Reference Manual
00809-0100-4101, Rev AA
July 2008

Rosemount 2051 Pressure Transmitter

with 4-20 mA HART and 1-5 Vdc Low Power Protocol

HART

ROSEMOUNT®

www.rosemount.com

EMERSON™
Process Management

Reference Manual
00809-0100-4101, Rev AA
July 2008

Rosemount 2051 Pressure Transmitter

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.

For technical assistance, contacts are listed below:

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

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

Asia Pacific- 65 777 8211

Europe/ Middle East/ Africa - 49 (8153) 9390

North American Response Center
Equipment service needs.

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

Outside of these areas, contact your local Emerson Process Management 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 Emerson Process Management Sales Representative.

Rosemount 2051 Pressure Transmitters may be protected by one or more of the following: U.S. Patent Nos. 4466290; 4612812; 4791352; 4798089; 4818994; 4866435; 4878012; 4988990; 4926340; 5083091; 5122794; 5166678; 5248167; 5278543; 5287746; 5329818; 5333504; 5585777; 6017143; 6119047; 6295875; Des. 317266; Des. 318432; Des 342456. May depend on model. Other U.S. and foreign patents issued and pending.

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APPENDIX A Reference Data

APPENDIX B Approval Information

APPENDIX C Glossary

Section 1 Introduction

USING THIS MANUAL

The sections in this manual provide information on installing, operating, and maintaining Rosemount 2051 pressure transmitters with HART® protocol. The sections are organized as follows:

- **Section 2: Installation** contains mechanical and electrical installation instructions, and field upgrade options.
- **Section 3: Configuration** provides instruction on commissioning and operating Rosemount 2051 transmitters. Information on software functions, configuration parameters, and online variables is also included.
- **Section 4: Operation and Maintenance** contains operation and maintenance techniques.
- **Section 5: Troubleshooting** provides troubleshooting techniques for the most common operating problems.
- **Appendix A: Reference Data** supplies reference and specification data, as well as ordering information.
- **Appendix B: Approval Information** contains intrinsic safety approval information, European ATEX directive information, and approval drawings.
- **Appendix C: Glossary**

SERVICE SUPPORT

To expedite the return process outside of the United States, contact the nearest Emerson Process Management representative.

Within the United States, call the Emerson Process Management Instrument and Valves 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.

Emerson Process Management Instrument and Valves Response Center representatives will explain the additional information and procedures necessary to return goods exposed to hazardous substances.

MODELS COVERED

The following Rosemount 2051 Pressure Transmitters are covered by this manual:

Rosemount 2051C Coplanar™ Pressure Transmitter

2051CD - Differential Pressure Transmitter
Measures differential pressure up to 2000 psi (137,9 bar)

2051CG - Gage Pressure Transmitter
Measures gage pressure up to 2000 psi (137,9 bar)

Rosemount 2051T In-Line Pressure Transmitter

2051TG - Gage Pressure Transmitter
Measures gage pressure up to 10000 psi (689,5 bar)

2051TA - Absolute Pressure Transmitter
Measures absolute pressure up to 10000 psi (689,5 bar)

Rosemount 2051L Liquid Level Pressure Transmitter

2051L - Flange-Mounted Liquid Level Transmitter
Provides precise level and specific gravity measurements up to 300 psi (20,7 bar) for a wide variety of tank configurations

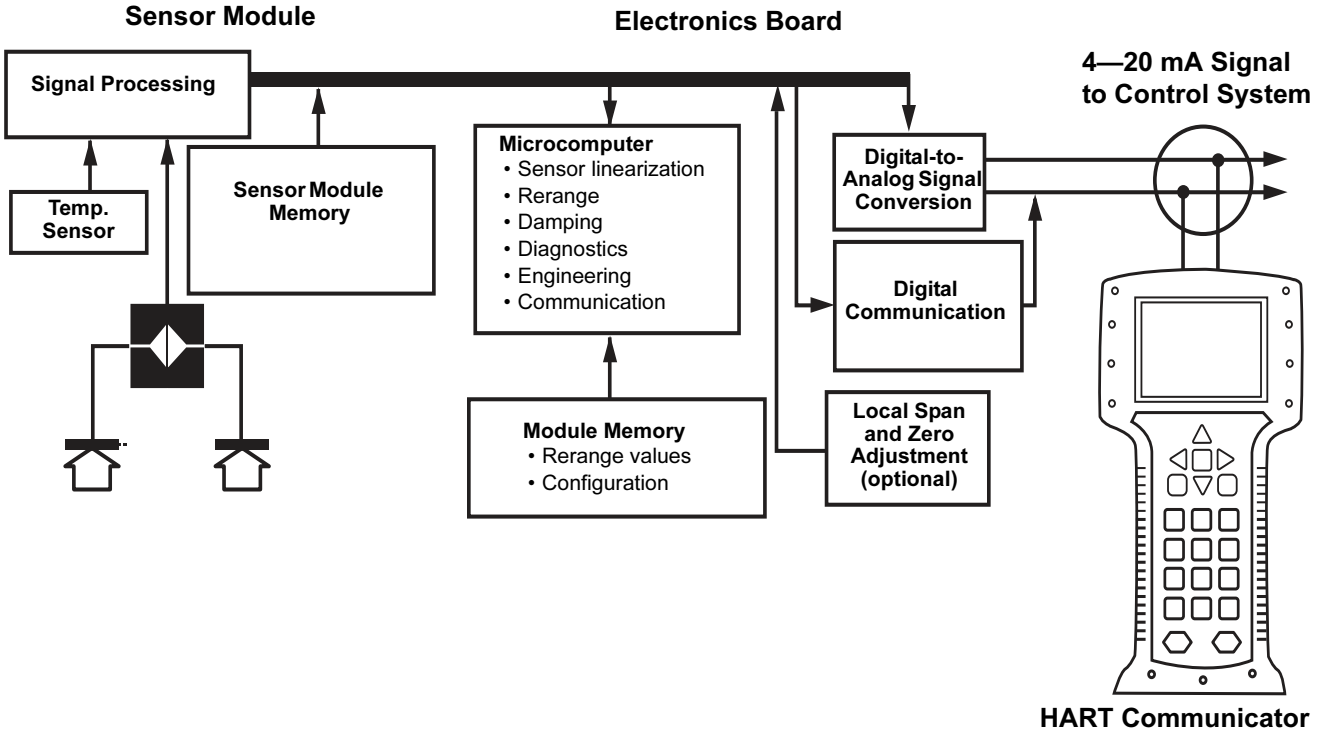
TRANSMITTER OVERVIEW

The Rosemount 2051C Coplanar design is offered for Differential Pressure (DP) and Gage Pressure (GP) measurements where it utilizes Emerson Process Management capacitance sensor technology. Piezoresistive sensor technology is utilized in the Rosemount 2051T measurements.

The major components of the Rosemount 2051C are the sensor module and the electronics housing. The sensor module contains the oil filled sensor system (isolating diaphragms, oil fill system, and sensor) and the sensor electronics. The sensor electronics are installed within the sensor module and include a temperature sensor (RTD), a memory module, and the capacitance to digital signal converter (C/D converter). The electrical signals from the sensor module are transmitted to the output electronics in the electronics housing. The electronics housing contains the output electronics board, the local zero and span buttons, and the terminal block. The basic block diagram of the Rosemount 2051CD is illustrated in Figure 1-1.

For the Rosemount 2051C design, pressure is applied to the isolating diaphragms, the oil deflects the center diaphragm, which then changes the capacitance. This capacitance signal is then changed to a digital signal in the C/D converter. The microprocessor then takes the signals from the RTD and C/D converter calculates the correct output of the transmitter. This signal is then sent to the D/A converter, which converts the signal back to an analog signal and superimposes the HART signal on the 4-20 mA output.

Figure 1-1. Block diagram of operation



Section 2 Installation

OVERVIEW

The information in this section covers installation considerations for the Rosemount 2051 with HART protocols. A Quick Installation Guide for HART protocol (document number 00825-0100-4101) is shipped with every transmitter to describe basic pipe-fitting and wiring procedures for initial installation. Dimensional drawings for each 2051 variation and mounting configuration are included on page 2-5.

HART Communicator and AMS Device Manager instructions are given to perform configuration functions. For convenience, HART Communicator fast key sequences are labeled “Fast Keys” for each software function below the appropriate headings.

SAFETY MESSAGES

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

Warnings

⚠WARNING

Explosions could result in death or serious injury:
Installation of this transmitter in an explosive environment must be in accordance with the appropriate local, national, and international standards, codes, and practices. Please review the approvals section of the 2051 reference manual for any restrictions associated with a safe installation.
- Before connecting a HART communicator in an explosive atmosphere, ensure the instruments in the loop are installed in accordance with intrinsically safe or non-incendive field wiring practices.
- In an Explosion-Proof/Flameproof installation, do not remove the transmitter covers when power is applied to the unit.

Process leaks may cause harm or result in death.
- Install and tighten process connectors before applying pressure.

Electrical shock can result in death or serious injury.
- Avoid contact with the leads and terminals. High voltage that may be present on leads can cause electrical shock.

⚠WARNING

Electrical shock can result in death or serious injury.
- Avoid contact with the leads and terminals.

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.

Replacement equipment or spare parts not approved by Emerson Process Management for use as spare parts could reduce the pressure retaining capabilities of the transmitter and may render the instrument dangerous.
- Use only bolts supplied or sold by Emerson Process Management as spare parts.
- Refer to page A-25 for a complete list of spare parts.

Improper assembly of manifolds to traditional flange can damage sensor module.
- For safe assembly of manifold to traditional flange, bolts must break back plane of flange web (i.e., bolt hole) but must not contact sensor module housing.

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. Also, consider 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 (found in the box) in unused conduit opening with a minimum of five threads engaged to comply with explosion-proof requirements.

For material compatibility considerations, see document number 00816-0100-3045 on www.emersonprocess.com/rosemount.

MECHANICAL CONSIDERATIONS

NOTE
For steam service or for applications with process temperatures greater than the limits of the transmitter, do not blow down impulse piping through the transmitter. Flush lines with the blocking valves closed and refill lines with water before resuming measurement.

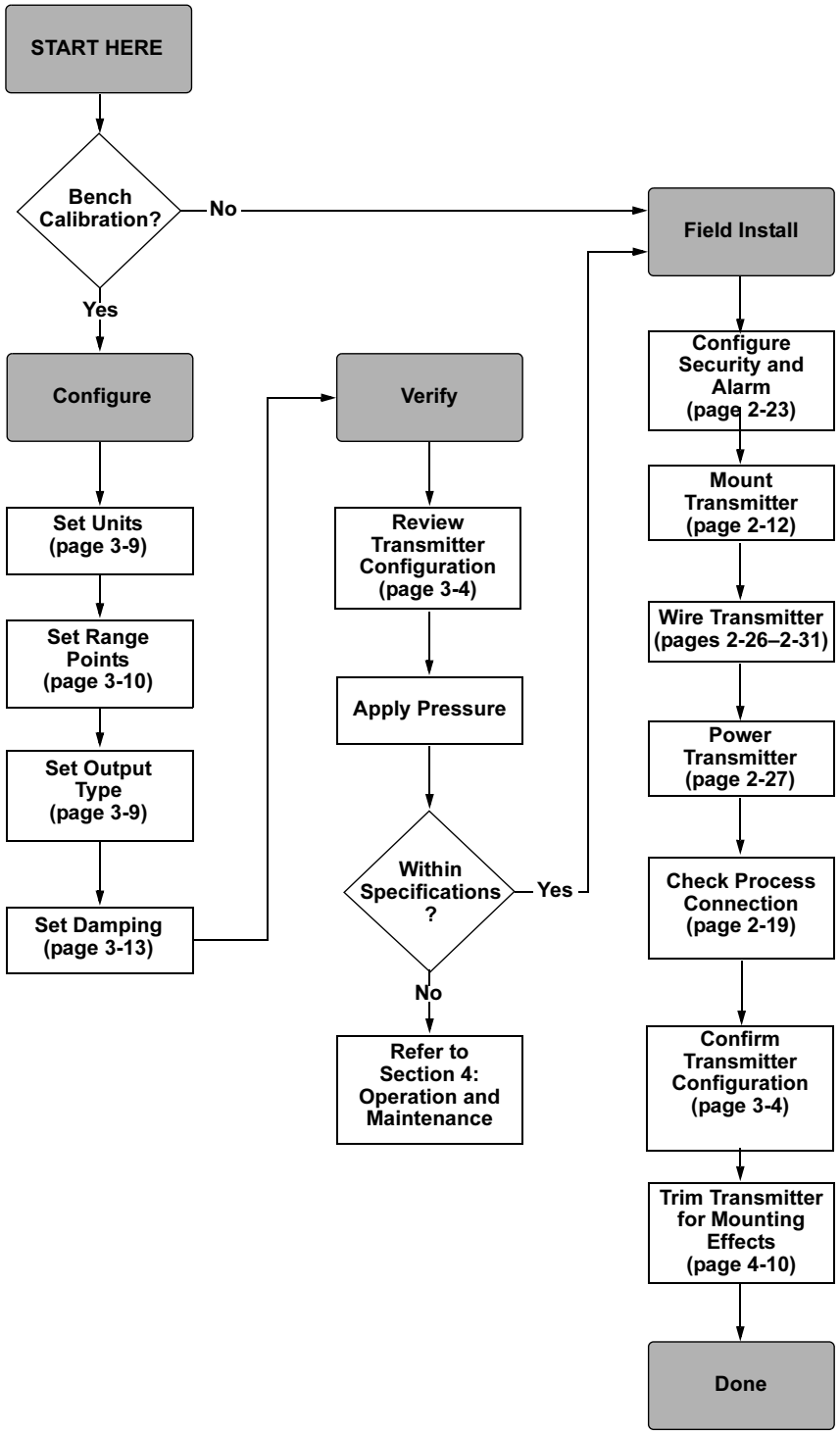
NOTE
When the transmitter is mounted on its side, position the Coplanar flange to ensure proper venting or draining. Mount the flange as shown in Figure 2-8 on page 2-18, keeping drain/vent connections on the bottom for gas service and on the top for liquid service.

ENVIRONMENTAL CONSIDERATIONS

Best practice is to mount the transmitter in an environment that has minimal ambient temperature change. The transmitter electronics temperature operating limits are –40 to 185 °F (–40 to 85 °C). Refer to Appendix A: Reference Data that lists the sensing element operating limits. Mount the transmitter so that it is not susceptible to vibration and mechanical shock and does not have external contact with corrosive materials.

HART INSTALLATION FLOWCHART

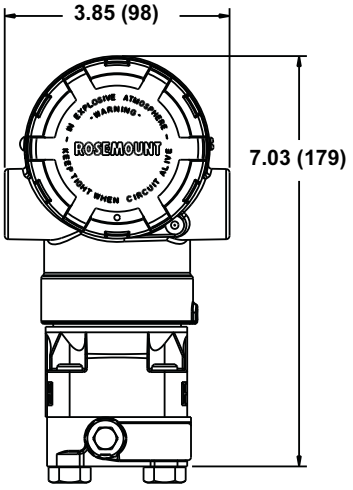
Figure 2-1. HART Installation Flowchart

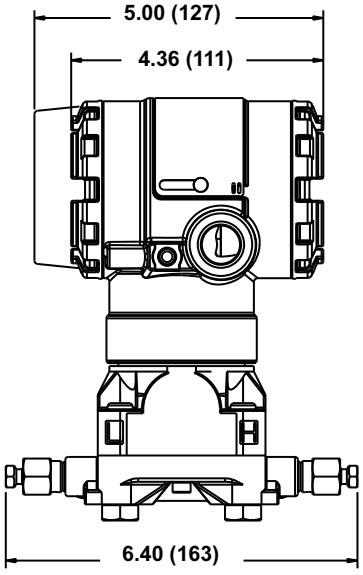


INSTALLATION PROCEDURES

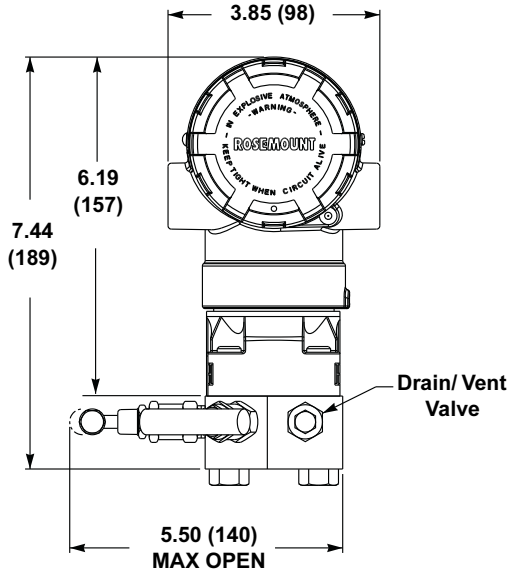
Dimensional Drawings

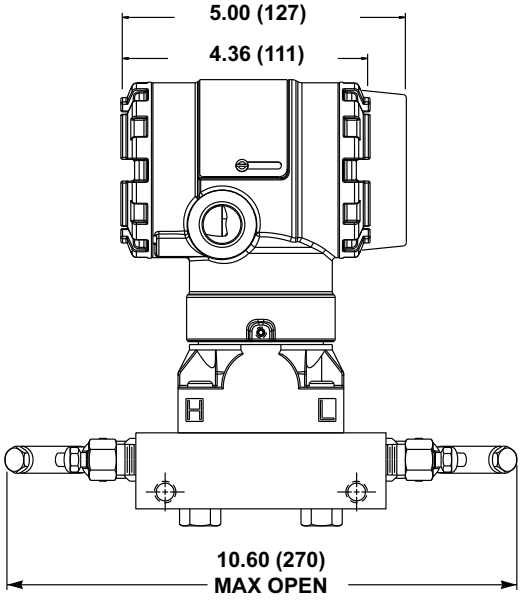
2051C Coplanar Flange Dimensional Drawing





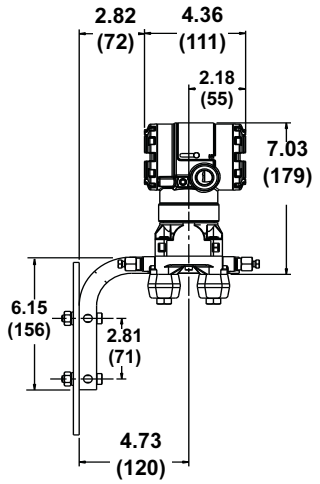
2051C Coplanar with Rosemount 305 Coplanar Integral Manifold

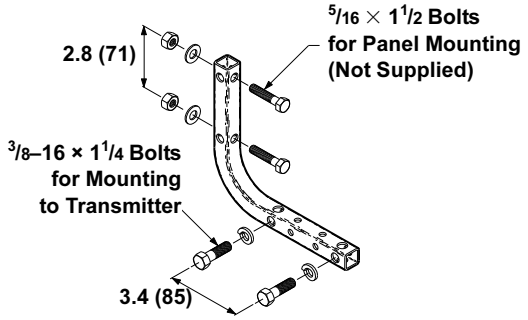




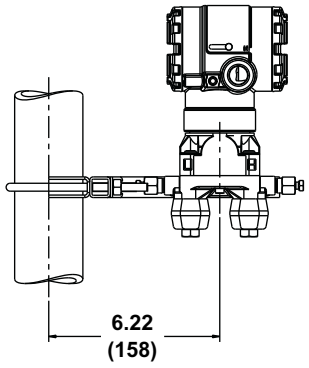
Coplanar Flange Mounting Configurations with Optional Bracket (B4) for 2-in. Pipe or Panel Mounting

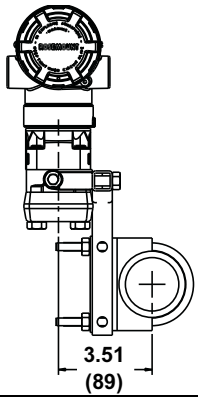
PANEL MOUNTING

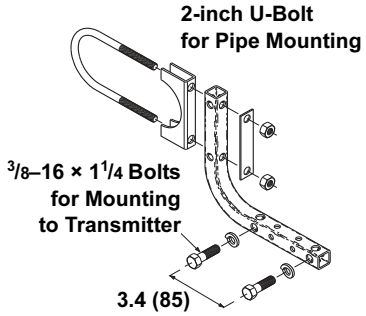




PIPE MOUNTING

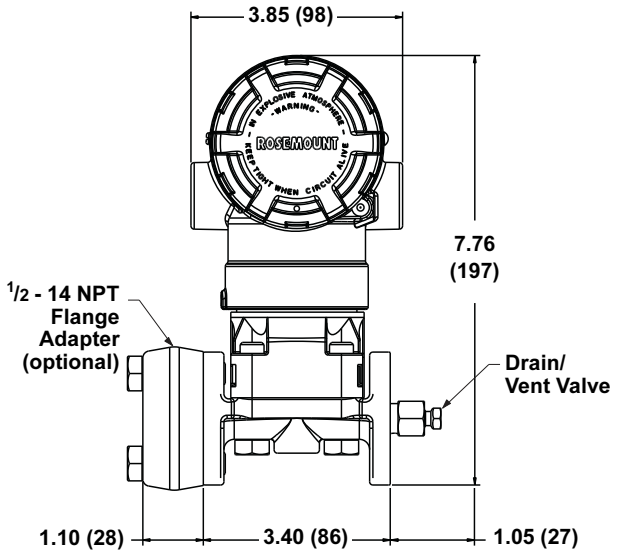


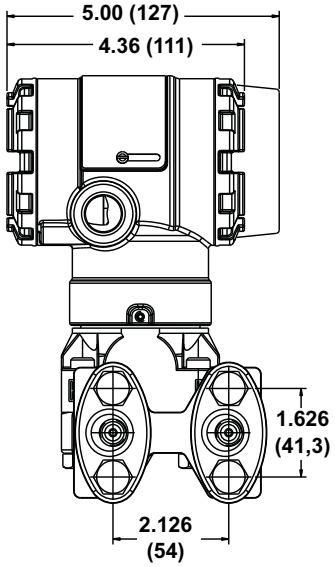




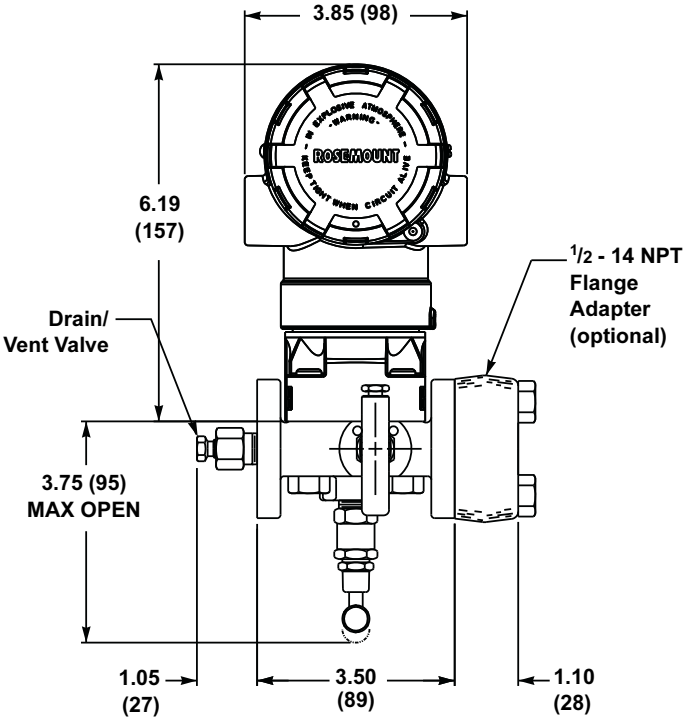
Dimensions are in inches (millimeters)

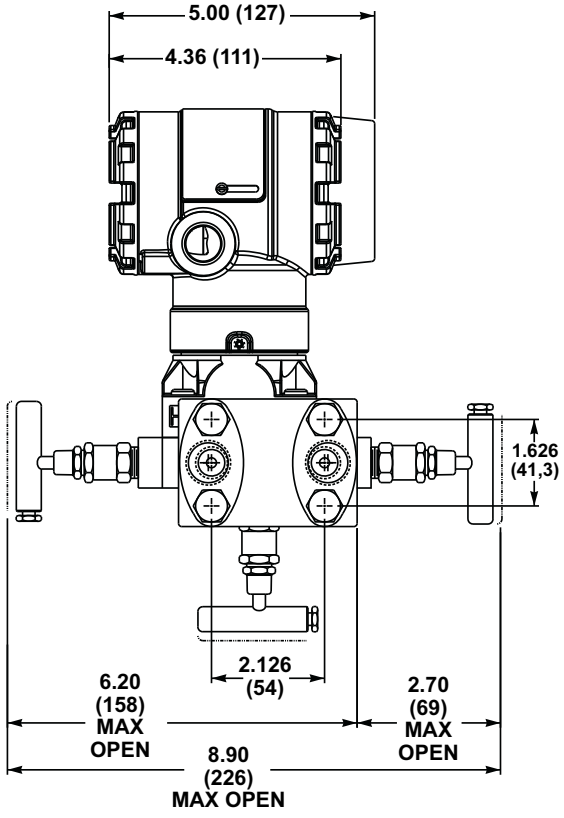
2051C Coplanar with Traditional Flange





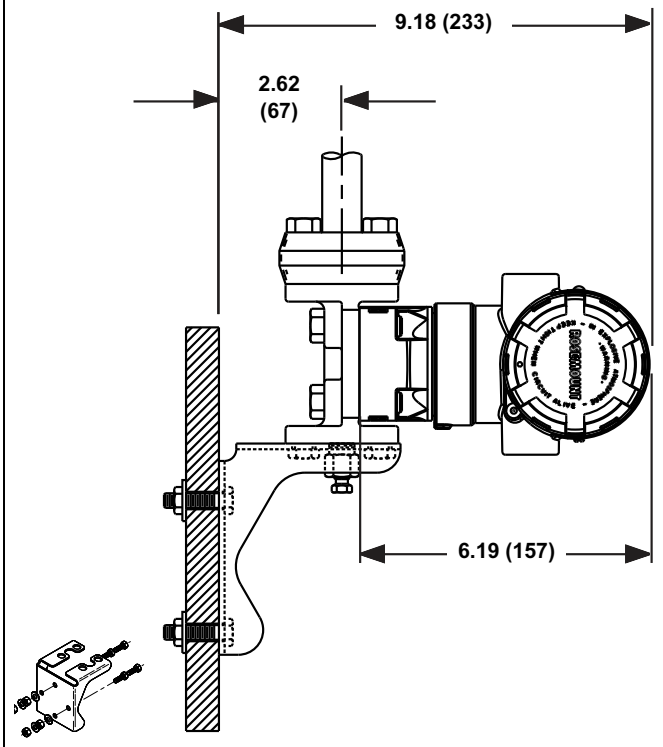
2051C Coplanar with Rosemount 305 Traditional Integral Manifold



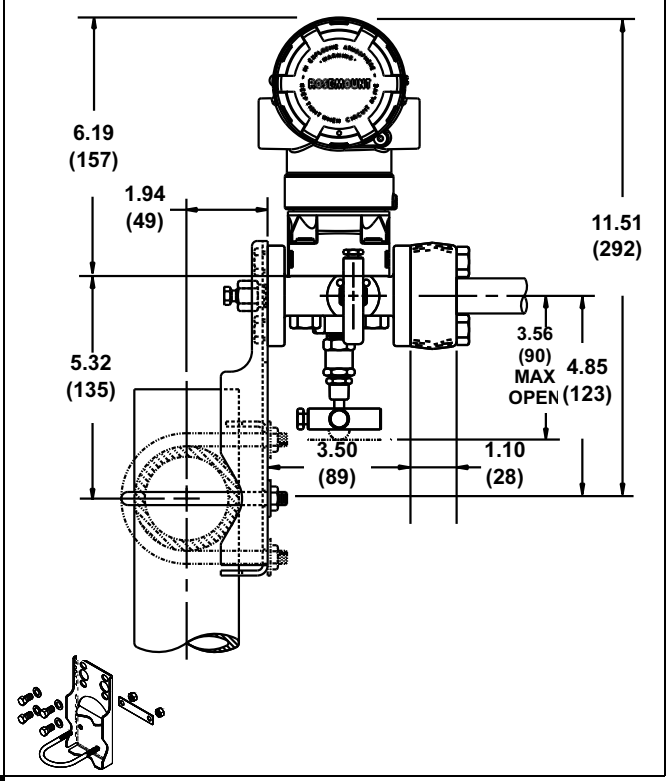


Traditional Flange Mounting Configurations with Optional Brackets for 2-in. Pipe or Panel Mounting

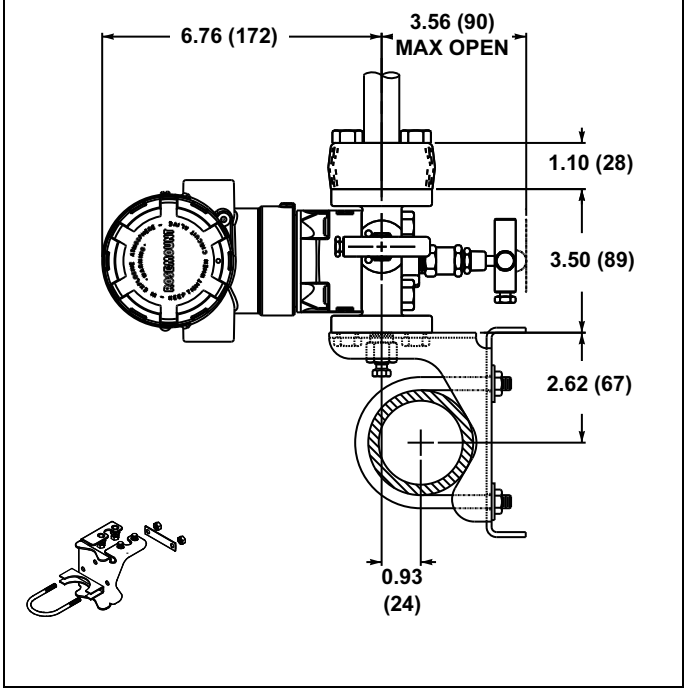
Panel Mount (Bracket Option B2 / B8)



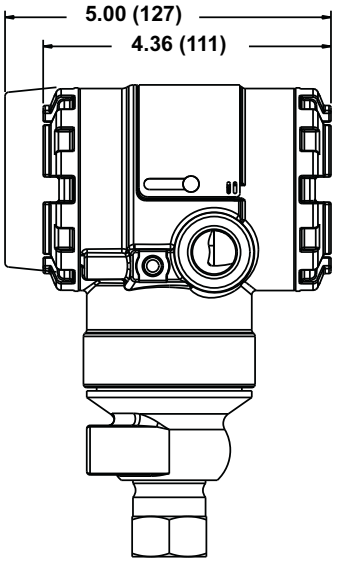
Pipe Mount (Bracket Option B3 / B9 / BC)

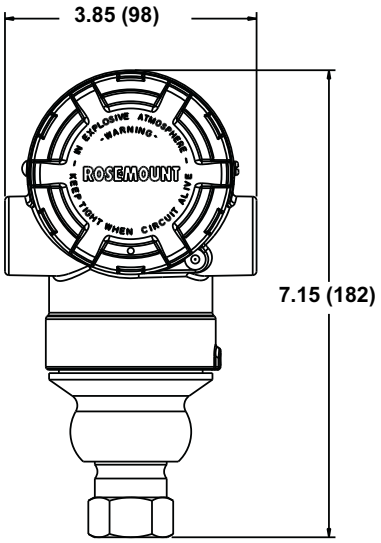


Pipe Mount (Bracket Option B1 / B7 / BA)

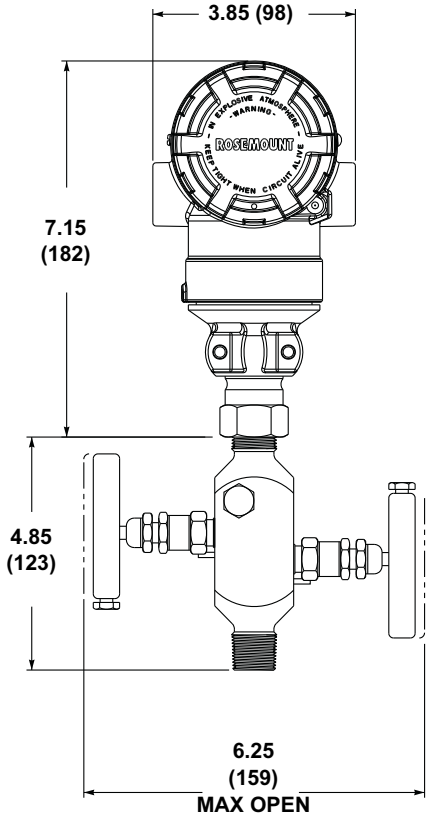


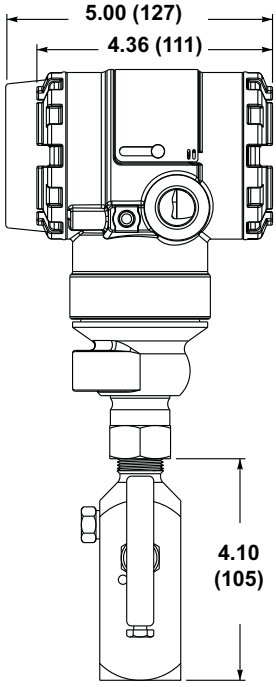
2051T Dimensional Drawings





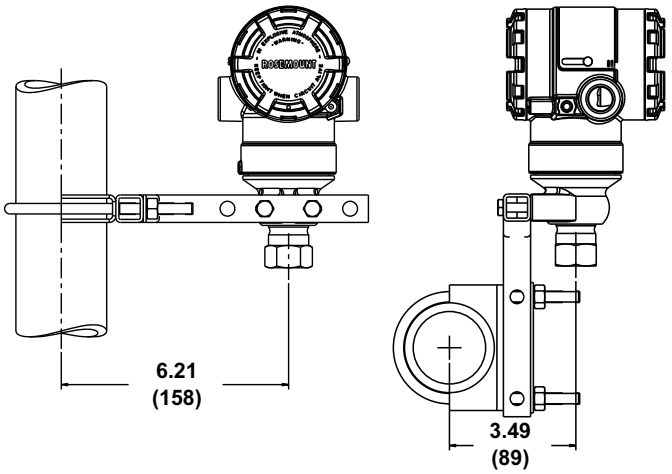
2051T with Rosemount 306 Integral Manifold



