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DATE: September 5, 2025

Mina Ching

EXHIBIT B

https://web.archive.org/web/20120322124738/http://www2.emersonprocess.com/siteadmincenter/PM%20Rosemount%20Documents/00809-0100-4774.pdf

00809-0100-4774
English
Rev. BA

Model 3051 Transmitter With FOUNDATION™ fieldbus protocol

Device Revision 7



FOUNDATION

ROSEMOUNT®

www.rosemount.com

EMERSON™
Process Management

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Product Manual

Model 3051 Transmitter with FOUNDATION™ fieldbus

NOTICE

Read this manual before working with the product. For personal and system safety, and for optimum product performance, make sure you thoroughly understand the contents before installing, using, or maintaining this product.

Within the United States, Rosemount Inc. has two toll-free assistance numbers:

Customer Central
Technical support, quoting, and order-related questions.

1-800-999-9307 (7:00 am to 7:00 pm CST)

North American Response Center
Equipment service needs.

1-800-654-7768 (24 hours—includes Canada)

Outside of the United States, contact your local Rosemount representative.

⚠CAUTION

The products described in this document are NOT designed for nuclear-qualified applications. Using non-nuclear qualified products in applications that require nuclear-qualified hardware or products may cause inaccurate readings.

For information on Rosemount nuclear-qualified products, contact your local Rosemount Sales Representative.

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00809-0100-4774 Rev. BA 11/00

Product documentation available at...
www.rosemount.com

Fisher-Rosemount satisfies all obligations coming from legislation to harmonise product requirements in the European Union.

ROSEMOUNT®

Section

1 Introduction

OVERVIEW

The sections in this manual provide information on installing, operating, and maintaining the Rosemount Model 3051 Transmitter with FOUNDATION™ fieldbus with Revision 7 software. The sections are organized as follows:

Section 2

Installation

- Mechanical and electrical installation instructions

Section 3

Configuration

- Basic transmitter operation
- Software functionality
- Provides basic configuration procedures

Section 4

Operation and Maintenance

- Provides general maintenance information and procedures

Appendix A

Specifications and Reference Data

- Specification data for all model 3051 transmitters with FOUNDATION fieldbus

Appendix B

Approvals

- Intrinsic safety approval drawings
- European ATEX directive information

Appendix C

Block Information

- Transducer Block operation and parameters
- Resource Block operation and parameters
- Advanced Diagnostic block information
- LCD block information

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Section 2

Installation

OVERVIEW

This section contains specific information pertaining to the installation of the Model 3051 Transmitter with FOUNDATION fieldbus.

SAFETY MESSAGES

Instructions and procedures in this section may require special precautions to ensure the safety of the personnel performing the operations. Information that raises potential safety issues is indicated by a warning symbol (⚠). Please refer to the following safety messages before performing an operation preceded by this symbol.

Warnings ⚠

⚠WARNING

Explosions can result in death or serious injury.

- Do not remove the transmitter covers in explosive environments when the circuit is live.
- Both transmitter covers must be fully engaged to meet explosionproof requirements.
- Verify that the operating atmosphere of the transmitter is consistent with the appropriate hazardous locations certifications.

⚠WARNING

Electrical shock can result in death or serious injury.

- Avoid contact with the leads and terminals.

⚠WARNING

Process leaks could result in death or serious injury.

- Install and tighten all four flange bolts before applying pressure.
- Do not attempt to loosen or remove flange bolts while the transmitter is in service.

⚠WARNING

Replacement equipment or spare parts not approved by Rosemount Inc. for use as spare parts could reduce the pressure retaining capabilities of the transmitter and may render the instrument dangerous.

- Use only bolts supplied with the Model 3051 or sold by Rosemount Inc. as spare parts for the Model 3051.

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GENERAL CONSIDERATIONS

Measurement accuracy depends upon proper installation of the transmitter and impulse piping. Mount the transmitter close to the process and use a minimum of piping to achieve best accuracy. Keep in mind the need for easy access, personnel safety, practical field calibration, and a suitable transmitter environment. Install the transmitter to minimize vibration, shock, and temperature fluctuation.

IMPORTANT
Install the enclosed pipe plug in unused conduit openings with a minimum of five threads engaged to comply with explosionproof requirements. The transmitter is shipped with the plug installed on the transmitters ordered with CSA explosionproof approval.

MECHANICAL CONSIDERATIONS

Figures 2-1 through 2-5 on pages 2-3 through 2-6 show dimensional drawings of Model 3051 transmitters. Figure 2-8 on page 2-10 shows installation examples. Figures 2-9 through 2-12 on pages 2-14 through 2-17 show dimensional drawings of mounting brackets.

NOTE
For Model 3051CD0 and 3051CD1, mount the transmitter solidly to prevent tilting. A tilt in the physical transmitter may cause a zero shift in the transmitter output.

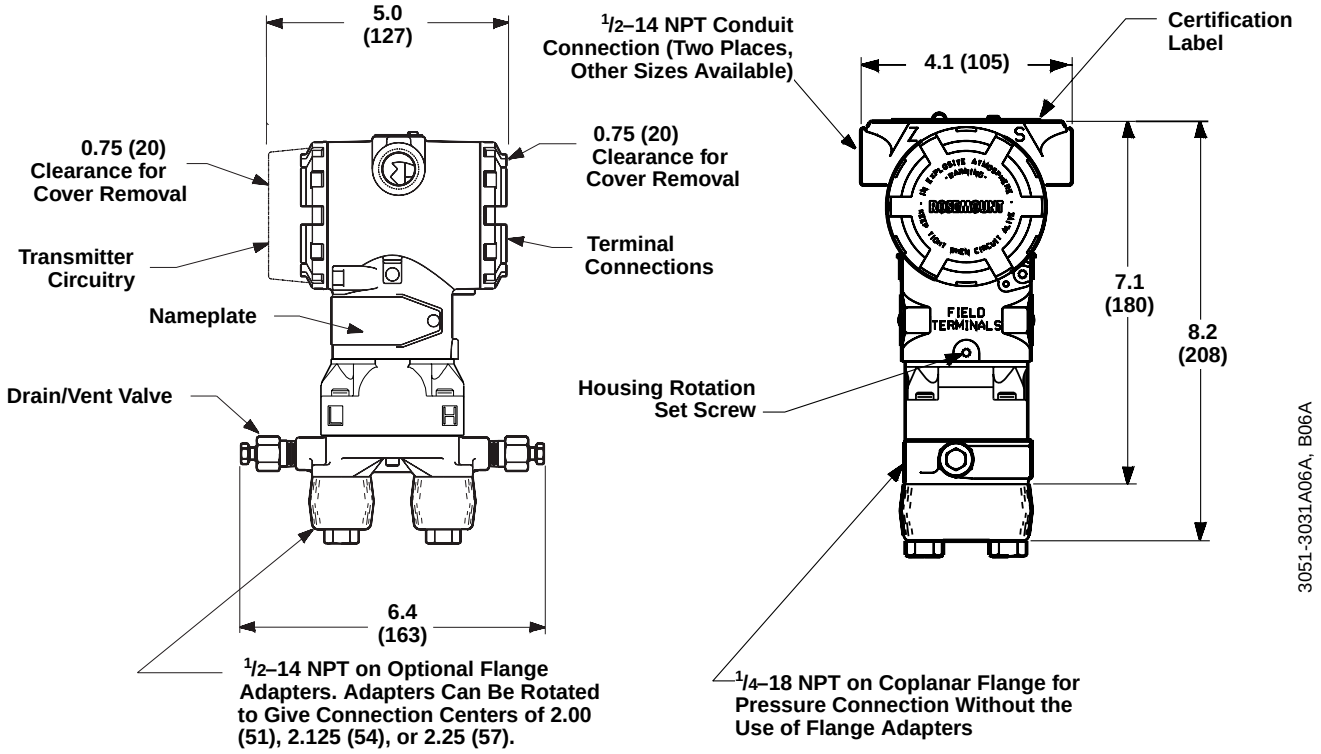
NOTE
For steam service, do not blow down impulse piping through the transmitter. Flush the lines with the blocking valves closed and refill the lines with water before resuming measurement.

NOTE
When the transmitter is mounted on its side, position the Coplanar flange to ensure proper venting or draining. Mount the flange as shown in Figure 2-8 on page 2-10, keeping drain/vent connections on the bottom for gas service and on the top for liquid service.

NOTE
The Model 3051 transmitter incorporates two independent seals between the process connection and the conduit connection.

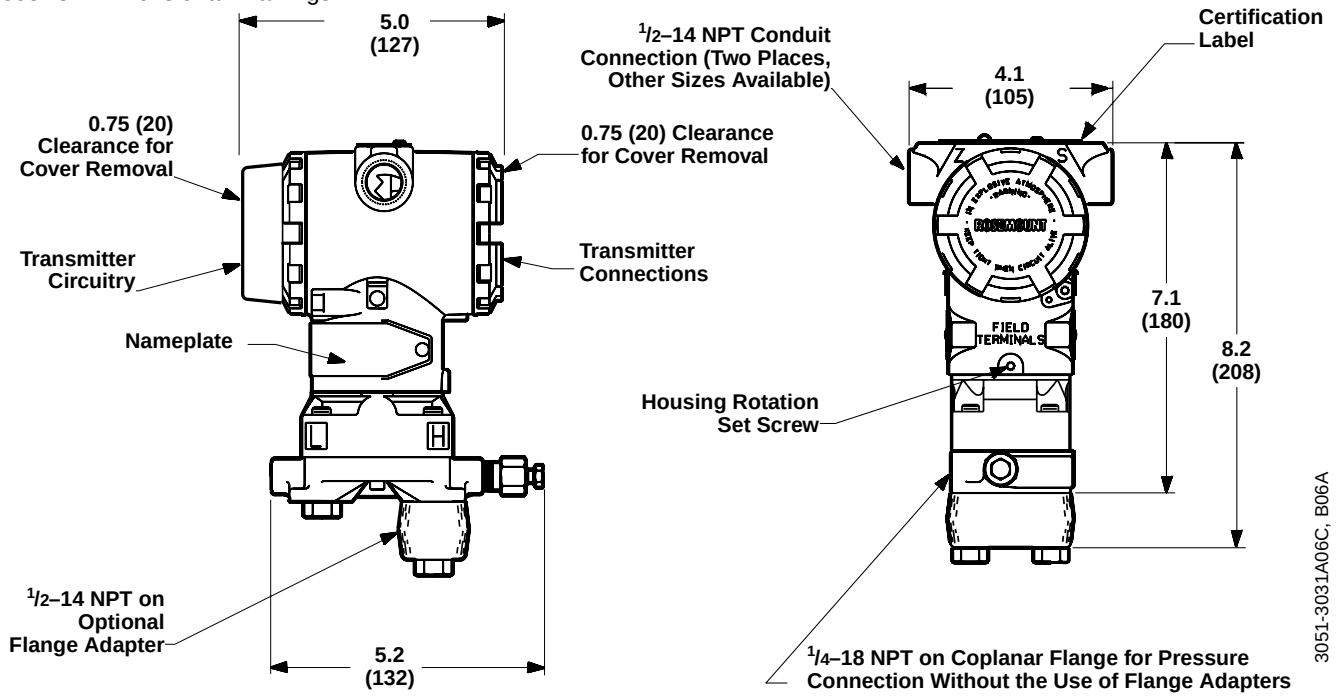
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Figure 2-1. Model 3051CD
Dimensional Drawings



NOTE: Dimensions are in inches (millimeters)

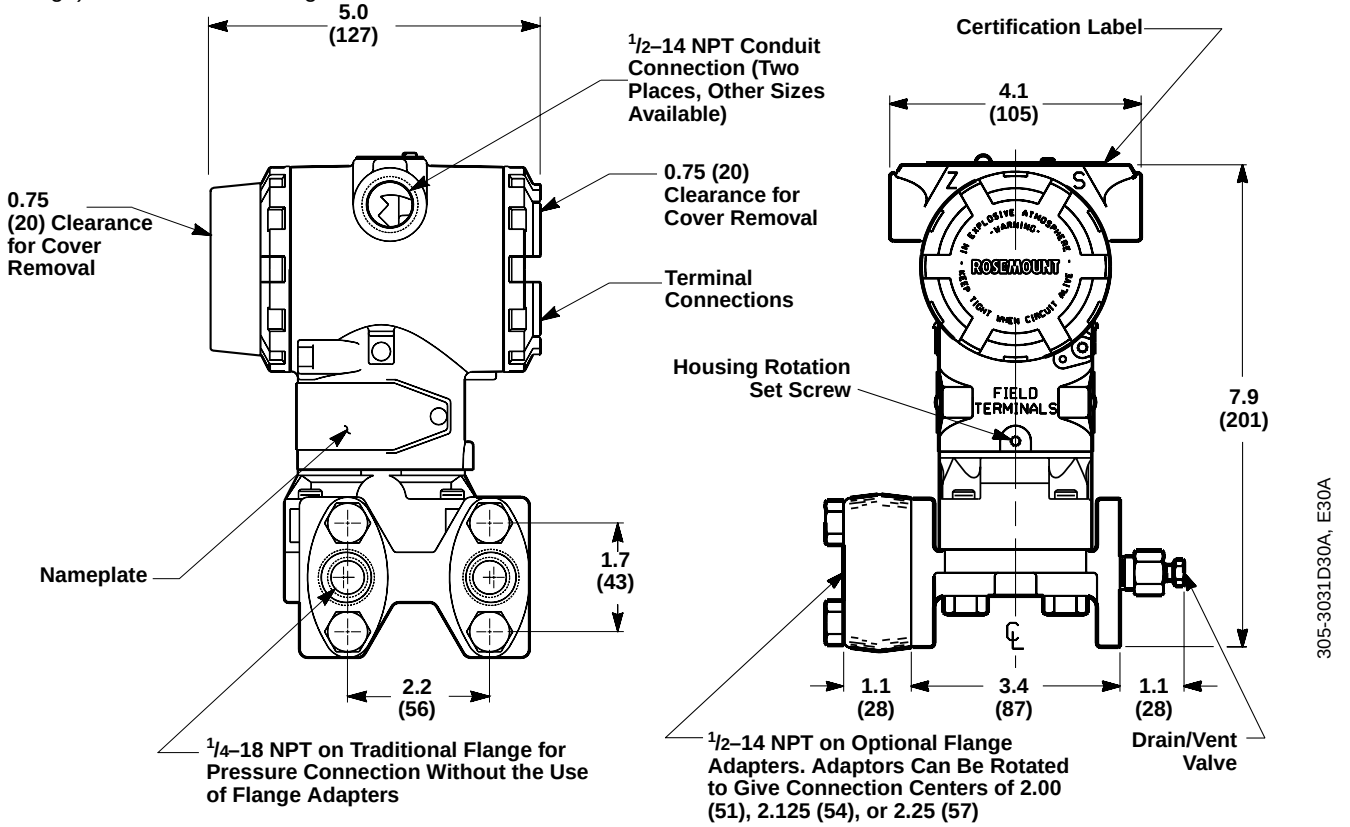
Figure 2-2. Model 3051CG and
3051CA Dimensional Drawings



NOTE: Dimensions are in inches (millimeters)

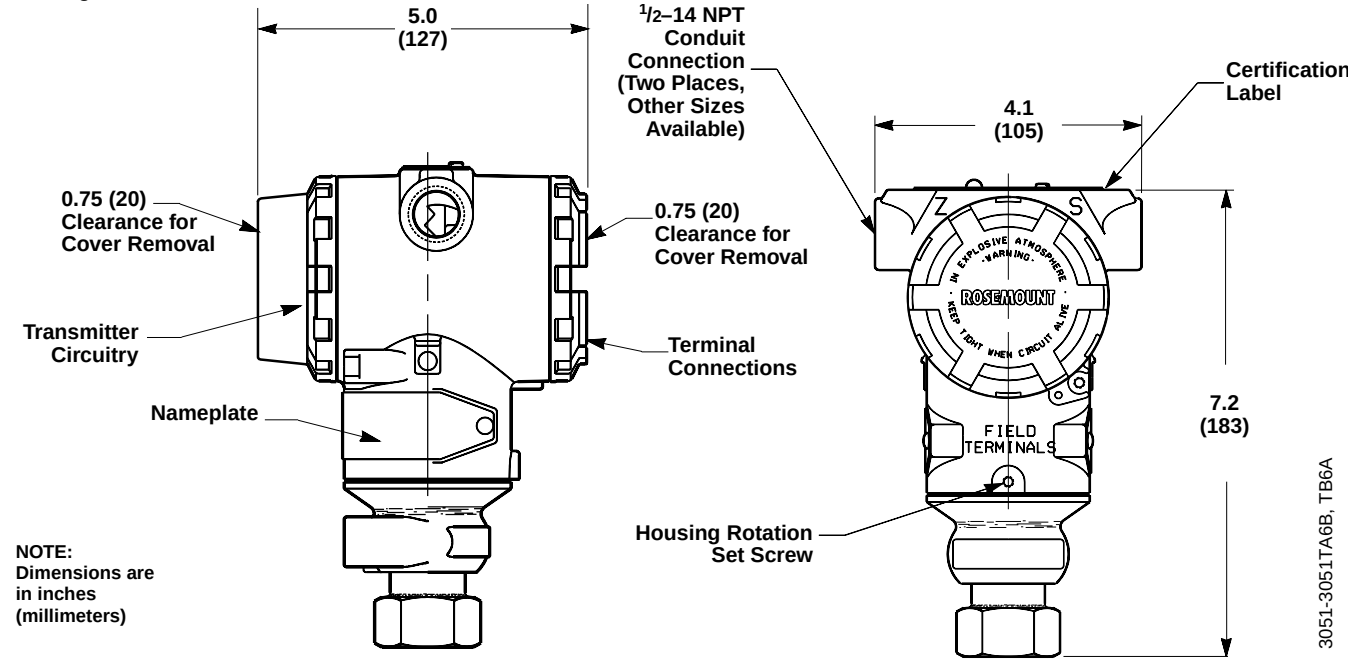
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Figure 2-3. Model 3051C (Traditional Flange) Dimensional Drawings



NOTE: Dimensions are in inches (millimeters).

Figure 2-4. Model 3051T Dimensional Drawings



NOTE: Dimensions are in inches (millimeters)

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Table 2-1. Model 3051L Dimensional Specifications—Except Where Noted, Dimensions Are in Inches (Millimeters)

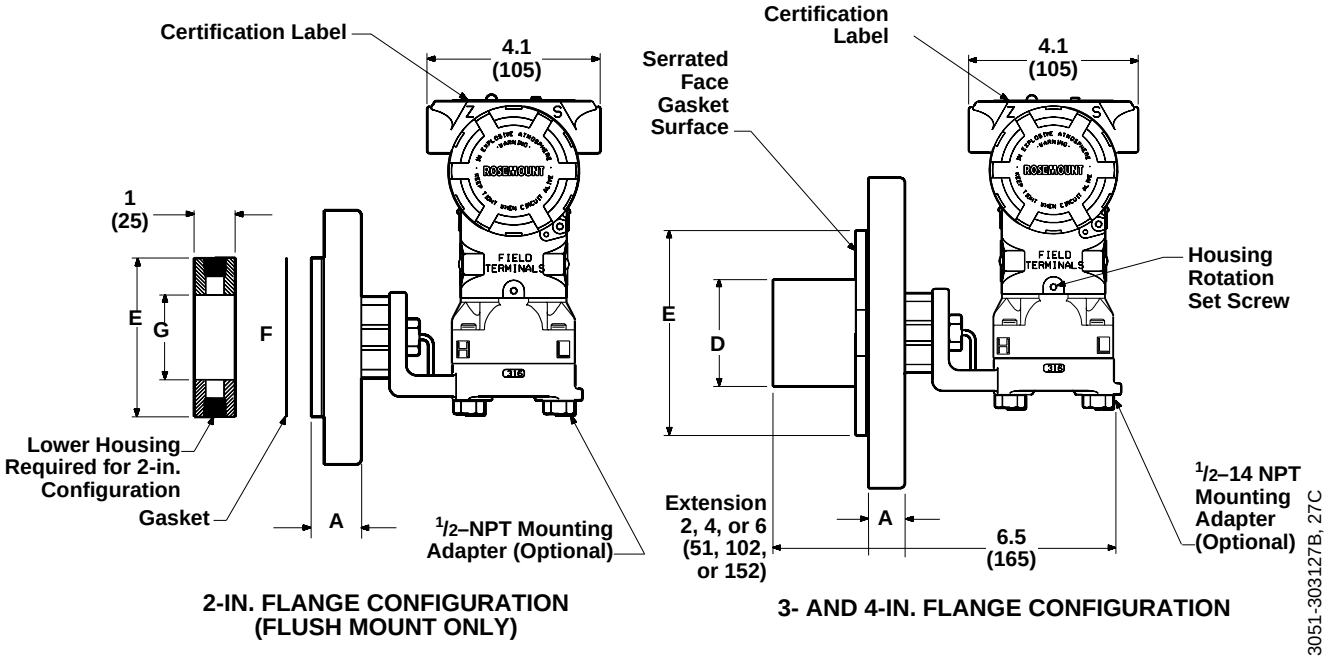
Class	Pipe Size	Flange Thickness	Bolt Diameter	Outside Diameter	No. of Bolts	Bolt Hole Diameter	Exten. Diam.(1)	O.D. Gask. Surf.	Lower Housing	
									Xmtr Side	Proc. Side
		A	B	C			D	E	F	G
ASME B 16.5 (ANSI) Class 150	2 (51)	1.12 (28)	4.75 (121)	6.0 (152)	4	0.75 (19)	NA	3.75 (95)	2.9 (74)	2.16 (55)
	3 (76)	1.31 (33)	6.0 (152)	7.5 (190)	4	0.75 (19)	2.58 (65)	5.0 (127)	3.11 (79)	3.11 (79)
	4 (102)	1.31 (33)	7.5 (190)	9.0 (228)	8	0.75 (19)	3.5 (89)	6.81 (173)	4.06 (103)	4.06 (103)
ASME B 16.5 (ANSI) Class 300	2 (51)	1.25 (32)	5.0 (127)	6.5 (165)	8	0.75 (19)	NA	3.75 (95)	2.9 (74)	2.16 (55)
	3 (76)	1.50 (38)	6.62 (168)	8.25 (209)	8	0.88 (22)	2.58 (65)	5.0 (127)	3.11 (79)	3.11 (79)
	4 (102)	1.62 (41)	7.88 (200)	10.0 (254)	8	0.88 (22)	3.5 (89)	6.81 (173)	4.06 (103)	4.06 (103)
ASME B 16.5 (ANSI) Class 600	2 (51)	1.12 (28)	5.0 (127)	6.5 (165)	8	0.75 (19)	NA	3.75 (95)	2.9 (74)	2.16 (55)
	3 (76)	1.37 (35)	6.62 (168)	6.62 (168)	8	0.88 (22)	2.58 (65)	5.0 (127)	3.11 (79)	3.11 (79)
DIN PN 10–40	DN 50	26 mm	125 mm	165 mm	4	18 mm	NA	95 mm	74 mm	55 mm
DIN PN 25/40	DN 80	30 mm	160 mm	200 mm	8	18 mm	65 mm	127 mm	79 mm	79 mm
	DN 100	30 mm	190 mm	235 mm	8	22 mm	89 mm	173 mm	103 mm	103 mm
DIN PN 10/16	DN 100	26 mm	180 mm	220 mm	8	18 mm	89 mm	173 mm	103 mm	103 mm

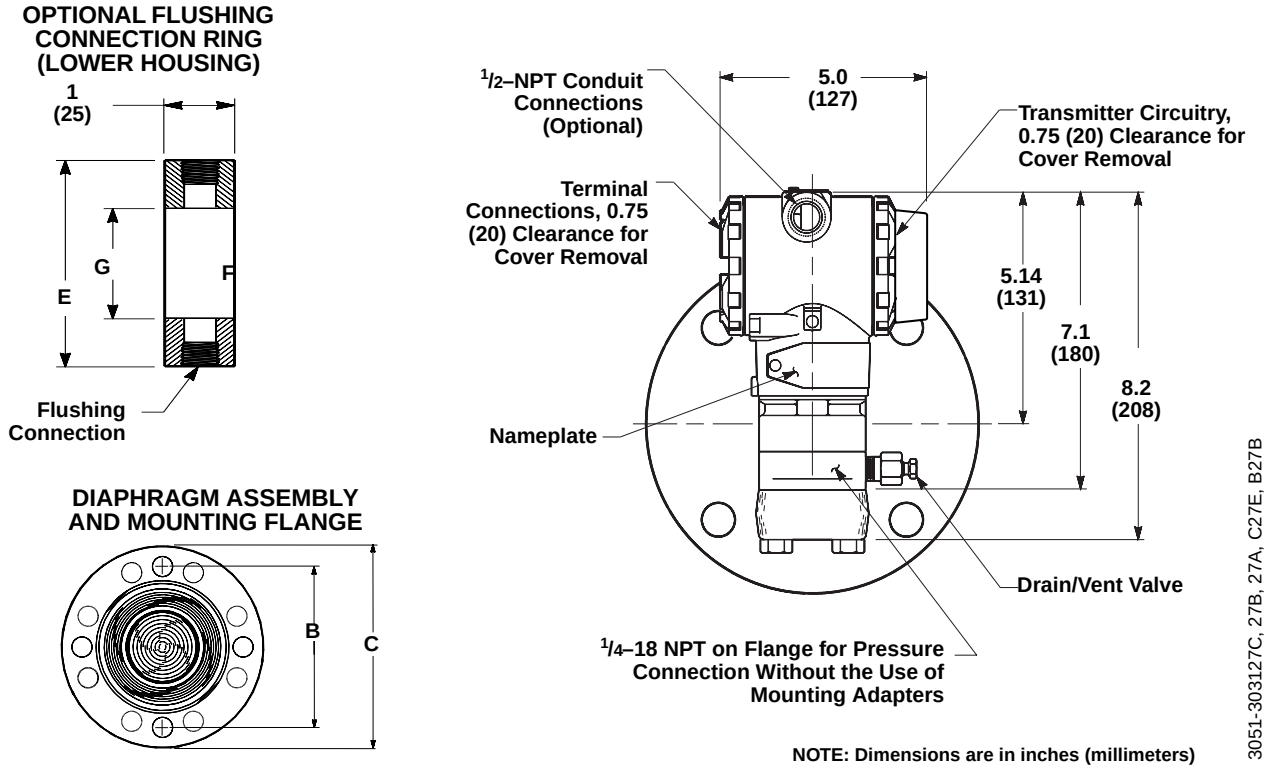
(1) Tolerances are 0.040 (1,02), –0.020 (0,51).

NOTE
Use Table 2-1 in combination with Figure 2-5.

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Figure 2-5. Model 3051L Dimensional Drawings.

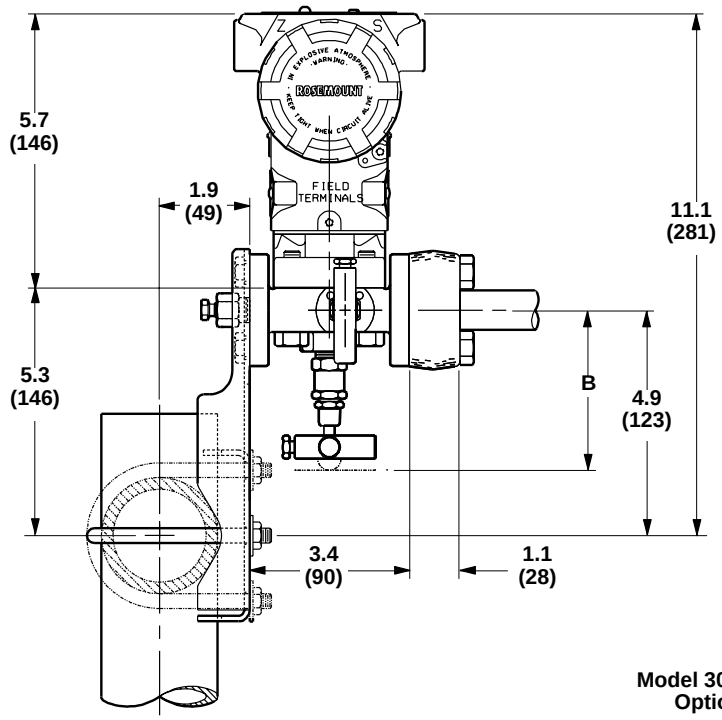




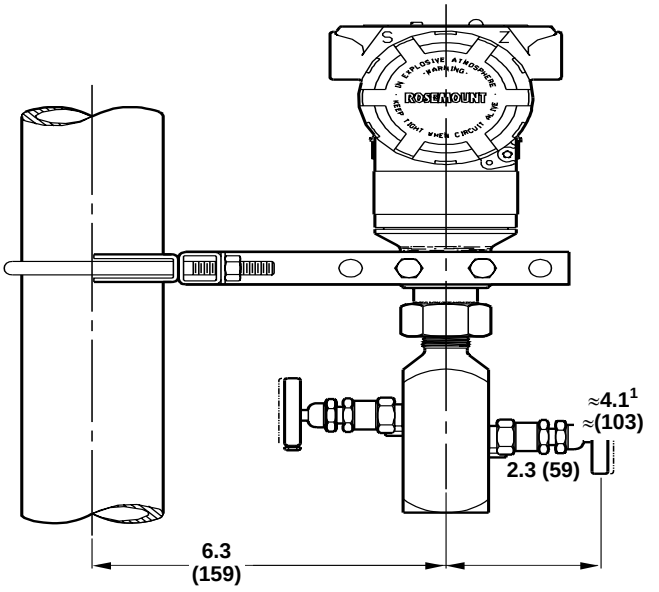
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Figure 2-6. Typical Mounting Configurations for Model 3051 Transmitters with Model 305 and 305 Manifolds

Model 3051C with Model 305 Manifold and Option Code B3/B9/BC Mounting Bracket



Model 3051T with Model 306 Manifold and Option Code B4 Mounting Bracket



Model Number	Dimension B in. (mm)
0305AT2, *Teflon* Packing	3.6 (90)
0305AT2, *Grafoil* Packing	4.2 (107)
0305AT3, *Teflon* Packing	3.6 (90)
0305AT3, *Grafoil* Packing	4.2 (107)
0305AT7, ASME B 31.1 (ANSI)	4.2 (107)
0305AT8, ASME B 31.1 (ANSI)	4.2 (107)

[1]Actual dimension depends on the number of threads engaged to be leak tight.

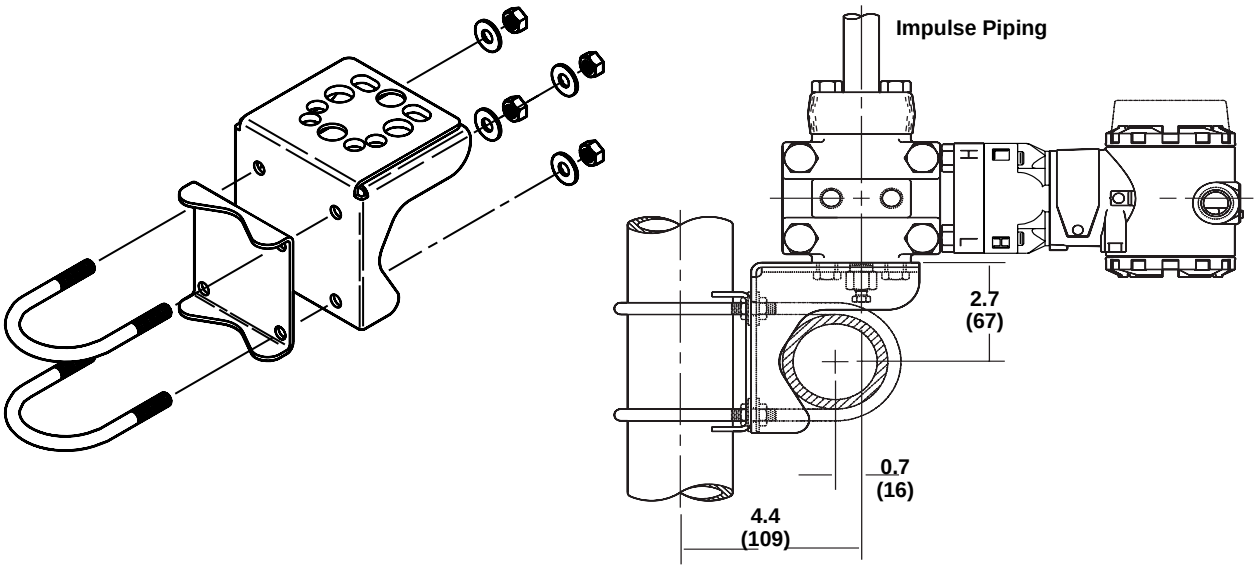
NOTE: Dimensions are in inches (millimeters)

305-3031L19A, 3051D04A

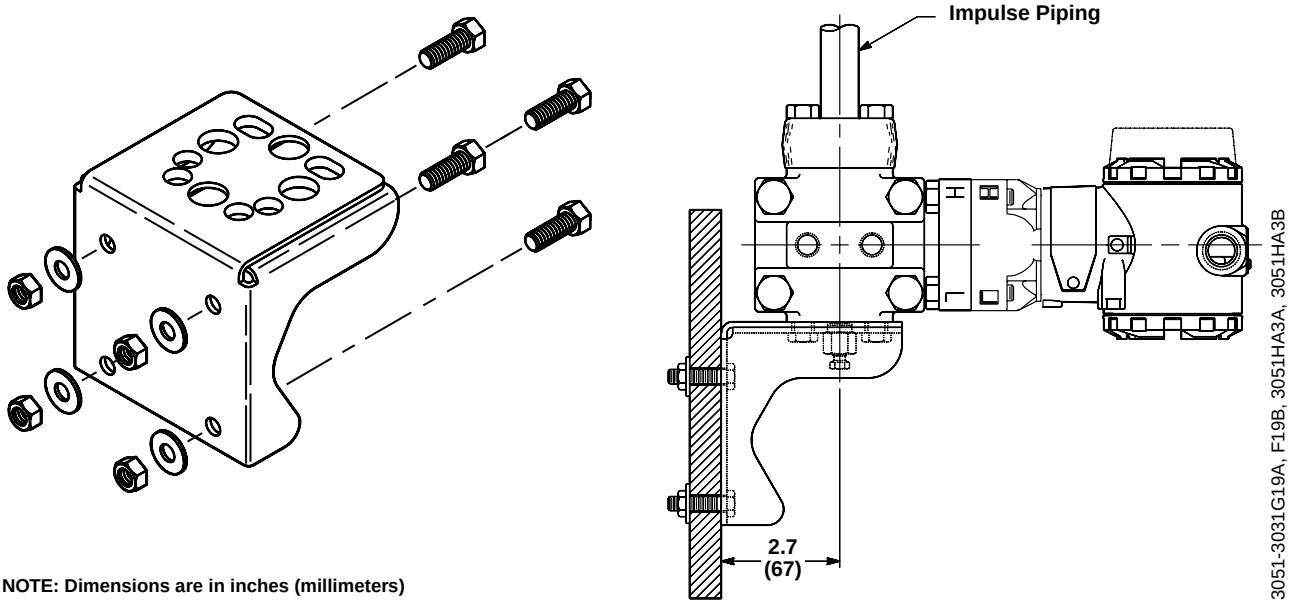
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Figure 2-7. Model 3051H Mounting Bracktes for 2-inch pipe and panel mount

PIPE MOUNTING CONFIGURATION



PANEL MOUNTING CONFIGURATION
7/16-20 X 3/4 bolts supplied for attaching brackets to transmitter



NOTE: Dimensions are in inches (millimeters)

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Mounting

The Model 3051C Pressure Transmitter weighs 5.8 lbs (2,6 kg) without additional options. Optional mounting brackets available with the Model 3051 allow mounting to a panel, wall, or 2-inch pipe. The B4 Bracket Option for use with the Coplanar flange and the Model 3051T is 304 SST with 316 SST bolts. Figures 2-9 and 2-10 on pages 2-14 and 2-15 show bracket dimensions and mounting configurations for the B4 Option.

Bracket options B1, B2, B3, B7, B8, and B9 are sturdy polyurethane painted carbon steel brackets designed for use in pipe or panel mounting the traditional flange (H2, H3, H4, or H7 option). The B1–B3 brackets have carbon steel bolts, while the B7–B9 brackets have stainless steel bolts. Bracket options BA and BC are stainless steel with stainless steel bolts. Dimensionally, these brackets are identical to the B1–B3 brackets used with the Rosemount Model 1151 Pressure Transmitter except for the length of the bolts used to mount the transmitter to the bracket. When installing the transmitter to one of the mounting brackets, torque the bolts to 125 inch-pounds.

NOTE
The transmitter is calibrated in an upright position at the factory. If you mount the transmitter in any other position, the zero point will shift by an amount equivalent to the liquid head caused by the varied mounting position. Triming the sensor may be necessary to compensate for mounting positioning effects. CROSS REF HERE

Mounting Requirements

Refer to Figure 2-8 for examples of the following mounting configurations:

Liquid Flow Measurement

- Place taps to the side of the line to prevent sediment deposits on the transmitter's process isolators.
- Mount the transmitter beside or below the taps so gases can vent into the process line.
- Mount drain/vent valve upward to allow gases to vent.

Gas Flow Measurement

- Place taps in the top or side of the line.
- Mount the transmitter beside or above the taps so liquid will drain into the process line.

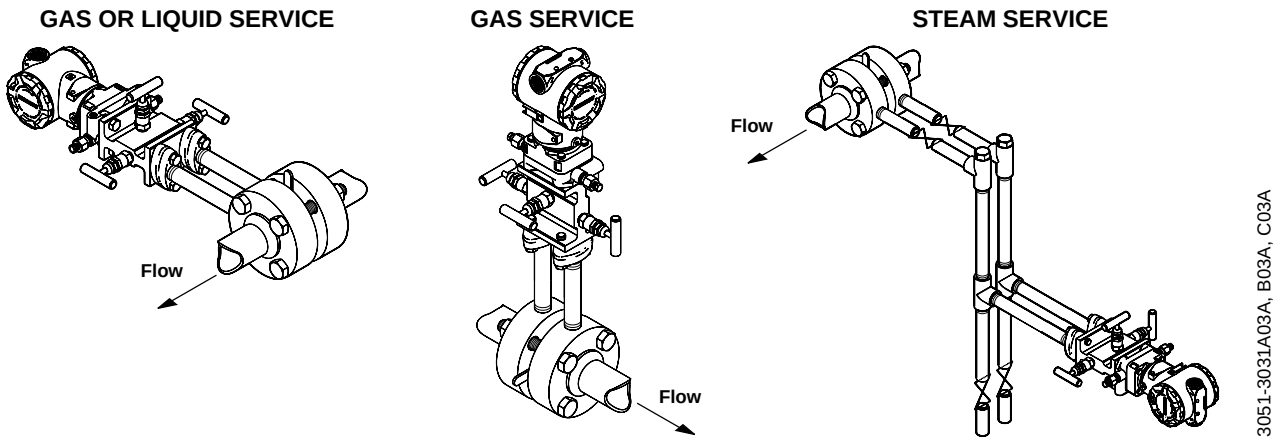
Steam Flow Measurement

- Place taps to the side of the line.
- Mount the transmitter below the taps to ensure that the impulse piping will stay filled with condensate.
- Fill impulse lines with water to prevent the steam from contacting the transmitter directly and to ensure accurate measurement at start-up.

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NOTE
In steam or other elevated temperature services, it is important that temperatures at the coplanar process flanges not exceed 250 °F (121 °C) for transmitters with silicone fill or 185 °F (85 °C) for inert fill. In vacuum service, these temperature limits are reduced to 220 °F (104 °C) for silicone fill and 160 °F (71 °C) for inert fill. Models 3051L, and the traditional flange allow higher temperatures.

Figure 2-8. Installation Examples



Impulse Piping

The piping between the process and the transmitter must accurately transfer the pressure to obtain accurate measurements. There are five possible sources of error: pressure transfer, leaks, friction loss (particularly if purging is used), trapped gas in a liquid line, liquid in a gas line, and density variations between the legs.

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The best location for the transmitter in relation to the process pipe depends on the process itself. Use the following guidelines to determine transmitter location and placement of impulse piping:

- Keep impulse piping as short as possible.
- For liquid service, slope the impulse piping at least 1 inch per foot (8 cm per m) upward from the transmitter toward the process connection.
- For gas service, slope the impulse piping at least 1 inch per foot (8 cm per m) downward from the transmitter toward the process connection.
- Avoid high points in liquid lines and low points in gas lines.
- Make sure both impulse legs are the same temperature.
- Use impulse piping large enough to avoid friction effects and blockage.
- Vent all gas from liquid piping legs.
- When measuring a fluid, fill both piping legs to the same level.
- When purging, make the purge connection close to the process taps and purge through equal lengths of the same size pipe. Avoid purging through the transmitter.
- Keep corrosive or hot (above 250 °F [121 °C]) process material out of direct contact with the sensor module and flanges.
- Prevent sediment deposits in the impulse piping.
- Keep the liquid head balanced on both legs of the impulse piping.
- Avoid conditions that might allow process fluid to freeze within the process flange.

Process Connections

Model 3051 process connections on the transmitter flange are ¼-18 NPT. Flange adapter unions with ½–14 NPT connections are supplied as standard. The threads are Class 2; use your plant-approved lubricant or sealant when making the process connections. The process connections on the transmitter flange are on 2⅛-inch (54 mm) centers to allow direct mounting to a three-valve or five-valve manifold. Rotate one or both of the flange adapters to attain connection centers of 2 inches (51 mm), 2⅛ inches (54 mm), or 2¼ inches (57 mm). See page 2-11 for information on the Model 3051T process connection.

⚠ Install and tighten all four flange bolts before applying pressure, or process leakage will result. When properly installed, the flange bolts will protrude through the top of the module housing. Do not attempt to loosen or remove the flange bolts while the transmitter is in service.

To install adapters to a Coplanar flange, perform the following procedure:

⚠ See “Safety Messages” on page 2-1 for complete warning information.

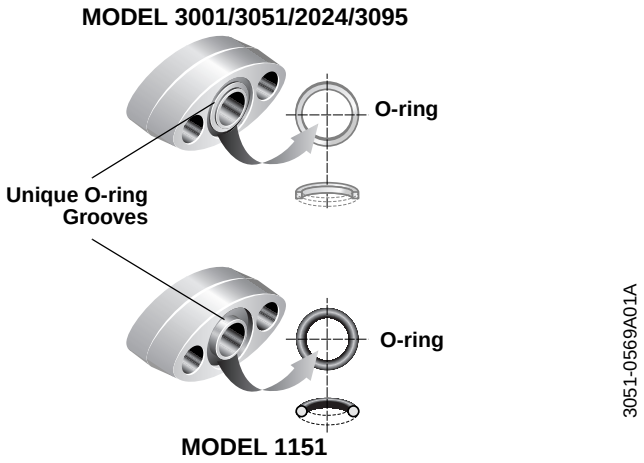
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1. Remove the flange bolts.
2. Leaving the flange in place, move the adapters into position with the O-ring installed.
3. Clamp the adapters and the Coplanar flange to the transmitter module using the larger of the bolts supplied.
4. Tighten the bolts. Refer to "Mounting Bolts" on page 2-17 for torque specifications.

⚠WARNING

Failure to install proper flange adapter O-rings can cause process leaks, which can result in death or serious injury.

Each style of Rosemount flange adapters requires a unique O-ring, as shown below. Flange adapters are distinguished by their unique grooves.



Use only the O-ring designed to seal with an adapter. Refer to the Spare Parts list in Appendix A: Specifications and Reference Data for the correct part numbers of the flange adapters and O-rings designed for Model 3051 transmitters.

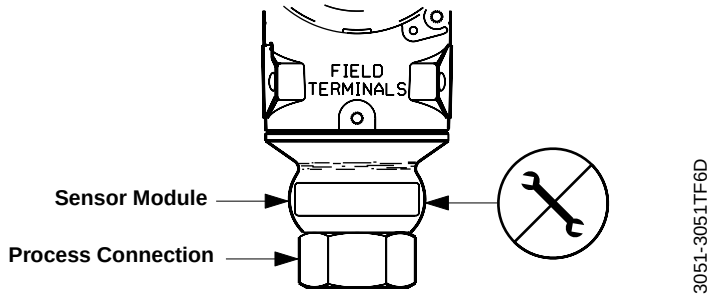
When compressed, Teflon® O-rings tend to cold flow, which aids in their sealing capabilities. Whenever you remove flanges or adapters, visually inspect the Teflon O-rings. Replace them if there are any signs of damage, such as nicks or cuts. If they are undamaged, you may reuse them. If you replace the O-rings, retorque the flange bolts after installation to compensate for cold flow. Refer to the process sensor body reassembly procedure in Section 4 Operation and Maintenance.

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Model 3051T Process Connection

⚠WARNING

Do not apply torque directly to the sensor module. Rotation between the sensor module and the process connection can damage the electronics. To avoid damage, apply torque only to the hex-shaped process connection.



Housing Rotation

The electronics housing can be rotated up to 180 degrees (left or right) to improve field access or to better view the optional LCD meter. To rotate the housing, perform the following procedure:

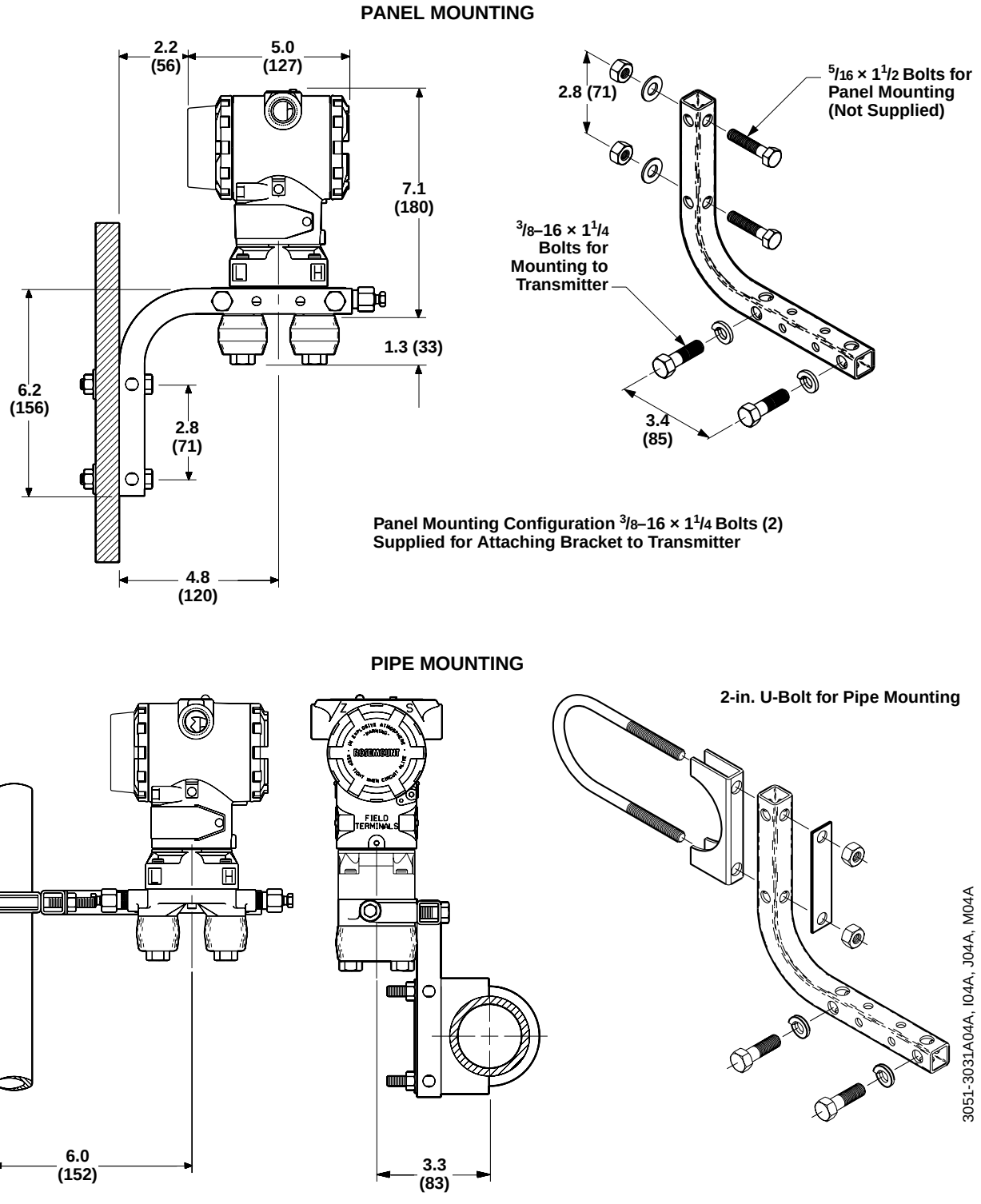
1. Loosen the housing rotation set screw using a 9/64-in. hex wrench.

NOTE
Do not rotate the housing more than 180 degrees without first performing a disassembly procedure (see "Disassembly Procedures" on page 4-1). Over-rotation will sever the electrical connection between the sensor module and the electronics module.

2. Turn the housing up to 180 degrees to the left or right of its original (as shipped) position.
3. Retighten the housing rotation set screw.

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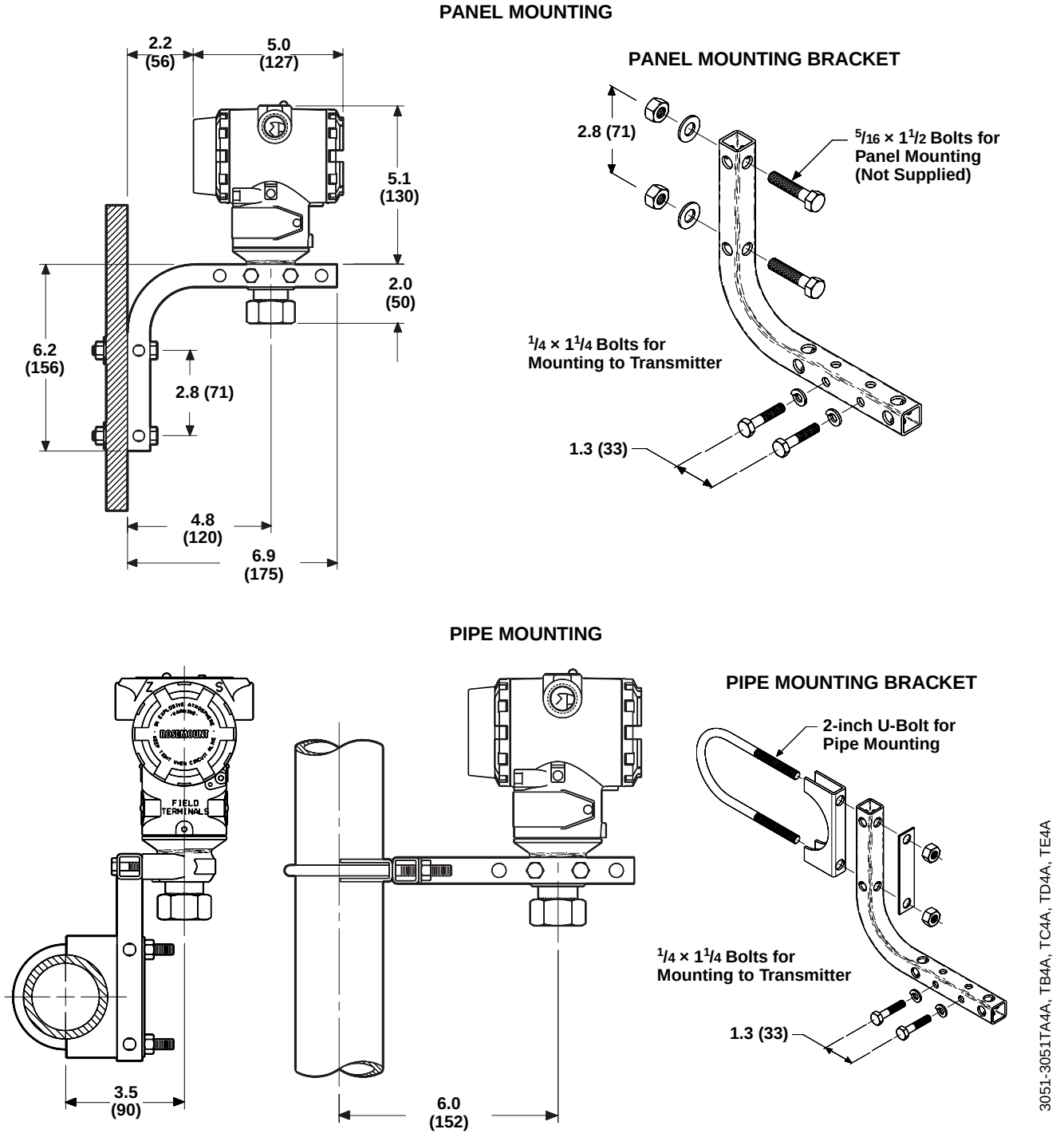
Figure 2-9. Coplanar Flange Mounting Configurations with Optional Bracket (B4) for 2-in. Pipe or Panel Mounting



NOTE
Dimensions are in inches (millimeters)

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Figure 2-10. Model 3051T Mounting Configurations with Optional Bracket (B4) for 2-in. Pipe or Panel Mounting

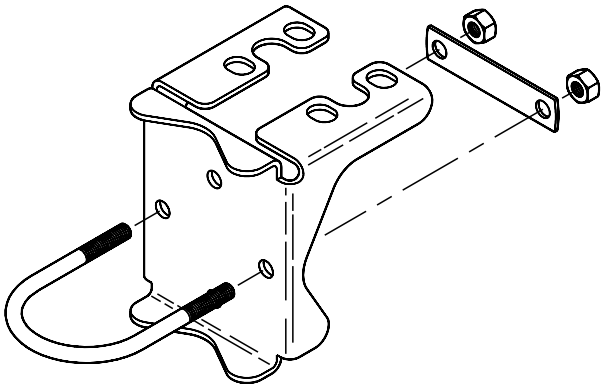


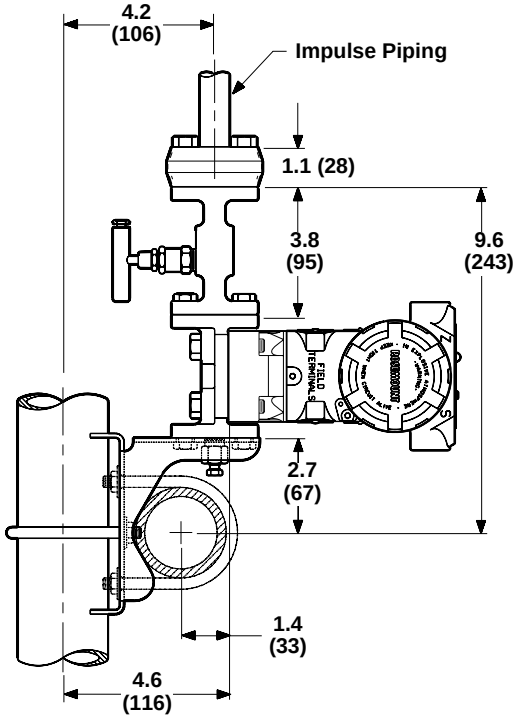
NOTE
Dimensions are in inches (millimeters)

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Figure 2-11. Optional Mounting Bracket
for Traditional Flange Options
B1/B7/BA

OPTION B1/B7/BA: TRADITIONAL FLANGE 2-IN. PIPE MOUNTING BRACKET



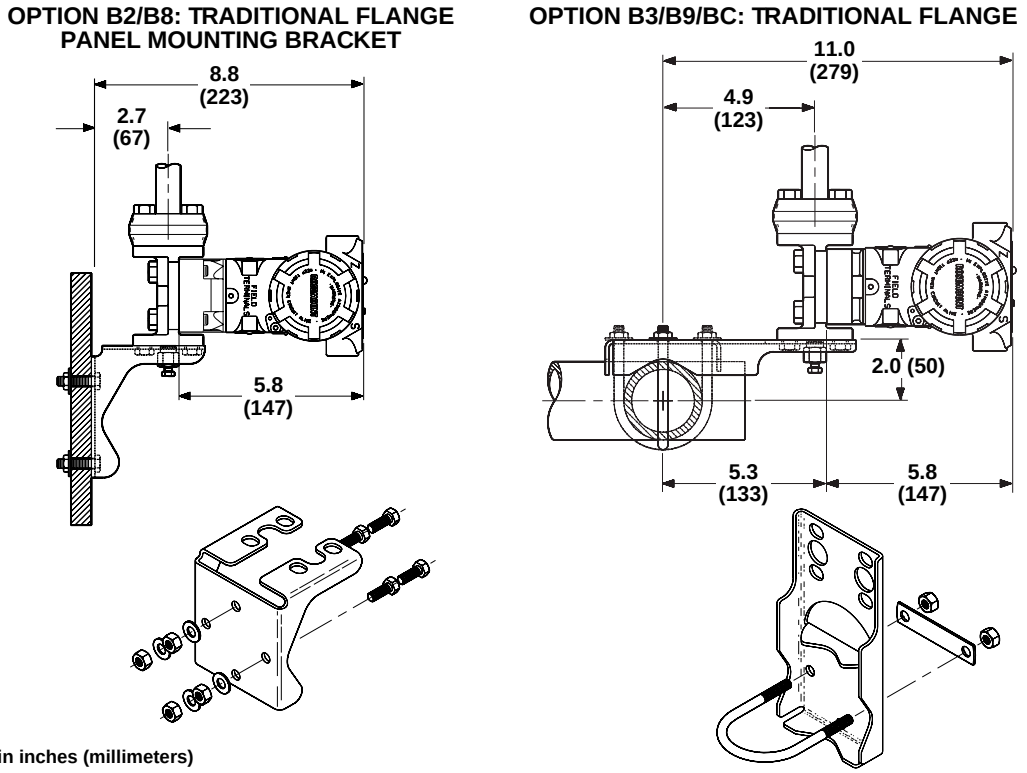


3051-3031C19A, I19A

NOTE
Dimensions are in inches (millimeters)

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Figure 2-12. Optional Mounting Brackets for Traditional Flange Options B2/B8, B3/B9/BC



NOTE
Dimensions are in inches (millimeters)

Mounting Bolts

The following guidelines have been established to ensure a tight flange, adapter, or manifold seal. The Model 3051 is shipped with the Coplanar flange installed with four 1.75-inch flange bolts. The following bolts also are supplied to facilitate other mounting configurations:

Differential Pressure

- Four 2.88-inch flange/adapter bolts for mounting the flange adapters to the Coplanar flange.
- Four 2.25-inch manifold/flange bolts for mounting the Coplanar flange on a three-valve manifold. In this configuration, the 1.75-inch bolts may be used to mount the flange adapters to the process connection side of the manifold.

Gage/Absolute Pressure

- Two 2.88-inch flange/adapter bolts for mounting the flange adapters to the Coplanar flange.

Figures 2-13 and 2-14 on pages 2-19 and 2-20 show mounting bolts and bolting configurations. Stainless steel bolts supplied by Rosemount Inc. are coated with a lubricant to ease installation. Carbon steel bolts do not require lubrication. No additional lubricant should be applied when installing either type of bolt. Bolts supplied by Rosemount Inc. are identified by their head markings:

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Head Markings

Carbon Steel (CS) — Option L5



Stainless Steel (SST) — Option L4



*** The last digit in the F593_ head marking may be any letter between A and M.**

Optional Flange and Adapter Bolts

Option Codes L4, L5, and L6 replace the standard carbon steel flange and adapter bolts with alternative materials. The material types and torque specifications are given in Table 2-2 .

Installation

⚠ Only use bolts supplied with the Model 3051 or sold by Rosemount Inc. as spare parts for the Model 3051 transmitter. Use the following bolt installation procedure:

1. Finger-tighten the bolts.
2. Torque the bolts to the initial torque value using a crossing pattern (see Table 2-2 for torque values).
3. Torque the bolts to the final torque value using the same crossing pattern.

Table 2-2. Bolt InstallationTorque Values.

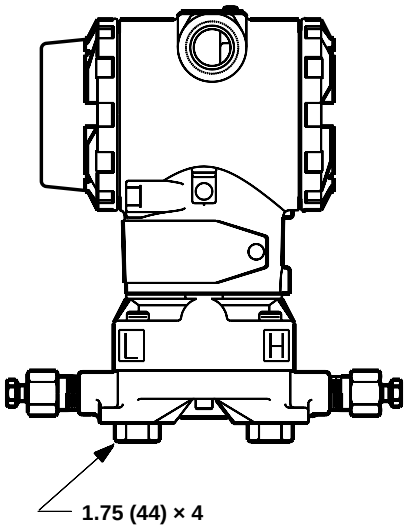
Bolt Material	Initial Torque Value	Final Torque Value
CS-ASTM-A449 Standard	300 in.-lb (34 N-m)	650 in.-lb (73 N-m)
316 SST—Option L4	150 in.-lb (17 N-m)	300 in.-lb (34 N-m)
ASTM-A-193-B7M—Option L5	300 in.-lb (34 N-m)	650 in.-lb (73 N-m)
Monel—Option L6	300 in.-lb (34 N-m)	650 in.-lb (73 N-m)

⚠ See “Safety Messages” on page 2-1 for complete warning information.

