≈0	Pepperl & Fuchs: KFA5-SR2-EX2.W KFA6-SR2-EX2.W
		Uo,V	**Io, mA**	**Po, mW**	**Co uF**	**Lo mH**	**Notes**
	Remote zero loop signal (J1 terminals 8+ and 9-)	8,03	0,81	6,5	8,4	1215	

		Ui,V	Ii, mA	Pi, mW	Ci, nF	Li, µH	Recommended Barrier #
Inductive Alarms	Inductive High Alarm circuits (terminals «+» and «-») – for connection of circuits Pepperl+Fuchs mod. SJ 3,5-SN type 2	10,6	19,1	51	30	100	Pepperl & Fuchs:KFA5-SR2-EX2.W or KFA6-SR2-EX2.W
	Inductive Low Alarm circuits (terminals «+» and «-») – for connection of circuits Pepperl+Fuchs mod. SJ 3,5-SN type 2	10,6	19,1	51	30	100	Pepperl & Fuchs:KFA5-SR2-EX2.W or KFA6-SR2-EX2.W

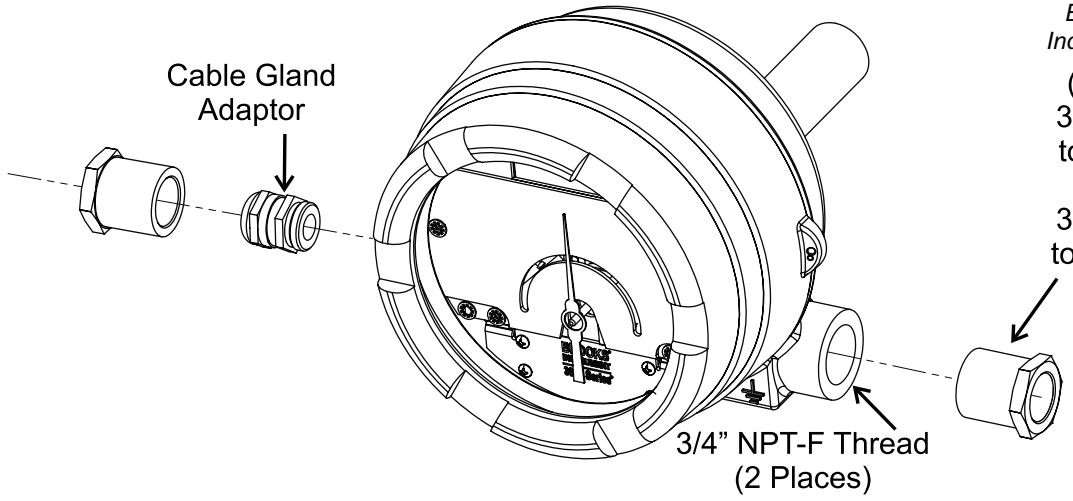
Table 1-14 Electrical Entries

Protection Concept / Electrical Connection Entry	ATEX/IECEx		CSA	UL
	Ex db/Ex tb	Ex ia, Ex ic Ex nA, Ex tc	Ex db/Ex tb	Ex ia, Ex ic Ex nA, Ex tc
3/4" NPT - F	X	X	X	X
3/4" NPT-M to M20 X 1.5 (Adaptor)	X	X	X	X
3/4" NPT-M to 1/2" NPT - F (Adapter)	X	X		X
Cable Gland (Adapter)		X		

MT3809G
Instrinsically Safe
Indicator Housing



MT3809G
Explosion Proof
Indicator Housing



General

This section contains the procedures for the receipt and installation of the instrument. Do not attempt to start the system until the instrument has been permanently installed. It is extremely important that the start-up procedures be followed in the exact sequence presented.

Receipt of Equipment

When the equipment is received, the outside packing case should be checked for damage incurred during shipment. If the packing case is damaged, the local carrier should be notified at once regarding his liability. A report should be submitted to the nearest Brooks Instrument location listed on the Global Service Network page on our website: BrooksInstrument.com/GlobalSupportCenters

Remove the envelope containing the packing list. Carefully remove the instrument from the packing case. Make sure spare parts are not discarded with the packing materials. Inspect for damaged or missing parts.

Recommended Storage Practices

If intermediate or long-term storage is required for equipment, as supplied by Brooks Instrument, it is recommended that the equipment be stored in accordance with the following:

a. Within the original shipping container.
b. Stored in a sheltered area, preferably a warm, dry, heated warehouse.
c. Ambient temperature of 21°C (70°F) nominal, 43°C (110°F) maximum, 7°C (45°F) minimum.
d. Relative humidity 45% nominal, 60% maximum, 25% minimum.

Upon removal from storage, a visual inspection should be conducted to verify the condition of equipment is "as received".

Return Shipment

Prior to returning any instrument to the factory for any reason, visit our website for instructions on how to obtain a Return Materials Authorization Number (RMA #) and complete a Decontamination Statement to accompany it: BrooksInstrument.com/Service. All instruments returned to Brooks also require a Material Safety Data Sheet (MSDS) for the fluid(s) used in the instrument. Failure to provide this information will delay processing of the instrument.

Instrument must have been purged in accordance with the following:

⚠WARNING

Before returning the device, purge thoroughly with a dry inert gas such as Nitrogen before disconnecting process connections. Failure to correctly purge the instrument could result in fire, explosion or death. Corrosion or contamination may occur upon exposure to air.

Installation of Flowmeter

⚠WARNING

If the inlet and outlet valves adjacent to the indicator are to be closed for any reason, the indicator must be completely drained. Failure to do so may result in thermal expansion of the liquid which can rupture the meter and cause possible personal injury.

⚠CAUTION

Meters weighing more than 40 pounds/18 kilograms are labeled and should be handled with care to prevent personal injury. The product can be lifted by the meter flange or meter pipe. The caution label is shown below.



⚠WARNING

The meter is capable of process fluids to 750°F/400°C with specific options. It is recommended that user install label(s) indicating hot surfaces.

Recommended installation for Models MT3809 and MT3810 is as follows:

a. Carefully remove the covers from each end of the flowmeter. The float may be fixed to avoid damage during transport. These plugs must be removed before use.

b. Install the flowmeter with the inlet at the bottom and the outlet at the top.

⚠CAUTION

Since this is a magnetically activated device, strong magnetic fields and materials with magnetic properties may cause faulty operation when in close proximity to the flowmeter. This includes steel pipes, steel conduit, motors and transformers.

⚠CAUTION

Flowmeters with a transmitter must be mounted at least 0.5 meters (18 inches) apart to prevent the interaction of adjacent float magnets and transmitter.

c. When installing the flowmeter in the process line, follow accepted plumbing practices.

i. **For flanged meters (without lining):**
Select bolts and gaskets (customer supply) in keeping with the flange pressure rating or the operating pressure. Also note corrosion resistance and thermal stability.
Align gasket and tighten nuts using the torques specified for the relevant pressure ratings. Advised bolting acc. ASTM A307 Grade B

ii. **For threaded meters:**
Follow the applicable installation instructions for threaded connections.
Important: ensure that thread sealing material does not get into the flow path. Loose pieces can cause obstruction inside the measurement section of the meter, and potentially even blockage of the measurement float within the measurement tube.

iii. **For ETFE lined meters:**
Select bolts and gaskets (customer supply) in keeping with the flange pressure rating or the operating pressure. Also note corrosion resistance and thermal stability.
Important: the inside diameter of the flanges deviates from the standard dimensions. Enlarge the flange gaskets to the appropriate size.Align gasket and tighten nuts using the torques specified in Table 2-1
Important: PTFE is deformable under pressure in the cold state. Do not exceed maximum torque.

d. Install the flowmeter within 5° of true vertical. Use of a level is recommended to determine the proper alignment.

e. When the process temperature is 300°C / 572°F or above insulation is required on the meter body and flanges. The insulation is installed between the indicator housing and the body and flanges. Do not wrap the indicator with insulation.

Recommended insulation materials are calcium silicate, cellular glass or mineral wool with a thermal conductivity of .083 W/m-K at 300°C / 572°F.

Installation and Maximum Torques of Model MT3809 ETFE

MAXIMUM TORQUES MODEL MT3809 ETFE
Please refer to Table 2-1 below.

- Select **bolts and gaskets** (customer supply) in keeping with the flange pressure rating or the operating pressure. Also note corrosion resistance and thermal stability.
Important: the inside diameter of the flanges deviates from the standard dimensions. Enlarge the flange gaskets to the appropriate size.
- **Align gaskets**, tighten nuts using the torques specified for the relevant pressure ratings.
- **Measuring section with E/TFE line with PTFE sealing face**
PTFE is deformable under pressure in the cold state.
- Tighten the flange bolts nuts only with the following maximum torques:
- Advised bolting acc. ASTM A307 Grade B)

Table 2-1 Maximum Torques Model MT3809 ETFE

Connection size				Stud bolts			Max. torque	
DIN		ASME		DIN	ASME			
DN	PN	inch	lb		150lb	300lb	Nm	ft.lbs
15	40	1/2"	150/300	4x M12	4x 1/2"	4x 1/2"	3.4	2.5
25	40	1"	150/300	4x M12	4x 1/2"	4x 5/8"	6.5	4.8
40	40	1,5"	150/300	4x M16	4x 1/2"	4x 3/4"	13.6	10
50	40	2"	150/300	4x M16	4x 5/8"	8x 5/8"	23.6	17.4

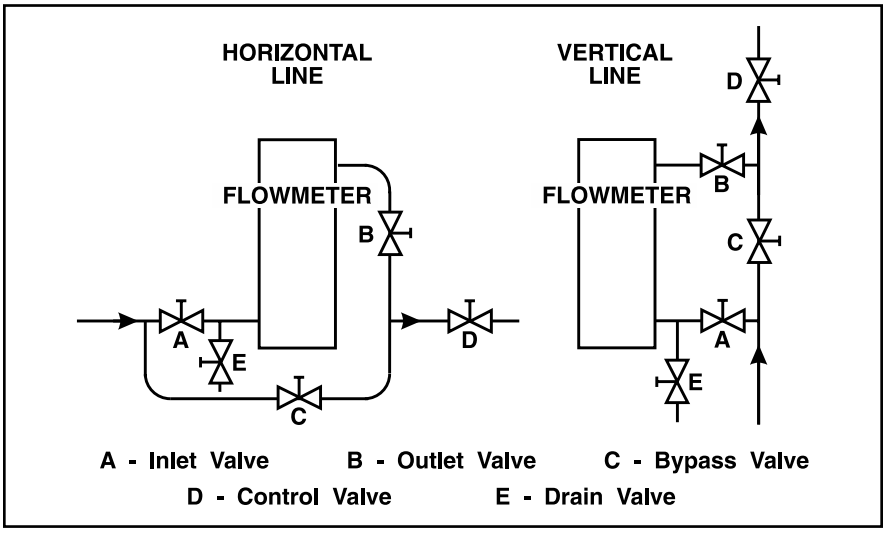


Figure 2-1 Typical Bypass Installation

How to Remove and Reinstall GP Housing Indicator Covers







Directions to remove and reinstall the GP Housing Cover and adjust the Pointer:

1. To begin, make sure the float is at rest and there isn't flow going through the meter.

2. Loosen the 4 cover screws.

- For aluminum housing, use a T20 TORX drive tool.

- For stainless steel housing, use a #2 Phillips drive tool. Note, the screws will stay attached to the cover.

3. Remove the cover from the housing. The gasket should still be attached to the cover in the gasket groove. If not, place the gasket into the groove of the cover.

4. Using a flat blade screwdriver with a 1/8" blade, hold the pointer and turn the screw to align with the "R" on the scale. It may take a few adjustments to get the pointer on the "R".

5. To replace the cover, place the cover against the housing and tighten the 4 screws using the same tool used in step 2. Tighten to 45 in-lbs or 5.08 N-m to keep a watertight seal. and tighten the 4 screws using a T20 TORX tool. Tighten to 45 in-lbs or 5.08 N-m to keep a watertight seal.







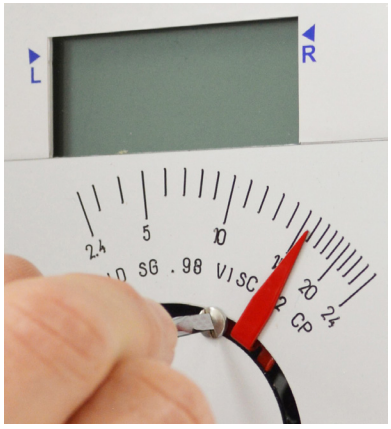
How to Remove and Reinstall IS Housing Indicator Covers

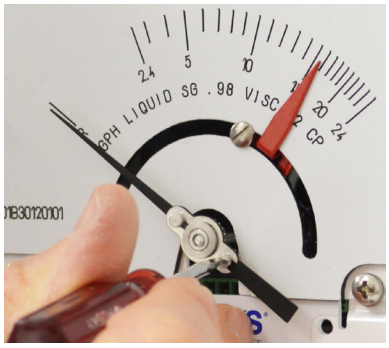
⚠ WARNING

If it becomes necessary to service or remove the instrument from the system, power to the device is disconnected at the power supply.





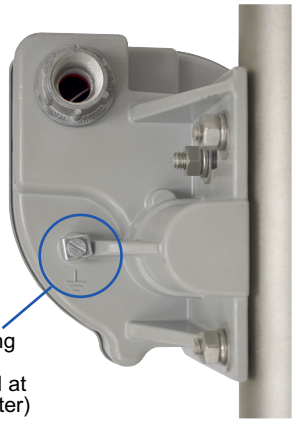




Directions to remove and reinstall the IS Housing Indicator Cover, adjust Alarms and the Pointer:

1. To begin make sure the float is at rest and there isn't flow going through the meter.
2. Using a T20 TORX tool loosen the 3 cover screws. Note, the screws will stay attached to the cover.
3. Remove the cover from the housing. The gasket should still be attached to the cover in the gasket groove. If not place the gasket into the groove of the cover.
4. Using a flat blade screwdriver with a 1/8" blade, hold the red alarm pointer and turn the screw counterclockwise to loosen the pointer, slide it to desired position on scale and tighten screw.
5. Using a flat blade screwdriver with a 1/8" blade, hold the pointer and turn the screw to align with the "R" on the scale. It may take a few adjustments to get the pointer on the "R".
6. To replace the cover, place the cover against the housing and tighten the 3 screws using a T20 TORX tool. Tighten to 45 in-lbs or 5.08 N-m to keep a watertight seal.





Grounding Screw (accessed at rear of meter)

How to Remove and Reinstall XP Housing Indicator Covers

⚠ WARNING

If it becomes necessary to service or remove the instrument from the system, power to the device is disconnected at the power supply.



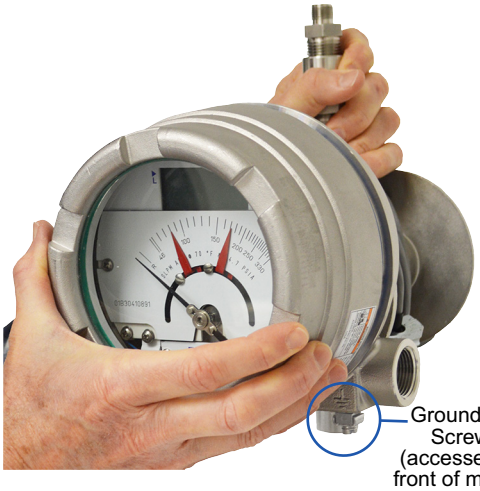






Directions to remove and reinstall the XP Housing Indicator Cover, adjust Alarms and the Pointer:

1. To begin make sure the float is at rest and there isn't flow going through the meter.
2. Using your hands or a strap wrench turn the cover counter clockwise to remove the cover from the housing
3. Remove the cover from the housing. The gasket should stay attached to the groove in the housing
4. Using a flat blade screwdriver with a 1/8" blade, hold the red alarm pointer and turn the screw counterclockwise to loosen the pointer, slide it to desired position on scale and tighten screw.
5. Using a flat blade screwdriver with a 1/8" blade, hold the pointer and turn the screw to align with the "R" on the scale. It may take a few adjustments to get the pointer aligned to the "R".
6. To replace the cover, place the cover against the housing and turn the cover clockwise. Note, it will take several rotations to tighten the cover and the cover must be in contact with the gasket to keep a watertight seal.



Electrical Connections to MT3809 with 4-20 mA/HART Transmitter, Alarms and Pulse Output

⚠ WARNING

If it becomes necessary to service or remove the instrument from the system, power to the device is disconnected at the power supply.

a) Before electrical connection, install the meter into the pipeline as described in previous Section 2.5.
b) The electrical installation practice for conventional 4-20 mA and wired HART devices is generally the same:

i. To avoid electrical interference and to meet the Electro Magnetic Compatibilty (EMC directive) requirements, use individually shielded twisted pair cable, either in single pair or multi-pair varieties. The minimum conductor size is 0.51mm diameter (#24 AWG) for cable runs less than 1,500 meters (@ 5,000 ft.) and 0.81mm diameter (#20 AWG) for longer distances.

ii. In case of installation into explosion hazardeous environments it is important to eliminate a potential incentive level of circulating current through the cable shield in the event that there are local differences in chassis ground potential between the two ends of the cable. Therefore, able shields shall be connected to chassis ground (earth) in accordance with the applicable national & regional installation codes and regulations. A terminal screw inside the device allows for shield to chassis connection in case the applicable installation regulation requires earthing at the transmitter end.

iii. To prevent external interference, the signal loop should be grounded at one point only. The single ground point will usually be at or near the host (e.g. at the control system).

iv. Ensuring a properly specified power supply. Power for a two-wire instrument loop is typically 24 Vdc. The voltage must be sufficient to provide the necessary minimum voltage at the transmitter terminal. Take into account voltage drops in the cable and load resistor, as well as from any intrinsic safety barrier present. The transmitter could take up to 22 mA to indicate an alarm condition. Use this value to calculate the worst loop voltage drop.

The maximum resistance of the loop resistor, the associated cable and the barrier is determined by the power supply voltage and is shown graphically in Figure 2-2.