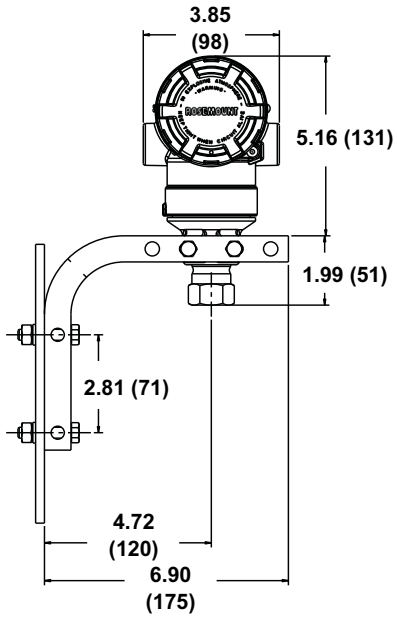


2051T Typical Mounting Configurations with Optional Mounting Bracket

Pipe Mounting

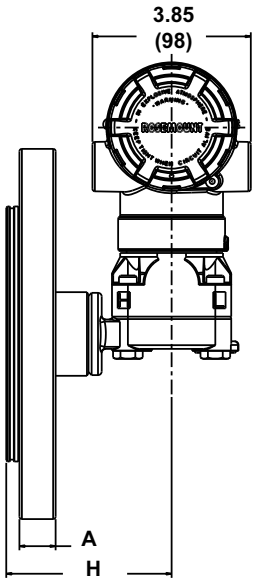


Panel Mounting

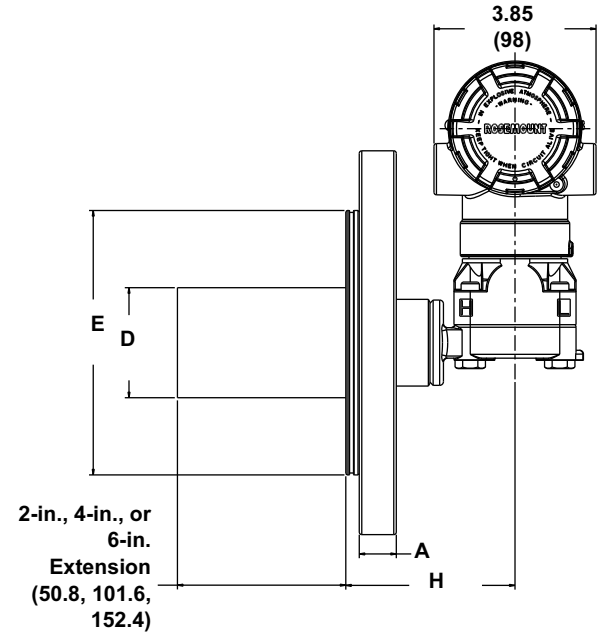


2051L Liquid Level

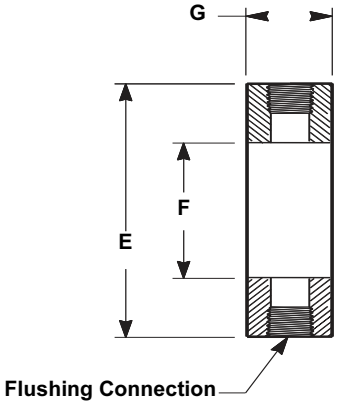
2-in. Flange Configuration (Flush Mount Only)



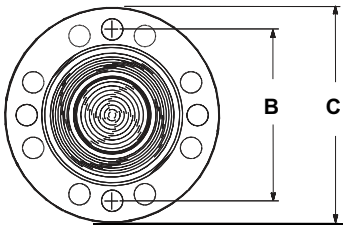
3- and 4-in. Flange Configuration



Optional Flushing Connection Ring (Lower Housing)



Diaphragm Assembly and Mounting Flange



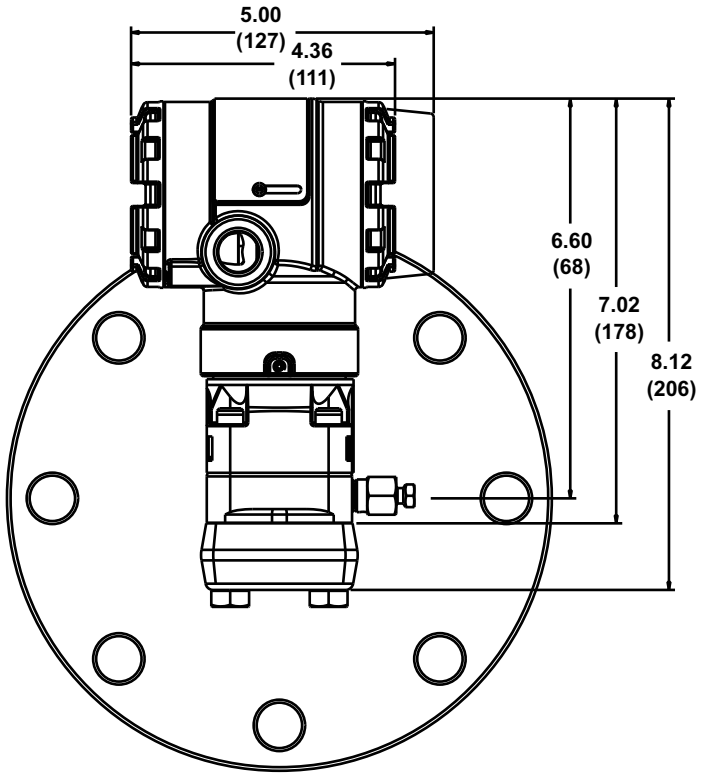


Table 2-1. 2051L Dimensional Specifications

Except where indicated, dimensions are in inches (millimeters).

Class	Pipe Size	Flange Thickness A	Bolt Circle Diameter B	Outside Diameter C	No. of Bolts	Bolt Hole Diameter	Extension Diameter(1) D	O.D. Gasket Surface E
ASME B16.5 (ANSI) 150	2 (51)	0.69 (18)	4.75 (121)	6.0 (152)	4	0.75 (19)	NA	3.6 (92)
	3 (76)	0.88 (22)	6.0 (152)	7.5 (191)	4	0.75 (19)	2.58 (66)	5.0 (127)
	4 (102)	0.88 (22)	7.5 (191)	9.0 (229)	8	0.75 (19)	3.5 (89)	6.2 (158)
ASME B16.5 (ANSI) 300	2 (51)	0.82 (21)	5.0 (127)	6.5 (165)	8	0.75 (19)	NA	3.6 (92)
	3 (76)	1.06 (27)	6.62 (168)	8.25 (210)	8	0.88 (22)	2.58 (66)	5.0 (127)
	4 (102)	1.19 (30)	7.88 (200)	10.0 (254)	8	0.88 (22)	3.5 (89)	6.2 (158)
DIN 2501 PN 10–40	DN 50	20 mm	125 mm	165 mm	4	18 mm	NA	4.0 (102)
DIN 2501 PN 25/40	DN 80	24 mm	160 mm	200 mm	8	18 mm	65 mm	5.4 (138)
	DN 100	24 mm	190 mm	235 mm	8	22 mm	89 mm	6.2 (158)

Class	Pipe Size	Process Side F	Lower Housing G		H
			1/4 NPT	1/2 NPT	
ASME B16.5 (ANSI) 150	2 (51)	2.12 (54)	0.97 (25)	1.31 (33)	5.65 (143)
	3 (76)	3.6 (91)	0.97 (25)	1.31 (33)	5.65 (143)
	4 (102)	3.6 (91)	0.97 (25)	1.31 (33)	5.65 (143)
ASME B16.5 (ANSI) 300	2 (51)	2.12 (54)	0.97 (25)	1.31 (33)	5.65 (143)
	3 (76)	3.6 (91)	0.97 (25)	1.31 (33)	5.65 (143)
	4 (102)	3.6 (91)	0.97 (25)	1.31 (33)	5.65 (143)
DIN 2501 PN 10–40	DN 50	2.4 (61)	0.97 (25)	1.31 (33)	5.65 (143)
DIN 2501 PN 25/40	DN 80	3.6 (91)	0.97 (25)	1.31 (33)	5.65 (143)
	DN 100	3.6 (91)	0.97 (25)	1.31 (33)	5.65 (143)

(1) Tolerances are -0.020 and +0.040 (-0,51 and +1,02)

Mount 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 possible human contact when the vents are used. In addition, consider the accessibility for a testing or calibration input.

NOTE
Most transmitters are calibrated in the horizontal position. Mounting the transmitter in any other position will shift the zero point to the equivalent amount of liquid head pressure caused by the varied mounting position. To reset zero point, refer to “Sensor Trim” on page 4-5.

Terminal Side of Electronics Housing

Mount the transmitter so the terminal side is accessible. Clearance of 0.75-in. (19 mm) is required for cover removal. Use a conduit plug on the unused side of the conduit opening.

Circuit Side of Electronics Housing

Provide 0.75 in. (19 mm) of clearance for units without an LCD display. Provide 3 in. (76 mm) of clearance for units installed with LCD.

Cover Installation

Always ensure a proper seal by installing the electronics housing covers so that metal contacts metal. Use Rosemount o-rings.

Mounting Brackets

Rosemount 2051 Transmitters may be panel-mounted or pipe-mounted through an optional mounting bracket. Refer to Table 2-2 for the complete offering and see Figure 2-2 through Figure 2-5 on pages 2-13 and 2-14 for dimensions and mounting configurations.

Table 2-2. Mounting Brackets

2051 Brackets										
	Process Connections			Mounting			Materials			
Option Code	Coplanar	In-Line	Traditional	Pipe Mount	Panel Mount	Flat Panel Mount	CS Bracket	SST Bracket	CS Bolts	SST Bolts
B4	X	X		X	X	X		X		X
B1			X	X			X		X	
B2			X		X		X		X	
B3			X			X	X		X	
B7			X	X			X			X
B8			X		X		X			X
B9			X			X	X			X
BA			X	X				X		X
BC			X			X		X		X

Figure 2-2. Mounting Bracket Option Code B4

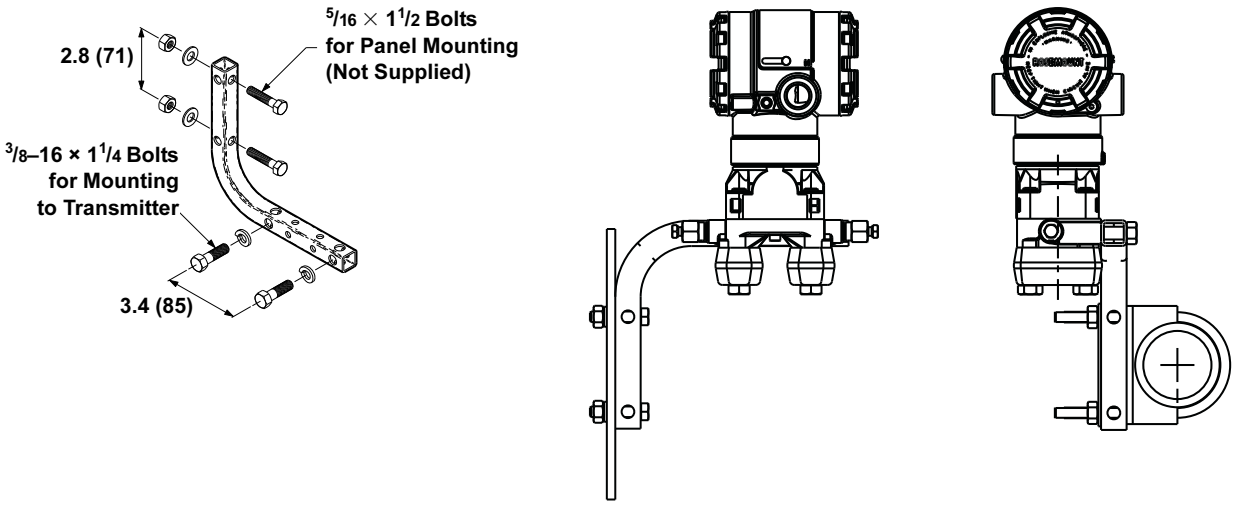


Figure 2-3. Mounting Bracket Option Codes B1, B7, and BA

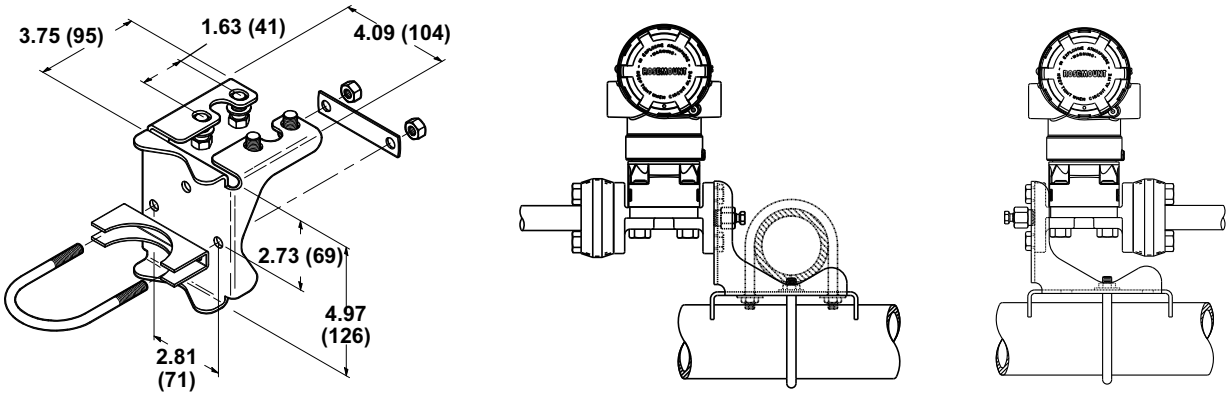


Figure 2-4. Panel Mounting Bracket Option Codes B2 and B8

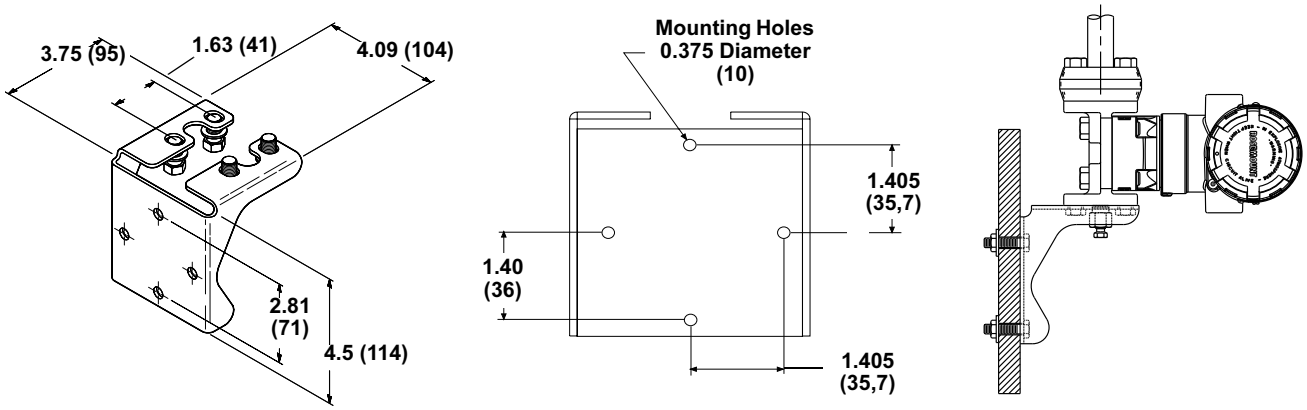
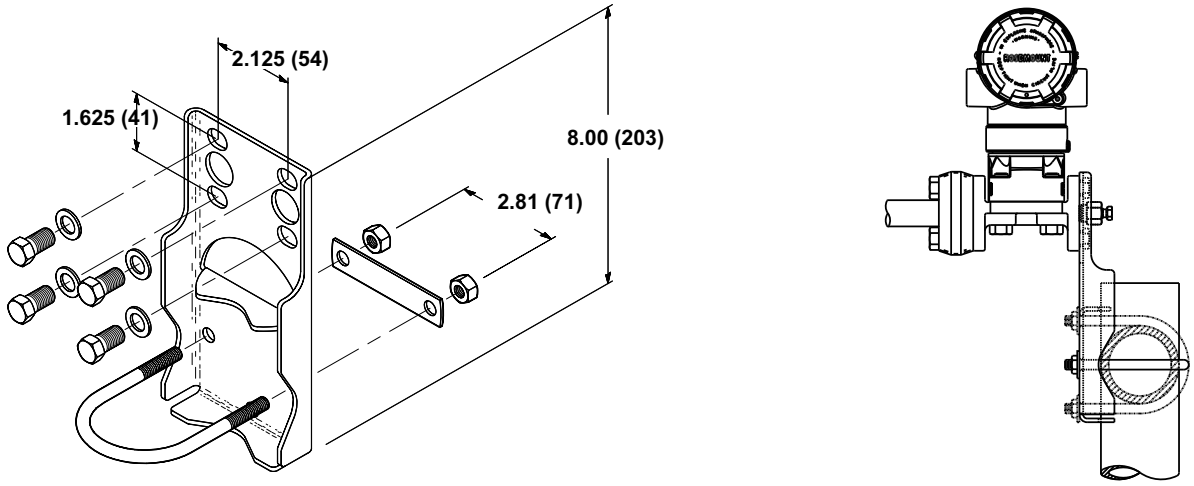


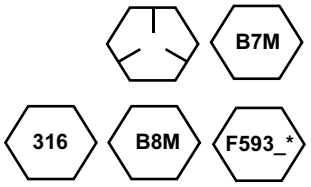
Figure 2-5. Flat Mounting Bracket Option Codes B3 and BC



NOTE
Dimensions are in inches (millimeters).

Flange Bolts

The 2051 is shipped with a Coplanar flange installed with four 1.75-in. (44 mm) flange bolts. See Figure 2-6 and Figure 2-7 on pages 2-16 and 2-16. Stainless steel bolts 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 are identified by their head markings:



Carbon Steel (CS) Head Markings

Stainless Steel (SST) Head Markings

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

Bolt Installation

⚠ Only use bolts supplied with the 2051 or provided by Emerson Process Management as spare parts. When installing the transmitter to one of the optional mounting brackets, torque the bolts to 125 in-lb. (0,9 N-m). Use the following bolt installation procedure:

1. Finger-tighten the bolts.
2. Torque the bolts to the initial torque value using a crossing pattern.
3. Torque the bolts to the final torque value using the same crossing pattern.

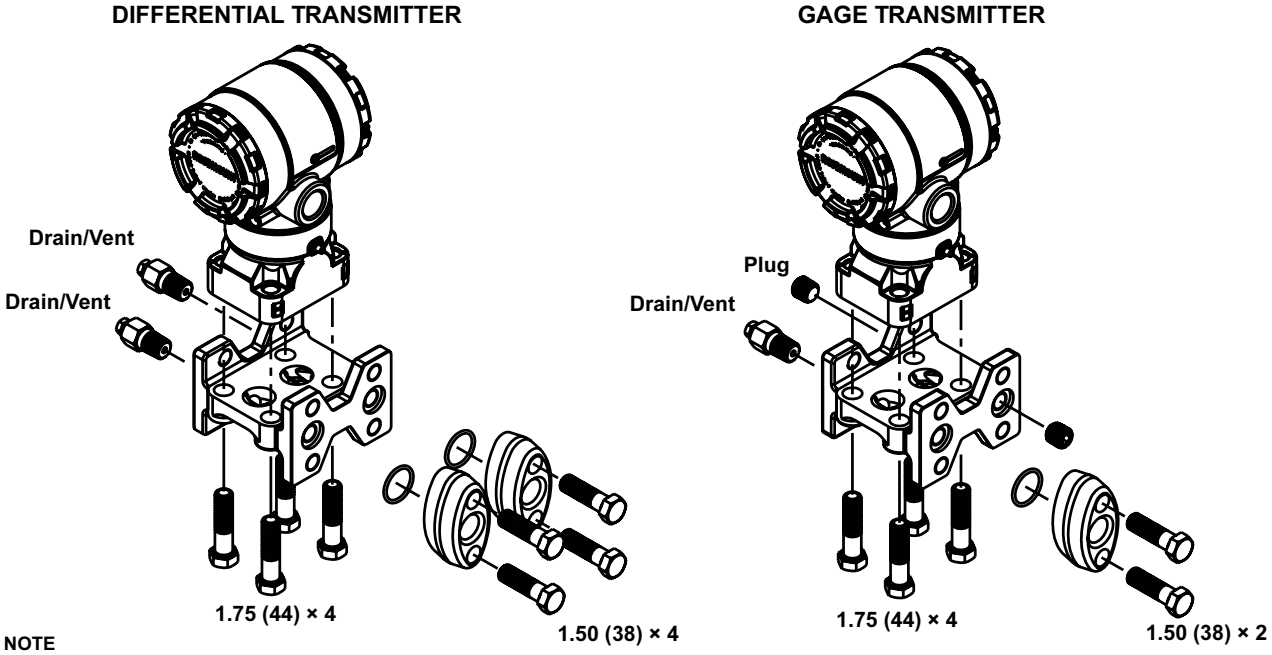
Torque values for the flange and manifold adapter bolts are as follows:

Table 2-3. 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)
ASTM-A-193 Class 2, Grade B8M—Option L8	150 in.-lb (17 N-m)	300 in.-lb (34 N-m)

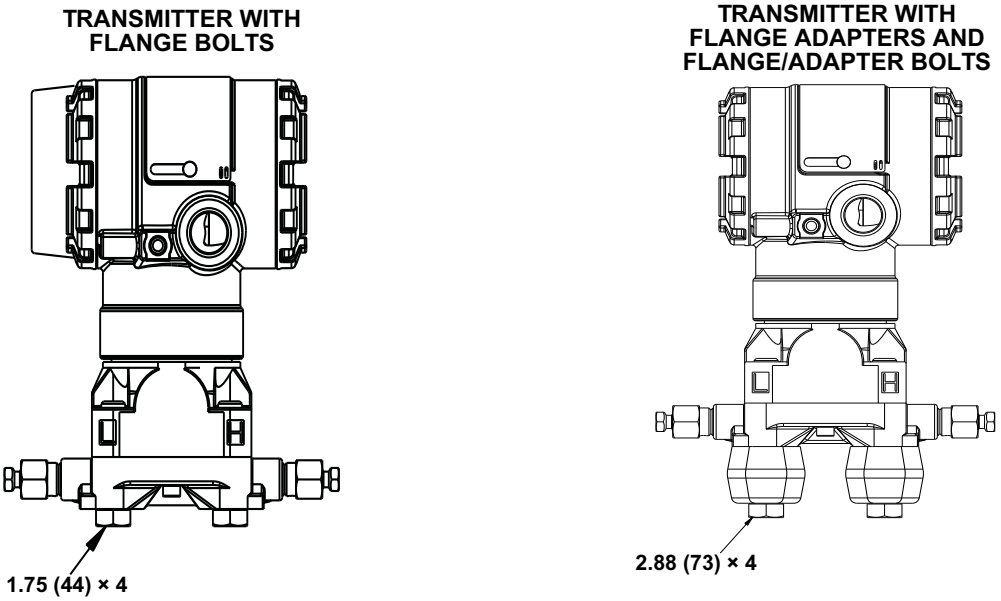
⚠ See “Safety Messages” on page 2-1 for complete warning information.

Figure 2-6. Traditional Flange Bolt Configurations



NOTE
Dimensions are in inches (millimeters).

Figure 2-7. Mounting Bolts and Bolt Configurations for Coplanar Flange



Description	Size in. (mm)
Flange Bolts	1.75 (44)
Flange/Adapter Bolts	2.88 (73)
Manifold/Flange Bolts	2.25 (57)

Note: Rosemount 2051T transmitters are direct mount and do not require bolts for process connection.

NOTE
Dimensions are in inches (millimeters).

Impulse Piping

The piping between the process and the transmitter must accurately transfer the pressure to obtain accurate measurements. There are six possible sources of impulse piping 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.

The best location for the transmitter in relation to the process pipe is dependent on the process. 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 in./foot (8 cm/m) upward from the transmitter toward the process connection.
- For gas service, slope the impulse piping at least 1 in./foot (8 cm/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 using a sealing 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.
- Maintain equal leg of head pressure on both legs of the impulse piping.
- Avoid conditions that might allow process fluid to freeze within the process flange.

Mounting Requirements

Impulse piping configurations depend on specific measurement conditions. 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 process isolators.
- Mount the transmitter beside or below the taps so gases vent into the process line.
- Mount drain/vent valve upward to allow gases to vent.

Gas Flow Measurement

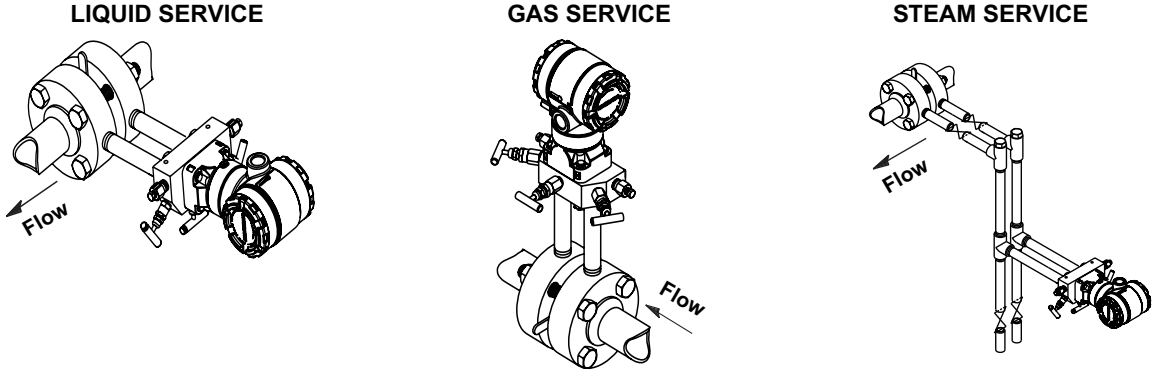
- Place taps in the top or side of the line.
- Mount the transmitter beside or above the taps so to drain liquid into the process line.

Steam Flow Measurement

- Place taps to the side of the line.
- Mount the transmitter below the taps to ensure that impulse piping will remain filled with condensate.
- In steam service above 250 °F (121 °C), fill impulse lines with water to prevent steam from contacting the transmitter directly and to ensure accurate measurement start-up.

NOTE
For steam or other elevated temperature services, it is important that temperatures at the process connection do not exceed the transmitter's process temperature limits. See "Process Temperature Limits" on page A-7 for details.

Figure 2-8. Installation Examples



Process Connections

Coplanar or Traditional 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 sensor module housing. Do not attempt to loosen or remove the flange bolts while the transmitter is in service.

⚠ **Flange Adaptors:**

Rosemount 2051DP and GP process connections on the transmitter flanges are 1/4–18 NPT. Flange adapters are available with standard 1/2–14 NPT Class 2 connections. The flange adapters allow users to disconnect from the process by removing the flange adapter bolts. Use plant-approved lubricant or sealant when making the process connections. Refer to Dimensional Drawings on page 2-5 for the distance between pressure connections. This distance may be varied ±1/8 in. (3.2 mm) by rotating one or both of the flange adapters.

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

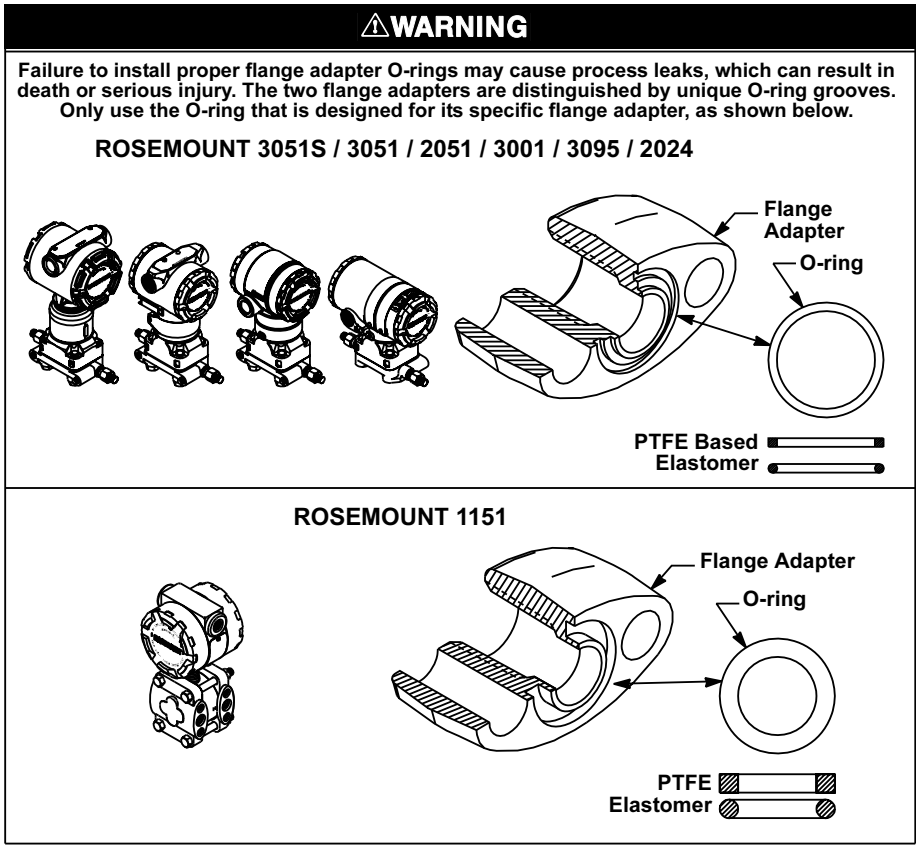
1. Remove the flange bolts.
2. Leaving the flange in place, move the adapters into position with the o-ring installed.
3. Clamp the adapters and the Coplanar flange to the transmitter sensor module using the larger of the bolts supplied.
4. Tighten the bolts. Refer to “Flange Bolts” on page 2-15 for torque specifications.

Whenever you remove flanges or adapters, visually inspect the PTFE o-rings. Replace with o-ring designed for Rosemount transmitter if there are any signs of damage, such as nicks or cuts. Undamaged o-rings may be reused. 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 5: Troubleshooting.

O-rings:

The two styles of Rosemount flange adapters (Rosemount 1151 and Rosemount 3051/2051/2024/3095) each require a unique O-ring (see Figure 2-9). Use only the O-ring designed for the corresponding flange adaptor.

Figure 2-9. O-Rings.



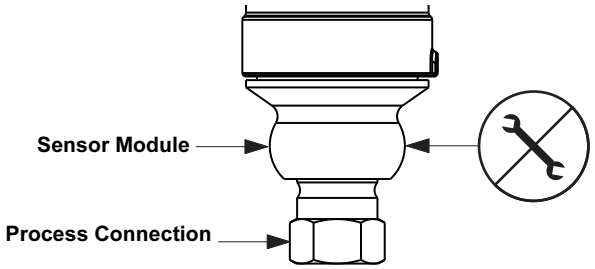
⚠ When compressed, PTFE O-rings tend to “cold flow,” which aids in their sealing capabilities.

NOTE
PTFE O-rings should be replaced if the flange adapter is removed.

Inline 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.

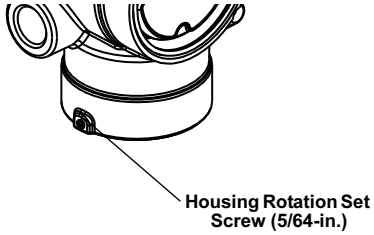


Housing Rotation

The electronics housing can be rotated up to 180 degrees in either direction to improve field access, or to better view the optional LCD display. To rotate the housing, perform the following procedure:

1. Loosen the housing rotation set screw using a $\frac{5}{64}$-in. hex wrench.
2. Turn the housing left or right up to 180° from its original position. Over rotating will damage the transmitter.
3. Retighten the housing rotation set screw.

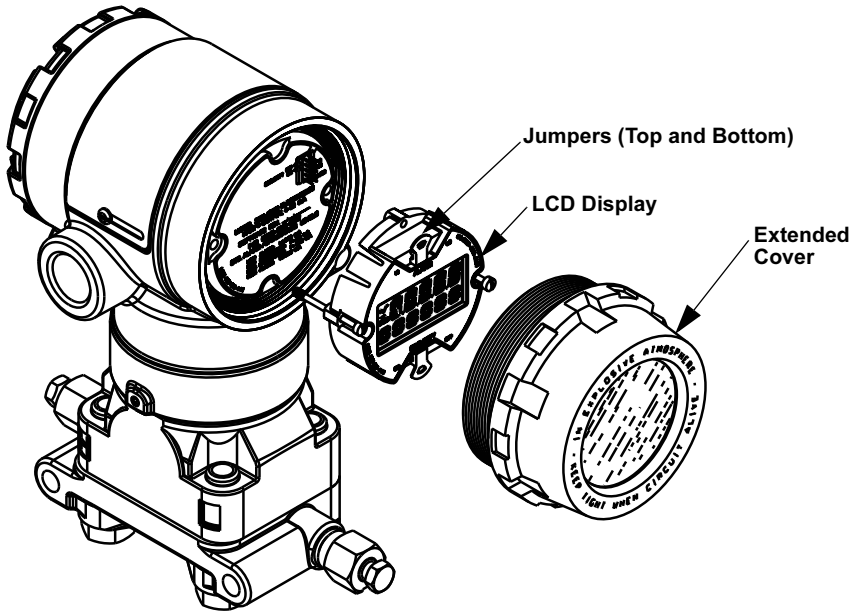
Figure 2-10. Housing Rotation



LCD Display

Transmitters ordered with the LCD option are shipped with the display installed. Installing the display on an existing 2051 transmitter requires a small instrument screwdriver.

Figure 2-11. LCD Display



Configure Security and Alarm

Security (Write Protect)

There are three security methods with the Rosemount 2051 transmitter:

1. Security Jumper: prevents all writes to transmitter configuration.
2. Local Keys (Local Zero and Span) Software Lock Out: prevents changes to transmitter range points via local zero and span adjustment keys. With local keys security enabled, changes to configuration are possible via HART.
3. Physical Removal of Local Keys (Local Zero and Span) Magnetic Buttons: removes ability to use local keys to make transmitter range point adjustments. With local keys security enabled, changes to configuration are possible via HART.

NOTE
The Local Keys (Local Zero and Span Adjustments) are optional (option code D4 in model number). If the Adjustments are not ordered on the transmitter, options 2 and 3 above are not valid security method options.