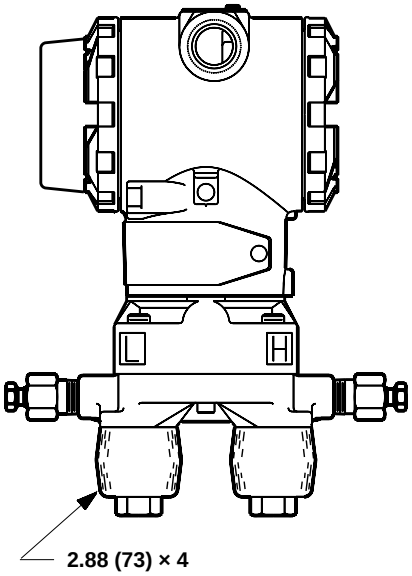
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Figure 2-13. Mounting Bolts and Bolt Configurations for Coplanar Flange

TRANSMITTER WITH FLANGE BOLTS



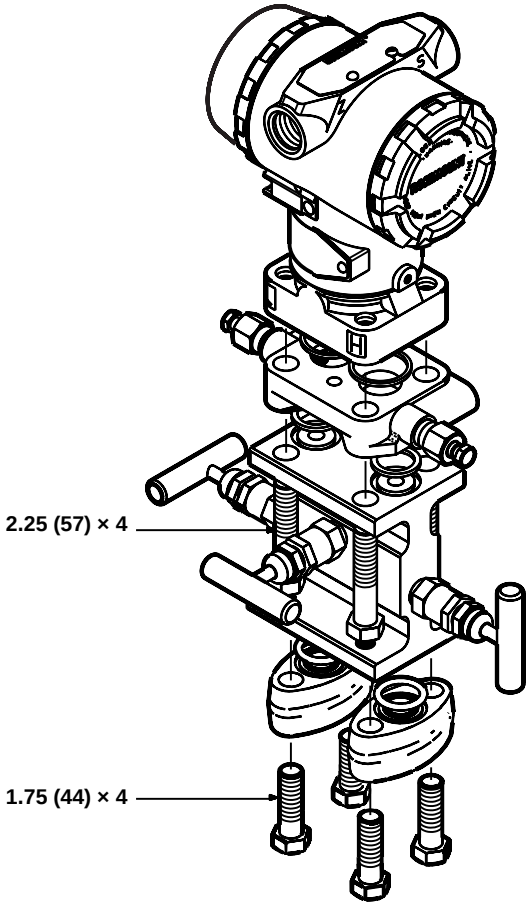
TRANSMITTER WITH FLANGE ADAPTERS AND FLANGE/ADAPTER BOLTS



NOTE
Dimensions are in inches (millimeters)

TRANSMITTER WITH 3-VALVE MANIFOLD MANIFOLD/FLANGE BOLTS FLANGE ADAPTERS AND FLANGE/ADAPTER BOLTS

(Differential Configuration Shown)



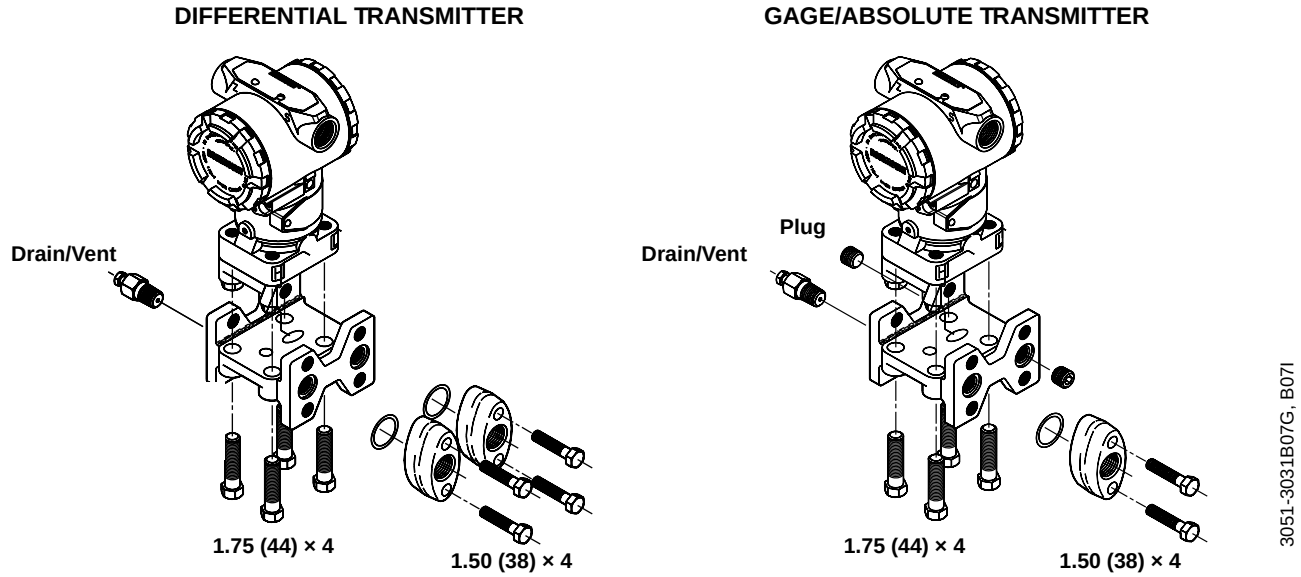
3051-3031E06FD E06F, 305-3031A29P

Description	Qty	Size in. (mm)
Differential Pressure		
Flange Bolts	4	1.75 (44)
Flange/Adapter Bolts	4	2.88 (73)
Manifold/Flange Bolts	4	2.25 (57)
Gage/Absolute Pressure (1)		
Flange Bolts	4	1.74 (44)
Flange/Adapter Bolts	2	2.88 (73)

(1) Model 3051T transmitters are direct mount and do not require bolts for process connection.

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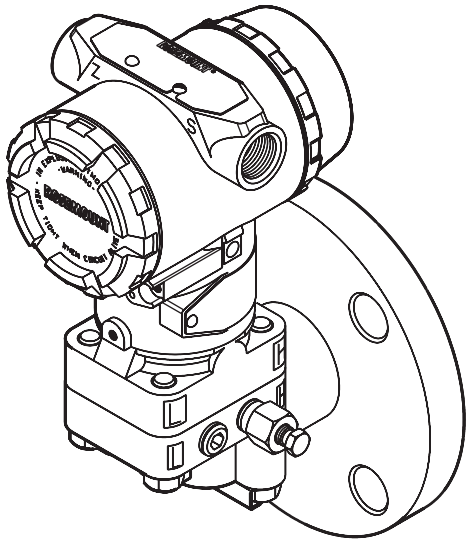
Figure 2-14. Traditional Flange Bolt Configurations



NOTE
Dimensions are in inches (millimeters)

Vertical Mount (Option Codes FA, FB, FC, FD, FP, and FQ)

Figure 2-15. Vertical Mount Flange



These options convert the Model 3051C transmitter to a vertical mount level transmitter. A vented fitting on the low pressure side of the flange makes the flange suitable for use with a gage pressure transmitter. The fitting can be removed and replaced with impulse piping or wet leg connections when a low pressure reference is required for differential pressure measurements. Table 2-3 shows the sizes and rating of the vertical mount flanges.

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Table 2-3. Vertical Mount Flanges by Option Code

Option Code	Material	Size	Flange Type	Flange Rating
FA	316 SST	2-in.	ASME B 16.5 (ANSI) Class 150	275 psi at 100 °F (19 bar at 38 °C)
FB	316 SST	2-in.	ASME B 16.5 (ANSI) Class 300	720 psi at 100 °F (50 bar at 38 °C)
FC	316 SST	3-in.	ASME B 16.5 (ANSI) Class 150	275 psi at 100 °F (19 bar at 38 °C)
FD	316 SST	3-in.	ASME B 16.5 (ANSI) Class 300	720 psi at 100 °F (50 bar at 38 °C)
FP	SST	DIN DN 50	DIN PN 40	580 psi at 248 °F (40 bar at 120 °C)
FQ	SST	DIN DN 80	DIN PN 40	580 psi at 248 °F (40 bar at 120 °C)

Optional Traditional Flanges (Option Codes H2, H3, H4, H7, HJ, HK, and HL)

Use a Model 3051 transmitter with the optional traditional flange in the following types of installations:

- When you are replacing an existing traditional-style transmitter but do not want to replace existing manifolds, impulse piping, or bracket arrangements.
- When you require a flange to withstand higher temperatures at the process ports. The traditional flange is rated to 300 °F (149 °C) at the process ports.

Process ports on the traditional flange meet DIN Standard 19213 with 2.13 ± 0.008 in. (54 ± .203 mm) connection centers.

Table 2-4 details the materials of construction and flange adapter sizes for each of the traditional flange types.

Table 2-4. Traditional Flange Materials and Bolt Sizes

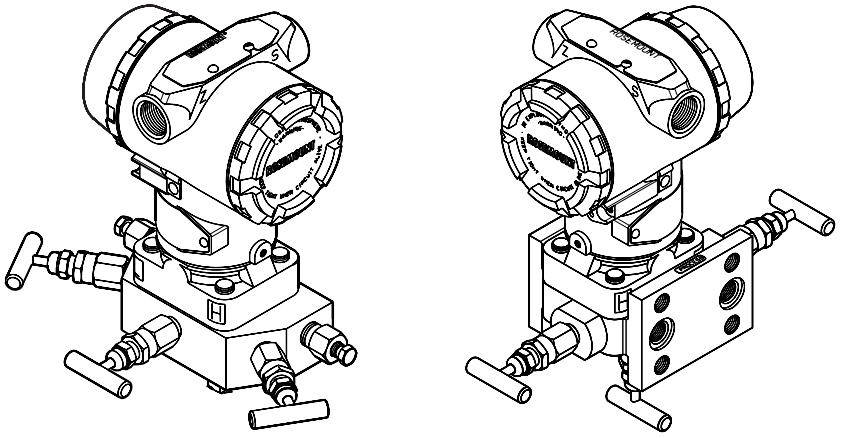
Option Code	Flange Material	Drain/Vent Valve Material	Flange Adapter Material	Flange to Adapter Bolt Size
H2	316 SST	SST	SST	$^{7}/_{16}$-in.
H3	Hastelloy C	Hastelloy C	Hastelloy C	$^{7}/_{16}$-in.
H4	Monel	Monel	Monel	$^{7}/_{16}$-in.
H7	316 SST	Hastelloy C	SST	$^{7}/_{16}$-in.
HJ	SST	SST	SST	$^{7}/_{16}$-in.
HK	SST	SST	N/A	10 mm
HL	SST	SST	N/A	12 mm

Model 305 Integral Manifolds

The Rosemount Model 305 integral manifold is available in two designs: traditional and Coplanar. The traditional Model 305 manifold can be mounted to the Rosemount Model 1195 Integral Orifice or to most primary elements with mounting adapters in the market today. Figure 2-16 shows both designs of the Model 305 manifold installed on a Model 3051 transmitter.

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Figure 2-16. Traditional and Coplanar Integral Manifolds



COPLANAR STYLE **TRADITIONAL STYLE**

FB-3051A29B, 3051-3031A29C

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Model 305 Installation Procedure

To install a Model 305 Integral mainfold to a Model 3051 transmitter follow the procedure below.

⚠ 1. Inspect the Teflon (PTFE) sensor module O-rings. If the O-rings are undamaged, reusing them is recommended. If the O-rings have nicks, cuts, or other damage, replace them with new O-rings.

IMPORTANT
Do not scratch or deface the O-ring grooves or the surface of the isolating diaphragm while you remove the O-rings.

2. Install the integral manifold on the sensor module:
   a. Align the manifold and sensor module by inserting and finger-tightening the four 2.25-inch (57 mm) manifold bolts.
   b. Tighten the bolts incrementally in a cross-pattern until each of them reaches the initial torque value (See Table 2-2, depending upon the bolt material).
   c. Tighten the bolts incrementally again until each of them reaches the final torque value (See Table 2-2, depending upon the bolt material).
3. If the Teflon (PTFE) sensor module O-rings have been replaced, the flange bolts should be re-tightened after installation to compensate for cold flow of the O-rings.
4. Install the drain/vent valves:
   a. Apply two complete turns of sealing tape to the valve body threads (with the open end of the threads pointing toward you, wrap the tape clockwise beginning at the edge closest to you).
   b. Tighten the the valve body into the manifold to 250 in-lb (28,3 N-m).
   c. Orient the opening of the valve so that once the transmitter is installed the valve opening will point to the ground and away from personnel when the valve is opened.
   d. Tighten the valve bonnet and stem onto the valve body to 70 ± 10 in-lb (7,9 ± 1,1 N-m).
   e. Repeat a-d for each drain/vent valve.

NOTE
Perform a zero trim on the transmitter/manifold assembly after you combine them to eliminate any mounting effects.

Model 306 Integral Manifolds

The Model 306 integral manifold is for use only with a Model 3051T transmitter.

Model 306 Installation

To install a Model 306 Integral mainfold to a Model 3051 transmitter follow the procedure below.

⚠ See “Safety Messages” on page 2-1 for complete warning information.

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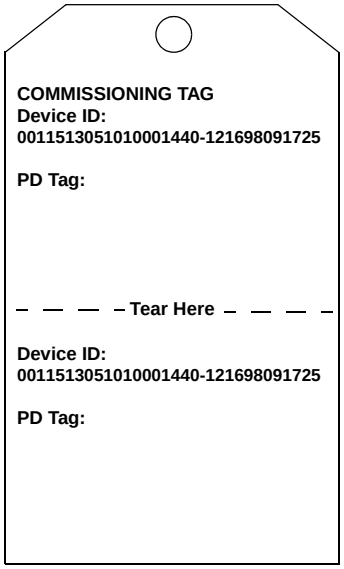
1. Apply two complete turns of sealing tape to the manifold threads (with the open end of the threads pointing toward you, wrap the tape clockwise beginning at the edge closest to you).
2. Turn the manfiold threads into the sensor module to leak tight.

Tagging

Commissioning (Paper) Tag

When commissioning more than one device on a fieldbus segment, it can be difficult to identify which device is at a particular location. A removable tag provided with the transmitter can aid in this process by linking the Device ID and a physical location. TheDevice ID is a unique code that identifies a particular device in the absence of a device tag. The device tag is used by the customer as an operational identification for the device and is usually defined by the Piping and Instrumentation Diagram (P & ID).

The installer should note the physical location in both places on the removable commissioning tag and tear off the bottom portion. This should be done for each device on the segment. The bottom portion of the tags can be used for commissioning the segment in the control system, providing a direct link between the Device ID and the tag location.



ELECTRICAL CONSIDERATIONS

Proper electrical installation is necessary to prevent errors due to improper grounding and electrical noise. Shielded, twisted pair cable should be used for best results in electrically noisy environments. Cable Type A is recommended by FOUNDATION fieldbus.

Hazardous Locations

The Model 3051 has an explosionproof housing and circuitry suitable for intrinsically safe and non-incendive operation. Individual transmitters are clearly marked with a tag indicating the certifications they carry. See Appendix A: Specifications and Reference Data for specific approval categories, and see Appendix B: Approvals for installation drawings.

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NOTE
Once a device labeled with multiple approval types is installed, it should not be reinstalled using any of the other labeled approval types. To ensure this, the approval label should be permanently marked to distinguish the used from the unused approval type(s).

Field Wiring

⚠ All power to the transmitter is supplied over the signal wiring. For best installation practices use a fieldbus type A cable. Do not run unshielded signal wiring in conduit or open trays with power wiring or near heavy electrical equipment. Do not remove the transmitter cover in explosive atmospheres when the circuit is alive.

NOTE
Do not apply high voltage (e.g. ac line voltage) to the transmitter terminals. Abnormally high voltage can damage the unit.

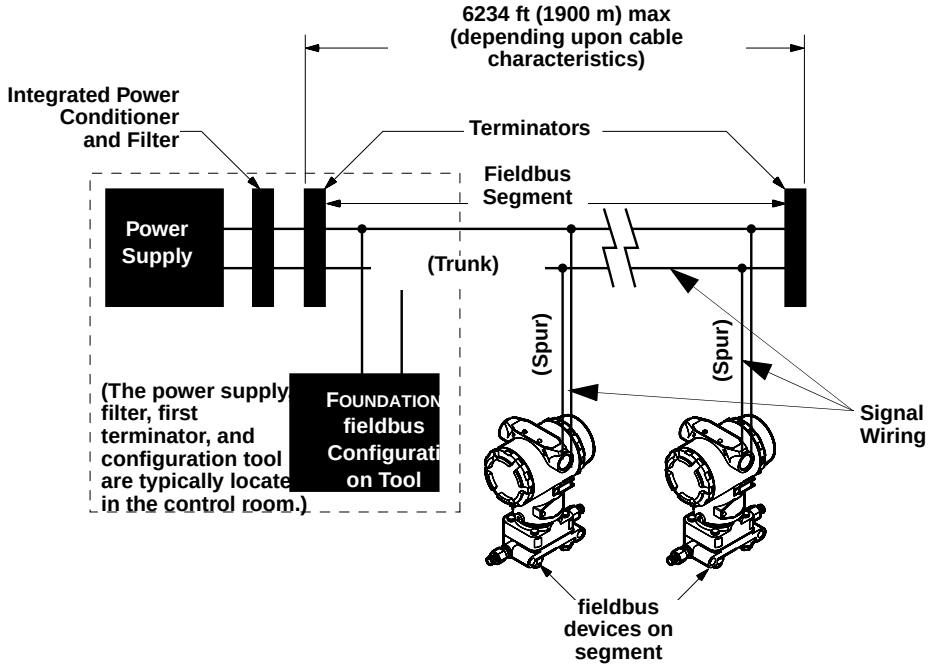
Grounding

Signal wiring of the fieldbus segment can not be grounded. Grounding out one of the signal wires will shut down the entire fieldbus segment.

Shield Wire Ground

To protect the fieldbus segment from noise, grounding techniques for shield wire usually require a single grounding point for shield wire to avoid creating a ground loop. The ground point is typically at the power supply.

Figure 2-17. Model 3051 Transmitter Field Wiring



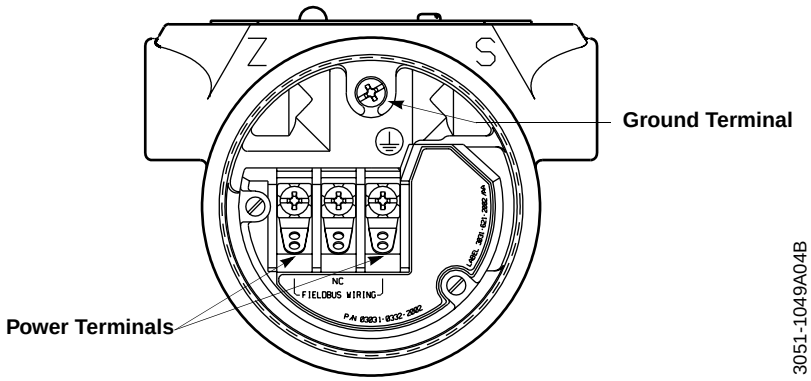
*Intrinsically safe installations may allow fewer devices per I.S. barrier due to current limitations.

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Power Connections

Use ordinary copper wire of sufficient size to ensure that the voltage across the transmitter power terminals does not go below 9 V dc. To power the transmitter, connect the power leads to the terminals marked “FIELDBUS WIRING” as shown in Figure 2-18. The power terminals are polarity insensitive, which means the electrical polarity of the power leads does not matter when connecting to the power terminals. When wiring to screw terminals, the use of crimped lugs is recommended. Tighten the terminal screws to ensure adequate contact.

Figure 2-18. Transmitter Terminal Block



NOTE
“NC” is a No Connect terminal (do not use)

NOTE
Do not ground out the live signal wiring to the housing when working on a segment. Grounding the communication wires may result in temporary loss of communication with all devices on the segment.

Grounding the Transmitter Housing

The transmitter housing should always be grounded in accordance with national and local electrical codes. The most effective transmitter case grounding method is direct connection to earth ground with minimal impedance. Methods for grounding the transmitter case include:

- **Internal Ground Connection:** The Internal Ground Connection screw is inside the FIELD TERMINALS side of the electronics housing. This screw is identified by a ground symbol (⏚), and is standard on all Model 3051 transmitters.
- **External Ground Assembly:** This assembly is included with the optional transient protection terminal block (Option Code T1), and it is included with CESI/CENELEC Flameproof Certification (Option Code E8), BASEEFA/CENELEC Intrinsic Safety Certification (Option Code I1), and BASEEFA/CENELEC Type N Certification (Option Code N1). The External Ground Assembly can also be ordered with the transmitter (Option Code V5), or as a spare part (03031-0398-0001).

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NOTE
Grounding the transmitter case using the threaded conduit connection may not provide a sufficient ground. The transient protection terminal block (Option Code T1) does not provide transient protection unless the transmitter case is properly grounded. Use the above guidelines to ground the transmitter case. Do not run the transient protection ground wire with signal wiring as the ground wire may carry excessive current if a lightning strike occurs.

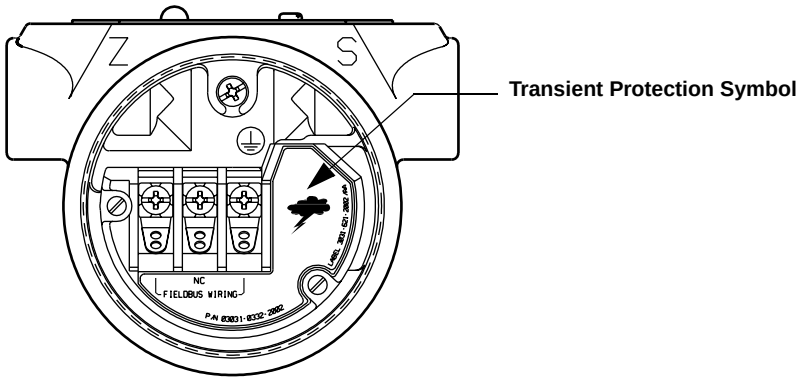
Surges/Transients

The transmitter will withstand electrical transients of the energy level usually encountered in static discharges or induced switching transients. However, high-energy transients, such as those induced in wiring from nearby lightning strikes, can damage the transmitter.

Optional Transient Protection Terminal Block

The transient protection terminal block can be ordered as an installed option (Option Code T1 in the transmitter model number) or as a spare part to retrofit existing Model 3051 transmitters in the field. The spare part number is 03031-0332-2002. The symbol shown in Figure 2-19 identifies the transient protection terminal block.

Figure 2-19. Transient Protection Terminal Block



Installation

When the transient protection terminal block is ordered as a spare part, it must be installed in place of the standard terminal block inside the transmitter housing. See “Remove the Terminal Block” on page 4-2.

NOTE
The transient protection terminal block provides transient protection only if the transmitter housing is properly grounded. See “Grounding the Transmitter Housing” on page 2-26.

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Performance

The transient protection terminal block increases the ability of the Model 3051 transmitter to withstand electrical transients induced by lightning, welding, or heavy electrical equipment. With the transient protection block installed, the Model 3051 transmitter meets the standard performance specifications as outlined in this product manual. In addition, the transient protection circuitry meets IEEE Standard 587, Category B and IEEE Standard 472, Surge Withstand Capability.

Jumpers

Security

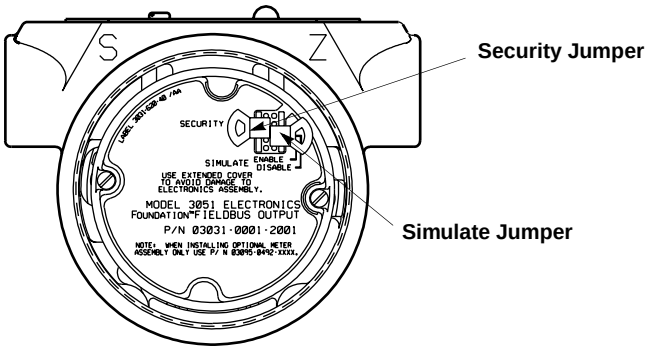
After you configure the transmitter, you may want to protect the configuration data from unwarranted changes. Each transmitter is equipped with a security jumper that can be positioned "ON" to prevent the accidental or deliberate change of configuration data. The jumper is located on the front side of the electronics module and is labeled SECURITY (see Figure 2-20).

Simulate

The simulate jumper is used in conjunction with the Analog Input (AI) function block. This switch is used to simulate the measurement and is used as a lock-out feature for the AI function block. To enable the simulate feature, insert the jumper across "ENABLE" (see Figure 2-20) while the transmitter is powered.

NOTE
When power is cycled to the transmitter, simulate is automatically disabled regardless of the position of the jumper. This prevents the transmitter from being accidentally left in simulate mode. Therefore, to enable the simulate feature, the jumper must be inserted *after* power is applied to the transmitter.

Figure 2-20. Transmitter Jumper Locations



ENVIRONMENTAL CONSIDERATIONS

The Model 3051 can tolerate a wide range of applications. To optimize performance, mount the transmitter to minimize ambient temperature changes, to avoid vibration and mechanical shock, and to avoid external contact with corrosive materials. Appendix A: Specifications and Reference Data lists the transmitter temperature operating limits.

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Access Requirements

When choosing an installation location and position, take into account the need for access to the transmitter.

Process Flange Orientation

Mount the process flanges with sufficient clearance for process connections. For safety reasons, place the drain/vent valves so the process fluid is directed away from technicians when the vents are used. In addition, consider the possible need for a testing or calibration input.

Housing Rotation

See “Housing Rotation” on page 2-13.

Terminal Side of Electronics Housing

Mount the transmitter so that the terminal side is accessible. A 0.75-inch (19 mm) clearance is required for cover removal. Install the provided conduit plug on the unused side of the conduit opening.

Circuit Side of Electronics Housing

Provide 3 inches (76.2 mm) clearance for cover removal. Three inches of clearance is required for cover removal if a meter is installed.

Cover Installation

Always install the electronics housing covers metal-to-metal to ensure a proper seal.

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Section 3

Configuration

INTRODUCTION

This section covers basic operation, software functionality, and basic configuration procedures for the Model 3051 transmitter with FOUNDATION fieldbus (Device Revision 7). For detailed information about FOUNDATION fieldbus technology and the function blocks used in the Model 3051 transmitter, refer to “Block Information” on page C-1 and the Foundation fieldbus Block manual (00809-0100-4783).

Node Address

The transmitter is shipped at a temporary address to allow a host to automatically assign an address.

FOUNDATION fieldbus function blocks

For more information on the Resource, Sensor Transducer, LCD Transducer, Advanced Process Diagnostics Transducer blocks refer to “Block Information” on page C-1.

Resource Block

The Resource block contains diagnostic, hardware, electronics and mode handling information. There are no linkable inputs or outputs to the Resource Block.

Sensor Transducer Block

The Sensor Transducer block contains sensor information including diagnostics and the ability to trim the pressure sensor or recall factory calibration.

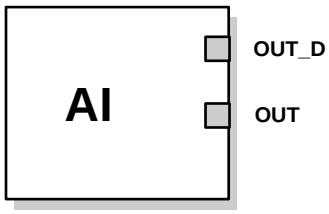
LCD Transducer Block

The LCD Transducer block configures the process variables to be displayed on the LCD.

Advanced Process Diagnostics Transducer Block

The Advanced Process Diagnostics Transducer block allows a user to view and configure the plugged line detection diagnostic and statistical process monitoring.

AI Block



OUT = **The block output value and status**

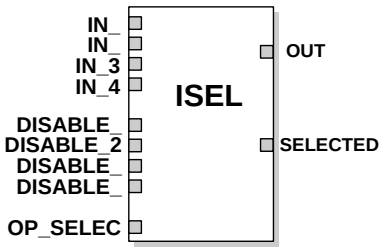
OUT_D = **Discrete output that signals a selected alarm condition**

FIELDBUS-FBUS_31A

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The Analog Input (AI) function block processes field device measurements and makes them available to other function blocks. The output value from the AI block is in engineering units and contains a status indicating the quality of the measurement. The measuring device may have several measurements or derived values available in different channels. Use the channel number to define the variable that the AI block processes.

ISEL Block

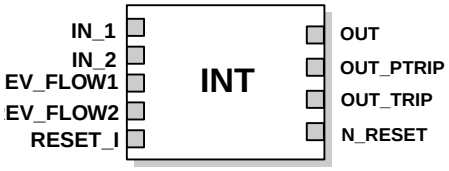


IN (1-4)	=	Input used in the selection algorithm.
DISABLE (1-4)	=	Discrete input used to enable or disable the associated input channel.
OP_SELECT	=	Input used to override algorithm.
TRK_VAL	=	The value after scaling applied to OUT in Local Override mode.
SELECTED	=	The selected channel number.
OUT	=	The block output and status.

fieldbus-fbus_40a

The Input Selector (ISEL) function block can be used to select the first good, Hot Backup, maximum, minimum, or average of as many as four input values and place it at the output. The block supports signal status propagation.

Integrator Block



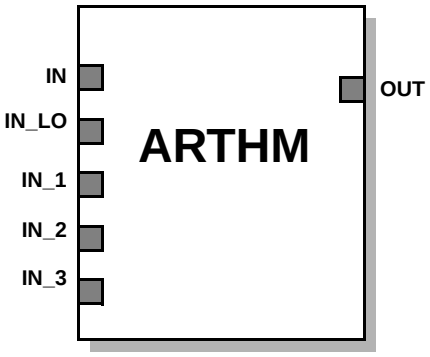
IN_1	=	The first input value and status.
IN_2	=	The second input value and status.
REV_FLOW1	=	The discrete input that specifies whether IN_1 is positive or negative.
REV_FLOW2	=	The discrete input that specifies whether IN_1 is positive or negative.
RESET_IN	=	The discrete input that resets the integrator and holds reset until released.
OUT	=	The integration output value and status.
OUT_PTRIP	=	A discrete value that is set when the pre-trip limit value is reached.
OUT_TRIP	=	A discrete value that is set when the trip target value (setpoint) is reached.
N_RESET	=	The number of times the integrator function block is initialized or reset.

FIELDBUS-FBUS_35A

The Integrator (INT) function block integrates one or two variables over time. The block compares the integrated or accumulated value to pre-trip and trip limits and generates discrete output signals when the limits are reached.

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Arithmetic Block



The Arithmetic function block provides the ability to configure a range extension function for a primary input and applies the nine (9) different arithmetic types as compensation to or augmentation of the range extended input. All operations are selected by parameter and input connection.

Signal Characterizer Block

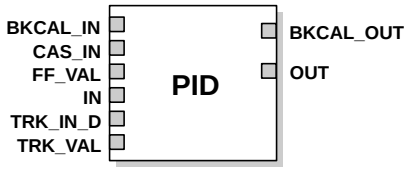


IN_1 and IN_2 = The input values to the block.
OUT_1 = The output associated with IN_1.
OUT_2 = The output associated with IN_2.

fieldbus-fbus_36a

The Signal Characterizer (SGCR) function block characterizes or approximates any function that defines an input/output relationship. The function is defined by configuring as many as twenty X,Y coordinates. The block interpolates an output value for a given input value using the curve defined by the configured coordinates. Two separate analog input signals can be processed simultaneously to give two corresponding separate output values using the same defined curve.

PID Block



BKCAL_IN = The analog input value and status from another block's BKCAL_OUT output that is used for backward output tracking for bumpless transfer and to pass limit status.
CAS_IN = The remote setpoint value from another function block.
FF_VAL = The feedforward control input value and status.
IN = The connection for the process variable from another function block.
TRK_IN_D = Initiates the external tracking function.
TRK_VAL = The value after scaling applied to OUT in Local Override mode.
BKCAL_OUT = The value and status required by the BKCAL_IN input of another function block to prevent reset windup and to provide bumpless transfer to closed loop control.
OUT = The block output and status.

FIELDBUS-FBUS_34A

The PID function block combines all of the necessary logic to perform proportional/integral/derivative (PID) control. The block supports mode control, signal scaling and limiting, feedforward control, override tracking, alarm limit detection, and signal status propagation.

The block supports two forms of the PID equation: Standard and Series. You can choose the appropriate equation using the FORM parameter. The Standard ISA PID equation is the default selection.

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Calibration

A description of the Calibration Method can be found in “Methods” on page C-6.

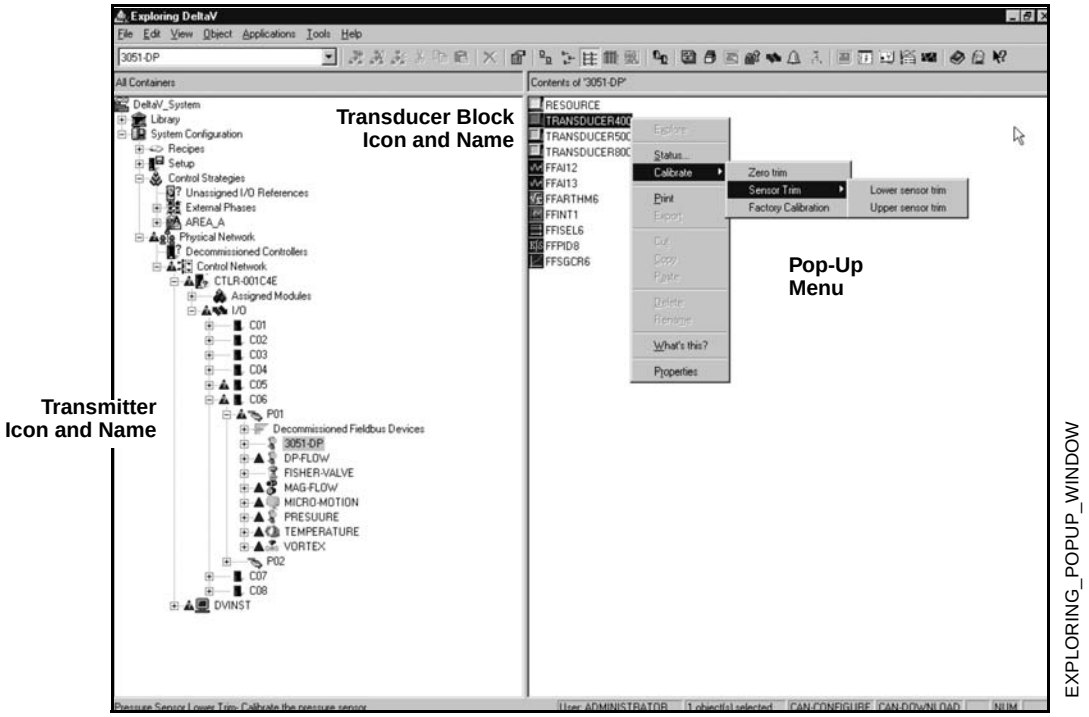
OPERATION WITH FISHER-ROSEMOUNT® DeltaV™

Software Trims

The Model 3051 transmitter with FOUNDATION fieldbus software is designed to permit remote testing and configuration using the Fisher-Rosemount DeltaV™ fieldbus configuration tool, or other FOUNDATION fieldbus host.

NOTE
Device support files for the Model 3051 with Foundation fieldbus are available on www.rosemount.com. Correct revision of Device Support Files must be loaded into DeltaV to provide proper functionality.

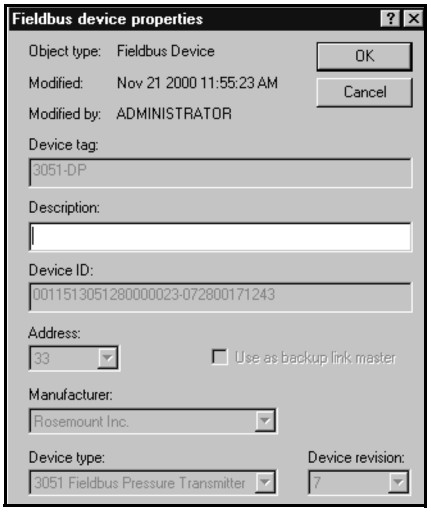
Figure 3-1. Navigating to Sensor Trim.



The **Fieldbus Device Properties** window appears (see Figure 3-2).

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Figure 3-2. **Fieldbus Device Properties** Window

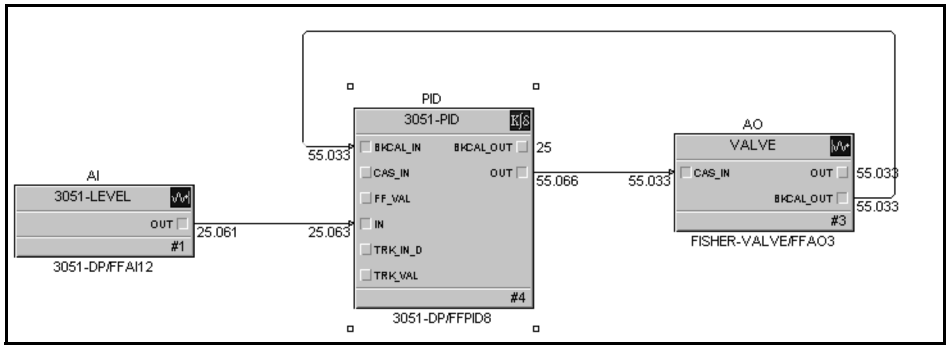


DEVICE_PROPERTIES

1. Enter a description of the device properties information in the window.
2. Select “OK” to add the device to the segment.

The device appears on the segment as a non-commissioned Fieldbus device (PT-101).

Figure 3-3. Basic Control Strategy



BASIC_CONTROL

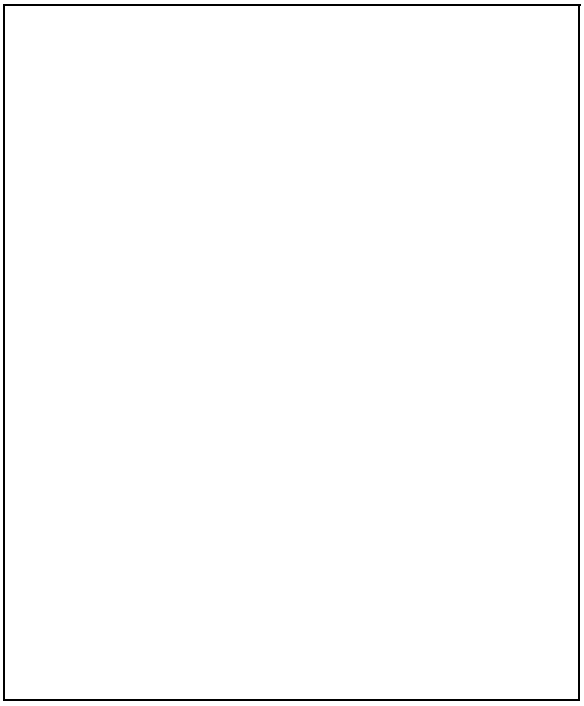
3. Save the control strategy.
4. Select the “Assign to Node” button ( ) to assign the strategy to the correct node in the controller.

Set Transmitter Configuration Parameters

1. Select **DeltaV > Engineering > DeltaV Explorer** from the Start menu.
2. Navigate through the file structure to find the transmitter you wish to configure (see Figure 3-4).

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Figure 3-4. Sample location of a transmitter in DeltaV Explorer

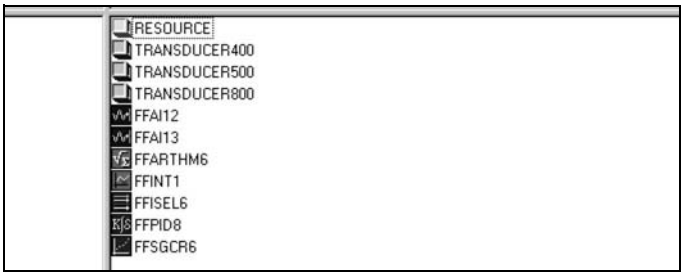


EXPLORER_DELTAV

3. Double click the transmitter you wish to configure/calibrate.

The function blocks within the transmitter appear in the right half of the DeltaV Explorer window (see Figure 3-5).

Figure 3-5. List of Function Blocks in **DeltaV Explorer**



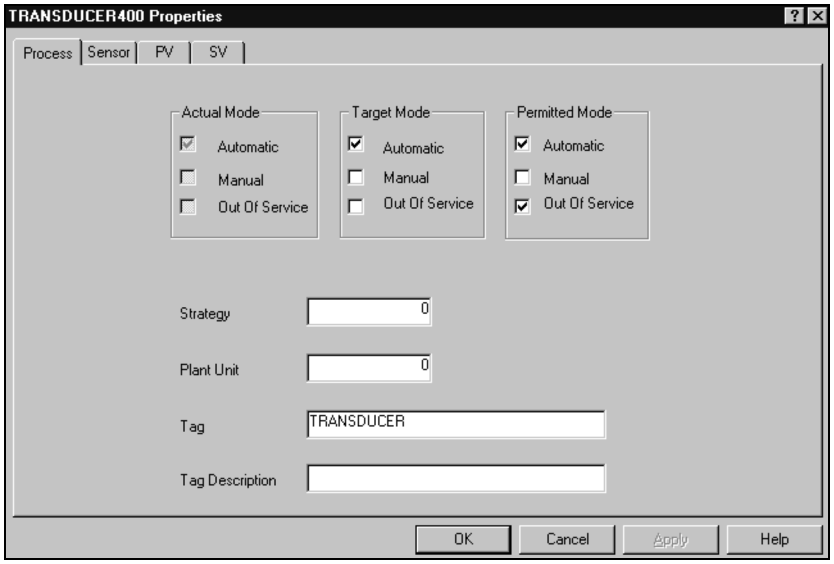
EXPLORER_DELTAV

4. Double click on the TRANSDUCER400 block icon.

The transducer block properties window appears.

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Figure 3-6. Transducer Block Properties Window



5. Select the **Mode** tab.
6. Select Out of Service (**OOS**) and deselect **Auto** in the **Target Mode** region of the window.

The parameters you change in the properties window remain highlighted (as in Figure 3-6) so you can easily track changes.

7. Click the **Apply** button to apply the changes you made.

The software warns you that the changes you made may upset the process and create a dangerous situation in your plant. Before you select **OK**, verify that the control loop is in manual control.

The **Actual Mode** region changes to **OOS**.

8. A warning window will pop up, click **OK** to return to the DeltaV Explorer.
9. Right click on the TRANSDUCER block icon to access the configuration parameters menu.
10. Select the parameter you wish to configure, and follow the on-line instructions to complete the configuration.

NOTE
As you make changes to the configuration parameters, the software warns you that the changes you made may upset the process and create a dangerous situation in your plant. Before you select **OK**, verify that the control loop is in manual control.

See “Transducer Block” on page C-1 to change the sensor type and to calibrate the sensors.

11. Repeat Steps 4 through 8 to return the mode of the transducer block to **Auto**.

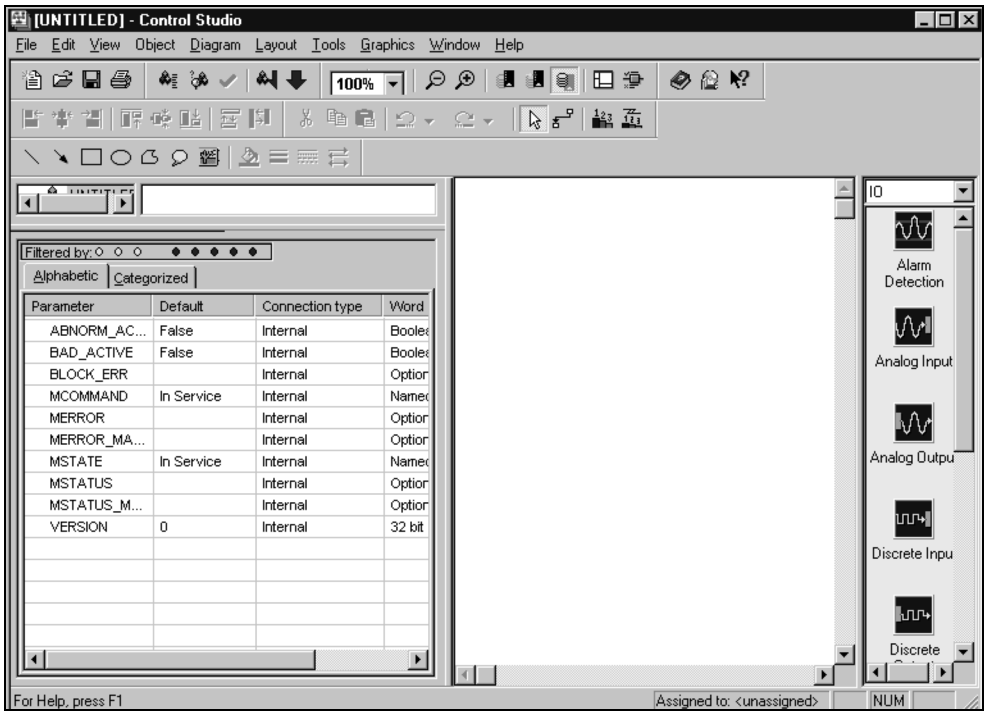
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Download the Control Strategy to the Device

1. Select **DeltaV > Engineering > Control Studio** from the start menu.

The main control studio screen appears (see Figure 3-7).

Figure 3-7. Main Control Studio Screen



CONTROL_STUDIO

2. Open the control strategy that you defined on Pages 3-5 and 3-5.
3. Click the “Download” button (the down arrow located in the tool bar), and follow the on-line instructions to download the control strategy to the transmitter.

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Section 4

Operation and Maintenance

OVERVIEW

This section provides instructions for disassembly and reassembly of the Model 3051 transmitter for the purpose of installing optional accessories or replacing spare parts.

For a complete listing of available spare parts or accessories, refer to Appendix A: Specifications and Reference Data.

SAFETY MESSAGES

Procedures and instructions in this section may require special precautions to ensure the safety of the personnel performing the operations. Information that raises potential safety issues is indicated by a warning symbol (⚠). Refer to the following safety messages before performing an operation preceded by this symbol.

Warnings ⚠

⚠WARNING

Explosions can result in death or serious injury.

- Do not remove the transmitter covers in explosive environments when the circuit is alive.
- Both transmitter covers must be fully engaged to meet explosionproof requirements.

⚠CAUTION

Static electricity can damage senstive components.

- Observe safe handling precautions for static-sensitive components.

NOTE

The pictures shown in Section 7 are of a Model 3051 with 4–20 mA HART electronics. The maintenance steps are also correct for the FOUNDATION fieldbus electronics.

DISASSEMBLY PROCEDURES

⚠ Do not remove the instrument cover in explosive atmospheres when the circuit is live.

⚠ See “Safety Messages” on page 4-1 for complete warning information.

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Remove the Transmitter from Service


3051-052AB

NOTE
Once you have determined a transmitter to be inoperable, remove it from service.

Be aware of the following:

- Isolate and vent the process from the transmitter before removing the transmitter from service.
- Remove all electrical leads and conduit. Avoid grounding out the lead wires if other devices on the fieldbus segment are operational.
- Detach the process flange by removing the four flange bolts and the two alignment screws that secure it.
- Do not scratch, puncture, or depress the isolating diaphragms.
- Clean isolating diaphragms with a soft rag and a mild cleaning solution, and rinse with clear water.
- Whenever you remove the process flange or flange adapters, visually inspect the Teflon O-rings. Replace the O-rings if they show any signs of damage, such as nicks or cuts. If they are undamaged, you may reuse them.

The Model 3051C transmitter is attached to the process connection by four bolts and two cap screws. Remove the four bolts and separate the transmitter from the process connection manifold or flange. You can leave the process connection in place and ready for re-installation.

The Model 3051T is attached to the process by a single hex nut process connection. Loosen the hex nut to separate the transmitter from the process.

Remove the Terminal Block

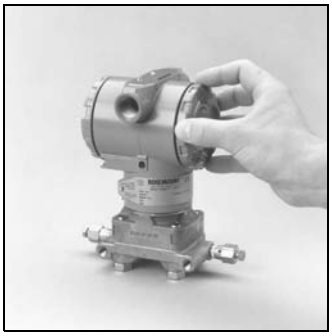
Electrical connections are located on the terminal block in the compartment labelled “FIELD TERMINALS.”

Loosen the two small screws located at the 9 o'clock and 4 o'clock positions, and pull the entire terminal block out to remove it.

Remove the Electronics Board

The transmitter electronics board is located in the compartment opposite the terminal side. To remove the electronics board perform the following procedure:

1. Remove the housing cover opposite the field terminal side.


3501-053AB

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3051-054AB

⚠ 2. Loosen the two captive screws that anchor the board to the housing. The electronics board is electrostatically sensitive; observe handling precautions for static-sensitive components.

NOTE
If you are disassembling a transmitter with a LCD meter, loosen the two captive screws that are visible on the right and left side of the meter display. The two screws anchor the LCD meter to the electronics board and the electronics board to the housing.

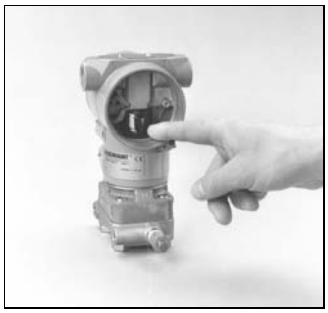

3051-055AB

3. Slowly pull the electronics board out of the housing. With the two captive screws free of the transmitter housing, only the sensor module ribbon cable holds the board to the housing.


3051-056AB

4. Disconnect the sensor module ribbon cable to release the electroncis board from the transmitter.

Remove the Sensor Module from the Electronics Housing

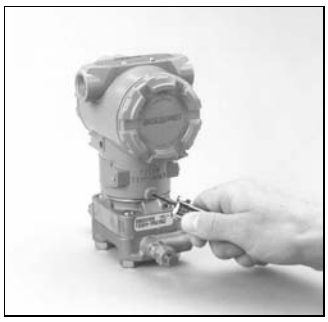

3051-057AB

1. Carefully tuck the cable connector completely inside of the internal shroud.

NOTE
Do not remove the housing until after you tuck the cable connector completely inside of the internal shroud. The shroud protects the cable from damage that can occur when you rotate the housing.

⚠ See “Safety Messages” on page 4-1 for complete warning information.

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3051-059AB

2. Loosen the housing rotation set screw with a 9/64-inch hex wrench, and back off one full turn.

IMPORTANT
To prevent damage to the sensor module ribbon cable, disconnect it from the electronics board before you remove the sensor module from the electrical housing.


3051-060AB

1.

3. Unscrew the housing from the module, making sure the shroud and sensor cable do not catch on the housing.

IMPORTANT
Make sure the sensor ribbon cable and internal shroud remain completely free of the housing as you rotate it. Damage can occur to the cable if the internal shroud and sensor cable become hung up and rotate with the housing.

REASSEMBLY PROCEDURES

Attach the Sensor Module to the Electronics Housing


3051-062AB

1. Inspect all cover and housing (non-process wetted) O-rings and replace if necessary. Lightly grease with silicone lubricant to ensure a good seal.
2. Carefully tuck the cable connector completely inside the internal shroud. To do so, turn the shroud and cable counterclockwise one rotation to tighten the cable.

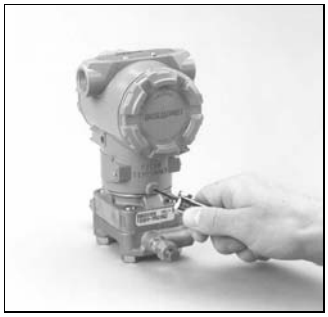

3051-060AB

3. Lower the electronics housing onto the module. Guide the internal shroud and cable through the housing and into the external shroud.
4. Turn the housing clockwise the fasten it to the module.

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IMPORTANT
To prevent damage to the cable connector, watch the cable and shroud as you attach the housing to the module. Make sure the cable connector does not slip out of the internal shroud and begin to rotate with the housing. Reinsert the cable connector into the shroud if it escapes before the housing is fully fastened.

⚠ 5. Thread the housing completely onto the sensor module. The housing must be no more than one full turn from flush with the sensor module to comply with explosionproof requirements.
6. Tighten the housing rotation set screw using a 9/64-inch hex wrench.


3051-059AB

Attach the Electronics Board


3051-056AB

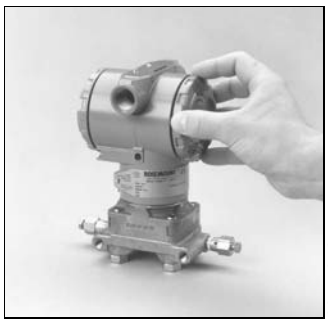
1. Remove the cable connector from its position inside of the internal shroud and attach it to the electronics board.
2. Insert the electronics board into the housing, making sure that the posts from the electronics housing properly engage the receptacles on the electronics board.


3051-054AB

3. Tighten the captive mounting screws.

⚠ See “Safety Messages” on page 4-1 for complete warning information.

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⚠ 4. Replace the electronics housing cover. The transmitter covers must be engaged metal-to-metal to ensure a proper seal and to meet explosionproof requirements.

Reassemble the Process Connection to the Sensor Module

1. Visually inspect the Teflon (PTFE) sensor module O-rings. If the O-rings are undamaged, you may reuse them. If the O-rings show signs of damage, such as nicks or cuts, or if there is any doubt about their ability to seal properly, replace them with new O-rings.

NOTE
If you are replacing the O-rings, be careful not to scratch the O-ring grooves or the surface of the isolating diaphragm when removing the damaged O-rings.

2. Install the process flange on the sensor module. To hold the process flange in place, install the two hex head alignment screws. These screws are not pressure retaining and need only be finger tight. Do not overtighten; this will affect the module/flange alignment.
3. Install the appropriate flange bolts.
   a. IF the installation requires a ¼–18 NPT mounting, THEN use four 1.75-inch flange bolts. Go to **Step f**.
   b. IF the installation requires a ½–14 NPT mounting, THEN use four 2.88-inch process flange/adapter bolts. EXCEPTION: For gage pressure configurations, use two 2.88-inch bolts and two 1.75-inch bolts. Go to **Step d**.
   c. IF the installation uses a three-valve manifold (differential pressure applications only), THEN use four 2.25-inch manifold flange bolts. Go to **Step e**.
   d. Hold the flange adapters and adapter O-rings in place while finger-tightening the bolts. Go to **Step g**.
   e. Align the process flange with the three-valve manifold.
   f. Finger tighten the bolts.
   g. Tighten the bolts to the inital torque value using a crossed pattern. See Table 4-1 for appropriate torque values.
   h. Tighten the bolts to the final torque value using a crossed pattern. See Table 4-1 for appropriate torque values. When fully tightened, the bolts should extend through the top of the module housing.
   i. If the installation uses a three-valve manifold, then install flange adapters on the process end of the manifold using the 1.75-inch flange bolts supplied with the transmitter.

⚠ See “Safety Messages” on page 4-1 for complete warning information.

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Table 4-1. Bolt Installation Torque Values.

Bolt Material	Initial Torque Value	Final Torque Value
CS-ASTM-A449 Standard	300 in.-lb (34 N-m)	650 in.-lb (73 N-m)
316 SST—Option L4	150 in.-lb (17 N-m)	300 in.-lb (34 N-m)
ASTM-A-193-B7M—Option L5	300 in.-lb (34 N-m)	650 in.-lb (73 N-m)
Monel—Option L6	300 in.-lb (34 N-m)	650 in.-lb (73 N-m)

4. IF you replaced the Teflon sensor module O-rings, THEN re-torque the flange bolts after installation to compensate for cold flow.
5. Install the drain/vent valve.
   a. Apply sealing tape to the threads on the seat. Starting at the base of the valve with the threaded end pointing toward the installer, apply two clockwise turns of the sealing tape.
   b. Take care to place the vent opening on the valve so that process fluid will drain toward the ground and away from personnel when the valve is opened.
   c. Tighten the drain/vent valve to 250 in.-lb (28.25 N-m).

NOTE
After replacing O-rings on Range 1 transmitters and re-installing the process flange, expose the transmitter to a temperature of 185 °F (85 °C) for two hours. Then re-tighten the flange bolts in a cross pattern, and again expose the transmitter to a temperature of 185 °F (85 °C) for two hours before calibration.

Returning Rosemount Products and Materials

To expedite the return process outside of the United States, contact the nearest Rosemount representative.

Within the United States, call the Rosemount National Response Center using the 1-800-654-RSMT (7768) toll-free number. This center, available 24 hours a day, will assist you with any needed information or materials.

The center will ask for product model and serial numbers, and will provide a Return Material Authorization (RMA) number. The center will also ask for the process material to which the product was last exposed.

⚠CAUTION

Individuals who handle products exposed to a hazardous substance can avoid injury if they are informed of and understand the hazard. If the product being returned was exposed to a hazardous substance as defined by OSHA, a copy of the required Material Safety Data Sheet (MSDS) for each hazardous substance identified must be included with the returned goods.

Rosemount National Response Center representatives will explain the additional information and procedures necessary to return goods exposed to hazardous substances.

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Appendix A

Specifications and Reference Data

PERFORMANCE SPECIFICATIONS

Total Performance is based upon combining errors of reference accuracy, ambient temperature effect, and line pressure.

Model 3051C (Ranges 2–5), Model 3051T

Reference Accuracy

±0.075% of calibrated range

Total Performance

±0.15% of calibrated range

±50 °F (28 °C)

Up to 1000 psi (6,9 MPa)

1:1 to 5:1 rangedown

Stability

±0.125% of URL for five years

±50 °F (28 °C)

Up to 1000 psi (6,9 MPa)

1:1 to 5:1 rangedown

Model 3051CD (Ranges 0–1)

Reference Accuracy

±0.10% of calibrated range

Stability

±0.2% of URL for one year

Model 3051L – Liquid Level

Reference Accuracy

±0.075% of calibrated range

Model 3051H — High Process

Reference Accuracy

±0.075% of span

Stability

±0.1% of URL for 12 months for Ranges 2 and 3

±0.2% of URL for 12 months for Ranges 4 and 5

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DETAILED PERFORMANCE SPECIFICATIONS

Zero-based calibrations, reference conditions, silicone oil fill, and 316 SST isolating diaphragm

Reference Accuracy

Model 3051T/CA Ranges 1–5:

For calibrated ranges less than 10:1, accuracy =

$$\left[0.0075\left(\frac{\text{URL}}{\text{Calibrated Range}}\right)\right]\% \text{ of Calibrated Rang}$$

Model 3051CA Range 0:

For calibrated ranges less than 5:1, accuracy=
Model 3051CD Ranges 1–5 and Model 3051CG:

$$\left[0.025 + 0.01\left(\frac{\text{URL}}{\text{Calibrated Range}}\right)\right]\% \text{ of Calibrated Ranç}$$

Model 3051 CD Ranges 1-5 and Model 3051 CG:

For calibrated ranges less than 10:1
(15:1 for Model 3051CD Range 1), accuracy:

$$\pm\left[0.025 + 0.005\left(\frac{\text{URL}}{\text{Calibrated Range}}\right)\right]\% \text{ of Calibrated Range}$$

Model 3051 CD Range 0

For calibrated ranges less than 2:1 to 30:1,
accuracy = 0.05% URL

Model 3051L and Model 3051H

For calibrated ranges less than 10:1, accuracy =

$$\pm\left[0.025 + 0.005\left(\frac{\text{URL}}{\text{Calibrated Range}}\right)\right]\% \text{ of Calibrated Range}$$

Ambient Temperature per 50 °F (28 °C)

Model 3051CD/CG

±(0.0125% URL + 0.0625% calibrated range) from 1:1 to 10:1
±(0.025% URL + 0.125% calibrated range) from 10:1 to 100:1

Range 1: ±(0.1% URL + 0.25% calibrated range)
Range 0: ±(0.25% URL + 0.05% calibrated range)

Model 3051L

See the Rosemount Instrument Toolkit® or SOAP 2000™ software.

Model 3051T and Model 3051CA

±(0.025% URL + 0.125% calibrated range) from 1:1 to 30:1
±(0.035% URL + 0.125% calibrated range) from 30:1 to 100:1

Range 0:±(0.1% URL + 0.25% calibrated range)
Range 5:±(0.1% URL + 0.15% calibrated range)

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Model 3051T Range 1:

±(0.025% URL + 0.125% calibrated range) from 1:1 to 10:1
±(0.05% URL + 0.125% calibrated range) from 10:1 to 100:1

Model 3051H

±(0.025% URL + 0.125% span + 0.35 inH_2O)

For spans below 30:1 rangedown:
±(0.035% URL + 0.125% span + 0.35 inH_2O)

Static Pressure

Zero Error (Calibrated)

Zero line pressure effect per 1000 psi (69 bar); for static pressures above 2000 psi (137,9 bar), see manual.

Model	Range	Zero Effect
3051CD	0(1)	±0.125% URL
	1	±0.25 URL %
	2,3	±0.05 URL %

(1) Specification expressed in%/100 psi (6,9 bar) up to 750 psi (52 bar)

Percent of Reading Error (Not Calibrated)

Percent of reading effect per 1000 psi (69 bar)

Model	Range	Zero Effect
3051CD	0(1)	±0.15% of reading
	1	±0.40% of reading
	2,3	±0.10% of reading
	4,5	±0.20% of reading

(1) Specification expressed in %/100 psi (6,9 bar) up to 750 psi (52 bar)

Model 3051HD

Zero Error (can be calibrated out at line pressure)

±0.1% of URL for line pressures from 0 to 2000 psi (0 to 137,9 bar)

For static pressures above 2000 psi (137,9 bar), see user manual (Rosemount publication number 00809-0100-4001).

Span Error

±0.1% of reading

Mounting Position Effects

Model 3051C

Zero shifts(1) up to ±1.25 inH_2O (3,1 mbar)

Model 3051L

Liquid level diaphragm with vertical plane: zero shift(1) up to 1 inH_2O (25,4 mmH_2O); diaphragm in horizontal plane: zero shift up to 5 inH_2O (127 mmH_2O) plus extension length on extended units

Model 3051T/CA

Zero shifts(1) up to 0.09 psi (6,2 mbar)

(1) All zero shifts can be calibrated out.

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Model 3051H

Zero shifts up to ±5 inH_2O (127 mmH_2O) can be calibrated out (no span effect)

Vibration Effect

All Models

Measurement effect due to vibrations is insignificant except at resonance frequencies. At resonance frequencies, vibration effect is less than ±0.1% of URL per g when tested between 15 and 2000 Hz in any axis relative to pipe-mounted process conditions.

Power Supply Effect

All Models

Less than ±0.005% of calibrated span per volt

RFI Effects

All Models

±0.1% of span from 20 to 1000 MHz and for field strength up to 30 V/m

Transient Protection (Option Code T1)

All Models

Meets IEEE Standard 587, Category B

1 kV crest (10 × 1 000 microseconds)

3 kV crest (8 × 20 microseconds)

6 kV crest (1,2 × 50 microseconds)

Meets IEEE Standard 472, Surge Withstand Capability

SWC 2,5 kV crest, 1 MHz wave form

General Specifications	
Response Time	< 1 nanosecond
Peak Surge Current	5000 amps to housing
Peak Transient Voltage	100 V dc
Loop Impedance	< 25 ohms
Applicable Standards	IEC 801-4, IEC 801-5

NOTE:

Calibrations at 68 °F (20 °C) per ASME Z210.1 (ANSI)

FUNCTIONAL SPECIFICATIONS

Range and Sensor Limits

See Table 1 for the Model 3051CD, 3051CG, 3051L, and 3051H Range and Sensor Limits.

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Table A-1. Model 3051CD, 3051CG, 3051L, and 3051H Range and Sensor Limits

	Minimum Calibrated Range	Range and Sensor Limits						
			Lower (LRL)					
Range	Model 3051 CD, CG, L, H	Upper (URL)	3051C Differential	3051C Gage	3051L Differential	3051L Gage	3051H Differential	3051H Gage
0	0.1 inH_2O (0,25 mbar)	3.0 inH_2O (7,5 mbar)	–3.0 inH_2O[1] (–7,5 mbar)	NA	NA	NA	NA	NA
1	0.5 inH_2O (1,2 mbar)	25 inH_2O (62,3 mbar)	–25 inH_2O [1] (–62,3 mbar)	NA	NA	NA	NA	NA
2	2.5 inH_2O (6,2 mbar)	250 inH_2O (0,6 bar)	–250 inH_2O (–0,6 bar)	–250 inH_2O (–0,6 bar)	–250 inH_2O (–0,6 bar)	–250 inH_2O (–0,6 bar)	–250 inH_2O (–0,6 bar)	–250 inH_2O (–0,6 bar)
3	10 inH_2O (25 mbar)	1000 inH_2O (2,5 bar)	–1000 inH_2O (–2,5 bar)	0.5 psia (34,5 mbar)	–1000 inH_2O (–2,5 bar)	0.5 psia (34,5 mbar)	–1000 inH_2O (–2,5 bar)	0.5 psia (34,5 mbar)
4	3 psi (0,20 bar)	300 psi (20,9 bar)	–300 psi [1] (–20,9 bar)	0.5 psia (34,5 mbar)	–300 psi (–20,9 bar)	0.5 psia (34,5 mbar)	–300 psi (–2,9 bar)	0.5 psia (34,5 mbar)
5	20 psi (1,4 bar)	2000 psi (138 bar)	– 2000 psi [1] (–138 bar)	0.5 psia (34,5 mbar)	NA	NA	– 2000 psi (–138 bar)	0.5 psia (34,5 mbar)

(1) This range not available for Model 3051P Reference Class Transmitters.