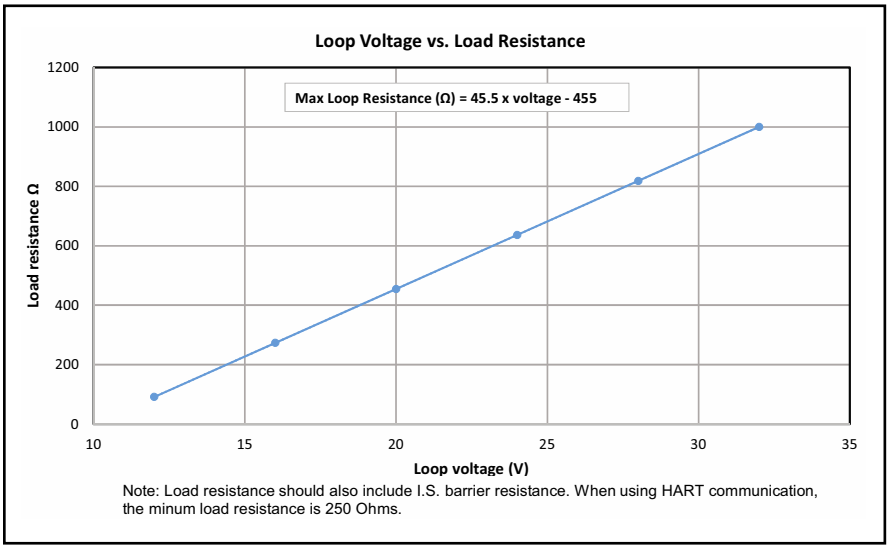


Figure 2-2 Power Supply vs. Maximum Load Resistance

v. Staying below the maximum allowable cable length which depends upon the cable capacitance and the number of network devices. Most installations are well within the 3000 meter (10,000 ft) theoretical limit for HART communication. However, the electrical characteristics of the cable (primarily its capacitance) and the number of connected devices can affect the maximum allowable cable length. Detailed information for determining the maximum cable length for any HART network configuration can be found in the HART Physical Layer Specifications.

c) The housing of the transmitter should be grounded in accordance with the applicable installation regulations. When the device is not sufficiently grounded via the process cables, a grounding terminal screw is available on the transmitter housing for earth connection.

d) Transmitter wiring connection diagrams are given in Sections 2-6-1. (4-20 mA/HART Transmitter Instrinsically Safe Installation), 2-6-2. (4-20mA/HART Transmitter Division 2 Installation) and 2-6-3. (4-20mA/HART Transmitter Flameproof Installation). Ensure that the installation complies with given hazardeous area protection requirements.

i. Intrinsically safe installations require the use of barriers, power supply limits and cable parameters as shown in the installation diagram. All connections are made in the transmitter housing.

ii. If the area classification is Division 2, barriers are not required and cable parameters are not applicable. However, the electrical code will require the use of conduit for wire protection.

iii. For flameproof installation the optional explosion proof enclosure is required and explosion proof installation methods must be followed

iv. For both Division 1 explosion proof and Division 2 non-incendive installations, the barriers shown in the installation drawings are optional.

⚠WARNING

To prevent ignition of hazardous atmospheres and serious personal injury, proper installation methods must be used as defined in Article 505 of the National Electrical Code, and the Canadian Electrical Code and ISA Standard 12.6 and in accordance with Cenelec regulations.

Transmitter with alarm and pulse output wiring connections
The alarm contact and pulse output digital signals are electrically identical, independent, optically coupled transistor outputs. Wiring will be as required by the external driven system - Prover, DCS/PLC, terminal-automation system, batch controller etc. These can be wired as an open collector or open signal on the high or low side of voltage-rail within the receiving equipment, depending upon the signal needs. When interfacing to external electronics, be careful to work within the voltage/current polarity and limits as specified in Section 1.

e) Common transmitter parameters are set during manufacturing at Brooks Instrument based on order information, meter configuration or defaults inherent to the transmitter. Further detailed configurations as well as on-line monitoring can be done through standard HART or FOUNDATION™ Fieldbus communication protocol, see Section 3-3. for details.

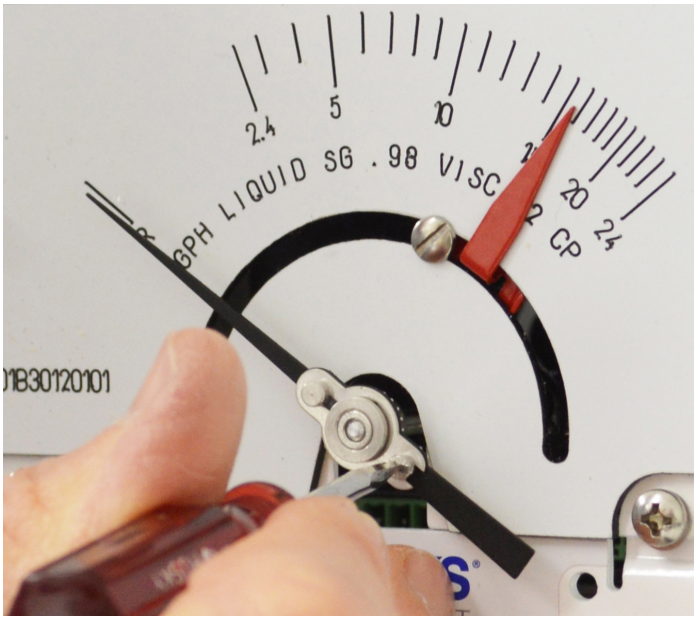
The float is constructed with an integral magnet that activates a magnetic sensor that is part of the transmitter. This same float magnet also drives the mechanical pointer. The flow rate is scaleable by setting independent high and low range parameters. The analog output (AO) transmitter parameters, AO Hi-Range and AO Lo-Range span the 4-20 mA signal. For example, if flow rate is normally between 100 and 500 gpm, the AO Hi-Range parameter is set at 500 and the AO Lo-Range is set at 100.

f) Typically applications require only the use of the 2 wire loop analog signal. In some applications where transmitters and actuators are widely separated (e.g. tank farms), devices are wired in a multi-drop configuration to save wiring costs. Each unit is given an individual HART address to distinguish each unit during communications over a common wire pair. In this configuration, the 4-20 mA output signal cannot be used. Follow the general HART foundation instructions for setting up a multi-drop configuration.

g) After installation and powering of the loop, the transmitter must be zeroed, both electrically and mechanically. This operation will compensate for any stray magnetic effects in the vicinity of the transmitter.
Important: The zero adjusting of the pointer influences the transmitter indication, but not the other way around. Therefore, first adjust the pointer at the zero flow position, then the transmitter must be zeroed.

i. Flow must be verified to be zero during the entire zeroing.

ii. With the flow at zero and the float at the zero flow position, adjust the mechanical indicator to point to the ‘R’ (reference line) using the adjustment screw on the face of the pointer, next to the hub.



Using a flat blade screwdriver with a 1/8" blade, hold the pointer and turn the screw to align with the “R” on the scale.

It may take a few adjustments to get the pointer on the “R”.

Figure 2-3 Mechanical Indicator Zero

iii. Then, zero the transmitter shorting the two pins at the terminal block. Reference Figure 2-4 below.

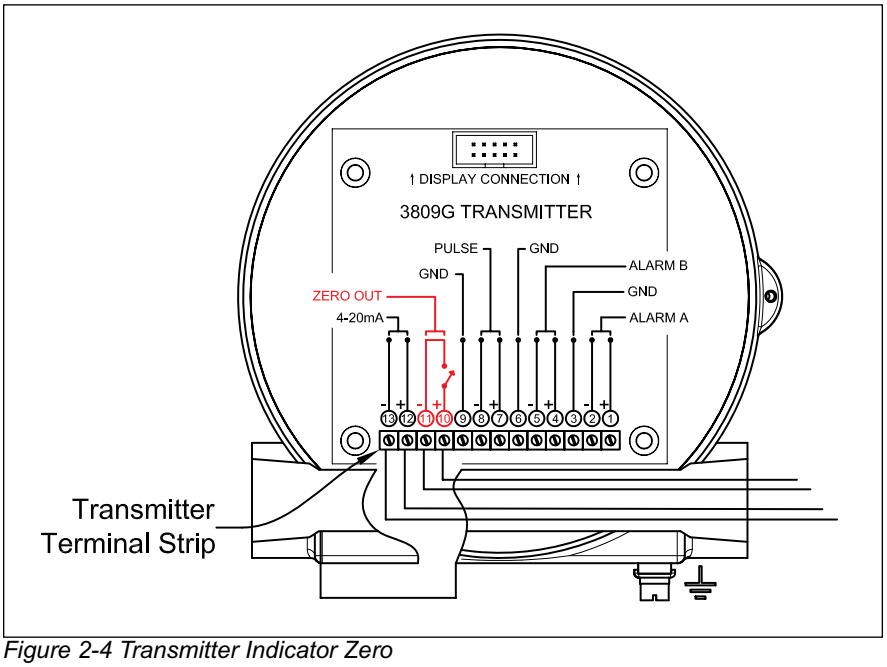


Figure 2-4 Transmitter Indicator Zero

Note: The zero function may be activated as part of a periodical maintenance check. If desired, a zero switch can be remotely mounted and wired to these terminals. The hazardous area classification will determine the wiring methods used for this switch.

h) Under actual flow conditions, verify that the transmitter output matches the mechanical pointer position. If a discrepancy is noted, the HART communications channel can be used to verify or adjust the transmitter settings repositioning the pointers.

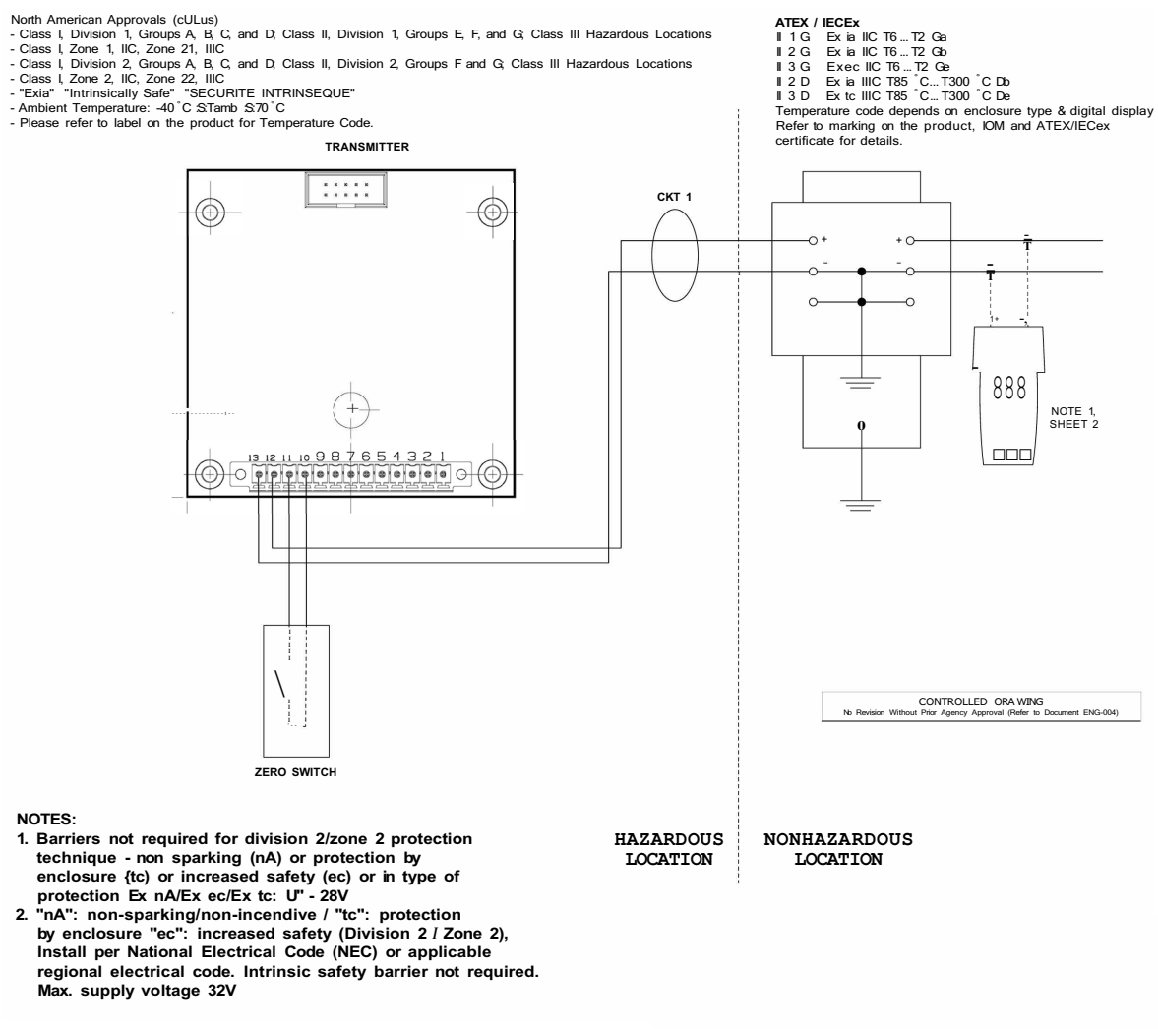
Installation of the Model MT3809 Flowmeter with Transmitter and Digital Display and Inductive Alarms

a. Install the meter as described in Section 2-5
b. Install the transmitter as described in Section 2-6
c. Install the inductive alarms as indicated below Section 2-8

4-20 mA/HART Transmitter Intrinsically Safe Installation

For intrinsically safe installation, intrinsic safety barrier selection, cable parameters, and power supply limits must be in accordance with the entity parameters shown in Figure 2-5a/2-5b. Alternatively, the optional intrinsically safe power supply available from Brooks may be used. Cable parameters for inductance and capacitance still apply.

Note: To ensure full EMC protection the ferrite core included with the meter must be installed to the input power I/O cable at the supply end of cable.



(Continued on next page)

Figure 2-5 Wiring Diagram, Model MT3809 Transmitter, 4-20 mA

1. This device is a Rosemount hand help communicator.
2. WARNING: SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY, AVERTISSEMENT: LA SUBSTITUTION DE COMPOSANTS PEUT COMPROMETTRE LA SÉCURITÉ INTRINSÈQUE
3. WARNING – EXPLOSION HAZARD – DO NOT DISCONNECT WHILE CIRCUIT IS LIVE UNLESS AREA IS KNOWN TO BE NON-HAZARDOUS. AVERTISSMENT – RISQUE D'EXPLOSION NE PAS DÉBRANCHER TANT QUE LE CIRCUIT EST SOUS TENSION À MOINS QU'IL NE S'AGISSE D'UN EMPLACEMENT NON DANGEREUX.
4. THIS EQUIPMENT IS SUITABLE FOR USE IN CLASS I, DIVISION 2, GROUPS (AS APPLICABLE) OR NON-HAZARDOUS LOCATIONS ONLY. CET EQUIPEMENT CONVIENT POUR UTILISATION CLASSE I, DIVISION 2, GROUPES (TOUS) OU LOCATIONS NON-DANGEREUSES SEULEMENT.
5. WARNING – ENCLOSURE CONTAINS ALUMINUM. PRECAUTIONS MUST BE TAKEN TO AVOID IGNITION DUE TO IMPACT. AVERTISSEMENT- LE BOÎTIER CONTIENS DE L'ALUMINIUM, DES PRÉCAUTIONS S'APPLIQUENT POUR ÉVITER L'IGNITION PAR IMPACT.
6. WARNING – FROM A SAFETY POINT OF VIEW THE CIRCUITS SHALL BE ASSUMED TO BE CONNECTED TO EARTH AVERTISSEMENT: PAR SÉCURITÉ LES CIRCUITS DEVRAIENT ÊTRE RELIÉS À LA MISE À LA TERRE.
7. Note for cULus approvals units: For devices using cable gland at field installation the following cable gland shall be used - American IP67 cable gland for the aluminum housing and an American rated IP68 cable gland for the Stainless steel and high temperature housings.
8. Entity Parameters:
   In type of protection Ex ia IIC/IIIC or Ex ic IIC/IIIC, only for connection to a certified intrinsically safe circuit, with following maximum values.

	Ui,V	Ii, mA	Pi, mW	Ci, nF	Li, µH	Recommended Barrier #
Signal 4-20mA (J1 terminals 12+ and 13-)	28	96	605	2,2	0.365	Stahl Type : 9001/01-280-075-101 Stahl Type : 9260-13-11-105
	Uo,V	Io, mA	Po, mW	Co, µF	Lo, mH	Notes
Remote zero loop signal (J1 terminals 10+ and 11-)	28	2.83	80	0.083	44	

   # Note: The Recommended barrier listed above is not part of this UL certification.
9. The intrinsically safe device does not provide 500 V isolation with respect to earth.
   Associated apparatus used must be galvanically isolated or dual channel shunt zener diode barriers with linear outputs used channel to channel.
10. Selected associated apparatus must be third party listed as providing intrinsically safe circuits for the application, and have Voc or Vt not exceeding Vmax (or Uo not exceeding Ui), Isc or It not exceeding Imax (or Io not exceeding Ii), and the Po of the associated apparatus must be less than or equal to the Pmax or Pi of the intrinsically safe equipment, as shown in Table 1.
11. Capacitance and inductance of the field wiring from the intrinsically safe equipment to the associated apparatus shall be calculated and must be included in the system calculations as shown in Table 1. Cable capacitance, Ccable, plus intrinsically safe equipment capacitance, Ci, must be less than the marked capacitance, Ca (or Co), shown on any associated apparatus used. The same applies for inductance (Lcable, Li and La or Lo, respectively). Where the cable capacitance and inductance per foot are not known, the following values shall be used: Ccable = 60 pF/ft., Lcable = 0.2 µH/ft.