You can prevent changes to the transmitter configuration data with the write protection jumper. Security is controlled by the security (write protect) jumper located on the electronics board or LCD display. Position the jumper on the transmitter circuit board in the “ON” position to prevent accidental or deliberate change of configuration data.

If the transmitter write protection jumper is in the “ON” position, the transmitter will not accept any “writes” to its memory. Configuration changes, such as digital trim and reranging, cannot take place when the transmitter security is on.

NOTE
If the security jumper is not installed, the transmitter will continue to operate in the security OFF configuration.

Configuring Transmitter Security and Alarm Jumper Procedure

To reposition the jumpers, follow the procedure described below.

1. Do not remove the transmitter covers in explosive atmospheres when the circuit is live. If the transmitter is live, set the loop to manual and remove power.
2. ⚠ Remove the housing cover opposite the field terminal side. Do not remove the transmitter covers in explosive atmospheres when the circuit is live.
3. Reposition the jumpers as desired.
   - Figure 2-12 shows the jumper positions for the 4-20 mA HART Transmitter.
   - Figure 2-13 shows the jumper positions for the 1-5 HART Vdc Low Power Transmitter.
4. ⚠ Reattach the transmitter cover. Always ensure a proper seal by installing the electronics housing covers so that metal contacts metal to meet explosion-proof requirements.

Figure 2-12. Electronics Board

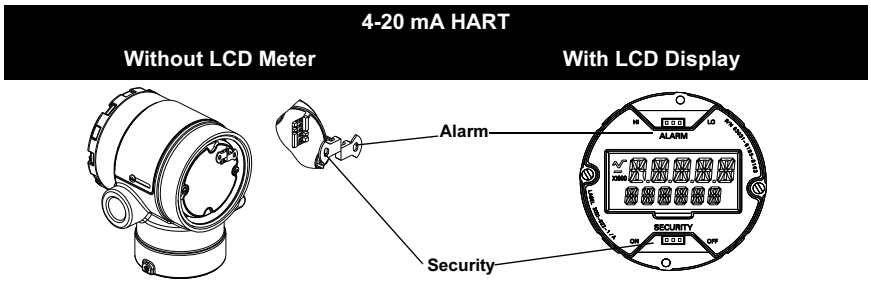
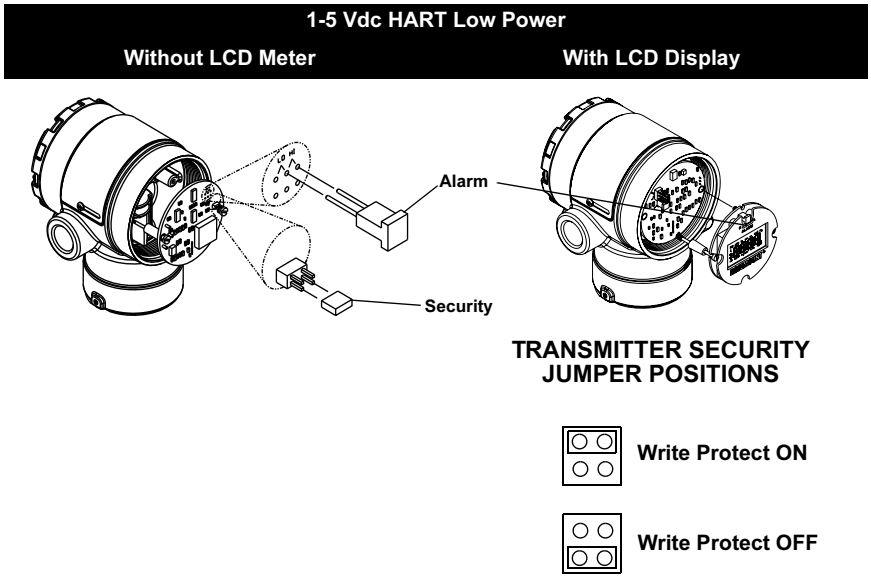


Figure 2-13. Low Power Transmitter Electronics Boards



NOTE
Security jumper not installed = Not Write Protected
Alarm jumper not installed = High Alarm

ELECTRICAL CONSIDERATIONS

NOTE
Make sure all electrical installation is in accordance with national and local code requirements.

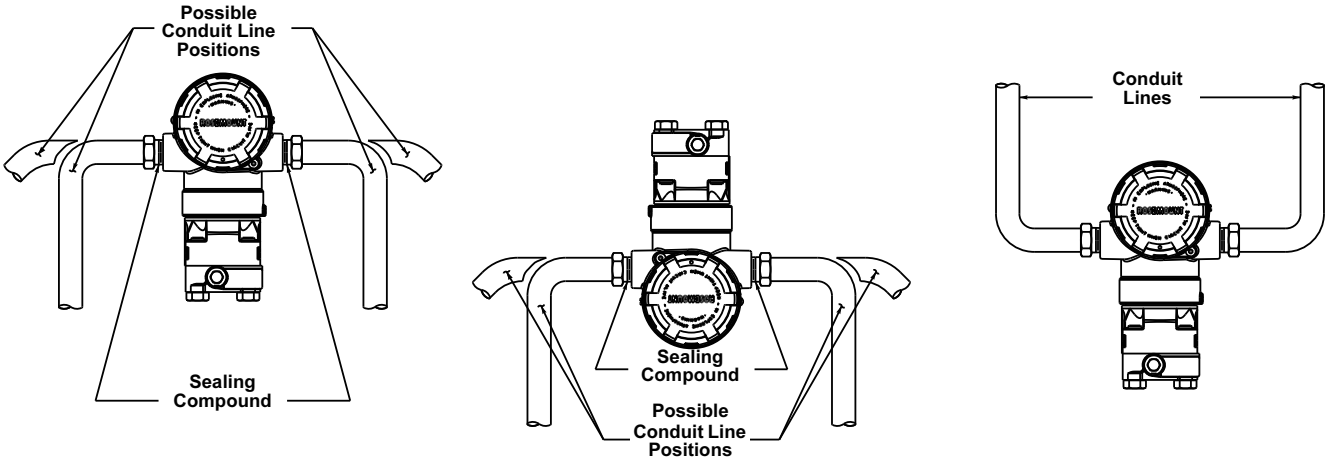
Conduit Installation

⚠CAUTION

If all connections are not sealed, excess moisture accumulation can damage the transmitter. Make sure to mount the transmitter with the electrical housing positioned downward for drainage. To avoid moisture accumulation in the housing, install wiring with a drip loop, and ensure the bottom of the drip loop is mounted lower than the conduit connections or the transmitter housing.

Recommended conduit connections are shown in Figure 2-14.

Figure 2-14. Conduit Installation Diagrams.



CORRECT **CORRECT** **INCORRECT**

Wiring

⚠CAUTION

Do not connect the power signal wiring to the test terminals. Voltage may burn out the reverse-polarity protection diode in the test connection.

NOTE
Use shielded twisted pairs to yield best results. To ensure proper communication, use 24 AWG or larger wire, and do not exceed 5000 feet (1500 meters).

Figure 2-15. 4-20 mA HART wiring

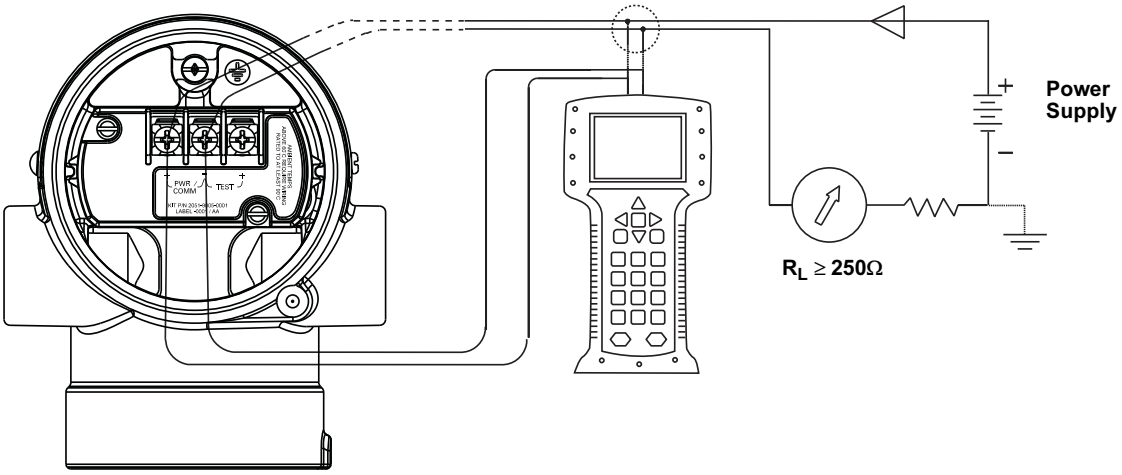
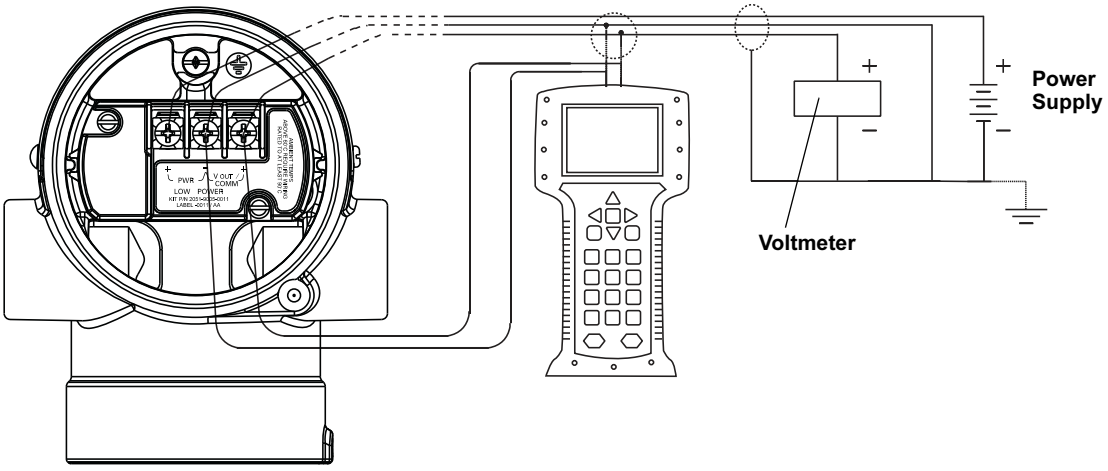


Figure 2-16. 1-5 Vdc Low Power wiring



Perform the following procedure to make wiring connections:

⚠ 1. Remove the housing cover on terminal compartment side. Do not remove the cover in explosive atmospheres when the circuit is live. Signal wiring supplies all power to the transmitter.

⚠ 2. a. For 4-20 mA HART output, connect the positive lead to the terminal marked (+) and the negative lead to the terminal marked (pwr/comm -). Do not connect powered signal wiring to the test terminals. Power could damage the test diode.

b. For 1-5 Vdc HART Low Power output, connect the positive lead to the terminal marked (+ pwr) and the negative lead to the terminal marked (pwr -). Connect signal lead to V_{out} / comm +.

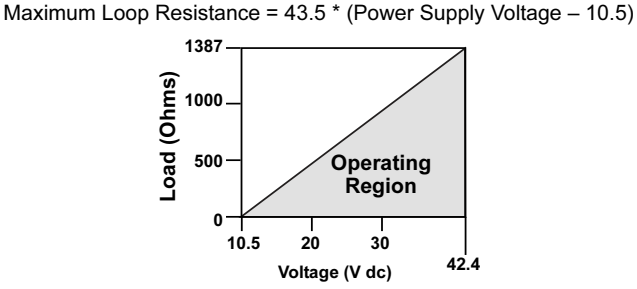
3. Plug and seal unused conduit connection on the transmitter housing to avoid moisture accumulation in the terminal side. Install wiring with a drip loop. Arrange the drip loop so the bottom is lower than the conduit connections and the transmitter housing.

Power Supply for 4-20 mA HART

Transmitter operates on 10.5 - 42.4 Vdc. The dc power supply should provide power with less than two percent ripple.

NOTE
A minimum loop resistance of 250 ohms is required to communicate with a HART Communicator. If a single power supply is used to power more than one 2051 transmitter, the power supply used, and circuitry common to the transmitters, should not have more than 20 ohms of impedance at 1200 Hz.

Figure 2-17. Load Limitation



The HART communicator requires a minimum loop resistance of 250Ω for communication.

The total resistance load is the sum of the resistance of the signal leads and the load resistance of the controller, indicator, and related pieces. Note that the resistance of intrinsic safety barriers, if used, must be included.

Power Supply for 1-5 Vdc HART Low Power

Low power transmitters operate on 9–28 Vdc. The dc power supply should provide power with less than two percent ripple. The V_{out} load should be 100 kΩ or greater.

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

Transient Protection Terminal Block

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.

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 2051 transmitters in the field. See “Spare Parts” on page A-38 for spare part numbers. The lightning bolt symbol shown in Figure 2-18 and Figure 2-19 identifies the transient protection terminal block.

Figure 2-18. 4-20 mA HART wiring with transient protection

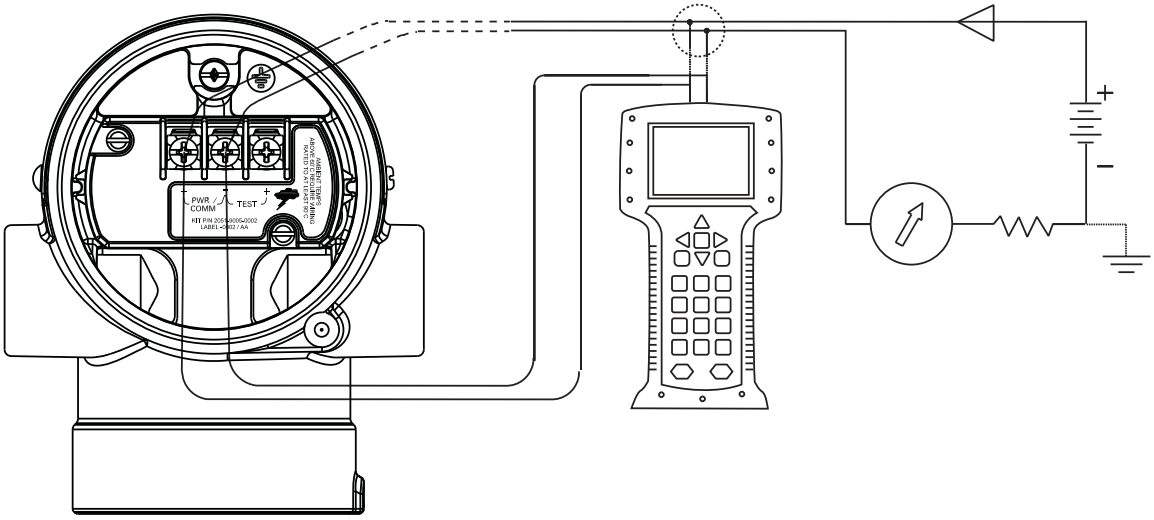
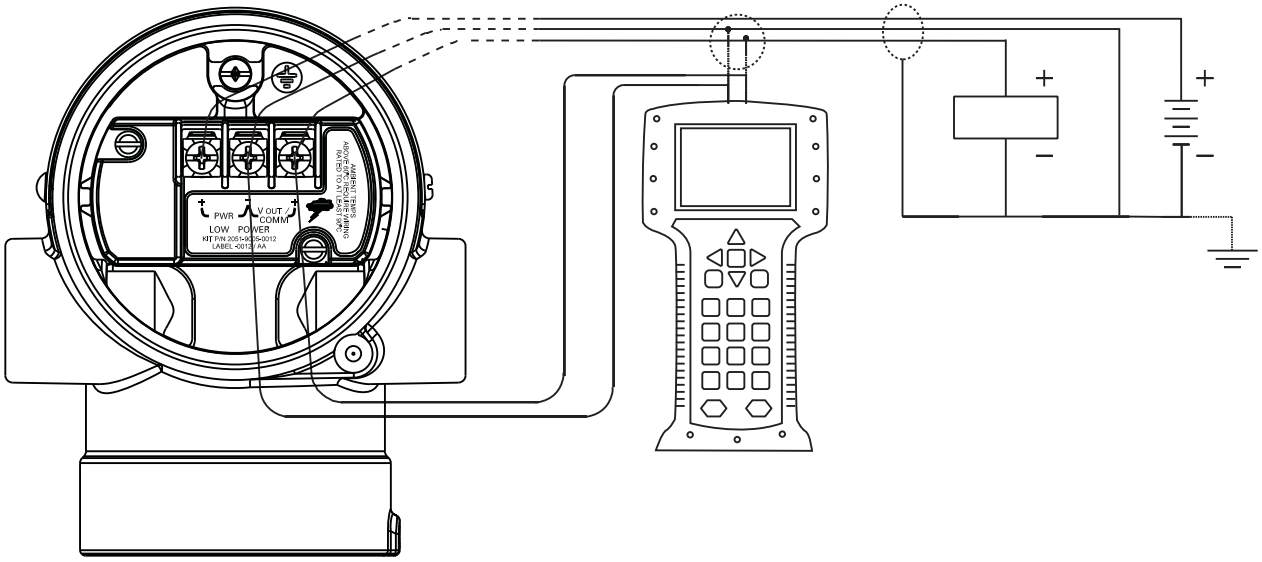


Figure 2-19. 1-5 Vdc Low Power wiring with transient protection



NOTE
The transient protection terminal block does not provide transient protection unless the transmitter case is properly grounded. Use the guidelines to ground the transmitter case. Refer to page 2-29.

Do not run the transient protection ground wire with signal wiring as the ground wire may carry excessive current if a lightning strike occurs.

Grounding

⚠ Use the following techniques to properly ground the transmitter signal wiring and case:

Signal Wiring

Do not run signal wiring in conduit or open trays with power wiring or near heavy electrical equipment. It is important that the instrument cable shield be:

- Trimmed close and insulated from touching the transmitter housing
- Connected to the next shield if cable is routed through a junction box
- Connected to a good earth ground at the power supply end

For 4-20 mA HART output, the signal wiring may be grounded at any one point on the signal loop or may be left ungrounded. The negative terminal of the power supply is a recommended grounding point.

For 1-5 Vdc HART Low Power output, the power wires may be grounded at only one point or left ungrounded. The negative terminal of the power supply is a recommended grounding point.

Transmitter Case

Always ground the transmitter case in accordance with national and local electrical codes. The most effective transmitter case grounding method is a 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 (⏚). The ground connection screw is standard on all Rosemount 2051 transmitters. Refer to Figure 2-20.
- **External Ground Assembly**: This assembly is included with the optional transient protection terminal block (Option Code T1), and it is included with various hazardous location certifications. The External Ground Assembly can also be ordered with the transmitter (Option Code V5), or as a spare part. See “Spare Parts” on page A-38. Refer to Figure 2-21 for location of the External Ground Screw.

Figure 2-20. Internal Ground Screw

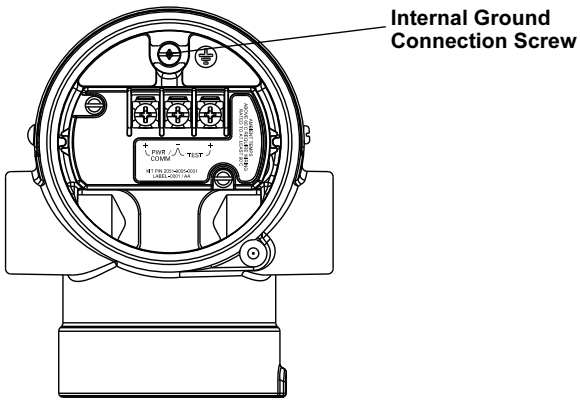
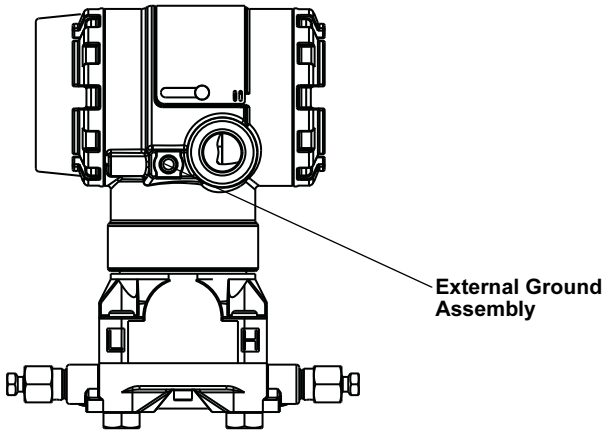


Figure 2-21. External Ground Assembly



NOTE
Grounding the transmitter case via threaded conduit connection may not provide sufficient ground continuity.

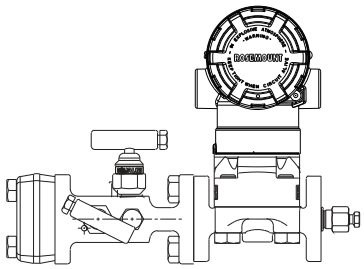
HAZARDOUS LOCATIONS CERTIFICATIONS

⚠ Individual transmitters are clearly marked with a tag indicating the approvals they carry. Transmitters must be installed in accordance with all applicable codes and standards to maintain these certified ratings. Refer to “Hazardous Locations Certifications” on page B-2 for information on these approvals.

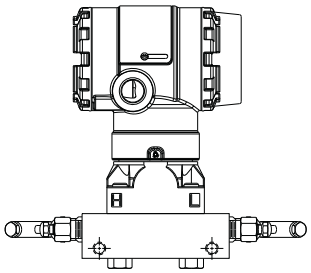
ROSEMOUNT 305, 306 AND 304 MANIFOLDS

The 305 Integral Manifold is available in two designs: Traditional and Coplanar. The traditional 305 Integral Manifold can be mounted to most primary elements with mounting adapters in the market today. The 306 Integral Manifold is used with the 2051T in-line transmitters to provide block-and-bleed valve capabilities of up to 10000 psi (690 bar).

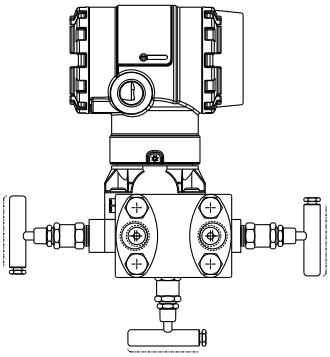
Figure 2-22. Manifolds



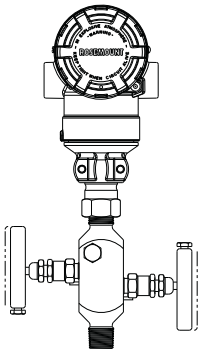
2051C AND 304 CONVENTIONAL



2051C AND 305 INTEGRAL COPLANAR



2051C AND 305 INTEGRAL TRADITIONAL



2051T AND 306 IN-LINE

Rosemount 305 Integral Manifold Installation Procedure

To install a 305 Integral Manifold to a 2051 transmitter:

⚠ 1. Inspect the PTFE sensor module o-rings. Undamaged o-rings may be reused. If the o-rings are damaged (if they have nicks or cuts, for example), replace with o-rings designed for Rosemount transmitter.

IMPORTANT
If replacing the o-rings, take care not to scratch or deface the o-ring grooves or the surface of the isolating diaphragm while you remove the damaged o-rings.

2. Install the Integral Manifold on the sensor module. Use the four 2.25-in. manifold bolts for alignment. Finger tighten the bolts, then tighten the bolts incrementally in a cross pattern to final torque value. See “Flange Bolts” on page 2-15 for complete bolt installation information and torque values. When fully tightened, the bolts should extend through the top of the sensor module housing.
3. If the 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.

NOTE
Always perform a zero trim on the transmitter/manifold assembly after installation to eliminate mounting effects.

Rosemount 306 Integral Manifold Installation Procedure

The 306 Manifold is for use only with a 2051T In-line transmitter.

⚠ Assemble the 306 Manifold to the 2051T In-line transmitter with a thread sealant.

Rosemount 304 Conventional Manifold Installation Procedure

To install a 304 Conventional Manifold to a 2051 transmitter:

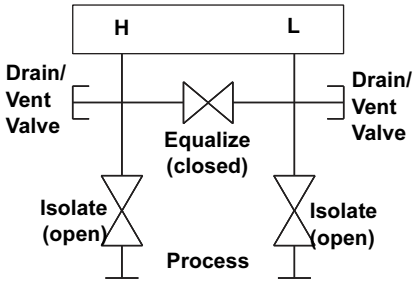
1. Align the Conventional Manifold with the transmitter flange. Use the four manifold bolts for alignment.
2. Finger tighten the bolts, then tighten the bolts incrementally in a cross pattern to final torque value. See “Flange Bolts” on page 2-6 for complete bolt installation information and torque values. When fully tightened, the bolts should extend through the top of the sensor module housing.
3. Leak-check assembly to maximum pressure range of transmitter.

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

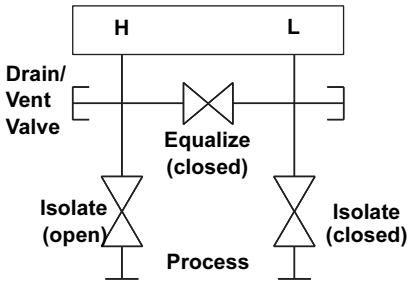
Integral Manifold Operation

Three-valve configuration shown.

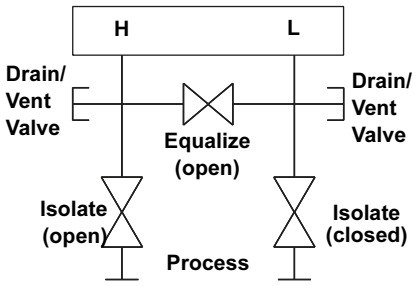
In normal operation the two isolate valves between the process and instrument ports will be open and the equalizing valve(s) will be closed.



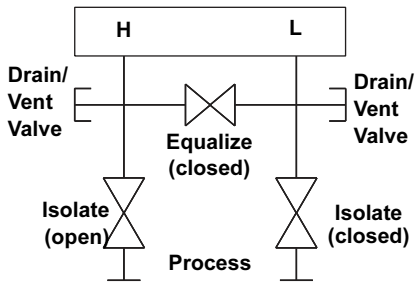
To zero the 2051, close the isolate valve to the low pressure (downstream side) of the transmitter first.



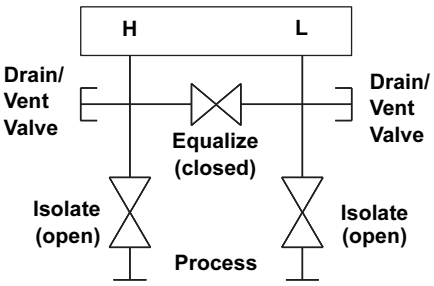
Next, open the center (equalize) valve(s) to equalize the pressure on both sides of the transmitter.



The manifold valves are now in the proper configuration for zeroing the transmitter. To return the transmitter to service, close the equalizing valve(s) first.



Next, open the isolate valve on the low pressure side of the transmitter.



LIQUID LEVEL MEASUREMENT

Differential pressure transmitters used for liquid level applications measure hydrostatic pressure head. Liquid level and specific gravity of a liquid are factors in determining pressure head. This pressure is equal to the liquid height above the tap multiplied by the specific gravity of the liquid. Pressure head is independent of volume or vessel shape.

Open Vessels

A pressure transmitter mounted near a tank bottom measures the pressure of the liquid above.

Make a connection to the high pressure side of the transmitter, and vent the low pressure side to the atmosphere. Pressure head equals the liquid's specific gravity multiplied by the liquid height above the tap.

Zero range suppression is required if the transmitter lies below the zero point of the desired level range. Figure 2-23 shows a liquid level measurement example.

Closed Vessels

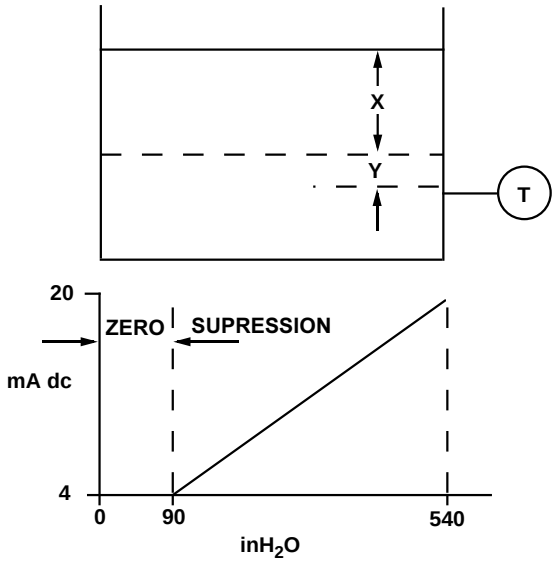
Pressure above a liquid affects the pressure measured at the bottom of a closed vessel. The liquid specific gravity multiplied by the liquid height plus the vessel pressure equals the pressure at the bottom of the vessel.

To measure true level, the vessel pressure must be subtracted from the vessel bottom pressure. To do this, make a pressure tap at the top of the vessel and connect this to the low side of the transmitter. Vessel pressure is then equally applied to both the high and low sides of the transmitter. The resulting differential pressure is proportional to liquid height multiplied by the liquid specific gravity.

Dry Leg Condition

Low-side transmitter piping will remain empty if gas above the liquid does not condense. This is a dry leg condition. Range determination calculations are the same as those described for bottom-mounted transmitters in open vessels, as shown in Figure 2-23.

Figure 2-23. Liquid Level Measurement Example.



Let **X** equal the vertical distance between the minimum and maximum measurable levels (500 in.).
Let **Y** equal the vertical distance between the transmitter datum line and the minimum measurable level (100 in.).
Let **SG** equal the specific gravity of the fluid (0.9).
Let **h** equal the maximum head pressure to be measured in inches of water.
Let **e** equal head pressure produced by **Y** expressed in inches of water.
Let **Range** equal **e** to **e** + **h**.

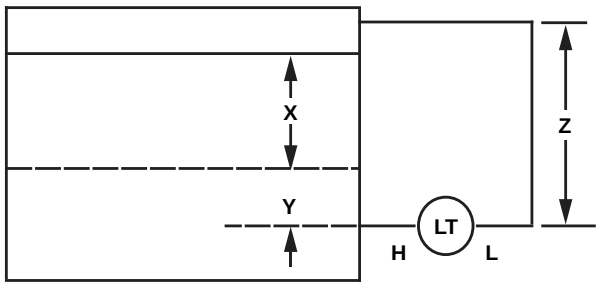
Then h = (**X**)(**SG**)
= 500 x 0.9
= 450 inH_2O
e = (**Y**)(**SG**)
= 100 x 0.9
= 90 inH_2O
Range = 90 to 540 inH_2O

Wet Leg Condition

Condensation of the gas above the liquid slowly causes the low side of the transmitter piping to fill with liquid. The pipe is purposely filled with a convenient reference fluid to eliminate this potential error. This is a wet leg condition.

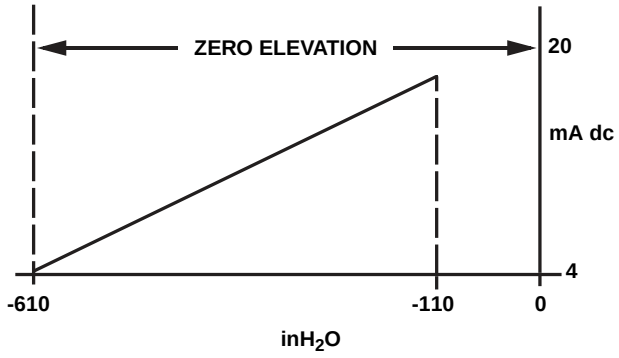
The reference fluid will exert a head pressure on the low side of the transmitter. Zero elevation of the range must then be made. See Figure 2-24

Figure 2-24. Wet Leg Example.



Let **X** equal the vertical distance between the minimum and maximum measurable levels (500 in.).
Let **Y** equal the vertical distance between the transmitter datum line and the minimum measurable level (50 in.).
Let **z** equal the vertical distance between the top of the liquid in the wet leg and the transmitter datum line (600 in.).
Let $\mathbf{SG_1}$ equal the specific gravity of the fluid (1.0).
Let $\mathbf{SG_2}$ equal the specific gravity of the fluid in the wet leg (1.1).
Let **h** equal the maximum head pressure to be measured in inches of water.
Let **e** equal the head pressure produced by **Y** expressed in inches of water.
Let **s** equal head pressure produced by **z** expressed in inches of water.
Let **Range** equal **e** – **s** to **h** + **e** – **s**.

Then h = $\mathbf{(X)(SG_1)}$
= 500 x 1.0
= 500 in H_2O
e = $\mathbf{(Y)(SG_1)}$
= 50 x 1.0
= 50 inH_2O
s = $\mathbf{(z)(SG_2)}$
= 600 x 1.1
= 660 inH_20
Range = **e – s** to **h + e – s**.
= 50 – 660 to 500 + 50 – 660
= –610 to –110 inH_20

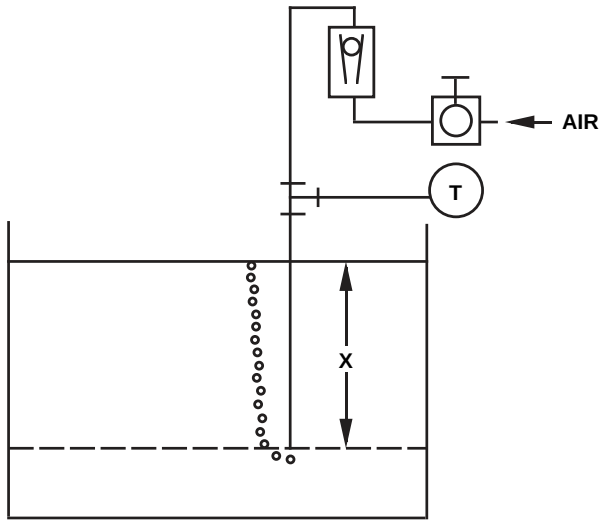


Bubbler System in Open Vessel

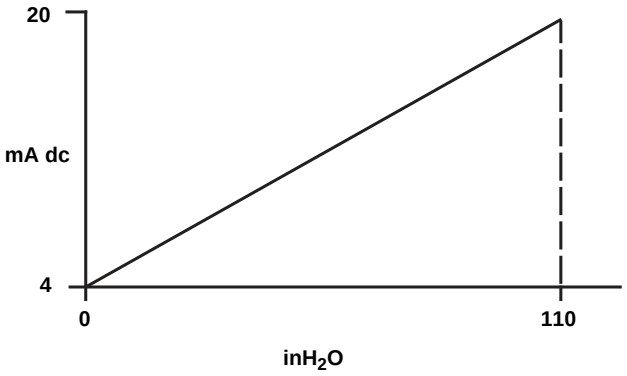
A bubbler system that has a top-mounted pressure transmitter can be used in open vessels. This system consists of an air supply, pressure regulator, constant flow meter, pressure transmitter, and a tube that extends down into the vessel.