Table A-2. Model 3051CA

Range	Minimum Calibrated Range	Range and Sensor Limits	
		Upper (URL)	Lower (LRL)
0	0.167 psia (11,5 mbar)	5 psia (0,34 bar)	0 psia (0 bar)
1	0.3 psia (20,7 mbar)	30 psia (2,07 bar)	0 psia (0 bar)
2	1.5 psia (103 mbar)	150 psia (10,3 bar)	0 psia (0 bar)
3	8 psia (0,55 bar)	800 psia (55,2 bar)	0 psia (0 bar)
4	40 psia (2,76 bar)	4,000 psia (276 bar)	0 psia (0 bar)

Table A-3. Model 3051T

Range	Minimum Calibrated Range	Range and Sensor Limits		
		Upper (URL)	Lower (LRL) (Abs.)	Lower[1] (LRL) (Gage)
1	0.3 psi (0,02 bar)	30 psi (2,1 bar)	0 psia (0 bar)	–14.7 psig (–1,01 bar)
2	1.5 psi (0,1 bar)	150 psi (10,3 bar)	0 psia (0 bar)	–14.7 psig (–1,01 bar)
3	8 psi (0,55 bar)	800 psi (55,2 bar)	0 psia (0 bar)	–14.7 psig (–1,01 bar)
4	40 psi (2,76 bar)	4000 psi (276 bar)	0 psia (0 bar)	–14.7 psig (–1,01 bar)
5	2000 psi (138 bar)	10000 psi (689 bar)	0 psia (0 bar)	–14.7 psig (–1,01 bar)

(1) Assumes atmospheric pressure of 14.7 psig

Service

Liquid, gas, and vapor applications

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Power Supply

External power supply required; transmitters operate on 9.0 to 32.0 V dc transmitter terminal voltage.

Current Draw

17.5 mA with all configurations (including LCD meter option)

Overpressure Limits

Transmitters withstand the following limits without damage:

Model 3051CD/CG

Range 0: 750 psi (52 bar)
Range 1: 2000 psig (137,9 bar)
Ranges 2–5: 3626 psig (250 bar)

Model 3051CA

Range 0: 60 psia (4,1 bar)
Range 1:120 psia (8,3 bar)
Range 2: 300 psia (20,7 bar)
Range 3: 1600 psia (110 bar)
Range 4: 6000 psia (414 bar)

Model 3051H

All Ranges: 3626 psig (250 bar)

Model 3051TG/TA

Range 1: 750 psi (52 bar)
Range 2: 1500 psi (103 bar)
Range 3: 1600 psi (110 bar)
Range 4: 6000 psi (414 bar)
Range 5: 15000 psi (1034 bar)

NOTE

For Model 3051L or Level Flange Option Codes FA, FB, FC, and FD, limit is 0 psia to the flange rating or sensor rating, whichever is lower.

Table A-4. Model 3051L and Level Flange Rating Limits

Standard	Class	Carbon Steel Rating	Stainless Steel Rating
ANSI/ASME	150	285 psig(1)	275 psig(1)
ANSI/ASME	300	740 psig(1)	720 psig(1)
ANSI/ASME	600	1480 psig(1)	1440 psig(1)
DIN	PN 10-40	40 bar(2)	40 bar(2)
DIN	PN 10/16	16 bar(2)	16 bar(2)
DIN	PN 25/40	40 bar(2)	40 bar(2)

(1) At 100 °F (38 °C), rating decreases with increasing temperature

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(2) At 248°F (120 °C), rating decreases with increasing temperature

Static Overpressure Limits

Transmitters withstand the following limits without damage:

Model 3051CD Only

Operates within specifications between static line pressures of 0.5 psia and 3626 psig (4500 psig for Option Code P9)
Range 0: 0.5 psia and 750 psig
Range 1 (Model CD): 0.5 psia and 2000 psig
Ranges 2–3 (Model PD): 0.5 psia and 2000 psig

For Model 3051L or Level Flange Option Codes FA, FB, FC, and FD, limit is 0.5 psia to the flange rating or sensor rating, whichever is lower.

Burst Pressure Limits

Burst pressure on Coplanar or traditional process flange is 10000 psig (689 bar)

Burst pressure for the Model 3051T is
Ranges 1–4:11000 psi (758 bar)
Range 5:26000 psig (1 793 bar)

Alarms

The AI block allows the user to configure HI-HI, HI, LO, or LO-LO alarms, with a variety of priority levels.

Temperature Limits

Ambient

–40 to 185 °F (–40 to 85 °C)
With integral meter: –4 to 175 °F (–20 to 80 °C)

Storage

–50 to 230 °F (–46 to 110 °C)
With integral meter: –40 to 185 °F (–40 to 85 °C)

Process

At atmospheric pressures and above (see Table A-4)

Table A-5. Model 3051 Process Temperature Limits

Models 3051CD, 3051CG, 3051CA	
Silicone Fill Sensor[1]	–40 to 250 °F (–40 to 121 °C)[2]
with Coplanar Flange	–40 to 300 °F (–40 to 149 °C)[2]
with Traditional Flange	–40 to 300 °F (–40 to 149 °C)[2]
with Level Flange	–40 to 300 °F (–40 to 149 °C)[2]
with Model 305 Integral Manifold	
Inert Fill Sensor[1]	0 to 185 °F (–18 to 85 °C)[3] [4]
Models 3051T (Process Fill Fluid)	
Silicone Fill Sensor[1]	–40 to 250 °F (–40 to 121 °C)[2]
Inert Fill Sensor[1]	–22 to 250 °F (–30 to 121 °C)[2]
Models 3051L Low-Side Temperature Limits	

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Table A-5. Model 3051 Process Temperature Limits

Silicone Fill Sensor(1)	–40 to 250 °F (–40 to 121 °C)(2)
Inert Fill Sensor(1)	0 to 185 °F (–18 to 85 °C)(2)
Models 3051L High-Side Temperature Limits (Process Fill Fluid)	
Syltherm® XLT	–100 to 300 °F (–73 to 149 °C)
D.C. Silicone 704(5)	60 to 600 °F (15 to 315 °C)
D.C. Silicone 200	–40 to 400 °F (–40 to 205 °C)
Inert	–50 to 350 °F (–45 to 177 °C)
Glycerin and Water	0 to 200 °F (–18 to 93 °C)
Neobee M-20®	0 to 400 °F (–18 to 205 °C)
Propylene Glycol and Water	0 to 200 °F (–18 to 93 °C)
Syltherm 800	–50 to 400 °F (–45 to 205 °C)
Model 3051H (Process Fill Fluid)	
D.C. Silicone 200(1)	–40 to 375 °F (–40 to 191 °C)
Inert(1)	–50 to 350 °F (–45 to 177 °C)
Neobee M-20®(1)	0 to 375 °F (–18 to 191 °C)

(1) Process temperatures above 185 °F (85 °C) require derating the ambient limits by a 1.5:1 ratio (0.6:1 ratio for Model 3051H)
(2) 220 °F (104 °C) limit in vacuum service; 130 °F (54 °C) for pressures below 0.5 psia
(3) 160 °F (71 °C) limit in vacuum service
(4) Not available for Model 3051CA
(5) Upper limit is for seal assemblies mounted away from the transmitter with the use of capillaries

Humidity Limits

0–100% relative humidity

Turn-on Time

Performance within specifications is achieved less than 2.0 seconds after power is applied to the transmitter

Volumetric Displacement

Less than 0.005 in^3 (0,08 cm^3)

Damping

Output response to a step input change is user-selectable from 0 to 36 seconds for one time constant. This software damping is in addition to sensor module response time.

PHYSICAL SPECIFICATIONS

Electrical Connections

1/2–14 NPT, PG 13.5, G1/2, and M20 x 1.5 (CM20) conduit

Process Connections

All Models except Model 3051L and Model 3051T

1/4–18 NPT on 2 1/8-in. centers;
1/2–14 NPT on 2-, 2 1/8-, or 2 1/4-in. centers

Model 3051L

High pressure side: 2-, 3-, or 4-in., Class 150, 300 or 600 flange; 50, 80, or 100 mm, PN 40 or 10/16 flange

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Low pressure side:
1/4–18 NPT on flange
1/2–14 NPT on adapter

Model 3051T

1/4–18, 1/2–14 NPT female, G1/2 A DIN 16288 Male (Available in SST for Range 1–4 transmitters only), or Autoclave type F-250-C (Pressure relieved 9/16–18 gland thread; 1/4 OD high pressure tube 60° cone; available in SST for Range 5 transmitters only)

Process-Wetted Parts

Table A-6. Process Isolating Diaphragms

Isolating Diaphragm Material	3051CD/CG	3051T	3051CA	3051L
316L SST	•	•	•	See Below
Hastelloy C-276	•	•	•	
Monel	•		•	
Tantalum	•			
Gold-plated *Monel*	•		•	
Gold-plated SST	•		•	

Drain/Vent Valves

316 SST, Hastelloy C, or Monel material
(Monel is unavailable with Model 3051L)

Process Flanges and Adapters

Plated carbon steel, CF-8M (Cast version of 316 SST, material per ASTM-A743), Hastelloy C, or Monel

Wetted O-rings

Glass-filled TFE (Graphite-filled TFE with isolating diaphragm Option Code 6)

Model 3051L Process Wetted Parts

Flanged Process Connection (Transmitter High Side)

Process diaphragms, including process gasket surface:

316L SST or Hastelloy C-276

Extension

CF-3M (Cast version of 316L SST, material per ASTM-A743), or Hastelloy C;
Fits schedule 40 and 80 pipe

Mounting Flange

Zinc-cobalt plated CS or SST

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Reference Process Connection (Low Side)

Isolating Diaphragms

316L SST or Hastelloy C-276

Reference Flange and Adapter

CF-3M (Cast version of 316 SST, material per ASTM-A743)

Non-Wetted Parts

Electronics Housing

Low-copper aluminum or CF-8M (Cast version of 316 SST, material per ASTM-A743); NEMA 4X,
IP 65, IP 66

Coplanar Sensor Module Housing

CF-3M (Cast version of 316L SST, material per ASTM-A743)

Bolts

Plated carbon steel per ASTM A449, Type 1; Austenitic 316 SST, ANSI/ASTM-A-193-B7M, or Monel

Sensor Module Fill Fluid

Silicone or inert halocarbon (inert not available with Model 3051CA or Model 3051H); Model 3051T uses Fluorinert® FC-43

Process Fill Fluid (Model 3051L and 3051H only)

Model 3051L: Syltherm® XLT, D.C.® Silicone 704, D.C. Silicone 200, inert, glycerin and water, Neobee
M-20®, propylene glycol and water, or Syltherm 800. Model 3051H: inert, Neobee M-20, or D.C. 200 Silicone

Paint

Polyurethane

Cover O-rings

Buna-N

Ordinary Location Certification

As standard, the transmitter has been examined and tested to determine that the design meets basic electrical, mechanical, and fire protection requirements by FM, a nationally recognized testing laboratory (NRTL) as accredited by the Federal Occupational Safety and Health Administration (OSHA).

Standard Configuration

Unless otherwise specified, transmitter is shipped as follows:

Engineering units:

Differential / Gage	inH_2O (Range 1, 2, and 3)
	psi (Range 4 and 5)
Absolute / 3051T	psi (all ranges)

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Calibration points:	Full range unless otherwise specified.
Flange type:	Specified model code option.
Flange material:	Specified model code option.
O-ring material:	Specified model code option.
Drain/vent:	Specified model code option.
Software tag:	(Blank)

Tagging

Three customer tagging options are available:

1. Standard SST hardware tag is wired to the transmitter. Tag character height is 0.125 in. (3,18 mm), 56 characters maximum.
2. Tag may be permanently stamped on transmitter nameplate upon request, 56 characters maximum.
3. A software only tag may be installed in the transmitter, or the first 30 characters specified in steps 1 or 2 will be stored in the transmitter.

Optional Model 305 Integral Manifolds

Factory assembled to Coplanar Model 3051 transmitters. Refer to PDS 00813-0100-4733 for ordering information.

Optional Three-Valve Conventional Manifolds

(Packaged separately.)

Part No. 01151-0150-0001

3-Valve Manifold, Carbon Steel
(Anderson, Greenwood & Co., M4AVIC).

Part No. 01151-0150-0002

3-Valve Manifold, 316 SST
(Anderson, Greenwood & Co., M4AVIS).

Output Information

Available units of measure include:

inH_2O @ 68 °F	psi	Pa
inHg @ 0 °C	bar	kPa
ftH_2O @ 68 °F	mbar	torr @ 0 °C
mmH_2O @ 68 °F	g/cm^2	atm
mmHg @ 0 °C	kg/cm^2	

Shipping Weights

Table A-7. Transmitter Weights without Options.

Transmitter	Add Weight in lb (kg)
Model 3051C	6.0 (2,7)
Model 3051L	See Table A-8
Model 3051T	3.0 (1,4)

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Table A-8. Model 3051L Transmitter Weights without Options.

Flush Mount		
Flange Size	**Flange Type**	**Weight: lb (kg)**
2-in.	ASME/(ANSI) Class 150	12.0 (5,5)
2-in.	ASME/(ANSI) Class 300	17.0 (7,7)
2-in.	ASME/(ANSI) Class 600	14.7 (6,7)
3-in.	ASME/(ANSI) Class 150	17.0 (7,7)
3-in.	ASME/(ANSI) Class 300	22.0 (10,0)
3-in.	ASME/(ANSI) Class 600	24.7 (11,2)
4-in.	ASME/(ANSI) Class 150	23.0 (10,5)
4-in.	ASME/(ANSI) Class 300	32.0 (14,5)
DIN DN 50	DIN PN 40	13.3 (6,0)
DIN DN 80	DIN PN 40	19.0 (8,6)
DIN DN 100	DIN PN 10/16	17.3 (7,9)
DIN DN 100	DIN PN 40	22.7 (10,3)
With 2-inch Extension		
Flange Size	**Flange Type**	**Weight: lb (kg)**
3-in.	ASME/(ANSI) Class 150	19.0 (8,6)
3-in.	ASME/(ANSI) Class 300	24.0 (10,9)
3-in.	ASME/(ANSI) Class 600	26.7 (12,1)
4-in.	ASME/(ANSI) Class 150	26.0 (11,8)
4-in.	ASME/(ANSI) Class 300	35.0 (15,9)
DIN DN 80	DIN PN 40	21.0 (9,5)
DIN DN 100	DIN PN 10/16	19.3 (8,8)
DIN DN 100	DIN PN 40	24.7 (11,3)
With 4-inch Extension		
Flange Size	**Flange Type**	**Weight: lb (kg)**
3-in.	ASME/(ANSI) Class 150	20.0 (9,1)
3-in.	ASME/(ANSI) Class 300	25.0 (11,3)
3-in.	ASME/(ANSI) Class 600	27.7 (12,6)
4-in.	ASME/(ANSI) Class 150	28.0 (12,7)
4-in.	ASME/(ANSI) Class 300	37.0 (16,8)
DIN DN 80	DIN PN 40	22.0 (10,0)
DIN DN 100	DIN PN 10/16	20.3 (9,3)
DIN DN 100	DIN PN 40	25.7 (11,7)
With 6-inch Extension		
Flange Size	**Flange Type**	**Weight: lb (kg)**
3-in.	ASME/(ANSI) Class 150	21.0 (9,5)
3-in.	ASME/(ANSI) Class 300	26.0 (11,8)
3-in.	ASME/(ANSI) Class 600	28.7 (13,0)
4-in.	ASME/(ANSI) Class 150	30 (13,6)
4-in.	ASME/(ANSI) Class 300	39.0 (17,7)
DIN DN 80	DIN PN 40	23.0 (10,4)
DIN DN 100	DIN PN 10/16	21.3 (9,7)
DIN DN 100	DIN PN 40	26.7 (12,1)

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Table A-9. Transmitter Option Weights.

Code	Option	Added Weight lb (kg)
J, K, L	Stainless Steel Housing	3.1 (1,4)
B4	SST Mounting Bracket for *Coplanar* Flange	1.0 (0,5)
B1, B2, B3	Mounting Bracket for Traditional Flange	2.3 (1,0)
B7, B8, B9	Mounting Bracket for Traditional Flange	2.3 (1,0)
BA, BC	SST Bracket for Traditional Flange	2.3 (1,0)
B5, B6	Mounting Bracket for Model 3051H	2.9 (1,3)
H2	Traditional Flange	2.4 (1,1)
H3	Traditional Flange	2.7 (1,2)
H4	Traditional Flange	2.6 (1,2)
H7	Traditional Flange	2.5 (1,1)
HJ	DIN Compliant Traditional Flange	
HK	DIN Compliant Traditional Flange	
HL	DIN Compliant Traditional Flange	
FC	Level Flange—3 in., 150	10.8 (4,9)
FD	Level Flange—3 in., 300	14.3 (6,5)
FA	Level Flange—2 in., 150	10.7 (4,8)
FB	Level Flange—2 in., 300	14.0 (6,3)
FP	DIN Level Flange: SST, DN 50, PN 40	8.3 (3,8)
FQ	DIN Level Flange: SST, DN 80, PN 40	13.7 (6,2)

Table A-10. Manifold Weights.

Manifold Model(1)	Added Weight(2) lb (kg)
0305AC2	4.5 (2,0)
0305AC3	5.0 (2,3)
0305AC7	4.7 (2,1)
0305AC8	5.2 (2,4)
0305AT2	5.9 (2,7)
0305AT3	6.4 (2,9)
0305AT7	6.1 (2,8)
0305AT8	6.6 (3,0)

(1) Refer to PDS 00813-0100-4733 for additional information on Integral Manifold model numbers and weights.
(2) For total weight, add the weight of the transmitter and options to the manifold weight.

SPARE

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Appendix B Approvals

HAZARDOUS LOCATIONS CERTIFICATIONS

Stainless steel certification tag provided when optional approval is specified.

Factory Mutual (FM) Approvals

E5 Explosion proof for Class I, Division 1, Groups B, C, and D. Dust-Ignition Proof for Class II and Class III, Division 1, Groups E, F, and G; suitable for indoor and outdoor (NEMA 4X) hazardous locations; temp code T5 (Ta = 85 °C);factory sealed

I5 Intrinsically Safe for use in Class I, Division 1, Groups A, B, C, and D; Class II, Division 1, Groups E, F, and G; Class III, Division 1 when connected in accordance with Rosemount drawing 03031-1019; temperature code T4 (Ta = 60 °C); non-incendive for Class I, Division 2, Groups A, B, C, and D; NEMA 4X; factory sealed.

FM Approved Entity Parameters for Model 3051C	FM Approved for Class I, II, III, Division 1 and 2, Groups:
V_{max} = 30V dc	A–G
I_{max} = 300 mA	A–G
P_{max} = 1.3 W	A–G
C_i = 0.0 µF	A–G
L_i = 0.0 µH	A–G

BASEEFA/CENELEC Intrinsic Safety and Dust Certification

I1 EEx ia IIC T4 (-60 °C < T_{amb} < 60 °C)
T70 °C(T_{amb} = –20 to + 40 °C) IP66
ATEX Category Marking: Ex II 1 GD

CENELEC Approved Entity Parameters

Ui= 30 V

Ii= 300 mA

Pi= 1.3 W

Ci= 0.0

Li= 0.0

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BASEEFA/CENELEC/Type N and Dust Certification

N1 EEx nL IIC T5 (-40 °C < T_{amb} < 70 °C)
T80 °C(T_{amb} = –20 to + 40 °C) IP66
ATEX Category Marking: Ex II 3 GD

SPECIAL CONDITIONS FOR SAFE USE:

When the (T1) optional transient protection terminal block is installed, the apparatus is not capable of withstanding the 500 V insulation test required by Clause 6.4.12 of EN50020:1994 for I1 and Clause 9.1 of EN50021:1998 for N1. This must be taken into account when installing the apparatus.

KEMA/CENELEC Flameproof and Dust Certification

E8 EEx d IIC T5 (–50 °C ≤ T_{amb} ≤ 80 °C)
EEx d IIC T6 (–50 °C ≤ T_{amb} ≤ 65 °C)
Dust rating T90 °C IP66

SPECIAL CONDITIONS FOR SAFE USE:

This device contains a thin wall diaphragm. Installation, maintenance and use shall take into account the environmental conditions to which the diaphragm will be subjected. The manufacturer's instructions for installation and maintenance shall be followed in detail to assure safety during its expected lifetime.

Canadian Standards Association (CSA) Approvals

E6 Explosion Proof for Class I, Division 1, Groups B, C, and D; dust-ignition proof for Class II and Class III, Division 1, Groups E, F, and G; suitable for Class I, Division 2, Groups A,B,C, and D; suitable for indoor and outdoor hazardous locations, CSA Enclosure Type 4X; factory sealed

I6 Intrinsically Safe for Class I, Division 1, Groups A, B, C, and D when connected in accordance with Rosemount drawings 03031-1024; temperature code T3C

CSA Approved Barriers for Model 3051C	CSA Approved for Class I, Division 1 and 2, Groups:
≤ 30 V, ≥ 300 Ω ≤ 28 V, ≥ 235 Ω ≤ 25 V, ≥ 160 Ω ≤ 22 V, ≥ 100 Ω	A–D
CSA Approved Entity Parameters for Model 3051C	
V_{max} = 30V dc	A–D
I_{max} = 300 mA	A–D
P_{max} = 1.3 W	A–D
C_i = 0.0 µF	A–D
L_i = 0.0 µH	A–D

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SAA Flameproof Certification

E7 Ex d IIC T6 (AMBIENT 40 °C) /DIP T6 (AMBIENT 40 °C)
Ex d IIC T5 (AMBIENT 80 °C) /DIP T6 (AMBIENT 80 °C)
IP65 Class I, Zone 1

SPECIAL CONDITIONS FOR SAFE USE:

When the transmitter enclosure has a cable entry thread other than metric conduit treads, the device must be used with an appropriately certified thread adaptor.

Combinations of Approvals

K5 Combination of **E5** and **I5**

KB Combination of **K5** and **C6**
FM and CSA Explosion proof and Instrinsic Safety

K6 Combination **C6**, **I1**, and **E8**

K8 Combination **I1** and **E8**

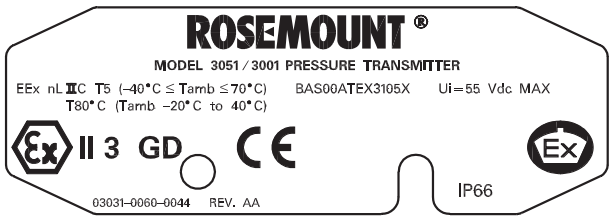
C6 Combination **I6** and **E6**

NOTE
Additional U.S., Canadian, Asian, and European Approvals Pending. Consult factory for updated approval information.

European ATEX Directive Information

CENELEC/BASEEFA Type N

Rosemount® Model 3051 pressure transmitters that have the following label attached, have been certified to comply with Directive 94/9/EC of the European Parliament and the Council as published in the Official Journal of the European Communities No. L 100/1 on 19–April–1994.



3051-0060A01A

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The following information is provided as part of the labeling of the transmitter:

- Name and address of the manufacturer (any of the following):
  - Rosemount USA
  - Rosemount Germany
  - Rosemount Singapore
  - Rosemount India

CE

- Complete model number (see Section 5 Specifications and Reference Data of the Model 3051 Reference Manual, document number 00809-0100-4001)
- The serial number of the device
- Year of construction
- Marking for explosion protection:  II 3 GD
  - EEx nL IIC T5 (–40 °C ≤ T_{amb} ≤ 0 °C)
  - Ui = 55 V dc Max
  - Dust rating T80 °C (T_{amb} –20 °C to 40 °C) IP66
- BASEEFA certificate number: BAS00ATEX3105X

Special Conditions for Safe Use (X):
Model 3051 transmitters fitted with the transient protection terminal block are not capable of withstanding the 500 V insulation test required by clause 9.1 of EN 50 021 (1998), and this must be taken into account when installing the apparatus.

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OVERVIEW

Index of intrinsically safe Factory Mutual barrier systems and entity parameters for Models 3051C/L/P/H/T and 3001C/S (Drawing Number 03031-1019, Rev AB).

Index of intrinsically safe C.S.A. barrier systems for Models 3051C/L/P/H/T and 3001C/S (Drawing Number 03031-1024, Rev AA).

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CONFIDENTIAL AND PROPRIETARY INFORMATION IS CONTAINED HEREIN AND MUST BE HANDLED ACCORDINGLY

REVISIONS

REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AA	ADD FIELDBUS	RTC1004088	**M.L.M.**	5/28/98
AB	ADD PROFIBUS, NONINCENDIVE PARAMETERS	RTC1008309	**P.C.S.**	2/4/00

ENTITY APPROVALS FOR

3051C 3001C
3051L 3001CL
3051P 3001CH
3051H 3001S
3051CA 3001SL
3051T 3001SH

OUTPUT CODE A (4-20 mA HART) I.S. SEE SHEETS 2-4
OUTPUT CODE M (LOW POWER) I.S. SEE SHEETS 5-6
OUTPUT CODE F/W (FIELDBUS) I.S. SEE SHEETS 7-9
ALL OUTPUT CODES NONINCENDIVE SEE SHEETS 10

THE ROSEMOUNT TRANSMITTERS LISTED ABOVE ARE F.M. APPROVED AS INTRINSICALLY SAFE WHEN USED IN CIRCUIT WITH F.M. APPROVED BARRIERS WHICH MEET THE ENTITY PARAMETERS LISTED IN THE CLASS I, II, AND III, DIVISION 1 GROUPS INDICATED, TEMP CODE T4. ADDITIONALLY, THE ROSEMOUNT 751 FIELD SIGNAL INDICATOR IS F.M. APPROVED AS INTRINSICALLY SAFE WHEN CONNECTED IN CIRCUIT WITH ROSEMOUNT TRANSMITTERS (FROM ABOVE) AND F.M. APPROVED BARRIERS WHICH MEET THE ENTITY PARAMETERS LISTED FOR CLASS I, II, AND III, DIVISION 1, GROUPS INDICATED, TEMP CODE T4.

TO ASSURE AN INTRINSICALLY SAFE SYSTEM, THE TRANSMITTER AND BARRIER MUST BE WIRED IN ACCORDANCE WITH THE BARRIER MANUFACTURER'S FIELD WIRING INSTRUCTIONS AND THE APPLICABLE CIRCUIT DIAGRAM.

CAD Maintained, (MICROSTATION)

UNLESS OTHERWISE SPECIFIED DIMENSIONS IN INCHES [mm]. REMOVE ALL BURRS AND SHARP EDGES. MACHINE SURFACE FINISH 125

-TOLERANCE-
.X ± .1 [2,5]
.XX ± .02 [0,5]
.XXX ± .010 [0,25]
FRACTIONS ± 1/32
ANGLES ± 2°

DO NOT SCALE PRINT

CONTRACT NO.

DR. **MIKE DOBE** 03/21/89
CHK'D
APP'D. **KELLY ORTH** 03/22/89
APP'D. GOVT.

ROSEMOUNT® MEASUREMENT
FISHER-ROSEMOUNT

Rosemount Inc.
12001 Technology Drive
Eden Prairie, MN 55344 USA

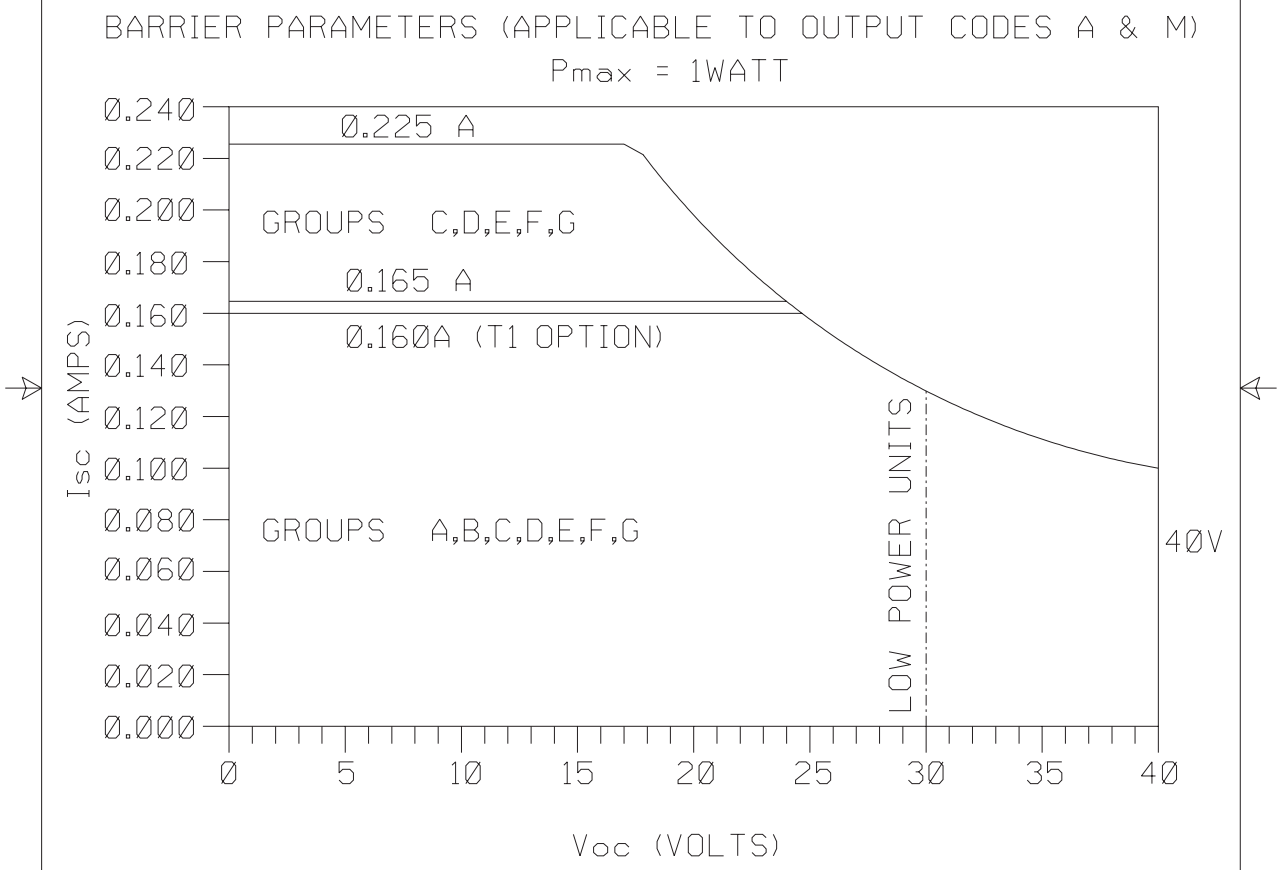
TITLE INDEX OF I.S. & NONINCENDIVE F.M. FOR 3051C/L/P/H/T AND 3001C/S

SIZE A | FSCM NO | DWG NO. 03031-1019

SCALE N/A | WT. ——— | SHEET 1 OF 10

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REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AB		RTC1008309		

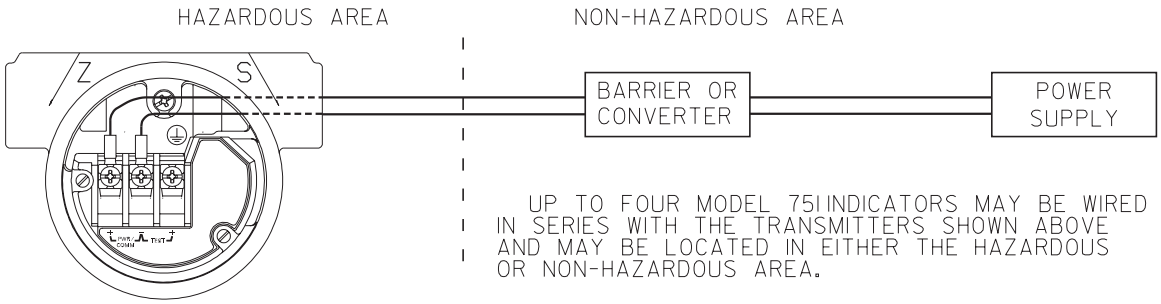


Rosemount Inc. 12001 Technology Drive Eden Prairie, MN 55344 USA			CAD Maintained, (MICROSTATION)
DR. MIKE DOBE	SIZE A	FSCM NO	DWG NO. 03031-1019
ISSUED	SCALE N/A	WT. ———	SHEET 2 OF 10

LIBERTY EXHIBIT 1032, Page 78
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

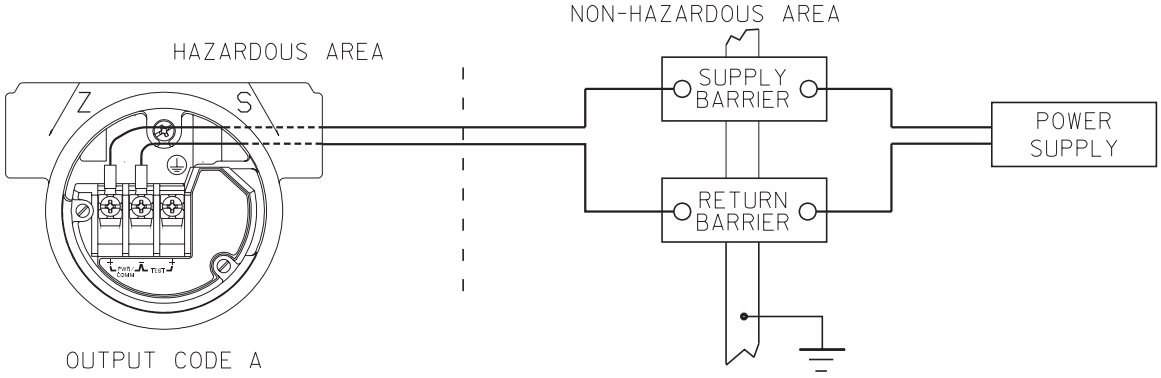
REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AB		RTC1008309		

CIRCUIT DIAGRAM 1
ONE BARRIER OR CONVERTER:
SINGLE OR DUAL CHANNEL



OUTPUT CODE A
MODELS INCLUDED
3051C, L, P, H, T, CA
3001C, CL, CH, S, SL, SH

CIRCUIT DIAGRAM 2
SUPPLY AND RETURN BARRIERS
(ONLY FOR USE WITH BARRIERS APPROVED IN THIS CONFIGURATION)



OUTPUT CODE A
MODELS INCLUDED
3051C, L, P, H, T, CA
3001C, CL, CH, S, SL, SH

Rosemount Inc. 12001 Technology Drive Eden Prairie, MN 55344 USA		CAD Maintained, (MICROSTATION)	
DR. MIKE DOBE	SIZE A	FSCM NO	DWG NO. 03031-1019
ISSUED	SCALE N/A	WT. ———	SHEET 3 OF 10

LIBERTY EXHIBIT 1032, Page 79
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REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AB		RTC1008309		

ENTITY CONCEPT APPROVALS

THE ENTITY CONCEPT ALLOWS INTERCONNECTION OF INTRINSICALLY SAFE APPARATUS TO ASSOCIATED APPARATUS NOT SPECIFICALLY EXAMINED IN COMBINATION AS A SYSTEM. THE APPROVED VALUES OF MAX. OPEN CIRCUIT VOLTAGE (Voc OR Vt) AND MAX. SHORT CIRCUIT CURRENT (Isc OR It) AND MAX. POWER (Voc X Isc/4) OR (Vt X It/4), FOR THE ASSOCIATED APPARATUS MUST BE LESS THAN OR EQUAL TO THE MAXIMUM SAFE INPUT VOLTAGE (Vmax), MAXIMUM SAFE INPUT CURRENT (Imax), AND MAXIMUM SAFE INPUT POWER (Pmax) OF THE INTRINSICALLY SAFE APPARATUS. IN ADDITION, THE APPROVED MAX. ALLOWABLE CONNECTED CAPACITANCE (Ca) OF THE ASSOCIATED APPARATUS MUST BE GREATER THAN THE SUM OF THE INTERCONNECTING CABLE CAPACITANCE AND THE UNPROTECTED INTERNAL CAPACITANCE (C_i) OF THE INTRINSICALLY SAFE APPARATUS, AND THE APPROVED MAX. ALLOWABLE CONNECTED INDUCTANCE (La) OF THE ASSOCIATED APPARATUS MUST BE GREATER THAN THE SUM OF THE INTERCONNECTING CABLE INDUCTANCE AND THE UNPROTECTED INTERNAL INDUCTANCE (L_i) OF THE INTRINSICALLY SAFE APPARATUS.

FOR OUTPUT CODE A

NOTE: ENTITY PARAMETERS LISTED APPLY ONLY TO ASSOCIATED APPARATUS WITH LINEAR OUTPUT.

CLASS I, DIV. 1, GROUPS A AND B

V_{MAX} = 40V	V_T OR V_{OC} IS LESS THAN OR EQUAL TO 40V
I_{MAX} = 165mA	I_T OR I_{SC} IS LESS THAN OR EQUAL TO 165mA
P_{MAX} = 1 WATT	$(\frac{V_T \times I_T}{4})$ OR $(\frac{Voc \times Isc}{4})$ IS LESS THAN OR EQUAL TO 1 WATT
C_I = .01µf	C_A IS GREATER THAN .01µf
L_I =10µH	L_A IS GREATER THAN 10µH

✳ FOR T1 OPTION:

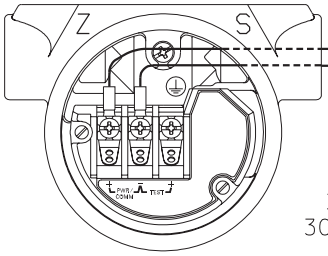
Imax = 160mA	I_T OR I_{SC} IS LESS THAN OR EQUAL TO 160mA
L_I =1.05mH	L_A IS GREATER THAN 1.05mH

CLASS I, DIV. 1, GROUPS C AND D

V_{MAX} = 40V	V_T OR V_{OC} IS LESS THAN OR EQUAL TO 40V
I_{MAX} = 225mA	I_T OR I_{SC} IS LESS THAN OR EQUAL TO 225mA
P_{MAX} = 1 WATT	$(\frac{V_T \times I_T}{4})$ OR $(\frac{Voc \times Isc}{4})$ IS LESS THAN OR EQUAL TO 1 WATT
C_I = .01µf	C_A IS GREATER THAN .01µf
L_I =10µH	L_A IS GREATER THAN 10µH

✳ FOR T1 OPTION:

L_I =1.05mH	L_A IS GREATER THAN 1.05mH



HAZARDOUS AREA | NON-HAZARDOUS AREA

ASSOCIATED APPARATUS

(SEE SHEET 3)

OUTPUT CODE A

MODELS INCLUDED

305IC, L, P, H, T, CA

300IC, CL, CH, S, SL, SH

Rosemount Inc. 12001 Technology Drive Eden Prairie, MN 55344 USA		CAD Maintained, (MICROSTATION)	
DR. MIKE DOBE	SIZE A / FSCM NO	DWG NO. 03031-1019	
ISSUED	SCALE N/A / WT. ———	SHEET 4 OF 10	

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Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AB		RTC1008309		

FOR OUTPUT CODE M

CLASS I, DIV. 1, GROUPS A AND B

V_{MAX} = 30V	V_T OR V_{OC} IS LESS THAN OR EQUAL TO 30V
I_{MAX} = 165mA	I_T OR I_{SC} IS LESS THAN OR EQUAL TO 165mA
P_{MAX} = 1 WATT	$(\frac{V_T \times I_T}{4})$ OR $(\frac{V_{OC} \times I_{SC}}{4})$ IS LESS THAN OR EQUAL TO 1 WATT
C_I = .042μf	C_A IS GREATER THAN .042μf
L_I =10μH	L_A IS GREATER THAN 10μH

* FOR T1 OPTION:

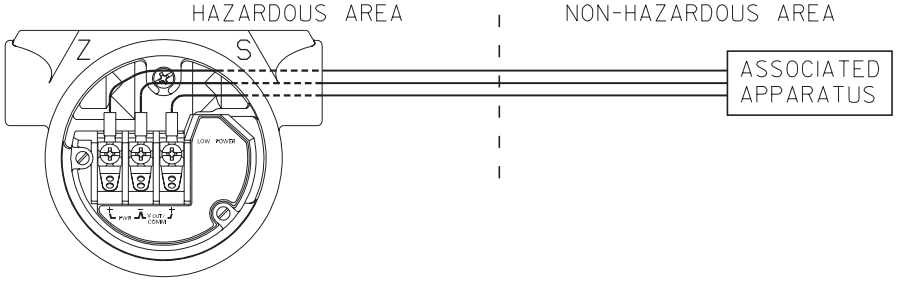
L_I =0.75mH	L_A IS GREATER THAN 0.75mH

CLASS I, DIV. 1, GROUPS C AND D

V_{MAX} = 30V	V_T OR V_{OC} IS LESS THAN OR EQUAL TO 30V
I_{MAX} = 225mA	I_T OR I_{SC} IS LESS THAN OR EQUAL TO 225mA
P_{MAX} = 1 WATT	$(\frac{V_T \times I_T}{4})$ OR $(\frac{V_{OC} \times I_{SC}}{4})$ IS LESS THAN OR EQUAL TO 1 WATT
C_I = .042μf	C_A IS GREATER THAN .042μf
L_I =10μH	L_A IS GREATER THAN 10μH

* FOR T1 OPTION:

L_I =0.75mH	L_A IS GREATER THAN 0.75mH



OUTPUT CODE M
AVAILABLE FOR THE MODELS LISTED

3051C 3051H
3051L 3051CA
3051P 3051T

Rosemount Inc.
12001 Technology Drive
Eden Prairie, MN 55344 USA

CAD Maintained, (MICROSTATION)

DR. MIKE DOBE

ISSUED

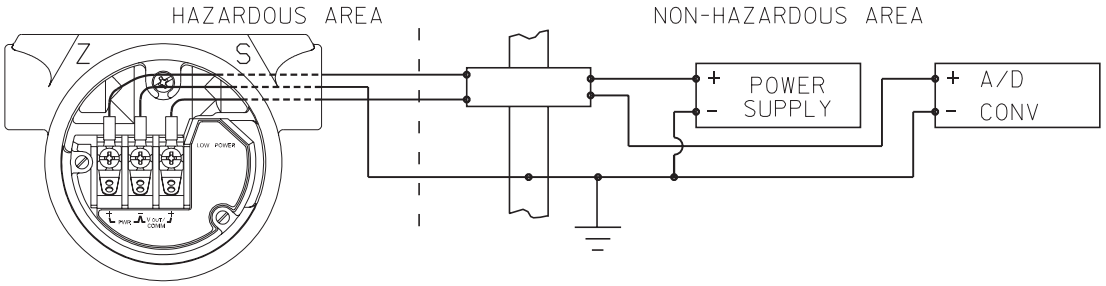
SIZE	FSCM NO	DWG NO.	
A		03031-1019	

SCALE N/A WT. ——— SHEET 5 OF 10

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REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AB		RTC1008309		

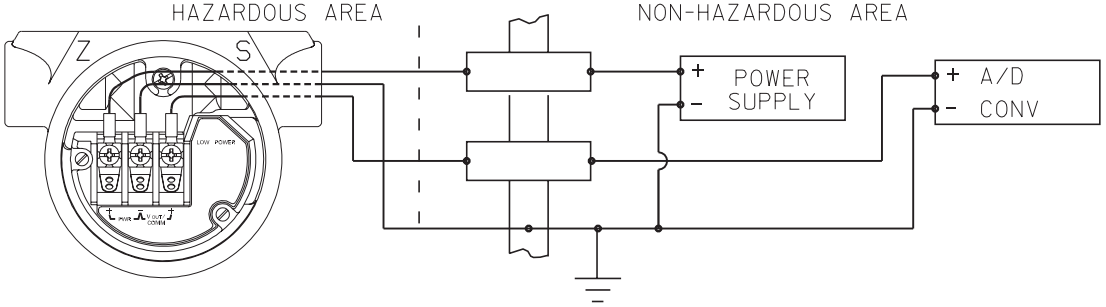
CIRCUIT DIAGRAM 3
ONE DUAL CHANNEL BARRIER



OUTPUT CODE M
AVAILABLE FOR THE MODELS LISTED

305IC	305IH
305IL	305ICA
305IP	305IT

CIRCUIT DIAGRAM 4
TWO SINGLE CHANNEL BARRIERS
(ONLY FOR USE WITH BARRIERS APPROVED
IN THIS CONFIGURATION)



OUTPUT CODE M
AVAILABLE FOR THE MODELS LISTED

305IC	305IH
305IL	305ICA
305IP	305IT

Rosemount Inc. 12001 Technology Drive Eden Prairie, MN 55344 USA		CAD Maintained, (MICROSTATION)	
DR. SANDI MANSON	SIZE A	FSCM NO	DWG NO. 03031-1019
ISSUED	SCALE N/A	WT. ———	SHEET 6 OF 10

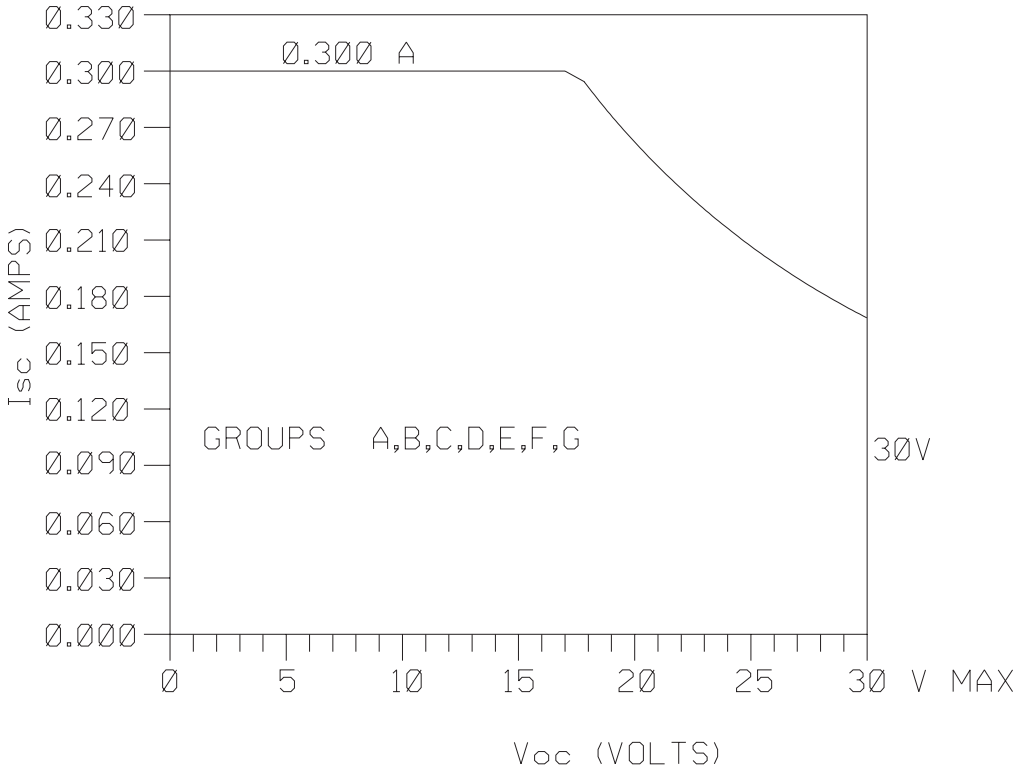
LIBERTY EXHIBIT 1032, Page 82
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AB		RTC1008309		

3051 WITH FOUNDATION FIELDBUS OR PROFIBUS. (OUTPUT CODE F OR W)

BARRIER PARAMETERS (APPLICABLE TO OUTPUT CODE F OR W)

Pmax = 1.3 WATT

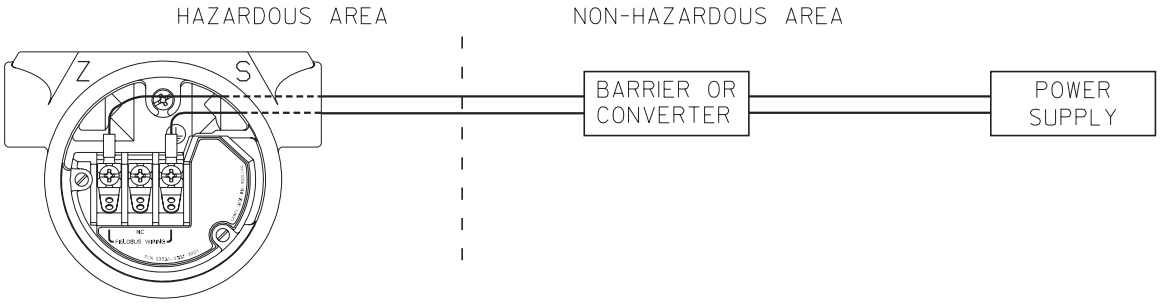


Rosemount Inc. 12001 Technology Drive Eden Prairie, MN 55344 USA			CAD Maintained, (MICROSTATION)
DR. Myles Lee Miller	SIZE A	FSCM NO	DWG NO. 03031-1019
ISSUED	SCALE N/A	WT. ———	SHEET 7 OF 10

LIBERTY EXHIBIT 1032, Page 83
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

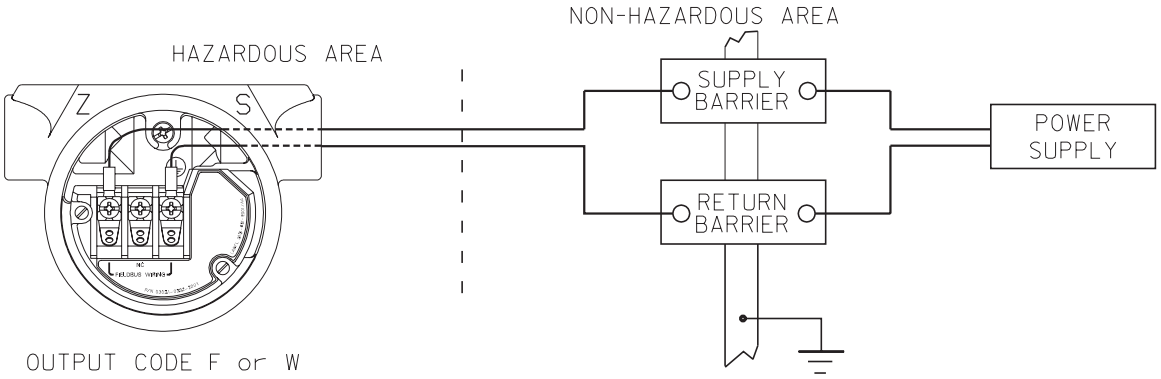
REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AB		RTC1008309		

CIRCUIT DIAGRAM 1
ONE BARRIER OR CONVERTER:
SINGLE OR DUAL CHANNEL



OUTPUT CODE F or W
MODELS INCLUDED
3051C, L, P, H, T, CA
3001C, CL, CH

CIRCUIT DIAGRAM 2
SUPPLY AND RETURN BARRIERS
(ONLY FOR USE WITH BARRIERS APPROVED IN THIS CONFIGURATION)



OUTPUT CODE F or W
MODELS INCLUDED
3051C, L, P, H, T, CA
3001C, CL, CH

Rosemount Inc. 12001 Technology Drive Eden Prairie, MN 55344 USA		CAD Maintained, (MICROSTATION)	
DR. Myles Lee Miller	SIZE A / FSCM NO	DWG NO.	03031-1019
ISSUED	SCALE N/A / WT.		SHEET 8 OF 10

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REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AB		RTC1008309		

ENTITY CONCEPT APPROVALS

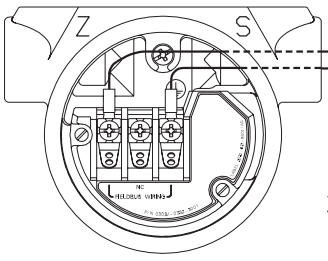
THE ENTITY CONCEPT ALLOWS INTERCONNECTION OF INTRINSICALLY SAFE APPARATUS TO ASSOCIATED APPARATUS NOT SPECIFICALLY EXAMINED IN COMBINATION AS A SYSTEM. THE APPROVED VALUES OF MAX. OPEN CIRCUIT VOLTAGE (Voc OR Vt) AND MAX. SHORT CIRCUIT CURRENT (Isc OR It) AND MAX. POWER (Voc X Isc/4) OR (Vt X It/4), FOR THE ASSOCIATED APPARATUS MUST BE LESS THAN OR EQUAL TO THE MAXIMUM SAFE INPUT VOLTAGE (Vmax), MAXIMUM SAFE INPUT CURRENT (Imax), AND MAXIMUM SAFE INPUT POWER (Pmax) OF THE INTRINSICALLY SAFE APPARATUS. IN ADDITION, THE APPROVED MAX. ALLOWABLE CONNECTED CAPACITANCE (Ca) OF THE ASSOCIATED APPARATUS MUST BE GREATER THAN THE SUM OF THE INTERCONNECTING CABLE CAPACITANCE AND THE UNPROTECTED INTERNAL CAPACITANCE (C_i) OF THE INTRINSICALLY SAFE APPARATUS, AND THE APPROVED MAX. ALLOWABLE CONNECTED INDUCTANCE (La) OF THE ASSOCIATED APPARATUS MUST BE GREATER THAN THE SUM OF THE INTERCONNECTING CABLE INDUCTANCE AND THE UNPROTECTED INTERNAL INDUCTANCE (L_i) OF THE INTRINSICALLY SAFE APPARATUS.

NOTE: ENTITY PARAMETERS LISTED APPLY ONLY TO ASSOCIATED APPARATUS WITH LINEAR OUTPUT.

FOR OUTPUT CODE F or W

CLASS I, DIV. 1, GROUPS A, B, C AND D

V_{MAX} = 30V	V_T OR V_{OC} IS LESS THAN OR EQUAL TO 30V
I_{MAX} = 300mA	I_T OR I_{SC} IS LESS THAN OR EQUAL TO 300mA
P_{MAX} = 1.3 WATT	$(\frac{V_T \times I_T}{4})$ OR $(\frac{Voc \times Isc}{4})$ IS LESS THAN OR EQUAL TO 1.3 WATT
C_I = 0 μf	C_A IS GREATER THAN 0 μf
L_I = 0 μH	L_A IS GREATER THAN 0 μH



HAZARDOUS AREA | NON-HAZARDOUS AREA

ASSOCIATED APPARATUS

(SEE SHEET 3)

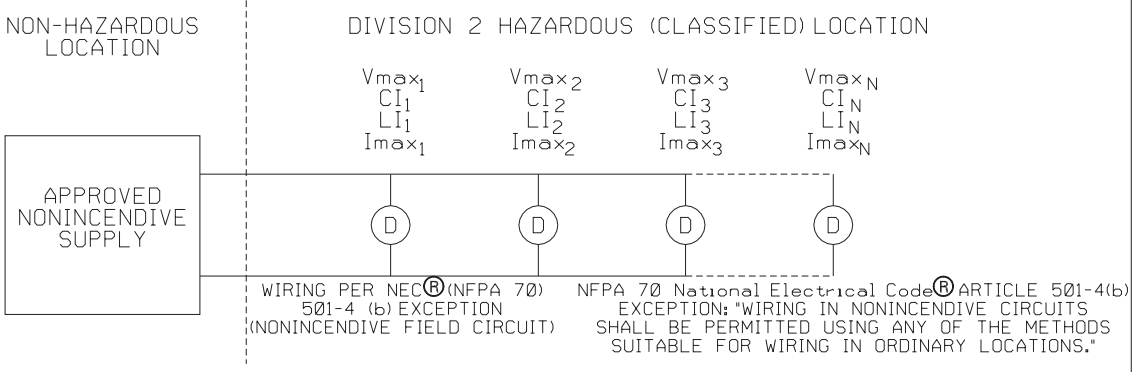
OUTPUT CODE F
MODELS INCLUDED
305IC, L, P, H, T, CA
300IC, CL, CH

Rosemount Inc. 12001 Technology Drive Eden Prairie, MN 55344 USA			CAD Maintained, (MICROSTATION)
DR. Myles Lee Miller	SIZE A	FSCM NO	DWG NO. 03031-1019
ISSUED	SCALE N/A	WT. ———	SHEET 9 OF 10

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REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AB		RTC1008309		

NONINCENDIVE FIELD CIRCUIT
CLASS I, DIV. 2 LOCATIONS



IN NORMAL OPERATION

DEVICES CONTROL THROUGH–CURRENT

PARAMETERS DEVICE

Voc <= Minimum of ($Vmax_1$, $Vmax_2$, ..., $Vmax_N$)

$Imax_1$ >= Iq_1 + $Isignal_1$

$Imax_2$ >= Iq_1 + $Isignal_2$

.

.

.

$Imax_N$ >= Iq_N + $Isignal_N$

Ca <= C_{i_1} + C_{i_2} +... + C_{i_N} + Ccable

La <= L_{i_1} + L_{i_2} +... + L_{i_N} + Lcable

Imax for an individual device = Iq + Isignal

Iq =Quiescent current through device (Maximum quiescent current for the device)

Isignal =Signaling current through device (Protocol may limit signaling to one device at a time)

Operating Imax = Iq_1 + Iq_2 +...+ Iq_N + $I_{signal\ max}$

$I_{signal\ max}$ = Max. of ($Isignal_1$, $Isignal_2$,...., $Isignal_N$)

ROSEMOUNT 3051/3001

	4-20mA / HART	FIELDBUS (F or W)
Vmax	40v	30v
Maximum normal operating current	22mA	27mA
Ca	.010uF	0uF
La	10uH	0uH

ROSEMOUNT 3051 TRANSMITTERS ARE CURRENT CONTROLLERS ON INDIVIDUAL PARALLEL BRANCHES WITH RESPECT TO THE POWER SUPPLY. IN NONINCENDIVE INSTALLATIONS THE Imax FOR EACH TRANSMITTER IS NOT RELATED TO THE MAXIMUM CURRENT OF THE POWER SUPPLY (Isc) IN THE SAME MANNER AS FOR TRANSMITTER INSTALLED PER I.S. REQUIREMENTS, BECAUSE NONINCENDIVE REQUIREMENTS INCLUDE ONLY NORMAL OPERATING CONDITIONS.

REFERENCE: APPENDIX A7.3 (FM3611)

Rosemount Inc. 12001 Technology Drive Eden Prairie, MN 55344 USA		CAD Maintained, (MICROSTATION)	
DR. Jon Steffens	SIZE A	FSCM NO	DWG NO. 03031-1019
ISSUED	SCALE N/A	WT. ———	SHEET 10 OF 10

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CONFIDENTIAL AND PROPRIETARY INFORMATION IS CONTAINED HEREIN AND MUST BE HANDLED ACCORDINGLY

REVISIONS

REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AA	ADD FIELDBUS	RTC1004232	M.L.M.	5/28/98
AB	ADD PROFIBUS, ENTITY PARAMETERS	RTC1008326	P.C.S.	2/4/00
AC	REM It, Vt FROM ENTITY PARAMETERS	RTC1009279	W.C.R.	7/11/00

APPROVALS FOR

3051C	3001C
3051L	3001CL
3051P	3001CH
3051H	3001S
3051CA	3001SL
3051T	3001SH

OUTPUT CODE A (4-20 mA HART) I.S. SEE SHEETS 2-3
OUTPUT CODE M (LOW POWER) I.S. SEE SHEETS 3-4
OUTPUT CODE F/W (FIELDBUS) I.S. SEE SHEETS 5
OUTPUT CODES A,F,W I.S. ENTITY PARAMETERS SHEET 6-7

TO ASSURE AN INTRINSICALLY SAFE SYSTEM, THE TRANSMITTER AND BARRIER MUST BE WIRED IN ACCORDANCE WITH THE BARRIER MANUFACTURER'S FIELD WIRING INSTRUCTIONS AND THE APPLICABLE CIRCUIT DIAGRAM.

WARNING - EXPLOSION HAZARD - SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS I, DIVISION 2.

AVERTISSEMENT - RISQUE D'EXPLOSION - LA SUBSTITUTION DE COMPOSANTS PEUT RENDRE CE MATERIEL INACCEPTABLE POUR LES EMPLACEMENTS DE CLASSE I, DIVISION 2.

CAD Maintained, (MICROSTATION)

UNLESS OTHERWISE SPECIFIED DIMENSIONS IN INCHES [mm]. REMOVE ALL BURRS AND SHARP EDGES. MACHINE SURFACE FINISH 125

-TOLERANCE-
.X ± .1 [2,5]
.XX ± .02 [0,5]
.XXX ± .010 [0,25]
FRACTIONS ± 1/32
ANGLES ± 2°

DO NOT SCALE PRINT

CONTRACT NO.

DR. Mike Dobe 08/27/90

CHK'D

APP'D. GLEN MONZO 8/31/90

APP'D. GOVT.

ROSEMOUNT® MEASUREMENT
FISHER-ROSEMOUNT

Rosemount Inc.
12001 Technology Drive
Eden Prairie, MN 55344 USA

TITLE
INDEX OF I.S. CSA FOR 3051C/L/P/H/T & 3001C/S

SIZE	FSCM NO	DWG NO.
A		03031-1024

SCALE N/A WT. ——— SHEET 1 OF 7

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REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AC		RTC1009279		

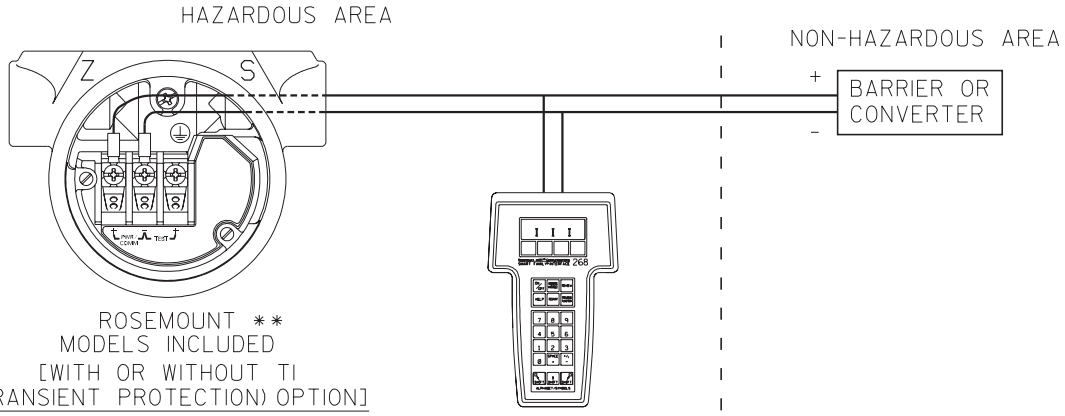
CSA INTRINSIC SAFETY APPROVALS

CIRCUIT CONNECTION WITH BARRIER OR CONVERTER

Ex ia

INTRINSICALLY SAFE/SECURITE INTRINSEQUE

4-20 mA, ("A" OUTPUT CODE)



ROSEMOUNT **
MODELS INCLUDED
[WITH OR WITHOUT TI
(TRANSIENT PROTECTION) OPTION]

3051C, L, P, H, T, CA
3001C, CL, CH, S, SL, SH

ROSEMOUNT
MODEL 268 or 275 SMART
FAMILY INTERFACE

** FOR THE LOW POWER OPTION, SEE PAGE 4 FOR THE CIRCUIT CONNECTION WITH BARRIER OR CONVERTER. FOR FIELDBUS OPTIONS("F" or "W" OUTPUT CODE), SEE PAGE 5 FOR PARAMETERS AND CIRCIUT CONNECTION TO BARRIER.