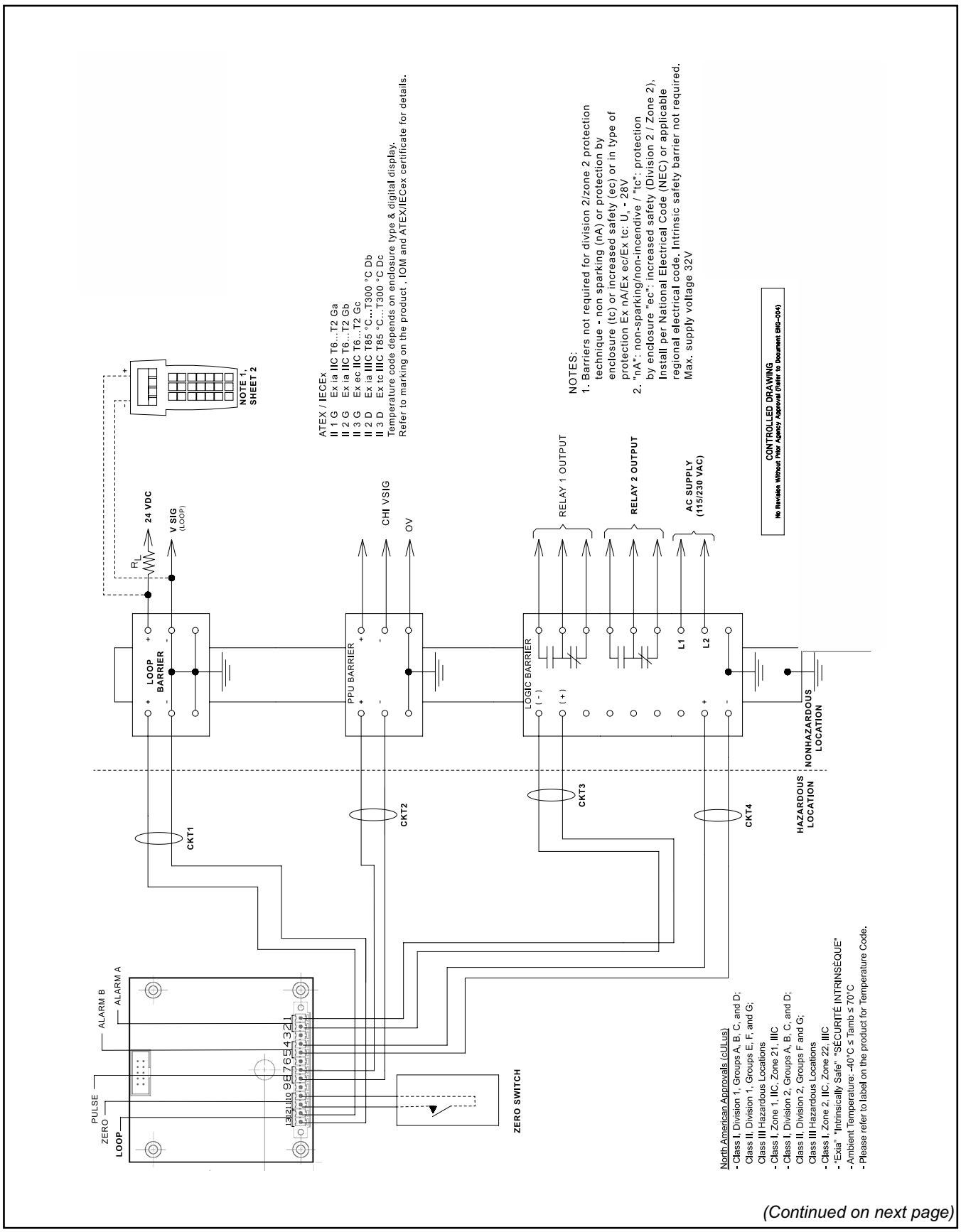
TABLE 1: I.S. Equipment		Associated Apparatus
V max (or Ui)	≥	Voc or Vt (or Uo)
I max (or Ii)	≥	Isc or It (or Io)
Pmax (or (Pi)	≥	Po
Ci + Ccable	≤	Ca (or Co)
Li + Lcable	≤	La (or Lo)

   If Po of the associated apparatus is not known, it may be calculated using the formula Po = (Voc * Isc)/4 = (Uo * Io)/4.

12. Associated apparatus must be installed in accordance with its manufacturer's control drawing and Article 504 of the National Electrical Code (ANSI/NFPA 70) for installation in the United States, or Section 18 of the Canadian Electrical Code for installations in Canada.
13. When required by the manufacturer's control drawing, the associated apparatus must be connected to a suitable ground electrode per the National Electrical Code (ANSI/NFPA 70), the Canadian Electrical Code, or other local installation codes, as applicable. The resistance of the ground path must be less than 1 ohm.
14. Where multiple circuits extend from the same piece of intrinsically safe equipment to associated apparatus, they must be installed in separate cables or in one cable having suitable insulation. Refer to Article 504.30(B) of the National Electrical Code (ANSI/NFPA 70) and Instrument Society of America Recommended Practice ISA RP12.6 for installing intrinsically safe equipment.
15. Associated apparatus must not be used in combination unless permitted by the associated apparatus certification.
16. Control equipment must not use or generate more than 250 V rms or dc with respect to earth.
17. Standards use for evaluation:
    US Standards: UL 913 - Ed 8, UL 60079-31 - Ed 2, UL 60079-15 - Ed 4, UL 60079-11 - Ed 6, UL 60079-0 - Ed 6, ISA 12.12.01
    Canadian Standards: CSA C22.2 NO. 157 - Ed 3, CSA C22.2 NO. 213-M1987 - Ed 1, CSA C22.2 NO. 60079-0:11 - Ed 2, CSA C22.2 NO. 60079-11:14 - Ed 2, CSA C22.2 NO. 60079-15:12 - Ed 1, CSA C22.2 NO. 60079-31:12 - Ed 1

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Figure 2-5 Wiring Diagram, Model MT3809 Transmitter, 4-20 mA (continued)



(Continued on next page)

Figure 2-6 Wiring Diagram, Model MT3809, 4-20 mA Transmitter, One or Two Optical Alarms and PPU

1. This device is a Rosemount hand help communicator.
2. WARNING: SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY. AVERTISSEMENT: LA SUBSTITUTION DE COMPOSANTS PEUT COMPROMETTRE LA SÉCURITÉ INTRINSÈQUE
3. WARNING – EXPLOSION HAZARD – DO NOT DISCONNECT WHILE CIRCUIT IS LIVE UNLESS AREA IS KNOWN TO BE NON-HAZARDOUS.
   AVERTISSMENT – RISQUE D'EXPLOSION. NE PAS DÉBRANCHER TANT QUE LE CIRCUIT EST SOUS TENSION À MOINS QU'IL NE S'AGISSE D'UN EMPLACEMENT NON DANGEREUX.
4. THIS EQUIPMENT IS SUITABLE FOR USE IN CLASS I, DIVISION 2, GROUPS (AS APPLICABLE) OR NON-HAZARDOUS LOCATIONS ONLY. CET EQUIPEMENT CONVIENT POUR UTILISATION CLASSE I, DIVISION 2, GROUPES (TOUS) OU LOCATIONS NON-DANGEREUSES SEULEMENT.
5. WARNING – ENCLOSURE CONTAINS ALUMINUM. PRECAUTIONS MUST BE TAKEN TO AVOID IGNITION DUE TO IMPACT.
   AVERTISSEMENT- LE BOÎTIER CONTIENS DE L'ALUMINUM. DES PRÉCAUTIONS S'APPLIQUENT POUR ÉVITER L'IGNITION PAR IMPACT.
6. WARNING – FROM A SAFETY POINT OF VIEW THE CIRCUITS SHALL BE ASSUMED TO BE CONNECTED TO EARTH
   AVERTISSEMENT: PAR SÉCURITÉ LES CIRCUITS DEVRAIENT ÊTRE RELIÉS À LA MISE À LA TERRE.
7. Note for cULus approvals units: For devices using cable gland at field installation the following cable gland shall be used - American IP67 cable gland for the aluminum housing and an American rated IP68 cable gland for the Stainless steel and high temperature housings.
8. Entity Parameters:
   In type of protection Ex ia IIC/IIC or Ex ic IIC/IIC, only for connection to a certified intrinsically safe circuit, with following maximum values.

CONTROLLED DRAWING
No Revision Without Prior Agency Approval (Refer to Document ENG-004)

Input/Output	Ui, V	Ii, mA	Pi, mW	Ci, nF	Li, µH	Recommended Barrier #
Signal 4-20mA (J1 terminals 12+ and 13-)	28	96	605	2.2	0.365	Stahl Type: 9001/01-280-075-101
Pulse output (J1 terminals 7+ and 8-)	10.6	19,1	51	~0	~0	Pepperl & Fuchs: KFA5-SR2-EX2.W or KFA6-SR2-EX2.W
	10,5	13	34	~0	~0	Pepperl & Fuchs: KFD2-SR2-EX2.W
Alarm circuits (J1 terminals 1+ and 2-)	10.6	19,1	51	~0	~0	Pepperl & Fuchs: KFA5-SR2-EX2.W or KFA6-SR2-EX2.W
	10,5	13	34	~0	~0	Pepperl & Fuchs: KFD2-SR2-EX2.W
Alarm circuits (J1 terminals 4+ and 5-)	10,6	19,1	51	~0	~0	Pepperl & Fuchs: KFA5-SR2-EX2.W or KFA6-SR2-EX2.W
	10,5	13	34	~0	~0	Pepperl & Fuchs: KFD2-SR2-EX2.W
	Uo,V	Io, mA	Po, mW	Co, µF	Lo, mH	Notes
Remote zero loop signal (J1 terminals 10+ and 11-)	28	2,83	80	0,083	44	

Note: The Recommended barriers listed above are not part of this UL certification.

9. The intrinsically safe device does not provide 500 V isolation with respect to earth. Associated apparatus used must be galvanically isolated or dual channel shunt zener diode barriers with linear outputs used channel to channel.
10. Selected associated apparatus must be third party listed as providing intrinsically safe circuits for the application, and have Voc or Vt not exceeding Vmax (or Uo not exceeding Ui), Isc or It not exceeding Imax (or Io not exceeding Ii), and the Po of the associated apparatus must be less than or equal to the Pmax or Pi of the intrinsically safe equipment, as shown in Table 1.
11. Capacitance and inductance of the field wiring from the intrinsically safe equipment to the associated apparatus shall be calculated and must be included in the system calculations as shown in Table 1. Cable capacitance, Ccable, plus intrinsically safe equipment capacitance, Ci, must be less than the marked capacitance, Ca (or Co), shown on any associated apparatus used. The same applies for inductance (Lcable, Li and La or Lo, respectively). Where the cable capacitance and inductance per foot are not known, the following values shall be used: Ccable = 60 pF/ft., Lcable = 0,2 µH/ft.

TABLE 1:

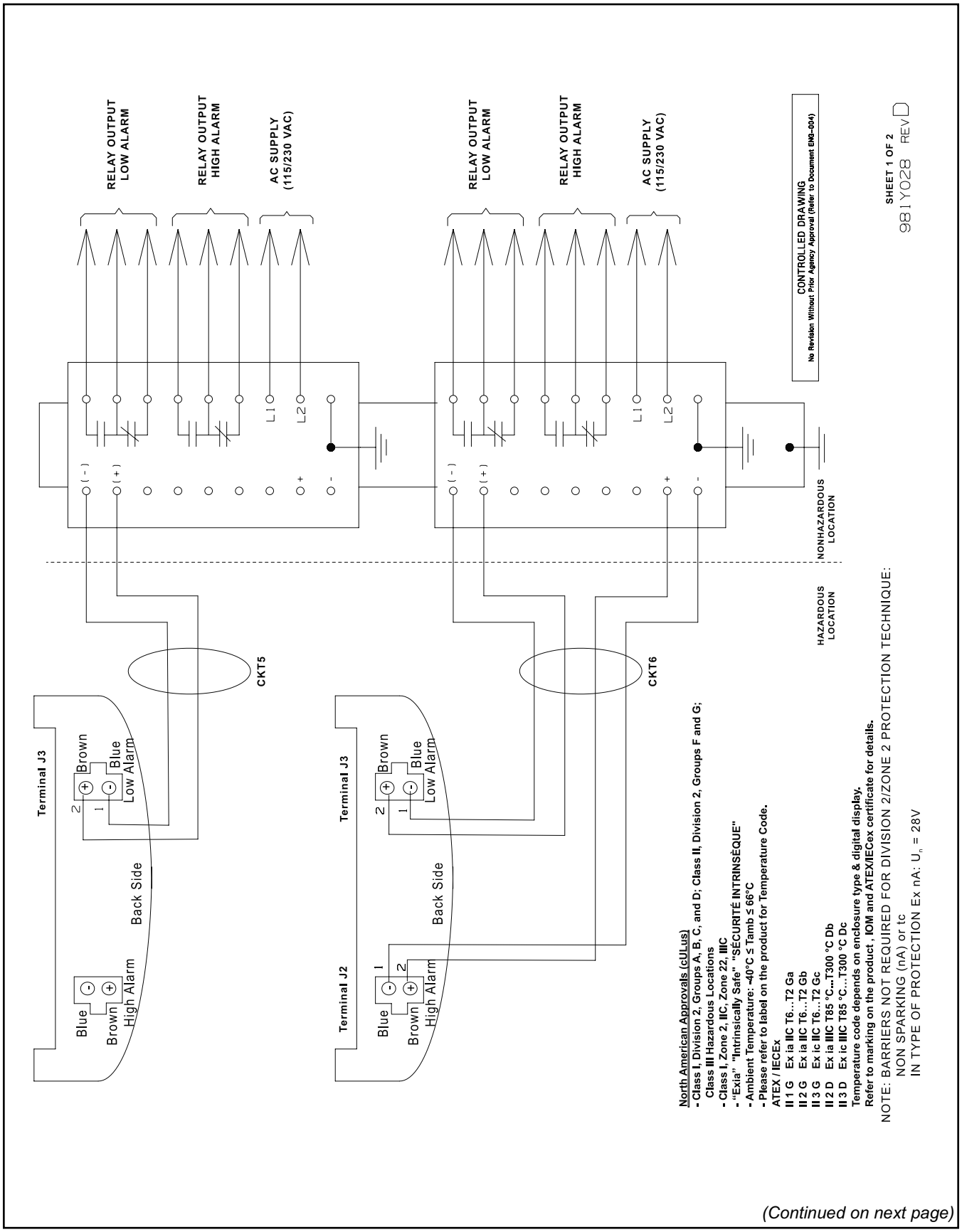
I.S. Equipment		Associated Apparatus
V max (or Ui)	≥	Voc or Vt (or Uo)
I max (or Ii)	≥	Isc or It (or Io)
Pmax (or (Pi)	≥	Po
Ci + Ccable	≤	Ca (or Co)
Li + Lcable	≤	La (or Lo)

If Po of the associated apparatus is not known, it may be calculated using the formula Po = (Voc * Isc)/4 = (Uo * Io)/4.

12. Associated apparatus must be installed in accordance with its manufacturer's control drawing and Article 504 of the National Electrical Code (ANSI/NFPA 70) for installation in the United States, or Section 18 of the Canadian Electrical Code for installations in Canada.
13. When required by the manufacturer's control drawing, the associated apparatus must be connected to a suitable ground electrode per the National Electrical Code (ANSI/NFPA 70), the Canadian Electrical Code, or other local installation codes, as applicable. The resistance of the ground path must be less than 1 ohm.
14. Where multiple circuits extend from the same piece of intrinsically safe equipment to associated apparatus, they must be installed in separate cables or in one cable having suitable insulation. Refer to Article 504.30(B) of the National Electrical Code (ANSI/NFPA 70) and Instrument Society of America Recommended Practice ISA RP12.6 for installing intrinsically safe equipment.
15. Associated apparatus must not be used in combination unless permitted by the associated apparatus certification.
16. Control equipment must not use or generate more than 250 V rms or dc with respect to earth.
17. Standards use for evaluation:
    US Standards: UL 913 - Ed 8, UL 60079-31 - Ed 2, UL 60079-15 - Ed 4, UL 60079-11 - Ed 6, UL 60079-0 - Ed 6, ISA 12.12.01
    Canadian Standards: CSA C22.2 NO. 157 - Ed 3, CSA C22.2 NO. 213-M1987 - Ed 1, CSA C22.2NO. 60079-0:11 - Ed 2,
    CSA C22.2 NO. 60079-11:14 - Ed 2, CSA C22.2 NO. 60079-15:12 - Ed 1, CSA C22.2 NO. 60079-31:12 - Ed 1

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Figure 2-6 Wiring Diagram, Model MT3809, 4-20 mA Transmitter, One or Two Optical Alarms and PPU (continued)



(Continued on next page)

Figure 2-7 Wiring Diagram, Model MT3809, One or Two Inductive Alarms

1. This device is a Rosemount hand help communicator.
2. WARNING: SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY. AVERTISSEMENT: LA SUBSTITUTION DE COMPOSANTS PEUT COMPROMETTRE LA SÉCURITÉ INTRINSÈQUE
3. WARNING – EXPLOSION HAZARD – DO NOT DISCONNECT WHILE CIRCUIT IS LIVE UNLESS AREA IS KNOWN TO BE NON-HAZARDOUS.
   AVERTISSMENT – RISQUE D'EXPLOSION. NE PAS DEBRANCHER TANT QUE LE CIRCUIT EST SOUS TENSION A MOINS QU'IL NE S'AGISSE D'UN EMPLACEMENT NON DANGEREUX.
4. THIS EQUIPMENT IS SUITABLE FOR USE IN CLASS I, DIVISION 2, GROUPS (AS APPLICABLE) OR NON-HAZARDOUS LOCATIONS ONLY.
   CET EQUIPEMENT CONVIENT POUR UTILISATION CLASSE I, DIVISION 2, GROUPES (TOUS) OU LOCATIONS NON-DANGEREUSES SEULEMENT.
5. WARNING – ENCLOSURE CONTAINS ALUMINUM. PRECAUTIONS MUST BE TAKEN TO AVOID IGNITION DUE TO IMPACT.
   AVERTISSEMENT- LE BOÎTIER CONTIENS DE L'ALUMINIUM. DES PRÉCAUTIONS S'APPLIQUENT POUR ÉVITER L'IGNITION PAR IMPACT.
6. WARNING – FROM A SAFETY POINT OF VIEW THE CIRCUITS SHALL BE ASSUMED TO BE CONNECTED TO EARTH
   AVERTISSEMENT: PAR SÉCURITÉ LES CIRCUITS DEVRAIENT ÊTRE RELIÉS À LA MISE À LA TERRE.
7. Note for cULus approvals units: For devices using cable gland at field installation the following cable gland shall be used - American IP67 cable gland for the aluminum housing and an American rated IP68 cable gland for the Stainless steel and high temperature housings.
8. Standards use for evaluation:
   US Standards: UL 60079-31 - Ed 2, UL 60079-15 - Ed 4, UL 60079-0 - Ed 6, ISA 12.12.01
   Canadian Standards: CSA C22.2 NO. 213-M1987 - Ed 1, CSA C22.2 NO. 60079-0:11 - Ed 2,
   CSA C22.2 NO. 60079-15:12 - Ed 1, CSA C22.2 NO. 60079-31:12 - Ed 1

   Notes 9 through 12 are not applicable for cULus certification

CONTROLLED DRAWING
No Revision Without Prior Agency Approval (Refer to Document ENG-0044)

9. Entity Parameters:
   In type of protection Ex ia IIC/IIIC or Ex ic IIC/IIIC, only for connection to a certified intrinsically safe circuit, with following maximum values.