Bubble air through the tube at a constant flow rate. The pressure required to maintain flow equals the liquid's specific gravity multiplied by the vertical height of the liquid above the tube opening. Figure 2-25 shows a bubbler liquid level measurement example.

Figure 2-25. Bubbler Liquid Level Measurement Example.



Let **X** equal the vertical distance between the minimum and maximum measurable levels (100 in.).
Let **SG** equal the specific gravity of the fluid (1.1).
Let **h** equal the maximum head pressure to be measured in inches of water.
Let **Range** equal **zero** to **h**.
Then **h** = **(X)(SG)**
= 100 x 1.1
= 110 inH_2O
Range = 0 to 110 inH_2O



Section 3 Configuration

OVERVIEW

This section contains information on commissioning and tasks that should be performed on the bench prior to installation.

HART Communicator and AMS Device Manager instructions are given to perform configuration functions. For convenience, HART Communicator fast key sequences are labeled “Fast Keys” for each software function below the appropriate headings.

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 could result in death or serious injury:
Installation of this transmitter in an explosive environment must be in accordance with the appropriate local, national, and international standards, codes, and practices. Please review the approvals section of the 2051 reference manual for any restrictions associated with a safe installation.
- Before connecting a HART communicator in an explosive atmosphere, ensure the instruments in the loop are installed in accordance with intrinsically safe or non-incendive field wiring practices.
- In an Explosion-Proof/Flameproof installation, do not remove the transmitter covers when power is applied to the unit.

Process leaks may cause harm or result in death.
- Install and tighten process connectors before applying pressure.

Electrical shock can result in death or serious injury.
- Avoid contact with the leads and terminals. High voltage that may be present on leads can cause electrical shock.

COMMISSIONING

Commissioning consists of testing the transmitter and verifying transmitter configuration data. The 2051 transmitters can be commissioned either before or after installation. Commissioning the transmitter on the bench before installation using a HART Communicator or AMS Device Manager ensures that all transmitter components are in working order.

⚠ To commission on the bench, required equipment includes a power supply, a milliamp meter, and a HART Communicator or AMS Device Manager. Wire equipment as shown in Figure 3-1 and Figure 3-2. To ensure successful communication, a resistance of at least 250 ohms must be present between the HART Communicator loop connection and the power supply. Connect the HART Communicator leads to the terminals labeled “COMM” on the terminal block.

Set all transmitter hardware adjustments during commissioning to avoid exposing the transmitter electronics to the plant environment after installation.

When using a HART Communicator, any configuration changes made must be sent to the transmitter by using the “Send” key. AMS Device Manager configuration changes are implemented when the “Apply” button is clicked.

Setting the Loop to Manual

Whenever sending or requesting data that would disrupt the loop or change the output of the transmitter, set the process application loop to manual. The HART Communicator or AMS Device Manager will prompt you to set the loop to manual when necessary. Acknowledging this prompt does not set the loop to manual. The prompt is only a reminder; set the loop to manual as a separate operation.

Wiring Diagrams

Connect the equipment as shown in Figure 3-1 for 4-20 mA HART or Figure 3-2 for 1-5 Vdc HART Low Power. To ensure successful communication, a resistance of at least 250 ohms must be present between the HART Communicator loop connection and the power supply. The HART Communicator or AMS Device Manager may be connected at “COMM” on the transmitter terminal block or across the load resistor. Connecting across the “TEST” terminals will prevent successful communication for 4-20 mA HART output.

Turn on the HART Communicator by pressing the ON/OFF key or log into AMS Device Manager. The HART Communicator or AMS Device Manager will search for a HART-compatible device and indicate when the connection is made. If the HART Communicator or AMS Device Manager fail to connect, it indicates that no device was found. If this occurs, refer to Section 5: Troubleshooting.

Figure 3-1. 4–20 mA HART Transmitter Wiring Diagrams

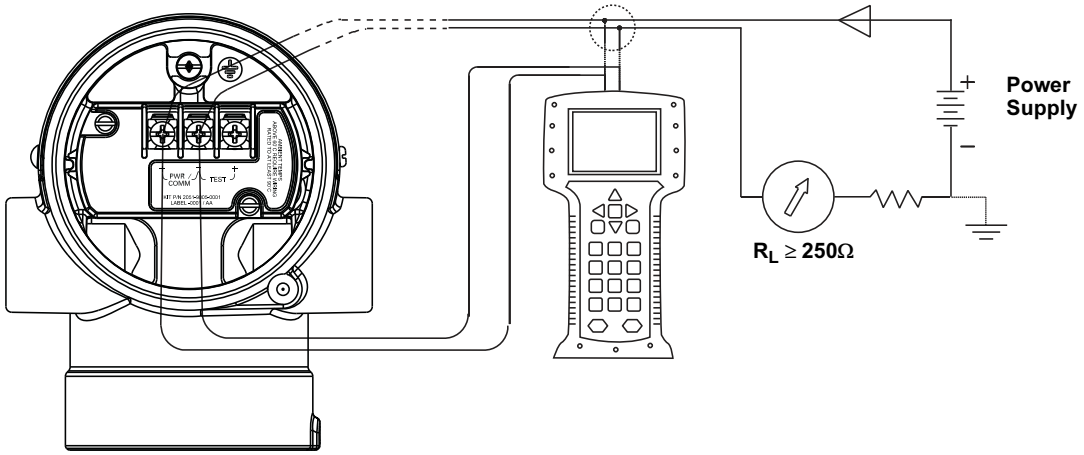
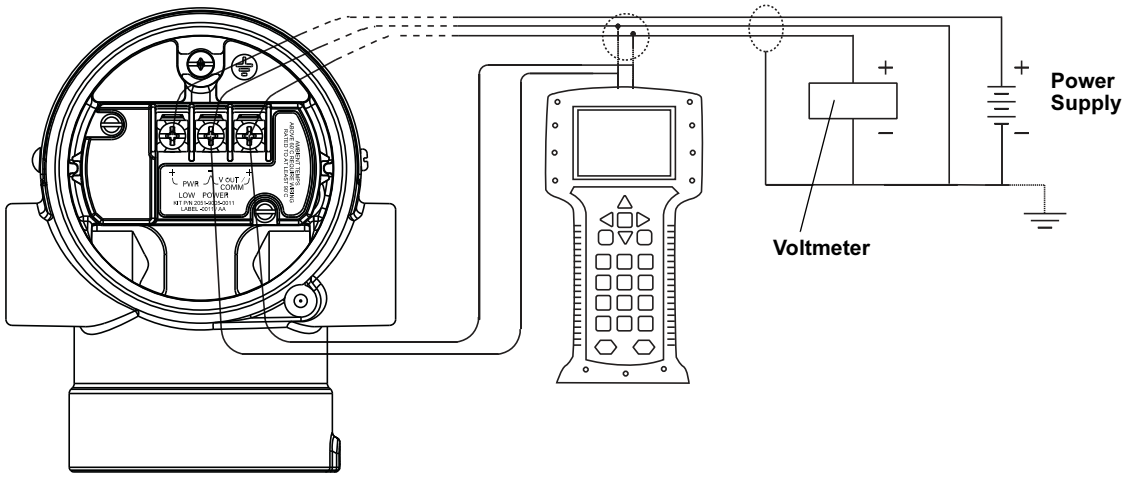


Figure 3-2. 1-5 Vdc HART Low Power Transmitter Wiring



CONFIGURATION DATA REVIEW

NOTE
Information and procedures in this section that make use of HART Communicator fast key sequences and AMS Device Manager assume that the transmitter and communication equipment are connected, powered, and operating correctly.

The following is a list of factory default configurations. These can be reviewed by using the HART Communicator or AMS Device Manager.

HART Communicator

4-20 mA Fast Keys	1, 5
1-5 Vdc Fast Keys	1, 5

Enter the fast key sequence to view the configuration data.

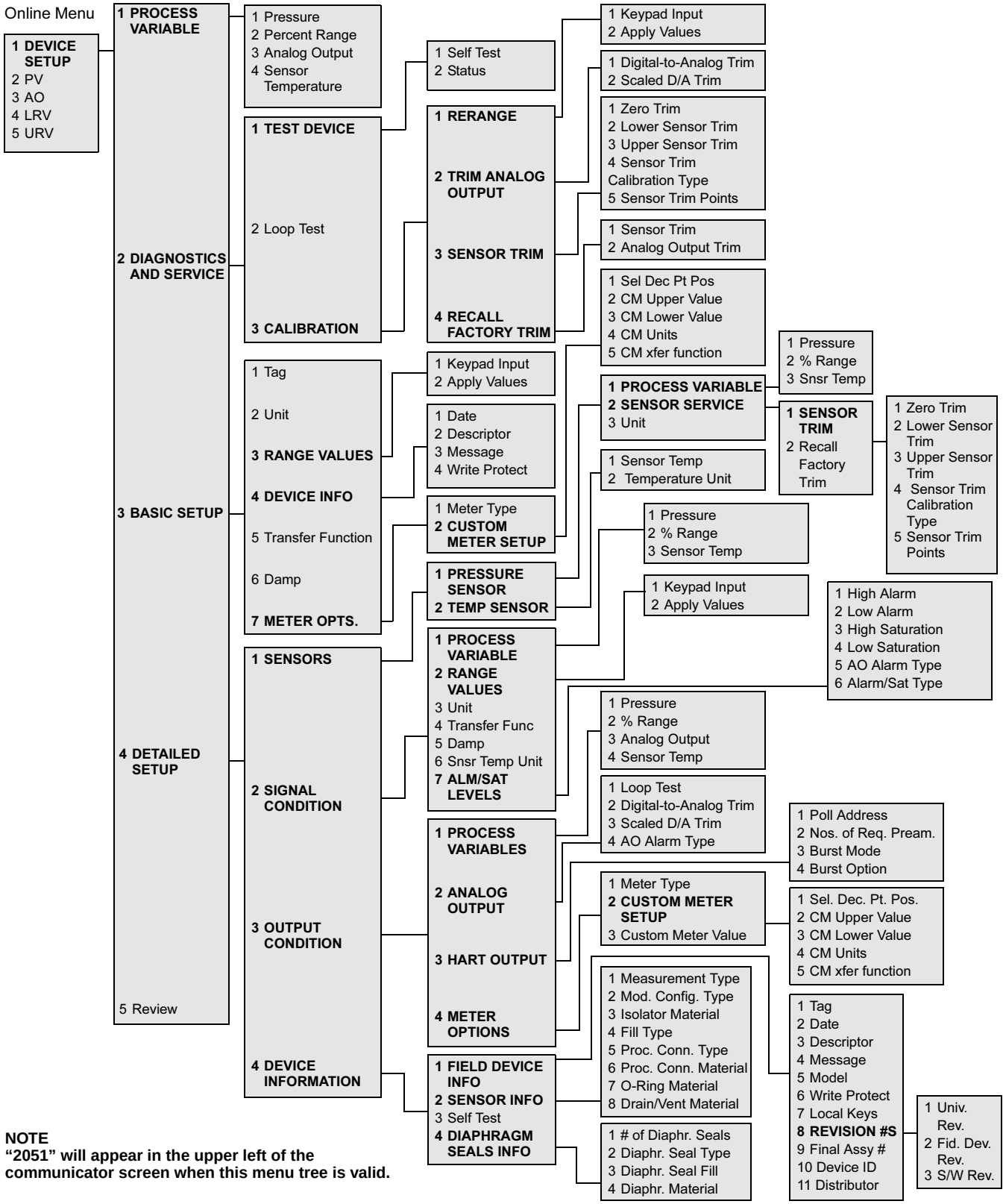
Transmitter Model	Type
Tag	Range
Date	Descriptor
Message	Minimum and Maximum Sensor Limits
Minimum Span	Units
4 and 20 mA points	Output (linear or sq. root)
Damping	Alarm Setting (high, low)
Security Setting (on, off)	Local Zero/Span Keys (enabled, disabled)
Integral Display	Sensor Fill
Isolator Material	Flange (type, material)
O-Ring Material	Drain/Vent
Remote Seal (type, fill fluid, isolator material, number)	Transmitter S/N
Address	Sensor S/N

AMS Device Manager

Right click on the device and select “Configuration Properties” from the menu. Select the tabs to review the transmitter configuration data.

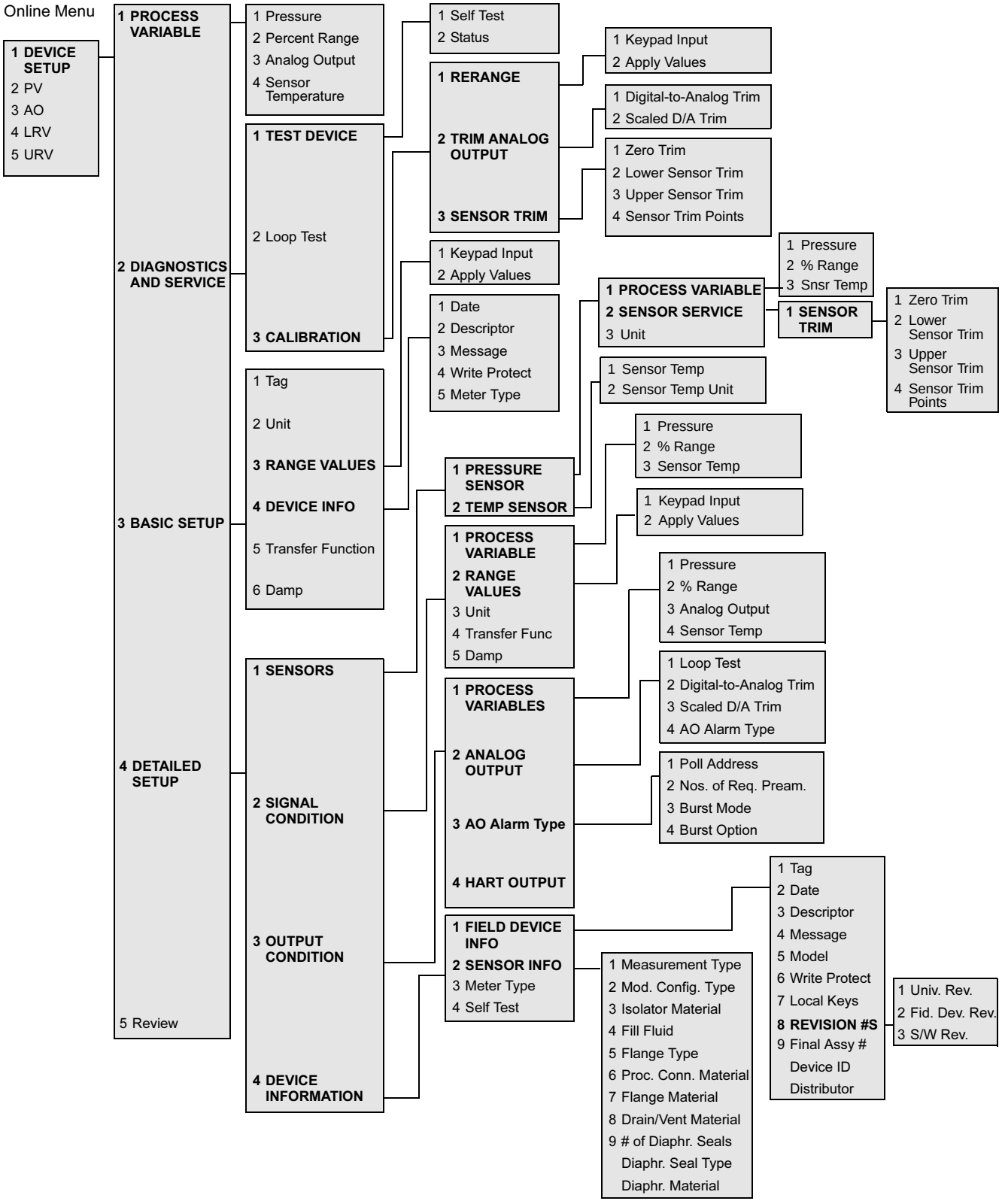
HART COMMUNICATOR MENU TREES

2051 HART menu tree for 4-20 mA HART output



NOTE
"2051" will appear in the upper left of the communicator screen when this menu tree is valid.

2051 HART menu tree for 1-5 Vdc HART Low Power



FAST KEY SEQUENCE

A check (√) indicates the basic configuration parameters. At minimum, these parameters should be verified as part of the configuration and startup procedure.

Table 3-1. 2051 Fast Key Sequence

	Function	4-20 mA HART	1-5 Vdc HART Low Power
✓	Alarm and Saturation Levels	1, 4, 2, 7	N/A
	Analog Output Alarm Type	1, 4, 3, 2, 4	1, 4, 3, 2, 4
	Burst Mode Control	1, 4, 3, 3, 3	1, 4, 3, 3, 3
	Burst Operation	1, 4, 3, 3, 4	1, 4, 3, 3, 4
	Custom Meter Configuration	1, 3, 7, 2	N/A
	Custom Meter Value	1, 4, 3, 4, 3	N/A
✓	Damping	1, 3, 6	1, 3, 6
	Date	1, 3, 4, 1	1, 3, 4, 1
	Descriptor	1, 3, 4, 2	1, 3, 4, 2
	Digital To Analog Trim (4-20 mA Output)	1, 2, 3, 2, 1	1, 2, 3, 2, 1
	Disable Local Span/Zero Adjustment	1, 4, 4, 1, 7	1, 4, 4, 1, 7
	Field Device Information	1, 4, 4, 1	1, 4, 4, 1
	Full Trim	1, 2, 3, 3	1, 2, 3, 3
	Keypad Input – Rerange	1, 2, 3, 1, 1	1, 2, 3, 1, 1
	Local Zero and Span Control	1, 4, 4, 1, 7	1, 4, 4, 1, 7
	Loop Test	1, 2, 2	1, 2, 2
	Lower Sensor Trim	1, 2, 3, 3, 2	1, 2, 3, 3, 2
	Message	1, 3, 4, 3	1, 3, 4, 3
	Meter Options	1, 4, 3, 4	N/A
	Number of Requested Preambles	1, 4, 3, 3, 2	1, 4, 3, 3, 2
	Poll Address	1, 4, 3, 3, 1	1, 4, 3, 3, 1
	Poll a Multidropped Transmitter	Left Arrow, 4, 1, 1	Left Arrow, 4, 1, 1
✓	Range Values	1, 3, 3	1, 3, 3
	Rerange	1, 2, 3, 1	1, 2, 3, 1
	Scaled D/A Trim (4–20 mA Output)	1, 2, 3, 2, 2	1, 2, 3, 2, 2
	Self Test (Transmitter)	1, 2, 1, 1	1, 2, 1, 1
	Sensor Info	1, 4, 4, 2	1, 4, 4, 2
	Sensor Temperature	1, 1, 4	1, 1, 4
	Sensor Trim Points	1, 2, 3, 3, 4	1, 2, 3, 3, 4
	Status	1, 2, 1, 2	1, 2, 1, 2
✓	Tag	1, 3, 1	1, 3, 1
✓	Transfer Function (Setting Output Type)	1, 3, 5	1, 3, 5
	Transmitter Security (Write Protect)	1, 3, 4, 4	1, 3, 4, 4
	Trim Analog Output	1, 2, 3, 2	1, 2, 3, 2
✓	Units (Process Variable)	1, 3, 2	1, 3, 2
	Upper Sensor Trim	1, 2, 3, 3, 3	1, 2, 3, 3, 3
	Zero Trim	1, 2, 3, 3, 1	1, 2, 3, 3, 1

CHECK OUTPUT

Before performing other transmitter on-line operations, review the digital output parameters to ensure that the transmitter is operating properly and is configured to the appropriate process variables.

Process Variables

The process variables for the 2051 provide transmitter output, and are continuously updated. The pressure reading in both engineering units and percent of range will continue to track with pressures outside of the defined range from the lower to the upper range limit of the sensor module.

HART Communicator

4-20 mA Fast Keys	1, 1
1-5 Vdc Fast Keys	1, 1

The process variable menu displays the following process variables:

- Pressure
- Percent of range
- Analog output

AMS Device Manager

Right click on the device and select “Process Variables...” from the menu.The process variable screen displays the following process variables:

- Pressure
- Percent of range
- Analog output

Sensor Temperature

The 2051 contains a temperature sensor near the pressure sensor in the sensor module. When reading this temperature, keep in mind the sensor is not a process temperature reading.

HART Communicator

4-20 mA Fast Keys	1, 1, 4
1-5 Vdc Fast Keys	1, 1, 4

Enter the fast key sequence “Sensor Temperature” to view the sensor temperature reading.

AMS Device Manager

Right click on the device and select “Process Variables...” from the menu. “Snsr Temp” is the sensor temperature reading.

BASIC SETUP

Set Process Variable Units

The PV Unit command sets the process variable units to allow you to monitor your process using the appropriate units of measure.

HART Communicator

4-20 mA Fast Keys	1, 3, 2
1-5 Vdc Fast Keys	1, 3, 2

Enter the fast key sequence “Set Process Variable Units.” Select from the following engineering units:

- inH_2O
- inHg
- ftH_2O
- mmH_2O
- mmHg
- psi
- bar
- mbar
- g/cm^2
- kg/cm^2
- Pa
- kPa
- torr
- atm
- inH_2O at 4 °C
- mmH_2O at 4 °C

AMS Device Manager

Right click on the device and select “Configure” from the menu. In the Basic Setup tab, use “Unit” drop down menu to select units.

Set Output (Transfer function)

The 2051 has two output settings: Linear and Square Root. Activate the square root output option to make analog output proportional to flow. As input approaches zero, the 2051 automatically switches to linear output in order to ensure a more smooth, stable output near zero (see Figure 3-3).

For 4-20 mA HART output, the slope of the curve is unity (y = x) from 0 to 0.6 percent of the ranged pressure input. This allows accurate calibration near zero. Greater slopes would cause large changes in output (for small changes at input). From 0.6 percent to 0.8 percent, curve slope equals 42 (y = 42x) to achieve continuous transition from linear to square root at the transition point.

HART Communicator

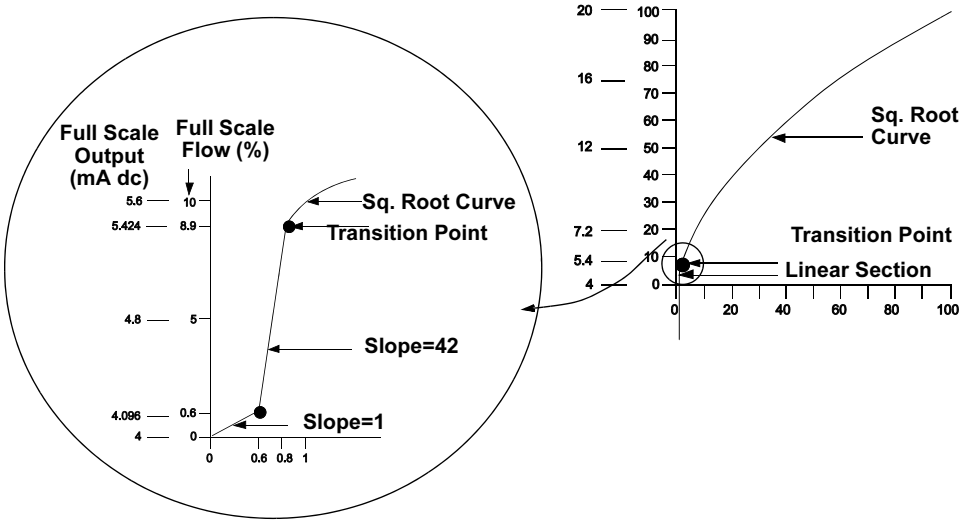
4-20 mA Fast Keys	1, 3, 5
1-5 Vdc Fast Keys	1, 3, 5

AMS Device Manager

Right click on the device and select “Configure” from the menu.

1. In the Basic Setup tab, use “Xfer fnctn” drop down menu to select output, click **Apply**.
2. After carefully reading the warning provided, select **yes**.

Figure 3-3. 4-20 mA HART Square Root Output Transition Point



NOTE
For a flow turndown of greater than 10:1 it is not recommended to perform a square root extraction in the transmitter. Instead, perform the square root extraction in the system.

Rerange

The Range Values command sets each of the lower and upper range analog values (4 and 20 mA points and 1 and 5 Vdc points) to a pressure. The lower range point represents 0% of range and the upper range point represents 100% of range. In practice, the transmitter range values may be changed as often as necessary to reflect changing process requirements. For a complete listing of Range & Sensor limits, refer to “Range and Sensor Limits” on page A-4.

NOTE
Transmitters are shipped from Emerson Process Management fully calibrated per request or by the factory default of full scale (zero to upper range limit).

NOTE
Regardless of the range points, the 2051 will measure and report all readings within the digital limits of the sensor. For example, if the 4 and 20 mA points are set to 0 and 10 inH_2O, and the transmitter detects a pressure of 25 inH_2O, it digitally outputs the 25 inH_2O reading and a 250% of range reading.

Select from one of the methods below to rerange the transmitter. Each method is unique; examine all options closely before deciding which method works best for your process.

- Rerange with a HART Communicator or AMS Device Manager only.
- Rerange with a pressure input source and a HART Communicator or AMS Device Manager.
- Rerange with a pressure input source and the local zero and span buttons (option D4).

NOTE
If the transmitter security switch is **ON,** adjustments to the zero and span will not be able to be made. Refer to “Configure Security and Alarm” on page 2-22 for security information.

Rerange with a HART Communicator or AMS Device Manager Only

The easiest and most popular way to rerange is to use the HART Communicator only. This method changes the range values of the analog 4 and 20 mA points (1 and 5 Vdc points) independently without a pressure input. This means that when you change either the 4 or 20 mA setting, you also change the span.

An example for the 4-20 mA HART output:

If the transmitter is ranged so that

4 mA = 0 inH_2O, and
20 mA = 100 inH_2O,

and you change the 4 mA setting to 50 inH_2O using the communicator only, the new settings are:
4 mA = 50 inH_2O, and
20 mA = 100 inH_2O.

Note that the span was also changed from 100 inH_2O to 50 inH_2O, while the 20 mA setpoint remained at 100 inH_2O.

To obtain reverse output, simply set the 4 mA point at a greater numerical value than the 20 mA point. Using the above example, setting the 4 mA point at 100 inH_2O and the 20 mA point at 0 inH_2O will result in reverse output.

HART Communicator

4-20 mA Fast Keys	1, 2, 3, 1
1-5 Vdc Fast Keys	1, 2, 3, 1

From the **HOME** screen, enter the fast key sequence “Rerange with a Communicator Only.”

AMS Device Manager

Right click on the device and select “Configure” from the menu. In the Basic Setup tab, locate the Analog Output box and perform the following procedure:

1. Enter the lower range value (LRV) and the upper range value (URV) in the fields provided. Click **Apply**.
2. After carefully reading the warning provided, select **yes**.

Rerange with a Pressure Input Source and a HART Communicator or AMS Device Manager

Reranging using the HART Communicator and applied pressure is a way of reranging the transmitter when specific 4 and 20 mA points (1 and 5 Vdc points) are not calculated.

NOTE
The span is maintained when the 4 mA point (1 Vdc point) is set. The span changes when the 20 mA point (5 Vdc point) is set. If the lower range point is set to a value that causes the upper range point to exceed the sensor limit, the upper range point is automatically set to the sensor limit, and the span is adjusted accordingly.

HART Communicator

4-20 mA Fast Keys	1, 2, 3, 1, 2
1-5 Vdc Fast Keys	1, 2, 3, 1, 2

From the **HOME** screen, enter the fast key sequence "Rerange with a Pressure Input Source and a HART Communicator or AMS Device Manager".

AMS Device Manager

Right click on the device, select “Calibrate”, then “Apply values” from the menu.

1. Select **Next** after the control loop is set to manual.
2. From the “Apply Values” menu, follow the on-line instructions to configure lower and upper range values.
3. Select **Exit** to leave the “Apply Values” screen.
4. Select **Next** to acknowledge the loop can be returned to automatic control.
5. Select **Finish** to acknowledge the method is complete.

Rerange with a Pressure Input Source and the Local Zero and Span buttons (option D4)

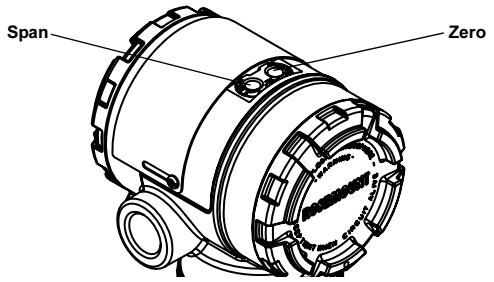
Reranging using the local zero and span adjustments (see Figure 3-4 on page 3-13) and a pressure source is a way of reranging the transmitter when specific 4 and 20 mA (1 and 5 Vdc) points are not known and a communicator is not available.

NOTE
When you set the 4 mA (1 Vdc) point the span is maintained; when you set the 20 mA (5 Vdc) point the span changes. If you set the lower range point to a value that causes the upper range point to exceed the sensor limit, the upper range point is automatically set to the sensor limit, and the span is adjusted accordingly.

To rerange the transmitter using the span and zero buttons, perform the following procedure:

1. Loosen the screw holding the certifications label on the side of the transmitter housing. Slide the label to expose the zero and span buttons. See Figure 3-4.
2. Apply the desired 4 mA (1 Vdc) pressure value to the transmitter. Push and hold the zero adjustment button for at least two seconds but no longer than ten seconds.
3. Apply the desired 20 mA (5 Vdc) pressure value to the transmitter. Push and hold the span adjustment button for at least two seconds but no longer than ten seconds.

Figure 3-4. Zero and Span buttons



NOTE
The span is maintained when the 4 mA point (1 Vdc point) is set. The span changes when the 20 mA point (5 Vdc point) is set. If the lower range point is set to a value that causes the upper range point to exceed the sensor limit, the upper range point is automatically set to the sensor limit, and the span is adjusted accordingly.

Damping

The “Damp” command introduces a delay in the micro-processing which increases the response time of the transmitter; smoothing variations in output readings caused by rapid input changes. Determine the appropriate damping setting based on the necessary response time, signal stability, and other requirements of the loop dynamics within your system. The default damping value is 0.4 seconds and it can be set to any of ten pre-configured damping values between 0 and 25.6 seconds. See list below.

- 0.00 seconds
- 0.05 seconds
- 0.10 seconds
- 0.20 seconds
- 0.40 seconds
- 0.80 seconds
- 1.60 seconds
- 3.20 seconds
- 6.40 seconds
- 12.8 seconds
- 25.6 seconds

The current damping value can be determined by executing the HART Communicator fast keys or going to "Configure" in AMS Device Manager.

HART Communicator

4-20 mA Fast Keys	1, 3, 6
1-5 Vdc Fast Keys	1, 3, 6

AMS Device Manager

Right click on the device and select “Configure” from the menu.

1. In the “Basic Setup” tab, enter the damping value in the “Damp” field, click **Apply**.
2. After carefully reading the warning provided, select **yes**.

LCD DISPLAY

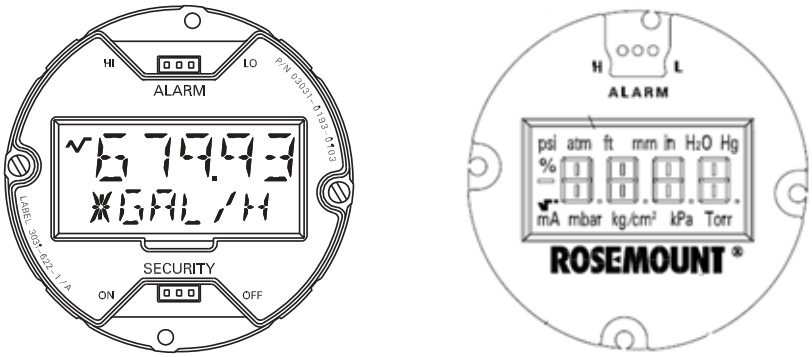
The LCD display connects directly to the interface board which maintains direct access to the signal terminals. The display indicates output and abbreviated diagnostic messages. A display cover is provided to accommodate the display.

For 4-20 mA HART output, the LCD display features a two-line display. The first line of five characters displays the actual measured value, the second line of six characters displays the engineering units. The LCD can also display diagnostic messages. Refer to Figure 3-5.

For 1-5 Vdc HART Low Power output, the LCD display features a single-line display with four characters that display the actual value. The LCD can also display diagnostic messages. Refer to Figure 3-5.

Figure 3-5.

4-20 mA HART **1-5 Vdc HART Low Power**



LCD Display Configuration for 4-20 mA HART only

The factory default alternates are between Engineering Units and % of Range. The LCD Display Configuration command allows customization of the LCD display to suit application requirements. The LCD display will alternate between the selected items:

- Eng. Units only
- % of Range only
- Custom Display only
- Alternate Eng. Units & % of Range
- Alternate Eng. Units & Custom Display
- Alternate % of Range & Custom Display

HART Communicator

4-20 mA Fast Keys	1, 3, 7

To change the standard default to one of the above options, follow these steps:

1. From the communicators main menu select (1) Device Setup (3) Basic Setup, (7) Meter Options.
2. Select (1) Meter Type. Using the up or down arrows scroll up or down until the desired display has been highlighted. Press ENTER, SEND, and HOME.

AMS

Right click on the device and select “Configuration Properties” from the menu.

1. In the “Local Display” tab, locate the “Meter Type” area. Select the desired options to suit your application needs, click **Apply**.
2. An “Apply Parameter Modification” screen appears, enter desired information and click **OK**.
3. After carefully reading the warning provided, select **OK**.

Custom Display Configuration 4-20 mA HART only

The user-configurable scale is a feature that enables the LCD display to display flow, level, or custom pressure units. With this feature you can define the decimal point position, the upper range value, the lower range value, the engineering units, and the transfer function.The display can be configured using a HART Communicator or AMS.