Rosemount Inc. 12001 Technology Drive Eden Prairie, MN 55344 USA		CAD Maintained, (MICROSTATION)	
DR. Mike Dobe 08/27/90	SIZE A	FSCM NO	DWG NO. 03031-1024
ISSUED	SCALE N/A	WT.	SHEET 2 OF 7

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REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AC		RTC1009279		

4-20 mA, ("A" OUTPUT CODE)

DEVICE	PARAMETERS	APPROVED FOR CLASS I, DIV.I
CSA APPROVED SAFETY BARRIER	30 V OR LESS *330 OHMS OR MORE * 28 V OR LESS 300 OHMS OR MORE 25 V OR LESS 200 OHMS OR MORE * 22 V OR LESS 180 OHMS OR MORE	GROUPS A, B, C, D
FOXBORO CONVERTER 2AI-I2V-CGB, 2AI-I3V-CGB, 2AS-I3I-CGB, 3A2-I2D-CGB, 3A2-I3D-CGB, 3AD-I3I-CGB, 3A4-I2D-CGB, 2AS-I2I-CGB, 3F4-I2DA		GROUPS B, C, D
CSA APPROVED SAFETY BARRIER	30 V OR LESS 150 OHMS OR MORE	GROUPS C, D

LOW POWER, ("M" OUTPUT CODE)

DEVICE	PARAMETERS	APPROVED FOR CLASS I, DIV.I
	Supply ≤ 28V, ≥300 Ω Return ≤ 10V, ≥47 Ω	GROUPS A, B, C, D
CSA APPROVED SAFETY BARRIER	Supply ≤ 30V, ≥150 Ω Return ≤ 10V, ≥47 Ω	GROUPS C, D

* MAY BE USED WITH ROSEMOUNT MODEL 268 or 275 SMART FAMILY INTERFACE.

Rosemount Inc. 12001 Technology Drive Eden Prairie, MN 55344 USA	CAD Maintained, (MICROSTATION)		
DR. Mike Dobe	SIZE A	FSCM NO	DWG NO. 03031-1024
ISSUED	SCALE N/A	WT. ———	SHEET 3 OF 7

LIBERTY EXHIBIT 1032, Page 89
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

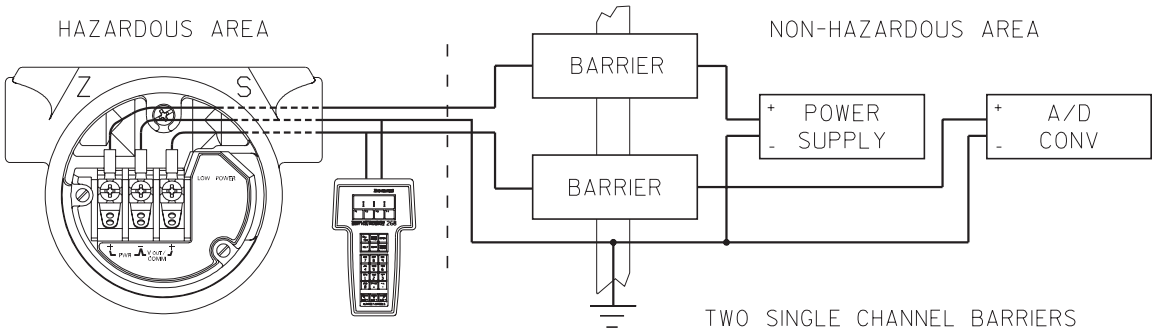
REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AC		RTC1009279		

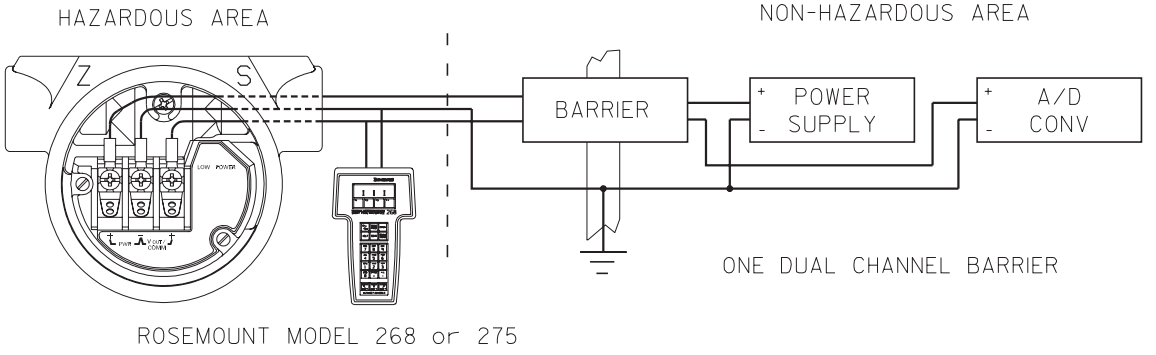
CSA INTRINSIC SAFETY APPROVALS

305IC LOW POWER CIRCUIT CONNECTION WITH INTRINSIC SAFETY BARRIERS

Ex ia

INTRINSICALLY SAFE/SECURITE INTRINSEQUE
LOWPOWER, ("M" OUTPUT CODE)





APPROVED FOR CLASS I, DIVISION I, GROUPS A,B,C,D WHEN USED IN CIRCUIT WITH TWO CSA APPROVED SINGLE CHANNEL SAFETY BARRIERS, ONE WITH APPROVED SAFETY PARAMETERS OF 28 VOLTS OR LESS AND 300 OHMS OR MORE IN +PWR LINE, AND ONE WITH APPROVED SAFETY PARAMETERS OF 10 VOLTS OR LESS AND 47 OHMS OR MORE IN Vout LINE, OR ONE CSA APPROVED DUAL CHANNEL SAFETY BARRIER WITH IDENTICAL APPROVED SAFETY PARAMETERS CONNECTED IN LIKE MANNER, AS ABOVE.

APPROVED FOR CLASS I, DIVISION I, GROUPS C,D WHEN USED IN CIRCUIT WITH TWO CSA APPROVED SINGLE CHANNEL SAFETY BARRIERS, ONE WITH APPROVED SAFETY PARAMETERS OF 30 VOLTS OR LESS AND 150 OHMS OR MORE IN +PWR LINE AND ONE WITH APPROVED SAFETY PARAMETERS OF 10 VOLTS OR LESS AND 47 OHMS OR MORE IN Vout LINE.

Rosemount Inc. 12001 Technology Drive Eden Prairie, MN 55344 USA			CAD Maintained, (MICROSTATION)
DR. SANDI MANSON	SIZE A	FSCM NO	DWG NO. 03031-1024
ISSUED	SCALE N/A	WT. ———	SHEET 4 OF 7

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REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AC		RTC1009279		

FIELDBUS, ("F" or "W" OUTPUT CODE)

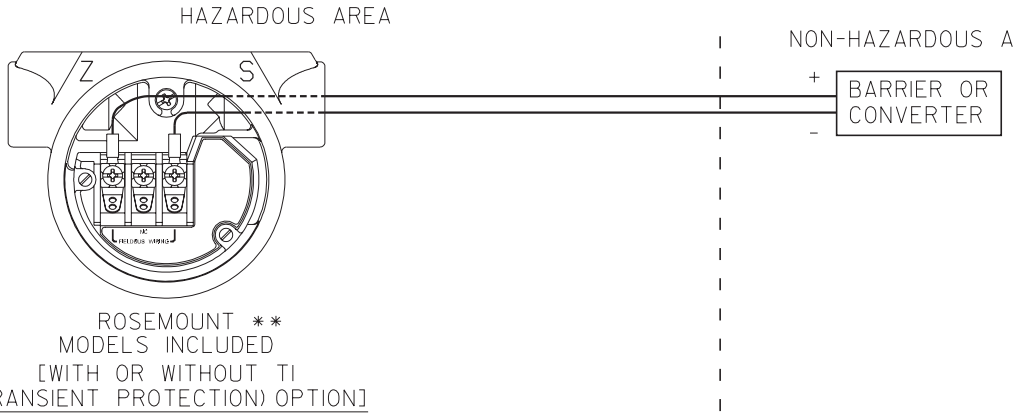
DEVICE	PARAMETERS	APPROVED FOR CLASS I, DIV.I
CSA APPROVED SAFETY BARRIER	30 V OR LESS 300 OHMS OR MORE 28 V OR LESS 235 OHMS OR MORE 25 V OR LESS 160 OHMS OR MORE 22 V OR LESS 100 OHMS OR MORE	GROUPS A, B, C, D

CSA INTRINSIC SAFETY APPROVALS

CIRCUIT CONNECTION WITH BARRIER OR CONVERTER

Ex ia

INTRINSICALLY SAFE/SECURITE INTRINSEQUE
FIELDBUS, ("F" or "W" OUTPUT CODE)



ROSEMOUNT **
MODELS INCLUDED
[WITH OR WITHOUT TI
(TRANSIENT PROTECTION) OPTION]

3051C, L, P, H, T, CA
3001C, CL, CH, S, SL, SH

WARNING - EXPLOSION HAZARD - SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS I, DIVISION 2.

AVERTISSEMENT - RISQUE D'EXPLOSION - LA SUBSTITUTION DE COMPOSANTS PEUT RENDRE CE MATERIEL INACCEPTABLE POUR LES EMPLACEMENTS DE CLASSE I, DIVISION 2.

Rosemount Inc. 12001 Technology Drive Eden Prairie, MN 55344 USA		CAD Maintained, (MICROSTATION)	
DR. Myles Lee Miller	SIZE A	FSCM NO	DWG NO. 03031-1024
ISSUED	SCALE N/A	WT. ———	SHEET 5 OF 7

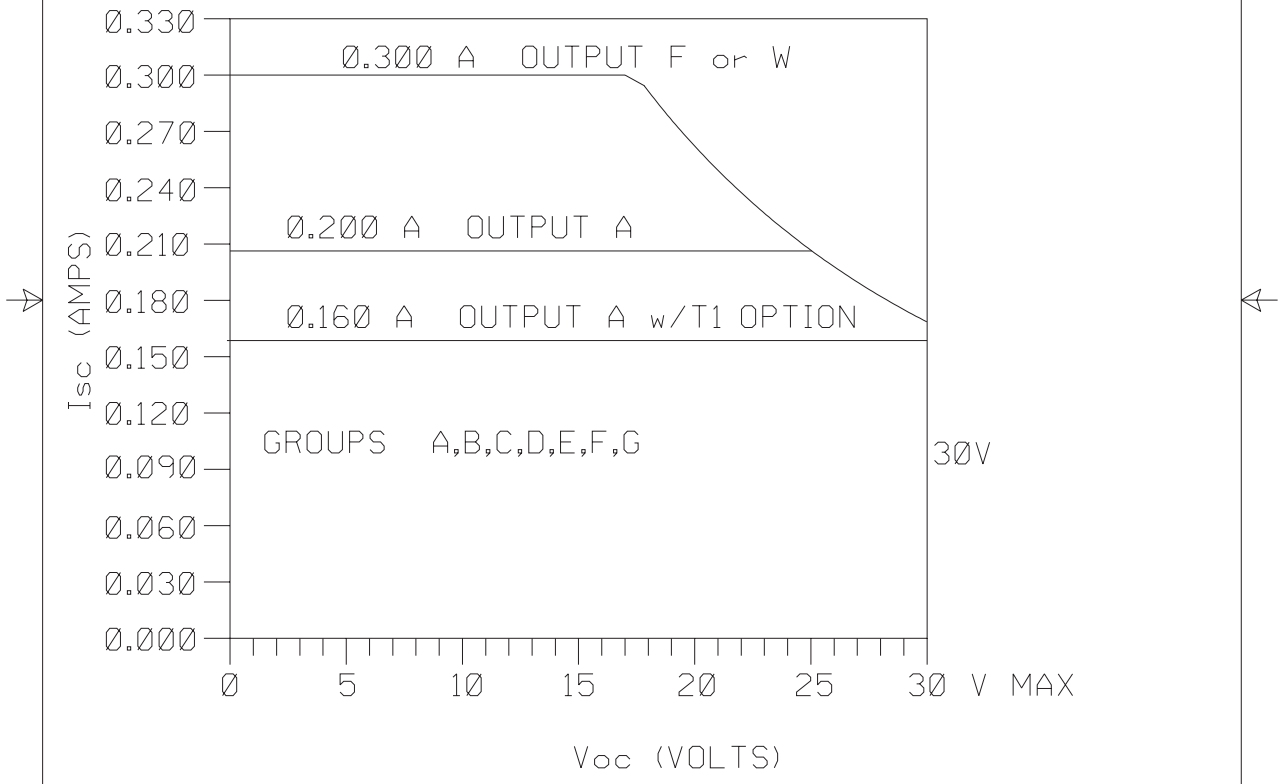
LIBERTY EXHIBIT 1032, Page 91
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REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AC		RTC1009279		

3051 I.S. ENTITY PARAMETERS. (OUTPUT CODE A,F, or W)

BARRIER PARAMETERS (APPLICABLE TO OUTPUT CODE A,F, or W)

Pmax = 1.3 WATT OUTPUT F or W
Pmax = 1.0 WATT OUTPUT A



Rosemount Inc. 12001 Technology Drive Eden Prairie, MN 55344 USA		CAD Maintained, (MICROSTATION)	
DR. JON STEFFENS	SIZE A / FSCM NO	DWG NO. 03031-1024	
ISSUED	SCALE N/A / WT. ———	SHEET 6 OF 7	

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REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AC		RTC1009279		

ENTITY CONCEPT APPROVALS

THE ENTITY CONCEPT ALLOWS INTERCONNECTION OF INTRINSICALLY SAFE APPARATUS TO ASSOCIATED APPARATUS NOT SPECIFICALLY EXAMINED IN COMBINATION AS A SYSTEM. THE APPROVED VALUES OF MAX. OPEN CIRCUIT VOLTAGE (Voc) AND MAX. SHORT CIRCUIT CURRENT (Isc) AND MAX. POWER (Voc X Isc/4), FOR THE ASSOCIATED APPARATUS MUST BE LESS THAN OR EQUAL TO THE MAXIMUM SAFE INPUT VOLTAGE (Vmax), MAXIMUM SAFE INPUT CURRENT (Imax), AND MAXIMUM SAFE INPUT POWER (Pmax) OF THE INTRINSICALLY SAFE APPARATUS. IN ADDITION, THE APPROVED MAX. ALLOWABLE CONNECTED CAPACITANCE (Ca) OF THE ASSOCIATED APPARATUS MUST BE GREATER THAN THE SUM OF THE INTERCONNECTING CABLE CAPACITANCE AND THE UNPROTECTED INTERNAL CAPACITANCE (C_1) OF THE INTRINSICALLY SAFE APPARATUS, AND THE APPROVED MAX. ALLOWABLE CONNECTED INDUCTANCE (La) OF THE ASSOCIATED APPARATUS MUST BE GREATER THAN THE SUM OF THE INTERCONNECTING CABLE INDUCTANCE AND THE UNPROTECTED INTERNAL INDUCTANCE (L_1) OF THE INTRINSICALLY SAFE APPARATUS.

FOR OUTPUT CODE A

CLASS I, DIV. 1, GROUPS A, B, C AND D

V_{MAX} = 30V	V_{OC} IS LESS THAN OR EQUAL TO 30V
I_{MAX} = 200mA	I_{SC} IS LESS THAN OR EQUAL TO 200mA
P_{MAX} = 1 WATT	$(\frac{Voc \times Isc}{4})$ IS LESS THAN OR EQUAL TO 1 WATT
C_I = .01μf	C_A IS GREATER THAN .01μf + C CABLE
L_I =10μH	L_A IS GREATER THAN 10μH + L CABLE

✳ FOR T1 OPTION:

Imax = 160mA	I_{SC} IS LESS THAN OR EQUAL TO 160mA
L_I =1.05mH	L_A IS GREATER THAN 1.05mH + L CABLE

FOR OUTPUT CODE F or W

CLASS I, DIV. 1, GROUPS A, B, C AND D

V_{MAX} = 30V	V_{OC} IS LESS THAN OR EQUAL TO 30V
I_{MAX} = 300mA	I_{SC} IS LESS THAN OR EQUAL TO 300mA
P_{MAX} = 1.3 WATT	$(\frac{Voc \times Isc}{4})$ IS LESS THAN OR EQUAL TO 1.3 WATT
C_I = 0μf	C_A IS GREATER THAN 0μf + C CABLE
L_I = 0μH	L_A IS GREATER THAN 0μH + L CABLE

NOTE: ENTITY PARAMETERS LISTED APPLY ONLY TO ASSOCIATED APPARATUS WITH LINEAR OUTPUT.

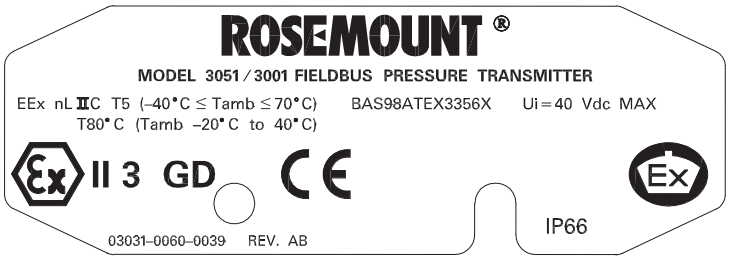
Rosemount Inc. 12001 Technology Drive Eden Prairie, MN 55344 USA		CAD Maintained, (MICROSTATION)	
DR. JON STEFFENS	SIZE A	FSCM NO	DWG NO. 03031-1024
ISSUED	SCALE N/A	WT. ———	SHEET 7 OF 7

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EUROPEAN ATEX DIRECTIVE INFORMATION

CENELEC/BASEEFA Type N

Rosemount® Model 3051 pressure transmitters that have the following label attached, have been certified to comply with Directive 94/9/EC of the European Parliament and the Council as published in the Official Journal of the European Communities No. L 100/1 on 19–April–1994.



3051-0038AO1B

The following information is provided as part of the labeling of the transmitter:

- Name and address of the manufacturer (any of the following):
  - Rosemount USA
  - Rosemount Germany
  - Rosemount Singapore
  - Rosemount India

CE

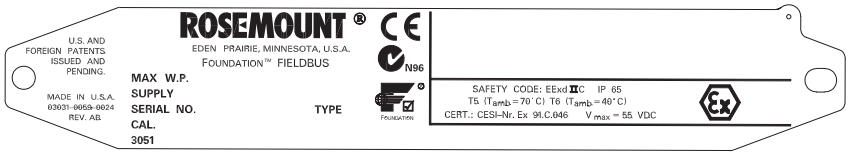
- Complete model number (see Section 5 Specifications and Reference Data of the Model 3051 Reference Manual, document number 00809-0100-4001)
- The serial number of the device
- Year of construction
- Marking for explosion protection: II 3 GD
  - EEx nL IIC T5 (–40 °C ≤ T_{amb} ≤ 0 °C)
  - Ui = 44 V dc Max
  - Dust rating T80 °C (T_{amb} –20 °C to 40 °C) IP66
- BASEEFA certificate number: BAS98ATEX3356X

Special Conditions for Safe Use (X):
Model 3051 transmitters fitted with the transient protection terminal block are not capable of withstanding the 500 V insulation test required by clause 9.1 of EN 50 021 (1998), and this must be taken into account when installing the apparatus.

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CENELEC/KEMA FLAMEPROOF AND DUST CERTIFICATION

Rosemount Model 3051 pressure transmitters that have the following label attached, have been certified to comply with Directive 94/9/EC of the European Parliament and the Council as published in the Official Journal of the European Communities No. L 100/1 on 19–April–1994.



3051-0059A24

The following information is provided as part of the labeling of the transmitter:

- Name and address of the manufacturer (any of the following):
  - Rosemount USA
  - Rosemount Germany
  - Rosemount Singapore

CE 0600

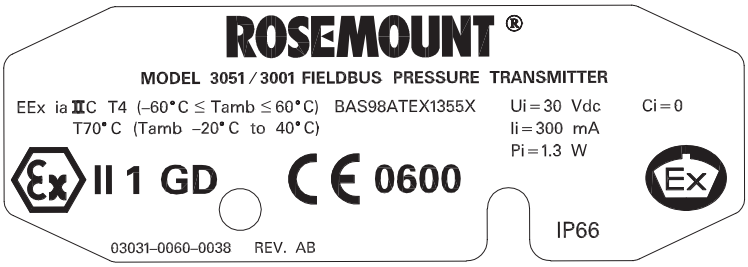
- Complete model number (see Section 6 of the Model 3051 with Foundation fieldbus protocol Reference Manual, document number 00809-0100-4774)
- The serial number of the device
- Year of construction
- Marking for explosion protection: Ex II 1/2 GD
  - EEx d IIC T5 ($-50\ °C \le T_{amb} \le 80\ °C$)
  - EEx d IIC T6 ($-50\ °C \le T_{amb} \le 65\ °C$)
  - Dust rating T90 °C IP66
- KEMA certificate number: KEMA00ATEX2013X

Special conditions for safe use (X)
This device contains a thin wall diaphragm. Installation, maintenance, and use shall take into account the environmental conditions to which the diaphragm will be subjected. The manufacture's instructions for installation and maintenance shall be followed in detail to assure safety during its expected lifetime.

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CENELEC/BASEEFA INTRINSIC SAFETY

Rosemount Model 3095MV Multivariable Mass Flow Transmitters that have the following label attached, have been certified to comply with Directive 94/9/EC of the European Parliament and the Council as published in the Official Journal of the European Communities No. L 100/1 on 19 April 1994.



3051-0038A01B

The following information is provided as part of the labeling of the transmitters:

- Name and address of the manufacturer (may be any of the following):
- Rosemount USA
- Rosemount England
- Rosemount Germany
- Rosemount Singapore

0600

- Complete model number (see Section 6 Specifications and Reference Data)
- The serial number of the device
- Year of construction
- Marking for explosion protection: II 1 G
- EEx ia IIC T5 ($-45\ °C \le T_{amb} \le 40\ °C$)
- EEx ia IIC T4 ($-45\ °C \le T_{amb} \le 70\ °C$)
- $U_i = 30$ Vdc $I_i = 200$ mA $P_i = 1.0$ W $C_i = 0.012\ \mu F$
- BASEEFA ATEX certificate number: BAS 98 ATEX 1359

Special conditions for safe use (X):
Model 3095 transmitters fitted with the transient protection terminal block are not capable of withstanding the 500 V insulation test required by Clause 6.4.12 of EN 50 020 (1994), and this must be taken into account when installing the apparatus.

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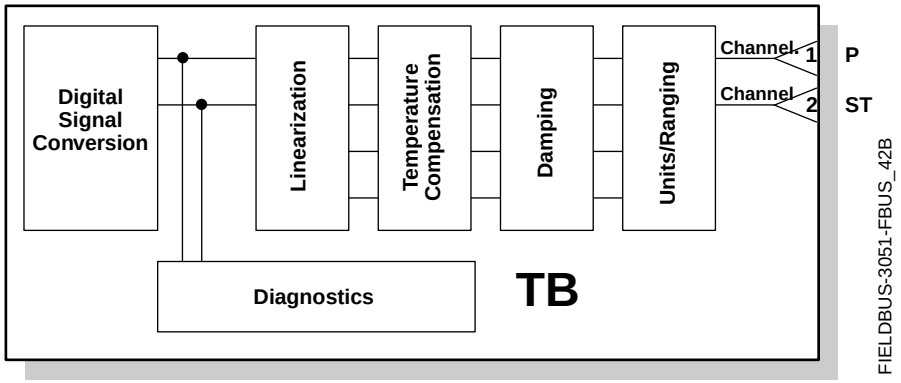
Appendix C Block Information

TRANSDUCER BLOCK

Overview

This section contains information on the 3051 Transducer Block (TB). Descriptions of all Transducer Block parameters, errors, and diagnostics are listed. Also, the modes, alarm detection, status handling, application information, and troubleshooting are discussed.

Figure 0-1. Transducer Block Diagram



Definition

The transducer block contains the actual measurement data, including a pressure and temperature reading. Channels 1–2 are assigned to these measurements (see Figure 0-1 above). The transducer block includes information about sensor type, engineering units, linearization, reranging, temperature compensation, and diagnostics.

Channel Definitions

Each input has a channel assigned to it allowing the AI block to link to it. The channels for the Model 3051 are the following:

1. P (Pressure)(1)
2. ST (Sensor Temperature)

(1) Can be either a DP, gage, or absolute pressure.

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Parameters and Descriptions

Table C-1. Transducer Block Parameters

Parameter	Index Number	Description
ALERT_KEY	04	The identification number of the plant unit.
BLOCK_ALM	08	The block alarm is used for all configuration, hardware, connection failure or system problems in the block. The cause of the alert is entered in the subcode field. The first alert to become active will set the Active status in the Status parameter. As soon as the Unreported status is cleared by the alert reporting task, another block alert may be reported without clearing the Active status, if the subcode has changed.
BLOCK_ERR	06	This parameter reflects the error status associated with the hardware or software components associated with a block. It is a bit string, so that multiple errors may be shown.
CAL_MIN_SPAN	18	The minimum calibration span value allowed. This minimum span information is necessary to ensure when calibration is done, the two calibrated points are not too close together.
CAL_POINT_HI	16	The highest calibrated value.
CAL_POINT_LO	17	The lowest calibrated value.
CAL_UNIT	19	The device description engineering units code index for the calibration values. Valid calibration units are the following: 1130 = Pa 1133 = kPa 1137 = bar 1138 = mbar 1139 = torr 1140 = atm 1141 = psi 1144 = g/cm^2 1145 = kg/cm^2 1148 = inH_2O @ 68 °F 1151 = mmH_2O @ 68 °F 1154 = ftH_2O @ 68 °F 1156 = inHg @ 0 °C 1158 = mmHg @ 0 °C
COLLECTION_DIRECTORY	12	A directory that specifies the number, starting indices, and DD Item ID's of the data collections in each transducer within a transducer block.
FACT_CAL_RECALL	33	Recalls the sensor calibration set at the factory.
MODE_BLK	05	The actual, target, permitted, and normal modes of the block. Target: The mode to “go to” Actual: The mode the “block is currently in” Permitted: Allowed modes that target may take on Normal: Most common mode for target
mODULE_TYPE	34	Indicates the type of sensor module. 0 = Standard coplanar (C) 1 = Standard threaded (T) 2 = Level Coplanar (L) 3 = Reference class coplanar (P) 4 = High temp. conventional (H) 252 = Unknown
PRIMARY_VALUE	14	The measured value and status available to the function block.

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Table C-1. Transducer Block Parameters (continued)

Parameter	Index Number	Description
PRIMARY_VALUE_RANGE	15	The high and low range limit values, the engineering unit code, and the number of digits to the right of the decimal point to be used to display the final value. Valid engineering units are the following: 1130 = Pa 1133 = kPa 1137 = bar 1138 = mbar 1139 = torr 1140 = atm 1141 = psi 1144 = g/cm^2 1145 = kg/cm^2 1148 = inH_2O @ 68 °F 1151 = mmH_2O @ 68 °F 1154 = ftH_2O @ 68 °F 1156 = inHg @ 0 °C 1158 = mmHg @ 0 °C
PRIMARY_VALUE_TYPE	13	Type of measurement represented by the primary value. 107 = Differential pressure 108 = Gage pressure 109 = Absolute pressure
SECONDARY_VALUE	29	The secondary value, related to the sensor.
SECONDARY_VALUE_UNIT	30	Engineering units to be used with SECONDARY_VALUE. 1001 °C 1002 °F
SENSOR_CAL_DATE	25	The last date on which the calibration was performed.This is intended to reflect the calibration of that part of the sensor that is usually wetted by the process.
SENSOR_CAL_LOC	24	The last location of the sensor calibration. This describes the physical location at which the calibration was performed.
SENSOR_CAL_METHOD	23	The last method used to calibrate the device. 103 = factory trim standard 104 = user trim standard
SENSOR_CAL_TYPE	35	The type of last sensor calibration. 0 = Differential pressure 1 = Gage pressures 2 = Absolute pressure 252 = Unknown
SENSOR_CAL_WHO	26	The name of the person responsible for the last sensor calibration.
SENSOR_FILL_FLUID	28	Type of fill fluid used in sensor. 0 = Undefined 1 = Silicone 2 = Inert 3 = Undefined 7 - Neobee 251 = "None" 252 = "Unknown" 253 = "Special"
SENSOR_ISOLATOR_MTL	27	Defines the construction material for the isolating diaphragms. 2 = 316 Stainless Steel 3 = Hastelloy C™ 4 = *Monel* 5 = Tantalum 253 = "Special"

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Table C-1. Transducer Block Parameters (continued)

Parameter	Index Number	Description
SENSOR_RANGE	21	The high and low range limit values, the engineering units code, and the number of digits to the right of the decimal point for the sensor.
SENSOR_SN	22	Serial number of the sensor.
SENSOR_TYPE	20	Type of sensor connected with the transducer block. Valid sensor types are the following: 117 = Capacitance 124 = Strain Gauge
ST_REV	01	The revision level of the static data associated with the function block.
STRATEGY	03	The strategy field can be used to identify grouping of blocks.
TAG_DESC	02	The user description of the intended application of the block.
TB_DETAILED_STATUS	31	Indicates the state of the transmitter. The parameter contains specific codes relating to the transducer block and the pressure sensor specifically.
TRANSDUCER_DIRECTORY	09	Directory that specifies the number and starting indices of the transducers in the transducer block.
TRANSDUCER_TYPE	10	Identifies the transducer that follows. 100 = Standard pressure with calibration
UPDATE_EVT	07	This alert is generated by any change to the static data.
XD_ERROR	11	Provides additional error codes related to transducer blocks.

Block/Transducer Errors

The following conditions are reported in the BLOCK_ERR and XD_ERROR parameters. Conditions in bold type are available. Conditions in italics are inactive for the Transducer block and are given here only for your reference.

Table C-2. BLOCK_ERR and XD_ERR Conditions

Condition Number	Condition Name and Description
0	Other
1	Block Configuration Error
2	Link Configuration Error
3	Simulate Active
4	Local Override
5	Device Fault State Set
6	Device Needs Maintenance Soon
7	Input failure/process variable has bad status
8	Output Failure
9	Memory Failure
10	Lost Static Data
11	Lost NV Data
12	Readback Check Failed
13	Device Needs Maintenance Now
14	**Power Up**: The device was just powered-up.
15	**Out of Service**: The actual mode is out of service.

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Table C-2. BLOCK_ERR and XD_ERR Conditions

Condition Number	Condition Name and Description
17	**General Error**: A general error that cannot be specified below occurred
20	**Electronics Failure**: An electrical component failed.
22	**I/O Failure**: An I/O failure occurred.
23	**Data Integrity Error**: Data stored in the device is no longer valid due to a non-volatile memory checksum failure, a data verify after write failure, etc.
25	**Algorithm Error:** The algorithm used in the transducer block produced an error due to overflow, data reasonableness failure, etc.

Diagnostics

In addition to the BLOCK_ERR and XD_ERROR parameters, more detailed information on the measurement status can be obtained via TB_DETAILED_STATUS. Table C-3 lists the potential errors and the possible corrective actions for the given values. The corrective actions are in order of increasing system level compromises. The first step should always be to reset the transmitter and then if the error persists, try the steps in Table C-3. Start with the first corrective action and then try the second.

Table C-3. TB_DETAILED_STATUS Descriptions and Corrective Actions.

Value	Description	Corrective Actions
0x00000001	Sensor hardware incompatible with software	1. Restart Processor 2. Send to Service Center
0x00000002	Sensor board EEPROM burn failure	1. Restart the Processor
0x00000004	Sensor board EEPROM not initialized with factory data	1. Restart Processor 2. Send to Service Center
0x00000008	Temperature sensor not updating	1. Restart Processor 2. Reconnect sensor ribbon cable 3. Send to Service Center
0x00000010	Pressure sensor not updating	1. Restart Processor 2. Reconnect sensor ribbon cable 3. Send to Service Center
0x00000080	Sensor EEPROM Checksum failure	1. Restart Processor 2. Send to Service Center
0x00000100	Pressure sensor HI limit exceeded	1. Check Pressure 2. Restart Processor
0x00000200	Pressure sensor LO limit exceeded	1. Check Pressure 2. Restart Processor
0x00001000	Temperature sensor HI limit exceeded	1. Check Ambient Temp. 2. Restart Processor
0x00004000	Temperature SECONDARY_VALUE range exceeded	1. Check Ambient Temp. 2. Restart Processor

Modes

The transducer block supports two modes of operation as defined by the MODE_BLK Parameter:

Automatic (Auto)—The channel outputs reflect the analog input measurement.

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Out of Service (OOS)—Channel outputs status is set to Bad: Out of Service for each channel. The BLOCK_ERR parameter shows Out of Service. In this mode, you can make changes to all configurable parameters. The target mode of a block may be restricted to one or more of the supported modes.

Alarm Detection

Alarms are not generated by the transducer block. By correctly handling the status of the channel values, the down stream block (AI) will generate the necessary alarms for the measurement. The error that generated this alarm can be determined by looking at BLOCK_ERR and XD_ERROR and TB_DETAILED_STATUS.

Status Handling

Normally, the status of the output channels reflects the status of the measurement value, the operating condition of the measurement electronics, and any active alarm condition.

In Auto mode, PRIMARY_VALUE reflects the value and status quality of the output channels.

Methods

Sensor Calibration

In order to calibrate the sensor, the following steps are performed by the user calibration method:

1. Set MODE_BLK.TARGET = OOS.
2. Apply desired pressure (low pressure); allow to stabilize. Pressure applied must be between range limits defined in PRIMARY_VALUE_RANGE.
3. Set CAL_POINT_LO to applied pressure.
4. Apply desired pressure (high pressure); allow to stabilize. Pressure applied must be between range limits defined in PRIMARY_VALUE_RANGE and greater than CAL_POINT_LO + CAL_MIN_SPAN.
5. Set CAL_POINT_HI to applied pressure.
6. Set SENSOR_CAL_DATE to current date.
7. Set SENSOR_CAL_WHO to person responsible for calibration.
8. Set SENSOR_CAL_LOC to calibration location.
9. Set MODE_BLK.TARGET = AUTO.

Troubleshooting

Refer to Table C-4 to troubleshoot any problems encountered.

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Table C-4. Troubleshooting

Symptom	Possible Causes	Corrective Action
Mode will not leave OOS	Target mode not set.	Set target mode to something other than OOS.
	Detailed status error	See “Diagnostics” on page C-5
	Resource block	The actual mode of the Resource block is OOS. See Resource Block Diagnostics for corrective action.
Pressure or Sensor Temperature Status is BAD	Measurement or Device Error	See “Diagnostics” on page C-5

RESOURCE BLOCK

Overview

This section contains information on the Model 3051 Resource Block. Descriptions of all Resource Block Parameters, errors, and diagnostics are included. Also the modes, alarm detection, status handling, and troubleshooting are discussed.

Definition

The resource block defines the physical resources of the device. The resource block also handles functionality that is common across multiple blocks. The block has no linkable inputs or outputs and it performs memory diagnostics.

Parameters and Descriptions

Table C-5 lists all of the configurable parameters of the Resource Block, including the descriptions and index numbers for each.

Table C-5. Resource Block Parameters

Parameter	Index Number	Description
ACK_OPTION	38	Selection of whether alarms associated with the function block will be automatically acknowledged.
ALARM_SUM	37	The current alert status, unacknowledged states, unreported states, and disabled states of the alarms associated with the function block.
ALERT_KEY	04	The identification number of the plant unit.
BLOCK_ALM	36	The block alarm is used for all configuration, hardware, connection failure or system problems in the block. The cause of the alert is entered in the subcode field. The first alert to become active will set the Active status in the Status parameter. As soon as the Unreported status is cleared by the alert reporting task, another block alert may be reported without clearing the Active status, if the subcode has changed.
BLOCK_ERR	06	This parameter reflects the error status associated with the hardware or software components associated with a block. It is a bit string, so that multiple errors may be shown.
CONFIRM_TIME	33	The time between retries of alert reports.
CYCLE_SEL	20	Used to select the block execution method for this resource. The 3051 supports the following: Scheduled: Blocks are only executed based on the function block schedule. Block Execution: A block may be executed by linking to another blocks completion.
CYCLE_TYPE	19	Identifies the block execution methods available for this resource.

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Table C-5. Resource Block Parameters (continued)

Parameter	Index Number	Description
DD_RESOURCE	09	String identifying the tag of the resource which contains the Device Description for this resource.
DD_REV	13	Revision of the DD associated with the resource - used by an interface device to locate the DD file for the resource.
define_write_lock	60	Enumerated value describing the implementation of the WRITE_LOCK.
detailed_status	55	Indicateds the state of the transmitter. See Resource Block detailed status codes.
DEV_REV	12	Manufacturer revision number associated with the resource - used by an interface device to locate the DD file for the resource.
DEV_TYPE	11	Manufacturer's model number associated with the resource - used by interface devices to locate the DD file for the resource.
download_mode	67	Gives access to the boot block code for over-the-wire downloads. 0 = Uninitialized 1 = Run mode 2 = Download mode
DRAIN_VENT_MAT	75	Type of material of the drain vents on the flange. See drain vent material codes. 2 = 316 Stainless Steel 3 = Hastelloy C™ 4 = Monel 251 = None 252 = "Unknown" 253 = "Special"
FEATURES	17	Used to shows supported resource block options.
FEATURES_SEL	18	Used to show selected resource block options. The 3051 supports the following: Unicode: Tells host to use unicode for string values Reports: Enables alarms. Must be set for alarming to work Software Lock: Software write locking enabled but not active. WRITE_LOCK must be set to activate. Hardware Lock: Hardware write locking enabled but not active. WRITE_LOCK follows the status of the security switch.
final_assembly_number	49	Final Assembly Number is placed on the neck label.
FLANGE_MTL	69	Type of material of the flange. See flange material codes. 0 = Carbon Steel 2 = 316 Stainless Steel 3 = Hastelloy C™ 4 = Monel 24 = Kynar™ 252 = "Unknown" 253 = "Special"

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Table C-5. Resource Block Parameters (continued)

Parameter	Index Number	Description
FLANGE_TYPE	68	Type of flange that is attached to the device. 12 = Conventional (Traditional) 13 = Coplanar 14 = Remote Seal 15 = Level; 3 in. 150 lbs. 16 = Level; 4 in. 150 lbs. 17 = Level; 3 in. 300 lbs. 18 = Level; 4 in. 300 lbs. 19 = Level; DN 80, PN 40 20 = Level; DN 100, PN 40 21 = Level; DN 100, PN 10/16 22 = Level; 2 in. 150 lbs. 23 = Level; 2 in. 300 lbs. 24 = Level; DN 50, PN 6 25 = Level; DN 50, PN 40 252 = "Unknown" 253 = "Special"
FREE_TIME	25	Percent of the block processing time that is free to process additional blocks.
FREE_SPACE	24	Percent of memory available for further configuration. Zero in a preconfigured device.
GRANT_DENY	14	Options for controlling access of host computers and local control panels to operating, tuning, and alarm parameters of the block. Not used by device.
HARD_TYPES	15	The types of hardware available as channel numbers.
hardware_rev	52	Hardware revision of the hardware that has the resource block in it.
LIM_NOTIFY	32	Maximum number of unconfirmed alert notify messages allowed.
MANUFAC_ID	10	Manufacturer identification number – used by an interface device to locate the DD file for the resource.
MAX_NOTIFY	31	Maximum number of unconfirmed alert notify messages possible.
MEMORY_SIZE	22	Available configuration memory in the empty resource. To be checked before attempting a download.
message_date	57	Date associated with the MESSAGE_TEXT parameter.
message_text	58	Used to indicate changes made by the user to the device's installation, configuration, or calibration.
MIN_CYCLE_T	21	Time duration of the shortest cycle interval of which the resource is capable.
MODE_BLK	05	The actual, target, permitted, and normal modes of the block: Target: The mode to “go to” Actual: The mode the “block is currently in” Permitted: Allowed modes that target may take on Normal: Most common mode for actual
NV_CYCLE_T	23	Minimum time interval specified by the manufacturer for writing copies of NV parameters to non-volitile memory. Zero means it will never be automativally copied. At the end of NV_CYCLE_T, only those parameters which have changed need to be updated in NVRAM.
O_RING_MTL	69	Type of material of the flange o-rings. See O-ring material codes. 10 = PTFE (Teflon TM) 11 = Viton 12 = Buna–N 13 = Ethyl–Prop 252 = "Unknown" 253 = "Special"
output_board_sn	53	Output board serial number.

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Table C-5. Resource Block Parameters (continued)

Parameter	Index Number	Description
self_test	59	Instructs resource block to perform self-test. Tests are device specific.
distributor	42	Reserved for use as distributor ID. No Foundation enumerations defined at this time.
REM_SEAL_FILL	73	Type of fill fluid used in the remote seals. 2 = Silicone 3 = Syltherm 800 4 = Inert (Halocarbon) 5 = Glycerin and Water 6 = Propylene Glycol and Water 7 = Neobee M–20 251 = None 252 = "Unknown" 253 = "Special"
REM_SEAL_ISO_MAT	70	Type of material of the remote seal isolators. See remote seal number codes. 2 = 316L Stainless Steel 3 = Hastelloy C–276 5 = Tantalum 9 = Co–Cr–Ni 251 = None 252 = "Unknown" 253 = "Special"
REM_SEAL_NUM	71	Number of remote seals. 1 = One seal 2 = Two seals 251 = None 252 = "Unknown" 253 = "Special"
REM_SEAL_TYPE	66	Type of remote seals. 0 = Undefined 1 = Reserved 2 = CTW 3 = EFW (Expanded Flange Seal) 4 = PFW (Pancake) 5 = RFW (Flanged Remote) 6 = RTW (Threaded Remote) 7 = SCW 8 = SSW 9 = High Temperature 10 = FFW (Flanged Flush Surface) 11 = UCW 12 = TSW 251 = None 252 = "Unknown" 253 = "Special"
RESTART	16	Allows a manual restart to be initiated. Several degrees of restart are possible. They are the following: 1 Run – nominal state when not restarting 2 Restart resource – not used 3 Restart with defaults – set parameters to default values. See START_WITH_DEFAULTS below for which parameters are set. 4 Restart processor – does a warm start of CPU.
RS_STATE	07	State of the function block application state machine.
save_config_blocks	62	Number of EEPROM blocks that have been modified since last burn. This value will count down to zero when the configuration is saved.
save_config_now	61	Controls saving of configuration.

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Table C-5. Resource Block Parameters (continued)

Parameter	Index Number	Description
security_IO	65	Status of security jumper/switch.
SHED_RCAS	26	Time duration at which to give up on computer writes to function block RCas locations. Shed from RCas shall never happen when SHED_ROUT = 0
SHED_ROUT	27	Time duration at which to give up on computer writes to function block ROut locations. Shed from ROut shall never happen when SHED_ROUT = 0
Simulate_STATE	66	The state of the simulate jumper. 0 = Uninitialized 1 = Jumper/ switch off, simulation not allowed 2 = Jumper/ switch on, simulation not allowed (need to cycle jumper/ switch)
simulate_IO	64	Status of simulate jumper/switch.
RB_SFTWR_REV_ALL	51	The string will contain the following fields: Major rev: 1-3 characters, decimal number 0-255 Minor rev: 1-3 characters, decimal number 0-255 Build rev: 1-5 characters, decimal number 0-255 Time of build: 8 characters, xx:xx:xx, military time Day of week of build: 3 characters, Sun, Mon,... Month of build: 3 characters, Jan, Feb... Day of month of build: 1-2 characters, decimal number 1-31 Year of build: 4 characters, decimal Builder: 7 characters, login name of builder
RB_SFTWR_REV_BUILD	50	Build of software that the resource block was created with.
RB_SFTWR_REV_MAJOR	48	Major revision of software that the resource block was created with.
RB_SFTWR_REV_MINIOR	49	Minor revision of software that the resource block was created with.
start_with_defaults	63	0 = Uninitialized 1 = do not power-up with NV defaults 2 = power-up with default node address 3 = power-up with default pd_tag and node address 4 = power-up with default data for the entire communications stack (no application data)
STRATEGY	03	The strategy field can be used to identify grouping of blocks.
ST_REV	01	The revision level of the static data associated with the function block.
summary_status	56	An enumerated value of repair analysis.
TAG_DESC	02	The user description of the intended application of the block.
TEST_RW	08	Read/write test parameter - used only for conformance testing.
UPDATE_EVT	35	This alert is generated by any change to the static data.
WRITE_ALM	40	This alert is generated if the write lock parameter is cleared.
WRITE_LOCK	34	If set, no writes from anywhere are allowed, except to clear WRITE_LOCK. Block inputs will continue to be updated.
WRITE_PRI	39	Priority of the alarm generated by clearing the write lock.

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Block Errors

Table C-2 lists conditions reported in the BLOCK_ERR parameter. Conditions in bold type are available. Conditions in italics are inactive for the Resource block and are given here only for your reference.

Table C-6. BLOCK_ERR Conditions

Condition Number	Condition Name and Description
0	**Other**
1	**Block Configuration Error**: A feature in FEATURES_SEL is set that is not supported by FEATURES or an execution cycle in CYCLE_SEL is set that is not supported by CYCLE_TYPE.
3	**Simulate Active:** This indicates that the simulation jumper is in place. This is not an indication that the I/O blocks are using simulated data.
4	*Local Override*
5	*Device Fault State Set*
6	*Device Needs Maintenance Soon*
7	*Input failure/process variable has bad status*
9	**Memory Failure**: A memory failure has occurred in FLASH, RAM, or EEROM memory
10	**Lost Static Data**: Static data that is stored in non-volatile memory has been lost.
11	**Lost NV Data**: Non-volatile data that is stored in non-volatile memory has been lost.
12	*Readback Check Failed*
13	Device Needs Maintenance Now
14	**Power Up**: The device was just powered-up.
15	**Out of Service**: The actual mode is out of service.

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Diagnostics

In addition to the BLOCK_ERR parameters, more detailed information on the device status can be obtained via DETAILED_STATUS. Table 5.3 lists potential errors and possible corrective actions for the given values. The first step should always be to reset the transmitter, then if the error persists, try steps in Table 5.3. Start with the first corrective action, and then try the second.

Table C-7. Detailed Status

Value	Description	Corrective Action
0x00000002	Sensor Transducer Error (Check TB_DETAILED_STATUS)	1. Restart processor 2. Send to service center
0x00000004	Manufacturing Block Integrity Error	1. Restart processor 2. Send to service center
0x00000008	HW/SW Incompatible	1. Restart processor 2. Send to service center
0x00000010	NV Integrity Error	1. Restart processor 2. Send to service center
0x00000040	ROM Integrity Error	1. Restart processor 2. Send to service center
0x00008000	ADB Transducer Block Error	1. Check impulse piping

Modes

The resource block supports two modes of operation as defined by the MODE_BLK parameter:

- **Automatic (Auto)** The block is processing its normal background memory checks.
- **Out of Service (OOS)** The block is not processing its tasks. When the resource block is in OOS, all blocks within the resource (device) are forced into OOS. The BLOCK_ERR parameter shows Out of Service. In this mode, you can make changes to all configurable parameters. The target mode of a block may be restricted to one or more of the supported modes.

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Alarm Detection

A block alarm will be generated whenever the BLOCK_ERR has an error bit set. The types of block error for the resource block are defined above.

A write alarm is generated whenever the WRITE_LOCK parameter is cleared. The priority of the write alarm is set in the WRITE_PRI parameter:

Alarms are grouped into five levels of priority

Priority Number	Priority Description
0	Alarm is disabled.
1	Alarm is detected, but not sent as a report.
2	Alarm report is sent, but does not require operator attention.
3-7	Alarm conditions of priority 3 to 7 are advisory alarms of increasing priority.
8-15	Alarm conditions of priority 8 to 15 are critical alarms of increasing priority.

Status Handling

There are no status parameters associated with the resource block.

Troubleshooting

Refer to Table C-8 to troubleshoot any problems that you encounter.

Table C-8. Troubleshooting

Symptom	Possible Causes	Corrective Action
Mode will not leave OOS	Target mode not set.	Set target mode to something other than OOS.
	Memory Failure	BLOCK_ERR will show the memory failure. Check RESTART vallue. Restart the device by setting RESTART to Processor. If the block error does not clear, call the factory.
Block Alarms Will not work	Features	FEATURES_SEL does not have Reports enabled. Enable the Reports bit.
	Notification	LIM_NOTIFY is not high enough. Set equal to MAX_NOTIFY.

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DIAGNOSTICS (ADB) TRANSDUCER BLOCK

The diagnostics block (ADB) is a transducer block that contains two different algorithms, Plugged Impulse Line Detection and Statistical Process Monitoring. Learning, detection and configuration are the three different phases to the Plugged Impulse Line and Statistical Process Monitoring.

Plugged Impulse Line Detection Overview

Plugged Impulse Line Detection is designed to be used in a continuous liquid flow application that is controlled by a set point.

Learning Phase

In the learning phase, the algorithm establishes a baseline of the process mean and process dynamics. The base line data is used to compare current process data when determining a plugged impulse line.

Detection Phase

The detection phase begins after a “Training Complete” message is posed by the learning phase. To determine if the impulse lines are plugged., the algorithm compares the baseline process variable mean to the standard deviation.

Configuration Phase

The configuration phase is an inactive state and the user can determine the affect on the PV status. Once the configuration is valid, the message “Valid Configuration is posted and the configuration phase stops. The configuration phase is also used to set up the parameters controlling the sensitivity, thresholds, length of leading and detecting phases.

Statistical Process Monitoring Overview

Statistical Process Monitoring algorithm is intended to provide basic information regarding the behavior of process measurement, PID control block and actual valve position. This algorithm can perform higher levels of diagnostics by distribution of computational power to field devices. The two statistical parameters monitored by the Statistical Process Monitoring is mean and standard deviation. By using the mean and standard deviation, the process or control levels and dynamics can be monitored for change over time. The algorithm also provides:

- Configure limits/alarms for changes in mean and standard deviation with respect to the learned levels
- High variation, low dynamics, and mean changes
- Necessary statistical information for Regulatory Control Loop Diagnostics, Root Cause Diagnostics, and Operations Diagnostics

Learning Phase

In the learning phase of Statistical Process Monitoring, the algorithm establishes a baseline of the mean and dynamics of a Statistical Process Monitoring variable. The baseline data is compared to current data for calculating any changes in mean or dynamics of the Statistical Process Monitoring variables.

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Monitoring Phase

The monitoring phase starts after a “Training Complete” message is posted for the variable. The algorithm compares the current values to the baseline values of the mean and standard deviation. During this phase the algorithm computes the percent change in mean and standard deviation to determine if the defined limits are violated.

Configuration Phase

The configuration phase is an inactive state or when the ADB mode is OOS. In this phase, the block tags, limits for high variation, low dynamics, and mean change detection can be set by the user.

ADB Parameters

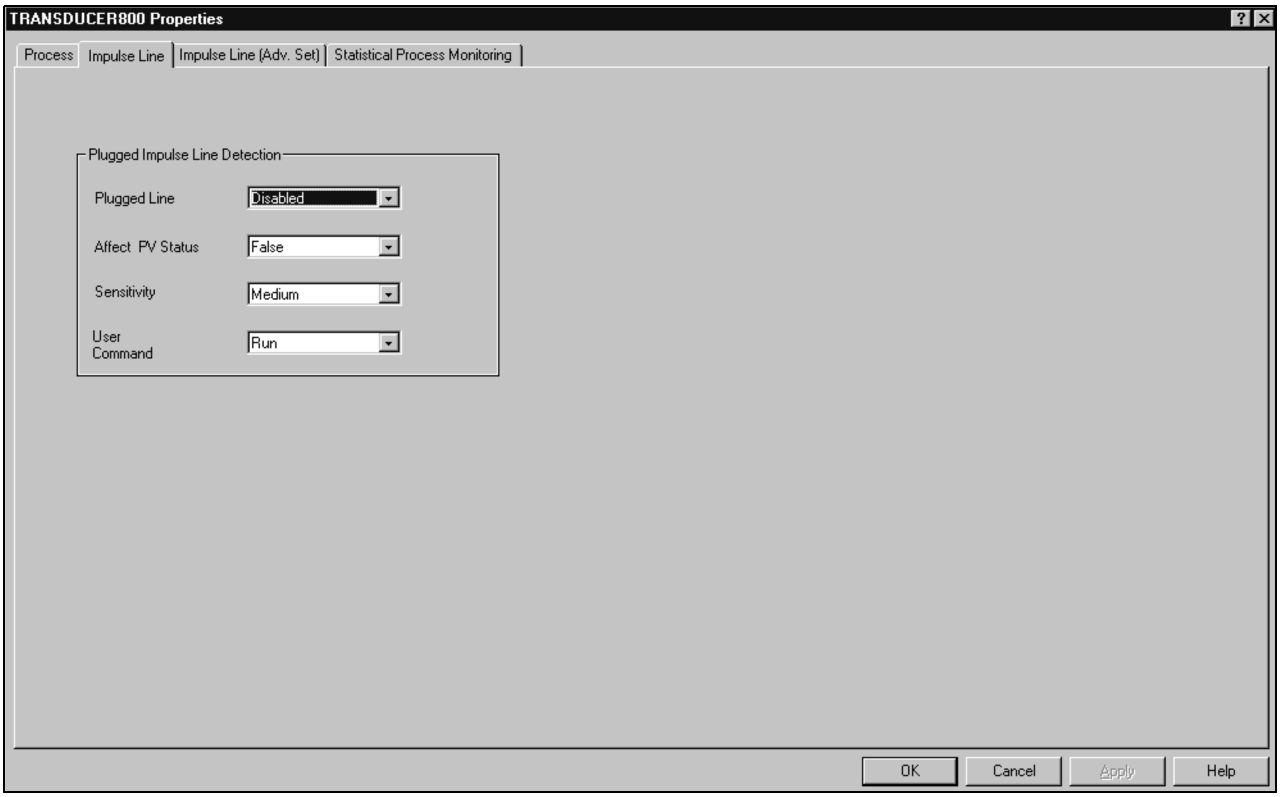
For a complete listing of the diagnostic block parameters refer to the FOUNDATION™ fieldbus manual 00809-0100-4783.

Configuration of the ADB

To launch the configuration screens in DeltaV Explorer right click on the TRANSDUCER800 and select Properties. The window under the Process tab is a generic transducer block configuration screen and will not be discussed here.

Impulse Line

Figure C-2. Impulse Line Screen



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Plugged Line
This parameter "enables" or "disables" the Plugged Impulse Line Algorithm. Having the ADB block activated does not automatically "enable" the Plugged Impulse Line Algorithm. The default state is "disabled".

Affect PV Status
Determines whether the quality of the DP measurement will be affected by the Plugged Impulse Line status. If the parameter is "true" the following status will cause the quality of the pressure measurement from the Sensor Transducer Block to go UNCERTAIN.

- All Lines Plugged
- Inactive...See History

If the parameter is "false" the algorithm will detect plugged impulse lines, but has no affect on the quality of the pressure measurement from the Sensor Transducer Block.

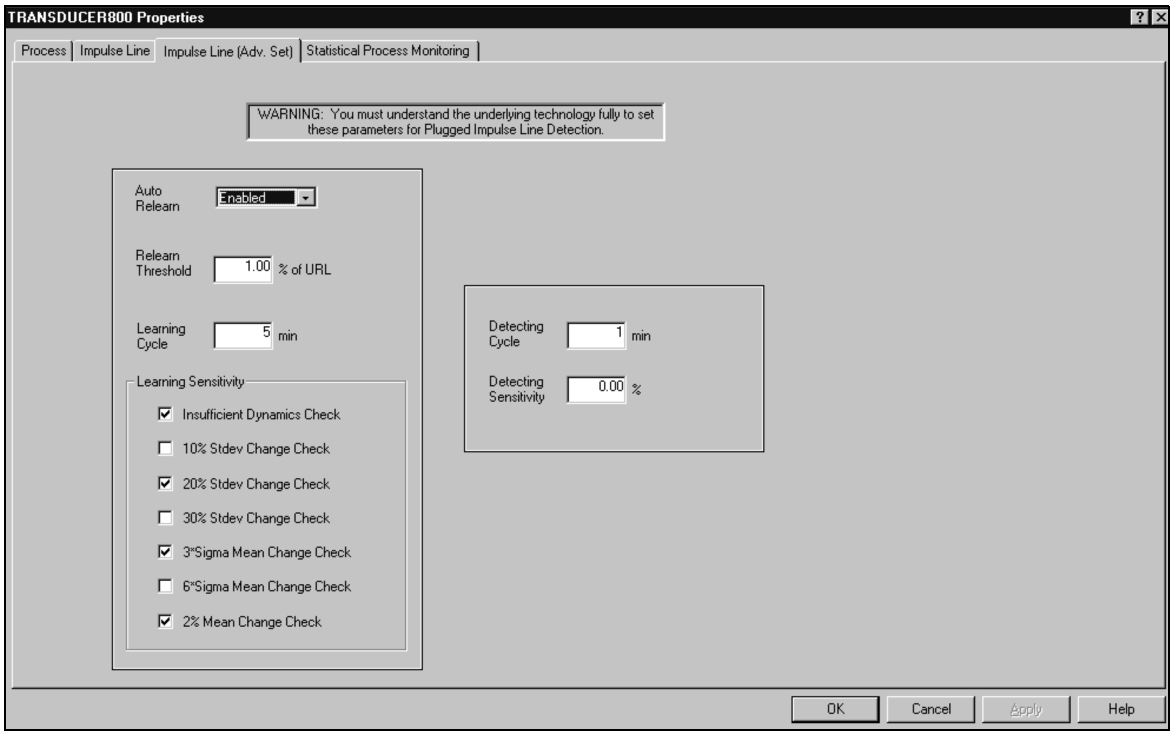
Sensitivity
Determines the sensitivity of the PIL Detection Algorithm. Low sensitivity is primarily used if the process contains large amount of dynamics. Medium sensitivity would be recommended for normal processes. High sensitivity would be used for a process with minimal dynamics.

User Command
Allows the user to activate the learning phase of the PIL Detection Algorithm. To activate the relearn "Relearn" must be selected from the drop down list. This can be used to reinitiate the algorithm after a plugged line has been detected. The proper measures must be taken to clear the plug, and the process should be running normally before relearning the process. Relearning the process may also be necessary after changing parameters on the Adv Set window.

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Impulse Line [Adv. Set]

Figure C-3. Impulse Line (Advanced Set) Screen



800_PROP_PIL(ADV.)

Auto Relearn

Determines whether or not the algorithm automatically changes to learning mode when the thresholds are exceeded. When "Enabled" is selected the algorithm will automatically relearn when the mean value changes by more than the Relearn Threshold value. If "Disabled" is selected relearn must be started manually on the Impulse Line window with the User Command.

Relearn Threshold

Is a value in % of URL of the transmitter range. If the mean has changed by this value and Auto Relearn is "Enabled", then the algorithm will automatically go into the learning state. If the Auto Relearn is "Disabled" this value is ignored.

Learning Cycle

Determines the length of time the learning cycle uses to calculate the mean and standard deviation for the baseline. If the process has a slow change in the mean over time, a longer learning cycle may provide a more stable value.

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Learning Sensitivity

These parameters are to provide very specific adjustments to the sensitivity during the learning state.

- Insufficient Dynamics Check: Ignores the insufficient dynamic check if not selected?
- 10%-30% Stdev Change Check: Allows for 10-30% change in Standard Deviation while in the learning state. If this value is exceeded, the algorithm will stay in the verifying state until the value is not exceeded.
- 3* & 6* Sigma Mean Change Check: Allows for a 3 or 6 Sigma change in the mean while in the learning state. If this value is exceeded, algorithm will stay in the verifying state until the value is not exceeded.
- 2% Mean Change Check: The mean value of the baseline calculation can not vary more than 2% during the learning or verifying states. If this value is exceeded, algorithm will stay in the verifying state until the value is not exceeded.

Detecting Cycle

Is the length of time the algorithm uses to take the process values and calculate the mean and standard deviation to compare to the learned baseline. This value should be same as the learning cycle to avoid false detections. Detection cycle must be larger than the macro cycle of the system.

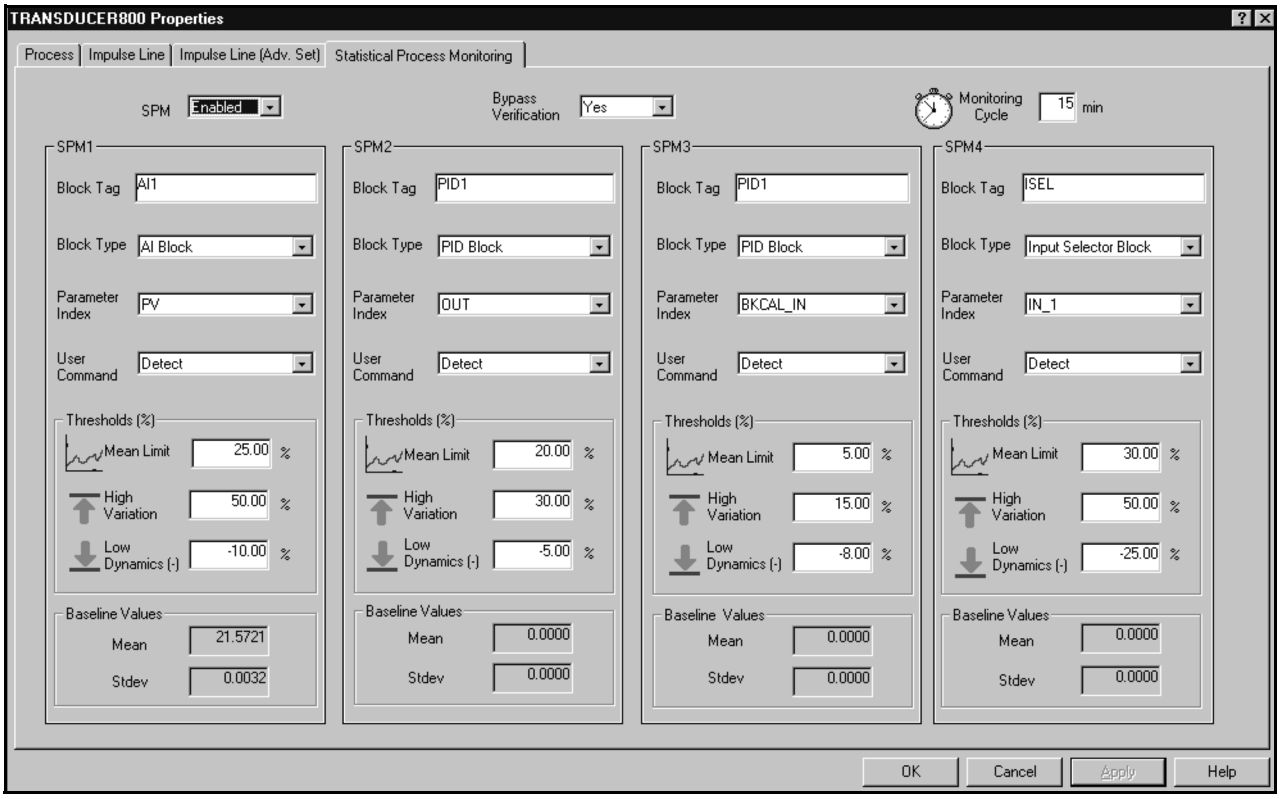
Detecting Sensitivity

Will override the sensitivity value from the Impulse Line Window. The values for this parameter are 10%-95% sensitivity. Low values are used in stable processes, and high values are used in noisy processes.

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Statistical Process Monitoring

Figure C-4. Statistical Process Monitoring Screen



SPM

Parameter that starts the Statistical Process Monitoring when "Enabled". "Disabled" turns the diagnostic monitoring off.