	Ui, V	Ii, mA	Pi, mW	Ci, nF	Li, µH	Recommended Barrier #
Inductive High Alarm circuits (terminals «+» and «-») – for connection of circuits Pepperl+Fuchs mod. SJ 3.5-SN type 2	10,6	19,1	51	30	100	Pepperl & Fuchs: KFA5-SR2-EX2.W or KFA6-SR2-EX2.W
Inductive Low Alarm circuits (terminals «+» and «-») – for connection of circuits Pepperl+Fuchs mod. SJ 3.5-SN type 2	10,6	19,1	51	30	100	Pepperl & Fuchs: KFA5-SR2-EX2.W or KFA6-SR2-EX2.W

10. The intrinsically safe device does not provide 500 V isolation with respect to earth. Associated apparatus used must be galvanically isolated or dual channel shunt zener diode barriers with linear outputs used channel to channel.
11. Selected associated apparatus must be third party listed as providing intrinsically safe circuits for the application, and have Voc or Vt not exceeding Vmax (or Uo not exceeding Ui), Isc or It not exceeding Imax (or Io not exceeding Ii), and the Po of the associated apparatus must be less than or equal to the Pmax or Pi of the intrinsically safe equipment, as shown in Table 1.
12. Capacitance and inductance of the field wiring from the intrinsically safe equipment to the associated apparatus shall be calculated and must be included in the system calculations as shown in Table 1.
    Cable capacitance, Ccable, plus intrinsically safe equipment capacitance, Ci, must be less than the marked capacitance, Ca (or Co), shown on any associated apparatus used.
    The same applies for inductance (Lcable, Li and La or Lo, respectively). Where the cable capacitance and inductance per foot are not known, the following values shall be used: Ccable = 60 pF/ft., Lcable = 0.2 µH/ft.

TABLE 1:

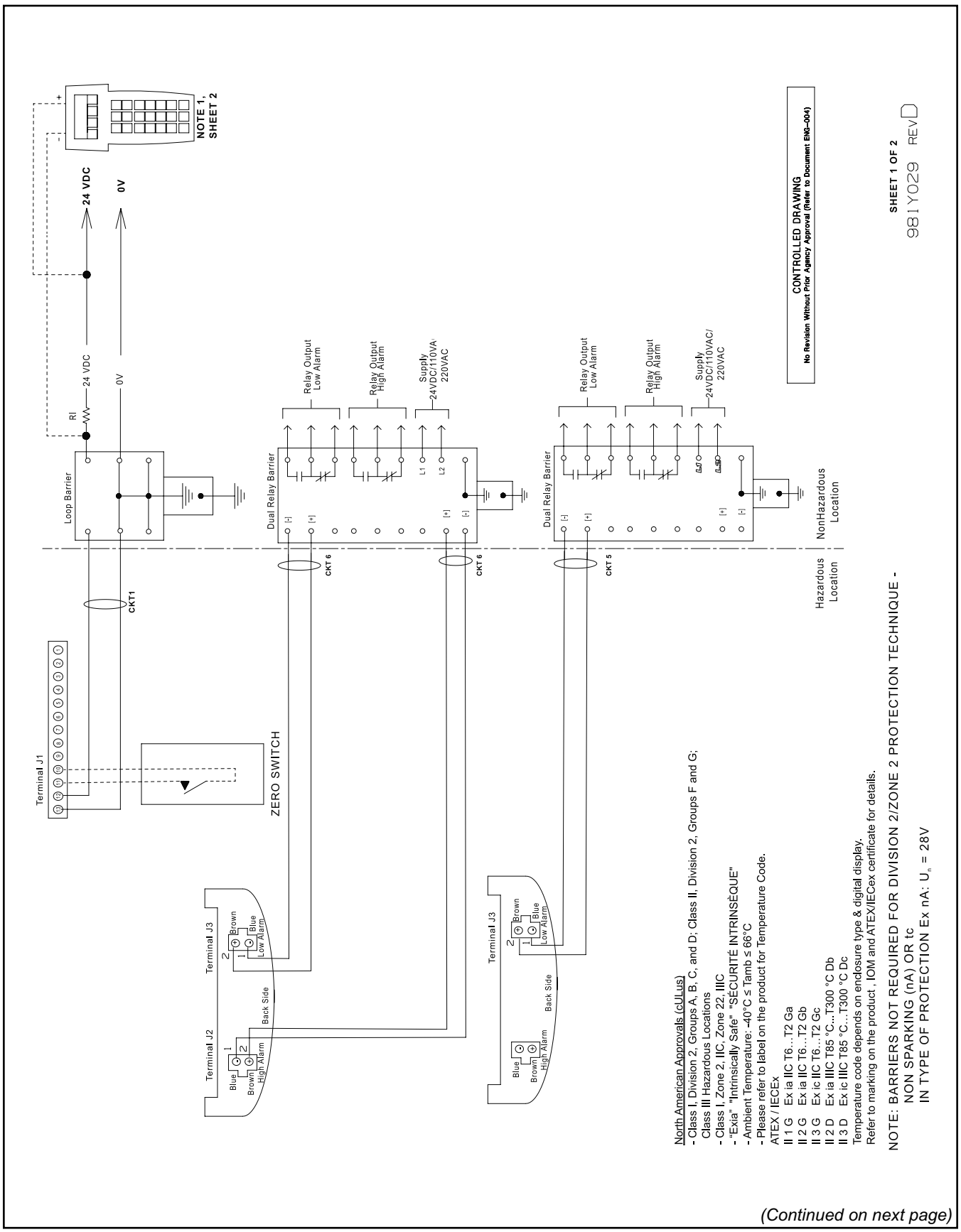
I.S. Equipment		Associated Apparatus
V max (or Ui)	≥	Voc or Vt (or Uo)
I max (or Ii)	≥	Isc or It (or Io)
Pmax (or (Pi)	≥	Po
Ci + Ccable	≤	Ca (or Co)
Li + Lcable	≤	La (or Lo)

If Po of the associated apparatus is not known, it may be calculated using the formula Po = (Voc * Isc)/4 = (Uo * Io)/4.

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Figure 2-7 Wiring Diagram, Model MT3809, One or Two Inductive Alarms (continued)



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Figure 2-8 Wiring Diagram, Model MT3809, 4-20 mA Transmitter, One or Two Inductive Alarms

1. This device is a Rosemount hand help communicator.
2. WARNING: SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY. AVERTISSEMENT: LA SUBSTITUTION DE COMPOSANTS PEUT COMPROMETTRE LA SÉCURITÉ INTRINSÈQUE
3. WARNING – EXPLOSION HAZARD – DO NOT DISCONNECT WHILE CIRCUIT IS LIVE UNLESS AREA IS KNOWN TO BE NON-HAZARDOUS.
   AVERTISSMENT – RISQUE D'EXPLOSION. NE PAS DÉBRANCHER TANT QUE LE CIRCUIT EST SOUS TENSION À MOINS QU'IL NE S'AGISSE D'UN EMPLACEMENT NON DANGEREUX.
4. THIS EQUIPMENT IS SUITABLE FOR USE IN CLASS I, DIVISION 2, GROUPS (AS APPLICABLE) OR NON-HAZARDOUS LOCATIONS ONLY.
   CET EQUIPEMENT CONVIENT POUR UTILISATION CLASSE I, DIVISION 2, GROUPES (TOUS) OU LOCATIONS NON-DANGEREUSES SEULEMENT.
5. WARNING – ENCLOSURE CONTAINS ALUMINUM. PRECAUTIONS MUST BE TAKEN TO AVOID IGNITION DUE TO IMPACT.
   AVERTISSEMENT- LE BOÎTIER CONTIENS DE L'ALUMINIUM. DES PRÉCAUTIONS S'APPLIQUENT POUR ÉVITER L'IGNITION PAR IMPACT.
6. WARNING – FROM A SAFETY POINT OF VIEW THE CIRCUITS SHALL BE ASSUMED TO BE CONNECTED TO EARTH
   AVERTISSEMENT: PAR SÉCURITÉ LES CIRCUITS DEVRAIENT ÊTRE RELIÉS À LA MISE À LA TERRE.
7. Note for cULus approvals units: For devices using cable gland at field installation the following cable gland shall be used - American IP67 cable gland for the aluminum housing and an American rated IP68 cable gland for the Stainless steel and high temperature housings.
8. Standards use for evaluation:
   US Standards: UL 60079-31 - Ed 2, UL 60079-15 - Ed 4, UL 60079-0 - Ed 6, ISA 12.12.01
   Canadian Standards: CSA C22.2 NO. 213-M1987 - Ed 1, CSA C22.2 NO. 60079-0:11 - Ed 2,
   CSA C22.2 NO. 60079-15:12 - Ed 1, CSA C22.2 NO. 60079-31:12 - Ed 1

   Notes 9 through 12 are not applicable for cULus certification

CONTROLLED DRAWING
No Revision Without Prior Agency Approval (Refer to Document ENG-004)

9. Entity Parameters:
   In type of protection Ex ia IIC/IIIC or Ex ic IIC/IIIC, only for connection to a certified intrinsically safe circuit, with following maximum values.

	Ui,V	Ii, mA	Pi, mW	Ci, nF	Li, µH	Recommended Barrier #
Signal 4-20mA (J1 terminals 12+ and 13-)	28	96	605	2,2	0.365	Stahl Type : 9001/01-280-075-101
Inductive High Alarm circuits (terminals «+» and «-») – for connection of circuits Pepperl+Fuchs mod. SJ 3,5-SN type 2	10,6	19,1	51	30	100	Pepperl & Fuchs: KFA5-SR2-EX2.W or KFA6-SR2-EX2.W
Inductive Low Alarm circuits (terminals «+» and «-») – for connection of circuits Pepperl+Fuchs mod. SJ 3,5-SN type 2	10,6	19,1	51	30	100	Pepperl & Fuchs: KFA5-SR2-EX2.W or KFA6-SR2-EX2.W
	Uo,V	Io, mA	Po, mW	Co, µF	Lo, mH	Notes
Remote zero loop signal (J1 terminals 10+ and 11-)	28	2,83	80	0.083	44	

10. The intrinsically safe device does not provide 500 V isolation with respect to earth. Associated apparatus used must be galvanically isolated or dual channel shunt zener diode barriers with linear outputs used channel to channel.
11. Selected associated apparatus must be third party listed as providing intrinsically safe circuits for the application, and have Voc or Vt not exceeding Vmax (or Uo not exceeding Ui), Isc or It not exceeding Imax (or Io not exceeding Ii), and the Po of the associated apparatus must be less than or equal to the Pmax or Pi of the intrinsically safe equipment, as shown in Table 1.
12. Capacitance and inductance of the field wiring from the intrinsically safe equipment to the associated apparatus shall be calculated and must be included in the system calculations as shown in Table 1.
    Cable capacitance, Ccable, plus intrinsically safe equipment capacitance, Ci, must be less than the marked capacitance, Ca (or Co), shown on any associated apparatus used. The same applies for inductance (Lcable, Li and La or Lo, respectively). Where the cable capacitance and inductance per foot are not known, the following values shall be used: Ccable = 60 pF/ft., Lcable = 0,2 µH/ft.

TABLE 1:

I.S. Equipment		Associated Apparatus
V max (or Ui)	≥	Voc or Vt (or Uo)
I max (or Ii)	≥	Isc or It (or Io)
Pmax (or (Pi)	≥	Po
Ci + Ccable	≤	Ca (or Co)
Li + Lcable	≤	La (or Lo)

If Po of the associated apparatus is not known, it may be calculated using the formula Po = (Voc * Isc)/4 = (Uo * Io)/4.

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Figure 2-8 Wiring Diagram, Model MT3809, 4-20 mA Transmitter, One or Two Inductive Alarms (continued)

4-20 mA/HART Transmitter Division 2 Installation

If the area classification is Division 2, a barrier is not required and cable parameters are not applicable. The electrical code will require the use of conduit for wire protection. Refer to Figure 2-5a/2-5b.

4-20 mA/HART Transmitter Flameproof Installation

For flameproof installation, the optional explosion proof enclosure is required and explosion proof installation methods must be followed. Refer to Figure 2-9.

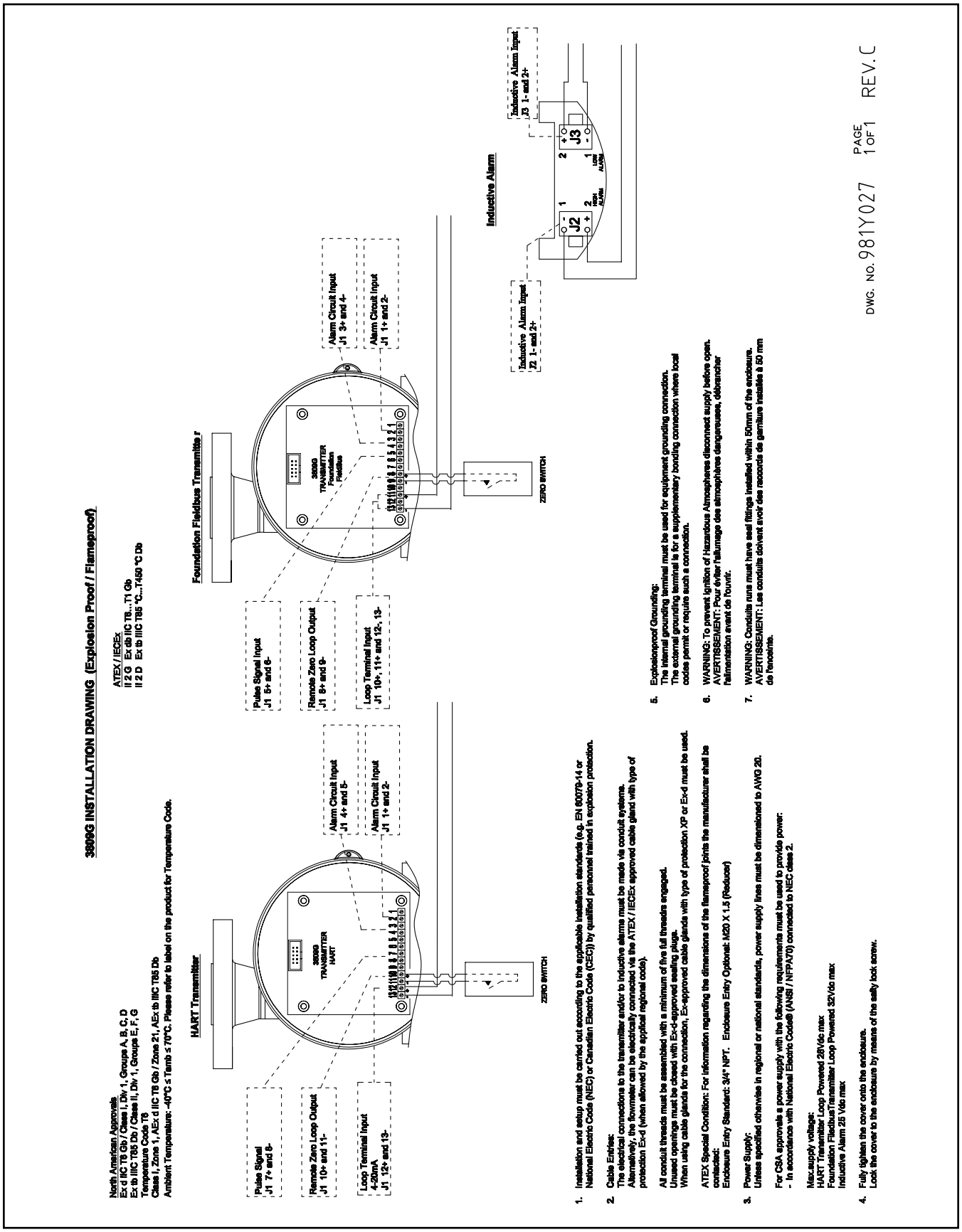


Figure 2-9 Wiring Diagram, Model MT3809 Explosion Proof with Transmitter and/or Inductive Alarm

Electrical Connections to MT3809 with FOUNDATION Fieldbus Transmitter, Alarms and Pulse Output

⚠ WARNING

If it becomes necessary to service or remove the instrument from the system, power to the device is disconnected at the power supply.

a) Before electrical connection, install the meter into the pipeline as described in previous Section 2-5.

b) For electrical installation follow the general FOUNDATION Fieldbus practices and take the following into account:

i. To avoid electrical interference and to meet the Electro Magnetic Compatibilty (EMC directive) requirements, use shielded twisted pair cables.

ii. In case of installation into explosion hazardeous environments it is important to eliminate a potential incentive level of circulating current through the cable shield in the event that there are local differences in chassis ground potential between the two ends of the cable. Therefore, cable shields shall be connected to chassis ground (earth) in accordance with the applicable regional & local installation code. A terminal screw inside the device allows for shield to chassis connection in case the applicable installation regulation requires earthing at the transmitter end.

iii. Ensuring a properly specified power supply:

- Bus supply voltage 9 .. 32 Vdc
- Nominal current 12mA

iv. Use cables as specified in IEC 61158-2. Stay below the maximum allowable cable length which depends upon the cable specifications, the number of network devices and the network topology. Connect the transmitter to the network following IEC 61158-2.

c) The housing of the transmitter should be grounded in accordance with the applicable installation regulations. When the device is not sufficiently grounded via the process cables, a grounding terminal screw is available on the transmitter housing for earth connection.

d) Transmitter wiring connection diagrams are given in Section 2-7-1 Ensure that the installation complies with given hazardous area protection requirements.

e) Transmitter wiring connection diagrams are given is Section 2-7-1. Ensure that installation complies with given hazardous area protection requirements.

i. Intrinsically safe installations require the use of barriers, power supply limits and cable parameters as shown in the installation diagram. All connections are made in the transmitter housing. Refer to Figures 2-5a/2-5b and 2-8a/2-8b.

ii. If the area classification is Division 2, barriers are not required and cable parameters are not applicable. However, the electrical code will require the use of conduit for wire protection.
Refer to Figures 2-5a/2-5b and 2-8a/2-8b.

iii. For flameproof installation the optional explosion proof enclosure is required and explosion proof installation methods must be followed. Refer to Figure 2-9.