The user-configurable scale feature can define:

- decimal point position
- upper range values
- lower range values
- engineering units
- transfer function

To configure the display with a HART communicator, perform the following procedure:

1. Change the Meter Type to “Custom Meter” by using the Fast Key sequence under “LCD Display Configuration for 4-20 mA HART only” on page 3-15.
2. Next from the **ONLINE** screen, *Select 1 Device Setup, 3 Basic Setup, 7 Meter Options, 2 Meter Options, 2 Custom Meter Setup*
3. To specify decimal point position:

⚠ See “Safety Messages” on page 3-1 for complete warning information.

a. Select *1 Sel dec pt pos*. Choose the decimal point representation that will provide the most accurate output for your application. For example, when outputting between 0 and 75 GPM, choose *XX.XXX* or use the decimal point examples below:

XXXXX
XXXX.X
XXX.XX
XX.XXX
X.XXXX

NOTE:
Make sure the selection has been sent and the decimal point has changed before proceeding to the next step.

b. SEND

4. To specify a custom upper range value:
   a. Select *2 CM Upper Value*. Type the value that you want the transmitter to read at the 20 mA point.
   b. SEND
5. To specify a custom lower range value:
   a. Select *3 CM Lower Value*. Type the value that you want the transmitter to read at the 4 mA point.
   b. SEND
6. To define custom units:
   a. Select *4 CM Units*. Enter the custom units (five characters maximum) that you want the display to display.
   b. SEND
7. To choose the transmitter transfer function for the display:
   a. Select *5 CM xfer fnct*. Enter the transmitter transfer function for the display. Select *sq root* to display flow units. The custom meter transfer function is independent of the analog output transfer function.
8. Select **SEND** to upload the configuration to the transmitter.

DETAILED SETUP

Failure Mode Alarm and Saturation

The 2051 transmitters automatically and continuously perform self-diagnostic routines. If the self-diagnostic routines detect a failure, the transmitter drives its output outside of the normal saturation values. The transmitter will drive its output low or high based on the position of the failure mode alarm jumper. See Table 3-2, Table 3-3, and Table 3-4 for failure mode and saturation output levels. To select alarm position, see “Configure Security and Alarm” on page 2-22.

Table 3-2. 4-20 mA HART Alarm and Saturation Values

Level	4–20 mA Saturation	4–20 mA Alarm
Low	3.9 mA	≤ 3.75 mA
High	20.8 mA	≥ 21.75 mA

Table 3-3. NAMUR-Compliant Alarm and Saturation Values

Level	4–20 mA Saturation	4–20 mA Alarm
Low	3.8 mA	≤ 3.6 mA
High	20.5 mA	≥ 22.5 mA

Table 3-4. 1-5 Vdc HART Low-Power Alarm and Saturation Values

Level	1–5 V Saturation	1–5 V Alarm
Low	0.97 V	≤ 0.95 V
High	5.20 V	≥ 5.4 V

CAUTION
Alarm level values will be affected by analog trim. Refer to “Analog Output Trim” on page 4-7.

NOTE
When a transmitter is in an alarm condition, the HART communicator indicates the analog output the transmitter would drive if the alarm condition did not exist. The transmitter will alarm high in the event of failure if the alarm jumper is removed.

Alarm and Saturation Levels for Burst Mode

Transmitters set to burst mode handle saturation and alarm conditions differently.

Alarm Conditions:

- Analog output switches to alarm value
- Primary variable is burst with a status bit set
- Percent of range follows primary variable
- Temperature is burst with a status bit set

Saturation:

- Analog output switches to saturation value
- Primary variable is burst normally
- Temperature is burst normally

Alarm and Saturation Values for Multidrop Mode

Transmitters set to multidrop mode handle saturation and alarm conditions differently.

Alarm Conditions:

- Primary variable is sent with a status bit set
- Percent of range follows primary variable
- Temperature is sent with a status bit set

Saturation:

- Primary variable is sent normally
- Temperature is sent normally

Alarm Level Verification

If the transmitter electronics board, sensor module, or LCD display is repaired or replaced, verify the transmitter alarm level before returning the transmitter to service. This feature is also useful in testing the reaction of the control system to a transmitter in an alarm state. To verify the transmitter alarm values, perform a loop test and set the transmitter output to the alarm value (see Tables 3-2, 3-3, and 3-4 on page 3-16, and "Loop Test" on page 3-18).

DIAGNOSTICS AND SERVICE

Diagnostics and service functions listed below are primarily for use after field installation. The Transmitter Test feature is designed to verify that the transmitter is operating properly, and the Loop Test feature is designed to verify proper loop wiring and transmitter output.

Transmitter Test

The Transmitter Test command initiates a more extensive diagnostics routine than that performed continuously by the transmitter. The test routine can quickly identify potential electronics problems. If the test detects a problem, messages to indicate the source of the problem are displayed on the HART Communicator screen.

HART Communicator

4-20 mA Fast Keys	1, 2, 1, 1
1-5 Vdc Fast Keys	1, 2, 1, 1

AMS Device Manager

Right click on the device and select "Diagnostics and Test," then "Self Test" from the menu.

1. Click **Next** to acknowledge test results.
2. Select **Finish** to acknowledge the method is complete.

Loop Test

The Loop Test command verifies the output of the transmitter, the integrity of the loop, and the operations of any recorders or similar devices installed in the loop.

HART Communicator

4-20 mA Fast Keys	1, 2, 2
1-5 Vdc Fast Keys	1, 2, 2

To initiate a loop test, perform the following procedure:

1. a. For 4-20 mA HART output, connect a reference meter to the transmitter by either connecting the meter to the test terminals on the terminal block, or shunting transmitter power through the meter at some point in the loop.
   b. For 1-5 Vdc Low Power HART output, connect a reference meter to the V_{out} terminal.
2. From the **HOME** screen, enter the fast key sequence “Loop Test” to verify the output of the transmitter.
3. Select **OK** after the control loop is set to manual (see “Setting the Loop to Manual” on page 3-2).
4. Select a discrete milliamp level for the transmitter to output. At the **CHOOSE ANALOG OUTPUT** prompt select 1: 4mA (1 Vdc), select 2: 20mA (5 Vdc), or select 3: “Other” to manually input a value.
   a. If you are performing a loop test to verify the output of a transmitter, enter a value between 4 and 20 mA (1 and 5 Vdc).
   b. If you are performing a loop test to verify alarm levels, enter the value representing an alarm state (see Tables 3-2, 3-3, and 3-4 on page 3-16).
5. Check that the reference meter displays the commanded output value.
   a. If the values match, the transmitter and the loop are configured and functioning properly.
   b. If the values do not match, the meter may be attached to the wrong loop, there may be a fault in the wiring or power supply, the transmitter may require an output trim, or the reference meter may be malfunctioning.

After completing the test procedure, the display returns to the loop test screen to choose another output value or to end loop testing.

AMS Device Manager

Right click on the device and select “Diagnostics and Test,” then “Loop test” from the menu.

1. a. For 4-20 mA HART output, connect a reference meter to the transmitter by either connecting the meter to the test terminals on the terminal block, or shunting transmitter power through the meter at some point in the loop.
   b. For 1-5 Vdc Low Power HART output, connect a reference meter to the V_{out} terminal.
2. Click **Next** after setting the control loop to manual.
3. Select desired analog output level. Click **Next**.
4. Click **Next** to acknowledge output being set to desired level.
5. Check that the reference meter displays the commanded output value.
   a. If the values match, the transmitter and the loop are configured and functioning properly.
   b. If the values do not match, the meter may be attached to the wrong loop, there may be a fault in the wiring or power supply, the transmitter may require an output trim, or the reference meter may be malfunctioning.

After completing the test procedure, the display returns to the loop test screen to choose another output value or to end loop testing.

6. Select **End** and click **Next** to end loop testing.
7. Select **Next** to acknowledge the loop can be returned to automatic control.
8. Select **Finish** to acknowledge the method is complete.

ADVANCED FUNCTIONS

Saving, Recalling, and Cloning Configuration Data

Use the cloning feature of the HART Communicator or the AMS Device Manager "User Configuration" feature to configure several 2051 transmitters similarly. Cloning involves configuring a transmitter, saving the configuration data, then sending a copy of the data to a separate transmitter. Several possible procedures exist when saving, recalling, and cloning configuration data. For complete instructions refer to the HART Communicator manual (publication no. 00809-0100-4276) or AMS Device Manager on-line guides. One common method is as follows:

HART Communicator

4-20 mA Fast Keys	left arrow, 1, 2
1-5 Vdc Fast Keys	left arrow, 1, 2

1. Completely configure the first transmitter.
2. Save the configuration data:
   a. Select **SAVE** from the HART Communicator **HOME/ONLINE** screen.
   b. Ensure that the location to which the data will be saved is set to **MODULE**. If it is not, select 1: Location to set the save location to **MODULE**.
   c. Select 2: Name, to name the configuration data. The default is the transmitter tag number.
   d. Ensure that the data type is set to **STANDARD**. If the data type is NOT **STANDARD**, select 3: Data Type to set the data type to **STANDARD**.
   e. Select **SAVE**.
3. Connect and power the receiving transmitter and HART Communicator.
4. Select the back arrow from the **HOME/ONLINE** screen. The HART Communicator menu appears.
5. Select 1: Offline, 2: Saved Configuration, 1: Module Contents to reach the **MODULE CONTENTS** menu.
6. Use the **DOWN ARROW** to scroll through the list of configurations in the memory module, and use the **RIGHT ARROW** to select and retrieve the required configuration.
7. Select 1: Edit.
8. Select 1: Mark All.
9. Select **SAVE**.
10. Use the **DOWN ARROW** to scroll through the list of configurations in the memory module, and use the **RIGHT ARROW** to select the configuration again.

11. Select 3: Send to download the configuration to the transmitter.
12. Select **OK** after the control loop is set to manual.
13. After the configuration has been sent, select **OK** to acknowledge that the loop can be returned to automatic control.

When finished, the HART Communicator informs you of the status. Repeat Steps 3 through 13 to configure another transmitter.

NOTE
The transmitter receiving cloned data must have the same software version (or later) as the original transmitter.

AMS Device Manager creating a Reusable Copy

To create a reusable copy of a configuration perform the following procedure:

1. Completely configure the first transmitter.
2. Select View then User Configuration View from the menu bar (or click the toolbar button).
3. In the User Configuration window, right click and select New from the context menu.
4. In the New window, select a device from the list of templates shown, and click **OK**.
5. The template is copied into the User Configurations window, with the tag name highlighted; rename it as appropriate and press **Enter**.

NOTE
A device icon can also be copied by dragging and dropping a device template or any other device icon from AMS Device Manager Explorer or Device Connection View into the User Configurations window.

The “Compare Configurations” window appears, showing the Current values of the copied device on one side and mostly blank fields on the other (User Configuration) side.

6. Transfer values from the current configuration to the user configuration as appropriate or enter values by typing the values into the available fields.
7. Click Apply to apply the values, or click **OK** to apply the values and close the window.

AMS Device Manager Applying a User Configuration

Any amount of user configurations can be created for the application. They can also be saved, and applied to connected devices or to devices in the Device List or Plant Database.

NOTE
When using AMS Device Manager Revision 6.0 or later, the device to which the user configuration is applied, must be the same model type as the one created in the user configuration. When using AMS Device Manager Revision 5.0 or earlier, the same model type and revision number are required.

To apply a user configuration perform the following procedure:

1. Select the desired user configuration in the User Configurations window.
2. Drag the icon onto a like device in AMS Device Manager Explorer or Device Connection View. The Compare Configurations window opens, showing the parameters of the target device on one side and the parameters of the user configuration on the other.
3. Transfer parameters from the user configuration to the target device as desired, Click **OK** to apply the configuration and close the window.

Burst Mode

When configured for burst mode, the 2051 provides faster digital communication from the transmitter to the control system by eliminating the time required for the control system to request information from the transmitter. Burst mode is compatible with the analog signal. Because the HART protocol features simultaneous digital and analog data transmission, the analog value can drive other equipment in the loop while the control system is receiving the digital information. Burst mode applies only to the transmission of dynamic data (pressure and temperature in engineering units, pressure in percent of range, and/or analog output), and does not affect the way other transmitter data is accessed.

Access to information other than dynamic transmitter data is obtained through the normal poll/response method of HART communication. A HART Communicator, AMS Device Manager or the control system may request any of the information that is normally available while the transmitter is in burst mode. Between each message sent by the transmitter, a short pause allows the HART Communicator, AMS Device Manager or a control system to initiate a request. The transmitter will receive the request, process the response message, and then continue “bursting” the data approximately three times per second.

HART Communicator

4-20 mA Fast Keys	1, 4, 3, 3, 3
1-5 Vdc Fast Keys	1, 4, 3, 3, 3

AMS Device Manager

Right click on the device and select “Configure” from the menu.

1. In the “HART” tab, use the drop down menu to select “Burst Mode ON or OFF.” For “Burst option” select the desired properties from the drop down menu. Burst options are as follows:
   - PV
   - % range/current
   - Process vars/crnt
   - Process variables
2. After selecting options click **Apply**.
3. After carefully reading the warning provided, select **yes**.

MULTIDROP COMMUNICATION

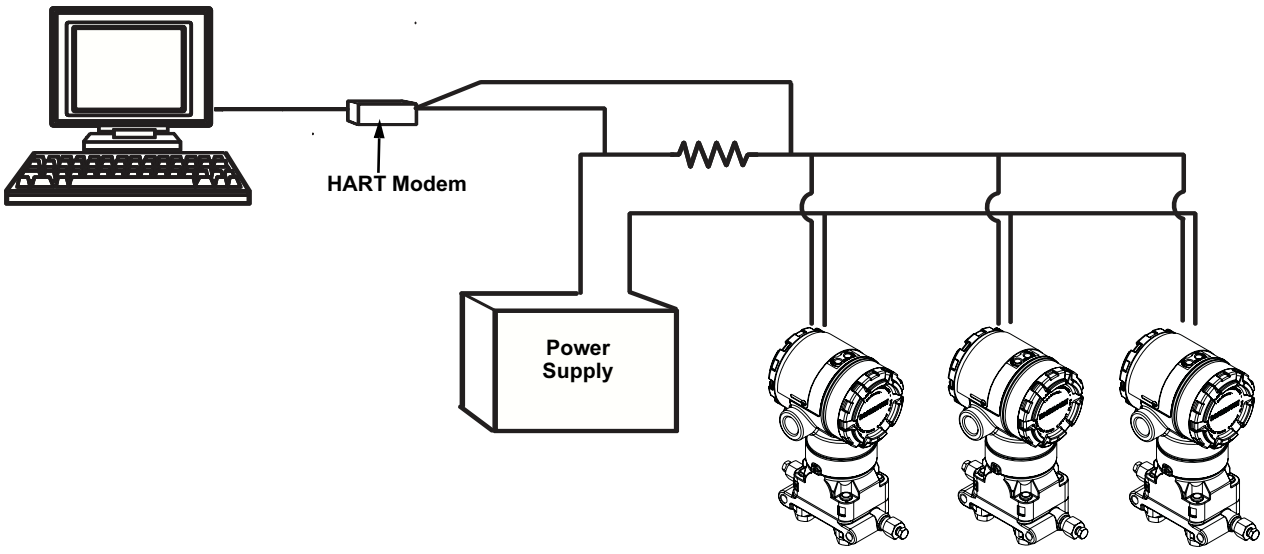
Multidropping transmitters refers to the connection of several transmitters to a single communications transmission line. Communication between the host and the transmitters takes place digitally with the analog output of the transmitters deactivated. With smart communications protocol, up to fifteen transmitters can be connected on a single twisted pair of wires, or over leased phone lines.

Multidrop installation requires consideration of the update rate necessary from each transmitter, the combination of transmitter models, and the length of the transmission line. Communication with transmitters can be accomplished with HART modems and a host implementing HART protocol. Each transmitter is identified by a unique address (1–15) and responds to the commands defined in the HART protocol. HART Communicators and AMS Device Manager can test, configure, and format a multidropped transmitter the same way as a transmitter in a standard point-to-point installation.

Figure 3-6 shows a typical multidrop network. This figure is not intended as an installation diagram.

NOTE
A transmitter in multidrop mode has the analog output fixed at 4 mA. If an LCD display is installed to a transmitter in multidrop mode, it will alternate the display between “current fixed” and the specified LCD display output(s).

Figure 3-6. Typical Multidrop Network



The 2051 is set to address zero (0) at the factory, which allows operation in the standard point-to-point manner with a 4–20 mA output signal. To activate multidrop communication, the transmitter address must be changed to a number from 1 to 15. This change deactivates the 4–20 mA analog output, sending it to 4 mA. It also disables the failure mode alarm signal, which is controlled by the upscale/downscale switch position. Failure signals in multidropped transmitters are communicated through HART messages.

Changing a Transmitter Address

To activate multidrop communication, the transmitter poll address must be assigned a number from 1 to 15, and each transmitter in a multidropped loop must have a unique poll address.

HART Communicator

4-20 mA Fast Keys	1, 4, 3, 3, 1
1-5 Vdc Fast Keys	1, 4, 3, 3, 1

AMS Device Manager

Right click on the device and select “Configuration Properties” from the menu.

1. In the “HART” tab, in “ID” box, enter poll address located in the “Poll addr” box, click **Apply**.
2. After carefully reading the warning provided, select **yes**.

Communicating with a Multidropped Transmitter

HART Communicator

4-20 mA Fast Keys	1, 4, 3, 3, 2
1-5 Vdc Fast Keys	1, 4, 3, 3, 2

To communicate with a multidropped transmitter, configure the HART Communicator to poll for a non-zero address.

1. From the **HOME** screen, enter the fast key sequence “Communicating with a Multidropped Transmitter.”
2. On the polling menu, scroll down and select “Digital Poll.” In this mode, the HART Communicator automatically polls for devices at addresses 0-15 upon start up.

AMS Device Manager

Click on the HART modem icon and select “Scan All Devices.”

Polling a Multidropped Transmitter

Polling a multidropped loop determines the model, address, and number of transmitters on the given loop.

HART Communicator

4-20 mA Fast Keys	Left arrow, 4, 1
1-5 Vdc Fast Keys	Left arrow, 4, 1

AMS Device Manager

Click on the HART modem icon and select “Scan All Devices.”

Section 4 Operation and Maintenance

OVERVIEW

This section contains information on calibrating and diagnostics messages on the Rosemount 2051 Pressure Transmitters.

HART Communicator and AMS instructions are given to perform configuration functions. For convenience, HART Communicator fast key sequences are labeled “Fast Keys” for each software function below the appropriate headings.

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 could result in death or serious injury:
Installation of this transmitter in an explosive environment must be in accordance with the appropriate local, national, and international standards, codes, and practices. Please review the approvals section of the 2051 reference manual for any restrictions associated with a safe installation.
- Before connecting a HART communicator in an explosive atmosphere, ensure the instruments in the loop are installed in accordance with intrinsically safe or non-incendive field wiring practices.
- In an Explosion-Proof/Flameproof installation, do not remove the transmitter covers when power is applied to the unit.

Process leaks may cause harm or result in death.
- Install and tighten process connectors before applying pressure.

Electrical shock can result in death or serious injury.
- Avoid contact with the leads and terminals. High voltage that may be present on leads can cause electrical shock.

CALIBRATION OVERVIEW

Calibration is defined as the process required to optimize transmitter accuracy over a specific range by adjusting the factory sensor characterization curve located in the microprocessor. Possible procedures are:

- Reranging: Setting the lower and upper range points (4 and 20 mA or 1 and 5 Vdc) points at required pressures. Reranging does not change the factory sensor characterization curve. Refer to page 3-10.
- Analog Output Trim: Adjusts the transmitter's analog characterization curve to match the plant standard of the control loop. There are two types of digital-to-analog output trims. Refer to page 4-7.
  - Digital-to-Analog Output Trim on 4-20 mA HART output (page 4-7)
  - Digital-to-Analog Output Trim on 4-20 mA HART output Using Other Scale (page 4-8)
- Sensor Trim: Adjusts the position of the factory sensor characterization curve due to a change in the sensor characteristics over time or a change in test equipment. Trimming has two steps, zero and sensor trims. Refer to page 4-10 and page 4-11.
  - Zero Trim (page 4-10)
  - Sensor Trim (page 4-11)

Figure 4-1 on page 4-3 illustrates 2051 transmitter data flow. Data flow can be summarized in four major steps:

1. A change in pressure is measured by a change in the sensor output (Sensor Signal).
2. The sensor signal is converted to a digital format that is understood by the microprocessor (Analog-to-Digital Signal Conversion). Sensor trim functions affect this value. Select these options to alter the digital signal on the LCD or HART Communicator.
3. Corrections are performed in the microprocessor to obtain a digital representation of the process input (Digital PV).
4. The Digital PV is converted to an analog value (Digital-to-Analog Signal Conversion). Rerange and Analog trim functions affect this value. Select these options to change the range points (4-20 mA or 1-5 Vdc).

For a summary of recommended calibration procedures, refer to Table 4-1 on page 4-3. Also, Figure 4-1 on page 4-3 identifies the approximate transmitter location for each calibration task. Data flows from left to right and a parameter change affects all values to the right of the changed parameter.

Figure 4-1. Transmitter Data Flow with Calibration Options

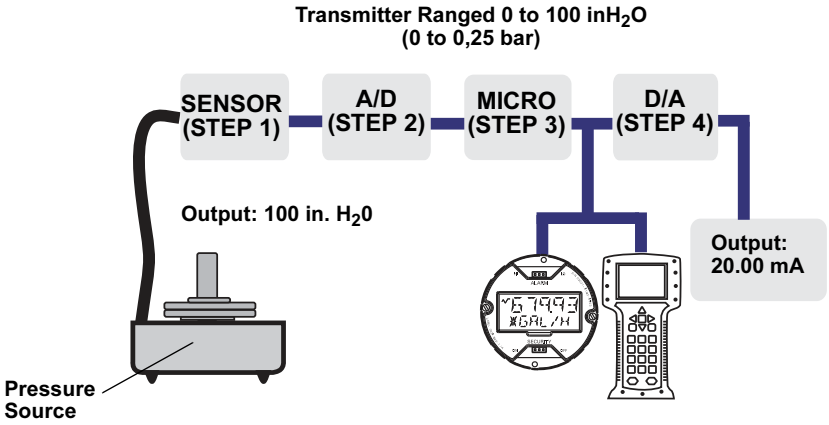


Table 4-1. Recommended Calibration Tasks

Transmitter	Bench Calibration Tasks	Field Calibration Tasks
2051CD 2051CG 2051L 2051TG, Range 1-4	1. Set output configuration parameters: a. Set the range points. b. Set the output units. c. Set the output type. d. Set the damping value. 2. *Optional*: Perform a sensor trim. (Accurate pressure source required.)	1. Reconfigure parameters if necessary. 2. Zero trim the transmitter to compensate for mounting effects or static pressure effects. 3. *Optional*: Perform an analog output trim. (Accurate multimeter required)
2051TA 2051TG, Range 5	1. Set output configuration parameters: a. Set the range points. b. Set the output units. c. Set the output type. d. Set the damping value. 2. *Optional*: Perform a sensor trim if equipment available (accurate absolute pressure source required), otherwise perform the low trim value section of the sensor trim procedure.	1. Reconfigure parameters if necessary. 2. Perform low trim value section of the sensor trim procedure to correct for mounting position effects. 3. *Optional*: Perform an analog output trim (Accurate multimeter required)

NOTE
The 2051 has been carefully calibrated at the factory. Trimming adjusts the position of the factory characterization curve. It is possible to degrade performance of the transmitter if any trim is done improperly or with inaccurate equipment.

NOTE
A HART communicator is required for all sensor and output trim procedures. Rosemount 2051C Range 4 and Range 5 transmitters require a special calibration procedure when used in differential pressure applications under high static line pressure (see“Compensating for Line Pressure” on page 4-13).

Determining Calibration Frequency

Calibration frequency can vary greatly depending on the application, performance requirements, and process conditions. Use the following procedure to determine calibration frequency that meets the needs of your application.

1. Determine the performance required for your application.
2. Determine the operating conditions.
3. Calculate the Total Probable Error (TPE).
4. Calculate the stability per month.
5. Calculate the calibration frequency.

Sample Calculation For A Standard 2051C

Step 1: Determine the performance required for your application.

Required Performance: 0.30% of span

Step 2: Determine the operating conditions.

Transmitter:	2051CD, Range 2 [URL=250 inH_2O(623 mbar)]
Calibrated Span:	150 inH_2O (374 mbar)
Ambient Temperature Change:	± 50 °F (28 °C)
Line Pressure:	500 psig (34,5 bar)

Step 3: Calculate total probable error (TPE).

$$TPE = \sqrt{(ReferenceAccuracy)^2 + (TemperatureEffect)^2 + (StaticPressureEffect)^2} = 0.189\% \text{ of span}$$

Where:

Reference Accuracy = ± 0.075% of span

Ambient Temperature Effect =

$$\pm\left(\frac{0.025 \times URL}{Span} + 0.125\right) \text{per } 50\ °F = \pm 0.1666\% \text{ of span}$$

Span Static Pressure Effect(1) =

0.1% reading per 1000 psi (69 bar) = ±0.05% of span at maximum span

(1) Zero static pressure effect removed by zero trimming at line pressure.

Step 4: Calculate the stability per month.

$$Stability = \pm\left[\frac{(0.100 \times URL)}{Span}\right]\% \text{ of span for 2 years} = \pm 0.0069\% \text{ of span per month}$$

Step 5: Calculate calibration frequency.

$$\text{Cal. Freq.} = \frac{(\text{Req. Performance} - TPE)}{\text{Stability per Month}} = \frac{(0.3\% - 0.189\%)}{0.0069\%} = 16 \text{months}$$

Sample Calculation for 2051C with P8 option (0.065% accuracy & 5-year stability)

Step 1: Determine the performance required for your application.

Required Performance: 0.30% of span

Step 2: Determine the operating conditions.

Transmitter:	2051CD, Range 2 [URL=250 inH_2O(623 mbar)]
Calibrated Span:	150 inH_2O (374 mbar)
Ambient Temperature Change:	± 50 °F (28 °C)
Line Pressure:	500 psig (34,5 bar)

Step 3: Calculate total probable error (TPE).

$$TPE = \sqrt{(ReferenceAccuracy)^2 + (TemperatureEffect)^2 + (StaticPressureEffect)^2} = 0.185\% \text{ of span}$$

Where:

Reference Accuracy = ± 0.065% of span

Ambient Temperature Effect =

$$\pm\left(\frac{0.025 \times URL}{Span} + 0.125\right) \text{per 50 °F} = \pm 0.1666\% \text{ of span}$$

Span Static Pressure Effect(1) =

0.1% reading per 1000 psi (69 bar) = ±0.05% of span at maximum span

(1) Zero static pressure effect removed by zero trimming at line pressure.

Step 4: Calculate the stability per month.

$$Stability = \pm\left[\frac{(0.125 \times URL)}{Span}\right]\% \text{ of span for 5 years} = \pm 0.0035\% \text{ of span per month}$$

Step 5: Calculate calibration frequency.

$$\text{Cal. Freq.} = \frac{(\text{Req. Performance} - TPE)}{\text{Stability per Month}} = \frac{(0.3\% - 0.185\%)}{0.0035\%} = 32 \text{ months}$$

Choosing a Trim Procedure

To decide which trim procedure to use, you must first determine whether the analog-to-digital section or the digital-to-analog section of the transmitter electronics need calibration. Refer to Figure 4-1 and perform the following procedure:

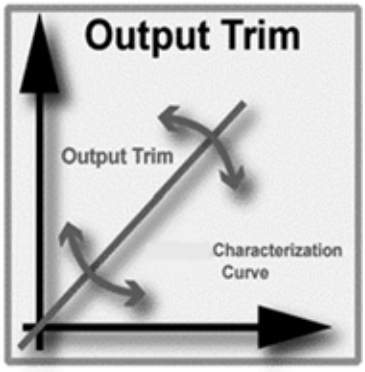
1. Connect a pressure source, a HART Communicator or AMS, and a digital readout device to the transmitter.
2. Establish communication between the transmitter and the HART Communicator.
3. Apply pressure equal to the upper range point pressure.
4. Compare the applied pressure to the pressure process variable valve on the Process Variables menu on the HART Communicator or the Process Variables screen in AMS. For instructions on how to access process variables, see page 3-7 of Section 3: Configuration.
    a. If the pressure reading does not match the applied pressure (with high-accuracy test equipment), perform a sensor trim. See “Sensor Trim Overview” on page 4-10 to determine which trim to perform.
5. Compare the Analog Output (AO) line, on the HART Communicator or AMS, to the digital readout device.

If the AO reading does not match the digital readout device (with high-accuracy test equipment), perform an analog output trim. See “Analog Output Trim” on page 4-7.

ANALOG OUTPUT TRIM

The Analog Output Trim commands allow you to adjust the transmitter's current output at the 4 and 20 mA (1 and 5 Vdc) points to match the plant standards. This command adjusts the digital to analog signal conversion.

Figure 4-2. Output Trim



Digital-to-Analog Trim

HART Communicator

4-20 mA Fast Keys	1, 2, 3, 2, 1
1-5 Vdc Fast Keys	1, 2, 3, 2, 1

To perform a digital-to-analog trim with a HART Communicator, perform the following procedure.

1. From the **HOME** screen, enter the fast key sequence "Digital-to-Analog Trim." Select **OK** after setting the control loop to manual, see "Setting the Loop to Manual" on page 3-2.
2. a. For 4-20 mA HART output, connect a reference meter to the transmitter by either connecting the meter to the test terminals on the terminal block, or shunting transmitter power through the meter at some point in the loop.
   b. For 1-5 Vdc Low Power HART output, connect a reference meter to the V_{out} terminal.
3. Select **OK** after connecting the reference meter.
4. Select **OK** at the **SETTING FLD DEV OUTPUT TO 4 MA (1 Vdc)** prompt. The transmitter outputs 4.0 mA.
5. Record the actual value from the reference meter, and enter it at the **ENTER METER VALUE** prompt. The HART Communicator prompts you to verify whether or not the output value equals the value on the reference meter.
6. Select 1: Yes, if the reference meter value equals the transmitter output value, or 2: No if it does not.
   a. If 1 is selected: Yes, proceed to Step 7.
   b. If 2 is selected: No, repeat Step 5.
7. Select **OK** at the **SETTING FLD DEV OUTPUT TO 20 MA (5 Vdc)** prompt, and repeat Steps 5 and 6 until the reference meter value equals the transmitter output value.
8. Select **OK** after the control loop is returned to automatic control.

AMS

Right click on the device and select “Calibrate,” then “D/A Trim” from the menu.

1. Click **Next** after setting the control loop to manual.
2. Click **Next** after connecting the reference meter.
3. Click **Next** at the “Setting fld dev output to 4mA (1 Vdc)” screen.
4. Record the actual value from the reference meter, and enter it at the “Enter meter value” screen and click **Next**.
5. Select **Yes**, if the reference meter value equals the transmitter output value, or **No** if it does not. Click **Next**.
   a. If Yes is selected, proceed to Step 6.
   b. If No is selected, repeat Step 4.
6. Click **Next** at the “Setting fld dev output to 20mA (5 Vdc)” screen.
7. Repeat Step 4 - Step 5 until the reference meter equals the transmitter output value.
8. Select **Next** to acknowledge the loop can be returned to automatic control.
9. Select **Finish** to acknowledge the method is complete.

Digital-to-Analog Trim Using Other Scale

The Scaled D/A Trim command matches the 4 and 20 mA (1 and 5 Vdc) points to a user selectable reference scale other than 4 and 20 mA (for example, 2 to 10 volts if measuring across a 500 ohm load, or 0 to 100 percent if measuring from a Distributed Control System (DCS)). To perform a scaled D/A trim, connect an accurate reference meter to the transmitter and trim the output signal to scale, as outlined in the Output Trim procedure.

NOTE
Use a precision resistor for optimum accuracy. If you add a resistor to the loop, ensure that the power supply is sufficient to power the transmitter to a 20 mA output with additional loop resistance. Refer to “Power Supply for 4-20 mA HART” on page 2-27.

HART Communicator

4-20 mA Fast Keys	1, 2, 3, 2, 2
1-5 Vdc Fast Keys	1, 2, 3, 2, 2

AMS

Right click on the device and select “Calibrate,” then “Scaled D/A trim” from the menu.

1. Click **Next** after setting the control loop to manual.
2. Select **Change** to change scale, click **Next**.
3. Enter Set scale-Lo output value, click **Next**.
4. Enter Set scale-Hi output value, click **Next**.
5. Click **Next** to proceed with Trim.
6. Click **Next** after connecting the reference meter.
7. Click **Next** at the “Setting fld dev output to 4 mA” screen.
8. Record the actual value from the reference meter, and enter it at the “Enter meter value” screen and click **Next**.
9. Select **Yes**, if the reference meter value equals the transmitter output value, or **No** if it does not. Click **Next**.
   a. If Yes is selected, proceed to Step 10.
   b. If No is selected, repeat Step 8.
10. Click **Next** at the “Setting fld dev output to 20mA” screen.
11. Repeat Step 8 - Step 9 until the reference meter equals the transmitter output value.
12. Select **Next** to acknowledge the loop can be returned to automatic control.
13. Select **Finish** to acknowledge the method is complete.

Recall Factory Trim—Analog Output

The Recall Factory Trim—Analog Output command allows the restoration of the as-shipped factory settings of the analog output trim. This command can be useful for recovering from an inadvertent trim, incorrect Plant Standard or faulty meter. This command is only available with 4-20 mA output.

HART Communicator

4-20 mA Fast Keys	1, 2, 3, 4, 2

AMS

Right click on the device and select “Calibrate,” then “Recall Factory Trim” from the menu.

1. Click **Next** after setting the control loop to manual.
2. Select “Analog output trim” under “Trim to recall” and click **Next**.
3. Click **Next** to acknowledge restoration of trim values is complete.
4. Select **Next** to acknowledge the loop can be returned to automatic control.
5. Select **Finish** to acknowledge the method is complete.

SENSOR TRIM

Sensor Trim Overview

Trim the sensor using either sensor or zero trim functions. Trim functions vary in complexity and are application-dependent. Both trim functions alter the transmitter's interpretation of the input signal.