Bypass Verification

If "Yes" the verification of the baseline is turned off. If "No" the learned baseline is compared to the next current calculated value to insure a good baseline value.

Monitoring Cycle

Length of time the process values are taken and used in each calculation. A longer monitoring cycle may provide a more stable mean value.

SPM1 - SPM4

Provides for up to four variables to be monitored in a loop. The blocks that are monitored should follow the following convention:

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SPM	Supported Blocks	Supported Parameters	Intended Use
1	AI or ISEL	AI.OUT or ISEL.OUT	Process Variable
2	PID or AO	PID.OUT or AO.CAS_IN	Control Block Output
3	PID or AO	PID.BKCAL_IN or AO.PV	Valve Position
4	AI or ISEL	AI.OUT or ISEL.OUT	2nd Process Variable or Redundant SPM1 value

- Block Tag - Must be a scheduled block. Otherwise the status will stay in the inactive state. Block tag must be entered, there is no pull down menu to select the tag.
- Block Type - Allows specific block types to be selected for the corresponding Block Tag.
- Parameter Index - Allows specific parameter types to be selected for the corresponding Block Type.
- User Command - Requires the user to select "Detect" when all the parameters have been selected and monitoring is requested. "Idle" is the default value, which is a waiting or unused state.

Thresholds

Are used to allow alerts to be seen in the status screen when the values are beyond the threshold values that have been set for each parameter.

- Mean Limit - Alert Limit value in +% change of the Mean compared with the baseline mean value.
- High Variation - Alert Limit value in +% change of the Stdev compared with the baseline Stdev value.
- Low Dynamics - Alert Limit value in -% change of the Stdev compared with the baseline Stdev value.

Baseline Values

Are the calculated values from the process over the Learning Cycle.

- Mean - Calculated average of the process variable over the Learning Cycle.
- Stdev - Calculated difference between minimum and maximum values over the Learning Cycle.

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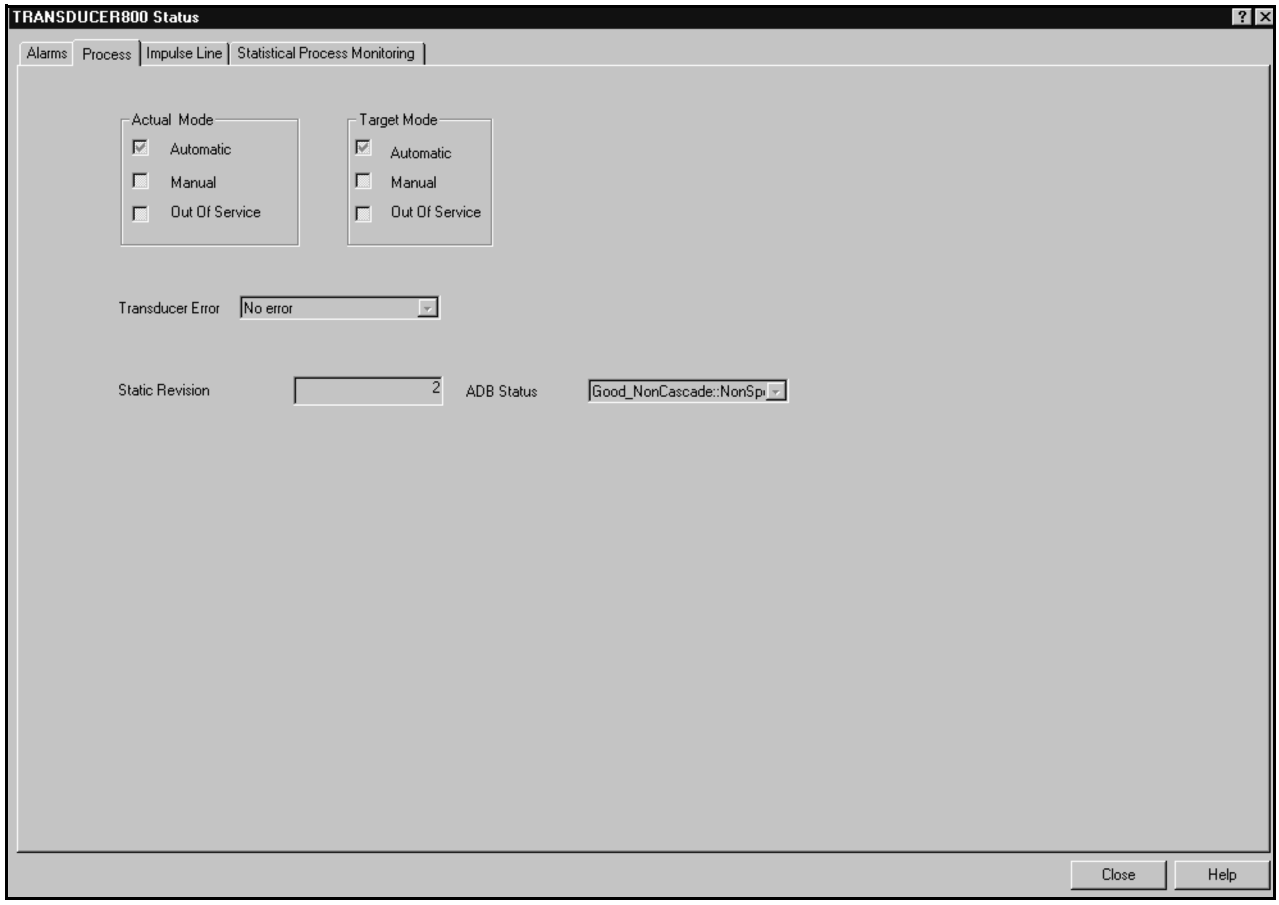
Status of the ADB

To launch the status screens in DeltaV Explorer right click on the TRANSDUCER800 and select Status. The window under the Alarms tab is a generic Transducer Block status screen and will not be discussed here.

Process

Take note of the ADB status on the Process tab window. The ADB status will change when the PIL status changes, only if the Affect PV Status is "True" (see configuration).

Figure C-5. Process Screen Capture



800_STATUS_PROCESS

Impulse Line

The Impulse Line tab contains the following information:

Time Stamp
Shows the timestamp of the last update to the Plugged Impulse Line Status. NOTE: The current version of the DeltaV does not display this field.

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Status

Current value of the Plugged Impulse Line Status.

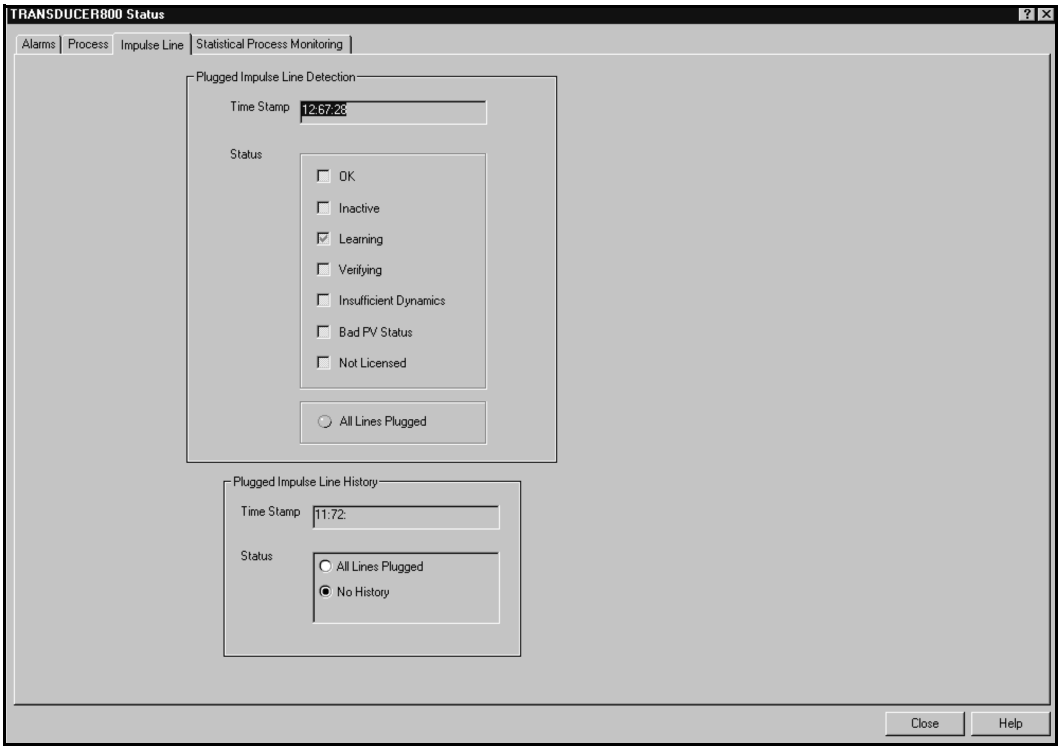
- OK - Algorithm is in the detection state.
- Inactive - The algorithm is not enabled or more than an hour has passed since All lines Plugged has been detected.
- Learning - Algorithm is currently learning the process characteristics.
- Verifying - Algorithm is currently comparing the learned baseline with the current process.
- Insufficient Dynamics - The process does not have enough dynamics to detect or the sensitivity is not set high enough. (see configuration)
- Bad PV Status - The Sensor Transducer Status is uncertain or Bad, therefore the algorithm is paused.
- Not Licenced - The ADB is not currently purchased or enabled in this device.
- All Lines Plugged - Algorithm has detected all lines plugged.

Plugged Impulse Line History

Shows the last plugged impulse line detection

- All Lines Plugged - All lines have been plugged.
- No History - There have been no plugged lines detected for this device.

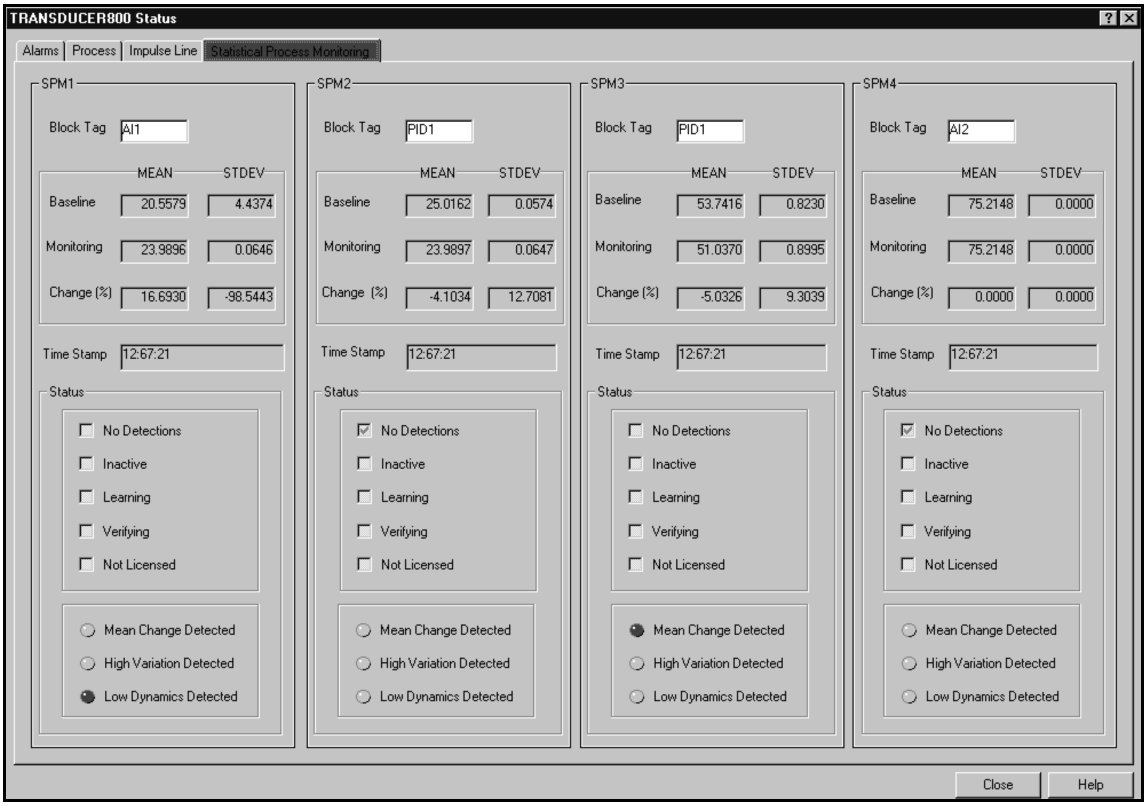
Figure C-6. Impulse Line Screen



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Statistical Process Monitoring

Figure C-7. Statistical Process Monitoring Screen



The Statistical Process Monitoring tab includes the following information:

Block Tag
Tag name that was entered in the configuration screen. (see configuration)

Baseline
Displays the Mean and Stdev values that were calculated during the learning state.

Monitoring
Current value that is calculated over the Monitoring Cycle.

Change
Value in % that is calculated using the Monitoring and Baseline values. The alert thresholds are compared to this value to determine Mean change, High Variation and Low Dynamic detections.

Timestamp
Displays the time value for the recent detections. This value is not currently displayed in DeltaV systems.

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Status
Shows the state of the diagnostic is currently in.

- No Detections - Monitoring the process and no detections are currently active.
- Inactive - User Command in "Idle", SPM not Enabled, or the block is not scheduled.
- Learning - Detect has been set in the User Command, and the baseline values are being calculated
- Verifying - Compares the learned values to the current calculated values to verify the process is stable.
- Not Licenced - SPM is not currently purchased or enabled in this device.

Mean Change Detected
Alert resulting from the Mean Change exceeding the Threshold Mean Limit. Can be caused by a set point change, a load change in the flow, or other obstruction or the removal of an obstruction in the process.

High Variation Detected
Alert resulting from the Stdev Change exceeding the Threshold High Variation value. This detection is a possible indicator for one impulse line being plugged, equipment failure such as a pump, an increase in the flow, or other flow turbulence.

Low Dynamics Detected
Alert resulting from the Stdev Change exceeding the Threshold Low Dynamics value. This is an indicator for all impulse lines being plugged, a lower flow, or other change resulting in a lowing of the turbulence in the flow.

USER NOTE
In fieldbus devices, a wealth of information is available to the user. Both process measurement and control is feasible at the device level. The devices themselves contain both the process measurements and control signals that are necessary to not only control the process, but to determine if the process and control is healthy. By looking at the process measurement data and control output over time, one can gain additional insight into the process. Under some load conditions and process demands, changes could be interpreted as degradation of instruments, valves or major components such as pumps, compressors, heat exchangers, etc... This degradation may also indicate that the loop control scheme needs to be re-tuned or re-evaluated. By learning a healthy process and continually comparing current information to the known healthy information, problems due to degradation and eventual failure can be avoided and remedied ahead of time. These diagnostics are to aid in the engineering and maintenance of the devices. These diagnostics can not possibly be 100% accurate in every process, temperature, and circumstance. False alarms and missed detections may occur. If a reoccurring problem in your process exists, please contact Rosemount for assistance with the diagnostics.

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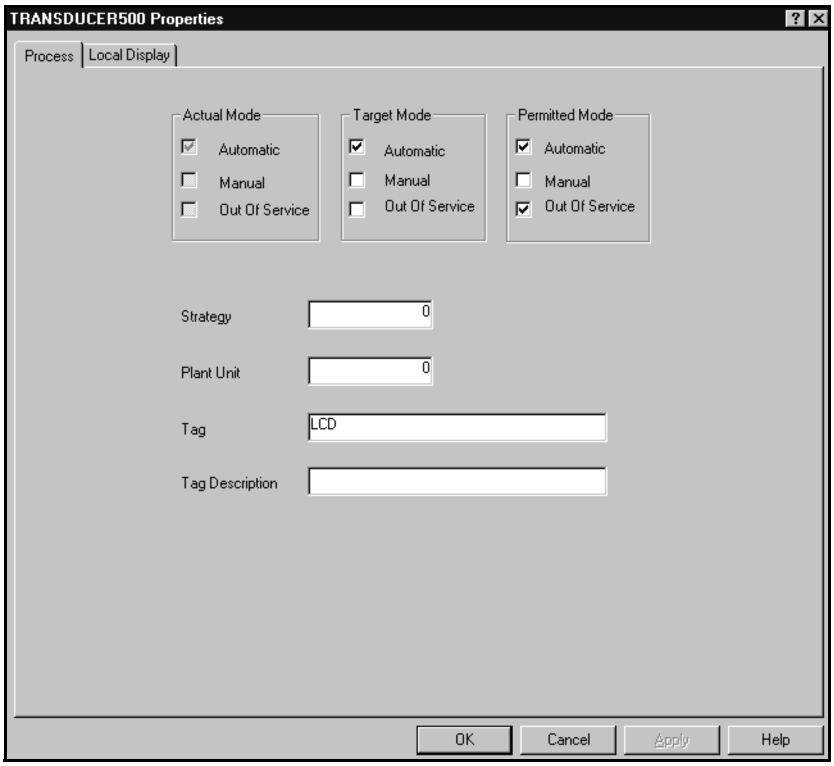
LCD BLOCK

The LCD can display up to four different parameters. If a parameter from a function block is displayed, then the function block must be scheduled (downloaded) in order for it to be displayed on the LCD. If a parameter from a different device is displayed, it must be linked to a block in the Model 3051 transmitter with the LCD display and it must be downloaded. It can display any input or output parameter of any block in the Model 3051. The first display is pre-configured to show the value of the transducer block of the Model 3051. This value can be left or changed.

1) Open the LCD block by double clicking on the LCD transducer block in Deltav Explorer.

Figure C-8 will appear. Make sure the block is in "Automatic" mode. Then select the "Local Display" tab.

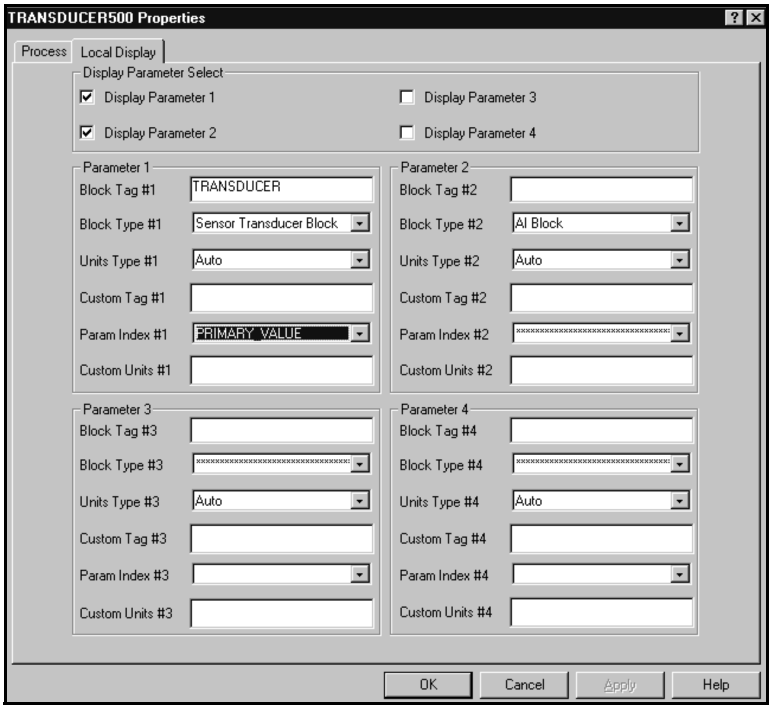
Figure C-8. Transducer500 Properties: Process Screen



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For each parameter n(n =1 - 4) displayed on the LCD there are several fields in the "Local Display" tab that must be setup.

Figure C-9. Transducer500 Properties Local Display Screen



500_PROP_LOCALDISPLAY

1. The first parameter is called "BLOCK TAG_n," here you must enter the exact name of the block to be displayed. This must be the same name as the one that is stored in the device.
2. Then select "BLOCK TYPE_n". This is a drop down menu showing the selections available in the device. Select the disired block to be displayed, in the "BLK_TYPE_n" field.
3. Select "UNITS_TYPE_n". Select "Custom" in this parameter if bringing a value from outside the Model 3051 device. "Auto" has only pressure units, which might or might not match the disired selection.
4. The next parameter is called "CUSTOM_TAG_n." This is an optional selection in identifying which parameter, block or device to be viewed on the LCD. This can be any name up to five characters long.
5. Then select "PARAM_INDEX_n". This is a drop down menu and the selections available in the device will appear. Select which parameter is to be displayed, in the "PARAM_INDEX_n" field.
6. Select "CUSTOM_UNITS_n" if "Custom" was selected previously in the "UNITS_TYPE_n" field above. This is limited to five characters and is where the disired units you wish to be displayed are entered.
7. To display more than one parameter be sure and check the appropriate number of boxes in the "Display Parameter Select" field.

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NATIONAL INSTRUMENT (NI) SET UP FOR LCD

This is a short procedure for displaying multiple devices on the Model 3051 transmitters LCD. If a value is brought in from a different device it must be linked to a block in the Model 3051 transmitter with the LCD display and it must be downloaded. . The LCD can display up to four different values. It can display any input or output of any block in the Model 3051. The first display is pre-configured to show the value of the transducer block of the Model 3051. The first display may be changed.

1. Open the LCD block. Select the "Others" tab. Next, scroll down the list of parameters and select "DISPLAY_PARAM_SEL." A drop down menu will appear. Select how the ammount of values to be displayed on the LCD. Next, select the "Write Changes" button.
2. The first parameter is called "BLK_TYPE_n". This is a drop down menu and the selections available in the device will appear. Select the block to be displayed, in the "BLK_TYPE_n" field.
3. Next, select "BLK_TAG_n," enter the exact name of the block to be to displayed. This must be the same name as the one that is stored in the device or shown in the NI-Configurator screen.
4. Then select "PARAM_INDEX_n." Use NI_Dialog for this step. The index number of the parameter that will be displayed on the LCD is needed for this step. Using NI-Dialog, open the "GetParamList" of the block in which the parameter resides. Count down the list until the desired parameter is reached. This is the number used next. Open the "GetParamList" list for the LCD block and write to parameter "PARAM_INDEX_n" the value obtained in the above parameter list, this must be in hex.
5. The next parameter is called "CUSTOM_TAG_n." This is an optional selection that identifies which parameter, block or device you are viewing on the LCD. This can be any name up to five characters long.
6. Select "UNITS_TYPE_n". Select "Custom" in this parameter if bringing a value from outside the Model 3051 device. "Auto" has only pressure units, which might or might not match the disired selection.
7. Select "CUSTOM_UNITS_n." This parameter is limited to five characters and is where the desired units are displayed if "Custom" was selected above.

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00809-0100-4774 Rev. BA 11/00

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EMERSON™
Process Management

https://web.archive.org/web/20120118001644/http://www2.emersonprocess.com/siteadmincenter/PM%20Rosemount%20Documents/00809-0100-4697.pdf

Reference Manual
00809-0100-4697, Rev EA
October 2011

Rosemount 848T High Density Temperature Transmitter with FOUNDATION™ fieldbus

Device Revision 7



FOUNDATION

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Reference Manual
00809-0100-4697, Rev EA
October 2011

Rosemount 848T High Density Temperature Transmitter with FOUNDATION fieldbus

NOTICE

Read this manual before working with the product. For personal and system safety, and for optimum product performance, make sure to thoroughly understand the contents before installing, using, or maintaining this product.

The United States has two toll-free assistance numbers and one international number.

Customer Central
1-800-999-9307 (7:00 a.m. to 7:00 p.m. CST)

National Response Center
1-800-654-7768 (24 hours a day)
Equipment service needs

International
1-(952) 906-8888

⚠CAUTION

The products described in this document are NOT designed for nuclear-qualified applications.

Using non-nuclear qualified products in applications that require nuclear-qualified hardware or products may cause inaccurate readings.

For information on Rosemount nuclear-qualified products, contact an Emerson Process Management Sales Representative.

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www.rosemount.com

EMERSON™
Process Management

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SAFETY MESSAGES

Instructions and procedures in this section may require special precautions to ensure the safety of the personnel performing the operations. Information that potentially raises safety issues is indicated by a warning symbol (⚠). Please refer to the following safety messages before performing an operation preceded by this symbol.

Warnings

⚠WARNING

Failure to follow these installation guidelines could result in death or serious injury.

- Make sure only qualified personnel perform the installation.

Process leaks could result in death or serious injury.

- Do not remove the thermowell while in operation. Removing while in operation may cause process fluid leaks.
- Install and tighten thermowells and sensors before applying pressure, or process leakage may result.

Electrical shock could cause death or serious injury.

- If the sensor is installed in a high voltage environment and a fault condition or installation error occurs, high voltage may be present on transmitter leads and terminals.
- Use extreme caution when making contact with the leads and terminals.

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OVERVIEW

Transmitter

The Rosemount 848T is optimal for process temperature measurement because of its ability to simultaneously measure eight separate and independent temperature points with one transmitter. Multiple temperature sensor types may be connected to each 848T transmitter. In addition, the 848T can accept 4-20 mA inputs. The enhanced measurement capability of the 848T allows it to communicate these variables to any FOUNDATION fieldbus host or configuration tool.

Manual

This manual is designed to assist in the installation, operation, and maintenance of the Rosemount 848T Temperature Transmitter.

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- Overview
- Considerations
- Return of Materials

Section 2: Installation
- Mounting
- Installation
- Wiring
- Power Supply
- Commissioning

Section 3: Configuration
- FOUNDATION fieldbus Technology
- Configuration
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Section 4: Operation and Maintenance
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- Troubleshooting

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- Hazardous Locations Certificates
- Intrinsically Safe and Non-Incendive Installations
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Appendix C: Foundation™ Fieldbus Technology
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SERVICE SUPPORT

To expedite the return process in North America, call the Emerson Process Management National Response Center toll-free at 800-654-7768. This center, available 24 hours a day, will assist with any needed information or materials.

⚠ The center will ask for the following information:

- Product model
- Serial numbers
- The last process material to which the product was exposed

The center will provide

- A Return Material Authorization (RMA) number
- Instructions and procedures that are necessary to return goods that were exposed to hazardous substances

For other locations, please contact an Emerson Process Management sales representative.

NOTE
If a hazardous substance is identified, a Material Safety Data Sheet (MSDS), required by law to be available to people exposed to specific hazardous substances, must be included with the returned materials.

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SAFETY MESSAGES

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- Make sure only qualified personnel perform the installation.

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- Do not remove the thermowell while in operation. Removing while in operation may cause process fluid leaks.
- Install and tighten thermowells and sensors before applying pressure, or process leakage may result.

Electrical shock could cause death or serious injury.

- If the sensor is installed in a high voltage environment and a fault condition or installation error occurs, high voltage may be present on transmitter leads and terminals.
- Use extreme caution when making contact with the leads and terminals.

MOUNTING

The 848T is always mounted remote from the sensor assembly. There are three mounting configurations:

- To a DIN rail without an enclosure
- To a panel with an enclosure
- To a 2-in pipe stand with an enclosure using a pipe mounting kit

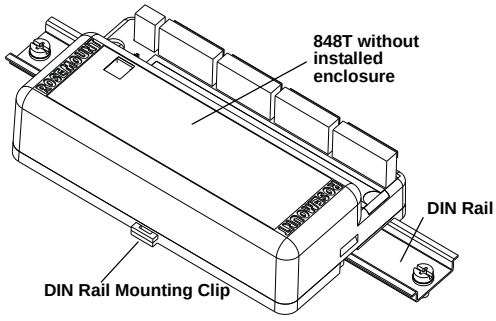
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Mounting to a DIN Rail Without an Enclosure

To mount the 848T to a DIN rail without an enclosure, follow these steps:

1. Pull up the DIN rail mounting clip located on the top back side of the transmitter.
2. Hinge the DIN rail into the slots on the bottom of the transmitter.
3. Tilt the 848T and place onto the DIN rail. Release the mounting clip. The transmitter should be securely fastened to the DIN rail.

Figure 2-1. Mounting the 848T to a DIN Rail

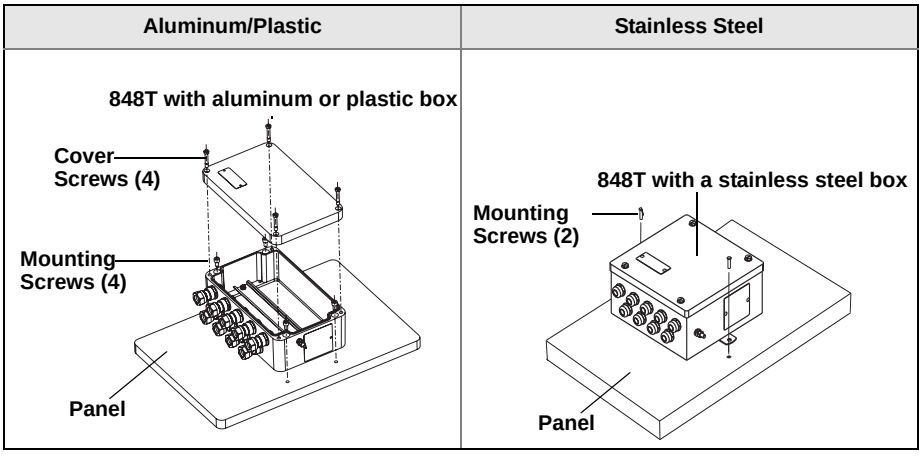


Mounting to a Panel with a Junction Box

When inside of a plastic or aluminum junction box, the 848T mounts to a panel using four 1/4-20 x 1.25-in. screws.

When inside of a stainless steel junction box, the 848T mounts to a panel using two 1/4-20 x 1/2-in. screws.

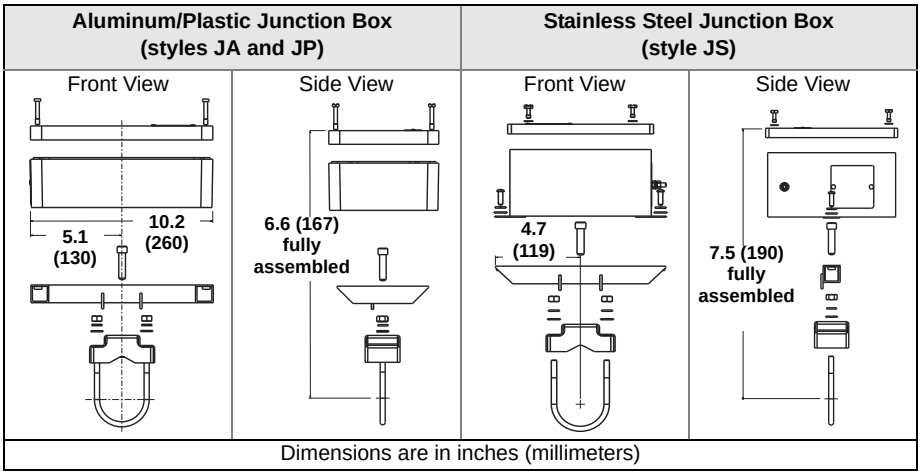
Figure 2-2. Mounting the 848T junction box to a panel

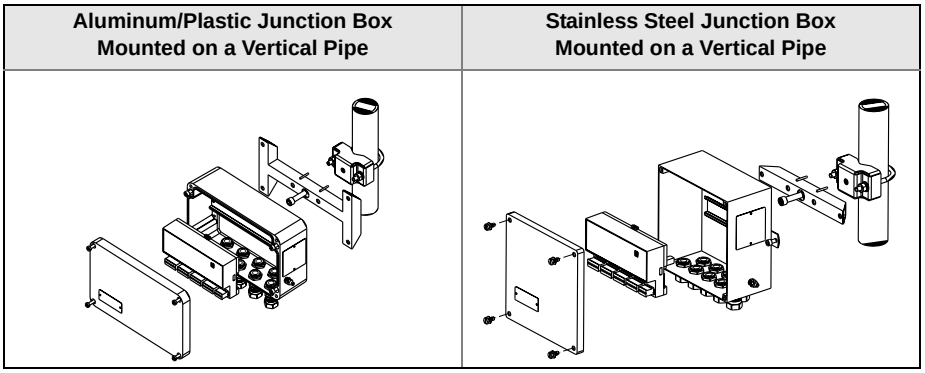


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Mounting to a 2-in. Pipe Stand

Use the optional mounting bracket (option code B6) to mount the 848T to a 2-in. pipe stand when using a junction box.





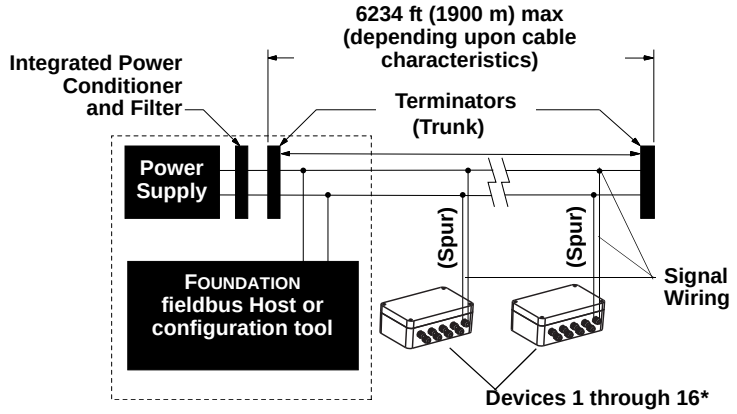
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WIRING

⚠ If the sensor is installed in a high-voltage environment and a fault condition or installation error occurs, the sensor leads and transmitter terminals could carry lethal voltages. Use extreme caution when making contact with the leads and terminals.

NOTE
Do not apply high voltage (e.g. AC line voltage) to the transmitter terminals. Abnormally high voltage can damage the unit (bus terminals are rated to 42.4 VDC).

Figure 2-3. 848T Transmitter Field Wiring

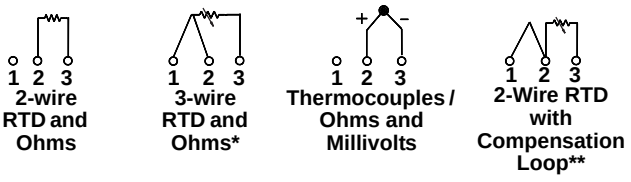


** Intrinsically safe installations may allow fewer devices per I.S. barrier*

Connections

The 848T transmitter is compatible with 2 or 3-wire RTD, thermocouple, Ohm, and millivolt sensor types. Figure 2-4 shows the correct input connections to the sensor terminals on the transmitter. The 848T can also accept inputs from analog devices using the optional analog input connector. Figure 2-5 shows the correct input connections to the analog input connector when installed on the transmitter. Tighten the terminal screws to ensure proper connection.

Figure 2-4. Sensor Wiring Diagram



* *Emerson Process Management provides 4-wire sensors for all single-element RTDs. Use these RTDs in 3-wire configurations by clipping the fourth lead or leaving it disconnected and insulated with electrical tape.*

** *The transmitter must be configured for a 3-wire RTD in order to recognize an RTD with a compensation loop.*

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RTD or Ohm Inputs

Various RTD configurations, including 2-wire and 3-wire are used in industrial applications. If the transmitter is mounted remotely from a 3-wire RTD, it will operate within specifications, without recalibration, for lead wire resistances of up to 60 ohms per lead (equivalent to 6,000 feet of 20 AWG wire). If using a 2-wire RTD, both RTD leads are in series with the sensor element, so errors can occur if the lead lengths exceed one foot of 20 AWG wire. Compensation for this error is provided when using 3-wire RTDs.

Thermocouple or Millivolt Inputs

Use appropriate thermocouple extension wire to connect the thermocouple to the transmitter. Make connections for millivolt inputs using copper wire. Use shielding for long runs of wire.

Analog Inputs

The analog connector converts the 4–20 mA signal to a 20–100 mV signal that can be read by the 848T and transmitted using FOUNDATION fieldbus.

Use the following steps when installing the 848T with the analog connector:

1. The 848T, when ordered with option code S002, comes with four analog connectors. Replace the standard connector with the analog connector on the desired channels.
2. Wire one or two analog transmitters to the analog connector according to Figure 2-5. There is space available on the analog connector label for identification of the analog inputs.

NOTE
Power supply should be rated to support the connected transmitter(s).

3. If the analog transmitters can communicate using HART protocol, the analog connectors are supplied with the ability to switch in a 250 ohm resistor for HART communication (see Figure 2-6).

   One switch is supplied for each input (top switch for “A” inputs and bottom switch for “B” inputs). Setting the switch in the “ON” position (to the right) bypasses the 250 ohm resistor. Terminals are provided for each analog input to connect a Field Communicator for local configuration.

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Figure 2-5. 848T Analog Input Wiring Diagram

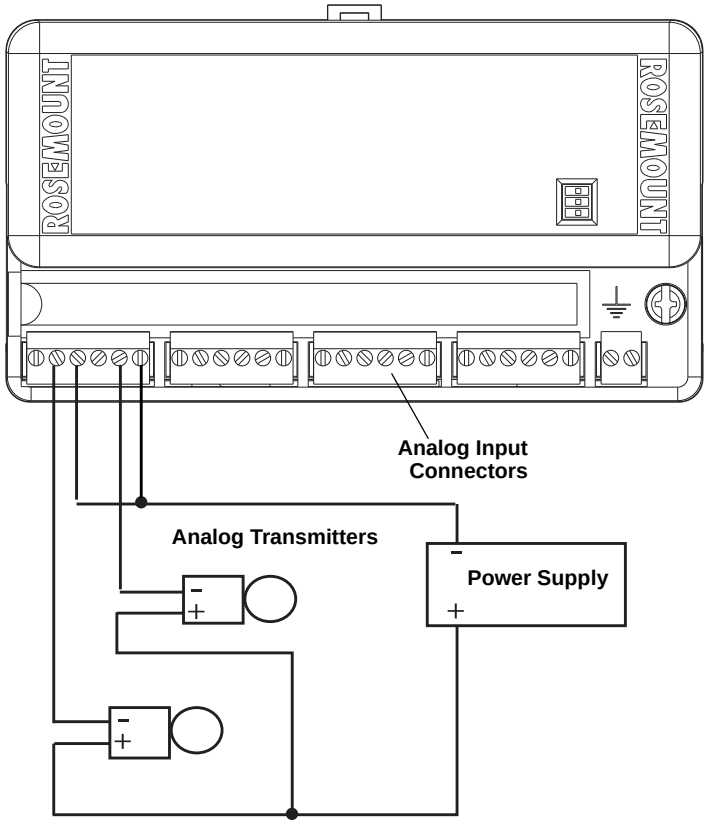
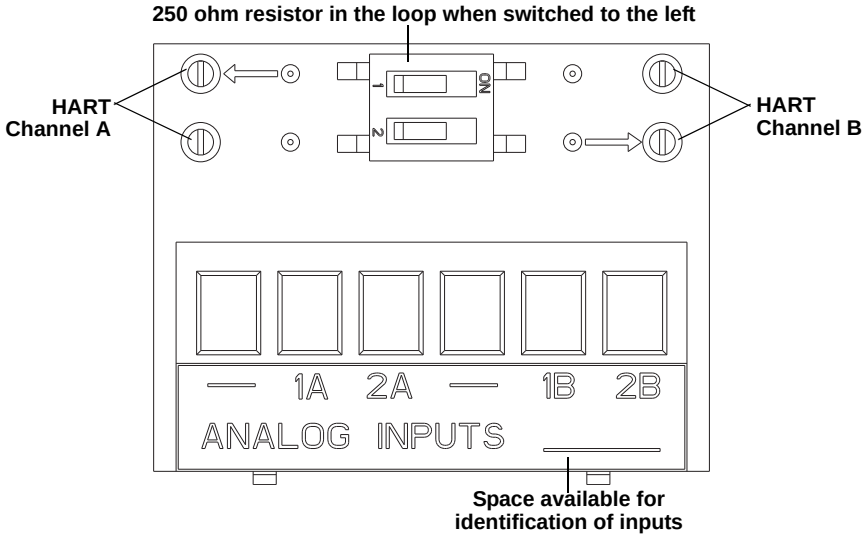


Figure 2-6. 848T Analog Connector



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Power Supply

Connections

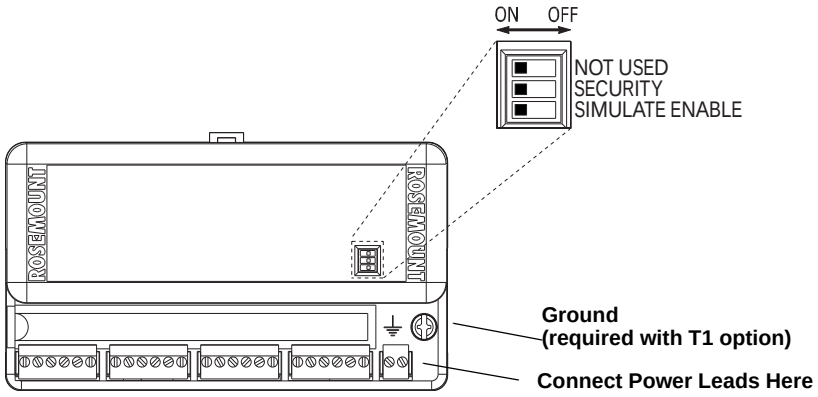
The transmitter requires between 9 and 32 VDC to operate and provide complete functionality. The DC power supply should provide power with less than 2% ripple. A fieldbus segment requires a power conditioner to isolate the power supply filter and decouple the segment from other segments attached to the same power supply.

⚠ All power to the transmitter is supplied over the signal wiring. Signal wiring should be shielded, twisted pair for best results in electrically noisy environments. Do not use unshielded signal wiring in open trays with power wiring or near heavy electrical equipment.

Use ordinary copper wire of sufficient size to ensure that the voltage across the transmitter power terminals does not go below 9 VDC. The power terminals are polarity insensitive. To power the transmitter:

1. Connect the power leads to the terminals marked “Bus,” as shown in Figure 2-7.
2. Tighten the terminal screws to ensure adequate contact. No additional power wiring is necessary.

Figure 2-7. Transmitter Label



Surges/Transients

The transmitter will withstand electrical transients encountered through static discharges or induced switching transients. However, a transient protection option (option code T1) is available to protect the 848T against high-energy transients. The device must be properly grounded using the ground terminal (see Figure 2-7).

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GROUNDING

The 848T transmitter provides input/output isolation up to 620 V rms.

NOTE
Neither conductor of the fieldbus segment can be grounded. Grounding out one of the signal wires will shut down the entire fieldbus segment.

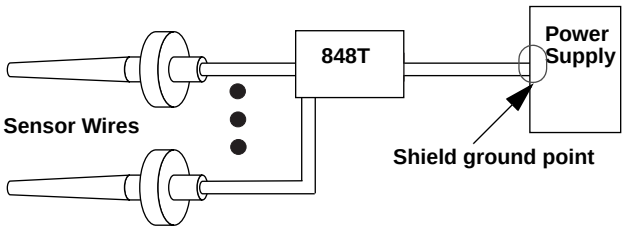
Shielded Wire

Each process installation has different requirements for grounding. Use the grounding options recommended by the facility for the specific sensor type or begin with grounding option 1 (most common).

Ungrounded Thermocouple, mV, and RTD/Ohm Inputs

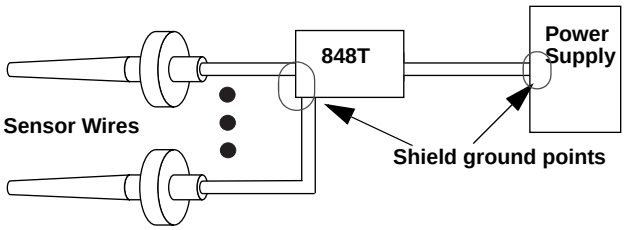
Option 1:

1. Connect signal wiring shield to the sensor wiring shield(s).
2. Ensure the shields are tied together and electrically isolated from the transmitter enclosure.
3. Only ground shield at the power supply end.
4. Ensure that the sensor shield(s) is electrically isolated from the surrounding grounded fixtures.



Option 2:

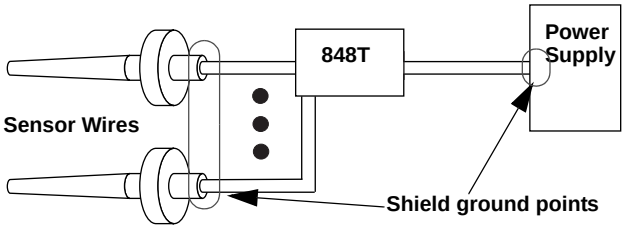
1. Connect sensor wiring shield(s) to the transmitter enclosure (only if the enclosure is grounded).
2. Ensure the sensor shield(s) is electrically isolated from surrounding fixtures that may be grounded.
3. Ground signal wiring shield at the power supply end.



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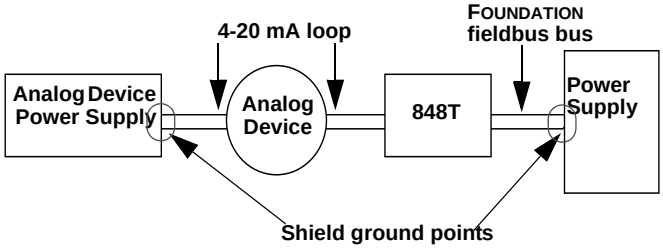
Grounded Thermocouple Inputs

1. Ground sensor wiring shield(s) at the sensor.
2. Ensure that the sensor wiring and signal wiring shields are electrically isolated from the transmitter enclosure.
3. Do not connect the signal wiring shield to the sensor wiring shield(s).
4. Ground signal wiring shield at the power supply end.



Analog Device Inputs

1. Ground analog signal wire at the power supply of the analog devices.
2. Ensure that the analog signal wire and the fieldbus signal wire shields are electrically isolated from the transmitter enclosure.
3. Do not connect the analog signal wire shield to the fieldbus signal wire shield.
4. Ground fieldbus signal wire shield at the power supply end.



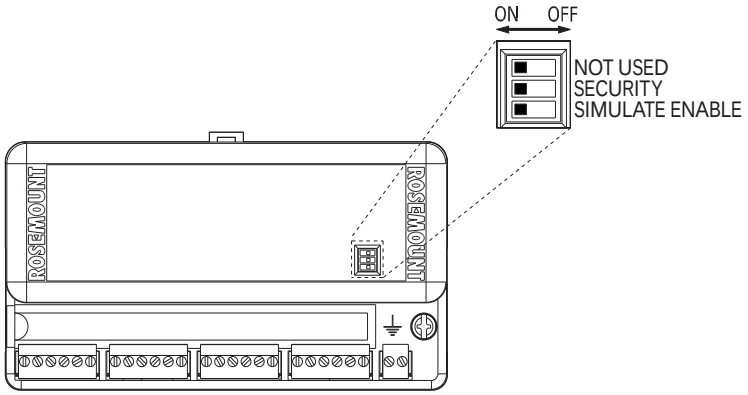
Transmitter Enclosure (optional)

Ground the transmitter in accordance with local electrical requirements.

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SWITCHES

Figure 2-8. Switch Location on the Rosemount 848T



Security

After configuring the transmitter, the data can be protected from unwarranted changes. Each 848T is equipped with a security switch that can be positioned “ON” to prevent the accidental or deliberate change of configuration data. This switch is located on the front side of the electronics module and is labeled SECURITY.

See Figure 2-8 for switch location on the transmitter label.

Simulate Enable

The switch labeled SIMULATE ENABLE is used in conjunction with the Analog Input (AI) and Multiple Analog Input (MAI) function blocks. This switch is used to simulate temperature measurement.

Not Used

The switch is not functional.

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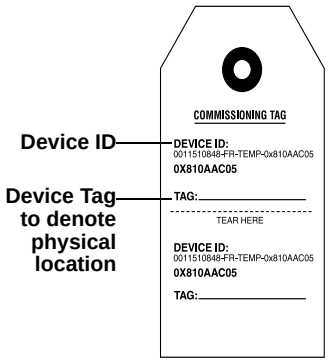
TAGGING

Commissioning Tag

The 848T has been supplied with a removable commissioning tag that contains both the Device ID (the unique code that identifies a particular device in the absence of a device tag) and a space to record the device tag (the operational identification for the device as defined by the Piping and Instrumentation Diagram (P&ID)).

When commissioning more than one device on a fieldbus segment, it can be difficult to identify which device is at a particular location. The removable tag, provided with the transmitter, can aid in this process by linking the Device ID to its physical location. The installer should note the physical location of the transmitter on both the upper and lower location of the commissioning tag. The bottom portion should be torn off for each device on the segment and used for commissioning the segment in the control system.

Figure 2-9. Commissioning Tag



Transmitter Tag

Hardware

- Tagged in accordance with customer requirements
- Permanently attached to the transmitter

Software

- The transmitter can store up to 32 characters
- If no characters are specified, the first 30 characters of the hardware tag will be used

Sensor Tag

Hardware

- A plastic tag is provided to record identification of eight sensors
- This information can be printed at the factory upon request
- In the field, the tag can be removed, printed onto, and reattached to the transmitter

Software

- If sensor tagging is requested, the Transducer Block SERIAL_NUMBER parameters will be set at the factory
- The SERIAL_NUMBER parameters can be updated in the field

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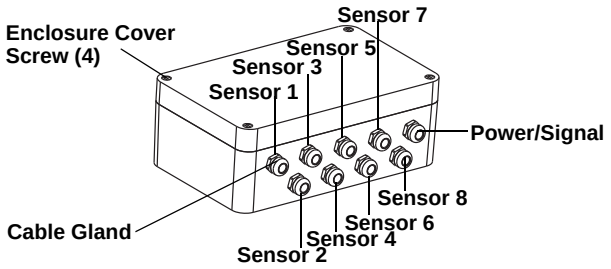
INSTALLATION

Using Cable Glands

Use the following steps to install the 848T with Cable Glands:

1. Remove the junction box cover by unscrewing the four cover screws.
2. Run the sensor and power/signal wires through the appropriate cable glands using the pre-installed cable glands (see Figure 2-10).
3. Install the sensor wires into the correct screw terminals (follow the label on the electronics module).
4. Install the power/signal wires onto the correct screw terminals. Power is polarity insensitive, allowing the user to connect positive (+) or negative (–) to either Fieldbus wiring terminal labeled “Bus.”
5. Replace the enclosure cover and securely tighten all cover screws.

Figure 2-10. Installing the 848T with Cable Glands

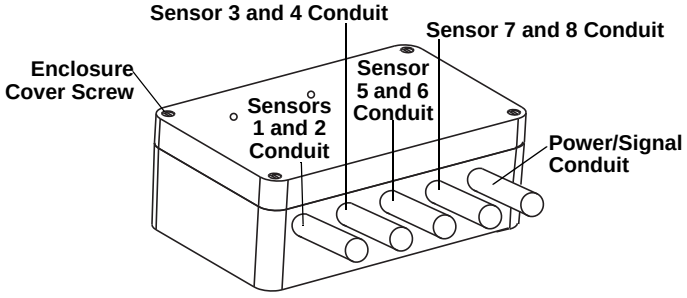


Using Conduit Entries

Use the following steps to install the 848T with Conduit Entries:

1. Remove the junction box cover by unscrewing the four cover screws.
2. Remove the five conduit plugs and install five conduit fittings (supplied by the installer).
3. Run pairs of sensor wires through each conduit fitting.
4. Install the sensor wires into the correct screw terminals (follow the label on the electronics module).
5. Install the power/signal wires into the correct screw terminals. Power is polarity insensitive, allowing the user to connect positive (+) or negative (–) to either Fieldbus wiring terminal labeled “Bus.”
6. Replace the junction box cover and securely tighten all cover screws.

Figure 2-11. Installing the 848T with Conduit Entries



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Section 3 Configuration

Safety Messages . . . . . page 3-1
Configuration . . . . . page 3-2
Common Configurations for High Density Applications page 3-4
Block Configuration . . . . . page 3-7

SAFETY MESSAGES

Instructions and procedures in this section may require special precautions to ensure the safety of the personnel performing the operations. Information that potentially raises safety issues is indicated by a warning symbol (⚠). Please refer to the following safety messages before performing an operation preceded by this symbol.

Warnings

⚠WARNING

Failure to follow these installation guidelines could result in death or serious injury.

- Make sure only qualified personnel perform the installation.

Process leaks could result in death or serious injury.

- Do not remove the thermowell while in operation. Removing while in operation may cause process fluid leaks.
- Install and tighten thermowells and sensors before applying pressure, or process leakage may result.

Electrical shock could cause death or serious injury.

- If the sensor is installed in a high voltage environment and a fault condition or installation error occurs, high voltage may be present on transmitter leads and terminals.
- Use extreme caution when making contact with the leads and terminals.

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CONFIGURATION

Standard

Each FOUNDATION fieldbus configuration tool or host system has a different way of displaying and performing configurations. Some will use Device Descriptions (DDs) and DD Methods to make configuration and displaying of data consistent across host platforms.

Unless otherwise specified, the 848T will be shipped with the following configuration (default):

Table 3-1. Standard Configuration Settings

Sensor Type(1)	Type J Thermocouple
Damping(1)	5 seconds
Measurement Units(1)	°C
Output(1)	Linear with Temperature
Line Voltage Filter(1)	60 Hz
Temperature Specific Blocks	• Transducer Block (1)
FOUNDATION fieldbus Function Blocks	• Analog Input (8) • Multiple Analog Input (2) • Input Selector (4)

(1) For all eight sensors

Refer to that systems documentation to perform configuration changes using a FOUNDATION fieldbus host or configuration tool.

NOTE
To make configuration changes, ensure that the block is Out of Service (OOS) by setting the MODE_BLK.TARGET to OOS, or set the SENSOR_MODE to Configuration.

Transmitter Configuration

The transmitter is available with the standard configuration setting. The configuration settings and block configuration may be changed in the field with the Emerson Process Management Systems DeltaV®, with AMS*inside*, or other FOUNDATION fieldbus host or configuration tool.

Custom Configuration

Custom configurations are to be specified when ordering.

Methods

For FOUNDATION fieldbus hosts or configuration tools that support device description (DD) methods, there are two configuration methods available in the Transducer block. These methods are included with the DD software.

- Sensor Configuration
- Sensor Input Trim (user input trim)

See the host system documentation for information on running DD methods from the host system. If the FOUNDATION fieldbus host or configuration tool does not support DD methods, refer to “Block Configuration” on page 3-7 for information on how to modify sensor configuration parameters.

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Alarms

Use the following steps to configure the alarms, which are located in the Resource Function Block.

1. Set the resource block to OOS.
2. Set WRITE_PRI to the appropriate alarm level (WRITE_PRI has a selectable range of priorities from 0 to 15, see “Alarm Priority Levels” on page 3-11. Set the other block alarm parameters at this time.
3. Set CONFIRM_TIME to the time, in $^{1}/_{32}$ of a millisecond, that the device will wait for confirmation of receiving a report before trying again (the device does not retry if CONFIRM_TIME is 0).
4. Set LIM_NOTIFY to a value between zero and MAX_NOTIFY. LIM_NOTIFY is the maximum number of alert reports allowed before the operator needs to acknowledge an alarm condition.
5. Enable the reports bit in FEATURES_SEL. (When Multi-bit alerts is enabled, every active alarm is visible for any of the eight sensors, generated by a PlantWeb alert. This is different than only viewing the highest priority alarm.)
6. Set the resource block to AUTO.

For modifying alarms on individual function blocks (AI or ISEL blocks), refer to Appendix D: Function Blocks.

Damping

Use the following steps to configure the damping, which is located in the Transducer Function Block.

1. Set Sensor Mode to Out of Service.
2. Change DAMPING to the desired filter rate (0.0 to 32.0 seconds).
3. Set Sensor Mode to In Service.

Configure the Differential Sensors

Use the following steps to configure the Differential Sensors:

1. Set Dual Sensor Mode to Out of Service.
2. Set Input A and Input B to the sensor values that are to be used in the differential equation diff = A–B. (NOTE: Unit types must be the same.)
3. Set the DUAL_SENSOR_CALC to either Not Used, Absolute, or INPUT A minus INPUT B.
4. Set Dual Sensor Mode to In Service.

Configure Measurement Validation

Use the following steps to configure Measurement Validation:

1. Set mode to Disabled for specific sensor.
2. Select sample rate. 1-10 sec/sample is available. 1 second/sample is preferred for sensor degradation. The higher the number of seconds between samples, the more emphasis put on process variation.
3. Select Deviation Limit from 0 to 10 units. If deviation limit is exceeded, a status event will be triggered.
4. Select Increasing Limit. Sets the limit for increasing rate of change. If limit is exceeded, a status event will be triggered.
5. Select Decreasing Limit. Sets the limit for decreasing rate of change. If limit is exceeded, a status event will be triggered.

NOTE:
The decreasing limit selected is required to be a negative value.

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6. Set the Deadband from 0 to 90%. This threshold is used to clear the PV status.
7. Set Status Priority. This determines what happens when the specific limit has been exceeded. No Alert - Ignores limit settings. Advisory - Sets Advisory Plant Web Alert, but does not do anything with PV status. Warning - Sets a Maintenance Plant Web Alert and sets PV status to uncertain. Failure - Sets A Failure Plant Web Alert and sets PV status to Bad.
8. Set mode to Enabled for specific sensor.

COMMON CONFIGURATIONS FOR HIGH DENSITY APPLICATIONS

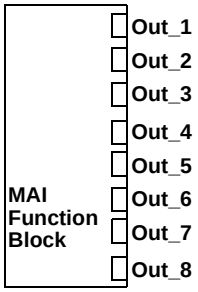
For the application to work properly, configure the links between the function blocks and schedule the order of their execution. The Graphical User Interface (GUI) provided by the FOUNDATION fieldbus host or configuration tool will allow easy configuration.

The measurement strategies shown in this section represent some of the common types of configurations available in the 848T. Although the appearance of the GUI screens will vary from host to host, the configuration logic is the same.

NOTE
Please ensure that the host system or configuration tool is properly configured before downloading the transmitter configuration. If configured improperly, the FOUNDATION fieldbus host or configuration tool could overwrite the default transmitter configuration.

Typical Profiling Application

Example: Distillation column temperature profile where all channels have the same sensor units (°C, °F, etc.).

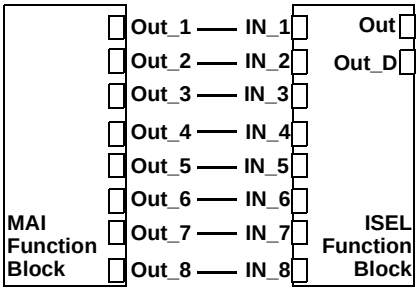


1. Place the Multiple Analog Input (MAI) function block in OOS mode (set MODE_BLK.TARGET to OOS).
2. Set CHANNEL= “channels 1 to 8.” Although the CHANNEL_X parameters remain writable, CHANNEL_X can only be set = X when CHANNEL=1.
3. Set L_TYPE to direct or indirect.
4. Set XD_SCALE (transducer measurement scaling) to the appropriate upper and lower range values, the appropriate sensor units, and display decimal point.
5. Set OUT_SCALE (MAI output scaling) to the appropriate upper and lower range values, the appropriate sensor units, and display decimal point.
6. Place the MAI Function Block in auto mode.
7. Verify that the function blocks are scheduled.

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Monitoring Application with a Single Selection

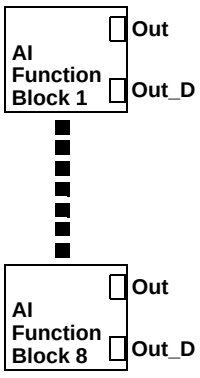
Example: Average exhaust temperature of gas and turbine where there is a single alarm level for all inputs.



1. Link the MAI outputs to the ISEL inputs.
2. Place the Multiple Analog Input (MAI) function block in OOS mode (set MODE_BLK.TARGET to OOS).
3. Set CHANNEL= “channels 1 to 8.” Although the CHANNEL_X parameters remain writable, CHANNEL_X can only be set = X when CHANNEL=1.
4. Set L_TYPE to direct or indirect.
5. Set XD_SCALE (transducer measurement scaling) to the appropriate upper and lower range values, the appropriate sensor units, and display decimal point.
6. Set OUT_SCALE (MAI output scaling) to the appropriate upper and lower range values, the appropriate sensor units, and display decimal point.
7. Place the MAI function block in auto mode.
8. Place the Input Selector (ISEL) function block in OOS mode by setting MODE_BLK.TARGET to OOS.
9. Set OUT_RANGE to match the OUT_SCALE in the MAI block.
10. Set SELECT_TYPE to the desired function (Maximum Value, Minimum Value, First Good Value, Midpoint Value, or Average Value).
11. Set the alarm limits and parameters if necessary.
12. Place the ISEL function block in auto mode.
13. Verify that the function blocks are scheduled.

Measuring Temperature Points Individually

Example: Miscellaneous monitoring of temperature in a “close proximity” where each channel can have different sensor inputs with different units and there are independent alarm levels for each input.



1. Place the first Analog Input (AI) function block in OOS mode (set MODE_BLK.TARGET to OOS).
2. Set CHANNEL to the appropriate channel value. Refer to “Alarm Priority Levels” on page 3-11 for a listing of channel definitions.
3. Set L_TYPE to direct.
4. Set XD_SCALE (transducer measurement scaling) to the appropriate upper and lower range values, the appropriate sensor units, and display decimal point.
5. Set OUT_SCALE (AI output scaling) to the appropriate upper and lower range values, the appropriate sensor units, and display decimal point.
6. Set the alarm limits and parameters if necessary.
7. Place the AI function block in auto mode.
8. Repeat steps 1 through 7 for each AI function block.
9. Verify that the function blocks are scheduled.

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Interfacing Analog Transmitters to FOUNDATION fieldbus

Transducer Block Configuration

Use the sensor configuration method to set the sensor type to mV – 2-wire for the applicable transducer block or follow these steps.

1. Set the MODE_BLK.TARGET to OOS mode, or set the SENSOR_MODE to configuration.
2. Set the SENSOR to mV.
3. Set the MODE_BLK.TARGET to AUTO, or set the SENSOR_MODE to operation.

Multiple Analog Input or Analog Input Block Configuration

Follow these steps to configure the applicable block.

1. Set the MODE_BLK.TARGET to OOS mode, or set the SENSOR_MODE to configuration.
2. Set CHANNEL to the transducer block configured for the analog input.
3. Set XD_SCALE.EU_0 to 20
   Set XD_SCALE.EU_100 to 100
   Set XD_SCALE.ENGUNITS to mV
4. SET OUT_SCALE to match the desired scale and units for the connected analog transmitter.
   Flow Example: 0 – 200 gpm
   OUT_SCALE.EU_0 = 0
   OUT_SCALE.EU_100 = 200
   OUT_SCALE.ENGUNITS = gpm
5. Set L_TYPE to INDIRECT.
6. Set the MODE_BLK.TARGET to AUTO, or set the SENSOR_MODE to operation.

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BLOCK CONFIGURATION

Resource Block

The resource block defines the physical resources of the device including type of measurement, memory, etc. The resource block also defines functionality, such as shed times, that is common across multiple blocks. The block has no linkable inputs or outputs and it performs memory-level diagnostics.