⚠WARNING

To prevent ignition of hazardous atmospheres and serious personal injury, proper installation methods must be used as defined in Article 505 of the National Electrical Code, and the Canadian Electrical Code and ISA Standard 12.6 and in accordance with Cenelec regulations.

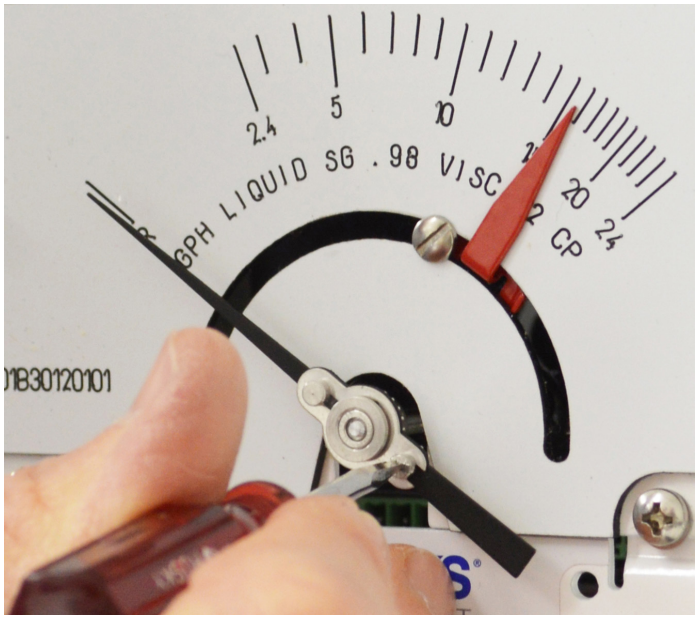
f) Common transmitter parameters are set during manufacturing at Brooks Instrument based on order information, meter configuration or defaults inherent to the transmitter. Further detailed configurations as well as on-line monitoring can be done through the FOUNDATION Fieldbus communication protocol.See Foundation Fieldbus supplemental manual (X-DPT-FF-MT3809G-Alarms-eng).

g) After installation and power up of the transmitter, the transmitter must be zeroed, both electrically and mechanically. This operation will compensate for any stray magnetic effects in the vicinity of the transmitter.
Important: The zero adjusting of the pointer influences the transmitter indication, but not the other way around. Therefore, first adjust the pointer at the zero flow position, then the transmitter must be zeroed.

i. Flow must be verified to be zero during the entire zeroing.

ii. With the flow at zero and the float at the zero flow position, adjust the mechanical indicator to point to the ‘R’ (reference line) using the adjustment screw on the face of the pointer, next to the hub. See Figure 2-10.

iii. Then, zero the transmitter shorting the two pins at the terminal block, See Figure 2-11.



Using a flat blade screwdriver with a 1/8" blade, hold the pointer and turn the screw to align with the “R” on the scale.

It may take a few adjustments to get the pointer on the “R”.

Figure 2-10 Mechanical Indicator Zero

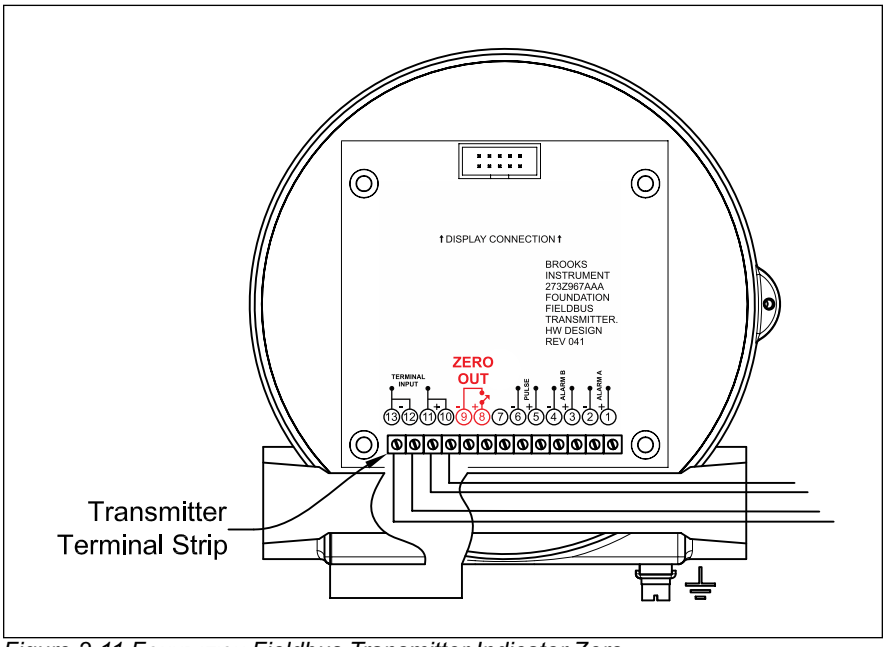


Figure 2-11 FOUNDATION Fieldbus Transmitter Indicator Zero

Note: The zero function may be activated as part of a periodical maintenance check. If desired, a zero switch can be remotely mounted and wired to these terminals. The hazardous area classification will determine the wiring methods used for this switch.

h) Under actual flow conditions, verify that the transmitter output matches the mechanical pointer position. If a discrepancy is noted, the FOUNDATION Fieldbus communication can be used to verify or adjust the transmitter settings.

Transmitter with alarm and pulse output wiring connections:
The alarm contact and pulse output digital signals are electrically identical, independent, optically coupled transistor outputs. Wiring will be as required by the external driven system - Prover, DCS/PLC, terminal-automation system, batch controller etc. These can be wired as an open collector or open signal on the high or low side of voltage-rail within the receiving equipment, depending upon the signal needs. When interfacing to external electronics, be careful to work within the voltage/current polarity and limits as specified in Section 1.

To install the typical transmitter alarms and/or pulse digital outputs configuration:

i. Intrinsically safe installations require the use of barriers, power supply limits and cable parameters. All connections are made in the transmitter housing. Refer to Table 1-12 in approvals section and Figures 2-5a/2-5b and 2-8a/2-8b.

ii. If the area classification is Division 2, barriers are not required and cable parameters are not applicable. However, the electrical code will require the use of conduit for wire protection. Refer to Figures 2-5a/2-5b and 2-8a/2-8b.

iii. For flameproof installation the optional explosion proof enclosure is required and explosion proof installation methods must be followed. Refer to Figure 2-9.

a. The shielded cable must be used for hook up. In case of installation into explosion hazardeous environments it is important to eliminate a potential incentive level of circulating current through the cable shield in the event that there are local differences in chassis ground potential between the two ends of the cable. Therefore, cable shields shall be connected to chassis ground (earth) in accordance with the applicable regional & local installation code. A terminal screw inside the device allows for shield to chassis connection in case the applicable installation regulation requires earthing at the transmitter end.

b. The pulse and alarm outputs function as isolated switch closures (optically isolated open collector) and must be supplied with a power source, as shown in wiring diagram, Figure 2-6a/2-6b. Observe polarity and do not exceed 30 volts for the supply and limit load current to 20 mA for each output.

FOUNDATION Fieldbus Transmitter Intrinsically Safe Installation

For intrinsically safe installation, intrinsic safety barrier selection, cable parameters, and power limits, follow Figures 2-12 through 2-15.

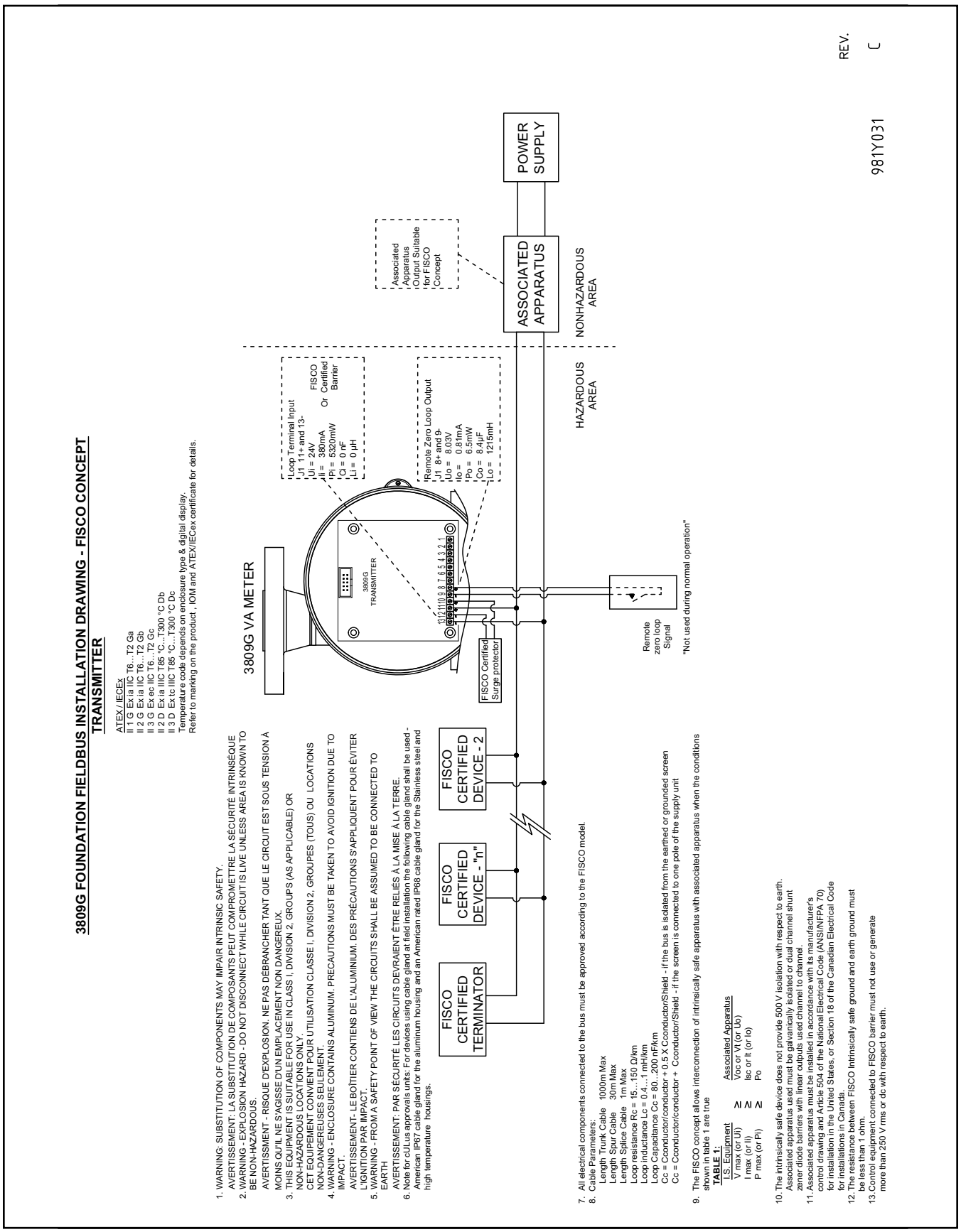


Figure 2-12 Wiring Diagram, Model MT3809, Foundation Fieldbus - FISCO Concept - Transmitter

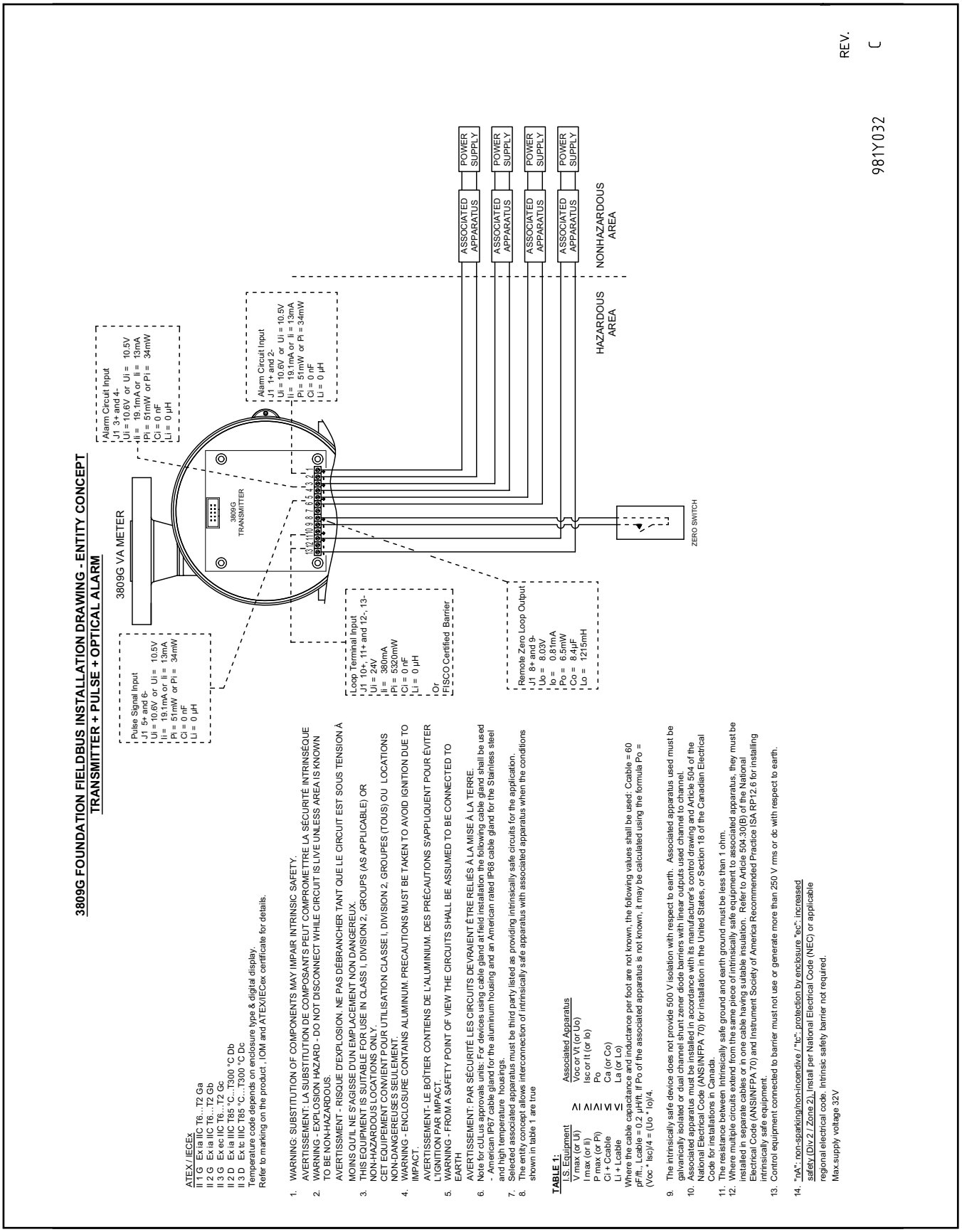


Figure 2-13 Wiring Diagram, Model MT3809, Foundation Fieldbus - Entity Concept - Transmitter

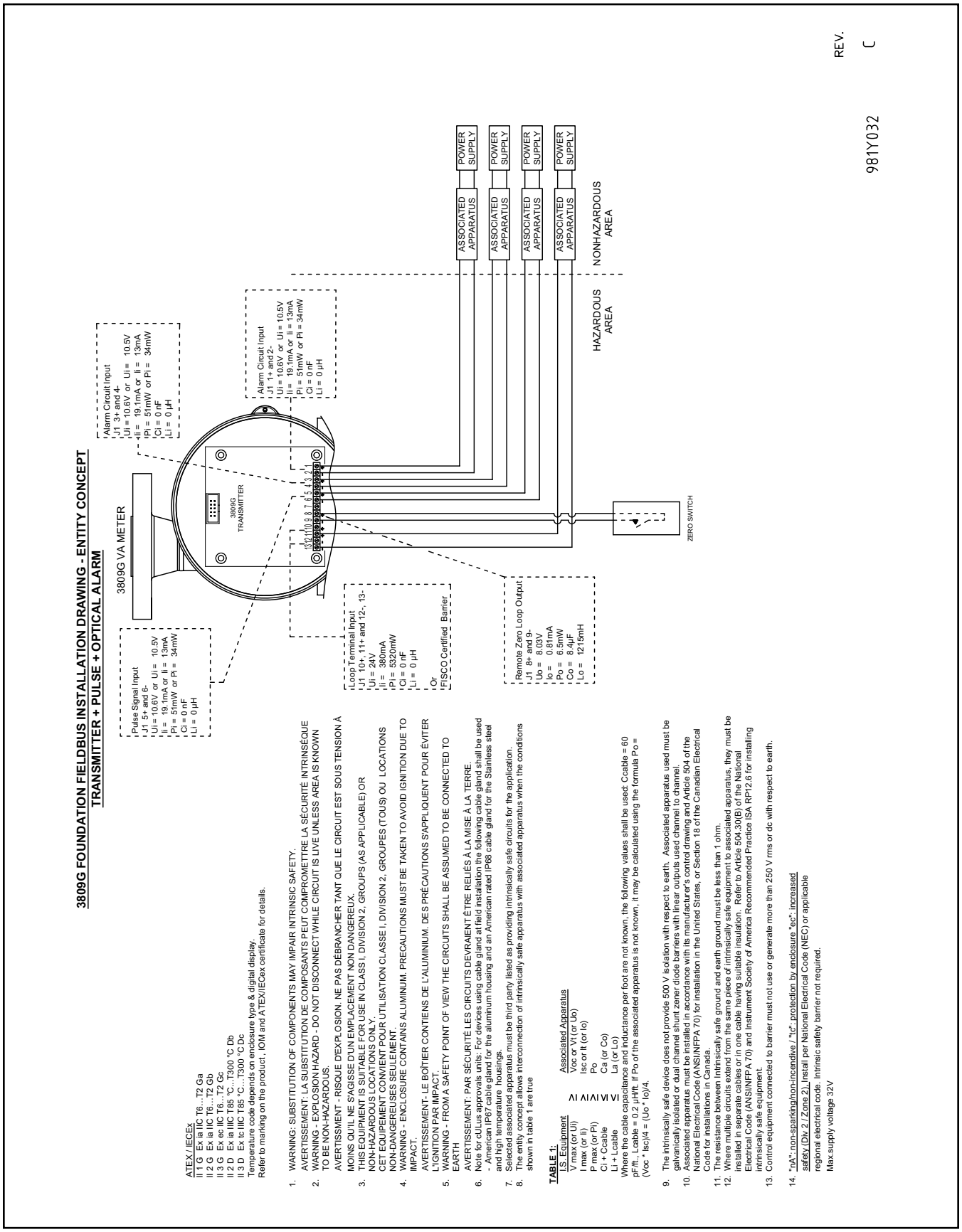


Figure 2-14 Wiring Diagram, Model MT3809, Foundation Fieldbus - Entity Concept - Transmitter - Pulse - Alarm Contacts