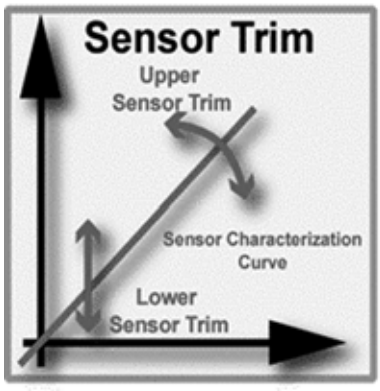
Zero trim is a single-point offset adjustment. It is useful for compensating for mounting position effects and is most effective when performed with the transmitter installed in its final mounting position. Since this correction maintains the slope of the characterization curve, it should not be used in place of a sensor trim over the full sensor range.

When performing a zero trim, ensure that the equalizing valve is open and all wet legs are filled to the correct levels.

NOTE
Do not perform a zero trim on Rosemount 2051T Absolute pressure transmitters. Zero trim is zero based, and absolute pressure transmitters reference absolute zero. To correct mounting position effects on a 2051T Absolute Pressure Transmitter, perform a low trim within the sensor trim function. The low trim function provides an offset correction similar to the zero trim function, but it does not require zero-based input.

Sensor trim is a two-point sensor calibration where two end-point pressures are applied, and all output is linearized between them. Always adjust the low trim value first to establish the correct offset. Adjustment of the high trim value provides a slope correction to the characterization curve based on the low trim value. The trim values allow you to optimize performance over your specified measuring range at the calibration temperature.

Figure 4-3. Sensor Trim



Zero Trim

NOTE
The transmitter must be within three percent of true zero (zero-based) in order to calibrate with zero trim function.

HART Communicator

4-20 mA Fast Keys	1, 2, 3, 3, 1
1-5 Vdc Fast Keys	1, 2, 3, 3, 1

Calibrate the sensor with a HART Communicator using the zero trim function as follows:

1. Vent the transmitter and attach a HART Communicator to the measurement loop.
2. From the **HOME** screen, follow the fast key sequence “Zero Trim.”
3. Follow the commands provided by the HART Communicator to complete the zero trim adjustment.

AMS

Right click on the device and select “Calibrate,” then “Zero trim” from the menu.

1. Click **Next** after setting the control loop to manual.
2. Click **Next** to acknowledge warning.
3. Click **Next** after applying appropriate pressure to sensor.
4. Select **Next** to acknowledge the loop can be returned to automatic control.
5. Select **Finish** to acknowledge the method is complete.

Sensor Trim

NOTE
Use a pressure input source that is at least three times more accurate than the transmitter, and allow the input pressure to stabilize for ten seconds before entering any values.

HART Communicator

4-20 mA Fast Keys	1, 2, 3, 3
1-5 Vdc Fast Keys	1, 2, 3, 3

To calibrate the sensor with a HART Communicator using the sensor trim function, perform the following procedure:

1. Assemble and power the entire calibration system including a transmitter, HART Communicator, power supply, pressure input source, and readout device.
2. From the **HOME** screen, enter the fast key sequence under “Sensor Trim.”
3. Select 2: Lower sensor trim. The lower sensor trim value should be the sensor trim point that is closest to zero.

Examples:

Calibration: 0 to 100 "H_2O - lower trim = 0, upper trim = 100

Calibration: -100 to 0 "H_2O - lower trim = 0, upper trim = -100

Calibration: -100 to 100 "H_2O - lower trim = -100 or 100,
upper trim = -100 or 100

NOTE
Select pressure input values so that lower and upper values are equal to or outside the 4 and 20 mA (1 and 5 Vdc) points. Do not attempt to obtain reverse output by reversing the high and low points. This can be done by going to “Rerange” on page 3-9 of Section 3: Configuration. The transmitter allows approximately five percent deviation.

4. Follow the commands provided by the HART Communicator to complete the adjustment of the lower value.
5. Repeat the procedure for the upper value, replacing 2: Lower sensor trim with 3: Upper sensor trim in Step 3.

AMS

Right click on the device and select “Calibrate,” then “Sensor trim” from the menu.

1. Select “Lower sensor trim.” The lower sensor trim value should be the sensor trim point that is closest to zero.
2. Click **Next** after setting the control loop to manual.
3. Click **Next** after applying appropriate pressure to sensor.
4. Select **Next** to acknowledge the loop can be returned to automatic control.
5. Select **Finish** to acknowledge the method is complete.
6. Right click on the device and select “Calibrate,” select “Sensor trim” from the menu.
7. Select “Upper sensor trim” and repeat steps 2-5.

Recall Factory Trim—Sensor Trim

The Recall Factory Trim—Sensor Trim command allows the restoration of the as-shipped factory settings of the sensor trim. This command can be useful for recovering from an inadvertent zero trim of an absolute pressure unit or inaccurate pressure source. This command is only available with 4-20 mA output.

HART Communicator

4-20 mA Fast Keys	1, 2, 3, 4, 1

AMS

Right click on the device and select “Calibrate,” then “Recall Factory Trim” from the menu.

1. Click **Next** after setting the control loop to manual.
2. Select “Sensor trim” under “Trim to recall” and click **Next**.
3. Click **Next** to acknowledge restoration of trim values is complete.
4. Select **Next** to acknowledge the loop can be returned to automatic control.
5. Select **Finish** to acknowledge the method is complete.

Compensating for Line Pressure

Rosemount 2051 Range 4 and 5 pressure transmitters require a special calibration procedure when used in differential pressure applications. The purpose of this procedure is to optimize transmitter performance by reducing the effect of static line pressure in these applications. The 2051 differential pressure transmitters (Ranges 1, 2, and 3) do not require this procedure because optimization occurs in the sensor.

Applying high static pressure to 2051 Range 4 and Range 5 pressure transmitters causes a systematic shift in the output. This shift is linear with static pressure; correct it by performing the Sensor Trim procedure on page 4-11.

The following specifications show the static pressure effect for 2051 Range 4 and Range 5 transmitters used in differential pressure applications:

Zero Effect:
± 0.1% of the upper range limit per 1000 psi (69 bar) for line pressures from 0 to 2000 psi (0 to 138 bar)

For line pressures above 2000 psi (138 bar), the zero effect error is ± 0.2% of the upper range limit plus an additional ± 0.2% of upper range limit error for each 1000 psi (69 bar) of line pressure above 2000 psi (138 bar).

Example: Line pressure is 3000 psi (3 kpsi). Zero effect error calculation:

± {0.2 + 0.2 x [3 kpsi - 2 kpsi]} = ± 0.4% of the upper range limit

Span Effect:
Correctable to ±0.2% of reading per 1000 psi (69 bar) for line pressures from 0 to 3626 psi (0 to 250 bar)

The systematic span shift caused by the application of static line pressure is -1.00% of reading per 1000 psi (69 bar) for Range 4 transmitters, and -1.25% of reading per 1000 psi (69 bar) for Range 5 transmitters.

Use the following example to compute corrected input values.

Example
A Range 4 transmitter with model number 2051_CD4 will be used in a differential pressure application where the static line pressure is 1200 psi (83 bar). The transmitter output is ranged with 4 mA at 500 inH_2O (1,2 bar) and 20 mA at 1500 inH_2O (3,7 bar).

To correct for systematic error caused by high static line pressure, first use the following formulas to determine corrected values for the low trim and high trim.

Low Trim Value

LT = LRV - (S/100 x P/1000 x LRV)

Where:	LT =	Corrected Low Trim Value
	LRV =	Lower Range Value
	S =	Span shift per specification (as a percent of reading)
	P =	Static Line Pressure in psi

In this example:

LRV =	500 inH_2O (1.24 bar)
S =	-1.00%
P =	1200 psi
LT =	500 inH_2O - (-1%/100 x 1200 psi/1000 x 500 inH_2O)
LT =	506 inH_2O

High Trim Value

HT = (URV - (S/100 x P/1000 x URV)

Where:	HT =	Corrected High Trim Value
	URV =	Upper Range Value
	S =	Span shift per specification (as a percent of reading)
	P =	Static Line Pressure in psi

In this example:

URV =	1500 inH_2O (3.74 bar)
S =	-1.00%
P =	1200 psi
HT =	1500 - (-1%/100 x 1200 psi/1000 x 1500 inH_2O)
HT =	1518 inH_2O

Complete the Sensor Trim procedure as described on page 4-11. In the example above, at step 4, apply the nominal pressure value of 500 inH_2O. However, enter the calculated correct lower trim (LT) value of 506 inH_2O with the HART Communicator. Repeat the procedure for the upper value.

NOTE
The range values for the 4 and 20 mA (1 and 5 Vdc) points should be at the nominal URV and LRV. In the example above, the values are 1500 inH_2O and 500 inH_2O respectively. Confirm the values on the HOME screen on the HART Communicator. Modify, if needed, by following the steps in the Rerange section on page 3-10.

Section 5 Troubleshooting

OVERVIEW

Table 5-1 provides summarized maintenance and troubleshooting suggestions for the most common operating problems.

If you suspect malfunction despite the absence of any diagnostic messages on the HART Communicator display, consider using Table 5-1 on page 5-2 to identify any potential problem.

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 could result in death or serious injury:
Installation of this transmitter in an explosive environment must be in accordance with the appropriate local, national, and international standards, codes, and practices. Please review the approvals section of the 2051 reference manual for any restrictions associated with a safe installation.
- Before connecting a HART communicator in an explosive atmosphere, ensure the instruments in the loop are installed in accordance with intrinsically safe or non-incendive field wiring practices.
- In an Explosion-Proof/Flameproof installation, do not remove the transmitter covers when power is applied to the unit.

Process leaks may cause harm or result in death.
- Install and tighten process connectors before applying pressure.

Electrical shock can result in death or serious injury.
- Avoid contact with the leads and terminals. High voltage that may be present on leads can cause electrical shock.

Table 5-1. Rosemount 2051 Troubleshooting Table for 4-20 mA output

Symptom	Corrective Actions
Transmitter milliamp reading is zero	Verify power is applied to signal terminals
	Check power wires for reversed polarity
	Verify terminal voltage is 10.5 to 42.4 Vdc
	Check for open diode across test terminal
Transmitter Not Communicating with HART Communicator	Verify the output is between 4 and 20 mA or saturation levels
	Verify terminal voltage is 10.5 to 42.4 Vdc
	Verify clean DC Power to transmitter (Max AC noise 0.2 volts peak to peak)
	Check loop resistance, 250 Ω minimum (PS voltage -transmitter voltage/loop current)
	Have HART Communicator poll for all addresses
Transmitter milliamp reading is low or high	Verify applied pressure
	Verify 4 and 20 mA range points
	Verify output is not in alarm condition
	Verify if 4 – 20 mA output trim is required
Transmitter will not respond to changes in applied pressure	Check test equipment
	Check impulse piping or manifold for blockage
	Verify the transmitter is not in multidrop mode
	Verify applied pressure is between the 4 and 20 mA set points
	Verify output is not in alarm condition
	Verify transmitter is not in Loop Test mode
Digital Pressure Variable reading is low or high	Check test equipment (verify accuracy)
	Check impulse piping for blockage or low fill in wet leg
	Verify transmitter is calibrated properly
	Verify pressure calculations for application
Digital Pressure Variable reading is erratic	Check application for faulty equipment in pressure line
	Verify transmitter is not reacting directly to equipment turning on/off
	Verify damping is set properly for application
Milliamp reading is erratic	Verify power source to transmitter has adequate voltage and current
	Check for external electrical interference
	Verify transmitter is properly grounded
	Verify shield for twisted pair is only grounded at one end

DIAGNOSTIC MESSAGES

In addition to the output, the LCD meter displays abbreviated operation, error, and warning messages for troubleshooting the transmitter. Messages appear according to their priority, with normal operating messages appearing last. To determine the cause of a message, use a HART Communicator or AMS to further interrogate the transmitter. A description of each LCD diagnostic message follows.

Error

Error messages appear on the LCD display to inform you of serious problems affecting the operation of the transmitter. The LCD displays an error message until the error condition is corrected, and the analog output is driven to the specified alarm level. No other transmitter information is displayed during an alarm condition.

FAIL
The transmitter CPU board and the sensor module are incompatible. See “Disassembly Procedures” on page 5-8.

Fail Module
The sensor module is disconnected or is malfunctioning. Verify that the sensor module ribbon cable is connected to the back of the electronics board. If the ribbon cable is properly connected, there is a problem within the sensor module. Possible sources of problems include:

- Pressure or temperature updates are not being received in the sensor module.
- A non-volatile memory fault that will effect transmitter operation has been detected in the module by the memory verification routine.

Some non-volatile memory faults are user-repairable. Use a HART Communicator to diagnose the error and determine if it is repairable. Any error message that ends in “FACTORY” is not repairable. In cases of non user-repairable errors, you must replace the transmitter.

Fail Elect
The transmitter electronics board is malfunctioning due to an internal fault. Some of the FAIL ELECT errors are user-repairable. Use a 275 HART Communicator to diagnose the error and determine if it is repairable. Any error message that ends in “FACTORY” is not repairable. In cases of non user-repairable errors, you must replace the electronics board. See “Disassembly Procedures” on page 5-3.

Fail Config
A memory fault has been detected in a location that could effect transmitter operation, and is user-accessible. To correct this problem, use a HART Communicator to interrogate and reconfigure the appropriate portion of the transmitter memory.

Warnings

Warnings appear on the LCD display to alert you of user-repairable problems with the transmitter, or current transmitter operations. Warnings appear alternately with other transmitter information until the warning condition is corrected or the transmitter completes the operation that warrants the warning message.

Press Limit
The process variable read by the transmitter is outside of the transmitter's range.

Temp Limit
The secondary temperature variable read by the transmitter is outside of the transmitter's range.

Curr Fixed
The transmitter is in multidrop mode. The analog output is not tracking pressure changes.

Curr Saturd
The pressure read by the module is outside of the specified range, and the analog output has been driven to saturation levels.

Loop Test
A loop test is in progress. During a loop test or 4–20 mA trim, the analog output is set to a fixed value. The meter display alternates between the current selected in milliamps and "LOOP TEST."

Xmtr Info
A non-volatile memory fault has been detected in the transmitter memory by the memory verification routine. The memory fault is in a location containing transmitter information. To correct this problem, use a HART Communicator to interrogate and reconfigure the appropriate portion of the transmitter memory. This warning does not effect the transmitter operation.

Operation

Normal operation messages appear on the LCD meter to confirm actions or inform you of transmitter status. Operation messages are displayed with other transmitter information, and warrant no action to correct or alter the transmitter settings.

Zero Pass
The zero value, set with the local zero adjustment button, has been accepted by the transmitter, and the output should change to 4 mA (1 Vdc).

Zero Fail
The zero value, set with the local zero adjustment button, exceeds the maximum rangedown allowed for a particular range, or the pressure sensed by the transmitter exceeds the sensor limits.

Span Pass
The span value, set with the local span adjustment button, has been accepted by the transmitter, and the output should change to 20 mA (5 Vdc).

Span Fail
The span value, set with the local span adjustment button, exceeds the maximum rangedown allowed for a particular range, or the pressure sensed by the transmitter exceeds the sensor limits.

LOCAL DSBLD
This message appears during reranging with the integral zero and span buttons and indicates that the transmitter local zero and span adjustments have been disabled. The adjustments may have been disabled by the transmitter security jumper on the transmitter circuit board or through software commands from the HART Communicator. See “Security (Write Protect)” on page 2-14 for information on the position of the security jumper and information on software lockout.

Write Protect
This message appears if you attempt to change the transmitter configuration data while the security jumper is in the **ON** position. See “Security (Write Protect)” on page 2-14 for more information about the security jumper.

HART Communicator Diagnostics

Table 5-2 is a list of messages used by the HART Communicator (HC) and their corresponding descriptions.

Variable parameters within the text of a message are indicated with <*variable parameter*>.

Reference to the name of another message is identified by *[another message]*.

Table 5-2. HART Communicator Messages

Message	Description
1k snsr EEPROM error-factory ON	Replace the transmitter
1k snsr EEPROM error-user-no out ON	Use the HART communicator to reset the following parameters: remote seal isolator, remote seal fill fluid, flange material, o-ring material, transmitter type, remote seal type, flange type, meter type, number of remote seals.
1k snsr EEPROM error-user ON	Perform a full trim to recalibrate the transmitter.
4k micro EEPROM error-factory ON	Replace the electronics board.
4k micro EEPROM error-user-no out ON	Use the HART communicator to reset the message field.
4k micro EEPROM error-user ON	Use the HART communicator to reset the following parameters: units, range values, damping, analog output, transfer function, tag, scaled meter values. Perform a D/A trim to ensure that the error is corrected.
4k snsr EEPROM error-factory ON	Replace the transmitter.
4k snsr EEPROM error-user ON	Use the HART communicator to reset the temperature units and the calibration type.
Add item for ALL device types or only for this ONE device type.	Asks the user whether the hot key item being added should be added for all device types or only for the type of device that is connected.
Command Not Implemented	The connected device does not support this function.
Communication Error	The communicator and the device are not communicating correctly. Check all connections between the HART Communicator and the device and resend the information.

Message	Description
Configuration memory not compatible with connected device	The configuration stored in memory is incompatible with the device to which a transfer has been requested.
CPU board not initialized ON	The electronics board is not initialized. Replace the electronics board.
CPU EEPROM write failure ON	Message sent to electronics board from HART signal failed. Replace the electronics board.
Device Busy	The connected device is busy performing another task.
Device Disconnected	The device failed to respond to a command. Check all connections between the HART Communicator and the device and resend the command.
Device write protected	Device is in write-protect mode. Data can not be written.
Device write protected. Do you still want to shut off?	Device is in write-protect mode. Press YES to turn the HART communicator off and lose the unsent data.
Display value of variable on hotkey menu?	Asks whether the value of the variable should be displayed adjacent to its label on the hotkey menu if the item being added to the hotkey menu is a variable.
Download data from configuration memory to device	Press the SEND softkey to transfer information from the communicator memory to the device.
Exceed field width	Indicates that the field width for the current arithmetic variable exceeds the device-specified description edit format.
Exceed precision	Indicates that the precision for the current arithmetic variable exceeds the device-specified description edit format.
Ignore next 50 occurrences of status?	Select YES to ignore the next 50 occurrences of device status, or select no to display every occurrence.
Illegal character	An invalid character for the variable type was entered.
Illegal date	The day portion of the date is invalid.
Illegal month	The month portion of the date is invalid.
Illegal year	The year portion of the date is invalid.
Incompatible CPU board and module ON	Upgrade the electronics board or the sensor module to the current revision.
Incomplete exponent	The exponent of a scientific notation floating point variable is incomplete.
Incomplete field	The value entered is not complete for the variable type.
Looking for a device	Polling for multidropped devices at addresses 1–15.
Local buttons operator error ON	Illegal pressure applied during zero or span operation. Repeat the process after verifying the correct pressures.
Mark as read only variable on hotkey menu?	Asks whether the user should be allowed to edit the variable from the hotkey menu if the item being added to the hotkey menu is a variable.
Module EEPROM write failure ON	Message sent to the module from the HART signal failed. Replace the transmitter.
No device configuration in configuration memory	There is no configuration saved in memory available to re-configure off-line or transfer to a device.
No Device Found	Poll of address zero fails to find a device, or poll of all addresses fails to find a device if auto-poll is enabled.
No hotkey menu available for this device.	There is no menu named “hotkey” defined in the device description for this device.
No pressure updates ON	No pressure updates being received from the sensor module. Verify that the sensor module ribbon cable is attached correctly. Or replace the transmitter.
No offline devices available.	There are no device descriptions available to be used to configure a device offline.
No simulation devices available.	There are no device descriptions available to simulate a device.

Message	Description
No temperature updates ON	No temperature updates being received from the sensor module. Verify that the sensor module ribbon cable is attached correctly. Or replace the transmitter.
No UPLOAD_VARIABLES in ddl for this device	There is no menu named “upload_variables” defined in the device description for this device. This menu is required for offline configuration.
No Valid Items	The selected menu or edit display contains no valid items.
OFF KEY DISABLED	Appears when the user attempts to turn the HC off before sending modified data or before completing a method.
Online device disconnected with unsent data. RETRY or OK to lose data.	There is unsent data for a previously connected device. Press RETRY to send data, or press OK to disconnect and lose unsent data.
Out of memory for hotkey configuration. Delete unnecessary items.	There is no more memory available to store additional hotkey items. Unnecessary items should be deleted to make space available.
Overwrite existing configuration memory	Requests permission to overwrite existing configuration either by a device-to-memory transfer or by an offline configuration. User answers using the softkeys.
Press OK...	Press the OK softkey. This message usually appears after an error message from the application or as a result of HART communications.
Restore device value?	The edited value that was sent to a device was not properly implemented. Restoring the device value returns the variable to its original value.
ROM checksum error ON	Checksum of transmitter software has detected a fault. Replace the electronics board.
Save data from device to configuration memory	Prompts user to press SAVE softkey to initiate a device-to-memory transfer.
Saving data to configuration memory.	Data is being transferred from a device to configuration memory.
Sending data to device.	Data is being transferred from configuration memory to a device.
Sensor board not initialized ON	The sensor module electronics board is not initialized. Replace the transmitter.
There are write only variables which have not been edited. Please edit them.	There are write-only variables which have not been set by the user. These variables should be set or invalid values may be sent to the device.
There is unsent data. Send it before shutting off?	Press YES to send unsent data and turn the HC off. Press NO to turn the HC off and lose the unsent data.
Too few data bytes received	Command returns fewer data bytes than expected as determined by the device description.
Transmitter Fault	Device returns a command response indicating a fault with the connected device.
Units for <variable label> has changed. Unit must be sent before editing, or invalid data will be sent.	The engineering units for this variable have been edited. Send engineering units to the device before editing this variable.
Unsent data to online device. SEND or LOSE data	There is unsent data for a previously connected device which must be sent or thrown away before connecting to another device.
Upgrade 275 software to access XMTR function. Continue with old description?	The communicator does not contain the most recent 2051 Device Descriptors (DDs). Select YES to communicate using the existing DDs. Select NO to abort communication.
Use up/down arrows to change contrast. Press DONE when done.	Gives direction to change the contrast of the HC display.

Message	Description
Value out of range	The user-entered value is either not within the range for the given type and size of variable or not within the min/max specified by the device.
<message> occurred reading/writing <variable label>	Either a read/write command indicates too few data bytes received, transmitter fault, invalid response code, invalid response command, invalid reply data field, or failed pre- or post-read method; or a response code of any class other than SUCCESS is returned reading a particular variable.
<variable label> has an unknown value. Unit must be sent before editing, or invalid data will be sent.	A variable related to this variable has been edited. Send related variable to the device before editing this variable.

DISASSEMBLY PROCEDURES

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

Remove from Service

Follow these steps:

- Follow all plant safety rules and procedures.
- Isolate and vent the process from the transmitter before removing the transmitter from service.
- Remove all electrical leads and disconnect conduit.
- Remove the transmitter from the process connection.
    - The Rosemount 2051C transmitter is attached to the process connection by four bolts and two cap screws. Remove the bolts and separate the transmitter from the process connection. Leave the process connection in place and ready for re-installation.
    - The Rosemount 2051T transmitter is attached to the process by a single hex nut process connection. Loosen the hex nut to separate the transmitter from the process. Do not wrench on neck of transmitter.
- 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.
- For the 2051C, whenever you remove the process flange or flange adapters, visually inspect the PTFE o-rings. Replace the o-rings if they show any signs of damage, such as nicks or cuts. Undamaged o-rings may be reused.

Remove Terminal Block

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

1. Remove the housing cover from the field terminal side.
2. Loosen the two small screws located on the assembly in the 9 o’clock and 3 o’clock positions.
3. Pull the entire terminal block out to remove it.

⚠ See “Safety Messages” on page 5-1 for complete warning information.

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.
2. If you are disassembling a transmitter with a LCD display, loosen the two captive screws that are visible on the right and left side of the meter display.
3. ⚠ 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. Use caution when removing the LCD as there is an electronic pin connector that interfaces between the LCD and electronics board. The two screws anchor the LCD display to the electronics board and the electronics board to the housing.
4. Using the two captive screws, slowly pull the electronics board out of the housing. The sensor module ribbon cable holds the electronics board to the housing. Disengage the ribbon cable by pushing the connector release.

Remove the Sensor Module from the Electronics Housing

1. Remove the electronics board. Refer to “Remove the Electronics Board” on page 5-9.

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.

2. Carefully tuck the cable connector completely inside of the internal black cap.

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

3. Loosen the housing rotation set screw with a $^{5}/_{64}$-inch hex wrench, and loosen one full turn.
4. Unscrew the module from the housing, making sure the black cap and sensor cable do not catch on the housing.

REASSEMBLY PROCEDURES

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 black cap. To do so, turn the black cap and cable counterclockwise one rotation to tighten the cable.
3. Lower the electronics housing onto the module. Guide the internal black cap and cable through the housing and into the external black cap.
4. Turn the module clockwise into the housing.

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

⚠ 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 explosion proof requirements.
6. Tighten the housing rotation set screw using a $^{5}/_{64}$-inch hex wrench.

Attach the Electronics Board

1. Remove the cable connector from its position inside of the internal black cap and attach it to the electronics board.
2. Using the two captive screws as handles, insert the electronics board into the housing. Make sure the posts from the electronics housing properly engage the receptacles on the electronics board. Do not force. The electronics board should slide gently on the connections.
3. Tighten the captive mounting screws.

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

Install the Terminal Block

1. Gently slide the terminal block into place, making sure the two posts from the electronics housing properly engage the receptacles on the terminal block.
2. Tighten the captive screws.
3. Replace the electronics housing cover. The transmitter covers must be fully engaged to meet Explosion-Proof requirements.

Reassemble the 2051C Process Flange

1. Inspect the sensor module PTFE o-rings. Undamaged o-rings may be reused. Replace o-rings that show any signs of damage, such as nicks, cuts, or general wear.

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 connection. Possible options include:

⚠ See “Safety Messages” on page 5-1 for complete warning information.

a. Coplanar Process Flange:

- Hold the process flange in place by installing the two alignment screws to finger tightness (screws are not pressure retaining). Do not overtighten as this will affect module-to-flange alignment.
- Install the four 1.75-in. flange bolts by finger tightening them to the flange.

b. Coplanar Process Flange with Flange Adapters:

- Hold the process flange in place by installing the two alignment screws to finger tightness (screws are not pressure retaining). Do not overtighten as this will affect module-to-flange alignment.
- Hold the flange adapters and adapter o-rings in place while installing the four configurations, use four 2.88-in. bolts. For gage pressure configurations, use two 2.88-in. bolts and two 1.75-in. bolts.

c. Manifold:

- Contact the manifold manufacturer for the appropriate bolts and procedures.

3. Tighten the bolts to the initial torque value using a crossed pattern. See Table 5-3 for appropriate torque values.

Table 5-3. Bolt Installation Torque Values

Bolt Material	Initial Torque Value	Final Torque Value
CS-ASTM-A445 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)
ASTM-A-193 Class 2, Grade B8M—Option L8	150 in.-lb (17 N-m)	300 in.-lb (34 N-m)

NOTE
If you replaced the PTFE sensor module o-rings, re-torque the flange bolts after installation to compensate for cold flow.

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.

Install the Drain/Vent Valve

1. 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 sealing tape.
2. Tighten the drain/vent valve to 250 in-lb. (28.25 N-m).
3. Take care to place the opening on the valve so that process fluid will drain toward the ground and away from human contact when the valve is opened.

Appendix A Reference Data

PERFORMANCE SPECIFICATIONS

For zero based spans, reference conditions, silicone oil fill, SST materials, Coplanar flange (2051C) or 1/2 in. - 14 NPT (2051T) process connections, digital trim values range points. Applies to 4-20 mA HART output only unless otherwise noted.

Conformance To Specification (±3σ (Sigma))

Technology leadership, advanced manufacturing techniques and statistical process control ensure specification conformance to at least ±3σ.

Reference Accuracy[1]

Models	Standard	Performance Option, P8
2051C		
Ranges 2-5	±0.075% of span For spans less than 10:1, accuracy = $\pm\left[0.025 + 0.005\left(\frac{URL}{Span}\right)\right]$% of Span	Ranges 2-5 High Accuracy Option, P8 ±0.065% of span For spans less than 10:1, accuracy = $\pm\left[0.015 + 0.005\left(\frac{URL}{Span}\right)\right]$% of Span
Range 1	±0.10% of span For spans less than 15:1, accuracy = $\pm\left[0.025 + 0.005\left(\frac{URL}{Span}\right)\right]$% of Span	
2051T		
Ranges 1-4	±0.075% of span For spans less than 10:1, accuracy = $\pm\left[0.0075\left(\frac{URL}{Span}\right)\right]$% of Span	Ranges 1-4 High Accuracy Option, P8 ±0.065% of span For spans less than 10:1, accuracy = $\pm\left[0.0075\left(\frac{URL}{Span}\right)\right]$% of Span
Range 5	±0.075% of span for spans greater than 5:1	
2051L		
Ranges 2-4	±0.075% of span For spans less than 10:1, accuracy = $\pm\left[0.025 + 0.005\left(\frac{URL}{Span}\right)\right]$% of Span	

(1) For FOUNDATION fieldbus transmitters, use calibrated range in place of span.

Long Term Stability

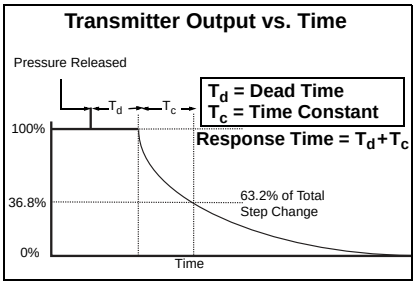
Models	Standard	Performance Option, P8
2051C[1]		
Ranges 2-5	±0.1% of URL for 2 years	±0.125% of URL for 5 years
2051CD		
Range 1	±0.2% of URL for 1 year	
2051T[1]		
Ranges 1-5	±0.1% of URL for 2 years	±0.125% of URL for 5 years

(1) Measured at reference conditions after exposure to temperature changes of up to ±50 °F (28 °C), and line pressure changes up to 1000 psi (6,9 mPa).

Dynamic Performance

	4 - 20 mA HART[1] 1-5 Vdc HART Lower Power[1]	Fieldbus[3]	Typical HART Transmitter Response Time
Total Response Time (T_d + T_c)[2]:			
2051C, Range 3-5:	115 milliseconds	152 milliseconds	
Range 1:	270 milliseconds	307 milliseconds	
Range 2:	130 milliseconds	152 milliseconds	
2051T:	100 milliseconds	152 milliseconds	
2051L:	See *Instrument Toolkit*®	See *Instrument Toolkit*	
Dead Time (Td)	60 milliseconds (nominal)	97 milliseconds	
Update Rate	22 times per second	22 times per second	

(1) Dead time and update rate apply to all models and ranges; analog output only
(2) Nominal total response time at 75 °F (24 °C) reference conditions.
(3) Transmitter fieldbus output only, segment macro-cycle not included.



Line Pressure Effect per 1000 psi (6,9 MPa)

For line pressures above 2000 psi (13,7 MPa) and Ranges 4-5, see user manual (Rosemount publication number 00809-0100-4101).

Models	Line Pressure Effect
2051CD	Zero Error[1]
Ranges 2-3	±0.1% of URL/1000 psi (68,9 bar) for line pressures from 0 to 2000 psi (0 to 13,7 MPa)
Range 1	±0.5% of URL/1000 psi (68,9 bar)
	Span Error
Ranges 2-3	±0.1% of reading/1000 psi (68,9 bar)
Range 1	±0.4% of reading/1000 psi (68,9 bar)

(1) Can be calibrated out at line pressure.

Ambient Temperature Effect per 50°F (28°C)

Models	Ambient Temperature Effect
2051C	
Ranges 2-5	±(0.025% URL + 0.125% span) from 1:1 to 5:1 ±(0.05% URL + 0.25% span) from 5:1 to 100:1
Range 1	±(0.2% URL + 0.5% span) from 1:1 to 50:1
2051T	
Range 2-4	±(0.05% URL + 0.25% span) from 1:1 to 30:1 ±(0.07% URL + 0.25% span) from 30:1 to 100:1
Range 1	±(0.05% URL + 0.25% span) from 1:1 to 10:1 ±(0.10% URL + 0.25% span) from 10:1 to 100:1
Range 5	±(0.2% URL + 0.3% span)
2051L	See *Instrument Toolkit*

Mounting Position Effects

Models	Mounting Position Effects
2051C	Zero shifts up to ±1.25 inH_2O (3,1 mbar), which can be calibrated out. No span effect.
2051T	Zero shifts up to ±2.5 inH_2O (6,2 mbar), which can be calibrated out. No span effect.
2051L	With liquid level diaphragm in vertical plane, zero shift of up to 1 inH_2O (2,49 mbar). With diaphragm in horizontal plane, zero shift of up to 5 inH_2O (12,43 mbar) plus extension length on extended units. Zero shifts can be calibrated out. No span effect.

Vibration Effect

Less than ±0.1% of URL when tested per the requirements of IEC60770-1 field or pipeline with high vibration level (10-60 Hz 0.21mm displacement peak amplitude / 60-2000 Hz 3g).

Power Supply Effect

Less than ±0.005% of calibrated span per volt.

Electromagnetic Compatibility (EMC)

Meets all relevant requirements of EN 61326 and NAMUR NE-21.

Transient Protection (Option Code T1)

Meets IEEE C62.41, Category Location B
6 kV crest (0.5 μs - 100 kHz)
3 kV crest (8 × 20 microseconds)
6 kV crest (1.2 × 50 microseconds)

FUNCTIONAL SPECIFICATIONS

Range and Sensor Limits

Range	2051CD, 2051CG, 2051L					
		Range and Sensor Limits				
			Lower (LRL)			
	Minimum Span	Upper (URL)	2051C Differential	2051C Gage(1)	2051L Differential	2051L Gage(1)
1	0.5 inH_2O (1,2 mbar)	25 inH_2O (62,3 mbar)	–25 inH_2O (–62,1 mbar)	–25 inH_2O (–62,1 mbar)	N/A	N/A
2	2.5 inH_2O (6,2 mbar)	250 inH_2O (0,62 bar)	–250 inH_2O (–0,62 bar)	–250 inH_2O (–0,62 bar)	–250 inH_2O (–0,62 bar)	–250 inH_2O (–0,62 bar)
3	10 inH_2O (24,9 mbar)	1000 inH_2O (2,49 bar)	-1000 inH_2O (-2,49 bar)	–393 inH_2O (–979 mbar)	–1000 inH_2O (–2,49 bar)	–393 inH_2O (–979 mbar)
4	3 psi (0,207 bar)	300 psi (20,6 bar)	-300 psi (-20,6 bar)	–14.2 psig (–979 mbar)	–300 psi (–20,7 bar)	–14.2 psig (–979 mbar)
5	20 psi (1,38 bar)	2000 psi (137,9 bar)	-2000 psi (-137,9 bar)	–14.2 psig (–979 mbar)	N/A	N/A

(1) Assumes atmospheric pressure of 14.7 psig.