Table 3-2. Resource Block Parameters

Number	Parameter	Description
01	ST_REV	The revision level of the static data associated with the function block.
02	TAG_DESC	The user description of the intended application of the block.
03	STRATEGY	The strategy field can be used to identify grouping of blocks.
04	ALERT_KEY	The identification number of the plant unit.
05	MODE_BLK	The actual, target, permitted, and normal modes of the block. For further description, see the Mode parameter formal model in FF-890.
06	BLOCK_ERR	This parameter reflects the error status associated with the hardware or software components associated with a block. Multiple errors may be shown. For a list of enumeration values, see FF-890, Block_Err formal model.
07	RS_STATE	State of the function block application state machine. For a list of enumeration values, see FF-890.
08	TEST_RW	Read/write test parameter - used only for conformance testing.
09	DD_RESOURCE	String identifying the tag of the resource which contains the Device Description for the resource.
10	MANUFAC_ID	Manufacturer identification number - used by an interface device to locate the DD file for the resource.
11	DEV_TYPE	Manufacturer's model number associated with the resource - used by interface devices to locate the DD file for the resource.
12	DEV_REV	Manufacturer revision number associated with the resource - used by an interface device to locate the DD file for the resource.
13	DD_REV	Revision of the DD associated with the resource - used by the interface device to locate the DD file for the resource.
14	GRANT_DENY	Options for controlling access of host computer and local control panels to operating, tuning and alarm parameters of the block.
15	HARD_TYPES	The types of hardware available as channel numbers. The supported hardware type is: SCALAR_INPUT
16	RESTART	Allows a manual restart to be initiated.
17	FEATURES	Used to show supported resource block options. The supported features are: Unicode, Reports, Soft_Write_Lock, Hard_Write_Lock, and Multi-Bit Alarms.
18	FEATURE_SEL	Used to select resource block options.
19	CYCLE_TYPE	Identifies the block execution methods available for this resource. The supported cycle types are: SCHEDULED, and COMPLETION_OF_BLOCK_EXECUTION
20	CYCLE_SEL	Used to select the block execution method for this resource.
21	MIN_CYCLE_T	Time duration of the shortest cycle interval of which the resource is capable.
22	MEMORY_SIZE	Available configuration memory in the empty resource. To be checked before attempting a download.
23	NV_CYCLE_T	Minimum time interval specified by the manufacturer for writing copies of NV parameters to non-volatile memory. Zero means it will never be automatically copied. At the end of NV_CYCLE_T, only those parameters which have changed need to be updated in NVRAM.
24	FREE_SPACE	Percent of memory available for further configuration. Zero in preconfigured resource.
25	FREE_TIME	Percent of the block processing time that is free to process additional blocks.
26	SHED_RCAS	Time duration at which to give up on computer writes to function block RCas locations. Shed from RCas will never happen when SHED_RCAS = 0.
27	SHED_ROUT	Time duration at which to give up on computer writes to function block ROut locations. Shed from ROut will never happen when SHED_ROUT = 0.

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Table 3-2. Resource Block Parameters

Number	Parameter	Description
28	FAULT_STATE	Condition set by loss of communication to an output block, fault promoted to an output block or physical contact. When FAIL_SAFE condition is set, then output function blocks will perform their FAIL_SAFE actions.
29	SET_FSTATE	Allows the FAIL_SAFE condition to be manually initiated by selecting Set.
30	CLR_FSTATE	Writing a Clear to this parameter will clear the device FAIL_SAFE if the field condition has cleared.
31	MAX_NOTIFY	Maximum number of unconfirmed notify messages possible.
32	LIM_NOTIFY	Maximum number of unconfirmed alert notify messages allowed.
33	CONFIRM_TIME	The time the resource will wait for confirmation of receipt of a report before trying again. Retry will not happen when CONFIRM_TIME=0.
34	WRITE_LOCK	If set, all writes to static and non-volatile parameters are prohibited, except to clear WRITE_LOCK. Block inputs will continue to be updated.
35	UPDATE_EVT	This alert is generated by any change to the static data.
36	BLOCK_ALM	The BLOCK_ALM is used for all configuration, hardware, connection failure or system problems in the block. The cause of the alert is entered in the subcode field. The first alert to become active will set the Active status in the Status attribute. As soon as the Unreported status is cleared by the alert reporting task, another block alert may be reported without clearing the Active status, if the subcode has changed.
37	ALARM_SUM	The current alert status, unacknowledged states, unreported states, and disabled states of the alarms associated with the function block.
38	ACK_OPTION	Selection of whether alarms associated with the block will be automatically acknowledged.
39	WRITE_PRI	Priority of the alarm generated by clearing the write lock.
40	WRITE_ALM	This alert is generated if the write lock parameter is cleared.
41	ITK_VER	Major revision number of the interoperability test case used in certifying this device as interoperable. The format and range are controlled by the Fieldbus FOUNDATION.
42	DISTRIBUTOR	Reserved for use as distributor ID. No FOUNDATION enumerations defined at this time.
43	DEV_STRING	This is used to load new licensing into the device. The value can be written but will always read back with a value of 0.
44	XD_OPTIONS	Indicates which transducer block licensing options are enabled.
45	FB_OPTIONS	Indicates which function block licensing options are enabled.
46	DIAG_OPTIONS	Indicates which diagnostics licensing options are enabled.
47	MISC_OPTIONS	Indicates which miscellaneous licensing options are enabled.
48	RB_SFTWR_REV_MAJOR	Major revision of software that the resource block was created with.
49	RB_SFTWR_REV_MINOR	Minor revision of software that the resource block was created with.
50	RB_SFTWR_REV_BUILD	Build of software that the resource block was created with.
51	RB_SFTWR_REV_ALL	The string will contains the following fields: Major rev: 1-3 characters, decimal number 0-255 Minor rev: 1-3 characters, decimal number 0-255 Build rev: 1-5 characters, decimal number 0-255 Time of build: 8 characters, xx:xx:xx, military time Day of week of build: 3 characters, Sun, Mon, … Month of build: 3 characters, Jan, Feb. Day of month of build: 1-2 characters, decimal number 1-31 Year of build: 4 characters, decimal Builder: 7 characters, login name of builder
52	HARDWARE_REV	Hardware revision of that hardware that has the resource block in it.
53	OUTPUT_BOARD_SN	Output board serial number.
54	FINAL_ASSY_NUM	The same final assembly number placed on the label.
55	DETAILED_STATUS	Indicates the state of the transmitter. NOTE: Will be writable when PWA_SIMULATE is On during simulation mode.
56	SUMMARY_STATUS	An enumerated value of repair analysis.
57	MESSAGE_DATE	Date associated with the MESSAGE_TEXT parameter
58	MESSAGE_TEXT	Used to indicate changes made by the user to the device's installation, configuration, or calibration.
59	SELF_TEST	Used to self test the device. Tests are device specific.

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Table 3-2. Resource Block Parameters

Number	Parameter	Description
60	DEFINE_WRITE_LOCK	Allows the operator to select how WRITE_LOCK behaves. The initial value is “lock everything”. If the value is set to “lock only physical device” then the resource and transducer blocks of the device will be locked but changes to function blocks will be allowed.
61	SAVE_CONFIG_NOW	Allows the user to optionally save all non-volatile information immediately.
62	SAVE_CONFIG_BLOCKS	Number of EEPROM blocks that have been modified since last burn. This value will count down to zero when the configuration is saved.
63	START_WITH_DEFAULTS	0 = Uninitialized 1 = do not power-up with NV defaults 2 = power-up with default node address 3 = power-up with default pd_tag and node address 4 = power-up with default data for the entire communications stack (no application data)
64	SIMULATE_IO	Status of Simulate jumper/switch
65	SECURITY_IO	Status of Security jumper/switch
66	SIMULATE_STATE	The state of the simulate jumper 0 = Uninitialized 1 = Jumper/switch off, simulation not allowed 2 = Jumper/switch on, simulation not allowed (need to cycle jumper/switch) 3 = Jumper/switch on, simulation allowed
67	DOWNLOAD_MODE	Gives access to the boot block code for over the wire downloads 0 = Uninitialized 1 = Run Mode 2 = Download Mode
68	RECOMMENDED_ACTION	Enumerated list of recommended actions displayed with a device alert.
69	FAILED_PRI	Designates the alarming priority of the FAILED_ALM.
70	FAILED_ENABLE	Enabled FAILED_ALM alarm conditions. Corresponds bit for bit to the FAILED_ACTIVE. A bit on means that the corresponding alarm condition is enabled and will be detected. A bit off means the corresponding alarm condition is disabled and will not be detected.
71	FAILED_MASK	Mask of FAILED_ALM. Corresponds bit for bit to FAILED_ACTIVE. A bit on means that the condition is masked out from alarming.
72	FAILED_ACTIVE	Enumerated list of failure conditions within a device.
73	FAILED_ALM	Alarm indicating a failure within a device which makes the device non-operational.
74	MAINT_PRI	Designates the alarming priority of the MAINT_ALM
75	MAINT_ENABLE	Enabled MAINT_ALM alarm conditions. Corresponds bit for bit to the MAINT_ACTIVE. A bit on means that the corresponding alarm condition is enabled and will be detected. A bit off means the corresponding alarm condition is disabled and will not be detected.
76	MAINT_MASK	Mask of MAINT_ALM. Corresponds bit for bit to MAINT_ACTIVE. A bit on means that the condition is masked out from alarming.
77	MAINT_ACTIVE	Enumerated list of maintenance conditions within a device.
78	MAINT_ALM	Alarm indicating the device needs maintenance soon. If the condition is ignored, the device will eventually fail.
79	ADVISE_PRI	Designates the alarming priority of the ADVISE_ALM
80	ADVISE_ENABLE	Enabled ADVISE_ALM alarm conditions. Corresponds bit for bit to the ADVISE_ACTIVE. A bit on means that the corresponding alarm condition is enabled and will be detected. A bit off means the corresponding alarm condition is disabled and will not be detected.
81	ADVISE_MASK	Mask of ADVISE_ALM. Corresponds bit for bit to ADVISE_ACTIVE. A bit on means that the condition is masked out from alarming.
82	ADVISE_ACTIVE	Enumerated list of advisory conditions within a device.

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Table 3-2. Resource Block Parameters

Number	Parameter	Description
83	ADVISE_ALM	Alarm indicating advisory alarms. These conditions do not have a direct impact on the process or device integrity.
84	HEALTH_INDEX	Parameter representing the overall health of the device, 100 being perfect and 1 being non-functioning. The value will be set based on the active PWA alarms in accordance with the requirements stated in “Device Alerts and Health Index PlantWeb Implementation Rules”. Each device may implement its own unique mapping between the PWA parameters and HEALTH_INDEX although a default mapping will be available based on the following rules. HEALTH_INDEX will be set based on the highest priority PWA *_ACTIVE bit as follows: FAILED_ACTIVE: 0 to 31 - HEALTH_INDEX = 10 MAINT_ACTIVE: 29 to 31 - HEALTH_INDEX = 20 MAINT_ACTIVE: 26 to 28 - HEALTH_INDEX = 30 MAINT_ACTIVE: 19 to 25 - HEALTH_INDEX = 40 MAINT_ACTIVE: 10 to 16 - HEALTH_INDEX = 50 MAINT_ACTIVE: 5 to 9 - HEALTH_INDEX = 60 MAINT_ACTIVE: 0 to 4 - HEALTH_INDEX = 70 ADVISE_ACTIVE: 16 to 31 - HEALTH_INDEX = 80 ADVISE_ACTIVE: 0 to 15 - HEALTH_INDEX = 90 NONE - HEALTH_INDEX = 100
85	PWA_SIMULATE	Allows direct writes to the PlantWeb Alert "ACTIVE" parameters and RB.DETAILED_STATUS. The simulate jumper must be "ON' and the SIMULATE_STATE must be "Jumper on, simulation allowed" before PWA_SIMULATE can be active.

Block Errors

Table 3-3 lists conditions reported in the BLOCK_ERR parameter.

Table 3-3. BLOCK_ERR Conditions

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Number	Name and Description
0	Other
1	Block Configuration Error: A feature in CYCLE_SEL is set that is not supported by CYCLE_TYPE.
3	Simulate Active: This indicates that the simulation jumper is in place. This is not an indication that the I/O blocks are using simulated data.
7	Input failure/process variable has bad status
9	Memory Failure: A memory failure has occurred in FLASH, RAM, or EEPROM memory.
10	Lost Static Data: Static data that is stored in non-volatile memory has been lost.
11	Lost NV Data: Non-volatile data that is stored in non-volatile memory has been lost.
13	Device Needs Maintenance Now
14	Power Up: The device was just powered-up.
15	OOS: The actual mode is out of service.

Modes

The resource block supports two modes of operation as defined by the MODE_BLK parameter:

Automatic (Auto)
The block is processing its normal background memory checks.

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Out of Service (OOS)
The block is not processing its tasks. When the resource block is in OOS, all blocks within the resource (device) are forced into OOS. The BLOCK_ERR parameter shows Out of Service. In this mode, changes can be made to all configurable parameters. The target mode of a block may be restricted to one or more of the supported modes.

Alarm Detection

A block alarm will be generated whenever the BLOCK_ERR has an error bit set. The types of block error for the resource block are defined above. A write alarm is generated whenever the WRITE_LOCK parameter is cleared. The priority of the write alarm is set in the following parameter:

- WRITE_PRI

Table 3-4. Alarm Priority Levels

Number	Description
0	The priority of an alarm condition changes to 0 after the condition that caused the alarm is corrected.
1	An alarm condition with a priority of 1 is recognized by the system, but is not reported to the operator.
2	An alarm condition with a priority of 2 is reported to the operator, but does not require operator attention (such as diagnostics and system alerts).
3-7	Alarm conditions of priority 3 to 7 are advisory alarms of increasing priority.
8-15	Alarm conditions of priority 8 to 15 are critical alarms of increasing priority.

Status Handling

There are no status parameters associated with the resource block.

PlantWeb™ Alerts

The alerts and recommended actions should be used in conjunction with “Operation and Maintenance” on page 4-1.

The Resource Block will act as a coordinator for PlantWeb alerts. There will be three alarm parameters (FAILED_ALARM, MAINT_ALARM, and ADVISE_ALARM) which will contain information regarding some of the device errors which are detected by the transmitter software. There will be a RECOMMENDED_ACTION parameter which will be used to display the recommended action text for the highest priority alarm and a HEALTH_INDEX parameters (0 - 100) indicating the overall health of the transmitter. FAILED_ALARM will have the highest priority followed by MAINT_ALARM and ADVISE_ALARM will be the lowest priority.

FAILED_ALARMS
A failure alarm indicates a failure within a device that will make the device or some part of the device non-operational. This implies that the device is in need of repair and must be fixed immediately. There are five parameters associated with FAILED_ALARMS specifically, they are described below.

FAILED_ENABLED
This parameter contains a list of failures in the device which makes the device non-operational that will cause an alert to be sent. Below is a list of the failures with the highest priority first.

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Table 3-5. Failure Alarms

Alarm	Priority
Electronics Failure	**1**
Memory Failure	**2**
Hardware/Software Incompatible	**3**
Body Temperature Failure	**4**
Sensor 8 Failure	**5**
Sensor 7 Failure	**6**
Sensor 6 Failure	**7**
Sensor 5 Failure	**7**
Sensor 4 Failure	**9**
Sensor 3 Failure	**10**
Sensor 2 Failure	**11**
Sensor 1 Failure	**12**

FAILED_MASK
This parameter will mask any of the failed conditions listed in FAILED_ENABLED. A bit on means that the condition is masked out from alarming and will not be reported.

FAILED_PRI
Designates the alerting priority of the FAILED_ALM, see Table 3-4 on page 3-11. The default is 0 and the recommended value are between 8 and 15.

FAILED_ACTIVE
This parameter displays which of the alarms is active. Only the alarm with the highest priority will be displayed. This priority is not the same as the FAILED_PRI parameter described above. This priority is hard coded within the device and is not user configurable.

FAILED_ALM
Alarm indicating a failure within a device which makes the device non-operational.

MAINT_ALARMS
A maintenance alarm indicates the device or some part of the device needs maintenance soon. If the condition is ignored, the device will eventually fail. There are five parameters associated with MAINT_ALARMS, they are described below.

MAINT_ENABLED
The MAINT_ENABLED parameter contains a list of conditions indicating the device or some part of the device needs maintenance soon.

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Table 3-6. Maintenance Alarms/Priority Alarm

Alarm	Priority
Sensor 8 Degraded	**1**
Sensor 7 Degraded	**2**
Sensor 6 Degraded	**3**
Sensor 5 Degraded	**4**
Sensor 4 Degraded	**5**
Sensor 3 Degraded	**6**
Sensor 2 Degraded	**7**
Sensor 1 Degraded	**8**
Body Temperature Out of Range	**9**
CJC Degraded	**10**

MAINT_MASK
The MAINT_MASK parameter will mask any of the failed conditions listed in MAINT_ENABLED. A bit on means that the condition is masked out from alarming and will not be reported.

MAINT_PRI
MAINT_PRI designates the alarming priority of the MAINT_ALM, Table 3-4 on page 3-11. The default is 0 and the recommended values is 3 to 7.

MAINT_ACTIVE
The MAINT_ACTIVE parameter displays which of the alarms is active. Only the condition with the highest priority will be displayed. This priority is not the same as the MAINT_PRI parameter described above. This priority is hard coded within the device and is not user configurable.

MAINT_ALM
An alarm indicating the device needs maintenance soon. If the condition is ignored, the device will eventually fail.

Advisory Alarms
An advisory alarm indicates informative conditions that do not have a direct impact on the device's primary functions. There are five parameters associated with ADVISE_ALARMS, they are described below.

ADVISE_ENABLED
The ADVISE_ENABLED parameter contains a list of informative conditions that do not have a direct impact on the device's primary functions. Below is a list of the advisories with the highest priority first.

Alarm	Priority
PWA Simulate Active	**1**
Excessive Deviation	**2**
Excessive Rate of Change	**3**

NOTE
Alarms are only prioritized if Multi-Bit Alerts are disabled. If MBA is enabled, all alerts are visible.

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ADVISE_MASK
The ADVISE_MASK parameter will mask any of the failed conditions listed in ADVISE_ENABLED. A bit on means the condition is masked out from alarming and will not be reported.

ADVISE_PRI
ADVISE_PRI designates the alarming priority of the ADVISE_ALM, see Table 3-4 on page 3-11. The default is 0 and the recommended values are 1 or 2.

ADVISE_ACTIVE
The ADVISE_ACTIVE parameter displays which of the advisories is active. Only the advisory with the highest priority will be displayed. This priority is not the same as the ADVISE_PRI parameter described above. This priority is hard coded within the device and is not user configurable.

ADVISE_ALM
ADVISE_ALM is an alarm indicating advisory alarms. These conditions do not have a direct impact on the process or device integrity.

Recommended Actions for PlantWeb Alerts

RECOMMENDED_ACTION
The RECOMMENDED_ACTION parameter displays a text string that will give a recommended course of action to take based on which type and which specific event of the PlantWeb alerts are active.

Table 3-7. RB.RECOMMENDED_ACTION

Alarm Type	Active Event	Recommended Action
None	None	No action is required.
Advisory	PWA Simulate Active	Disable simulation to return to process monitoring.
Advisory	Excessive Deviation	
Advisory	Excessive Rate of Change	
Maintenance	CJC Degraded	If T/C sensors are being used, restart the device. If condition persists, replace the device.
Maintenance	Body Temperature Out of Range	Verify the ambient temperature is within operating limits.
Maintenance	Sensor 1 Degraded	Confirm the operating range of Sensor 1 and/or verify the sensor connection and device environment.
Maintenance	Sensor 2 Degraded	Confirm the operating range of Sensor 2 and/or verify the sensor connection and device environment.
Maintenance	Sensor 3 Degraded	Confirm the operating range of Sensor 3 and/or verify the sensor connection and device environment.
Maintenance	Sensor 4 Degraded	Confirm the operating range of Sensor 4 and/or verify the sensor connection and device environment.
Maintenance	Sensor 5 Degraded	Confirm the operating range of Sensor 5 and/or verify the sensor connection and device environment.
Maintenance	Sensor 6 Degraded	Confirm the operating range of Sensor 6 and/or verify the sensor connection and device environment.
Maintenance	Sensor 7 Degraded	Conform the operating range of Sensor 7 and/or verify the sensor connection and device environment.

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Alarm Type	Active Event	Recommended Action
Maintenance	Sensor 8 Degraded	Confirm the operating range of Sensor 8 and/or verify the sensor connection and device environment.
Failed	Sensor 1 Failure	Verify the Sensor 1 Instrument process is within the Sensor range and/or confirm sensor configuration and wiring.
Failed	Sensor 2 Failure	Verify the Sensor 2 Instrument process is within the Sensor range and/or confirm sensor configuration and wiring.
Failed	Sensor 3 Failure	Verify the Sensor 3 Instrument process is within the Sensor range and/or confirm sensor configuration and wiring.
Failed	Sensor 4 Failure	Verify the Sensor 4 Instrument process is within the Sensor range and/or confirm sensor configuration and wiring.
Failed	Sensor 5 Failure	Verify the Sensor 5 Instrument process is within the Sensor range and/or confirm sensor configuration and wiring.
Failed	Sensor 6 Failure	Verify the Sensor 6 Instrument process is within the Sensor range and/or confirm sensor configuration and wiring.
Failed	Sensor 7 Failure	Verify the Sensor 7 Instrument process is within the Sensor range and/or confirm sensor configuration and wiring.
Failed	Sensor 8 Failure	Verify the Sensor 8 Instrument process is within the Sensor range and/or confirm sensor configuration and wiring.
Failed	Body Temperature Failure	Verify that the body temperature is within the operating limits of this device.
Failed	Hardware/Software Incompatible	Contact Service Center to verify the Device Information (RESOURCE.HARDWARE_REV, AND RESOURCE.RB_SFTWR_REV_ALL).
Failed	Memory Error	Restart the device. If the problem persists, replace the device.
Failed	Electronics Failure	Restart the device. If the problem persists, replace the device.

NOTE
If status is set up to flag failure/warning you will see associated sensor degraded or failure alert.

Transducer Blocks

The transducer block allows the user to view and manage the channel information. There is one Transducer Block for the eight sensors that contains specific temperature measurement data, including:

- Sensor Type
- Engineering Units
- Damping
- Temperature Compensation
- Diagnostics

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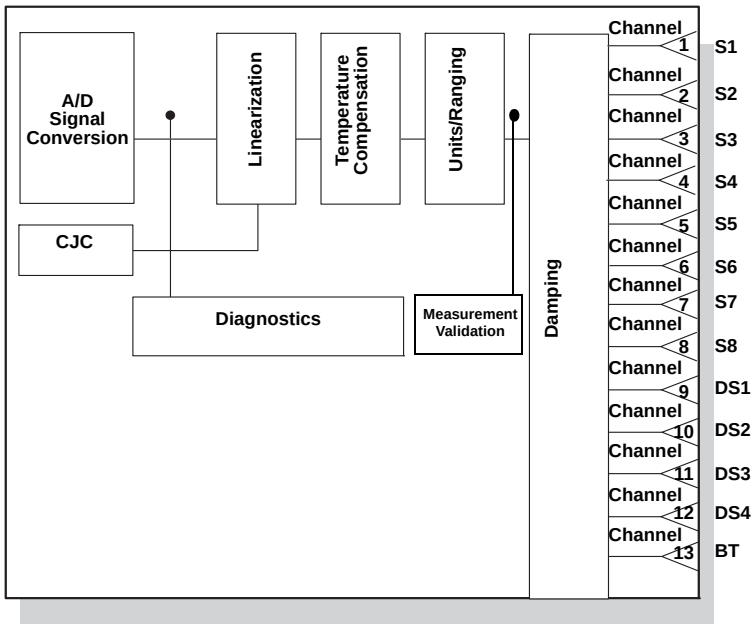
Transducer Block Channel Definitions

The 848T supports multiple sensor inputs. Each input has a channel assigned to it allowing an AI or MAI Function Blocks to be linked to that input. The channels for the 848T are as follows:

Table 3-8. Channel Definitions for the 848T

Channel	Description		Channel	Description
1	Sensor One		16	Sensor 3 Deviation
2	Sensor Two		17	Sensor 4 Deviation
3	Sensor Three		18	Sensor 5 Deviation
4	Sensor Four		19	Sensor 6 Deviation
5	Sensor Five		20	Sensor 7 Deviation
6	Sensor Six		21	Sensor 8 Deviation
7	Sensor Seven		22	Sensor 1 Rate Change
8	Sensor Eight		23	Sensor 2 Rate Change
9	Differential Sensor 1		24	Sensor 3 Rate Change
10	Differential Sensor 2		25	Sensor 4 Rate Change
11	Differential Sensor 3		26	Sensor 5 Rate Change
12	Differential Sensor 4		27	Sensor 6 Rate Change
13	Body Temperature		28	Sensor 7 Rate Change
14	Sensor 1 Deviation		29	Sensor 8 Rate Change
15	Sensor 2 Deviation			

Figure 3-1. Transducer Block Data Flow



Transducer Block Errors

The following conditions are reported in the BLOCK_ERR and XD_ERROR parameters.

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Table 3-9. Block/Transducer Error

	Condition Number, Name, and Description	
BLOCK_ERR	0	Other(1)
	7	Input failure/process variable has bad status
	15	Out of service: The actual mode is out of service

(1) If BLOCK_ERR is "other," then see XD_ERROR.

Transducer Block Modes

The transducer block supports two modes of operation as defined by the MODE_BLK parameter:

Automatic (Auto)
The block outputs reflect the analog input measurement.

Out of Service (OOS)
The block is not processed. Channel outputs are not updated and the status is set to Bad: Out of Service for each channel. The BLOCK_ERR parameter shows Out of Service. In this mode, changes can be made to all configurable parameters. The target mode of a block may be restricted to one or more of the supported modes.

Transducer Block Alarm Detection

Alarms are not generated by the transducer block. By correctly handling the status of the channel values, the down stream block (AI or MAI) will generate the necessary alarms for the measurement. The error that generated this alarm can be determined by looking at BLOCK-ERR and XD_ERROR.

Transducer Block Status Handling

Normally, the status of the output channels reflect the status of the measurement value, the operating condition of the measurement electronics card, and any active alarm conditions. In a transducer, PV reflects the value and status quality of the output channels.

Table 3-10. Transducer Block Parameters

Number	Parameter	Description
0	BLOCK	
1	ST_REV	The revision level of the static data associated with the function block.
2	TAG_DESC	The user description of the intended application of the block.
3	STRATEGY	The strategy field can be used to identify grouping of blocks.
4	ALERT_KEY	The identification number of the plant unit.
5	MODE_BLK	The actual, target, permitted, and normal modes of the block.
6	BLOCK_ERR	This parameter reflects the error status associated with the hardware or software components associated with a block. Multiple errors may be shown. *For a list of enumeration values, see FF-890, Block_Err formal model*.
7	UPDATE_EVENT	This alert is generated by any change to the static data.
8	BLOCK_ALM	The BLOCK-ALM is used for all configuration, hardware, connection failure or system problems in the block. The cause of the alert is entered in the subcode field. The first alert to become active will set the Active status in the Status attribute. As soon as the Unreported status is cleared by the alert reporting task, another block alert may be reported without clearing the Active status, if the subcode has changed.
9	TRANSDUCER_DIRECTORY	A directory that specified the number and stating indices of the transducers in the transducer block.
10	TRANSDUCER_TYPE	Identifies the transducer that follows 101 – Standard Temperature with Calibration.
11	XD_ERROR	Provides additional error codes related to transducer blocks. *For a list of enumeration values, see FF-902*. Please see tables below for a list of sub-parameters that pertain to XD_ERROR messages.

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Table 3-10. Transducer Block Parameters

Number	Parameter	Description
12	COLLECTION_DIRECTORY	A directory that specifies the number, starting indices, and DD Item ID's of the data collections in each transducer block.
13	SENSOR_1_CONFIG	Sensor Configuration Parameters. Please see tables below for a list of sub-parameters that pertain to Sensor Configuration functions.
14	PRIMARY_VALUE_1	The measured value and status available to the function block.
15	SENSOR_2_CONFIG	Sensor Configuration parameters. Please see tables below for a list of sub-parameters that pertain to Sensor Configuration functions.
16	PRIMARY_VALUE_2	The measured value and status available to the function block.
17	SENSOR_3_CONFIG	Sensor Configuration Parameters. Please see tables below for a list of sub-parameters that pertain to Sensor Configuration functions.
18	PRIMARY_VALUE_3	The measured value and status available to the function block
19	SENSOR_4_CONFIG	Sensor Configuration Parameters. Please see tables below for a list of sub-parameters that pertain to Sensor Configuration functions.
20	PRIMARY_VALUE_4	The measured value and status available to the function block.
21	SENSOR_5_CONFIG	Sensor Configuration Parameters. Please see tables below for a list of sub-parameters that pertain to Sensor Configuration functions.
22	PRIMARY_VALUE_5	The measured value and status available to the function block.
23	SENSOR_6_CONFIG	Sensor Configuration Parameters. Please see tables below for a list of sub-parameters that pertain to Sensor Configuration functions.
24	PRIMARY_VALUE_6	The measured value and status available to the function block.
25	SENSOR_7_CONFIG	Sensor Configuration Parameters. Please see tables below for a list of sub-parameters that pertain to Sensor Configuration functions.
26	PRIMARY_VALUE_7	The measured value and status available to the function block.
27	SENSOR_8_CONFIG	Sensor Configuration Parameters. Please see tables below for a list of sub-parameters that pertain to Sensor Configuration functions.
28	PRIMARY_VALUE_8	The measured value and status available to the function block
29	SENSOR_STATUS	Status of each individual sensor. Please see tables below for a list of possible status messages.
30	SENSOR_CAL	Parameter structure to allow for calibration of each sensor. Please see tables below for a list of sub-parameters that pertain to Sensor Calibration functions.
31	CAL_STATUS	Status of the calibration that was previously performed. Please see tables below for a list of possible Calibration Statuses.
32	ASIC_REJECTION	A configurable power line noise rejection setting.
33	BODY_TEMP	Body Temperature of the device.
34	BODY_TEMP_RANGE	The range of the body temperature including the units index.
35	TB_SUMMARY_STATUS	Overall summary status of the sensor transducer. Please see tables below for a list of possible transducer statuses.
36	DUAL_SENSOR_1_CONFIG	Parameter structure to allow for calibration of each differential measurement. Please see tables below for a list of sub-parameters that pertain to Dual Sensor Calibration functions.
37	DUAL_SENSOR_VALUE_1	The measured value and status available to the function block.
38	DUAL_SENSOR_2_CONFIG	Parameter structure to allow for calibration of each differential measurement. Please see tables below for a list of sub-parameters that pertain to Dual Sensor Calibration functions.
39	DUAL_SENSOR_VALUE_2	The measured value and status available to the function block.
40	DUAL_SENSOR_3_CONFIG	Parameter structure to allow for calibration of each differential measurement. Please see tables below for a list of sub-parameters that pertain to Dual Sensor Calibration functions.
41	DUAL_SENSOR_VALUE_3	The measured value and status available to the function block.
42	DUAL_SENSOR_4_CONFIG	Parameter structure to allow for calibration of each differential measurement. Please see tables below for a list of sub-parameters that pertain to Dual Sensor Calibration functions.
43	DUAL_SENSOR_VALUE_4	The measured value and status available to the function block.
44	DUAL_SENSOR_STATUS	Status of each individual differential measurement. Please see tables below for a list of possible Dual Sensor statuses.
45	VALIDATION_SNSR1_CONFIG	Validation configuration parameters. Please see tables below for a list of sub-parameters that pertain to Validation Configuration functions.
46	VALIDATION_SNSR1_VALUES	Validation value parameters. Please see tables below for a list of sub-parameters that pertain to Validation values.
47	VALIDATION_SNSR2_CONFIG	Validation configuration parameters. Please see tables below for a list of sub-parameters that pertain to Validation Configuration functions.

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Table 3-10. Transducer Block Parameters

Number	Parameter	Description
48	VALIDATION_SNSR2_VALUES	Validation value parameters. Please see tables below for a list of sub-parameters that pertain to Validation values.
49	VALIDATION_SNSR3_CONFIG	Validation configuration parameters. Please see tables below for a list of sub-parameters that pertain to Validation Configuration functions.
50	VALIDATION_SNSR3_VALUES	Validation value parameters. Please see tables below for a list of sub-parameters that pertain to Validation values.
51	VALIDATION_SNSR4_CONFIG	Validation configuration parameters. Please see tables below for a list of sub-parameters that pertain to Validation Configuration functions.
52	VALIDATION_SNSR4_VALUES	Validation value parameters. Please see tables below for a list of sub-parameters that pertain to Validation values.
53	VALIDATION_SNSR5_CONFIG	Validation configuration parameters. Please see tables below for a list of sub-parameters that pertain to Validation Configuration functions.
54	VALIDATION_SNSR5_VALUES	Validation value parameters. Please see tables below for a list of sub-parameters that pertain to Validation values.
55	VALIDATION_SNSR6_CONFIG	Validation configuration parameters. Please see tables below for a list of sub-parameters that pertain to Validation Configuration functions.
56	VALIDATION_SNSR6_VALUES	Validation value parameters. Please see tables below for a list of sub-parameters that pertain to Validation values.
57	VALIDATION_SNSR7_CONFIG	Validation configuration parameters. Please see tables below for a list of sub-parameters that pertain to Validation Configuration functions.
58	VALIDATION_SNSR7_VALUES	Validation value parameters. Please see tables below for a list of sub-parameters that pertain to Validation values.
59	VALIDATION_SNSR8_CONFIG	Validation configuration parameters. Please see tables below for a list of sub-parameters that pertain to Validation Configuration functions.
60	VALIDATION_SNSR8_VALUES	Validation value parameters. Please see tables below for a list of sub-parameters that pertain to Validation values.

Changing the Sensor Configuration in the Transducer Block

If the FOUNDATION fieldbus configuration tool or host system does not support the use of DD methods for device configuration, the following steps illustrate how to change the sensor configuration in the transducer block:

1. Set the MODE_BLK.TARGET to OOS, or set the SENSOR_MODE to configuration.
2. Set SENSOR_n_CONFIG.SENSOR to the appropriate sensor type, and then set SENSOR_n_CONFIG.CONNECTION to the appropriate type and connection.
3. In the Transducer Block, set MODE_BLK.TARGET to AUTO, or set the SENSOR_MODE to operation.

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Transducer Block Sub-Parameter Tables

Table 3-11. XD_ERROR Sub-Parameter Structure

XD ERROR		Description
0	No Error	
17	General Error	An error has occurred that could not be classified as one of the errors listed below.
18	Calibration Error	An error occurred during calibration of the device or a calibration error has been detected during operation of the device.
19	Configuration Error	An error occurred during configuration of the device or a configuration error has been detected during operation of the device.
20	Electronics Failure	An electronic component has failed.
22	I/O Failure	An I/O failure has occurred.
23	Data Integrity Error	Indicates that data stored within the system may no longer be valid due to non-volatile memory checksum failure, data verify after write failure, etc.
24	Software Error	The software has detected an error. This could be caused by an improper interrupt service routine, an arithmetic overflow, a watchdog timer, etc.
25	Algorithm Error	The algorithm used in the transducer block produced an error. This could be due to an overflow, data reasonableness.

Table 3-12. SENSOR_CONFIG Sub-Parameter Structure

SENSOR CONFIG STRUCTURE	
Parameter	**Description**
SENSOR_MODE	Disables or enables a sensor for configuration.
SENSOR_TAG	Sensor description.
SERIAL_NUMBER	Serial number for the attached sensor.
SENSOR	Sensor Type and Connection. MSB is the sensor type and LSB is the connection.
DAMPING	Sampling Interval used to smooth output using a first order linear filter. A value entered between 0 and the Update_Rate, will result in a damping value equal to the Update_Rate.
INPUT_TRANSIENT_FILTER	Enables or Disables the option for reporting fast changing sensor inputs without temporary holdoff. 0 = Disable, 1 = Enabled.
RTD_2_WIRE_OFFSET	User entered value for constant lead-wire resistance correction in a 2-wire RTD and Ohm sensor types.
ENG_UNITS	The engineering units used for reporting measured sensor values.
UPPER_RANGE	The upper sensor limit for the selected sensor is displayed using Units_Index sub parameter.
LOWER_RANGE	The lower sensor limit for the selected sensor is displayed using Units_Index sub parameter.

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Table 3-13. SENSOR_STATUS Sub-Parameter Structure

Sensor Status Table	
0x00	Active
0x01	Out of Service
0x02	Inactive
0x04	Open
0x08	Short
0x10	Out of Range
0x20	Beyond Limits
0x40	Excess EMF Detected
0x80	Other

Table 3-14. SENSOR_CAL Sub-Parameter Structure

SENSOR CALIBRATION STRUCTURE	
Parameter	**Description**
SENSOR_NUMBER	The sensor number to calibrate
CALIB_POINT_HI	The High calibration point for the selected sensor
CALIB_POINT_LO	The Low calibration point for the selected sensor
CALIB_UNIT	The engineering units used for calibrating the sensor
CALIB_METHOD	The method of the last calibration for sensor 103 - factory trim standard calibration 104 - user trim standard calibration
CALIB_INFO	Information regarding the calibration
CALIB_DATE	Date that the calibration was completed
CALIB_MIN_SPAN	The minimum calibration span value allowed. This minimum span information is necessary to ensure that when calibration is done, the two calibrated points are not too close together
CALIB_PT_HI_LIMIT	The High calibration unit
CALIB_PT_LO_LIMIT	The Low calibration unit

Table 3-15. CAL_STATUS Structure

	Cal Status
0	No Command Active
1	Command Executing
2	Command Done
3	Command Done: Errors

Table 3-16. Transducer Status Sub-Parameter Structure

	Transducer Status Table
0x01	A/D Failure
0x02	Sensor Failure
0x04	Dual Sensor Failure
0x08	CJC Degraded
0x10	CJC Failure
0x20	Body Temp Failure
0x40	Sensor Degraded
0x80	Body Temperature Degraded

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Table 3-17. DUAL_SENSOR CONFIG Sub-Parameter Structure

DUAL SENSOR CONFIG STRUCTURE	
Parameter	**Description**
DUAL_SENSOR_MODE	Disables or enables a sensor for configuration
DUAL_SENSOR_TAG	Differential description
INPUT_A	Sensor to be used in DUAL_SENSOR_CALC
INPUT_B	Sensor to be used in DUAL_SENSOR_CALC
DUAL_SENSOR_CALC	Equation used for the dual sensor measurement including: Not Used, Difference (Input A - Input B), and Absolute Difference (Input A - Input B)
ENG_UNITS	Units used to display sensor parameter
UPPER_RANGE	Upper Differential Limit (Input A High - Input B Low)
LOWER_RANGE	Lower Differential Limit (Input A Low - Input B High)

Table 3-18. DUAL_SENSOR_ STATUS Sub-Parameter Structure

	Dual Sensor Status Table
0x00	Active
0x01	Out of Service
0x02	Inactive
0x04	Component Sensor Open
0x08	Component Sensor Short
0x10	Component Sensor Out of Range or Degraded
0x20	Component Sensor Out of Limits
0x40	Component Sensor Inactive
0x80	Configuration Error

Table 3-19. Validation Value Sub-Parameter Structure

Validation Value Sub-Parameter Structure	
Parameter	**Description**
VALIDATION_STATUS	State of the channel specific measurement validation measurement
DEVIATION_VALUE	Deviation output value
DEVIATION_STATUS	Status of the deviation output
RATE_OF_CHANGE_VALUE	Rate of change value output
RATE_OF_CHANGE_STATUS	Status of Rate of change output

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Table 3-20. Validation Config Sub-Parameter Structure

Validation Value Sub-Parameter Structure	
Parameter	**Description**
VALIDATION_MODE	Activates the measurement validation data gathering process 0 = Disable 1 = Enable
SAMPLE_RATE	Number of seconds per sample used for measurement validation data collection. This shouldn't exceed 10 seconds per sample, but currently there are no upper limits.
DEVIATION_LIMIT	Sets the limit for the deviation diagnostic. DD limits the upper range to 10.
DEVIATION_ENG_UNITS	Units tied to the deviation output value
DEVIATION_ALERT_SEVERITY	Advisory, Maintenance, Failure 0 = Disabled = Does not use the limits, but provides an output 1 = Advisory = No effect on sensor status, sets advisory PWA 2 = Maint = Sets sensor status to uncertain, sets advisory PWA 3 = Failure = Sets sensor status to Bad, sets advisory PWA
DEVIATION_PCNT_LIM_HYST	Deviation Hysteresis Limit = (1 - DEVIATION_PCNT_LIM_HYST/100) * DEVIATION_LIMIT
RATE_INCREASING_LIMIT	Increasing Rate of Change limit set point
RATE_DECREASING_LIMIT	Decreasing Rate of Change limit set point
RATE_ENG_UNITS	Units tied to the rate of change output value
RATE_ALERT_SEVERITY	Advisory, Maintenance, Failure 0 = Disabled = Does not use the limits, but provides an output 1 = Advisory = No effect on sensor status, sets advisory PWA 2 = Maint = Sets sensor status to uncertain, sets advisory PWA 3 = Failure = Sets sensor status to Bad, sets advisory PWA
RATE_PCNT_LIM_HYST	Rate of Change Increasing Hysteresis Limit = (1 - RATE_PCNT_LIM_HYST/100) * RATE_INCREASING_LIMIT

Sensor Calibration in the Sensor Transducer Block

If the FOUNDATION fieldbus configuration tool or host system does not support the use of DD methods for device configuration, the following steps illustrate how to calibrate the sensor from the sensor transducer block:

NOTE:
Active calibrators should not be used in conduction with RTDs on any multiple input temperature transmitter such as the 848T.

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1. Under SENSOR_CALIB, the SENSOR_NUMBER to the number of the sensor to calibrate.
2. Set CALIB_UNIT to calibration unit.
3. Set CALIB_METHOD to User Trim (seeTable 3-8 on page 3-16 for valid values).
4. Set the input value of the sensor simulator to be within the range defined by CALIB_LO_LIMIT and CALIB_HI_LIMIT.
5. Set CALIB_POINT_LO (CALIB_POINT_HI) to the value set at the sensor simulator.
6. Read CALIB_STATUS and wait until it reads “Command Done”
7. Repeat steps 3 to 5 if performing a two-point trim. Note that the difference in values between CALIB_POINT_LO and CALIB_POINT_HI must be greater than CALIB_MIN_SPAN.

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Section 4 Operation and Maintenance

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Foundation fieldbus Information . . . . . page 4-1
Hardware Maintenance . . . . . page 4-3
Troubleshooting . . . . . page 4-4

SAFETY MESSAGES

Instructions and procedures in this section may require special precautions to ensure the safety of the personnel performing the operations. Information that potentially raises safety issues is indicated by a warning symbol (⚠). Please refer to the following safety messages before performing an operation preceded by this symbol.

Warnings

⚠WARNING

Failure to follow these installation guidelines could result in death or serious injury.

- Make sure only qualified personnel perform the installation.

Process leaks could result in death or serious injury.

- Do not remove the thermowell while in operation. Removing while in operation may cause process fluid leaks.
- Install and tighten thermowells and sensors before applying pressure, or process leakage may result.

Electrical shock could cause death or serious injury.

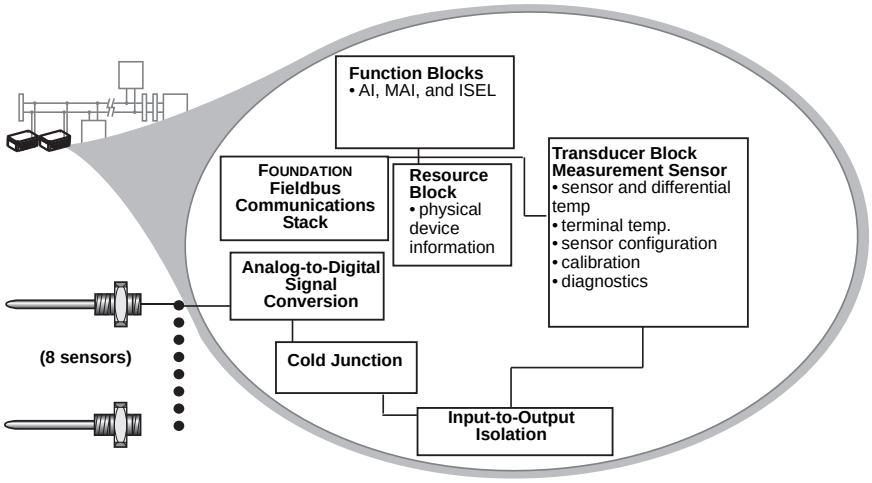
- If the senor is installed in a high voltage environment and a fault condition or installation error occurs, high voltage may be present on transmitter leads and terminals.
- Use extreme caution when making contact with the leads and terminals.

FOUNDATION FIELDBUS INFORMATION

FOUNDATION fieldbus is an all-digital, serial, two-way, multidrop communication protocol that interconnects devices such as transmitters and valve controllers. It is a local area network (LAN) for instruments that enable basic control and I/O to be moved to the field devices. The Model 848T uses FOUNDATION fieldbus technology developed and supported by Emerson Process Management and the other members of the independent Fieldbus FOUNDATION.

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Table 4-1. Block Diagram for the Rosemount 848T



Commissioning (Addressing)

To be able to setup, configure, and have it communicate with other devices on a segment, a device must be assigned a permanent address. Unless requested otherwise, it is assigned a temporary address when shipped from the factory.

If there are two or more devices on a segment with the same address, the first device to start up will use the assigned address (ex. Address 20). Each of the other devices will be given one of the four available temporary addresses. If a temporary address is not available, the device will be unavailable until a temporary address becomes available.

Use the host system documentation to commission a device and assign a permanent address.

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HARDWARE MAINTENANCE

The 848T has no moving parts and requires a minimal amount of scheduled maintenance. If a malfunction is suspected, check for an external cause before performing the diagnostics presented below.

Sensor Check

⚠ To determine whether the sensor is causing the malfunction, connect a sensor calibrator or simulator locally at the transmitter. Consult an Emerson Process Management representative for additional temperature sensor and accessory assistance.

Communication/Power Check

If the transmitter does not communicate or provides an erratic output, check for adequate voltage to the transmitter. The transmitter requires between 9.0 and 32.0 VDC at the terminals to operate with complete functionality. Check for wire shorts, open circuits, and multiple grounds.

Resetting the Configuration (RESTART)

There are two types of restarts available in the Resource Block. The following section outlines the usage for each of these. For further information, see RESTART in Table 3-2 on page 3-6.

Restart Processor (cycling)

Performing a Restart **Processor** has the same effect as removing power from the device and reapplying power.

Restart with Defaults

Performing a Restart with **Defaults** resets the static parameters for all of the blocks to their initial state. This is commonly used to change the configuration and/or control strategy of the device, including any custom configurations done at the Rosemount factory.

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TROUBLESHOOTING

FOUNDATION fieldbus

Symptom	Possible Cause	Corrective Action
Device does not show up in the live list	Network configuration parameters are incorrect	Set the network parameters of the LAS (host system) according to the FF Communications Profile
		ST: 8
		MRD: 4
		DLPDU PhLO: 4
		MID: 7
		TSC: 4 (1 ms)
		T1: 96000 (3 seconds)
		T2: 9600000 (300 seconds)
		T3: 480000 (15 seconds)
	Network address is not in polled range	Set first Unpolled Node and Number of UnPolled Nodes so that the device address is within range
	Power to the device is below the 9 VDC minimum	Increase the power to at least 9V
	Noise on the power / communication is too high	Verify terminators and power conditioners are within specification Verify that the shield is properly terminated and not grounded at both ends. It is best to ground the shield at the power conditioner
Device that is acting as a LAS does not send out CD	LAS Scheduler was not downloaded to the Backup LAS device	Ensure that all of the devices that are intended to be a Backup LAS are marked to receive the LAS schedule
All devices go off live list and then return	Live list must be reconstructed by Backup LAS device	Current link setting and configured links settings are different. Set the current link setting equal to the configured settings.

Resource Block

Symptom	Possible Causes	Corrective Action
Mode will not leave OOS	Target mode not set	Set target mode to something other than OOS.
	Memory Failure	BLOCK_ERR will show the lost NV Data or Lost Static Data bit set. Restart the device by setting RESTART to Processor. If the block error does not clear, call the factory.
Block Alarms Will not work	Features	FEATURES_SEL does not have Alerts enabled. Enable the report bit.
	Notification	LIM_NOTIFY is not high enough. Set equal to MAX_NOTIFY.

Transducer Block Troubleshooting

Symptom	Possible Causes	Corrective Action
Mode will not leave OOS	Target mode not set	Set target mode to something other than OOS.
	A/D board check sum error	The A/D board has a checksum error.
	Resource block	The actual mode of the Resource block is in OOS. See Resource Block Diagnostics for corrective action.
	Transducer Block	The actual mode of the Transducer Block is OOS.
The primary value is BAD	Measurement	Look at the SENSOR_STATUS parameter (See Table 3-16 on page 3-21)

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Appendix A Reference Data

Functional Specifications . . . . . page A-1
Physical Specifications . . . . . page A-3
Performance Specifications . . . . . page A-4
Function Blocks . . . . . page A-4
Dimensional Drawings . . . . . page A-8
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FUNCTIONAL SPECIFICATIONS

Inputs

Eight independently configurable channels including combinations of 2- and 3-wire RTDs, thermocouples, mV, 2- and 3-wire and ohm inputs.

4–20 mA inputs using optional connector(s).

Outputs

Manchester-encoded digital signal that conforms to IEC 61158 and ISA 50.02.

Status

- 600 Vdc channel to channel isolation(1)
- 10 Vdc channel to channel isolation for all operating conditions with maximum 150 m. (500 ft) of sensor lead length 18 AWG.

Ambient Temperature Limits

–40 to 185 °F (–40 to 85 °C)

Isolation

Isolation between all sensor channels is rated to 10Vdc over all operating conditions. No damage will occur to the device with up to 600 Vdc between any sensor channel.

Power Supply

Powered over FOUNDATION fieldbus with standard fieldbus power supplies. The transmitter operates between 9.0 and 32.0 V dc, 22 mA maximum. (Transmitter power terminals are rated to 42.4 V dc.)

(1) Reference conditions are -40 to 60 °C (-40 to 140 °F) with 30 m. (100 ft) of sensor lead length 18 AWG wire.

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Transient Protection

The transient protector (option code T1) helps to prevent damage to the transmitter from transients induced on the loop wiring by lightning, welding, heavy electrical equipment, or switch gears. This option is installed at the factory for the Rosemount 848T and is not intended for field installation.

Update Time

Approximately 1.5 seconds to read all 8 inputs.

Humidity Limits

0–99% non-condensing relative humidity

Turn-on Time

Performance within specifications is achieved in less than 30 seconds after power is applied to the transmitter.

Alarms

The AI and ISEL function blocks allow the user to configure the alarms to HI-HI, HI, LO, or LO-LO with a variety of priority levels and hysteresis settings.

Backup Link Active Scheduler (LAS)

The transmitter is classified as a device link master, which means it can function as a Link Active Scheduler (LAS) if the current link master device fails or is removed from the segment.

The host or other configuration tool is used to download the schedule for the application to the link master device. In the absence of a primary link master, the transmitter will claim the LAS and provide permanent control for the H1 segment.

FOUNDATION fieldbus Parameters

Schedule Entries	20
Links	30
Virtual Communications Relationships (VCR)	20

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PHYSICAL SPECIFICATIONS

Mounting

The Rosemount 848T can be mounted directly onto a DIN rail or it can be ordered with an optional junction box. When using the optional junction box, the transmitter can be mounted onto a panel or a 2-in. pipe stand (with option code B6).

Entries for Optional Junction Box

No entry

- Used for custom fittings

Cable Gland

- 9 x M20 nickel-plated brass glands for 7.5–11.9 mm unarmored cable

Conduit

- 5 plugged 0.86-in. diameter holes suitable for installing ½-in. NPT fittings.

Materials of Construction for Optional Junction Box

Junction Box Type	Paint
Aluminum	Epoxy Resin
Plastic	NA
Stainless Steel	NA
Aluminum Explosion-proof	NA

Weight

Assembly	Weight		
	oz	lb	kg
Rosemount 848T only	7.5	.47	.208
Aluminum(1)	78.2	4.89	2.22
Plastic (1)	78.2	4.89	2.22
Stainless Steel (1)	77.0	4.81	2.18
Aluminum Explosion-proof	557	34.8	15.5

(1) Add 35.2 oz. (2.2 lb., 0.998 kg) for nickel-plated brass glands

Environmental Ratings

NEMA Type 4X and IP66 with optional junction box. JX3 Explosion-proof enclosure rated to -4 °F (-20 °C).

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FUNCTION BLOCKS

Analog Input (AI)

- Processes the measurement and makes it available on the fieldbus segment.
- Allows filtering, alarming, and engineering unit changes.

Input Selector (ISEL)

- Used to select between inputs and generate an output using specific selection strategies such as minimum, maximum, midpoint, or average temperature.
- Since the temperature value always contains the measurement status, this block allows the selection to be restricted to the first “good” measurement.

Multiple Analog Input Block (MAI)

- The MAI block allows the eight AI blocks to be multiplexed together so they serve as one function block on the H1 segment, resulting in greater network efficiency.

PERFORMANCE SPECIFICATIONS

Stability

- ±0.1% of reading or 0.1 °C (0.18 °F), whichever is greater, for 2 years for RTDs
- ±0.1% of reading or 0.1 °C (0.18 °F), whichever is greater, for 1 year for thermocouples.

Self Calibration

The transmitter’s analog-to-digital circuitry automatically self-calibrates for each temperature update by comparing the dynamic measurement to extremely stable and accurate internal reference elements.

Vibration Effect

Transmitters are tested to high pipeline vibration specification per IEC 60770-1 1999 with no effect on performance.

Electromagnetic Compatibility Compliance Testing

- Meets the criteria under IEC 61326:2006
- Meets the criteria under European Union Directive 2004/108/EC

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Accuracy

Table 1. Input Options/Accuracy

Sensor Option	Sensor Reference	Input Ranges		Accuracy Over Range(s)	
		°C	°F	°C	°F
2- and 3-Wire RTDs					
Pt 50 (α = 0.00391)	GOST 6651-94	–200 to 550	–328 to 1022	± 0.57	± 1.03
Pt 100 (α = 0.00391)	GOST 6651-94	–200 to 550	–328 to 1022	± 0.28	± 0.50
Pt 100 (α = 0.00385)	IEC 751; α = 0.00385, 1995	–200 to 850	–328 to 1562	± 0.30	± 0.54
Pt 100 (α = 0.003916)	JIS 1604, 1981	–200 to 645	–328 to 1193	± 0.30	± 0.54
Pt 200 (α = 0.00385)	IEC 751; α = 0.00385, 1995	–200 to 850	–328 to 1562	± 0.54	± 0.98
Pt 200 (α = 0.003916)	JIS 1604; α = 0.003916, 1981	–200 to 645	–328 to 1193	± 0.54	± 0.98
Pt 500	IEC 751; α = 0.00385, 1995	–200 to 850	–328 to 1562	± 0.38	± 0.68
Pt 1000	IEC 751; α = 0.00385, 1995	–200 to 300	–328 to 572	± 0.40	± 0.72
Ni 120	Edison Curve No. 7	–70 to 300	–94 to 572	± 0.30	± 0.54
Cu 10	Edison Copper Winding No. 15	–50 to 250	–58 to 482	± 3.20	± 5.76
Cu 100 (a=428)	GOST 6651-94	-185 to 200	-365 to 392	± 0.48	±0.86
Cu 50 (a=428)	GOST 6651-94	-185 to 200	-365 to 392	± 0.96	±1.73
Cu 100 (a=426)	GOST 6651-94	-50 to 200	-122 to 392	± 0.48	±0.86
Cu 50 (a=426)	GOST 6651-94	-50 to 200	-122 to 392	± 0.96	±1.73
Thermocouples—Cold Junction Adds + 0.5 °C to Listed Accuracy					
NIST Type B (Accuracy varies according to input range)	NIST Monograph 175	100 to 300 301 to 1820	212 to 572 573 to 3308	± 6.00 ± 1.54	± 10.80 ± 2.78
NIST Type E	NIST Monograph 175	–200 to 1000	–328 to 1832	± 0.40	± 0.72
NIST Type J	NIST Monograph 175	–180 to 760	–292 to 1400	± 0.70	± 1.26
NIST Type K	NIST Monograph 175	–180 to 1372	–292 to 2501	± 1.00	± 1.80
NIST Type N	NIST Monograph 175	–200 to 1300	–328 to 2372	± 1.00	± 1.80
NIST Type R	NIST Monograph 175	0 to 1768	32 to 3214	± 1.50	± 2.70
NIST Type S	NIST Monograph 175	0 to 1768	32 to 3214	± 1.40	± 2.52
NIST Type T	NIST Monograph 175	–200 to 400	–328 to 752	± 0.70	± 1.26
DIN L	DIN 43710	–200 to 900	–328 to 1652	± 0.70	± 1.26
DIN U	DIN 43710	–200 to 600	–328 to 1112	± 0.70	± 1.26
w5Re26/W26Re	ASTME 988-96	0 to 2000	32 to 3632	± 1.60	± 2.88
GOST Type L	GOST R 8.585-2001	-200 to 800	-392 to 1472	± 0.71	± 1.28
Terminal Temperature		-50 to 85	-58 to 185	±3.50	± 6.30
Ohm Input		0 to 2000 ohms		± 0.90 ohms	
Millivolt Input		-10 to 100 mV		± 0.05 mV	
1000 mV		-10 to 1000 mV		± 1.0 mA	
4–20 mA (Rosemount)(1)		4–20 mA		± 0.01 mA	
4–20 mA (NAMUR)(1)		4–20 mA		± 0.01 mA	
Multipoint Sensors(2)					

(1) Requires the S002 option code.
(2) Multipoint (up to 8 points) thermocouples and RTDs are available for purchase with the Rosemount 848T. Input ranges and accuracy for these sensors will depend on the specific multipoint sensor chosen. For more information, contact your local Emerson representative.

Differential Configuration Notes

Differential capability exists between any two sensor types.

For all differential configurations, the input range is X to Y where X = Sensor A minimum - Sensor B max.
Y = Sensor A maximum - Sensor B min.

Accuracy for Differential Configurations:

If sensor types are similar (for example, both RTDs or both thermocouples), the accuracy = 1.5 times worst case accuracy of either sensor type.
If sensor types are dissimilar (for example, one RTD and one thermocouple), the accuracy = Sensor 1 Accuracy + Sensor 2 Accuracy.

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Analog Sensors 4–20mA

Two types of 4–20 mA sensors are compatible with the Rosemount 848T. These types must be ordered with the S002 option code complete with an analog connector kit. The alarm levels, accuracy for each type are listed in Table 2.

Table 2. Analog Sensors

Sensor Option	Alarm Levels	Accuracy
4–20mA (Rosemount Standard)	3.9 to 20.8 mA	± 0.01mA
4–20mA (NAMUR)	3.8 to 20.5 mA	± 0.01mA

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Ambient Temperature Effect

Transmitter may be installed in locations where the ambient temperature is between -40 and 85 °C (-40 and 185 °F)

Table 3. Ambient Temperature Effects

NIST Type	Accuracy per 1.0 °C (1.8 °F) Change in Ambient Temperature[(1)]C	Temperature Range (°C)
RTD		
Pt 50 (α = 0.00391)	• 0.004 °C (0.0072 °F)	NA
Pt 100 (α = 0.00391)	• 0.002 °C (0.0036 °F)	NA
Pt 100 (α = 0.00385)	• 0.003 °C (0.0054 °F)	NA
Pt 100 (α = 0.003916)	• 0.003 °C (0.0054 °F)	NA
Pt 200 (α = 0.003916)	• 0.004 °C (0.0072 °F)	NA
Pt 200 (α = 0.00385)	• 0.004 °C (0.0072 °F)	NA
Pt 500	• 0.003 °C (0.0054 °F)	NA
Pt 1000	• 0.003 °C (0.0054 °F)	NA
Cu 10	• 0.03 °C (0.054 °F)	NA
Cu 100 (a=428)	• 0.002 °C (0.0036 °F)	NA
Cu 50 (a=428)	• 0.004 °C (.0072 °F)	NA
Cu 100 (a=426)	• 0.002 °C (0.0036 °F)	NA
Cu 50 (a=426)	• 0.004 °C (.0072 °F)	NA
Ni 120	• 0.003 °C (0.0054 °F)	NA
Thermocouple (R = the value of the reading)		
Type B	• 0.014 °C • 0.032 °C - (0.0025% of (R - 300)) • 0.054 °C - (0.011% of (R - 100))	• R ≥ 1000 • 300 ≤ R < 1000 • 100 ≤ R < 300
Type E	• 0.005 °C + (0.00043% of R)	• All
Type J, DIN Type L	• 0.0054 °C + (0.00029% of R) • 0.0054 °C + (0.0025% of |R|)	• R ≥ 0 • R < 0
Type K	• 0.0061 °C + (0.00054% of R) • 0.0061 °C + (0.0025% of |R|)	• R ≥ 0 • R < 0
Type N	• 0.0068 °C + (0.00036% of R)	• All
Type R, Type S	• 0.016 °C • 0.023 °C - (0.0036% of R)	• R ≥ 200 • R < 200
Type T, DIN Type U	• 0.0064 °C • 0.0064 °C + (0.0043% of |R|)	• R ≥ 0 • R < 0
GOST Type L	• 0.007 °C • 0.007 °C + (0.003% of IRI)	• R ≥ 0 • R < 0
Millivolt	• 0.0005 mV	NA
2- and 3-wire Ohm	• 0.0084 ohms	NA
4–20 mA (Rosemount)	• 0.0001 mA	NA
4-20 mA (NAMUR)	• 0.0001 mA	NA

(1) Change in ambient is in reference to the calibration temperature of the transmitter (20 °C (68 °F) typical from the factory).

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Ambient Temperature Notes
Examples:

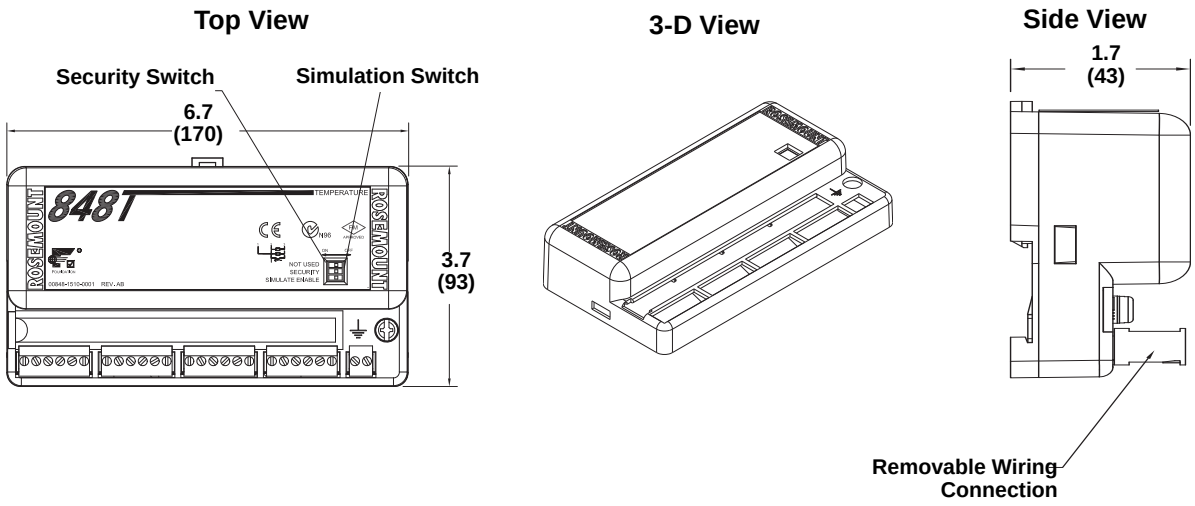
When using a Pt 100 (α = 0.00385) sensor input at 30 °C ambient temperature:

- Digital Temperature Effects: 0.003 °C x (30 - 20) = .03 °C
- Worst Case Error: Digital + Digital Temperature Effects = 0.3 °C + .03 °C = .33 °C
- Total Probable Error $\sqrt{0.30^2 + 0.03^2} = 0.30°C$

DIMENSIONAL DRAWINGS

Junction Boxes with no entries (option codes JP1, JA1, and JS1)– external dimensions are the same as those outlined for the other junction box materials in this section.