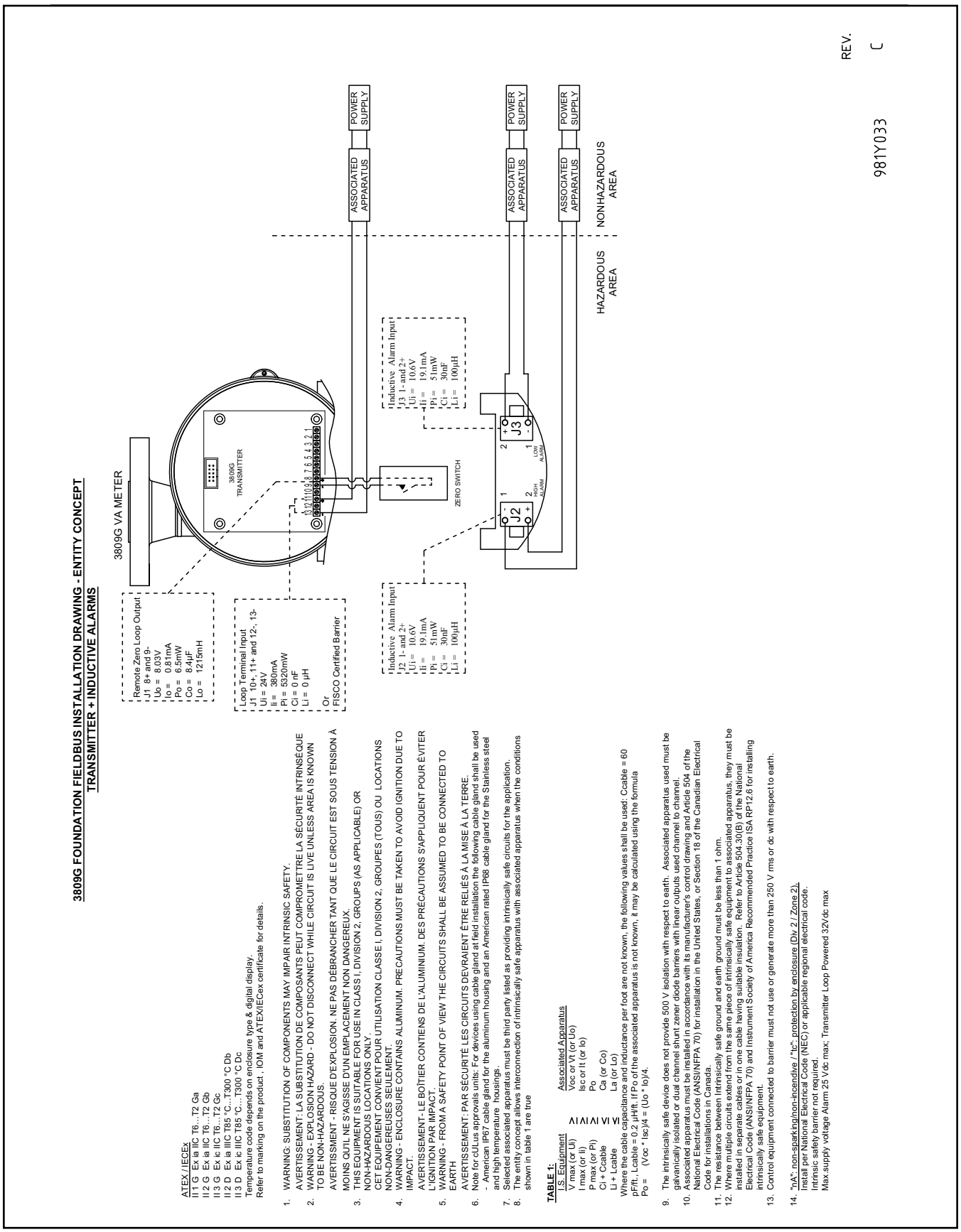


Figure 2-15 Wiring Diagram, Model MT3809, Foundation Fieldbus - Entity Concept - Transmitter - Inductive Alarms

Installation of the Model MT3809 Flowmeter with Inductive Alarms (1 or 2 switches)

⚠ WARNING

If it becomes necessary to service or remove the instrument from the system, power to the device is disconnected at the power supply.

⚠ WARNING

To prevent ignition of hazardous atmospheres and serious personal injury, proper installation methods must be used as defined in Article 505 of the National Electrical Code, and the Canadian Electrical Code and ISA Standard 12.6 and in accordance with Cenelec regulations.

a. Install the meter as described in Section 2-5

b. Install the inductive alarms (1 or 2 switches) following the wiring instructions given in Section 2-6 or 2-7, depending on the configuration (with or without HART or FOUNDATION™ Fieldbus transmitter)

c. Intrinsically safe installations require the use of relay isolators for the alarms and a barrier for the transmitter, if equipped. Power supply limits and cable parameters must be as shown in the applicable installation diagram from Section 2-6. or 2-7.

d. If the area classification is Division 2, the transmitter barrier and cable parameters are not applicable. However for proper operation of the inductive alarms, the relay isolators must be used. The electrical code will require the use of conduit for wire protection.

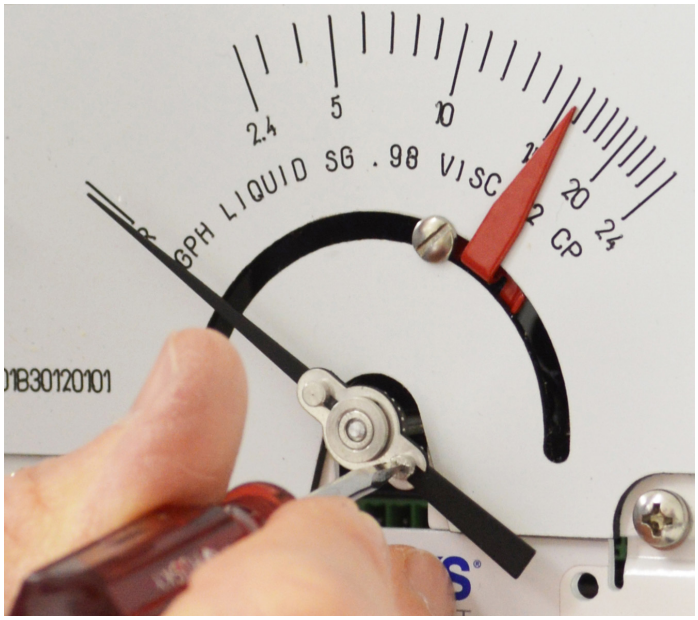
e. For flameproof installation the optional explosion proof enclosure is required and explosion proof installation methods must be followed. For proper operation of the inductive switches, the relay isolators must be used.

f. The shielded cable must be used for hook up. The shields should beconnected to chassis ground at the transmitter/alarm end and should be taped up and not connected at the receiver end. The taping and insulation of the shields at the receiving end is especially important for intrinsically safe installations.

g. The relay isolator has built in power handling contacts. Refer to the specifications for these ratings.

h. The pointer must be adjusted to the reference line on the scale using the adjustment screw on the face of the pointer, next to the hub. See Figure 2-16.

i. Proper operation of the inductive alarms can be determined by manually rotating the mechanical pointer and observing the status lights on the relay isolator. The small alarm pointers indicate the alarm trip points. Changes to the set points can be made by loosening the pointer screws and repositioning the pointers.



Using a flat blade screwdriver with a 1/8" blade, hold the pointer and turn the screw to align with the “R” on the scale.

It may take a few adjustments to get the pointer on the “R”.

Figure 2-16 Mechanical Indicator Zero

Start-up and Operation of Flowmeter

⚠WARNING

Operating Procedure: Do not operate this instrument in excess of the specifications listed in Section 1. Before bringing the unit into operation, make sure that all fluid connections have been correctly tightened and that all electrical connections where applicable have been made. Failure to heed this warning can result in serious personal injury and/or damage to the equipment.

a. After the flowmeter has been properly installed in the process, it is ready for operation. When initiating flow, slowly open the valve to avoid a flow surge. Bypass is a help in bringing the flow on smoothly. Avoid starting a pump to supply the flowmeter without the use of a valve upstream of the flowmeter.

b. Check for leaks around the meter inlet and outlet connections. If no leaks are present, bring the system up to operating pressure.

⚠ CAUTION

Any sudden change in system pressure may cause mechanical damage to elastomer materials. Damage can occur when there is a rapid expansion of fluid that has permeated elastomer materials. The user must take the necessary precautions to avoid such conditions.

c. At no flow condition the indicator pointer should align with the “R” mark on the scale. If necessary, adjust the pointer as per directions in the Maintenance Section 4.

Operation of the Model MT3809 Flowmeter with a Transmitter with or without Optional Alarms and Pulse Output for Totalization

***** Start-up the meter as described in Section 3-1.
* Programming performed prior to shipment (parameters).
The transmitter with or without alarms and pulse output is preprogrammed prior to shipment for the following parameters based on the order information, meter configuration and application. If parameters are not specified in the customer purchase order, the defaults inherent to the electronics will be as shown in (parenthesis).

Transmitter only pre-programmed parameters	**Transmitter plus alarms and pulse output preprogrammed parameters**
Model Number	Alarm LoLimit (0% FS flow)
Serial Number	Alarm HiLimit (100% FS flow)
Tag Name (blank)	Pulse output units (1 ppl)
Flow Rate units of measure (lpm)	Resettable totalizer units of measure (lit.)
Low Flow cutoff (8% FS flow)	Inventory totalizer units of measurement (lit.)
Calibration factor (% scales only)	
Analog Output LoRange (4 mA @ 0% flow)	
Analog Output HiRange (20 mA @ 100% flow)	

* Manual programming or reprogramming of the electronics.
Programming of the transmitter with or without alarms and pulse output may also be done locally via an HART or FOUNDATION Fieldbus Communicator. Please refer to the manual of the communicator for detailed description.

***** Recalibration of transmitter output (spanning high and low)
At any time after factory calibration, shipment, installation, or service, the transmitter can be recalibrated by overwriting any of the previous calibration point-pairs, assuming that the user can provide a series of accurate rates of flow through the meter. If preferred, the meter with transmitter may be returned for recalibration at the Brooks service department for a fee.

***** Basic transmitter setup parameters
These are meter identification parameters set prior to shipment of the meter.
Flowmeter identification: Model number, serial number, tag name.
Flowmeter configuration: Low flow cutoff, calibration factor, flow rate units of measure.
Transmitter analog output: Analog output HiRange, analog output LoRange.

***** Optional programmable alarm and pulse output parameters and features

Alarm contact output: HiLimit, LoLimit
Latching or non-latching option shall be added for contact outputs.
Alarm contact outputs can be configured to either latching type or non-latching type.

Communication with HART Transmitter using Device Descriptor

The structure of the device descriptor for the HART transmitter is given in Figures 3-1 and 3-2. The alarms may be set at the minimum and maximum flow rate or at any other preferred high and low limits. The units of measure of the alarm limits are the same units of measure as the process variable itself.

DD structure:

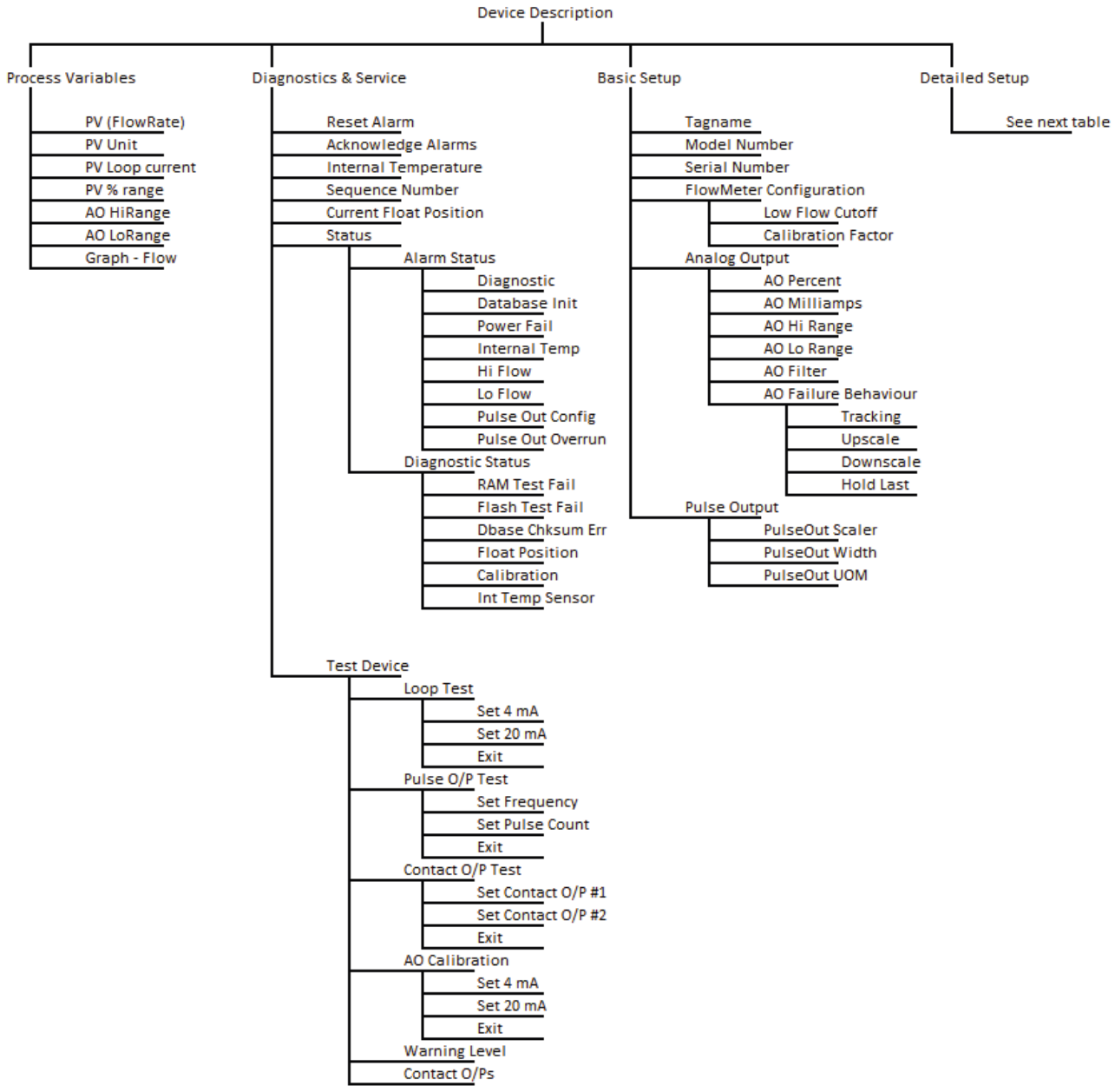


Figure 3-1 Model MT3809 Electronics Basic Setup Menu Tree

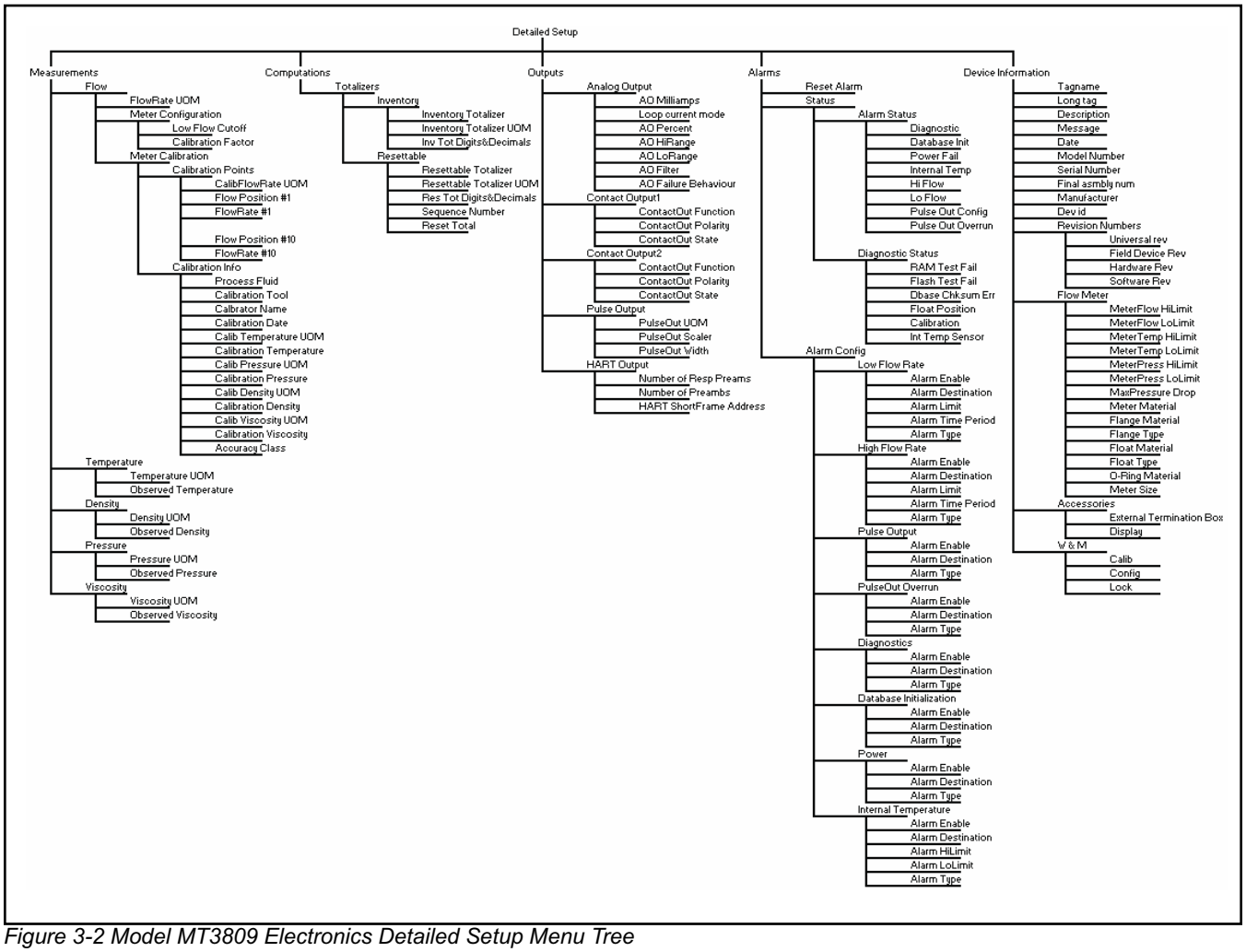


Figure 3-2 Model MT3809 Electronics Detailed Setup Menu Tree

Computations: Totalization
Totalizers are available in both resettable and inventory options. Resettable totalization is used for batching while inventory totalization measures the total volume over time. Units of measure are set independently for each of these options.