Range	2051T			
		Range and Sensor Limits		
	Minimum Span	Upper (URL)	Lower (LRL) (Abs)	Lower(1) (LRL) (Gage)
1	0.3 psi (20,6 mbar)	30 psi (2,06 bar)	0 psia (0 bar)	–14.7 psig (–1,01 bar)
2	1.5 psi (0,103 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 (275,8 bar)	0 psia (0 bar)	–14.7 psig (–1,01 bar)
5	2000 psi (137,9 bar)	10000 psi (689,4 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

Protocols

4–20 mA HART (Output Code A)

Output
Two-wire 4–20 mA, user-selectable for linear or square root output. Digital process variable superimposed on 4–20 mA signal, available to any host that conforms to the *HART* protocol.

Power Supply
External power supply required. Standard transmitter operates on 10.5 to 42.4 V dc with no load.

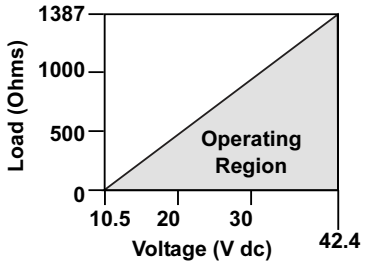
Turn-On Time
Performance within specifications less than 2.0 sections after power is applied to the transmitter.

Load Limitations

Maximum loop resistance is determined by the voltage level of the external power supply, as described by:

Table A-1.

Maximum Loop Resistance = 43.5 * (Power Supply Voltage – 10.5)



The HART communicator requires a minimum loop resistance of 250Ω for communication.

FOUNDATION™ fieldbus (Output Code F)

Power Supply

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

Current Draw

17.5 mA for all configurations (including LCD display option)

Turn-On Time

Performance within specifications less than 20.0 sections after power is applied to the transmitter.

***FOUNDATION* fieldbus Function Block Execution Times**

Block	Execution Time
Resource	-
Transducer	-
LCD Block	-
Analog Input 1, 2	30 milliseconds
PID	45 milliseconds

***FOUNDATION* fieldbus Parameters**

Schedule Entries	7 (max.)
Links	20 (max.)
Virtual Communications Relationships (VCR)	12 (max.)

Standard Function Blocks

Resource Block

- Contains hardware, electronics, and diagnostic information.

Transducer Block

- Contains actual sensor measurement data including the sensor diagnostics and the ability to trim the pressure sensor or recall factory defaults.

LCD Block

- Configures the local display.

2 Analog Input Blocks

- Processes the measurements for input into other function blocks. The output value is in engineering units or custom and contains a status indicating measurement quality.

PID Block

- Contains all logic to perform PID control in the field including cascade and feedforward.

Backup Link Active Scheduler (LAS)

The transmitter can function as a Link Active Scheduler if the current link master device fails or is removed from the segment.

1-5 Vdc HART Low Power (Output Code M)

Output

Three wire 1–5 Vdc output, user-selectable for linear or square root output. Digital process variable superimposed on voltage signal, available to any host conforming to the *HART* protocol.

Power Supply

External power supply required. Standard transmitter operates on 9 to 28 Vdc with no load.

Power Consumption

3.0 mA, 27–84 mW

Output Load

100 kΩ or greater

Turn-On Time

Performance within specifications less than 2.0 sections after power is applied to the transmitter.

Overpressure Limits

Transmitters withstand the following limits without damage:

2051C

- Ranges 2–5: 3626 psig (250 bar)
  4500 psig (310,3 bar) for option code P9
- Range 1: 2000 psig (137,9 bar)

2051T

- Range 1: 750 psi (51,7 bar)
- Range 2: 1500 psi (103,4 bar)
- Range 3: 1600 psi (110,3 bar)
- Range 4: 6000 psi (413,7 bar)
- Range 5: 15000 psi (1034,2 bar)

2051L

Limit is flange rating or sensor rating, whichever is lower (see Table A-2).

Table A-2. 2051L Flange Rating

Standard	Type	CS Rating	SST Rating
ANSI/ASME	Class 150	285 psig	275 psig
ANSI/ASME	Class 300	740 psig	720 psig
At 100 °F (38 °C), the rating decreases with increasing temperature.			
DIN	PN 10–40	40 bar	40 bar
DIN	PN 10/16	16 bar	16 bar
At 248 °F (120 °C), the rating decreases with increasing temperature.			

Static Pressure Limit

2051CD

- Operates within specifications between static line pressures of -14.2 psig (0.034 bar) and 3626 psig (250 bar)
  - For Option Code P9, 4500 psig (310,3 bar)
- Range 1: 0.5 psia to 2000 psig (34 mbar and 137,9 bar)

Burst Pressure Limits

2051C Coplanar or traditional process flange

- 10000 psig (689,5 bar)

2051T

- Ranges 1–4: 11000 psi (758,4 bar)
- Range 5: 26000 psi (1792,64 bar)

Temperature Limits

Ambient

–40 to 185 °F (–40 to 85 °C)

With LCD display[1]: –40 to 175 °F (–40 to 80 °C)

Storage

–50 to 230 °F (–46 to 110 °C)

With LCD display: –40 to 185 °F (–40 to 85 °C)

(1) LCD display may not be readable and LCD updates will be slower at temperatures below -4 °F (-20 °C).

Process Temperature Limits

At atmospheric pressures and above.

Table A-3. 2051 Process Temperature Limits

2051C	
Silicone Fill Sensor[1]	
with Coplanar Flange	–40 to 250 °F (–40 to 121 °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 305 Integral Manifold	–40 to 300 °F (–40 to 149 °C)[2]
Inert Fill Sensor[1]	0 to 185 °F (–18 to 85 °C)[3]
2051T (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]
2051L Low-Side Temperature Limits	
Silicone Fill Sensor[1]	–40 to 250 °F (–40 to 121 °C)[2]

Table A-3. 2051 Process Temperature Limits

Inert Fill Sensor(1)	0 to 185 °F (–18 to 85 °C)(2)
2051L High-Side Temperature Limits (Process Fill Fluid)	
Syltherm® XLT	–100 to 300 °F (–73 to 149 °C)
D.C. Silicone 704®	32 to 400 °F (0 to 205 °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)

(1) Process temperatures above 185 °F (85 °C) require derating the ambient limits by a 1.5:1 ratio.
(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.

Humidity Limits

0–100% relative humidity

Volumetric Displacement

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

Damping

Analog output response to a step input change is user-selectable from 0 to 25.6 seconds for one time constant. This software damping is in addition to sensor module response time.

Failure Mode Alarm

If self-diagnostics detect a sensor or microprocessor failure, the analog signal is driven either high or low to alert the user. High or low failure mode is user-selectable with a jumper on the transmitter. The values to which the transmitter drives its output in failure mode depend on whether it is factory-configured to *standard* or *NAMUR-compliant* operation. The values for each are as follows:

Standard Operation			
Output Code	**Linear Output**	**Fail High**	**Fail Low**
A	$3.9 \leq I \leq 20.8$	$I \geq 21.75$ mA	$I \leq 3.75$ mA
M	$0.97 \leq V \leq 5.2$	$V \geq 5.4$ V	$V \leq 0.95$V

NAMUR-Compliant Operation			
Output Code	**Linear Output**	**Fail High**	**Fail Low**
A	$3.8 \leq I \leq 20.5$	$I \geq 22.5$ mA	$I \leq 3.6$ mA

Output Code F

If self-diagnostics detect a gross transmitter failure, that information gets passed as a status along with the process variable.

PHYSICAL SPECIFICATIONS

Electrical Connections

1/2–14 NPT, G1/2, and M20 × 1.5 (CM20) conduit.

Process Connections

2051C

- 1/4–18 NPT on 2 1/8-in. centers
- 1/2–14 NPT and RC 1/2 on 2-in.(50.8mm), 2 1/8-in. (54.0 mm), or 2 1/4-in. (57.2mm) centers (process adapters)

2051T

- 1/2–14 NPT female
- G1/2 A DIN 16288 Male (available in SST for Range 1–4 transmitters only)
- 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)

2051L

- High pressure side: 2-in.(50.8mm), 3-in. (72 mm), or 4-in. (102mm), ASME B 16.5 (ANSI) Class 150 or 300 flange;
  50, 80 or 100 mm, DIN 2501 PN 40 or 10/16 flange
- Low pressure side: 1/4–18 NPT on flange, 1/2–14 NPT on process adapter

2051C Process Wetted Parts

Drain/Vent Valves
316 SST or Alloy C-276

Process Flanges and Adapters
Plated carbon steel, SST CF-8M (cast version of 316 SST, material per ASTM-A743), or CW12MW (cast version of Alloy C-276)

Wetted O-rings
Glass-filled PTFE or Graphite-filled PTFE

Process Isolating Diaphragms
316L SST or Alloy C-276

2051T Process Wetted Parts

Process Connections

- 316L SST or Alloy C-276

Process Isolating Diaphragms

- 316L SST or Alloy C-276

2051L Process Wetted Parts

Flanged Process Connection (Transmitter High Side)

Process Diaphragms, Including Process Gasket Surface

- 316L SST or Alloy C-276

Extension

- CF-3M (Cast version of 316L SST, material per ASTM-A743), or Cast C-276. Fits schedule 40 and 80 pipe.

Mounting Flange

- Zinc-cobalt plated CS or SST

Reference Process Connection (Transmitter Low Side)

Isolating Diaphragms

- 316L SST or Alloy C-276

Reference Flange and Adapter

- CF-8M (Cast version of 316 SST, material per ASTM-A743)

Non-Wetted Parts for 2051C/T/L

Electronics Housing
Low-copper aluminum or CF-8M (Cast version of 316 SST). Enclosure Type 4X, IP 65, IP 66, IP68

Coplanar Sensor Module Housing
CF-3M (Cast version of 316L SST)

Bolts
ASTM A449, Type 1 (zinc-cobalt plated carbon steel)
ASTM F593G, Condition CW1 (Austenitic 316 SST)
ASTM A193, Grade B7M (zinc plated alloy steel)

Sensor Module Fill Fluid
Silicone oil (D.C. 200) or Fluorocarbon oil (Halocarbon or Fluorinert® FC-43 for 2051T)

Process Fill Fluid (2051L only)
Syltherm XLT, D.C. Silicone 704,
D.C. Silicone 200, inert, glycerin and water, Neobee M-20 or propylene glycol and water

Paint
Polyurethane

Cover O-rings
Buna-N

Shipping Weights

Table A-4. Transmitter Weights without Options

Transmitter	lb. (kg)
2051C	4.9 (2,2)
2051L	Table A-5 below
2051T	3.1 (1,4)

Table A-5. 2051L Weights without Options

Flange	Flush lb. (kg)	2-in. Ext. lb (kg)	4-in. Ext. lb (kg)	6-in. Ext. lb (kg)
2-in., 150	12.5 (5,7)	—	—	—
3-in., 150	17.5 (7,9)	19.5 (8,8)	20.5 (9,3)	21.5 (9,7)
4-in., 150	23.5 (10,7)	26.5 (12,0)	28.5 (12,9)	30.5 (13,8)
2-in., 300	17.5 (7,9)	—	—	—
3-in., 300	22.5 (10,2)	24.5 (11,1)	25.5 (11,6)	26.5 (12,0)
4-in., 300	32.5 (14,7)	35.5 (16,1)	37.5 (17,0)	39.5 (17,9)
DN 50/PN 40	13.8 (6,2)	—	—	—
DN 80/PN 40	19.5 (8,8)	21.5 (9,7)	22.5 (10,2)	23.5 (10,6)
DN 100/ PN 10/16	17.8 (8,1)	19.8 (9,0)	20.8 (9,5)	21.8 (9,9)
DN 100/ PN 40	23.2 (10,5)	25.2 (11,5)	26.2 (11,9)	27.2 (12,3)

Table A-6. Transmitter Options Weights

Code	Option	Add lb (kg)
J, K, L, M	Stainless Steel Housing	3.9 (1,8)
M5	LCD display for Aluminum Housing	0.5 (0,2)
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)
H2	Traditional Flange	2.6 (1,2)
H3	Traditional Flange	3.0 (1,4)
H4	Traditional Flange	3.0 (1,4)
H7	Traditional Flange	2.7 (1,2)
FC	Level Flange—3 in., 150	12.7 (5,8)
FD	Level Flange—3 in., 300	15.9 (7,2)
FA	Level Flange—2 in., 150	8.0 (3,6)
FB	Level Flange—2 in., 300	8.4 (3,8)
FP	DIN Level Flange, SST, DN 50, PN 40	7.8 (3,5)
FQ	DIN Level Flange, SST, DN 80, PN 40	12.7 (5,8)

ORDERING INFORMATION

Model	Transmitter Type (Select One)			CD	CG
2051C	Pressure Transmitter			•	•
Model	**Measurement Type**			**CD**	**CG**
D	Differential			•	—
G	Gage			—	•
Code	**Pressure Ranges (Range/Min. Span)**			**CD**	**CG**
	2051CD	**2051CG**			
1	–25 to 25 inH_2O/0.5 inH_2O (–62,2 to 62,2 mbar/1,2 mbar)	–25 to 25 inH_2O/0.5 inH_2O (–62,1 to 62,2 mbar/1,2 mbar)		•	•
2	–250 to 250 inH_2O/2.5 inH_2O (–623 to 623 mbar/6,2 mbar)	–250 to 250 inH_2O/2.5 inH_2O (–623 to 623 mbar/6,2 mbar)		•	•
3	–1000 to 1000 inH_2O/10 inH_2O (–2,5 to 2,5 bar/25 mbar)	–393 to 1000 inH_2O/10 inH_2O (–0,98 to 2,5 bar/25 mbar)		•	•
4	–300 to 300 psi/3 psi (–20,7 to 20,7 bar/0,2 bar)	–14.2 to 300 psi/3 psi (–0,98 to 20,7 bar/0,2 bar)		•	•
5	–2000 to 2000 psi/20 psi (–137,9 to 137,9 bar/1,4 bar)	–14.2 to 2000 psig/20 psi (–0,98 to 137,9 bar/1,4 bar)		•	•
Code	**Output**			**CD**	**CG**
A	4–20 mA with Digital Signal Based on *HART* Protocol			•	•
M	Low-Power, 1–5 V dc with Digital Signal Based on HART Protocol			•	•
F	FOUNDATION fieldbus Protocol			•	•
Code	**Materials of Construction**			**CD**	**CG**
	Process Flange Type	**Flange Material**	**Drain/Vent**		
2	Coplanar	SST	SST	•	•
3(1)	Coplanar	Cast C-276	Alloy C-276	•	•
5	Coplanar	Plated CS	SST	•	•
7(1)	Coplanar	SST	Alloy C-276	•	•
8(1)	Coplanar	Plated CS	Alloy C-276	•	•
0	Alternate Process Connection (Requires selecting Flange, Manifold, or Primary Element option code, see page A-13)			•	•
Code	**Isolating Diaphragm**			**CD**	**CG**
2(1)	316L SST			•	•
3(1)	Alloy C-276			•	•
Code	**O-ring**				
A	Glass-filled PTFE			•	•
B	Graphite-filled PTFE			•	•
Code	**Fill Fluid**			**CD**	**CG**
1	Silicone			•	•
2	Inert fill (Halocarbon)			•	•
Code	**Housing Material**		**Conduit Entry Size**	**CD**	**CG**
A	Polyurethane-covered Aluminum		½–14 NPT	•	•
B	Polyurethane-covered Aluminum		M20 × 1.5 (CM20)	•	•
D	Polyurethane-covered Aluminum		G½	•	•
J	SST (consult factory for availability)		½–14 NPT	•	•
K	SST (consult factory for availability)		M20 × 1.5 (CM20)	•	•
M	SST (consult factory for availability)		G½	•	•

Code	Options	CD	CG
Alternate Process Connection: Flange[2]			
H2	Traditional Flange, 316 SST, SST Drain/Vent	•	•
H3[1]	Traditional Flange, Cast C-276, Alloy C-276 Drain/Vent	•	•
H7[1]	Traditional Flange, 316 SST, Alloy C-276 Drain/Vent	•	•
HJ	DIN Compliant Traditional Flange, SST, 7/16 in. Adapter/Manifold Bolting	•	•
HK[3]	DIN Compliant Traditional Flange, SST, 10 mm Adapter/Manifold Bolting	•	•
HL	DIN Compliant Traditional Flange, SST, 12mm Adapter/Manifold Bolting	•	•
FA	Level Flange, SST, 2 in., ANSI Class 150, Vertical Mount	•	•
FB	Level Flange, SST, 2 in., ANSI Class 300, Vertical Mount	•	•
FC	Level Flange, SST, 3 in., ANSI Class 150, Vertical Mount	•	•
FD	Level Flange, SST, 3 in., ANSI Class 300, Vertical Mount	•	•
FP	DIN Level Flange, SST, DN 50, PN 40, Vertical Mount	•	•
FQ	DIN Level Flange, SST, DN 80, PN 40, Vertical Mount	•	•
Alternate Process Connection: Manifold[2][4]			
S5	Assemble to Rosemount 305 Integral Manifold	•	•
S6	Assemble to Rosemount 304 Manifold or Connection System	•	•
Alternate Process Connection: Primary Element[2][4]			
S4[5]	Assemble to Rosemount Primary Element	•	—
S3	Assemble to Rosemount 405 Primary Element	•	—
Diaphragm Seal Assemblies[4]			
S1[6]	Assemble to one Rosemount 1199 diaphragm seal	•	•
S2[7]	Assemble to two Rosemount 1199 diaphragm seals	•	—
Mounting Brackets			
B1[8]	Traditional Flange Bracket for 2-in. Pipe Mounting, CS Bolts	•	•
B2[8]	Traditional Flange Bracket for Panel Mounting, CS Bolts	•	•
B3[8]	Traditional Flange Flat Bracket for 2-in. Pipe Mounting, CS Bolts	•	•
B4[9]	Coplanar Flange Bracket for 2-in. Pipe or Panel Mounting, all SST	•	•
B7[8]	B1 Bracket with Series 300 SST Bolts	•	•
B8[8]	B2 Bracket with Series 300 SST Bolts	•	•
B9[8]	B3 Bracket with Series 300 SST Bolts	•	•
BA[8]	SST B1 Bracket with Series 300 SST Bolts	•	•
BC[8]	SST B3 Bracket with Series 300 SST Bolts	•	•
Product Certifications			
E1[10]	ATEX Flameproof	•	•
E2[10]	INMETRO Flameproof (consult factory for availability)	•	•
E3[10]	China Flameproof (consult factory for availability)	•	•
E4[10]	TIIS Flameproof (consult factory for availability)	•	•
E5	FM Explosion-proof, Dust Ignition-proof	•	•
E6	CSA Explosion-proof, Dust Ignition-proof, Division 2	•	•
E7	IECEx Flameproof	•	•
EP[10]	Korea (KOSHA) Flameproof Approval (consult factory for availability)	•	•
EW[10]	India (CCOE) Flameproof Approval (consult factory for availability)	•	•
EM[10]	GOST Explosion-proof (consult factory for availability)	•	•
I1	ATEX Intrinsic Safety	•	•
I2[10]	INMETRO Intrinsic Safety (consult factory for availability)	•	•
I3[10]	China Intrinsic Safety (consult factory for availability)	•	•
I4[10]	TIIS Intrinsic Safety (consult factory for availability)	•	•
I5	FM Intrinsically Safe, Division 2	•	•
I6	CSA Intrinsically Safe	•	•
I7[10]	IECEx Intrinsic Safety	•	•
IA[11]	ATEX FISCO Intrinsic Safety	•	•
IB[11]	INMETRO FISCO Intrinsic Safety (consult factory for availability)	•	•
ID[11]	TIIS FISCO Intrinsic Safety (consult factory for availability)	•	•
IE[11]	FM FISCO Intrinsically Safe	•	•

IF[11]	CSA FISCO Intrinsically Safe	•	•
IG[11]	IECEx FISCO Intrinsically Safe	•	•
IP[10]	Korea (KOSHA) Instrinsic Safety (consult factory for availability)	•	•
IM[10]	GOST Intrinsically Safe (consult factory for availability)	•	•
IW[10]	India (CCOE) Intrinsic Safety Approval (consult factory for availability)	•	•
K1[10]	ATEX Flameproof, Intrinsic Safety, Type n, Dust	•	•
K2[10]	INMETRO Flameproof, Intrinsic Safety, Type n (consult factory for availability)	•	•
K4[10]	TIIS Flameproof, Intrinsic Safety (consult factory for availability)	•	•
K5	FM Explosion-proof, Dust Ignition-proof, Intrinsically Safe, Division 2	•	•
K6	CSA Explosion-proof, Dust Ignition-proof, Intrinsically Safe, Division 2	•	•
K7[10]	IECEx Flameproof, Intrinsic Safety, Type n	•	•
KA	ATEX and CSA Flameproof, Intrinsically Safe, Division 2	•	•
KB	FM and CSA Explosion-proof, Dust Ignition-proof, Intrinsically Safe, Division 2	•	•
KC	FM and ATEX Explosion-proof, Intrinsically Safe, Division 2	•	•
KD[10]	FM, CSA, and ATEX Explosion-proof, Intrinsically Safe	•	•
N1[10]	ATEX Type n	•	•
N7[10]	IECEx Type n	•	•
ND	ATEX Dust	•	•
Bolting Configurations		•	•
L4	Austenitic 316 SST Bolts	•	•
L5	ASTM A 193, Grade B7M Bolts	•	•
L8	ASTM A 193 Class 2, Grade B8M Bolts	•	•
Digital Display			
M5	LCD display	•	•
Special Configuration (Hardware)			
D4[12]	Zero and Span Hardware Adjustments	•	•
DF[13]	1/2-14 NPT Flange Adapters	•	•
D9[14]	JIS Process Connection-RC 1/4 Flange with RC 1/2 Flange Adapter	•	•
V5[15]	External Ground Screw Assembly	•	•
Performance			
P8[16]	0.065% accuracy and 5 year stability	•	•
Terminal Blocks			
T1	Transient Protection Terminal Block	•	•
Special Configuration (Software)			
C1[17]	Custom Software Configuration (Requires completed Configuration Data Sheet)	•	•
C4[17][18]	Analog Output Levels Compliant with NAMUR Recommendation NE 43, Alarm High	•	•
CN[17][18]	Analog Output Levels Compliant with NAMUR Recommendation NE 43 Alarm Low	•	•
Special Procedures			
P1	Hydrostatic Testing with Certificate	•	•
P2[19]	Cleaning for Special Service	•	•
P9	4500 psig (310 bar) static pressure limit (Ranges 2-5 only)	•	•
P3[19]	Cleaning for <1 PPM Chlorine/Fluorine	•	•
Special Certifications			
Q4	Calibration Certificate	•	•
Q8	Material Traceability Certification per EN 10204 3.1.B	•	•
QS[17]	Prior-use certificate of FMEDA data	•	•
Q16[20]	Surface finish certification for sanitary remote seals	•	•
QP	Calibration certification and tamper evident seal	•	•
QZ[20]	Remote Seal System Performance Calculation Report	•	•

Typical Model Number: 2051C D 2 A 2 2 A 1 A B4 M5

(1) Materials of Construction comply with recommendations per NACE MR0175/ISO 15156 for sour oil field production environments. Environmental limits apply to certain materials. Consult latest standard for details. Selected materials also conform to NACE MR0103 for sour refining environments.
(2) Requires 0 code in Materials of Construction for Alternate Process Connection.
(3) Not valid with optional code P9 for 4500psi Static Pressure.
(4) "Assemble-to" items are specified separately and require a completed model number.
(5) Process Flange limited to Coplanar (codes 2, 3, 5, 7, 8) or Traditional (H2, H3, H7).

(6) Not valid with optional code D9 for RC1/2 Adaptors.
(7) Not valid with optional codes DF & D9 for Adaptors.
(8) Requires option in the Alternate Process Connection: Flange section.
(9) Requires Coplanar flange.
(10) Not available with Low Power output code M.
(11) Only valid with FOUNDATION fieldbus output code F.
(12) Not available with FOUNDATION fieldbus output code F.
(13) Not valid with Alternate Process Connection options S3, S4, S5, S6.
(14) Not available with Alternate Process Connection: DIN Flanges and Level Flanges.
(15) The V5 option is not needed with the T1 option; external ground screw assembly is included with the T1 option.
(16) Available for HART 4-20mA output code A. Valid for Ranges 2-5 only.
(17) Only available with HART 4-20mA output (output code A).
(18) NAMUR-Compliant operation is pre-set at the factory and cannot be changed to standard operation in the field.
(19) Not valid with Alternate Process Connections S5 & S6.
(20) Requires one of the Diaphragm Seal Assemblies codes (S1 or S2).

Model	Transmitter Type (Select One)	
2051T	In-Line Pressure Transmitter	
Model	**Measurement Type**	
G	Gage	
A	Absolute	
Code	**Pressure Ranges (Ranges/ Min. Span)**	
	2051TG	**2051TA**
1	–14.7 to 30 psi/0.3 psi (–1,01 to 2,1 bar/20,7 mbar)	0 to 30 psia/0.3 psia (0 to 2,1 bar/20,7 mbar)
2	–14.7 to 150 psi/1.5 psi (–1,01 to 10,3 bar/103,4 mbar)	0 to 150 psia/1.5 psia (0 to 10,3 bar/103,4 mbar)
3	–14.7 to 800 psi/8 psi (–1,01 to 55,2 bar/0,55 bar)	0 to 800 psia/8 psia (0 to 55,2 bar/0,55 bar)
4	–14.7 to 4000 psi/40 psi (–1,01 to 275,8 bar/2,8 bar)	0 to 4000 psia/40 psia (0 to 275,8 bar/2,8 bar)
5	–14.7 to 10000 psi/2000 psi (–1,01 to 689,5 bar/138 bar)	0 to 10000 psia/2000 psia (0 to 689,5 bar/138 bar)
Code	**Output**	
A	4–20 mA with Digital Signal Based on HART Protocol	
M	Low-Power, 1–5 V dc with Digital Signal Based on HART Protocol	
F	FOUNDATION fieldbus Protocol	
Code	**Process Connection Style**	
2B	1/2–14 NPT female	
2C	G1/2 A DIN 16288 male (Range 1-4 only)	
2F	Coned and Threaded, Compatible with Autoclave Type F-250-C (Includes Gland and Collar, Available in SST for Range 5 only)	
Code	**Isolating Diaphragm**	
2(1)	316L SST	
3(1)	Alloy C-276	
Code	**Fill Fluid**	
1	Silicone	
2	Inert fill (Fluorinert FC-43)	
Code	**Housing Material**	**Conduit Entry Size**
A	Polyurethane-covered Aluminum	½–14 NPT
B	Polyurethane-covered Aluminum	M20 × 1.5 (CM20)
D	Polyurethane-covered Aluminum	G½
J	SST (consult factory for availability)	½–14 NPT
K	SST (consult factory for availability)	M20 × 1.5 (CM20)
M	SST (consult factory for availability)	G½
Code	**Options**	
Manifold Assemblies		
S5(2)	Assemble to Rosemount 306 Integral Manifold	
Diaphragm Seal Assemblies		
S1(2)	Assemble to one Rosemount 1199 diaphragm seal	
Mounting Brackets		
B4	Bracket for 2-in. Pipe or Panel Mounting, all SST	
Product Certifications		
E1(3)	ATEX Flameproof	
E2(3)	INMETRO Flameproof (consult factory for availability)	
E3(3)	China Flameproof (consult factory for availability)	
E4(3)	TIIS Flameproof (consult factory for availability)	
E5	FM Explosion-proof, Dust Ignition-proof	
E6	CSA Explosion-proof, Dust Ignition-proof, Division 2	
E7	IECEx Flameproof	
EP(3)	Korea (KOSHA) Flameproof Approval (consult factory for availability)	
EW(3)	India (CCOE) Flameproof Approval (consult factory for availability)	
EM(3)	GOST Explosion-proof (consult factory for availability)	

I1	ATEX Intrinsic Safety
I2[3]	INMETRO Intrinsic Safety (consult factory for availability)
I3[3]	China Intrinsic Safety (consult factory for availability)
I4[3]	TIIS Intrinsic Safety (consult factory for availability)
I5	FM Intrinsically Safe, Division 2
I6	CSA Intrinsically Safe
I7[3]	IECEx Intrinsic Safety
IA[4]	ATEX FISCO Intrinsic Safety
IB[4]	INMETRO FISCO Intrinsic Safety (consult factory for availability)
ID[4]	TIIS FISCO Intrinsic Safety (consult factory for availability)
IE[4]	FM FISCO Intrinsically Safe
IF[4]	CSA FISCO Intrinsically Safe
IG[4]	IECEx FISCO Intrinsically Safe
IP[3]	Korea (KOSHA) Instrinsic Safety (consult factory for availability)
IM[3]	GOST Intrinsically Safe (consult factory for availability)
IW[3]	India (CCOE) Intrinsic Safety Approval (consult factory for availability)
K1[3]	ATEX Flameproof, Intrinsic Safety, Type n, Dust
K2[3]	INMETRO Flameproof, Intrinsic Safety, Type n (consult factory for availability)
K4[3]	TIIS Flameproof, Intrinsic Safety (consult factory for availability)
K5	FM Explosion-proof, Dust Ignition-proof, Intrinsically Safe, Division 2
K6	CSA Explosion-proof, Dust Ignition-proof, Intrinsically Safe, Division 2
K7[3]	IECEx Flameproof, Intrinsic Safety, Type n
KA	ATEX and CSA Flameproof, Intrinsically Safe, Division 2
KB	FM and CSA Explosion-proof, Dust Ignition-proof, Intrinsically Safe, Division 2
KC	FM and ATEX Explosion-proof, Intrinsically Safe, Division 2
KD[3]	FM, CSA, and ATEX Explosion-proof, Intrinsically Safe
N1[3]	ATEX Type n
N7[3]	IECEx Type n
ND	ATEX Dust
Digital Display	
M5	LCD display
Special Configuration (Hardware)	
D4[5]	Zero and Span Hardware Adjustments
V5[6]	External Ground Screw Assembly
Performance	
P8[7]	0.065% accuracy and 5 year stability
Terminal Blocks	
T1	Transient Protection Terminal Block
Special Configuration (Software)	
C1[8]	Custom Software Configuration (Requires completed Configuration Data Sheet)
C4[8][9]	Analog Output Levels Compliant with NAMUR Recommendation NE 43, Alarm High
CN[8][9]	Analog Output Levels Compliant with NAMUR Recommendation NE 43 Alarm Low
Special Procedures	
P1	Hydrostatic Testing with Certificate
P2[10]	Cleaning for Special Service
P3[10]	Cleaning for <1 PPM Chlorine/Fluorine

Special Certifications	
Q4	Calibration Certificate
Q8	Material Traceability Certification per EN 10204 3.1.B
QS[8]	Prior-use certificate of FMEDA data
Q16[11]	Surface finish certification for sanitary remote seals
QP	Calibration certification and tamper evident seal
QZ[11]	Remote Seal System Performance Calculation Report

Typical Model Number: 2051T G 3 A 2B 1 A B4 M5

(1) Materials of Construction comply with recommendations per NACE MR0175/ISO 15156 for sour oil field production environments. Environmental limits apply to certain materials. Consult latest standard for details. Selected materials also conform to NACE MR0103 for sour refining environments.
(2) "Assemble-to" items are specified separately and require a completed model number.
(3) Not available with Low Power output code M.
(4) Only valid with FOUNDATION fieldbus output code F.
(5) Not available with FOUNDATION fieldbus output code F.
(6) The V5 option is not needed with the T1 option; external ground screw assembly is included with the T1 option.
(7) Available for HART 4-20mA output code A. Valid for Ranges 1-4 only.
(8) Only available with HART 4-20mA output (output code A).
(9) NAMUR-Compliant operation is pre-set at the factory and cannot be changed to standard operation in the field.
(10) Not valid with Alternate Process Connection S5.
(11) Requires S1 Diaphragm Seal Assembly code.