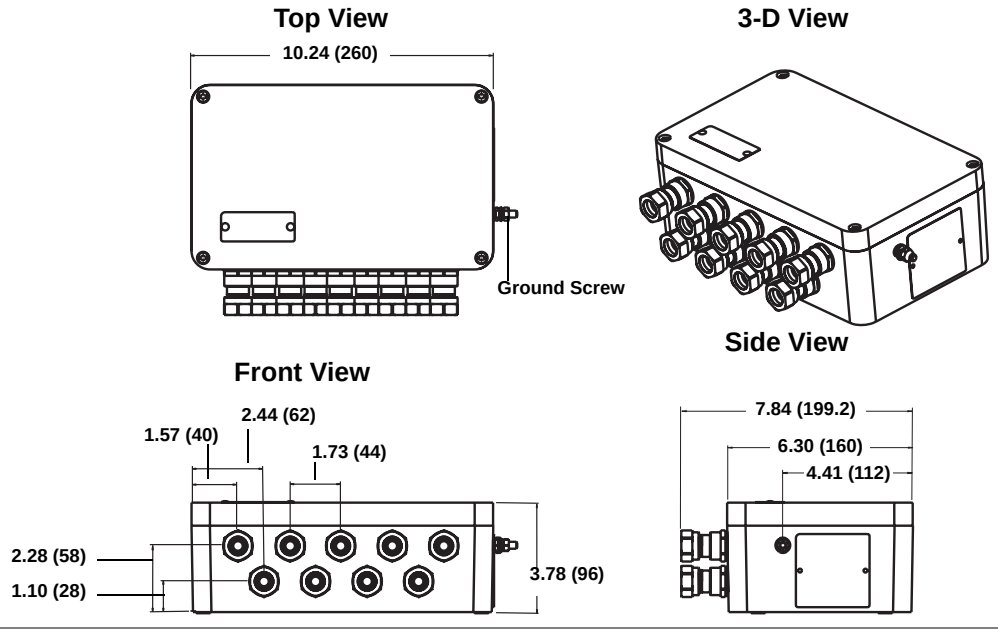
Rosemount 848T



Dimensions are in inches (millimeters)

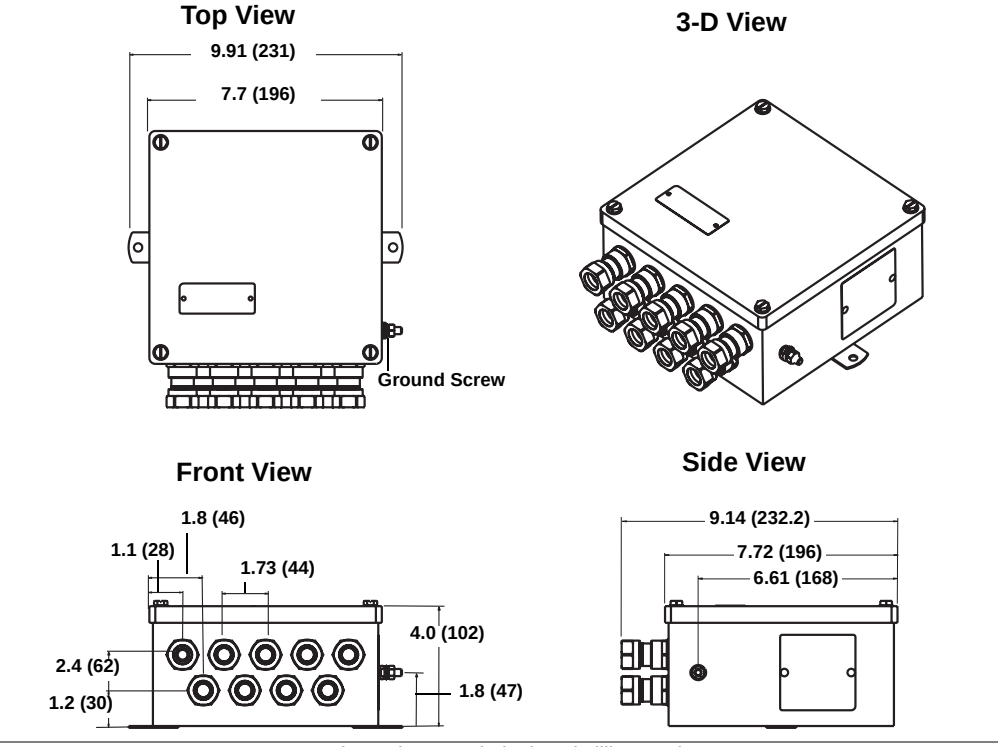
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Aluminum/Plastic Junction Box—Cable Gland (option codes JA2 and JP2)



Dimensions are in inches (millimeters)

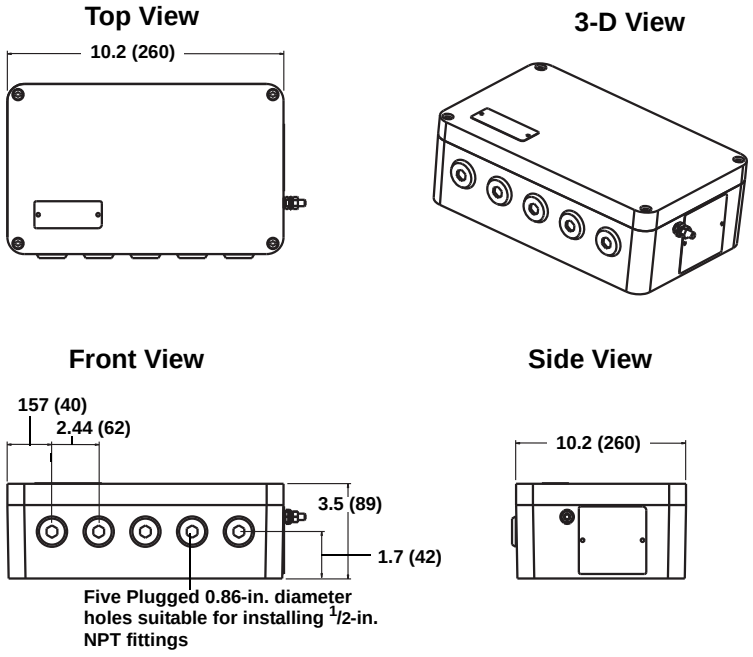
Stainless Steel Junction Box—Cable Gland (option code JS2)



Dimensions are in inches (millimeters)

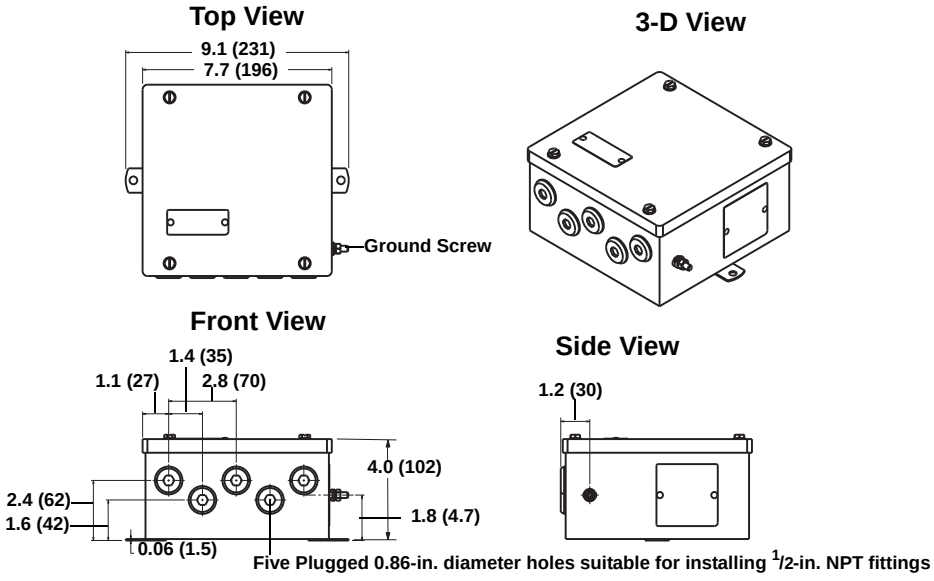
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Aluminum/Plastic Junction Box—Conduit Entry (option codes JA3 and JP3)



Dimensions are in inches (millimeters)

Stainless Steel Junction Box—Conduit Entry (option code JS3)



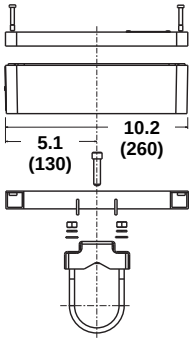
Dimensions are in inches (millimeters)

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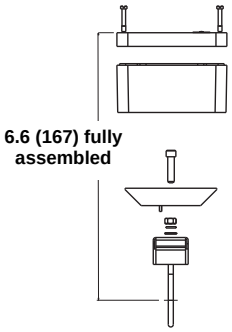
Mounting Options

Aluminum/Plastic Junction Box (styles JA and JP)

Front View

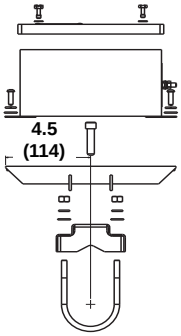


Side View

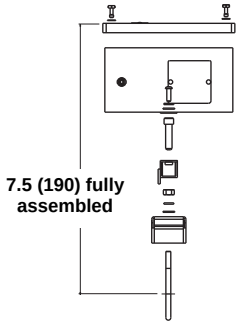


Stainless Steel Junction Box (style JS)

Front View

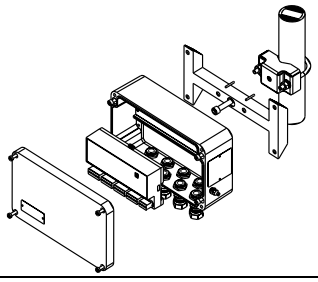


Side View

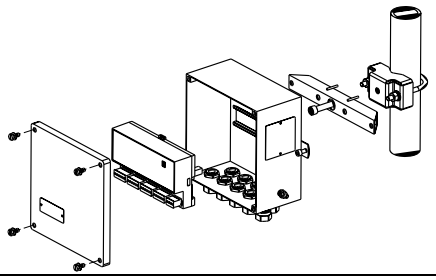


Dimensions are in inches (millimeters)

Aluminum/Plastic Junction Box Mounted on a Vertical Pipe



Stainless Steel Junction Box Mounted on a Vertical Pipe



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ORDERING INFORMATION

Table A-1. Rosemount 848T FOUNDATION fieldbus Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery.
The Expanded offering is subject to additional delivery lead time.

Model	Product Description		
848T	High Density Temperature Measurement Family		
Transmitter Output			
Standard			**Standard**
F	FOUNDATION fieldbus digital signal (includes AI, MAI, and ISEL function blocks, and Backup Link Active Scheduler)		★
Product Certifications[1]		**Rosemount Junction Box required?**	
Standard			**Standard**
I1	ATEX Intrinsic Safety	No	★
I3	NEPSI Intrinsic Safety	No	★
I4	TIIS Intrinsically Safety (FISCO) Type '1a'	No	★
H4	TIIS Intrinsic Safety (FISCO) Type '1b'	No	★
I5[2]	FM Intrinsically Safe	No	★
I6[2]	CSA Intrinsically Safe	No	★
I7	IECEx Intrinsic Safety	No	★
IA	ATEX FISCO Intrinsic Safety	No	★
IE	FM FISCO Intrinsically Safe	No	★
IF[2]	CSA FISCO Intrinsically Safe, Division 2	No	★
IG	IECEx FISCO (Intrinsic Safety)	No	★
N1	ATEX Type n (enclosure required)	Yes	★
N5	FM Class I, Division 2, and Dust Ignition-proof (enclosure required)	Yes	★
N6	CSA Class I, Division 2	No	★
N7	IECEx Type n (enclosure required)	Yes	★
NC	ATEX Type n Component (Ex nA nL)	No[3]	★
ND	ATEX Dust (enclosure required)	Yes	★
NJ	IECEx Type n Component (Ex nA nL)	No[3]	★
NK	FM Class 1, Division 2	No	★
NA	No Approval	No	★
Expanded			
E6	CSA Explosion-proof, Dust Ignition-proof, Division 2 (JX3 enclosure required)	Yes[4]	

Options (Include with selected model number)

Input Types		
Standard		**Standard**
S001	RTD, Thermocouple, mV, Ohm Inputs	★
S002[5]	RTDs, Thermocouple, mV, Ohm and 4–20 mA Inputs	★
PlantWeb Advanced Diagnostics		
Standard		**Standard**
D04	Measurement Validation Diagnostic	★
Transient Protection		
Standard		**Standard**
T1	Integral Transient Protector	★
Mounting Bracket		
B6	Mounting Bracket for 2-in. pipe mounting – SST bracket and bolts	★

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Table A-1. Rosemount 848T FOUNDATION fieldbus Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery.
The Expanded offering is subject to additional delivery lead time.

Enclosure Options		
Standard		**Standard**
JP1	Plastic Junction Box; No Entries	★
JP2	Plastic Box, Cable Glands (9 x M20 nickel-plated brass glands for 7.5–11.9 mm unarmored cable)	★
JP3	Plastic Box, Conduit Entries (5 Plugged Holes, suitable for installing $^1/_2$-in. NPT fittings)	★
JA1	Aluminum Junction Box; No Entries	★
JA2	Aluminum Cable Glands (9 x M20 nickel-plated brass glands for 7.5–11.9 mm unarmored cable)	★
JA3	Aluminum Conduit Entries (5 Plugged Holes, suitable for installing $^1/_2$-in. NPT fittings)	★
JS1	Stainless Steel Junction Box; No Entries	★
JS2	Stainless Steel Box, Cable Glands (9 x M20 nickel-plated brass glands for 7.5–11.9 mm unarmored cable)	★
JS3	Stainless Steel Box, Conduit Entries (5 Plugged Holes, suitable for installing $^1/_2$-in. NPT fittings)	★
JX3(6)	Explosion-proof Box, Conduit Entries (4 Plugged Holes, suitable for installing $^1/_2$-in. NPT fittings)	★
Software Configuration		
Standard		**Standard**
C1	Custom Configuration of Date, Descriptor, Message and Wireless Parameters (Requires CDS with Order)	★
Line Filter		
Standard		**Standard**
F5	50 Hz Line Voltage Filter	★
Calibration Certificate		
Standard		**Standard**
Q4	Calibration Certificate (3-Point Calibration)	★
Shipboard Certification		
Standard		**Standard**
SBS	American Bureau of Shipping (ABS) Type Approval	★
SLL	Lloyd's Register (LR) Type Approval	★
Special Temperature Test		
Expanded		
LT	Test to -60 °F (-51.1 °C)	
Conduit Electrical Connector		
Standard		**Standard**
GE(7)	M12, 4-pin, Male Connector (eurofast®)	★
GM(7)	A size Mini, 4-pin, Male Connector (minifast®)	★
Typical Model Number: 848T F I5 S001 T1 B6 JA2		

(1) Consult factory for availability.
(2) Available only with S001 option.
(3) The Rosemount 848T ordered with component approval is not approved as a stand-alone unit. Additional system certification is required.
(4) Enclosure Option JX3 must be ordered with Product Certification Code E6. (O-ring for the JX3 enclosure rated to -20 °C).
(5) S002 is only available with Product Certification N5, N6, N1, NC, NK, and NA.
(6) JX3 Explosion-proof enclosure rated to -4 °F (-20 °C).
(7) Available with no approval or Intrinsically Safe approvals only. For FM Intrinsically Safe (option code I5), install in accordance with Rosemount drawing 00848-4402.

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Appendix B Product Certificates

Hazardous Locations Certificates . . . . . page B-1
Intrinsically Safe and Non-Incendive Installations . . . . . page B-11
Installation Drawings . . . . . page B-12

HAZARDOUS LOCATIONS CERTIFICATES

North American Approvals

Factory Mutual (FM) Approvals

I5 Intrinsically Safe and Non-Incendive
Intrinsically Safe for use in Class I, Division 1, Groups A, B, C, D; when installed per Rosemount drawing 00848-4404.

Temperature Code:
T4 (T_{amb} = –40 to 60 °C)

Non-Incendive for use in Class I, Division 2, Groups A, B, C, D (suitable for use with Non-Incendive field wiring) when installed in accordance with Rosemount Drawing 00848-4404.

Temperature Code:
T4A (T_{amb} = -40 to 85 °C)
T5 (T_{amb} = -40 to 70 °C)
Rosemount Enclosure Required.
Indoor Hazardous (Classified) Locations.

Table B-1. FM Approved Entity Parameters

Power/Bus	Sensor(1)
V_{max} = 30 V	V_{OC} = 12.5 V
I_{max} = 300 mA	I_{SC}= 4.8 mA
P_i = 1.3 W	P_o = 15 mW
C_i = 2.1 nF	C_A = 1.2 µF
L_i = 0	L_A = 1 H

(1) Entity parameters apply to entire device, not individual sensor channels.

Table B-2. Entity Parameters for Non Incendive Field Wiring

Power/Bus	Sensor(1)
V_{max} = 42.4 V	V_{OC} = 12.5 V
C_i = 2.1nF	I_{SC} = 4.8 mA
L_i = 0	P_o = 15 mW
	C_A = 1.2 µF
	L_A = 1 H

(1) Entity parameters apply to entire device, not individual sensor channel.

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IE FISCO (Fieldbus Intrinsically Safe Concept) Intrinsic Safety
Intrinsically safe for use in Class I, Division 1, Groups A, B, C, D; when installed in accordance with Rosemount Drawing 00848-4404.

Temperature Code:
T4 (T_{amb} = –40 to 60 °C)

Non-incendive for use in Class I, Division 2, Groups A, B, C, D (suitable for use with non-incendive field wiring); when installed in accordance with Rosemount Drawing 00848-4404.

Temperature Code:
T4A (T_{amb} = –40 to 85 °C)
T5 (T_{amb} = –40 to 70 °C)

Table B-3. Entity Parameters

Power/Bus	Sensor(1)
V_{max} = 17.5 V	V_{OC} = 12.5 V
I_{max} = 380 mA	I_{SC} = 4.8 mA
P_i = 5.32 W	P_o = 15 mW
C_i = 2.1nF	C_A = 1.2 µF
L_i = 0	L_A = 1 H

(1) Entity parameters apply to entire device, not individual sensor channels.

N5 Dust Ignition-Proof
For use in Class II, III, Division 1, Groups E, F, G. Class I, Division 2, Groups A, B, C, D;
Non-incendive for Class 1, Division 2, Groups A, B, C, D when installed to Rosemount Control Drawing 00848-4404.
Rosemount Enclosure Required.
Valid with both S001 and S002 options.

Temperature Code:
T4A (T_{amb} = –40 to 85 °C)
T5 (T_{amb} = –40 to 70 °C)

NK Non-Incendive for use in Class I, Division 2, Groups A, B, C, D (suitable for use with Non-Incendive field wiring) when installed in accordance with Rosemount Drawing 00848-4404.

Temperature Code:
T4A (T_{amb} = -40 to 85 °C)
T5 (T_{amb} = -40 to 70 °C)
Rosemount Enclosure Required.
Indoor Hazardous (Classified) Locations.

Table B-4. FM Approved Entity Parameters(1)

Power/Bus	Sensor
V_{max} = 42.4 V	V_{OC} = 12.5 V
C_i = 2.1 µF	I_{SC} = 4.8 mA
L_i = 0 H	P_o = 15 mW
	C_A = 1.2 µF
	L_A = 1 H

(1) Intrinsically safe and non-incendive parameters.

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Canadian Standards Association (CSA) Certifications

E6 Explosion-Proof and Dust Ignition-Proof
Class I, Division 1, Groups B, C, and D.

Class II, Division 1, Groups E, F, and G.
Class III

Must be installed in enclosure option JX3.
Install per drawing 00848-1041.
Conduit seal not required.

Suitable for use in Class I, Division 2, Groups A, B, C, D. when installed per Rosemount drawing 00848-4405.
Temperature Code:
T3C = ($-50 \leq T_{amb} \leq 60$ °C)
Must be installed in a suitable enclosure as determined acceptable by the local inspection authority.

I6 Intrinsically Safe, Division 2
For use in Class I, Division 1, Groups A, B, C, D; when installed per Rosemount drawing 00848-4405.

Temperature Code:
T3C (T_{amb} = –50 to 60 °C)

Suitable for Class I, Division 2, Groups A, B, C, D. Rated 42.4 VDC max.
Not valid with S002 option.

Table B-5. CSA Approved Entity Parameters

Power/Bus	Sensor(1)
V_{max} = 30 V	V_{OC} = 12.5 V
I_{max} = 300 mA	I_{SC} = 4.8 mA
C_i = 2.1nF	P_o = 15 mW
L_i = 0	C_A = 1.2 µF
	L_A = 1 H

(1) Entity parameters apply to entire device, not individual sensor channels.

IF FISCO (Intrinsically Safe)
For use in Class I, Division 1, Groups A, B, C, D; when installed per Rosemount drawing 00848-4405.

Temperature Code:
T3C (T_{amb} = –50 to 60 °C)

Suitable for Class I, Division 2, Groups A, B, C, D. Rated 42.4 VDC max.
Not valid with S002 option.

Table B-6. CSA Approved Entity Parameters

Power/Bus	Sensor(1)
U_i = 17.5 V	V_{OC} = 12.5 V
I_i = 380 mA	I_{SC} = 4.8 mA
P_i = 5.32 W	P_o = 15 mW
C_i = 2.1nF	C_a = 1.2 µF
L_i = 0	L_a = 1 H

(1) Entity parameters apply to entire device, not individual sensor channels.

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N6 Class I, Division 2
Suitable for use in Class I, Division 2, Groups A, B, C, D. when installed per Rosemount drawing 00848-4405.
Temperature Code:
T3C = ($-50 \leq T_a \leq 60$ °C)
Must be installed in a suitable enclosure as determined acceptable by the local inspection authority.

European Approvals

ATEX Certifications

I1 Intrinsic Safety
Certification Number: Baseefa09ATEX0093X
ATEX Marking ⟨Ex⟩ II 1 G
Ex ia IIC T4 (T_{amb} = –50 to 60 °C)
CE 1180

Table B-7. ATEX Approved Entity Parameters

Power/Bus	Sensor
U_i = 30 V	U_o = 12.5 V
I_i = 300 mA	I_o = 4.8 mA
P_i = 1.3 W	P_o = 15 mW
C_i = 0	C_i = 1.2 µF
L_i = 0	L_i = 1 H

Special Conditions for Safe Use (x):

1. This apparatus must be installed in an enclosure which affords it a degree of protection of at least IP20. Non-metallic enclosures must have a surface resistance of less than 1Gohm. Light alloy or zirconium enclosures must be protected from impact and friction when installed.
2. The apparatus will not meet the 500V rms isolation test required by Clause 6.4.12 on EN 60079-11:2007. This must be taken into account when installing the apparatus.

IA FISCO (Fieldbus Intrinsically Safe Concept) Intrinsic Safety
Certificate Number: BASEEFA09ATEX0093X
ATEX Marking ⟨Ex⟩ II 1 G
Ex ia IIC T4 (T_{amb} = –50 to 60 °C)
CE 1180

Table B-8. ATEX Approved Entity Parameters

Power/Bus	Sensor
U_i = 17.5 V	U_o = 12.5 V
I_i = 380 mA	I_o = 4.8 mA
P_i = 5.32 W	P_o = 15 mW
C_i = 0	C_i = 1.2 µF
L_i = 0	L_i = 1 H

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Special Conditions for Safe Use (x):

1. This apparatus must be installed in an enclosure which affords it a degree of protection of at least IP20. Non-metallic enclosures must have a surface resistance of less than 1Gohm. Light alloy or zirconium enclosures must be protected from impact and friction when installed.
2. The apparatus will not meet the 500V rms isolation test required by Clause 6.4.12 on EN 60079-11:2007. This must be taken into account when installing the apparatus.

NE ATEX TYPE ‘n’ APPROVAL
Certification Number: BASEFFA09ATEX0095X
ATEX Marking ⟨Ex⟩ II 3 G
Ex nA nL IIC T5 (T_{amb} = –40 to 65 °C)

Table B-9. Baseefa Approved Entity Parameters

Power/Bus	Sensor
U_i = 42.4 Vdc	U_o = 5 Vdc
C_i = 0	I_o = 2.5 mA
L_i = 0	C_o = 1000 µF
	L_o = 1000 mH

Special Conditions for Safe Use (x):

1. Provisions shall be made, external to the apparatus to prevent the rated voltage (42.4 Vdc) from being exceeded by transient disturbances of more than 40%.
2. The ambient temperature range of use shall be the most restrictive of the apparatus, cable gland, or blanking plug.

NOTE:
NE is valid with S001 Input Type ONLY

N1 ATEX Type n
Certification Number: Baseefa09ATEX0095X
ATEX Marking ⟨Ex⟩ II 3 G
Ex nL IIC T5 (T_{amb} = –40 to 65 °C)

Table B-10. Entity Parameters

Power/Bus	Sensor
U_i = 42.4 Vdc	U_o = 12.5 Vdc
C_i = 0	I_o = 4.8 mA
L_i = 0	P_o = 15 mW
	C_o = 1.2 µF
	L_o = 1 H

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Special Conditions for Safe Use (x):

1. Provisions shall be made, external to the apparatus, to prevent the rated voltage of the apparatus supply is not exceeded by transient disturbances of more than 40%
2. The electrical circuit is connected directly to earth; this must be taken into account when installing the apparatus.

NC ATEX Type n Component
Certification Number: Baseefa09ATEX0094U
ATEX Marking ⟨Ex⟩ II 3 G
Ex nA nL IIC T4 (T_{amb} = –50 to 85 °C)
Ex nA nL IIC T5 (T_{amb} = –50 to 70 °C)

Special Conditions for Safe Use (x):

1. The component must be housed in a suitable certified enclosure that provides a degree of protection of at least IP54 and meets the relevant material and environmental requirements of EN 60079-0, and EN-60079-15.
2. Provisions shall be made, external to the apparatus, to prevent the rated voltage (42.4 VDC) being exceeded by transient disturbances of more than 40%.
3. The electrical circuit is connected directly to earth: this must be taken into account when installing the apparatus.

NOTE
NC is valid with S001 Input Type ONLY

ND ATEX Dust Ignition Proof
Certification Number: BAS01ATEX1315X
ATEX Marking ⟨Ex⟩ II 1 D
T90C (T_{amb} = – 40 to 65 °C) IP66

Special Conditions for Safe Use (x):

1. The user must ensure that the maximum rated voltage and current (42.4 volts, 22 mA, DC) are not exceeded. All connections to other apparatus or associated apparatus shall have control over this voltage and current equivalent to a category “ib” circuit according to EN50020.
2. Component approved EEx e cable entries must be used which maintain the ingress protection of the enclosure to at least IP66.
3. Any unused cable entry holes must be filled with component approved EEx e blanking plugs.
4. The ambient temperature range of use shall be the most restrictive of the apparatus, cable gland, or blanking plug.

Table B-11. Baseefa Approved Entity Parameters

Power/Bus	Sensor
U_i = 42.4 V	U_o = 5V dc
C_i = 0	I_o = 2.5 mA
L_i = 0	C_o = 1000 μF
	L_o = 1 H

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Special Conditions of Safe Use (x):

1. The component must be housed in a suitable certified enclosure.
2. Provisions shall be made, external to the apparatus, to prevent the rated voltage (42.2 V dc) being exceeded by transient disturbances of more than 40%.

IECEx Certifications

I7 IECEx Intrinsic Safety
Certificate No.: IECExBAS09.0030X
Ex ia IIC T4 (T_{amb} = –50 to 60 °C)

Table B-12. IECEx Approved Entity Parameters

Power/Bus	Sensor
U_i = 30 V	U_o = 12.5 V
I_i = 300 mA	I_o = 4.8 mA
P_i = 1.3 W	P_o = 15 mW
C_i = 2.1 μF	C_i = 1.2 μF
L_i = 0	L_i = 1 H

Special Conditions of Safe Use (x):

1. The apparatus must be installed in an enclosure that provides a degree of protection of at least IP20. Non-metallic enclosures must be suitable to prevent electrostatic hazards and light alloy or zirconium enclosures must be protected from impact and friction when installed.
2. The apparatus is not capable of withstanding the 500V isolation test required by IEC 60079-11: 2006 clause 6.3.12. This must be taken into account when installing the apparatus.

IG IECEx FISCO
Certificate No.: IECExBAS09.0030X
Ex ia IIC T4 (T_{amb} = – 50 to 60 °C)

Table B-13. IECEx Approved Entity Parameters

Power/Bus	Sensor
U_i =17.5 Vdc	U_o = 12.5 Vdc
I_i = 380 mA	I_o = 4.8 mA
P_i = 5.32 W	P_o = 15 mW
C_i = 2.1 μF	C_i = 1.2 μF
L_i = 0	L_i = 1 H

Special Conditions of Safe Use (x):

1. The apparatus must be installed in an enclosure that provides a degree of protection of at least IP20. Non-metallic enclosures must be suitable to prevent electrostatic hazards and light alloy or zirconium enclosures must be protected from impact and friction when installed.
2. The apparatus is not capable of withstanding the 500V isolation test required by IEC 60079-11: 2006 clause 6.3.12. This must be taken into account when installing the apparatus.

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N7 IECEx Type n Approval
Certificate No." IECExBAS09.0032X
Ex Na nL IIC T5 (T_{amb} = – 40 to 65 °C)

NOTE:
N7 is valid with S001 and S002 Input Types

Table B-14. IECEx Approved Entity Parameters

Power/Bus	Sensor
U_i = 42.4 Vdc	U_o = 5 Vdc
C_i = 0	I_o = 2.5 mA
L_i = 0	C_o = 1000 µF
	L_o = 1000 mH

Special Conditions of Safe Use:

1. The component must be housed in a suitable component certified enclosure that provides a degree of protection of at least IP54 and meets the relevant material and environmental requirements of IEC 60079-0: 2004 & IEC 60079-15: 2005.
2. Provision must be made, external to the component, to ensure the rated voltage of the component supply is not exceeded by transient disturbances of more than 40%.
3. The electrical circuit is connected directly to earth; this must be taken into account when installing the component.

NJ IECEx Type n COMPONENT Approval
Certification Number: IECExBAS09.0031U
EEx nA nL IIC T4 (T_{amb} = -50 to 85 °C)
EEx nA nL IIC T5 (T_{amb} = -50 to 70 °C)

NOTE:
NJ is valid with S001 and S002 Input Types

Table B-15. IECEx Approved Entity Parameters

Power/Bus	Sensor
U_i = 42.4 Vdc	U_o = 5 Vdc
C_i = 0	I_o = 2.5 mA
L_i = 0	C_o = 1000 µF
	L_o = 1000 mH

Special Conditions of Safe Use:

1. The component must be housed in a suitable component certified enclosure that provides a degree of protection of at least IP54 and meets the relevant material and environmental requirements of IEC 60079-0: 2004 & IEC 60079-15: 2005.
2. Provision must be made, external to the component, to ensure the rated voltage of the component supply is not exceeded by transient disturbances of more than 40%.
3. The electrical circuit is connected directly to earth; this must be taken into account when installing the component.

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China (NEPSI)Certifications

I3 Intrinsic Safety
Ex ia IIC T4
Certification Number: GYJ111365X

Special Conditions for Safe Use (x):

2.1. Only when temperature transmitter is installed in IP 20(GB4208-2008) housing, it could be used in hazardous location. The metallic housing should observe the requirements of GB3836.1-2000 Clause 8. The non-metallic housing should observe the requirements of GB3836.1-2000 Clause 7.3. This apparatus is not capable of withstanding the 500V rms insulation test required by Clause 6.4.12 of GB3836.4-2000.

2.2. The ambient temperature range is:

Output	T code	Ambient temperature
F	**T4**	-50 °C < Ta < + 60 °C

2.3. Parameters:

Terminals of power/loop (1-2):

Output	Maximum Output Voltage: U_o (V)	Maximum Output Current: I_o (mA)	Maximum Output Power: P_o (mW)	Maximum external parameters:	
				C_o (μF)	Lo (H)
F	**30**	300	1.3	2.1	0
F (FISCO)	**17.5**	380	5.32	2.1	0

NOTE
Non-FISCO parameters listed above must be derived from a linear supply with a resistance limited output.

Terminals of sensor:

Output	Terminals	Maximum Output Voltage: U_o (V)	Maximum Output Current: I_o (mA)	Maximum Output Power: P_o (mW)	Maximum external parameters:	
					C_o (μF)	Lo (H)
F	**1-8**	12.5	4.8	15	1.2	1

2.4. The product complies to the requirements for FISCO field devices specified in IEC60079-27: 2008. For the connection of an intrinsically safe circuit in accordance FISCO model, FISCO parameters of this product are as above.

2.5. The product should be used with Ex-certified associated apparatus to establish explosion protection system that can be used in explosive gas atmospheres. Wiring and terminals should comply with the instruction manual of the product and associated apparatus.

2.6. The cables between this product and associated apparatus should be shielded cables (the cables must have insulated shield). The shielded cable has to be grounded reliably in non-hazardous area.

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2.7. End users are not permitted to change any component's insides, but to settle the problem, in conjunction with manufacturer to avoid damage to the product.

2.8. During installation, use and maintenance of this product, observe following standards:

GB3836.13-1997 "Electrical apparatus for explosive gas atmospheres Part 13: Repair and overhaul for apparatus used in explosive gas atmospheres."

GB3836.15-2000 "Electrical apparatus for explosive gas atmospheres Part 15: Electrical installations in hazardous area (other than mines)."

GB3836.16-2006 "Electrical apparatus for explosive gas atmospheres Part 16: Inspection and maintenance of electrical installation (other than mines)."

GB50257-1996 "Code for construction and acceptance of electric device for explosion atmospheres and fire hazard electrical equipment installation engineering."

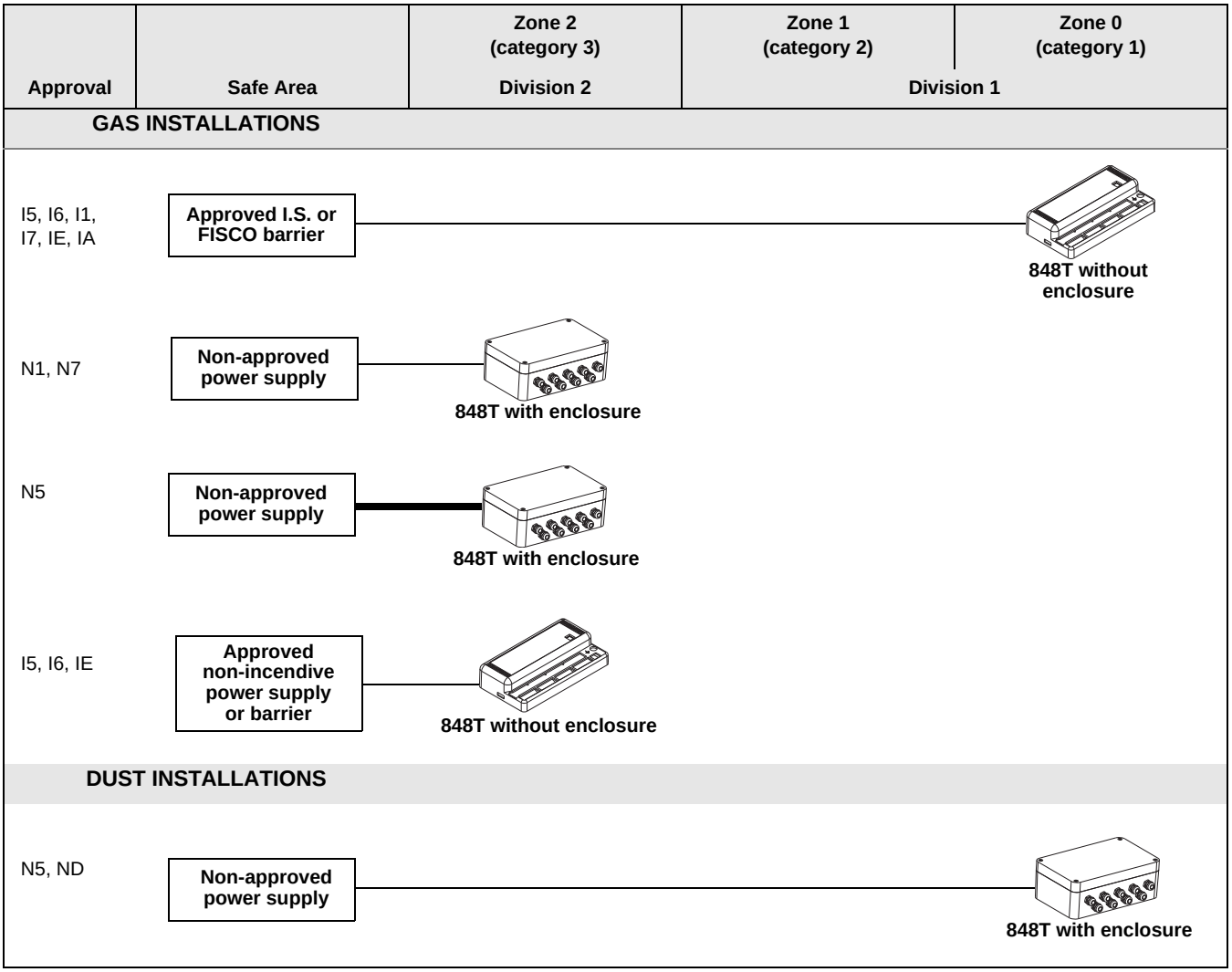
Japanese Certifications

I4 TISS Intrinsic Safety FISCO Type '1a'
Ex ia IIC T4
Certification Number: TC19713

H4 TISS Intrinsic Safety FISCO Type '1b'
Ex ia IIB T4
Certification Number: TC19714

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INTRINSICALLY SAFE AND NON-INCENDIVE INSTALLATIONS



Standard cable

Division 2 wiring

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INSTALLATION DRAWINGS

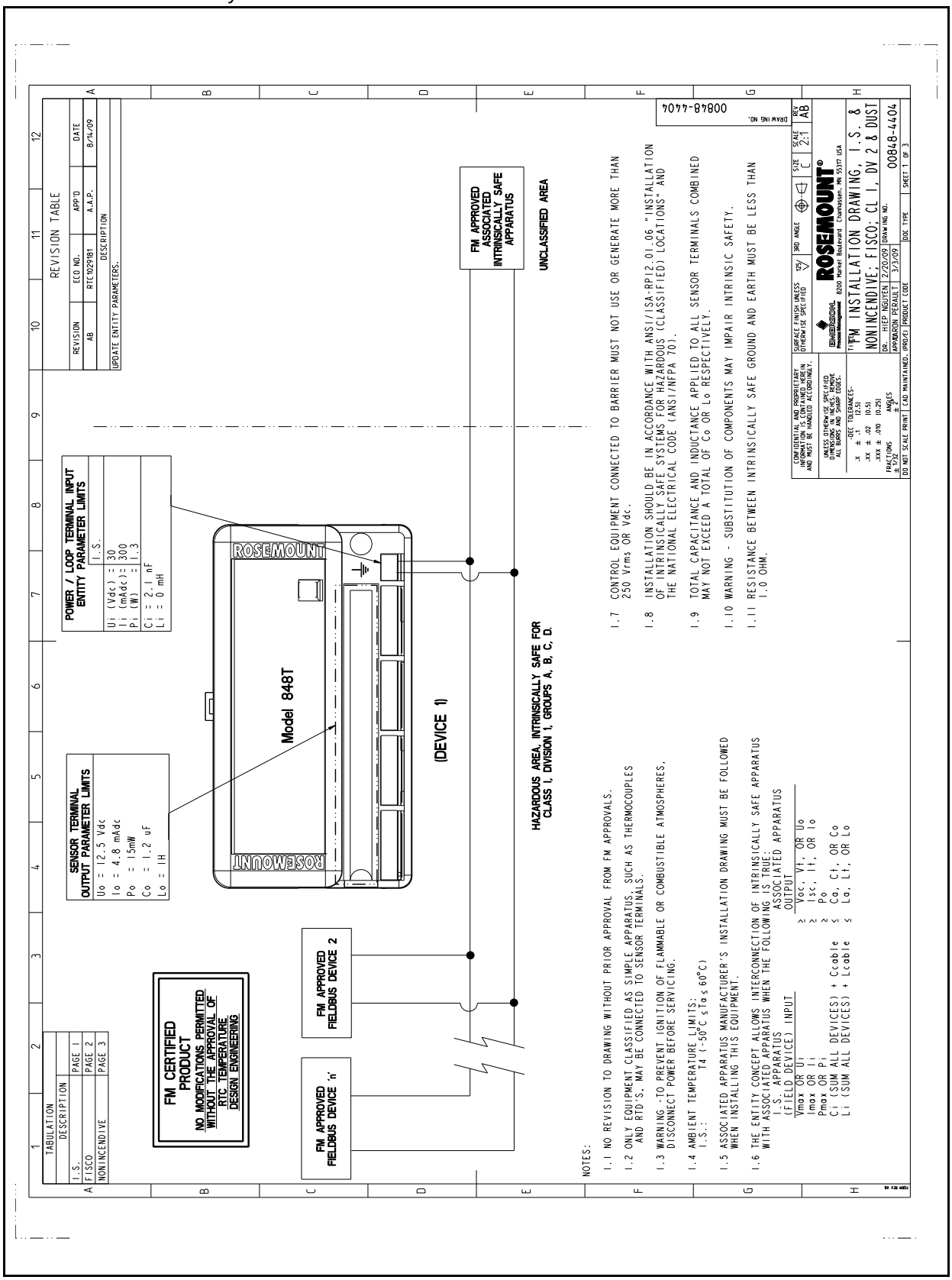
The installation guidelines presented by the drawings must be followed in order to maintain certified ratings for installed transmitters.

Rosemount Drawing 00848-4404, 3 Sheets
Factory Mutual Intrinsic Safety/ FISCO Installation Drawing

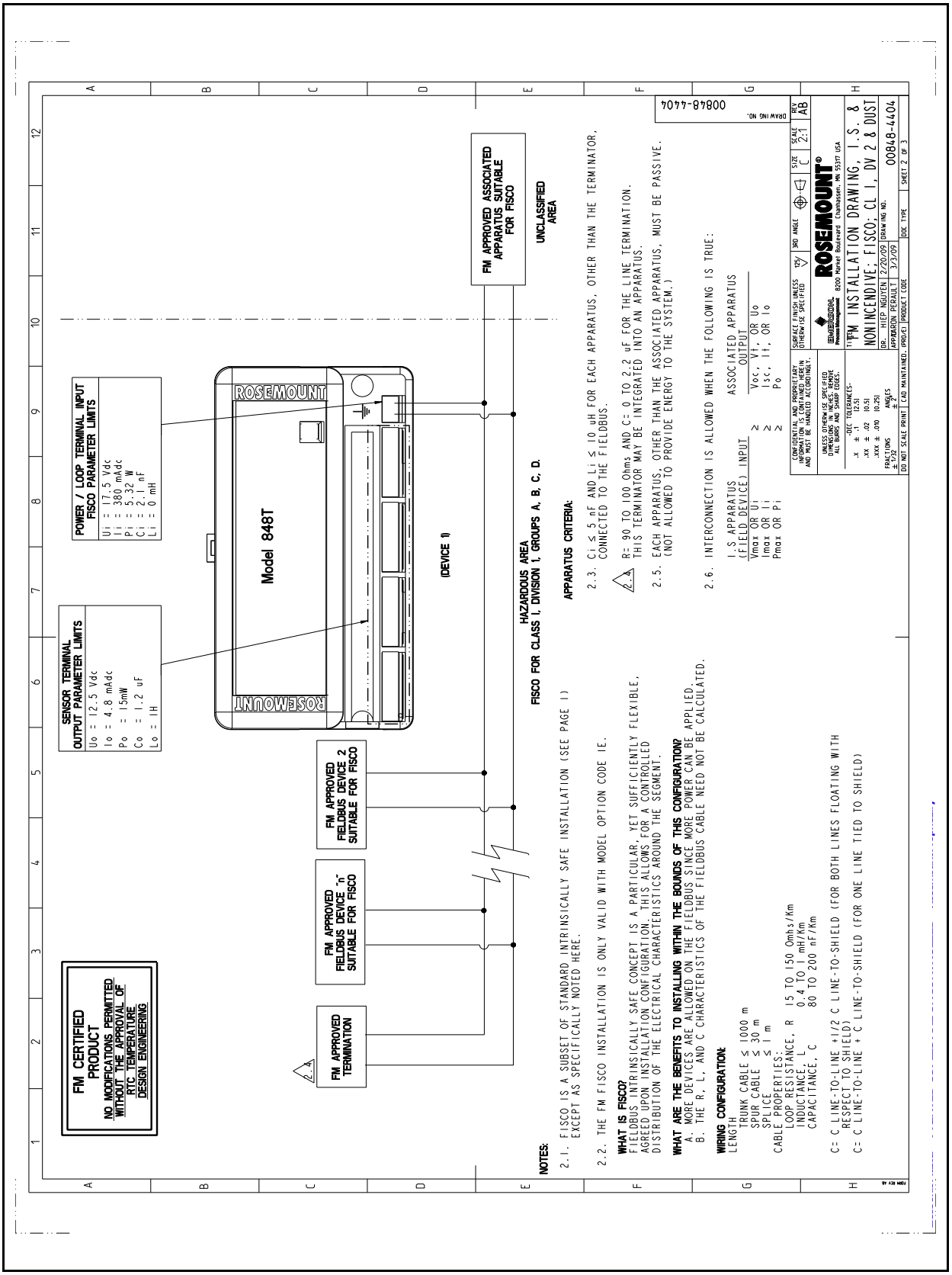
Rosemount Drawing 00848-4405, 2 Sheets
Canadian Standards Association Intrinsic Safety/FISCO Installation Drawing

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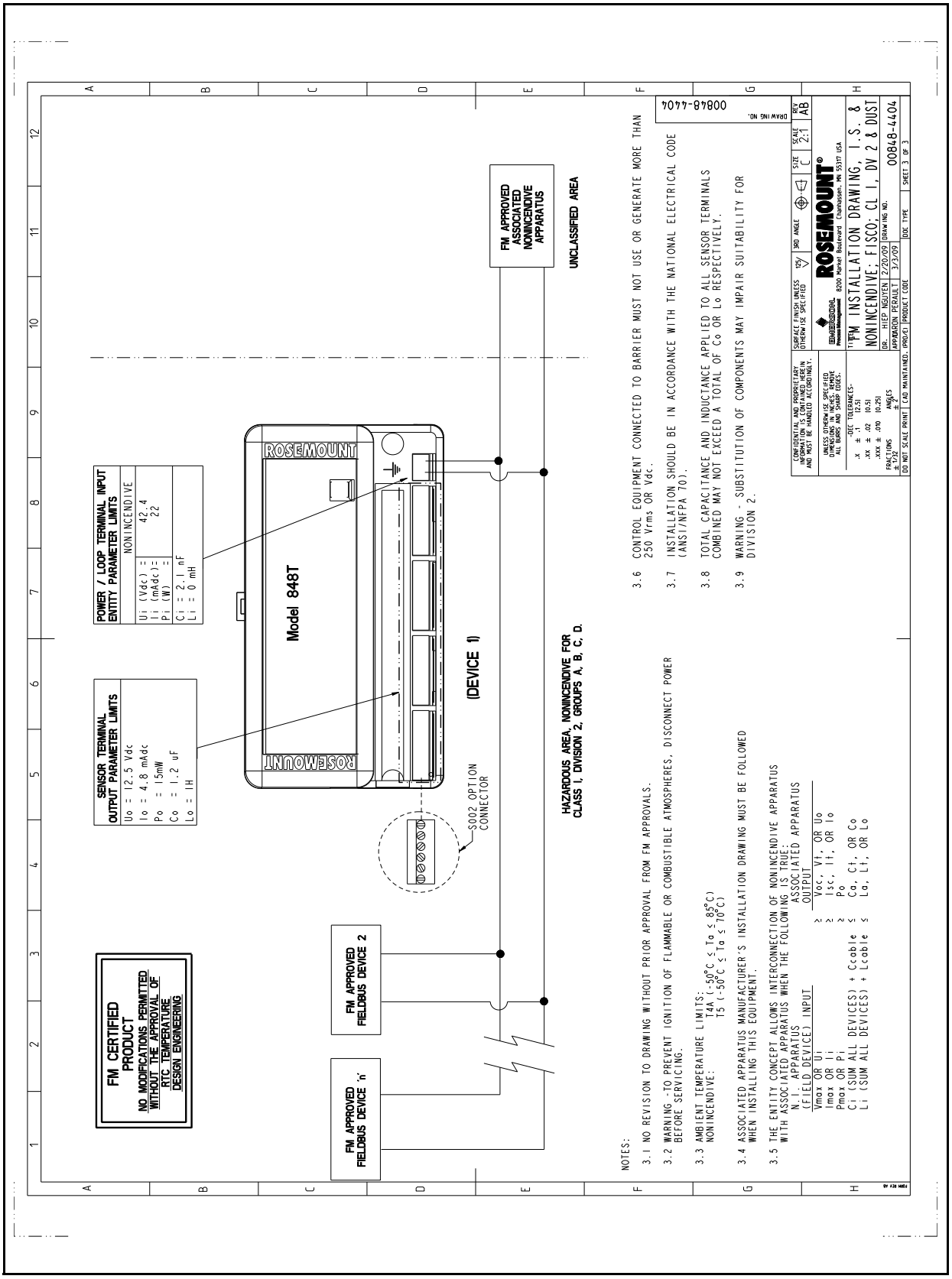
Figure B-1. FM Intrinsic Safety/ FISCO



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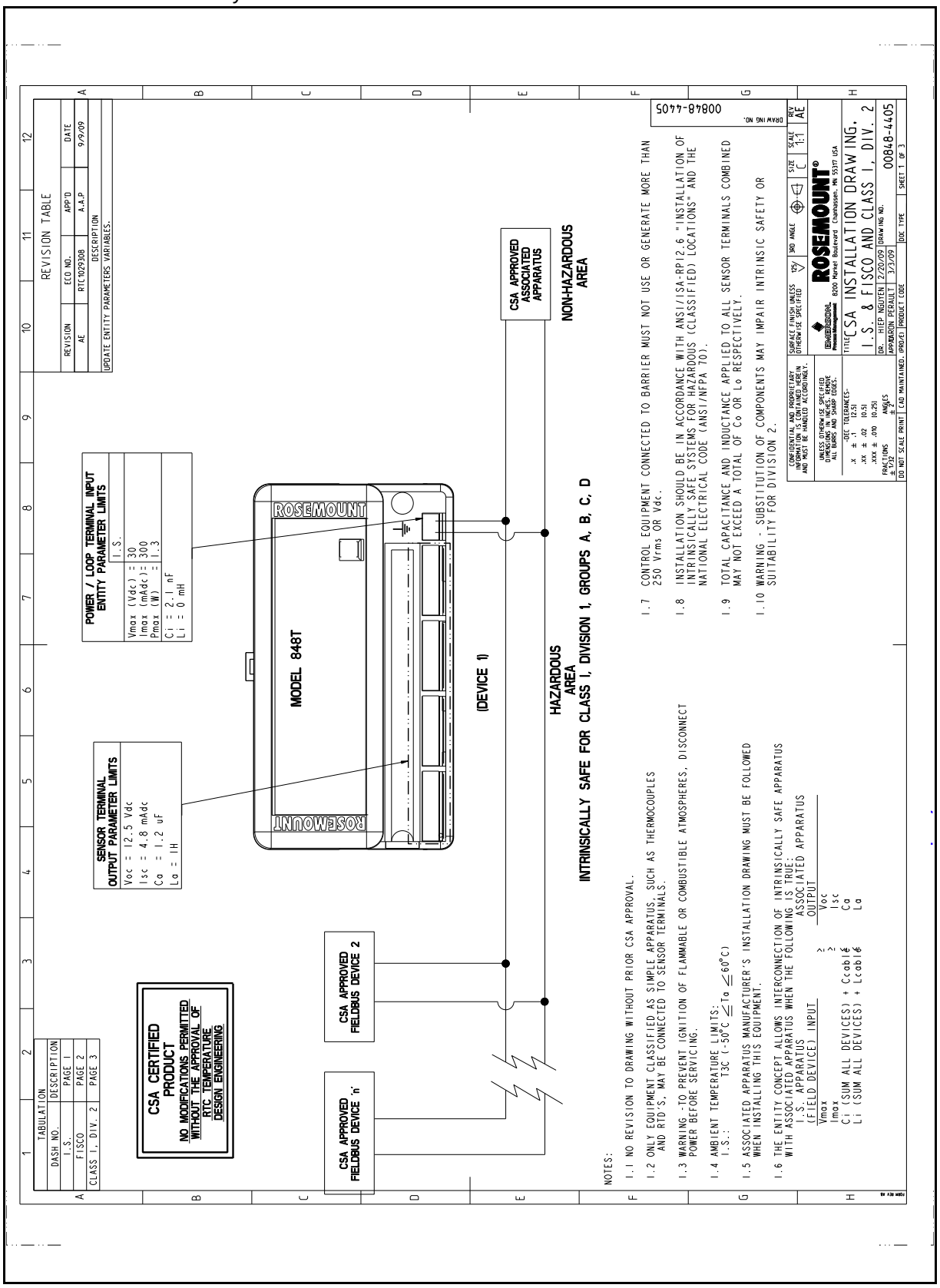


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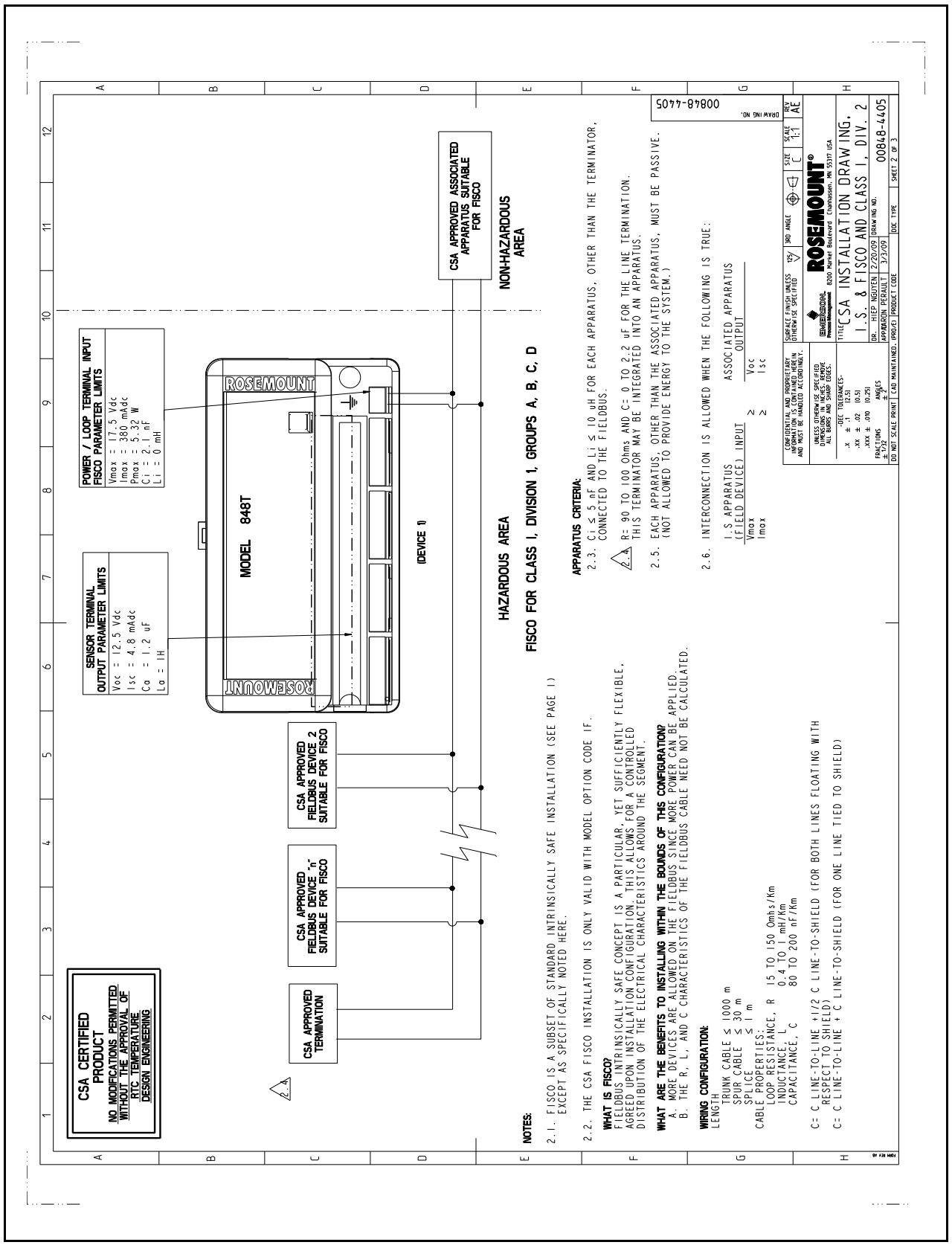


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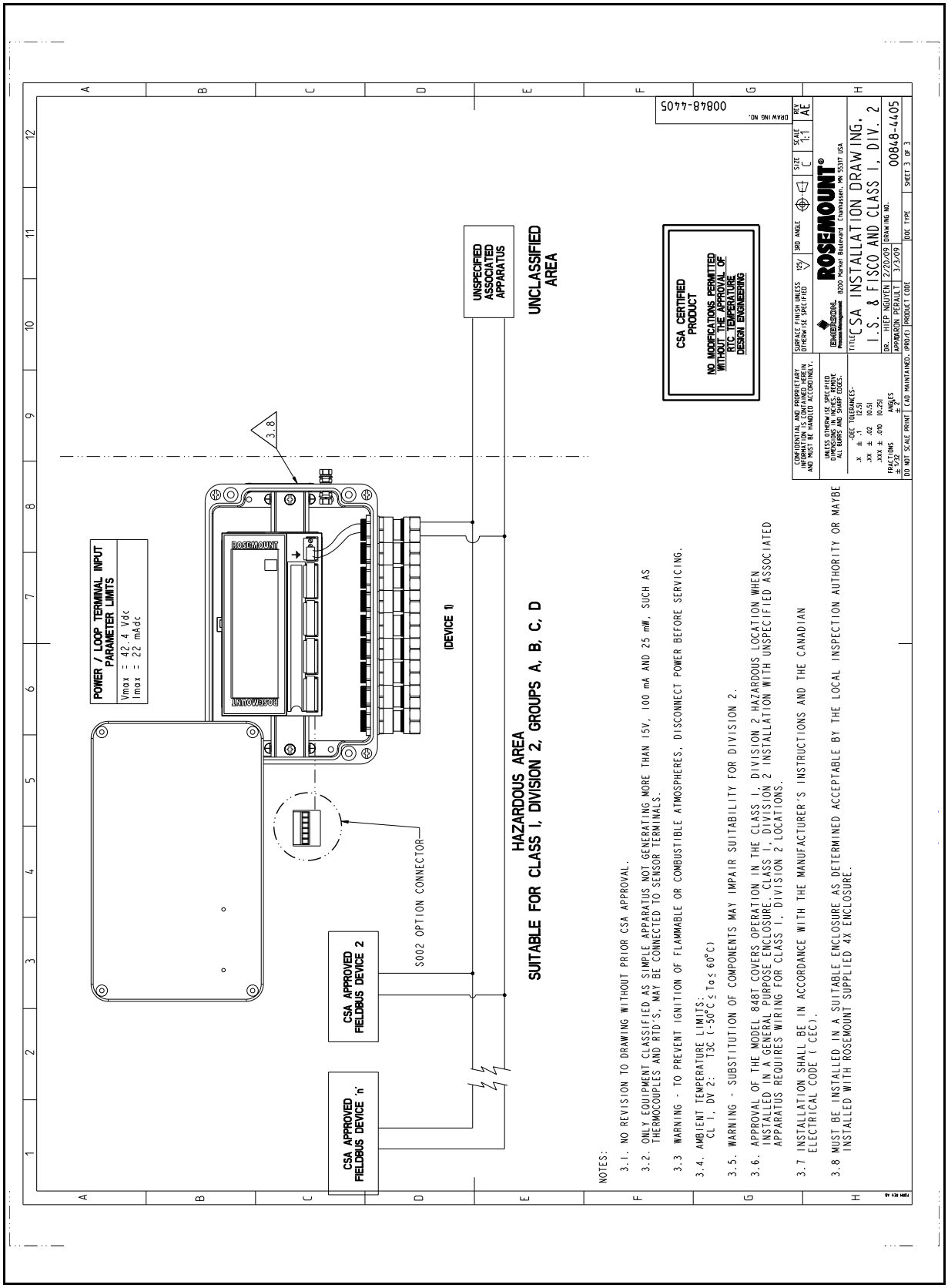
Figure B-2. CSA Intrinsic Safety/ FISCO



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Appendix C FOUNDATION™ fieldbus Technology

Overview . . . . . **page C-1**
Function Blocks . . . . . **page C-1**
Device Descriptions . . . . . **page C-3**
Block Operation . . . . . **page C-3**
Network Communication . . . . . **page C-4**

OVERVIEW

FOUNDATION fieldbus is an all-digital, serial, two-way, multidrop communication protocol that interconnects devices such as transmitters, sensors, actuators, and valve controllers. Fieldbus is a Local Area Network (LAN) for instruments that are used in both process and manufacturing automation, having the built-in capability to distribute the control applications across the network. The fieldbus environment is the base level group of digital networks and the hierarchy of plant networks.

The FOUNDATION fieldbus retains the desirable features of the 4–20 mA analog system, including standardized physical interface to the wire, bus-powered devices on a single pair of wires, and intrinsic safety options. It also enables the following capabilities:

- Increased capabilities due to full digital communication.
- Reduced wiring and wire terminations due to multiple devices on one pair of wires.
- Increased supplier selection due to interoperability
- Reduced loading on control room equipment due to the distribution of some control and input/output functions to field devices.

FOUNDATION fieldbus devices work together to provide I/O and control for automated processes and operations. The Fieldbus FOUNDATION provides a framework for describing these systems as a collection of physical devices interconnected by a fieldbus network. One of the ways that the physical devices are used is to perform their portion of the total system operation by implementing one or more function blocks.

FUNCTION BLOCKS

Function blocks perform process control functions, such as analog input (AI) and analog output (AO) functions as well as proportional-integral-derivative (PID) functions. The standard function blocks provide a common structure for defining function block inputs, outputs, control parameters, events, alarms, and modes, and combining them into a process that can be implemented within a single device or over the fieldbus network. This simplifies the identification of characteristics that are common to function blocks.