Pulse output: Pulse out scaler, pulse out width
The transmitter has a pulse output channel that indicates flow rate as a variable frequency and therefore can pass information to many types of external equipment such as batch controllers, automation systems or provers. The output pulse width default is 1 millisec but may be user-configured since certain external receiving equipment cannot keep up with high incoming frequency.

Low flow cutoff warning for pulse output and totalization
The low flow cutoff parameter can be programmed to signal when the flow level is below which the process is intended. Below this level, the totalizer will assume that the flow rate is actually zero and that no data should be accumulated by the totalizers.

Pulse output overrun alarm
If a larger than acceptable output pulse width is configured, totalizer pulses may be delayed or queued. No loss of pulses will occur. The totalizer output pulses will to be sent until the queue is empty. Under these circumstances, an alarm message will be sent to the control station. However, the alarm can be disabled if not required.

Optional alarm configurations- enable, destination, alarm type (latching)
Three additional parameters may be programmed for process and diagnostic alarms to control functionality- enable, destination, and alarm type (latching). ‘Enable’ allows alarms to be enabled and disabled depending on use of the alarm. For example, if output pulses are being used it may be normal practice to delay (e.g. queue up) output pulses because of a slow receiving end-device that requires a wide pulse-width. The ‘enable’ parameter allows the user to *disable* the pulse output overrun alarm and not send an alarm when in fact pulse outputs are delayed by choice. Some critical diagnostic alarms, such as database initialization, can not be disabled or turned off. When an alarm occurs, it can be posted through the defined ‘destination’ digital contact closure outputs #1, #2 both or neither. Therefore the alarms may be managed according to local operating practices and the need to notify upstream control/safety systems.

An alarm may be posted at a designated destination only when the alarm situation is occurring or posted until the alarm is acknowledged by the operator. The decision to ‘latch or unlatch’ the alarm is controlled by setting the ‘alarm type’ parameter. By utilizing this optional parameter, the operator can see that there is an alarm as it is occurring (unlatched) or even after the fact, in the case when the operator did not directly observe the unit alarm (latched).

Communication with FOUNDATION Fieldbus Transmitter

For details on the Foundation Fieldbus interface, refer to the supplemental manual (X-DPT-FF-MT3809G-Alarms-eng), also available on BrooksInstrument.com/Documentation

Communication with Transmitter using Local Operator Interface with LCD Display

The LCD display is a three line liquid crystal display. It can easily be programmed to provide basic information such as flow rates and product totalization. Configuration adjustments to upper/lower range values can also be performed using the display. Access to the display can be accomplished by removing the cover or by using the supplied magnet with the cover in place. Refer to Figure 3-4 for the menu tree for more details.

Adjusting Inductive Alarms (1 or 2 switches)

To modify the alarm set points, remove the front cover with gasket of the indicator housing by removing the four screws. Set the alarm position by loosening the two pointer screws, moving the pointer to the desired alarm setting and tightening the screws. Replace the indicator housing cover with gasket and secure with the four screws.

Simulate

Foundation Fieldbus specs require that the customer be able to access and enable/disable physical "simulate", this can be done by creating a short between Pin 9 and Pin 7 on the terminal strip. See Figure 3-3 below.

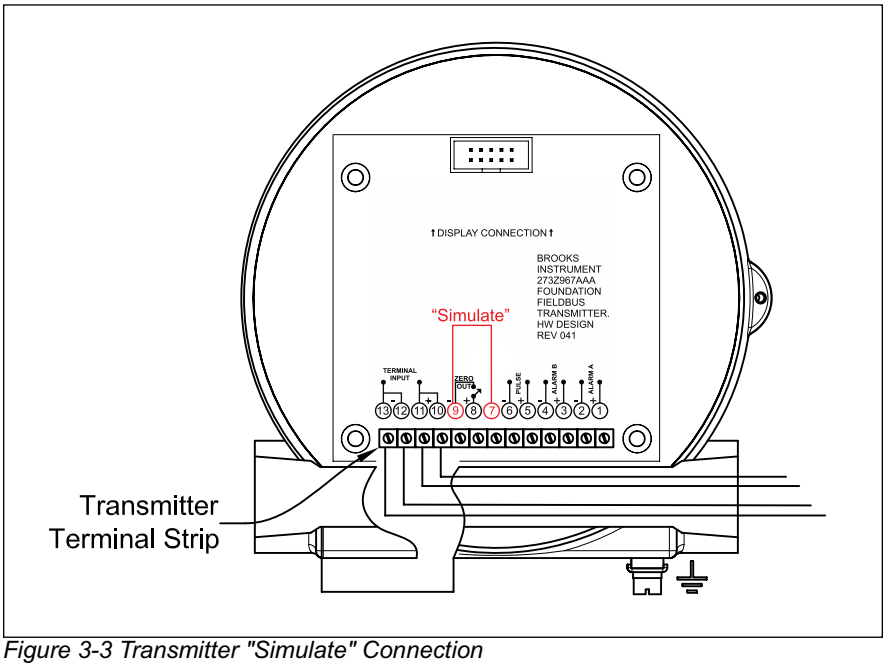


Figure 3-3 Transmitter "Simulate" Connection

Left LOI button = Scroll through options.
Right LOI button = Activate option.

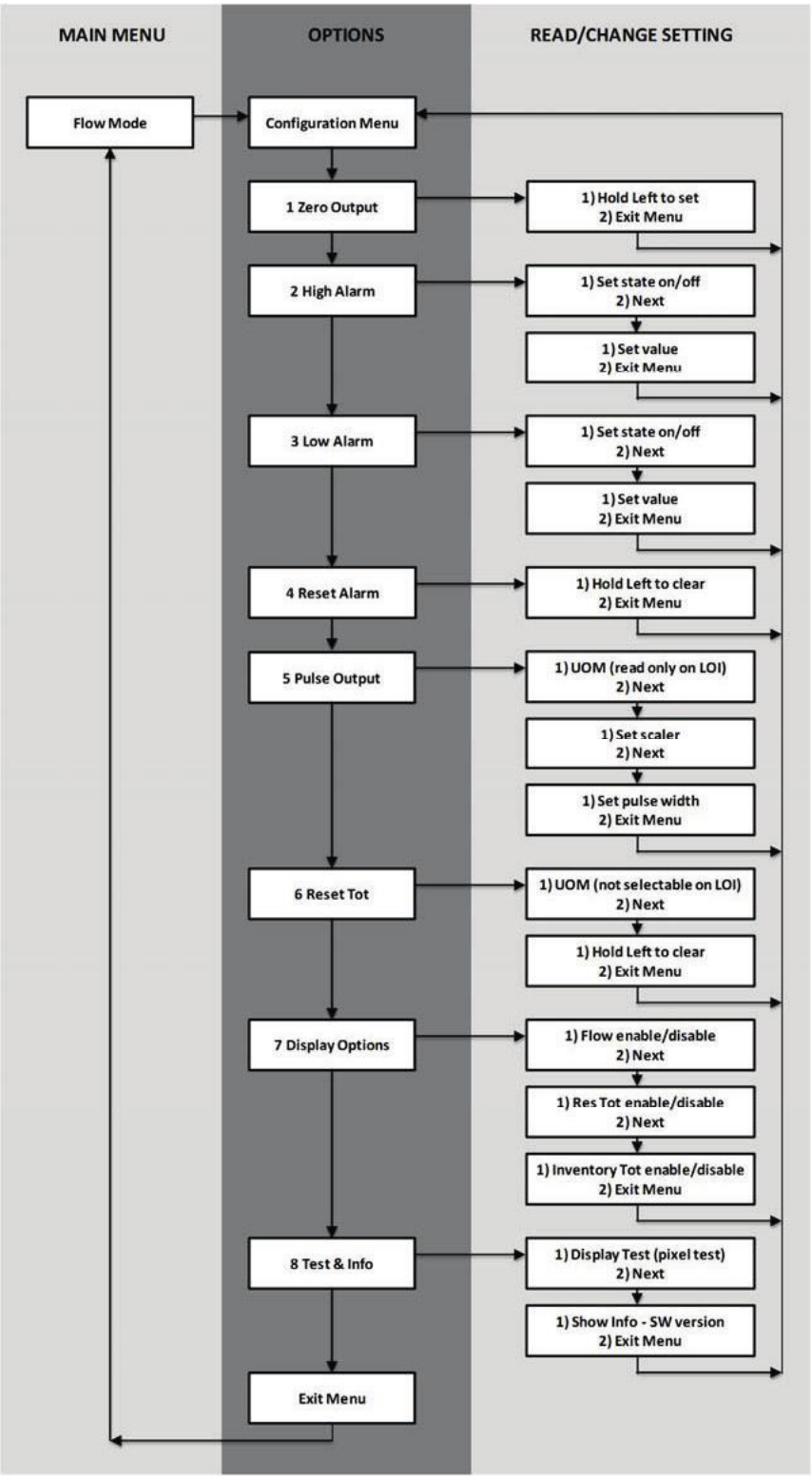


Figure 3-4 Model MT3809 Electronics LOI Chart Menu

General Service Information

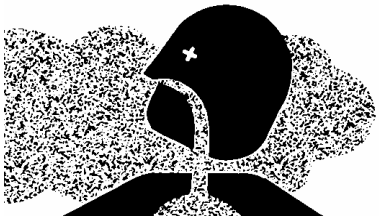
There is no routine maintenance required for the Models MT3809 and MT3810 flowmeters. However should it become necessary to replace, adjust or remove components of the flowmeter, specific recommendations must be followed.

⚠ CAUTION

It is important that this device only be serviced by properly trained and qualified personnel.

⚠ WARNING

If this equipment is not properly serviced, serious personal injury and/or damage to the equipment can result from potentially high operating pressures. Process line pressure should be removed prior to servicing.



⚠ WARNING

METER SEAL COMPATIBILITY

It is the "user's" responsibility to select gasket materials that are corrosion resistant and compatible with their process and process conditions. Using materials that are not compatible with the process or process conditions could result in the Meter leaking process fluid outside the pressure boundary of the device, resulting in personnel injury or death.

It is recommended that the user check the Meter on a regular schedule to ensure that it is leak free as both metal and elastomeric seals, gaskets and O-rings may change with age, exposure to process fluid, temperature, and /or pressure.

⚠ WARNING

If it becomes necessary to remove the instrument from the system power to the device is disconnected at the power supply.

⚠ WARNING

If it becomes necessary to remove the flowmeter from the system after exposure to toxic, pyrophoric, flammable or corrosive fluid, purge the flowmeter thoroughly with a dry inert gas such as Nitrogen before disconnecting the process connections. Failure to correctly purge the flowmeter could result in fire, explosion or death. Corrosion or contamination of the flowmeter upon exposure to air, may also occur.

Meter Float Cleaning (MT3809 & MT3810)

Float replacement procedures are dependent on the meter size, connection type and fluid (gas vs. liquid) application. Please refer to the appropriate section below for instructions along with Figures 4-1 thru 4-4.

1. FLANGED CONNECTION

a. Size 0 to 5 (½") flanged, liquid or gas service

1. It is NOT recommended to disassemble these meters. Contact Service for repair.

b. Size 7 (½") flanged, liquid or gas service

1. Remove the meter from the process line and lay the meter horizontal on a table.
2. Remove the gasket support ring. A bearing puller of the correct size is recommended to remove the gasket support ring.
3. Push the entire float assembly slowly downward and out of the meter inlet by pushing from the top with a round bar stock (3/4" or 19 mm diameter).
4. Remove the float snap-ring to clean individual float assembly parts.
5. Reassemble the meter by reassembling the float assembly and inserting it into the bottom of the meter. Replace the spiral retaining ring in the meter inlet.

c. Size 8 (½") flanged, liquid service

1. Remove the meter from the process line and lay the meter horizontal on a table.
2. Remove the gasket support ring. A bearing puller of the correct size is recommended to remove the gasket support ring
3. Loosen the float assembly with two screwdrivers one on each end of the meter and turn to loosen the inlet and outlet screws. Remove inlet screw at the bottom of the meter.
4. Remove the guide vane at the bottom of the meter and gently push the float assembly up and out the top/outlet side.
5. Reassemble by inserting the float assembly into the top of the meter. Replace the guide vane and secure the float assembly by tightening the inlet and outlet screws. Replace the spiral retaining ring in the meter inlet.

d. Size 8 (½") flanged, gas service

1. Remove the meter from the process line and lay the meter horizontal on a table.
2. Remove the gasket support ring. A bearing puller of the correct size is recommended to remove the gasket support ring.
3. Secure the damper from turning by inserting a 1/8” pin through the top guide cartridge. While holding the damper in place, remove the top/outlet screw.
4. Push the float assembly out through the inlet/bottom.
5. To clean the gas damper, unscrew the cylinder head. Then remove the bolt and carefully take out the small piston so as to not damage the critical surfaces.
6. Reassemble the meter by assembling the damper with float assembly. Insert the float assembly with damper into the inlet/bottom of the meter. Secure the inlet/bottom screw. While holding the damper in place with a pin(1/8” diameter), insert and secure the top/outlet screw. Replace the spiral retaining ring.

e. Sizes 10 (1"), 12 (1½"), 13 (2") flanged, liquid service

1. Remove the meter from the process line and lay the meter horizontal on a table.
2. Remove the gasket support ring. A bearing puller of the correct size is recommended to remove the gasket support ring.
3. Loosen the inlet and outlet screws. Remove inlet screw at the bottom of the meter.
4. Remove the guide vane at the bottom of the meter and gently push the float assembly up and out the top/outlet side.
5. Reassemble by inserting the float assembly into the top of the meter. Replace the guide vane and secure the float assembly by tightening the inlet and outlet screws.

f. Sizes 10 (1"), 12 (1½"), 13 (2") flanged, gas service

1. Remove the gasket support ring. A bearing puller of the correct size is recommended to remove the gasket support ring.
2. Secure the damper from turning by inserting a 1/8” pin through the top guide cartridge. While holding the damper in place, remove the top/outlet screw.
3. Push the float assembly out through the inlet/bottom.
4. To clean the gas damper, unscrew the cylinder head. Then remove the bolt and carefully take out the small piston so as to not damage the critical surfaces.
5. Reassemble the meter by assembling the damper with float assembly. Insert the float assembly with damper into the inlet/bottom of the meter. Secure the inlet/bottom screw. While holding the damper in place with a pin (1/8” diameter), insert and secure the top/outlet screw. Replace the spiral retaining ring.

g. Sizes 15 and 16 (3" and 4") flanged, liquid or gas service (size 15 only)

1. Remove the meter from the process line and lay the meter horizontal on a table.
2. Loosen the float assembly by fixating two pliers one on each end of the float assembly inlet guide cartridge. Turn to loosen with the help of a pin wrench.
3. Carefully remove the complete float assembly and conical taper as well as the spacer bushing (size 16 only) out the inlet/bottom of the meter.
4. Reassemble by inserting the float assembly inside the conical taper (as well as the spacer bushing, size 16 only). Then insert the complete float assembly into the bottom of the meter. Replace the float assembly inlet guide cartridge and tighten the float assembly into place.

2. THREADED CONNECTION

a. Size 0 to 5 (½") threaded, liquid or gas service

1. It is NOT recommended to disassemble these meters. Contact Service for repair.

b. Size 7 (½") Threaded, liquid or gas service

1. Remove the meter from the process line and lay the meter horizontal on a table.
2. Unscrew the inlet fitting at the bottom of the meter.
3. Push the entire float assembly slowly downward and out of the meter inlet by pushing from the top with a round bar stock (3/4” or 19 mm

diameter).
4. Remove the float snap-ring and clean individual float assembly parts.
5. Reassemble the meter by reassembling the float assembly and inserting it into the bottom of the meter. Reinstall and secure the inlet fitting.

c. Size 8 (½"), 10 (1"), 12 (1½") 13 (2") Threaded liquid service

1. Remove the meter from the process line and lay the meter horizontal on a table.
2. Unscrew the inlet fitting at the bottom of the meter.
3. Loosen the float assembly with two screwdrivers one on each end of the meter and turn to loosen the inlet and outlet screws. Remove inlet screw at the bottom of the meter.
4. Remove the guide vane at the bottom of the meter and gently push the float assembly up and out the top/outlet side.
5. Reassemble by inserting the float assembly into the top of the meter. Replace the guide vane and secure the float assembly by tightening the inlet and outlet screws. Reinstall and secure the inlet fitting.

d. Size 8 (½") Threaded gas service

1. Remove the meter from the process line and lay the meter horizontal on a table.
2. Unscrew the outlet fitting at the top/outlet of the meter and remove the gas damper.
3. Unscrew the inlet/bottom fitting and slowly remove the float assembly.
4. To reassemble the meter, insert the float assembly into the inlet/ bottom of the meter. Secure the inlet/bottom fitting. Replace the gas damper and secure the outlet/top fitting.

e. Size 10 (1"), 12 (1½"), 13 (2") Threaded, gas service

1. Remove the meter from the process line and lay the meter horizontal on a table.
2. Remove the top/outlet screw.
3. Loosen the float assembly by holding the damper in place with a pin (1/8" diameter) in the top while loosening the inlet/bottom fitting. Gently push the float assembly out through the inlet/bottom.
4. To clean the gas damper, unscrew the cylinder head. Then remove the bolt and take out the small piston carefully so as to not damage the critical surfaces.
5. Reassemble the meter by inserting the float assembly with damper into the inlet/bottom of the meter. Secure the inlet/bottom screw by holding the damper in place with a pin (1/8" diameter). Replace and secure the top/outlet screw. Reinstall and secure the inlet fitting.