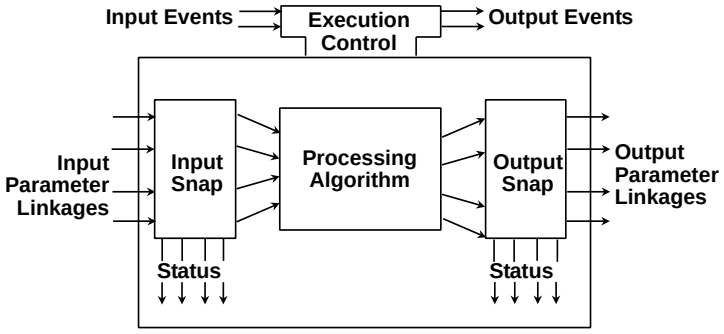
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The Fieldbus FOUNDATION has established the function blocks by defining a small set of parameters used in all function blocks called universal parameters. The FOUNDATION has also defined a standard set of function block classes, such as input, output, control, and calculation blocks. Each of these classes has a small set of parameters established for it. They have also published definitions for transducer blocks commonly used with standard function blocks. Examples include temperature, pressure, level, and flow transducer blocks.

The FOUNDATION specifications and definitions allow vendors to add their own parameters by importing and subclassing specified classes. This approach permits extending function block definitions as new requirements are discovered and as technology advances.

Figure C-1 illustrates the internal structure of a function block. When execution begins, input parameter values from other blocks are snapped-in by the block. The input snap process ensures that these values do not change during the block execution. New values received for these parameters do not affect the snapped values and will not be used by the function block during the current execution.

Figure C-1. Function Block Internal Structure



Once the inputs are snapped, the algorithm operates on them, generating outputs as it progresses. Algorithm executions are controlled through the setting of contained parameters. Contained parameters are internal to function blocks and do not appear as normal input and output parameters. However, they may be accessed and modified remotely, as specified by the function block.

Input events may affect the operation of the algorithm. An execution control function regulates the receipt of input events and the generation of output events during execution of the algorithm. Upon completion of the algorithm, the data internal to the block is saved for use in the next execution, and the output data is snapped, releasing it for use by other function blocks.

A block is a tagged logical processing unit. The tag is the name of the block. System management services locate a block by its tag. Thus the service personnel need only know the tag of the block to access or change the appropriate block parameters.

Function blocks are also capable of performing short-term data collection and storage for reviewing their behavior.

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DEVICE DESCRIPTIONS

Device Descriptions (DD) are specified tool definitions that are associated with the Resource and Transducer Blocks. Device descriptions provide the definition and description of the function blocks and their parameters.

To promote consistency of definition and understanding, descriptive information, such as data type and length, is maintained in the device description. Device Descriptions are written using an open language called the Device Description Language (DDL). Parameter transfers between function blocks can be easily verified because all parameters are described using the same language. Once written, the device description can be stored on an external medium, such as a CD-ROM or diskette. Users can then read the device description from the external medium. The use of an open language in the device description permits interoperability of function blocks within devices from various vendors. Additionally, human interface devices, such as operator consoles and computers, do not have to be programmed specifically for each type of device on the bus. Instead their displays and interactions with devices are driven from the device descriptions.

Device descriptions may also include a set of processing routines called methods. Methods provide a procedure for accessing and manipulating parameters within a device.

BLOCK OPERATION

In addition to function blocks, fieldbus devices contain two other block types to support the function blocks. These are the resource block and the transducer block.

Instrument- Specific Function Blocks

Resource Blocks

Resource blocks contain the hardware–specific characteristics associated with a device; they have no input or output parameters. The algorithm within a resource block monitors and controls the general operation of the physical device hardware. The execution of this algorithm is dependent on the characteristics of the physical device, as defined by the manufacturer. As a result, the algorithm may cause the generation of events. There is only one resource block defined for a device. For example, when the mode of a resource block is “Out of Service (OOS),” it impacts all of the other blocks.

Transducer Blocks

Transducer blocks connect function blocks to local input/output functions. They read sensor hardware and write to effector (actuator) hardware. This permits the transducer block to execute as frequently as necessary to obtain good data from sensors and ensure proper writes to the actuator without burdening the function blocks that use the data. The transducer block also isolates the function block from the vendor–specific characteristics of the physical I/O.

Alerts

When an alert occurs, execution control sends an event notification and waits a specified period of time for an acknowledgment to be received. This occurs even if the condition that caused the alert no longer exists. If the acknowledgment is not received within the pre-specified time-out period, the event notification is retransmitted, assuring that alert messages are not lost.

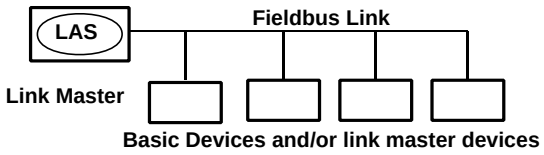
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Two types of alerts are defined for the block: events and alarms. Events are used to report a status change when a block leaves a particular state, such as when a parameter crosses a threshold. Alarms not only report a status change when a block leaves a particular state, but also report when it returns back to that state.

NETWORK COMMUNICATION

Figure C-2 illustrates a simple fieldbus network consisting of a single segment (link).

Figure C-2. Simple, Single-Link Fieldbus Network



Link Active Scheduler (LAS)

All links have one Link Active Scheduler (LAS). The LAS operates as the bus arbiter for the link. The LAS does the following:

- recognizes and adds new devices to the link.
- removes non-responsive devices from the link.
- distributes Data Link Time (DL) and Link Scheduling Time (LS) on the link. DL is a network-wide time periodically distributed by the LAS to synchronize all device clocks on the bus. LS time is a link-specific time represented as an offset from DL. It is used to indicate when the LAS on each link begins and repeats its schedule. It is used by system management to synchronize function block execution with the data transfers scheduled by the LAS.
- polls devices for process loop data at scheduled transmission times.
- distributes a priority-driven token to devices between scheduled transmissions.

Any device on the link may become the LAS. The devices that are capable of becoming the LAS are called Link Master devices (LM). All other devices are referred to as basic devices. When a segment first starts up, or upon failure of the existing LAS, the link master devices on the segment bid to become the LAS. The link master that wins the bid begins operating as the LAS immediately upon completion of the bidding process. Link masters that do not become the LAS act as basic devices. However, the link masters can act as LAS backups by monitoring the link for failure of the LAS and then bidding to become the LAS when a LAS failure is detected.

Only one device can communicate at a time. Permission to communicate on the bus is controlled by a centralized token passed between devices by the LAS. Only the device with the token can communicate. The LAS maintains a list of all devices that need access to the bus. This list is called the “Live List.”

Two types of tokens are used by the LAS. A time-critical token, Compel Data (CD), is sent by the LAS according to a schedule. A non-time critical token, pass token (PT), is sent by the LAS to each device in ascending numerical order according to address.

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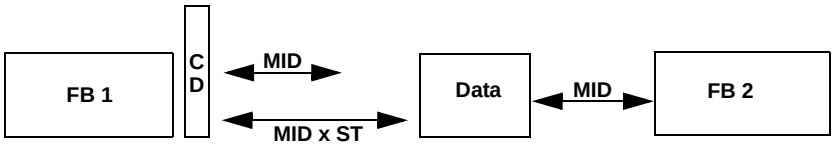
There may be many LM devices on a segment but only the LAS is actively controlling communication traffic. The remaining LM devices on the segment are in a stand-by state, ready to take over if the primary LAS fails. This is achieved by constantly monitoring the communication traffic on the bus and determining if activity is not present. Since there can be multiple LM devices on the segment when the primary LAS fails, the device with the lowest node address will become the primary LAS and take control of the bus. Using this strategy, multiple LAS failures can be handled with no loss of the LAS capability of the communications bus.

LAS Parameters

There are many bus communication parameters but only a few are used. For standard RS-232 communications, the configuration parameters are baud rate, start / stop bits, and parity. The key parameters for H1 FOUNDATION fieldbus are as follows.

- **Slot Time (ST)** – Used during the bus master election process. It is the maximum amount of time permitted for device A to send a message to device B. Slot time is a parameter which defines a worst case delay which includes internal delay in the sending device and the receiving device. Increasing the value of ST slows down bus traffic because a LAS device must wait longer prior to determining that the LM is down.
- **Minimum Inter-PDU Delay (MID)** – The minimum gap between two messages on the fieldbus segment or it is the amount of time between the last byte of one message and the first byte of the next message. The units of the MID are octets. An octet is 256 μs, hence the units for MID are approximately $^1/_4$ ms. This would mean an MID of 16 would specify approximately a minimum of 4 ms between messages on the Fieldbus. Increasing the value of MID slows down bus traffic because a larger “gap” between messages occurs.
- **Maximum Response (MRD)** – Defines the maximum amount of time permitted to respond to an immediate response request, e.g. CD, PT. When a published value is requested using the CD command, the MRD defines how long before the device publishes the data. Increasing this parameter will slow down the bus traffic by decreasing how fast CDs can be put onto the network. The MRD is measured in units of ST.
- **Time Synchronization Class (TSC)** – A variable that defines how long the device can estimate its time before drifting out of specific limits. The LM will periodically send out time update messages to synchronize devices on the segment. Decreasing the parameter number increases the number of times that time distribution messages must be published, increasing bus traffic and overhead for the LM device. See Figure C-3.

Figure C-3. LAS Parameter diagram



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Backup LAS

A LM device is one that has the ability to control the communications on the bus. The LAS is the LM capable device that is currently in control of the bus. While there can be many LM devices acting as backups, there can only be one LAS. The LAS is typically a host system but for stand-alone applications, a device may be providing the role of primary LAS.

Addressing

To setup, configure, and communicate with other devices on a segment, a device must be assigned a permanent address. Unless requested otherwise, it is assigned a temporary address when shipped from the factory.

FOUNDATION fieldbus uses addresses between 0 and 255. Addresses 0 through 15 are reserved for group addressing and for use by the data link layer.

If there are two or more devices on a segment with the same address, the first device to start up will use the assigned address. Each of the other devices will be given one of the four temporary addresses. If a temporary address is not available, the device will be unavailable until a temporary address is available.

Use the host system documentation to commission a device and assign a permanent address.

Scheduled Transfers

Information is transferred between devices over the FOUNDATION fieldbus using three different types of reporting.

Publisher/Subscriber

This type of reporting is used to transfer critical process loop data, such as the process variable. The data producers (publishers) post the data in a buffer that is transmitted to the subscriber, when the publisher receives the Compel Data (CD). The buffer contains only one copy of the data. New data completely overwrites previous data. Updates to published data are transferred simultaneously to all subscribers in a single broadcast. Transfers of this type can be scheduled on a precisely periodic basis.

Report Distribution

This type of reporting is used to broadcast and multicast event and trend reports. The destination address may be predefined so that all reports are sent to the same address, or it may be provided separately with each report. Transfers of this type are queued. They are delivered to the receivers in the order transmitted, although there may be gaps due to corrupted transfers. These transfers are unscheduled and occur between scheduled transfers at a given priority.

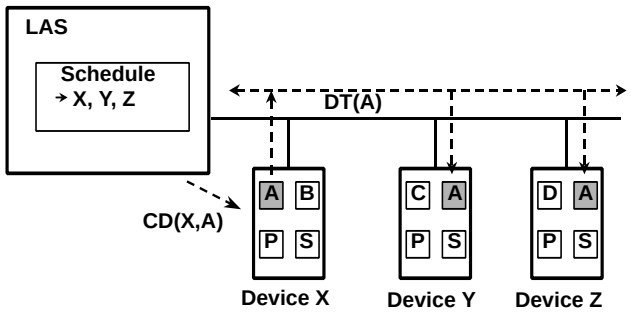
Client/Server

This type of reporting is used for request/response exchanges between pairs of devices. Like Report Distribution reporting, the transfers are queued, unscheduled, and prioritized. Queued means the messages are sent and received in the order submitted for transmission, according to their priority, without overwriting previous messages. However, unlike Report Distribution, these transfers are flow controlled and employ a retransmission procedure to recover from corrupted transfers.

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Figure C-4 diagrams the method of scheduled data transfer. Scheduled data transfers are typically used for the regular cyclic transfer of process loop data between devices on the fieldbus. Scheduled transfers use publisher/ subscriber type of reporting for data transfer. The LAS maintains a list of transmit times for all publishers in all devices that need to be cyclically transmitted. When it is time for a device to publish data, the LAS issues a CD message to the device. Upon receipt of the CD, the device broadcasts or "publishes" the data to all devices on the fieldbus. Any device that is configured to receive the data is called a "subscriber."

Figure C-4. Scheduled Data Transfer



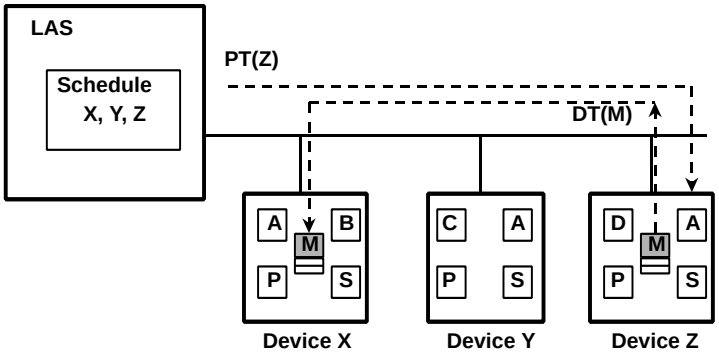
LAS = Link Active Scheduler
P = Publisher
S = Subscriber
CD = Compel Data
DT = Data Transfer Packet

Unscheduled Transfers

Figure C-5 diagrams an unscheduled transfer. Unscheduled transfers are used for things like user-initiated changes, including set point changes, mode changes, tuning changes, and upload/download. Unscheduled transfers use either report distribution or client/server type of reporting for transferring data.

All of the devices on the FOUNDATION fieldbus are given a chance to send unscheduled messages between transmissions of scheduled data. The LAS grants permission to a device to use the fieldbus by issuing a pass token (PT) message to the device. When the device receives the PT, it is allowed to send messages until it has finished or until the "maximum token hold time" has expired, whichever is the shorter time. The message may be sent to a single destination or to multiple destinations.

Figure C-5. Unscheduled Data Transfer



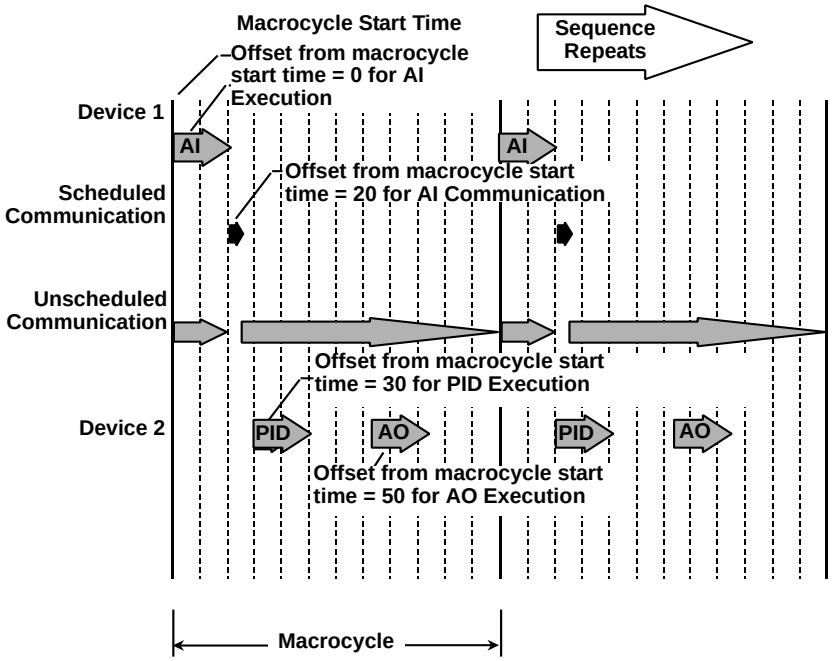
P = Publisher S = Subscriber PT = Pass Token M = Message

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Function Block Scheduling

Figure C-6 shows an example of a link schedule. A single iteration of the link-wide schedule is called the macrocycle. When the system is configured and the function blocks are linked, a master link-wide schedule is created for the LAS. Each device maintains its portion of the link-wide schedule, known as the Function Block Schedule. The Function Block Schedule indicates when the function blocks for the device are to be executed. The scheduled execution time for each function block is represented as an offset from the beginning of the macrocycle start time.

Figure C-6. Example Link Schedule Showing Scheduled and Unscheduled Communication



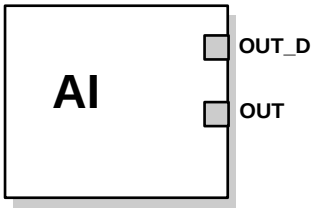
To support synchronization of schedules, periodically Link Scheduling (LS) time is distributed. The beginning of the macrocycle represents a common starting time for all Function Block schedules on a link and for the LAS link-wide schedule. This permits function block executions and their corresponding data transfers to be synchronized in time.

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Appendix D Function Blocks

Analog Input (AI) Function Block . . . . . page D-1
Multiple Analog Input (MAI) Function Block . . . . . page D-9
Input Selector Function Block . . . . . page D-15

ANALOG INPUT (AI) FUNCTION BLOCK



Out = The block output value and status
Out_D = Discrete output that signals a selected alarm condition

The Analog Input (AI) function block processes field device measurements and makes them available to other function blocks. The output value from the AI block is in engineering units and contains a status indicating the quality of the measurement. The measuring device may have several measurements or derived values available in different channels. Use the channel number to define the variable that the AI block processes.

The AI block supports alarming, signal scaling, signal filtering, signal status calculation, mode control, and simulation. In Automatic mode, the block's output parameter (OUT) reflects the process variable (PV) value and status. In Manual mode, OUT may be set manually. The Manual mode is reflected on the output status. A discrete output (OUT_D) is provided to indicate whether a selected alarm condition is active. Alarm detection is based on the OUT value and user specified alarm limits. The block execution time is 30 ms.

Table D-1. Analog Input Function Block Parameters

Number	Parameter	Units	Description
01	ST_REV	None	The revision level of the static data associated with the function block. The revision value will be incremented each time a static parameter value in the block is changed.
02	TAG_DESC	None	The user description of the intended application of the block.
03	STRATEGY	None	The strategy field can be used to identify a grouping of blocks. This data is not checked or processed by the block.
04	ALERT_KEY	None	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
05	MODE_BLK	None	The actual, target, permitted, and normal modes of the block. Actual: The mode the "block is currently in" Target: The mode to "go to" Permitted: Allowed modes that target may take on Normal: Most common mode for target
06	BLOCK_ERR	None	This parameter reflects the error status associated with the hardware or software components associated with a block. It is a bit string, so that multiple errors may be shown.
07	PV	EU of XD_SCALE	The process variable used in block execution.
08	OUT	EU of OUT_SCALE or XD_SCALE if in direct L_TYPE	The block output value and status.
09	SIMULATE	None	A group of data that contains the current transducer value and status, the simulated transducer value and status, and the enable/disable bit.

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Table D-1. Analog Input Function Block Parameters

Number	Parameter	Units	Description
10	XD_SCALE	None	The high and low scale values, engineering units code, and number of digits to the right of the decimal point associated with the channel input value. The XD_SCALE units code must match the units code of the measurement channel in the transducer block. If the units do not match, the block will not transition to MAN or AUTO.
11	OUT_SCALE	None	The high and low scale values, engineering units code, and number of digits to the right of the decimal point associated with OUT when L_TYPE is not direct.
12	GRANT_DENY	None	Options for controlling access of host computers and local control panels to operating, tuning, and alarm parameters of the block. Not used by device.
13	IO_OPTS	None	Allows the selection of input/output options used to alter the PV. Low cutoff enabled is the only selectable option.
14	STATUS_OPTS	None	Allows the user to select options for status handling and processing. The options supported in the AI block are the following: Propagate fault forward Uncertain if limited Bad if limited Uncertain if Manual mode.
15	CHANNEL	None	The CHANNEL value is used to select the measurement value. Configure the CHANNEL parameter before configuring the XD_SCALE parameter. Refer to Table 3-5 on page 3-11.
16	L_TYPE	None	Linearization type. Determines whether the field value is used directly (Direct), is converted linearly (Indirect), or is converted with the square root (Indirect Square Root).
17	LOW_CUT	%	If percentage value of transducer input fails below this, PV = 0.
18	PV_FTIME	Seconds	The time constant of the first-order PV filter. It is the time required for a 63% change in the PV or OUT value.
19	FIELD_VAL	Percent	The value and status from the transducer block or from the simulated input when simulation is enabled.
20	UPDATE_EVT	None	This alert is generated by any change to the static data.
21	BLOCK_ALM	None	The block alarm is used for all configuration, hardware, connection failure or system problems in the block. The cause of the alert is entered in the subcode field. The first alert to become active will set the Active status in the Status parameter. As soon as the Unreported status is cleared by the alert reporting task, another block alert may be reported without clearing the Active status, if the subcode has changed.
22	ALARM_SUM	None	The summary alarm is used for all process alarms in the block. The cause of the alert is entered in the subcode field. The first alert to become active will set the Active status in the Status parameter. As soon as the Unreported status is cleared by the alert reporting task, another block alert may be reported without clearing the Active status, if the subcode has changed.
23	ACK_OPTION	None	Used to set auto acknowledgment of alarms.
24	ALARM_HYS	Percent	The amount the alarm value must return within the alarm limit before the associated active alarm condition clears.
25	HI_HI_PRI	None	The priority of the HI HI alarm.
26	HI_HI_LIM	EU of PV_SCALE	The setting for the alarm limit used to detect the HI HI alarm condition.
27	HI_PRI	None	The priority of the HI alarm.
28	HI_LIM	EU of PV_SCALE	The setting for the alarm limit used to detect the HI alarm condition.
29	LO_PRI	None	The priority of the LO alarm.
30	LO_LIM	EU of PV_SCALE	The setting for the alarm limit used to detect the LO alarm condition.
31	LO_LO_PRI	None	The priority of the LO LO alarm.
32	LO_LO_LIM	EU of PV_SCALE	The setting for the alarm limit used to detect the LO LO alarm condition.
33	HI_HI_ALM	None	The HI HI alarm data, which includes a value of the alarm, a timestamp of occurrence and the state of the alarm.
34	HI_ALM	None	The HI alarm data, which includes a value of the alarm, a timestamp of occurrence and the state of the alarm.
35	LO_ALM	None	The LO alarm data, which includes a value of the alarm, a timestamp of occurrence and the state of the alarm.

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Table D-1. Analog Input Function Block Parameters

Number	Parameter	Units	Description
36	LO_LO_ALM	None	The LO LO alarm data, which includes a value of the alarm, a timestamp of occurrence and the state of the alarm.
37	OUT_D	None	Discrete output to indicate a selected alarm condition.
38	ALM_SEL	None	Used to select the process alarm conditions that will cause the OUT_D parameter to be set.
39	STDDEV	% of OUT Range	Standard deviation of the measurement for 100 macrocycles.
40	CAP_STDDEV	% of OUT Range	Capability standard deviation, the best deviation that can be achieved.

Functionality

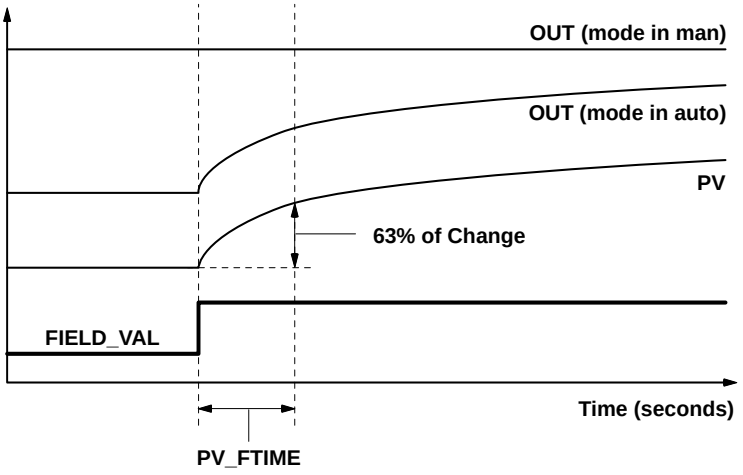
Simulation

To support testing, either change the mode of the block to manual and adjust the output value, or enable simulation through the configuration tool and manually enter a value for the measurement value and its status. In simulation, the ENABLE jumper must be set on the field device.

NOTE
All FOUNDATION fieldbus instruments have a simulation jumper. As a safety measure, the jumper has to be reset every time there is a power interruption. This measure is to prevent devices that went through simulation in the staging process from being installed with simulation enabled.

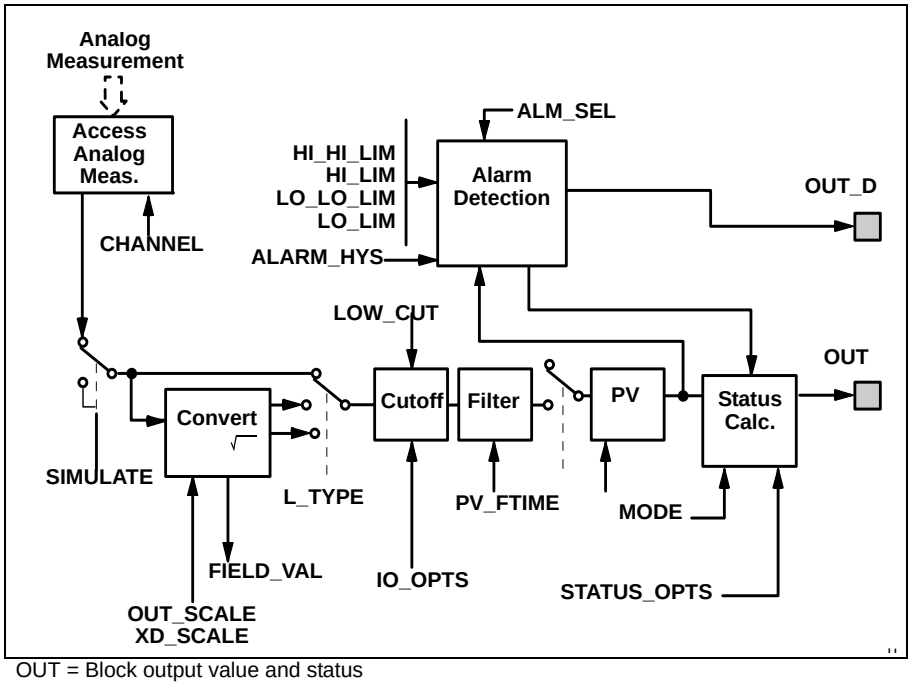
With simulation enabled, the actual measurement value has no impact on the OUT value or the status.

Figure D-1. Analog Input Function Block Timing Diagram



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Figure D-2. Analog Input Function Block Schematic



OUT = Block output value and status
OUT_D = Discrete output that signals a selected alarm condition

Filtering

The filtering feature changes the response time of the device to smooth variations in output readings caused by rapid changes in input. Adjust the filter time constant (in seconds) using the PV_FTIME parameter. Set the filter time constant to zero to disable the filter feature.

Signal Conversion

Set the signal conversion type with the Linearization Type (L_TYPE) parameter. View the converted signal (in percent of XD_SCALE) through the FIELD_VAL parameter.

$$\text{FIELD\_VAL} = \frac{100 \times (\text{Channel Value} - \text{EU*@0\%})}{(\text{EU*@100\%} - \text{EU*@0\%})}$$

*** XD_SCALE values**

Choose from direct, indirect, or indirect square root signal conversion with the L_TYPE parameter.

Direct

Direct signal conversion allows the signal to pass through the accessed channel input value (or the simulated value when simulation is enabled).

$$\text{PV} = \text{Channel Value}$$

Indirect

Indirect signal conversion converts the signal linearly to the accessed channel input value (or the simulated value when simulation is enabled) from its specified range (XD_SCALE) to the range and units of the PV and OUT parameters (OUT_SCALE).

$$\text{PV} = \left(\frac{\text{FIELD\_VAL}}{100}\right) \times (\text{EU**@100\%} - \text{EU**@0\%}) + \text{EU**@0\%}$$

**** OUT_SCALE values**

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Indirect Square Root

Indirect Square Root signal conversion takes the square root of the value computed with the indirect signal conversion and scales it to the range and units of the PV and OUT parameters.

$$PV = \sqrt{\left(\frac{FIELD\_VAL}{100}\right)} \times (EU^{**}@100\% - EU^{**}@0\%) + EU^{**}@0\%$$

**** OUT_SCALE values**

When the converted input value is below the limit specified by the LOW_CUT parameter, and the Low Cutoff I/O option (IO_OPTS) is enabled (True), a value of zero is used for the converted value (PV). This option eliminates false readings when the differential pressure measurement is close to zero and it may be useful with zero-based measurement devices such as flowmeters.

NOTE
Low Cutoff is the only I/O option supported by the AI block. Set the I/O option when the block is OOS.

Block Errors

Table D-2 lists conditions reported in the BLOCK_ERR parameter. Conditions in **bold** are inactive for the AI block and are given here for reference.

Table D-2. BLOCK_ERR Conditions

Number	Name and Description
0	Other
1	Block Configuration Error: the selected channel carries a measurement that is incompatible with the engineering units selected in XD_SCALE, the L_TYPE parameter is not configured, or CHANNEL = zero.
2	**Link Configuration Error**
3	Simulate Active: Simulation is enabled and the block is using a simulated value in its execution.
4	**Local Override**
5	**Device Fault State Set**
6	**Device Needs Maintenance Soon**
7	Input Failure/Process Variable has Bad Status: The hardware is bad, or a bad status is being simulated.
8	Output Failure: The output is bad based primarily upon a bad input.
9	**Memory Failure**
10	**Lost Static Data**
11	**Lost NV Data**
12	**Readback Check Failed**
13	**Device Needs Maintenance Now**
14	Power Up
15	Out of Service: The actual mode is out of service.

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Modes

The AI Function Block supports three modes of operation as defined by the MODE_BLK parameter:

Manual (Man)
The value of the block output (OUT) may be set manually

Automatic (Auto)
OUT reflects the analog input measurement or the simulated value when simulation is enabled.

Out of Service (OOS)
The block is not processed. FIELD_VAL and PV are not updated and the OUT status is set to Bad: Out of Service. The BLOCK_ERR parameter shows Out of Service. In this mode, changes can be made to all configurable parameters.

Alarm Detection

A block alarm will be generated whenever the BLOCK_ERR has an error bit set. The types of block error for the AI block are defined above.

Process Alarm detection is based on the OUT value. Configure the alarm limits of the following standard alarms:

- High (HI_LIM)
- High high (HI_HI_LIM)
- Low (LO_LIM)
- Low low (LO_LO_LIM)

To avoid alarm chatter when the variable is oscillating around the alarm limit, an alarm hysteresis in percent of the PV span can be set using the ALARM_HYS parameter. The priority of each alarm is set in the following parameters:

- HI_PRI
- HI_HI_PRI
- LO_PRI
- LO_LO_PRI

Table D-3. Alarm Priority Levels

Number	Description
0	The priority of an alarm condition changes to 0 after the condition that caused the alarm is corrected.
1	An alarm condition with a priority of 1 is recognized by the system, but is not reported to the operator.
2	An alarm condition with a priority of 2 is reported to the operator, but does not require operator attention (such as diagnostics and system alerts).
3-7	Alarm conditions of priority 3 to 7 are advisory alarms of increasing priority.
8-15	Alarm conditions of priority 8 to 15 are critical alarms of increasing priority.

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Status Handling

Normally, the status of the PV reflects the status of the measurement value, the operating condition of the I/O card, and any active alarm condition. In Auto mode, OUT reflects the value and status quality of the PV. In Man mode, the OUT status constant limit is set to indicate that the value is a constant and the OUT status is *Good*.

If the sensor limit exceeds the high or low range, PV status is set high or low and EU range status is set to uncertain.

In the STATUS_OPTS parameter, select from the following options to control the status handling:

BAD if Limited
Sets the OUT status quality to *Bad* when the value is higher or lower than the sensor limits.

Uncertain if Limited
Sets the OUT status quality to *Uncertain* when the value is higher or lower than the sensor limits.

Uncertain if in Manual mode
The status of the Output is set to *Uncertain* when the mode is set to Manual

NOTES
1. The instrument must be in OOS mode to set the status option.
2. The AI block only supports the BAD if Limited option, uncertain if limited, and uncertain if manual.

Advanced Features

The AI function block provided with Rosemount fieldbus devices provides added capability through the addition of the following parameters:

ALARM_TYPE
Allows one or more of the process alarm conditions detected by the AI function block to be used in setting its OUT_D parameter.

OUT_D
Discrete output of the AI function block based on the detection of process alarm condition(s). This parameter may be linked to other function blocks that require a discrete input based on the detected alarm condition.

STD_DEV and CAP_STDDEV
Diagnostic parameters that can be used to determine the variability of the process.

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Application Information

The configuration of the AI function block and its associated output channels depends on the specific application. A typical configuration for the AI block involves the following parameters:

CHANNEL
The device supports more than one measurement, so verify that the selected channel contains the appropriate measurement or derived value. Refer to Table 3-5 on page 3-11 for a listing of available channels on the 848T.

L_TYPE
Select **Direct** when the measurement is in the desired engineering units for the block output. Select **Indirect** when converting the measured variable into another, for example, pressure into level or flow into energy.

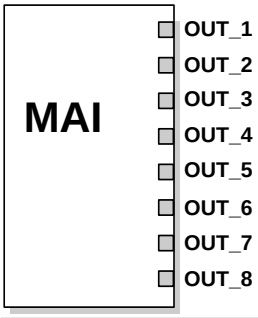
SCALING
XD_SCALE provides the range and units of the measurement and OUT_SCALE provides the range and engineering units of the output. OUT_SCALE is only used when in indirect or indirect square root.

AI Block Troubleshooting

Symptom	Possible Causes	Corrective Action
Mode will not leave OOS	Target mode not set.	Set target mode to something other than OOS.
	Configuration error	BLOCK_ERR will show the configuration error bit set. The following are parameters that must be set before the block is allowed out of OOS: • CHANNEL must be set to a valid value and cannot be left at initial value of 0. • XD_SCALE.UNITS_INDEX must match the units in the transducer block channel value. Setting the units in the AI block automatically sets them in the XD_BLOCK. • L_TYPE must be set to Direct, Indirect, or Indirect Square Root and cannot be left at initial value of 0.
	Resource block	The actual mode of the Resource block is OOS. See Resource Block Diagnostics for corrective action.
	Schedule	Block is not scheduled and therefore cannot execute to go to Target Mode. Typically, BLOCK_ERR will show “Power-Up” for all blocks that are not scheduled. Schedule the block to execute.
Process and/or block alarms will not work.	Features	FEATURES_SEL does not have Alerts enabled. Enable the Alerts bit.
	Notification	LIM_NOTIFY is not high enough. Set equal to MAX_NOTIFY. Alarm not linked to host.
	Status Options	STATUS_OPTS has Propagate Fault Forward bit set. This should be cleared to cause an alarm to occur.
Value of output does not make sense	Linearization Type	L_TYPE must be set to Direct, Indirect, or Indirect Square Root and cannot be left at initial value of 0.
	Scaling	Scaling parameters are set incorrectly: • XD_SCALE.EU0 and EU100 should match that of the transducer block channel value. • OUT_SCALE.EU0 and EU100 are not set properly. • Both STB on each asic used must by in auto.
Cannot set HI_LIMIT, HI_HI_LIMIT, LO_LIMIT, or LO_LO_LIMIT Values	Scaling	Limit values are outside the OUT_SCALE.EU0 and OUT_SCALE.EU100 values. Change OUT_SCALE or set values within range.

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MULTIPLE ANALOG INPUT (MAI) FUNCTION BLOCK



Out1 = The block output value and status for the first channel.

The Multiple Analog Input (MAI) function block has the ability to process up to eight field device measurements and make them available to other function blocks. The output values from the MAI block are in engineering units and contain a status indicating the quality of the measurement. The measuring device may have several measurements or derived values available in different channels. Use the channel numbers to define the variables that the MAI block processes.

The MAI block supports signal scaling, signal filtering, signal status calculation, mode control, and simulation. In Automatic mode, the block's output parameters (OUT_1 to OUT_8) reflects the process variable (PV) values and status. In Manual mode, OUT may be set manually. The Manual mode is reflected on the output status. Table D-4 lists the MAI block parameters and their units of measure, descriptions, and index numbers. The block execution time is 30 ms.

Table D-4. Multiple Analog Input Function Block Parameters

Number	Parameter	Units	Description
1	ST_REV	None	The revision level of the static data associated with the input selector block. The revision value will be incremented each time a static parameter value in the block is changed.
2	TAG_DESC	None	The user description of the intended application of the block.
3	STRATEGY	None	The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.
4	ALERT_KEY	None	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
5	MODE_BLK	None	The actual, target, permitted, and normal modes of the block. Actual: The mode the "block is currently in" Target: The mode to "go to" Permitted: Allowed modes that target may take on Normal: Most common mode for target
6	BLOCK_ERR	None	This parameter reflects the error status associated with the hardware or software components associated with a block. It is a bit string, so that multiple errors may be shown.
7	CHANNEL	None	Allows for custom channel setting. Valid values include: 0: Unitialized 1: Channels 1 to 8 (index values 27 to 34 can only be set to their corresponding channel number, i.e. CHANNEL_X=X) 2: Custom settings (index values 27 to 34 can be configured for any valid channel as defined by the DD)
8, 9, 10, 11, 12, 13, 14, 15	OUT (1, 2, 3, 4, 5, 6, 7, 8)	EU of OUT_SCALE	The block output value and status
16	UPDATE_EVT	None	This alert is generated by any change to the static data
17	BLOCK_ALM	None	The block alarm is used for all configuration, hardware connection feature, or system problems in the block. The cause of the alert is entered in the subcode field. The first alert to become active will set the Active status in the Status parameter. As soon as the Unreported status is cleared by the alert reporting task, another block may be reported without clearing the Active status, if the subcode has changed.
18	SIMULATE	None	A group of data that contains the current sensor transducer value and status, and the enable/disable bit.

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Table D-4. Multiple Analog Input Function Block Parameters

Number	Parameter	Units	Description
19	XD_SCALE	None	The high and low scale values, engineering units code and number of digits to the right of the decimal point associated with the channel input value. The XD_SCALE units code must match the units code of the measurement channel in the transducer block. If the units do not match, the block will not transition to MAN or AUTO. It will automatically change units in the STB block to the last one written. Multiple blocks reading the same channel may conflict (only one unit type per channel).
20	OUT_SCALE	None	The high and low scale values, engineering unit code and number of digits to the right of the decimal point associated with OUT.
21	GRANT_DENY	None	Options for controlling access of host computers and local control panels for operating, tuning, and alarm parameters of the block. Not used by device.
22	IO_OPTS	None	Allows the selection of input/output options used to alter the PV. Low cutoff enabled is the only selectable option.
23	STATUS_OPTS	None	Allows the user to select options for status handling and processing. The options supported in the MAI block are the following: • Propagate fault forward • Uncertain if limited • Bad if limited • Uncertain if manual mode
24	L_TYPE	None	Linearization type. Determines whether the field value is uses directly (Direct), is converted linearly (Indirect), or is converted with the square root (Indirect Square Root)
25	LOW_CUT	%	If percentage value of the sensor transducer input falls below this, PV = 0
26	PV_FTIME	Seconds	The time constant of the first-order PV filter. It is the time required for a 63% change in the IN value.
27, 28, 29, 30, 31, 32, 33, 34	CHANNEL_(1, 2, 3,4 5, 6, 7, 8)	None	The CHANNEL (1, 2, 3, 4, 5, 6, 7, 8) value is used to select the measurement value. See Table D-4 on page D-6 for available channels. Configure the CHANNEL parameters to custom (2) before configuring the CHANNEL parameters.
35, 36, 37, 38, 39, 40, 41, 42	STDDEV_(1, 2, 3, 4, 5, 6, 7, 8)	% of OUT Range	Standard deviation of the corresponding measurement.
43, 44, 45, 46, 47, 48, 49, 50	CAP_STDDEV_(1 , 2, 3, 4, 5, 6, 7, 8)	% of OUT Range	Capability standard deviation, the best deviation that can be achieved.

Functionality

Simulation

To support testing, either change the mode of the block to manual and adjust the output value or enable simulation through the configuration tool and manually enter a value for the measurement value and its status (this single value will apply to all outputs). In both cases, first set the ENABLE jumper on the field device.

NOTE
All FOUNDATION fieldbus instruments have a simulation jumper. As a safety measure, the jumper has to be reset every time there is a power interruption. This measure is to prevent devices that went through simulation in the staging process from being installed with simulation enabled.

With simulation enabled, the actual measurement value has no impact on the OUT value or the status. The OUT values will all have the same value as determined by the simulate value.

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Figure D-3. Multiple Analog Input Function Block Timing Diagram

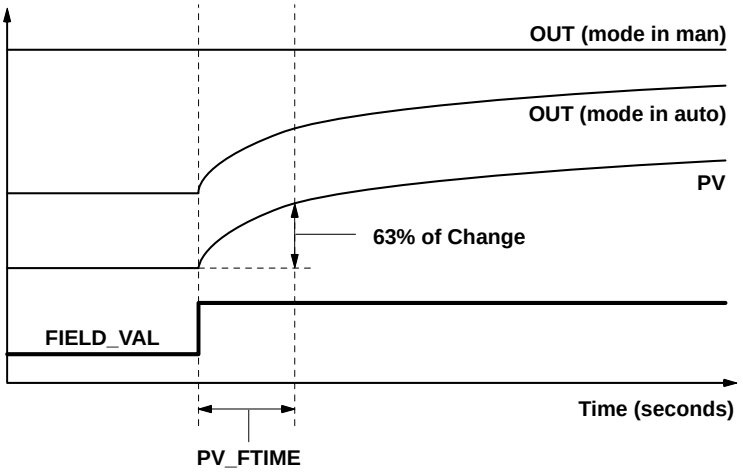
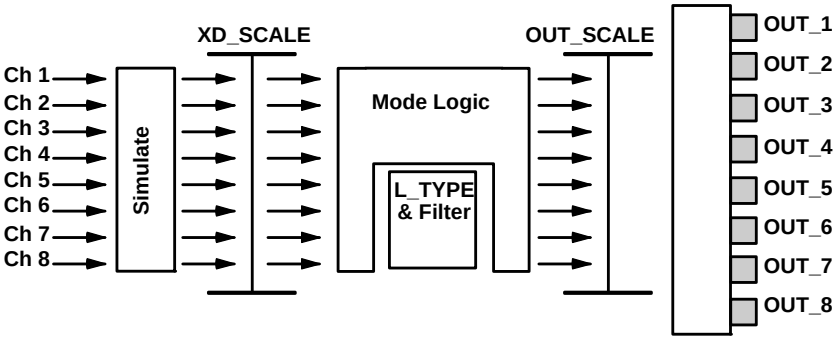


Figure D-4. Multiple Analog Input Function Block Schematic



Filtering

The filtering feature changes the response time of the device to smooth variations in output readings caused by rapid changes in input. Adjust the filter time constant (in seconds) using the PV_FTIME parameter (same value applied to eight channels). Set the filter time constant to zero to disable the filter feature.

Signal Conversion

Set the signal conversion type with the Linearization Type (L_TYPE) parameter. Choose from direct, indirect, or indirect square root signal conversion with the L_TYPE parameter.

Direct

Direct signal conversion allows the signal to pass through the accessed channel input value (or the simulated value when simulation is enabled).

PV = Channel Value

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Indirect
Indirect signal conversion converts the signal linearly to the accessed channel input value (or the simulated value when simulation is enabled) from its specified range (XD_SCALE) to the range and units of the PV and OUT parameters (OUT_SCALE).

$$PV = \left(\frac{\text{Channel Value}}{100}\right) \times (EU^{**}@100\% - EU^{**}@0\%) + EU^{**}@0\%$$

**** OUT_SCALE values**

Indirect Square Root
Indirect Square Root signal conversion takes the square root of the value computed with the indirect signal conversion and scales it to the range and units of the PV and OUT parameters.

$$PV = \sqrt{\left(\frac{\text{Channel Value}}{100}\right)} \times (EU^{**}@100\% - EU^{**}@0\%) + EU^{**}@0\%$$

**** OUT_SCALE values**

When the converted input value is below the limit specified by the LOW_CUT parameter, and the Low Cutoff I/O option (IO_OPTS) is enabled (True), a value of zero is used for the converted value (PV). This option is useful to eliminate false readings when the differential temperature measurement is close to zero, and it may also be useful with zero-based measurement devices such as flowmeters.

NOTE
Low Cutoff is the only I/O option supported by the MAI block. Set the I/O option in Manual or Out of Service mode only.

Block Errors

Table D-5 lists conditions reported in the BLOCK_ERR parameter. Conditions in **bold** are inactive for the MAI block and are given for reference.

Table D-5. BLOCK_ERR Conditions

Number	Name and Description
0	Other
1	Block Configuration Error: the selected channel carries a measurement that is incompatible with the engineering units selected in XD_SCALE, the L_TYPE parameter is not configured, or WRITE_CHECK = zero.
2	**Link Configuration Error**
3	Simulate Active: Simulation is enabled and the block is using a simulated value in its execution.
4	**Local Override**
5	**Device Fault State Set**
6	**Device Needs Maintenance Soon**
7	Input Failure/Process Variable has Bad Status: The hardware is bad, or a bad status is being simulated.
8	Output Failure: The output is bad based primarily upon a bad input.
9	**Memory Failure**
10	**Lost Static Data**
11	**Lost NV Data**
12	**Readback Check Failed**
13	**Device Needs Maintenance Now**
14	Power Up
15	Out of Service: The actual mode is out of service.

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Modes

The MAI Function Block supports three modes of operation as defined by the MODE_BLK parameter:

Manual (Man)
The block output (OUT) may be set manually

Automatic (Auto)
OUT_1 to OUT_8 reflects the analog input measurement or the simulated value when simulation is enabled.

Out of Service (OOS)
The block is not processed. PV is not updated and the OUT status is set to Bad: Out of Service. The BLOCK_ERR parameter shows Out of Service. In this mode, changes can be made to all configurable parameters. The target mode of a block may be restricted to one or more of the supported modes.

Status Handling

Normally, the status of the PV reflects the status of the measurement value, the operating condition of the I/O card, and any active alarm condition. In Auto mode, OUT reflects the value and status quality of the PV. In Man mode, the OUT status constant limit is set to indicate that the value is a constant and the OUT status is *Good*.

If the sensor limit exceeds the high or low side range, PV status is set high or low and EU range status is set to uncertain.

In the STATUS_OPTS parameter, select from the following options to control the status handling:

BAD if Limited
Sets the OUT status quality to *Bad* when the value is higher or lower than the sensor limits.

Uncertain if Limited
Sets the OUT status quality to *Uncertain* when the value is higher or lower than the sensor limits.

Uncertain if in Manual mode
The status of the Output is set to *Uncertain* when the mode is set to Manual

NOTES

1. The instrument must be OOS to set the status option.
2. The MAI block only supports the BAD if Limited option.

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Application Information

The intended use for this type of function block is for applications where the sensor types and functionality of each channel (i.e. the simulate, scaling, filtering, alarms type, and options) are the same.

The configuration of the MAI function block and its associated output channels depends on the specific application. A typical configuration for the MAI block involves the following parameters:

CHANNEL
If the device supports more than one measurement, verify that the selected channel contains the appropriate measurement or derived value. Refer to Table D-4 on page D-6 for a listing of available channels on the 848T.

L_TYPE
Select **Direct** when the measurement is already in the desired engineering units for the block output. Select **Indirect** when converting the measured variable into another, for example, pressure into level or flow into energy. Select **Indirect Square Root** when the block I/O parameter value represents a flow measurement made using differential pressure, and when square root extraction is not performed by the transducer.

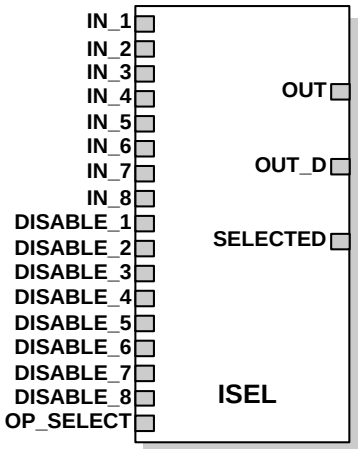
SCALING
XD_SCALE provides the range and units of the measurement and OUT_SCALE provides the range and engineering units of the output.

MAI Block Troubleshooting

Symptom	Possible Causes	Corrective Action
Mode will not leave OOS	Target mode not set.	Set target mode to something other than OOS.
	Configuration error	BLOCK_ERR will show the configuration error bit set. The following are parameters that must be set before the block is allowed out of OOS: • Initial value is 1. • XD_SCALE.UNITS_INDEX must match the units in all the corresponding sensor transducer blocks. • L_TYPE must be set to Direct, Indirect, or Indirect Square Root and cannot be left at initial value of 0.
	Resource block	The actual mode of the Resource block is OOS. See Resource Block Diagnostics for corrective action.
	Schedule	Block is not scheduled and therefore cannot execute to go to Target Mode. Typically, BLOCK_ERR will show “Power-Up” for all blocks that are not scheduled. Schedule the block to execute.
Process and/or block alarms will not work.	Features	FEATURES_SEL does not have Alerts enabled. Enable the Alerts bit.
	Notification	LIM_NOTIFY is not high enough. Set equal to MAX_NOTIFY.
	Status Options	STATUS_OPTS has Propagate Fault Forward bit set. This should be cleared to cause an alarm to occur.
Value of output does not make sense	Linearization Type	L_TYPE must be set to Direct, Indirect, or Indirect Square Root and cannot be left at initial value of 0.
	Scaling	Scaling parameters are set incorrectly: • XD_SCALE.EU0 and EU100 should match that of the corresponding sensor transducer block. • OUT_SCALE.EU0 and EU100 are not set properly. • Both STBs in an ASIC must be set to auto. Best in 1, 2, 7, 8, ASICs in Auto for thermocouples

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INPUT SELECTOR FUNCTION BLOCK



IN (1-8) = Input

DISABLE (1-8) = Discrete input used to disable the associated input channel

SELECTED = The selected channel number

OUT = The block output and status

OUT_D = Discrete output that signals a selected alarm condition

The Input Selector (ISEL) function block can be used to select the first good, Hot Backup, maximum, minimum, or average of as many as eight input values and place it at the output. The block supports signal status propagation. There is process alarm detection in the Input Selector function block. Table D-6 lists the ISEL block parameters and their descriptions, units of measure, and index numbers. The block execution time is 30 ms.

Table D-6. Input Selector Function Block Parameters

Number	Parameter	Units	Description
1	ST_REV	None	The revision level of the static data associated with the input selector block. The revision value will be incremented each time a static parameter value in the block is changed.
2	TAG_DESC	None	The user description of the intended application of the block.
3	STRATEGY	None	The strategy field can be used to identify groupings of blocks. This data is not checked or processed by the block.
4	ALERT_KEY	None	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
5	MODE_BLK	None	The actual, target, permitted, and normal modes of the block. Actual: The mode the “block is currently in” Target: The mode to “go to” Permitted: Allowed modes that target may take on Normal: Most common mode for target
6	BLOCK_ERR	None	This parameter reflects the error status associated with the hardware or software components associated with a block. It is a bit string, so that multiple errors may be shown.
7	OUT	OUT_RANGE	The primary analog value calculated as a result of executing the function block.
8	OUT_RANGE	EU of OUT	The engineering units code to be used in displaying the OUT parameter and parameters which have the same scaling as OUT.
9	GRANT_DENY	None	Options for controlling access of host computers and local control panels to operating, tuning, and alarm parameters of the block. Not used by device.
10	STATUS_OPTS	None	Allows the user to select options for status handling and processing.
11,1 2, 13, 14, 25, 26, 27, 28	IN_(1, 2, 3, 4, 5, 6, 7, 8)	Determined by source	A connection input from another block

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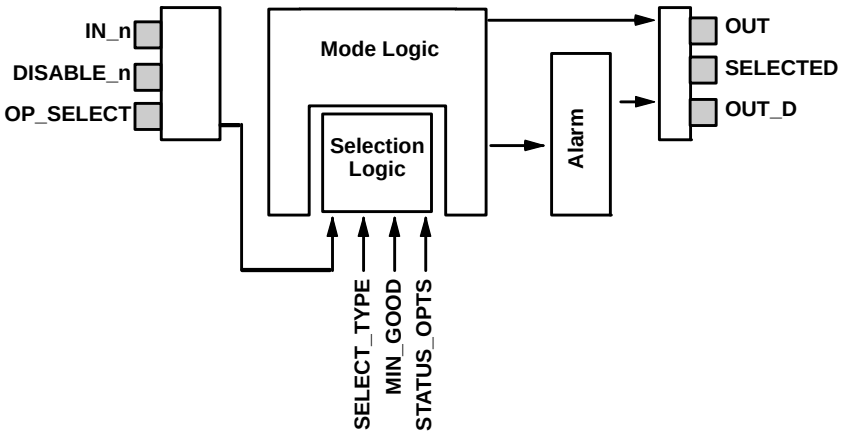
Table D-6. Input Selector Function Block Parameters

Number	Parameter	Units	Description
15, 16, 17, 18, 29, 30, 31, 32	DISABLE_(1, 2, 3, 4, 5, 6, 7, 8)	None	A connection from another block that disables the associated input from the selection.
19	SELECT_TYPE	None	Specifies input selection method. Methods available include: First Good, Minimum, Maximum, Middle, Average, or Hot Backup.
20	MIN_GOOD	None	The minimum number of good inputs.
21	SELECTED	None	The selected input number (1 to 8) or the number of input used for the average output.
22	OP_SELECT	None	Overrides the algorithm to select 1 of the 8 inputs regardless of the selection type.
23	UPDATE_EVT	None	This alert is generated by any change to the static data
24	BLOCK_ALM	None	The block alarm is used for all configuration, hardware, connection failure, or system problems in the block. The cause of the alert is entered in the subcode field. The first alert to become active will set the Active status in the Status parameter. As soon as the Unreported status is cleared by the alert reporting task, another block may be reported without clearing the Active status, if the subcode has changed.
33	AVG_USE	None	Number of parameters to use in the averaging calculation. For example, if AVG_USE is 4 and the number of connected inputs is 6, then the highest and lowest values would be dropped prior to calculating the average. If AVG_USE is 2 and the number of connected inputs is 7, then the two highest and lowest values would be dropped prior to calculating the average and the average would be based on the middle three inputs.
34	ALARM_SUM	None	The current alert status, unacknowledged states, and disabled states of the alarms associated with the function block.
35	ACK_OPTION	None	Used to set automatic acknowledgement of alarms.
36	ALARM_HYS	Percent	The amount the alarm value must return within the alarm limit before the associated active alarm condition clears
37	HI_HI-PRI	None	The priority of the HI HI alarm
38	HI_HI_LIM	Percent	The setting for the alarm limit used to detect the HI HI alarm condition.
39	HI_PRI	None	The priority of the HI alarm
40	HI_LIM	EU of IN	The setting for the alarm limit used to detect the HI alarm condition
41	LO_PRI	None	The priority of the LO alarm
42	LO_LIM	EU of IN	The setting of the alarm limit used to detect the LO alarm condition
43	LO_LO_PRI	None	The priority of the LO LO alarm
44	LO_LO_LIM	EU of IN	The setting for the alarm limit sued to detect the LO LO alarm condition
45	HI_HI_ALM	None	The HI HI alarm data, which includes a value of the alarm, a timestamp of occurrence and the state of the alarm
46	HI_ALM	None	The HI alarm data, which includes a value of the alarm, a timestamp of occurrence and the state of the alarm
47	LO_ALM	None	The LO alarm data, which includes a value of the alarm, a timestamp of occurrence and the state of the alarm
48	LO_LO_ALM	None	The LO LO alarm data, which includes a value of the alarm, a timestamp of occurrence and the state of the alarm
49	OUT_D	None	Discrete output to indicate a selected alarm value
50	ALM_SEL	None	Used to select the process alarm conditions that will cause the OUT_D parameter to be set.

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Functionality

Figure D-5. Input Selector Function Block Schematic



Block Errors

Table D-7 lists conditions reported in the BLOCK_ERR parameter. Conditions in **bold** are inactive for the ISEL block and are given for reference.

Table D-7. BLOCK_ERR Conditions

Number	Name and Description
0	Other: The output has a quality of uncertain.
1	**Block Configuration Error: Select type is not configured**
2	**Link Configuration Error**
3	**Simulate Active**
4	Local Override
5	**Device Fault State Set**
6	**Device Needs Maintenance Soon**
7	Input Failure/Process Variable has Bad Status: One of the inputs is Bad.
8	Output Failure
9	**Memory Failure**
10	**Lost Static Data**
11	**Lost NV Data**
12	**Readback Check Failed**
13	**Device Needs Maintenance Now**
14	Power Up: The device was just powered-up.
15	Out of Service: The actual mode is out of service.

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Modes

The ISEL function block supports three modes of operation as defined by the MODE_BLK parameter:

Manual (Man)
The block output (OUT) may be set manually.

Automatic (Auto)
OUT reflects the selected value.

Out of Service (OOS)
The block is not processed. The BLOCK_ERR parameter shows Out of Service. The target mode of a block may be restricted to one or more of the supported modes. In this mode, changes can be made to all configurable parameters.

Alarm Detection

A block alarm will be generated whenever the BLOCK_ERR has an error bit set. The type of block errors for the ISEL block are defined above.

Process Alarm detection is based on the OUT value. The alarm limits of the following standard alarms can be configured:

- High (HI_LIM)
- High high (HI_HI_LIM)
- Lo (LO_LIM)
- Lo low (LO_LO_LIM)

In order to avoid alarm chattering when the variable is oscillating around the alarm limit, an alarm hysteresis in percent of the PV span can be set using the ALARM_HYS parameter. The priority of each alarm is set in the following parameters:

- HI_PRI
- HI_HI_PRI
- LO_PRI
- LO_LO_PRI

Table D-8. Alarm Priority Levels

Number	Description
0	The priority of an alarm condition changes to 0 after the condition that caused the alarm is corrected.
1	An alarm condition with a priority of 1 is recognized by the system, but is not reported to the operator.
2	An alarm condition with a priority of 2 is reported to the operator, but does not require operator attention (such as diagnostics and system alerts).
3-7	Alarm conditions of priority 3 to 7 are advisory alarms of increasing priority.
8-15	Alarm conditions of priority 8 to 15 are critical alarms of increasing priority.

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Block Execution

The ISEL function block reads the values and status of up to eight inputs. To specify which of the six available methods (algorithms) is used to select the output, configure the selector type parameter (SELECT_TYPE) as follows:

- **Max** selects the maximum value of the inputs.
- **Min** selects the minimum value of the inputs.
- **Avg** calculates the average value of the inputs.
- **Mid** calculates the update for eight sensors.
- **1st Good** selects the first available good input.

If the DISABLE_N is active, the associated input is not used in the selection algorithm.

If an input is not connected, it is also not used in the algorithm.

If the OP_SELECT is set to a value between 1 and 8, the selection type logic is overridden and the output value and status is set to the value and status of the input selected by OP_SELECT.

SELECTED will have the number of selected input unless the SELECT_TYPE is mid, in which case it will take the average of the two middle values. Then SELECTED will be set to “0” if there is an even number of inputs.

Status Handling

In Auto mode, OUT reflects the value and status quality of the selected input. If the number of inputs with Good status is less than MIN_GOOD, the output status will be Bad.

In Man mode, the OUT status high and low limits are set to indicate that the value is a constant and the OUT status is always Good.

In the STATUS_OPTS parameter, select from the following options to control the status handling:

Use Uncertain as Good
Sets the OUT status quality to Good when the selected input status is Uncertain.

Uncertain if in Manual mode
The status of the Output is set to Uncertain when the mode is set to manual.

NOTE
The instrument must be to OOS to set the status option.

Application Information

Use the ISEL function block to:

- Select the maximum temperature input from eight inputs and send it to another function block (see Figure D-6)
- Calculate the average temperature of the eight inputs (see Figure D-7)
- Use only six of the eight inputs to calculate the average temperature.

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Figure D-6. Input Selector Function Block Application Example (SEL_TYPE = max)

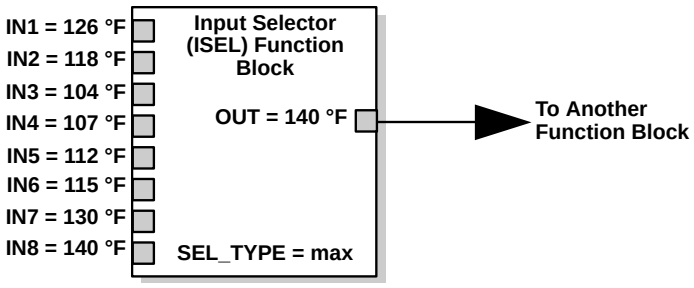
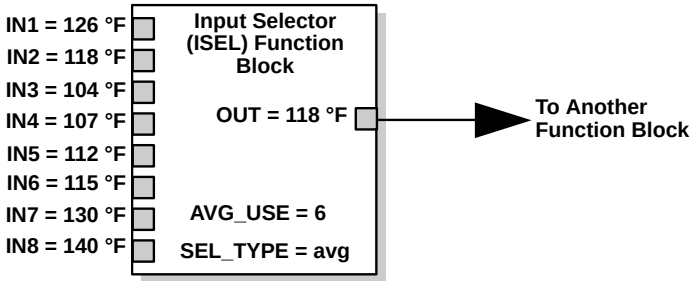


Figure D-7. Input Selector Function Block Application Example (SEL_TYPE = average) AVG_USE = 6



To determine OUT for a 6-input reading, read all eight, sort in numerical order, drop the highest and lowest values, and calculate the average.

$$\frac{107 + 112 + 115 + 118 + 126 + 130}{6} = 118°F$$

ISEL Block Troubleshooting

Symptom	Possible Causes	Corrective Action
Mode will not leave OOS	Target mode not set.	Set target mode to something other than OOS.
	Configuration error	BLOCK_ERR will show the configuration error bit set. SELECT_TYPE must be set to a valid value and cannot be left at 0.
	Resource block	The actual mode of the Resource block is OOS. See Resource Block Diagnostics for corrective action.
	Schedule	Block is not scheduled and therefore cannot execute to go to Target Mode. Typically, BLOCK_ERR will show “Power-Up” for all blocks that are not scheduled. Schedule the block to execute.
Status of output is BAD	Inputs	All inputs have Bad status
	OP selected	OP_SELECT is not set to 0 (or it is linked to an input that is not 0), and it points to an input that is Bad.
	Min good	The number of Good inputs is less than MIN_GOOD.
	Block is in OOS mode	Change mode to Auto
Block alarms will not work.	Features	FEATURES_SEL in the resource block does not have Alerts enabled. Enable the Alerts bit.
	Notification	LIM_NOTIFY in the resource block is not high enough. Set equal to MAX_NOTIFY.
	Status Options	STATUS_OPTS has Propagate Fault Forward bit set. This should be cleared to cause an alarm to occur.
Cannot set HI_LIMIT, HI_HI_LIMIT, LO_LIMIT, LO_LO_LIMIT	Scaling	Limit values are outside the OUT_SCALE.EU0 and OUT_SCALE.EU100 values. Change OUT_SCALE or set values within range.

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