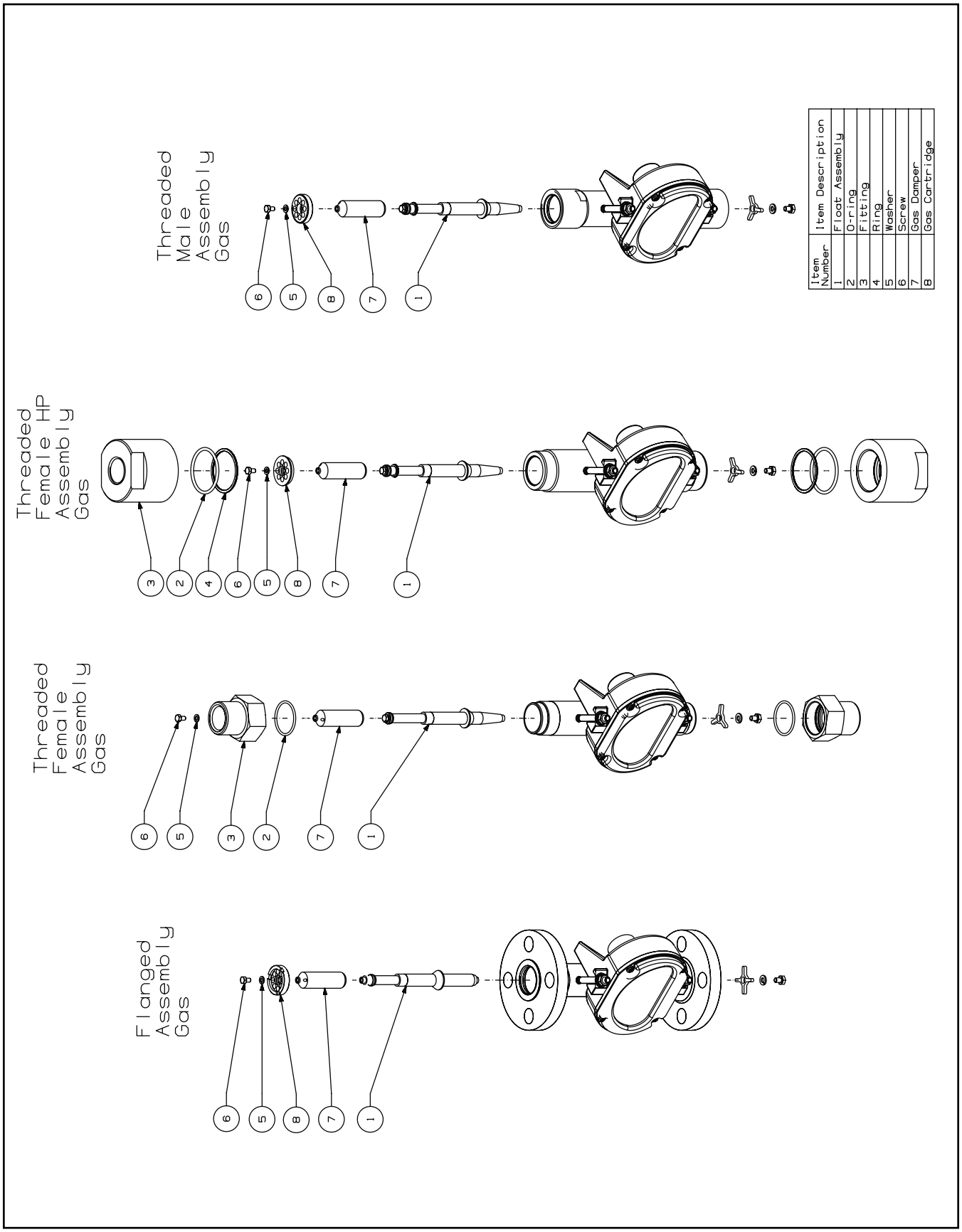


Figure 4-1 Exploded View, Model MT3809G and MT3810G - Gas Service

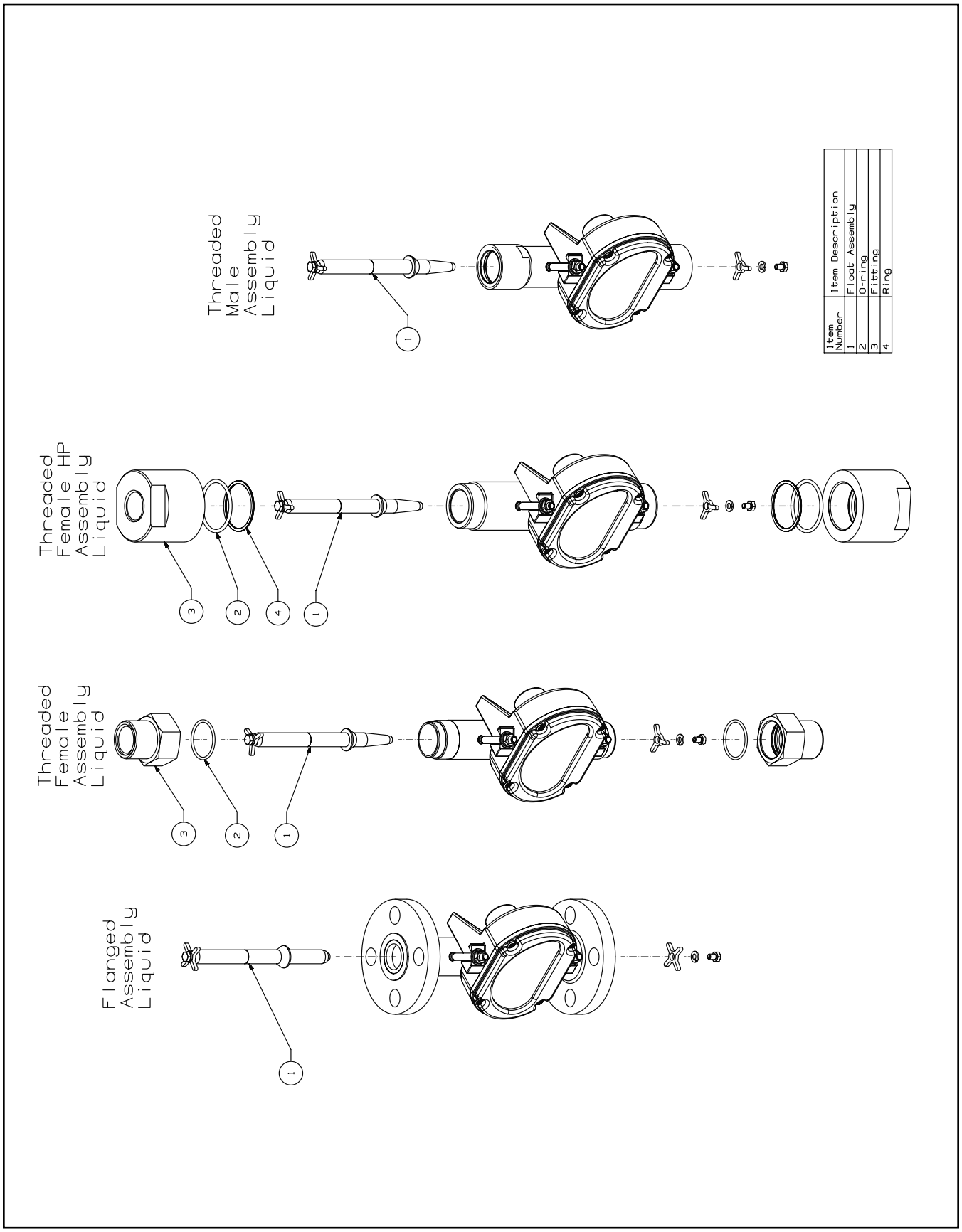


Figure 4-2 Exploded View, Model MT3809G and MT3810G - Liquid Service

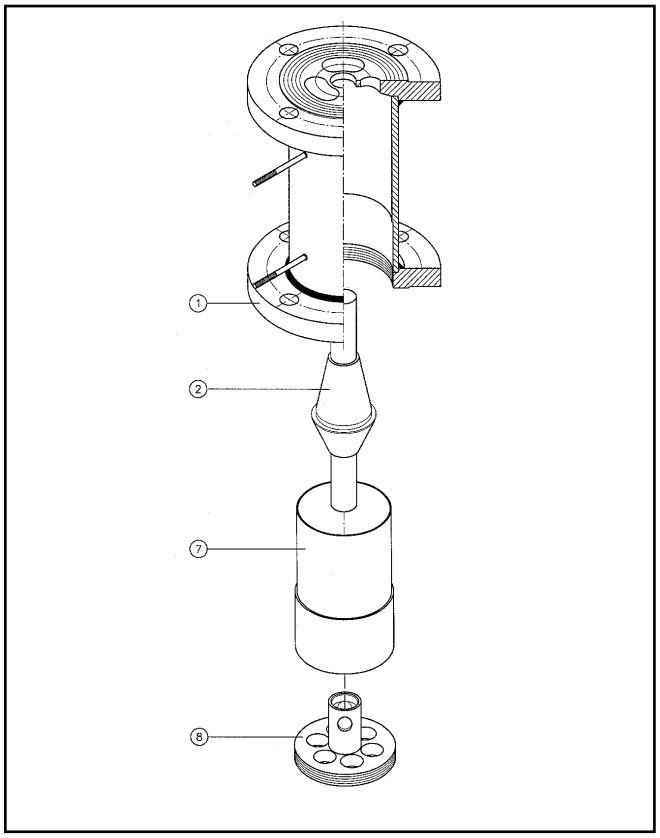


Figure 4-3 Exploded View, Model MT3809G, Size 15 (Gas or Liquid Service)

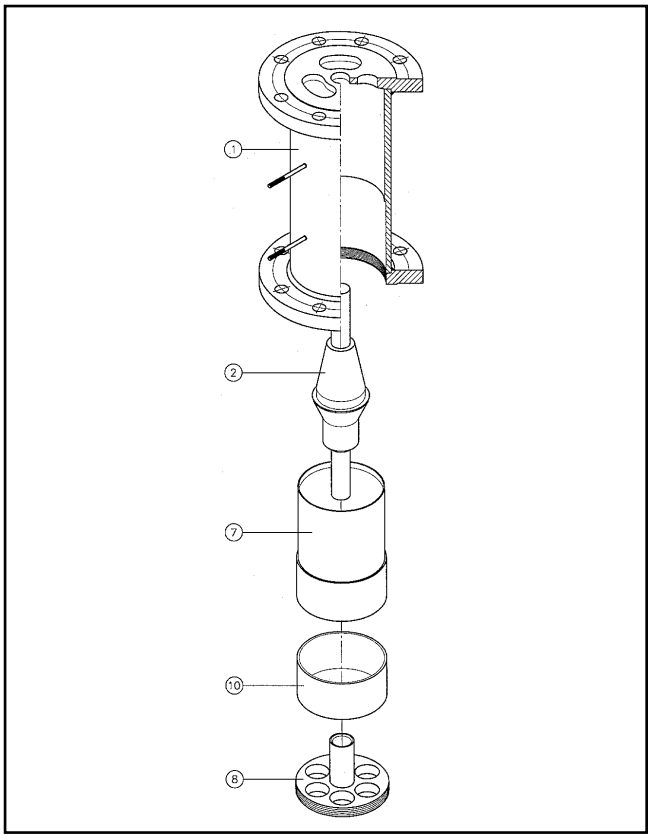


Figure 4-4 Exploded View, Model MT3809G, Size 16 (Liquid Service Only)

Meter Float Cleaning (MT3809 ETFE Option)

Flanged connections, all sizes, liquid or gas.
a. Flush only. Contact factory.

Meter Indicator Reference Mark (zero) Adjustment

This adjustment is performed with no process flow with the float resting on the guide vane or the inlet end fitting.

a. Completely stop fluid flow through the flowmeter.
b. See Section 2-5-1 on how to remove indicator housing and expose the pointer assembly.
c. Turn the slotted screw on the bottom of the point until the pointer is in line with the reference (zero) mark on the scale.
d. Replace the indicator housing cover with gasket and secure, see Section 2-5-1 for details.

Transmitter Replacement with or without Alarms and Pulse Output

All transmitters are self contained units matched specifically to the associated flowmeter. If there is a need to replace, please contact your nearest authorized Brooks service representative.

Inductive Alarm Replacement

a. Remove the front cover of the indicator housing, refer to Section 2-5-1.

b. The wires from the alarm switch(es) are wired into the alarm terminal connector.
c. Loosen the two screws securing the scale, with the alarm switches attached, and remove the scale.
d. Remove the two screws securing the wire cover.
e. Turn the wire cover over to expose the alarm terminal blocks.
f. Remove the wires from the terminal blocks
g. Turn the scale over and locate the screw centered in the green alarm switch. Remove the screw being careful not to lose the nut on the outside of the alarm set bracket. Remove the alarm switch from support.
h. Place the switch on the bracket with the open end facing towards the center of the scale plate and the wires facing away from the scale plate.
i. Place the switch screw through the opening in the switch, and the support bracket. Use the nut to secure the screw and tighten.
j. Connect the alarm switch wires to the terminal block.
Refer to Alarm Wiring Diagrams Figures 2-6a & 2-6b, 2-7a & 2-7b, 2-8a & 2-8b and 2-9a & 2-9b.
k. Replace the scale and tighten two clamping screws. Make sure that the alarm switch wires do not interfere with the alarm cam. Insure that the pointer is aligned with the ‘R’ or zero mark. If not, refer to Section 4-3, indicator reference mark (zero) adjustment.
l. Set the alarm position, by loosening the two pointer screws, moving the point of the desired alarm setting, and tightening the screws.
m. Connect the field wiring.
n. Replace the indicator housing cover and secure with four screws.

Transmitter Replacement with Inductive Alarms

The transmitter is a self contained unit matched specifically to the associated flowmeter. If there is a need to replace, please contact your nearest authorized Brooks service representative. However, the inductive alarms may be replaced according to the procedure in Section 4.6

Digital Display Replacement

If there is a need to replace, please contact your nearest authorized Brooks service representative.

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Patents Pending: Please visit BrooksInstrument.com/Fieldbus for a complete list.

Installation-Manual-MT3809G-MT3810G-EN/541B182AAG/B/2024-02

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BROOKS® INSTRUMENT
Bevond Measure

Calibration Procedure	
Model:	**Model MT3809 (un-lined and ETFE lined and ELF) & MT3810**

1. Scope

1.1 P.D.S./I.O.M. of in Header of this document mentioned Models.

2. Purpose

2.1 To calibrate, against a certified calibration installation, VA type Flow meters series: MT3809, (both un-lined and ETFE Lined and ELF) and MT3810. Including the range of 2-100 cubic m^3 per hour (size #15 and #16).

3. Equipment

3.1 The liquid calibration can be executed with a reference measurement on a comparison stand or measuring by weighing. For both methods the test fluid is water at ambient temperature. For gas service the Vol-U-Meter, 3750 cal stand, and the Bell-Prover type calibration units can be used (for sizes 1 inch and smaller). The calibration benches must have a valid certificate.

4. References

4.1 The VASE (or other) computer program for saving the information and/or to calculate to other units/conditions.

5. Standards

5.1 VDI/VDE 3513 Accuracy class 1.6, 2.5, 4 or 2%, 3%, 5% FS and from maximum flow. Optional is 1% from maximum flow (not for ELF execution).

At all test points within the range of the instrument the maximum error must be within the tolerances mentioned in the particular class.

Example: Accuracy ± 1.6 or ± 2% of max. flow.

At all test points within the range of the instrument the maximum allowed error must be less than ± 1,6 or ± 2% of max. flow.

Rev.	No.	Description	Revised by	Chk.	Date
J	EZ53	Update for ELF, & ETFE lined options	JC	JvL	02-12-15
H	ER82	Update for 38xxG and add #15/16	RB	JvL	24-07-13
G	DS66	Reduce of calibration points	AL	JvL	21-07-08
F	DR25	Format update	JvL	JvL	20-03-08
E	DC84	Replace"x" by accuracy	RH	JW	01-12-04

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6. Qualifications

6.1 N.A.

7. Responsibilities

7.1 The operator is responsible to carry out the test according the procedures.

In case of discrepancies or doubt concerning the measuring results, the responsible engineer must be consulted.

8. Instructions for MT3809 size 7-13 and 3809 ELF sizes 0-5

8.1 Mount a degree test scale towards the instrument and adjust the pointer at zero. The instrument must be leveled during calibration. The wandering of the float assembly must be tested prior to the calibration, by turning the float 360 degrees and checking the pointer movement.

8.2 Measure the flow at degree readings as indicated at section 8.3 a and b. Number of the positions are a minimum of 5 points, but depend on the requested accuracy and customer conditions.

8.3 a) Class 4 VDI/VDE & 3% FS: First calibration point is the maximum water or gas value as specified on the order, following readings must be taken 20 or 30 degrees apart, in decreasing trend from maximum value. The calibration points must be taken considering that the last calibration point must be between 5 to 10% of max flow, and that there should be at least 5 calibration points.

b) Class 1.6, 2.5 VDI/VDE & 1% FS: First reading point is the maximum water or gas value as specified on the order. Next calibration point is 10 or 20 degree below the maximum value. Further calibration points must be taken 20 or 30 degrees apart, in decreasing trend from maximum value. The calibration points must be taken considering that the last calibration point must be below 5 to 10% of max flow, and that there should be at least 5 calibration points.

8.4 Instructions for #15 and #16:

Connect the hoses to the calibration stand towards the pump/tank. Fix the calibration stand to the ground by means of the four supports. Connect the RFT main cable. Put the device to be tested into the calibration stand. Fix it by bolting the two brass rings down.
Close the valve at the outlet side of the instrument. Open the valve on the inlet side to let the water into the device by exhausting with the valve underneath the pressure gauge.
When the system is filled, the outlet valve can be opened. Pump the water through the instrument until there is no air left in the water. Stop pumping and close the outlet valve. Zero the Coriolis reference instrument (needs only to be done when main was disconnected).

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Open the valve and adjust the flow until the maximum flow of the instrument (to be read on the production copy) is reached. Take the first higher step e.g. 110 degree scale reading and read the value on the RFT. Decrease the flow in scale reading steps of 20 degree, the last point to be tested must be below the 10% from full scale flow. Put the data into the VASE system for calculation and scale engraving. Close the outlet valve and vent the system, when the lower sight true indicator is empty the device can be removed.

8.5 All instruments with a transmitter, after engraving and mounting the customer scale, the mA readings must be tested at 100%, 10% and on 50%. Readings must be: 100% - 20mA, 10% - 5.6mA, 50% - 12mA.

9. Reports/Records

9.1 Calibration information must be saved in an electronic file system or serial number file.

10. Flow Charts

10.1 N.A.

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