Model	Transmitter Type		
2051L	Flange-Mounted Liquid Level Transmitter		
Code	**Pressure Ranges (Range/Minimum Span)**		
2	–250 to 250 inH_2O/2.5 inH_2O (–0,6 to 0,6 bar/6,2 mbar)		
3	–1000 to 1000 inH_2O/10 inH_2O (–2,5 to 2,5 bar/25 mbar)		
4	–300 to 300 psi/3 psi (–20,7 to 20,7 bar/0,2 bar)		
Code	**Output**		
A	4–20 mA with Digital Signal Based on HART Protocol		
M	Low-Power, 1–5 V dc with Digital Signal Based on HART Protocol		
F	FOUNDATION fieldbus Protocol		
Code	**High Pressure Side**		
	Diaphragm Size	**Material**	**Extension Length**
G0	2 in./DN 50	316L SST	Flush Mount Only
H0	2 in./DN 50	Alloy C-276	Flush Mount Only
A0	3 in./DN 80	316L SST	Flush Mount
A2	3 in./DN 80	316L SST	2 in./50 mm
A4	3 in./DN 80	316L SST	4 in./100 mm
A6	3 in./DN 80	316L SST	6 in./150 mm
B0	4 in./DN 100	316L SST	Flush Mount
B2	4 in./DN 100	316L SST	2 in./50 mm
B4	4 in./DN 100	316L SST	4 in./100 mm
B6	4 in./DN 100	316L SST	6 in./150 mm
C0	3 in./DN 80	Alloy C-276	Flush Mount
C2	3 in./DN 80	Alloy C-276	2 in./50 mm
C4	3 in./DN 80	Alloy C-276	4 in./100 mm
C6	3 in./DN 80	Alloy C-276	6 in./150 mm
D0	4 in./DN 100	Alloy C-276	Flush Mount
D2	4 in./DN 100	Alloy C-276	2 in./50 mm
D4	4 in./DN 100	Alloy C-276	4 in./100 mm
D6	4 in./DN 100	Alloy C-276	6 in./150 mm
Code	**Mounting Flange**		
	Size	**Rating**	**Material**
M	2 in.	Class 150, ANSI	CS
A	3 in.	Class 150, ANSI	CS
B	4 in.	Class 150, ANSI	CS
N	2 in.	Class 300, ANSI	CS
C	3 in.	Class 300, ANSI	CS
D	4 in.	Class 300, ANSI	CS
X	2 in.	Class 150, ANSI	SST
F	3 in.	Class 150, ANSI	SST
G	4 in.	Class 150, ANSI	SST
Y	2 in.	Class 300, ANSI	SST
H	3 in.	Class 300, ANSI	SST
J	4 in.	Class 300, ANSI	SST
Q	DN50	PN 10-40, DIN	CS
R	DN80	PN 40, DIN	CS
K	DN50	PN 10-40, DIN	SST
T	DN80	PN 40, DIN	SST

Code	Process Fill-High Pressure Side		Temperature Limits	
A	Syltherm® XLT		-100 to 300 °F (-73 to 135 °C)	
C	D.C. Silicone 704		60 to 400 °F (15 to 205 °C)	
D	D.C. Silicone 200		-40 to 400 °F (-40 to 205 °C)	
H	Inert (Halocarbon)		-50 to 350 °F (-45 to 177 °C)	
G	Glycerin and Water		0 to 200 °F (-17 to 93 °C)	
N	Neobee® M-20		0 to 400 °F (-17 to 205 °C)	
P	Propylene Glycol and Water		0 to 200 °F (-17 to 93 °C)	
Code	**Low Pressure Side**			
	Configuration	**Flange Adapter**	**Diaphragm Material**	**Sensor Fill Fluid**
11	Gage	SST	316L SST	Silicone
21	Differential	SST	316L SST	Silicone
22	Differential (SST Valve Seat)	SST	Alloy C-276	Silicone
2A	Differential	SST	316L SST	Inert (Halocarbon)
2B	Differential (SST Valve Seat)	SST	Alloy C-276	Inert (Halocarbon)
31	Remote Seal	SST	316L SST	Silicone
Code	**O-ring**			
A	Glass-filled PTFE			
Code	**Housing Material**		**Conduit Entry Size**	
A	Polyurethane-covered Aluminum		½–14 NPT	
B	Polyurethane-covered Aluminum		M20 × 1.5 (CM20)	
D	Polyurethane-covered Aluminum		G½	
J	SST (consult factory for availability)		½–14 NPT	
K	SST (consult factory for availability)		M20 × 1.5 (CM20)	
M	SST (consult factory for availability)		G½	
Code	**Options**			
Diaphragm Seal Assembly				
S1[1]	Assemble to one Rosemount 1199 diaphragm seal			
Product Certifications				
E1[2]	ATEX Flameproof			
E2[2]	INMETRO Flameproof (consult factory for availability)			
E3[2]	China Flameproof (consult factory for availability)			
E4[2]	TIIS Flameproof (consult factory for availability)			
E5	FM Explosion-proof, Dust Ignition-proof			
E6	CSA Explosion-proof, Dust Ignition-proof, Division 2			
E7	IECEx Flameproof			
EP[2]	Korea (KOSHA) Flameproof Approval (consult factory for availability)			
EW[2]	India (CCOE) Flameproof Approval (consult factory for availability)			
EM[2]	GOST Explosion-proof (consult factory for availability)			
I1	ATEX Intrinsic Safety			
I2[2]	INMETRO Intrinsic Safety (consult factory for availability)			
I3[2]	China Intrinsic Safety (consult factory for availability)			
I4[2]	TIIS Intrinsic Safety (consult factory for availability)			
I5	FM Intrinsically Safe, Division 2			
I6	CSA Intrinsically Safe			
I7[2]	IECEx Intrinsic Safety			
IA[3]	ATEX FISCO Intrinsic Safety			
IB[3]	INMETRO FISCO Intrinsic Safety (consult factory for availability)			
ID[3]	TIIS FISCO Intrinsic Safety (consult factory for availability)			
IE[3]	FM FISCO Intrinsically Safe			
IF[3]	CSA FISCO Intrinsically Safe			
IG[3]	IECEx FISCO Intrinsically Safe			
IP[2]	Korea (KOSHA) Instrinsic Safety (consult factory for availability)			
IM[2]	GOST Intrinsically Safe (consult factory for availability)			

IW[2]	India (CCOE) Intrinsic Safety Approval (consult factory for availability)
K1[2]	ATEX Flameproof, Intrinsic Safety, Type n, Dust
K2[2]	INMETRO Flameproof, Intrinsic Safety, Type n (consult factory for availability)
K4[2]	TIIS Flameproof, Intrinsic Safety (consult factory for availability)
K5	FM Explosion-proof, Dust Ignition-proof, Intrinsically Safe, Division 2
K6	CSA Explosion-proof, Dust Ignition-proof, Intrinsically Safe, Division 2
K7[2]	IECEx Flameproof, Intrinsic Safety, Type n
KA	ATEX and CSA Flameproof, Intrinsically Safe, Division 2
KB	FM and CSA Explosion-proof, Dust Ignition-proof, Intrinsically Safe, Division 2
KC	FM and ATEX Explosion-proof, Intrinsically Safe, Division 2
KD[2]	FM, CSA, and ATEX Explosion-proof, Intrinsically Safe
N1[2]	ATEX Type n
N7[2]	IECEx Type n
ND	ATEX Dust
Digital Display	
M5	LCD display
Special Configuration (Hardware)	
D4[4]	Zero and Span Hardware Adjustments
DF[5]	1/2-14 NPT Flange Adapters
V5[6]	External Ground Screw Assembly
Terminal Blocks	
T1	Transient Protection Terminal Block
Special Configuration (Software)	
C1[7]	Custom Software Configuration (Requires completed Configuration Data Sheet)
C4[7][8]	Analog Output Levels Compliant with NAMUR Recommendation NE 43, Alarm High
CN[7][8]	Analog Output Levels Compliant with NAMUR Recommendation NE 43 Alarm Low
Special Certifications	
Q4	Calibration Certificate
Q8	Material Traceability Certification per EN 10204 3.1.B
QS[7]	Prior-use certificate of FMEDA data
Q16	Surface finish certification for sanitary remote seals
QP	Calibration certification and tamper evident seal
Flushing Connections	
F1	One 1/4-inch Connector, SST Ring Material
F2	Two 1/4-inch Connectors, SST Ring Material
F3[9]	One 1/4-inch Connector, Cast C-276 Ring Material
F4[9]	Two 1/4-inch Connectors, Cast C-276 Ring Material
F7	One 1/2-inch Connector, SST Ring Material
F8	Two 1/2-inch Connectors, SST Ring Material
F9	One 1/2-inch Connector, Cast C-276 Ring Material
F0	Two1/2-inch Connectors, Cast C-276 Ring Material

Typical Model Number: 2051L 2 A 2 2 A 1 A B4

(1) "Assemble-to" items are specified separately and require a completed model number.
(2) Not available with Low Power output code M.
(3) Only valid with FOUNDATION fieldbus output code F.
(4) Not valid with FOUNDATION fieldbus output code F.
(5) Not available with Diaphragm Seal Assembly option S1.
(6) The V5 option is not needed with the T1 option; external ground screw assembly is included with the T1 option.
(7) Only available with HART 4-20mA output (output code A).
(8) NAMUR-Compliant operation is pre-set at the factory and cannot be changed to standard operation in the field.
(9) Not available with Option Codes A0, B0, and G0.

OPTIONS

Standard Configuration

Unless otherwise specified, transmitter is shipped as follows:

Engineering Units 2051C:	inH_2O (Ranges 1-3), psi (Ranges 4-5)
Engineering Units 2051T:	psi (all ranges)
Engineering Units 2051L:	inH_2O
4 mA (1 V dc)(1):	0 (engineering units above)
20 mA (5 V dc)(1):	Upper range limit
Output:	Linear
Flange type:	Specified model code option
Flange material:	Specified model code option
Drain/vent:	Specified model code option
Integral meter:	Installed or none
Alarm(1):	High
Software tag:	(Blank)

(1) Not applicable to fieldbus.

Tagging (3 options available)

- Standard SST hardware tag is permanently affixed on transmitter. Tag character height is 0.125 in. (3,18 mm), 140 characters maximum.
- Tag may be wired to the transmitter nameplate upon request, 85 characters maximum.
- Tag may be stored in transmitter memory (8 characters maximum). Software tag is left blank unless specified.

Commissioning tag (fieldbus only)

A temporary commissioning tag is attached to all transmitters. The tag indicates the device ID and allows an area for writing the location.

Optional Rosemount 304, 305 or 306 Integral Manifolds

Factory assembled to 2051C and 2051T transmitters. Refer to Product Data Sheet (document number 00813-0100-4839 for Rosemount 304 and 00813-0100-4733 for Rosemount 305 and 306) for additional information.

Optional Diaphragm and Sanitary Seals

Refer to Product Data Sheet (document number 00813-0100-4016 or 00813-0201-4016) for additional information.

Output Information

Output range points must be the same unit of measure. Available units of measure include:

inH_2O	inH_2O@4 °C(1)	psi	Pa
inHg	ftH_2O	bar	kPa
mmH_2O	mmH_2O@4 °C(1)	mbar	torr
mmHg	g/cm2	kg/cm2	atm

(1) Not available on low power.

Hardware Adjustments

D4 Local zero and span adjustments

- Alarm and security adjustments ship standard

LCD display

M5 Digital Meter

- 2-Line, 5-Digit LCD for 4-20 mA HART and FOUNDATION fieldbus
- 1-Line, 4-Digit LCD for 1-5 Vdc HART Low Power
- Direct reading of digital data for higher accuracy
- Displays user-defined flow, level, volume, or pressure units
- Displays diagnostic messages for local troubleshooting
- 90-degree rotation capability for easy viewing

Transient Protection

T1 Integral Transient Protection Terminal Block

Meets IEEE C62.41, Category Location B

6 kV crest (0.5 μs - 100 kHz)
3 kV crest (8 × 20 microseconds)
6 kV crest (1.2 × 50 microseconds)

Bolts for Flanges and Adapters

- Standard material is plated carbon steel per ASTM A449, Type 1

L4 Austenitic 316 Stainless Steel Bolts
L5 ASTM A 193, Grade B7M Bolts
L8 ASTM A 193 Class 2, Grade B8M Bolts

Rosemount 2051C Coplanar Flange and 2051T Bracket Option

B4 Bracket for 2-in. Pipe or Panel Mounting

- For use with the standard Coplanar flange configuration
- Bracket for mounting of transmitter on 2-in. pipe or panel
- Stainless steel construction with stainless steel bolts

Rosemount 2051C Traditional Flange Bracket Options

B1 Bracket for 2-in. Pipe Mounting

- For use with the traditional flange option
- Bracket for mounting on 2-in. pipe
- Carbon steel construction with carbon steel bolts
- Coated with polyurethane paint

B2 Bracket for Panel Mounting

- For use with the traditional flange option
- Bracket for mounting transmitter on wall or panel
- Carbon steel construction with carbon steel bolts
- Coated with polyurethane paint

B3 Flat Bracket for 2-in. Pipe Mounting

- For use with the traditional flange option
- Bracket for vertical mounting of transmitter on 2-in. pipe
- Carbon steel construction with carbon steel bolts
- Coated with polyurethane paint

B7 B1 Bracket with SST Bolts

- Same bracket as the B1 option with Series 300 stainless steel bolts

B8 B2 Bracket with SST Bolts

- Same bracket as the B2 option with Series 300 stainless steel bolts

B9 B3 Bracket with SST Bolts

- Same bracket as the B3 option with Series 300 stainless steel bolts

BA Stainless Steel B1 Bracket with SST Bolts

- B1 bracket in stainless steel with Series 300 stainless steel bolts

BC Stainless Steel B3 Bracket with SST Bolts

- B3 bracket in stainless steel with Series 300 stainless steel bolts

SPARE PARTS

Terminal Block, HART	Part Number
4-20 mA HART Output	
Standard terminal block assembly	02051-9005-0001
Transient terminal block assembly (option T1)	02051-9005-0002
1-5 Vdc HART Low Power Output	
Standard terminal block assembly	02051-9005-0011
Transient terminal block assembly (option T1)	02051-9005-0012

Electronics Board, HART	Part Number
Assemblies for 4-20 mA HART	
4-20 mA HART for use without D4 option	02051-9001-0001
4-20 mA HART for use with D4 option	02051-9001-0002
4-20 mA HART NAMUR Compliant for use with or without D4 option	02051-9001-0012
Assembly for 1-5 Vdc HART Low Power	
1-5 Vdc HART	02051-9001-1001

LCD Display, HART	
LCD Display Kit(1)	
4-20 mA with Aluminum Housing	03031-0193-0101
4-20 mA with SST Housing	03031-0193-0111
1-5 Vdc with Aluminum Housing	03031-0193-0001
1-5 Vdc with SST Housing	03031-0193-0011
LCD Displays Only(2)	
For 4-20 mA output	03031-0193-0103
For 1-5 Vdc Low Power output	03031-0193-0003
LCD Display Hardware, both 4-20 mA and 1-5 Vdc Low Power	
Aluminum Display Cover Assembly(3)	03031-0193-0002
SST Display Cover Assembly(3)	03031-0193-0012
O-ring package for electronics housing cover, pkg of 12	03031-0232-0001
Zero and Span Hardware Adjustments (D4 option)	
Zero and Span Kit for 4-20 mA HART(4)	
Zero and Span Kit for Aluminum Housing	02051-9010-0001
Zero and Span Kit for SST Housing	02051-9010-0002
Zero and Span Kit for 4-20 mA HART NAMUR Compliant (C4/CN) option(5)	
Zero and Span Kit for Aluminum Housing	02051-9010-1001
Zero and Span Kit for SST Housing	02051-9010-1002
Zero and Span Kit for 1-5 Vdc HART Low Power(5)	
Zero and Span Kit for Aluminum Housing	02051-9010-1001
Zero and Span Kit for SST Housing	02051-9010-1002

O-Ring Packages (package of 12)	Part Number
Electronic housing, cover (standard and meter)	03031-0232-0001
Electronics housing, module	03031-0233-0001
Process flange, glass-filled PTFE	03031-0234-0001
Process flange, graphite-filled PTFE	03031-0234-0002
Flange adapter, glass-filled PTFE	03031-0242-0001
Flange adapter, graphite-filled PTFE	03031-0242-0002

(1) Kit includes LCD display, captive mounting hardware, 10-pin interconnection header, cover assembly.
(2) Displays include LCD, captive mounting hardware, 10-pin interconnection header. No cover assembly.
(3) Display Cover Assembly includes the cover and o-ring only.
(4) Kit includes zero and span hardware adjustments and electronics board.
(5) Kit includes zero and span hardware adjustments only.

Flanges	Part Number
Differential Coplanar Flange	
Nickel-plated carbon steel	03031-0388-0025
316 SST	03031-0388-0022
Cast C-276	03031-0388-0023
Gage Coplanar Flange	
Nickel-plated carbon steel	03031-0388-1025
316 SST	03031-0388-1022
Cast C-276	03031-0388-1023
Coplanar Flange Alignment Screw (package of 12)	03031-0309-0001
Traditional Flange	
316 SST	03031-0320-0002
Cast C-276	03031-0320-0003
Level Flange, Vertical Mount	
2 in., class 150, SST	03031-0393-0221
2 in., class 300, SST	03031-0393-0222
3 in., class 150, SST	03031-0393-0231
3 in., class 300, SST	03031-0393-0232
DIN, DN 50, PN 40	03031-0393-1002
DIN, DN 80, PN 40	03031-0393-1012

Flange Adapter	Part Number
Nickel-plated carbon steel	02024-0069-0005
316 SST	02024-0069-0002
Cast C-276	02024-0069-0003

Drain/Vent Valve Kits (each kit contains parts for one transmitter)	Part Number
Differential Drain/Vent Kits	
316 SST stem and seat kit	01151-0028-0022
Alloy C-276 stem and seat kit	01151-0028-0023
316 SST ceramic ball drain/vent kit	03031-0378-0022
Alloy C-276ceramic ball drain/vent kit	01151-0028-0123
Gage Drain/Vent Kits	
316 SST stem and seat kit	01151-0028-0012
Alloy C-276 stem and seat kit	01151-0028-0013
316 SST ceramic ball drain/vent kit	03031-0378-0012
Alloy C-276 ceramic ball drain/vent kit	01151-0028-0113

Mounting Brackets	
2051C and 2051L Coplanar Flange Bracket Kit	
B4 bracket, SST, 2-in. pipe mount, SST bolts	03031-0189-0003
2051T Bracket Kit	
B4 bracket, SST, 2-in. pipe mount, SST bolts	03031-0189-0004
2051C Traditional Flange Bracket Kits	
B1 bracket, 2-in. pipe mount, CS bolts	03031-0313-0001
B2 bracket, panel mount, CS bolts	03031-0313-0002
B3 flat bracket for 2-in. pipe mount, CS bolts	03031-0313-0003
B7 (B1 style bracket with SST bolts)	03031-0313-0007
B8 (B2 style bracket with SST bolts)	03031-0313-0008
B9 (B3 style bracket with SST bolts)	03031-0313-0009
BA (SST B1 bracket with SST bolts)	03031-0313-0011
BC (SST B3 bracket with SST bolts)	03031-0313-0013

Bolt Kits	
COPLANAR FLANGE	
Flange Bolt Kit {44 mm (1.75 in.)} (Set of 4)	
Carbon steel	03031-0312-0001
316 SST	03031-0312-0002
ASTM A 193, Grade B7M	03031-0312-0003
ASTM A 193, Class 2, Grade B8M	03031-0312-0005
Flange/Adapter Bolt Kit {73 mm (2.88 in.)} (Set of 4)	
Carbon steel	03031-0306-0001
316 SST	03031-0306-0002
ASTM A 193, Grade B7M	03031-0306-0003
ASTM A 193, Class 2, Grade B8M	03031-0306-0005
Manifold/Flange Kit {57 mm (2.25 in.)} (Set of 4)	
Carbon steel	03031-0311-0001
316 SST	03031-0311-0002
ASTM A 193, Grade B7M	03031-0311-0003
ASTM A 193, Class 2, Grade B8M	03031-0311-0020
TRADITIONAL FLANGE	
Differential Flange and Adapter Bolt Kit {44 mm (1.75 in.)} (Set of 8)	
Carbon steel	03031-0307-0001
316 SST	03031-0307-0002
ASTM A 193, Grade B7M	03031-0307-0003
ASTM A 193, Class 2, Grade B8M	03031-0307-0005
Gage Flange and Adapter Bolt Kit (Set of 6)	
Carbon steel	03031-0307-1001
316 SST	03031-0307-1002
ASTM A 193, Grade B7M	03031-0307-1003
ASTM A 193, Class 2, Grade B8M	03031-0307-1005
Manifold/Traditional Flange Bolts	
Carbon steel	Use bolts supplied with manifold
316 SST	Use bolts supplied with manifold
LEVEL FLANGE, VERTICAL MOUNT	
Flange Bolt Kit (Set of 4)	
Carbon steel	03031-0395-0001
316 SST	03031-0395-0002
Covers	
Aluminum field terminal cover + o-ring	03031-0292-0001(1)
SST field terminal cover + o-ring	03031-0292-0002(1)
Aluminum HART electronics cover: cover + o-ring	03031-0292-0001(1)
316 SST HART electronics cover: cover + o-ring	03031-0292-0002(1)
Aluminum Electronics / LCD Display Cover Assembly: cover + o-ring	03031-0193-0002
SST Electronics / LCD Display Cover Assembly: cover + o-ring	03031-0193-0012
Miscellaneous	
External ground screw assembly (option V5)	03031-0398-0001

(1) Covers are blind, not for use with LCD Display. Refer to LCD Display section for LCD covers.

Appendix B Approval Information

OVERVIEW

This Appendix contains information on Approved manufacturing locations, European directive information, Ordinary Location certification, Hazardous Locations Certifications and approval drawings for HART protocol.

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 could result in death or serious injury:

Installation of this transmitter in an explosive environment must be in accordance with the appropriate local, national, and international standards, codes, and practices. Please review this section of the Rosemount 2051 reference manual for any restrictions associated with a safe installation.

- Before connecting a HART-based communicator in an explosive atmosphere, make sure the instruments in the loop are installed in accordance with intrinsically safe or non-incendive field wiring practices.
- In an Explosion-Proof/Flameproof installation, do not remove the transmitter covers when power is applied to the unit.

Process leaks may cause harm or result in death.

- Install and tighten process connectors before applying pressure.

Electrical shock can result in death or serious injury.

- Avoid contact with the leads and terminals. High voltage that may be present on leads can cause electrical shock.

⚠WARNING

Cable gland and plug must comply with the requirements listed on the certificates.

Approved Manufacturing Locations

Rosemount Inc. — Chanhassen, Minnesota USA
Emerson Process Management GmbH & Co. — Wessling, Germany
Emerson Process Management Asia Pacific Private Limited — Singapore
Beijing Rosemount Far East Instrument Co., LTD — Beijing, China

European Directive Information

The EC declaration of conformity for all applicable European directives for this product can be found on the Rosemount website at www.rosemount.com. A hard copy may be obtained by contacting an Emerson Process Management representative.

ATEX Directive (94/9/EC)
All 2051 transmitters comply with the ATEX Directive.

European Pressure Equipment Directive (PED) (97/23/EC)
2051CG2, 3, 4, 5; 2051CD2, 3, 4, 5 (also with P9 option)
— QS Certificate of Assessment - EC No. PED-H-100
Module H Conformity Assessment

All other 2051 Pressure Transmitters
— Sound Engineering Practice

Transmitter Attachments: Diaphragm Seal - Process Flange - Manifold
— Sound Engineering Practice

Electro Magnetic Compatibility (EMC) (2004/108/EC)
All 2051 Pressure Transmitters meet all of the requirements of IECEN61326:2006 and NAMUR NE-21.

Ordinary Location Certification for Factory Mutual
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).

HART Protocol

Hazardous Locations Certifications

North American Certifications

FM Approvals

E5 Explosion-Proof for Class I, Division 1, Groups B, C, and D.
Dust-Ignition-Proof for Class II, Division 1, Groups E, F, and G.
Dust-Ignition-Proof for Class III, Division 1.
T5 (Ta = 85 °C), Factory Sealed, Enclosure Type 4X

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 per Rosemount drawing 02051-1009; Non-incendive for Class I, Division 2, Groups A, B, C, and D.
Temperature Code:T4 (Ta = 40 °C), T3 (Ta = 85 °C),
Enclosure Type 4X
For input parameters see control drawing 02051-1009.

Canadian Standards Association (CSA)

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 for indoor and outdoor hazardous locations. Enclosure type 4X, factory sealed

I6 Intrinsically safe approval. Intrinsically safe for Class I, Division 1, Groups A, B, C, and D when connected in accordance with Rosemount drawing 02051-1008. Temperature Code T3C.
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 hazardous locations. Enclosure type 4X, factory sealed
For input parameters see control drawing 02051-1008.

European Certifications

I1 ATEX Intrinsic Safety
Certification No. Baseefa08ATEX0129X ⟨Ex⟩ II 1 G
Ex ia IIC T4 ($-60 \leq T_a \leq +70$ °C)
IP66 IP68
CE 1180

Table B-1. Input Parameters

U_i = 30V
I_i = 200 mA
P_i = 1.0W
C_i = 0.012 µF

Special Conditions for Safe Use (X):
When the optional transient protection terminal block is installed, the apparatus is not capable of withstanding the 500V insulation test required by Clause 6.3.12 of EN60079-11. This must be taken into account when installing the apparatus.

N1 ATEX Type n
Certification No. Baseefa08ATEX0130X ⟨Ex⟩ II 3 G
Ex nAnL IIC T4 ($-40 \leq T_a \leq +70$ °C)
U_i = 42.4 Vdc max
IP66 IP68
CE

Special Conditions for Safe Use (X):
When the optional transient protection terminal block is installed, the apparatus is not capable of withstanding a 500V r.m.s. test to case. This must be taken into account on any installation in which it is used, for example by assuring that the supply to the apparatus is galvanically isolated.

E1 ATEX Flame-Proof
Certification No. KEMA 08ATEX0090X G ⟨Ex⟩ II 1/2 G
Ex d IIC T6 (–50 ≤ T_a ≤ 65 °C)
Ex d IIC T5 (–50 ≤ T_a ≤ 80 °C)
IP66 IP68
CE 1180
Vmax = 42.4 V dc

Special Conditions for Safe Use (X):

1.Appropriate ex d blanking plugs, cable glands, and wiring needs to be suitable for a temperature of 90 °C.

2.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 maintenance shall be followed in detail to assure safety during its expected lifetime.

3.The 2051 does not comply with the requirements of IEC 60079-1 Clause 5 for flameproof joints. Contact Emerson Process Management for information on the dimensions of flameproof joints.

ND ATEX Dust
Certification No. Baseefa08ATEX0182X ⟨Ex⟩ II 1 D
Dust Rating: T80 °C (–20 ≤ T_a ≤ 40 °C) IP66 IP68
Vmax = 42.4 V dc
A = 22 mA
CE 1180

Special Conditions for Safe Use (X):

1. The user must ensure that the maximum rated voltage and current (42.4 volts, 22 milliampere, 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 EN 60079-1.
2. Cable entries must be used which maintain the ingress protection of the enclosure to at least IP66.
3. Unused cable entries must be filled with suitable blanking plugs which maintain the ingress protection of the enclosure to at least IP66.
4. Cable entries and blanking plugs must be suitable for the ambient range of the apparatus and capable of withstanding a 7J impact test.

IECEx Certifications

I7 IECEx Intrinsic Safety
Certification No. IECExBAS08.0045X ⟨Ex⟩ II 1 GD
Ex ia IIC T4 (–60 ≤ T_a ≤ +70 °C)
Dust Rating: T80 °C (–20 ≤ T_a ≤ 40 °C) IP66 IP68
CE 1180

Table B-1. Input Parameters

U_i = 30V
I_i = 200 mA
P_i = 1.0W
C_i = 0.012 µF

Special Conditions for Safe Use (X):
When the optional transient protection terminal block is installed, the apparatus is not capable of withstanding the 500V insulation test required by Clause 6.3.12 of IEC60079-11. This must be taken into account when installing the apparatus.

E7 IECEx Explosion-Proof (Flame-Proof)
Certification No. IECEx KEM 08.0020X Ⓔx II 1/2 G
Ex d IIC T6 ($-50 \leq T_a \leq 65$ °C)
Ex d IIC T5 ($-50 \leq T_a \leq 80$ °C)
CE 1180
Vmax = 42.4 V dc

Special Conditions for Safe Use (X):

1.Appropriate ex d blanking plugs, cable glands, and wiring needs to be suitable for a temperature of 90 °C.

2.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 maintenance shall be followed in detail to assure safety during its expected lifetime.

3.The 2051 does not comply with the requirements of IEC 60079-1 Clause 5 for flameproof joints. Contact Emerson Process Management for information on the dimensions of flameproof joints.

N7 IECEx Type n
Certification No. IECExBAS08.0046X Ⓔx II 3 G
Ex nAnL IIC T4 ($-40 \leq T_a \leq +70$ °C)
U_i = 42.4 Vdc max
CE

Special Conditions for Safe Use (X):

When the optional transient protection terminal block is installed, the apparatus is not capable of withstanding a 500V r.m.s. test to case. This must be taken into account on any installation in which it is used, for example by assuring that the supply to the apparatus is galvanically isolated.

TIIS Certifications
(consult factory for availability)

E4 TIIS Flame-Proof
Ex d IIC T6

I4 TIIS Intrinsic Safety
Ex ia IIC T4

INMETRO Certifications
(consult factory for availability)

E2 Flame-Proof
BR-Ex d IIC T6/T5

I2 Intrinsic Safety
BR-Ex ia IIC T4

GOST Certifications
(consult factory for availability)

IM Intrinsic Safety
Certificate Pending

EM Flame-Proof
Certificate Pending

China (NEPSI) Certifications
(consult factory for availability)

E3 Flame-Proof
Ex d II B+H_2T3~T5

I3 Intrinsic Safety
Ex ia IIC T3/T4

KOSHA Certifications
(consult factory for availability)

EP Flame-Proof
Ex d IIB+H2 T5

IP Intrinsic Safety
Ex ia IIC T3

CCoE Certifications
(consult factory for availability)

IW Intrinsic Safety
Ex ia IIC T4

EW Flame-Proof
Ex d IIC T5 or T6

Combinations of Certifications

Stainless steel certification tag is provided when optional approval is specified. Once a device labeled with multiple approval types is installed, it should not be reinstalled using any other approval types. Permanently mark the approval label to distinguish it from unused approval types.

K1 **E1, I1, N1,** and **ND** combination

K2 **E2** and **I2** combination (consult factory for availability)

K4 **E4** and **I4** combination (consult factory for availability)

K5 **E5** and **I5** combination

K6 **I6** and **E6** combination

K7 **E7, I7,** and **N7** combination

KA **E1, I1, E6,** and **I6** combination

KB **E5, I5, E6,** and **I6** combination

KC **E1, I1, E5,** and **I5** combination

KD **E1, I1, E5, I5, E6,** and **I6** combination

APPROVAL DRAWINGS

Factory Mutual (FM)

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

REVISIONS

REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AA	NEW RELEASE	RTC1025889	J.G.K.	4/21/08

ENTITY APPROVALS FOR
2051C
2051L
2051T

OUTPUT CODE A (4-20 mA HART) I.S. SEE SHEETS 2-5
OUTPUT CODE M (LOW POWER) I.S. SEE SHEETS 6-7
OUTPUT CODE F/W (FIELDBUS) I.S. SEE SHEETS 8-12
ALL OUTPUT CODES NONINCENDIVE SEE SHEET 13

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. Myles Lee Miller 4/16/08
CHK'D
APP'D.

APP'D. GOVT.

EMERSON. Process Management

ROSEMOUNT®
8200 Market Boulevard • Chanhassen, MN 55317 USA

TITLE INDEX OF I.S. & NONINCENDIVE F.M. FOR 2051C/L/T

SIZE	FSCM NO	DWG NO.	
A		02051-1009	

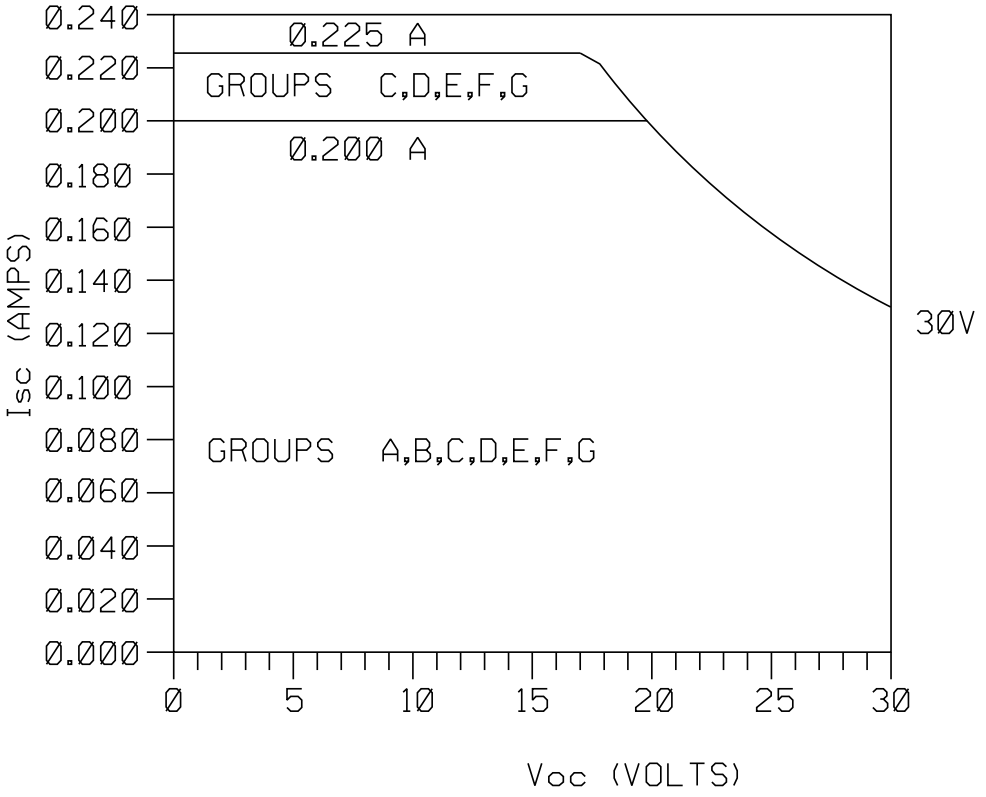
SCALE N/A WT. ——— SHEET 1 OF 13

Form, Rev AC

REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AA				

BARRIER PARAMETERS (APPLICABLE TO OUTPUT CODES A & M)

Pmax = 1WATT

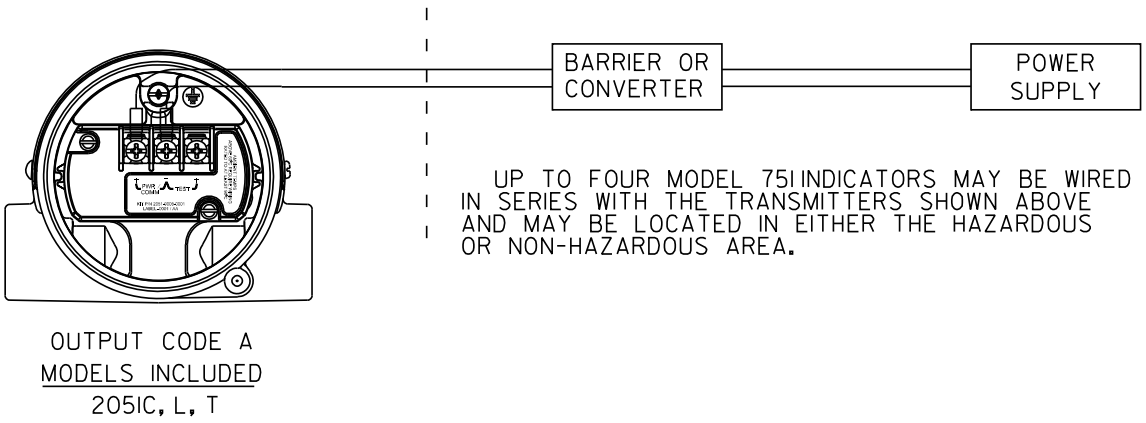


Rosemount Inc. 8200 Market Boulevard Chanhassen, MN 55317 USA			CAD MAINTAINED (MicroStation)
DR. Myles Lee Miller	SIZE A	FSCM NO	DWG NO. 02051-1009
ISSUED	SCALE N/A	WT. ———	SHEET 2 OF 13

Form Rev AC

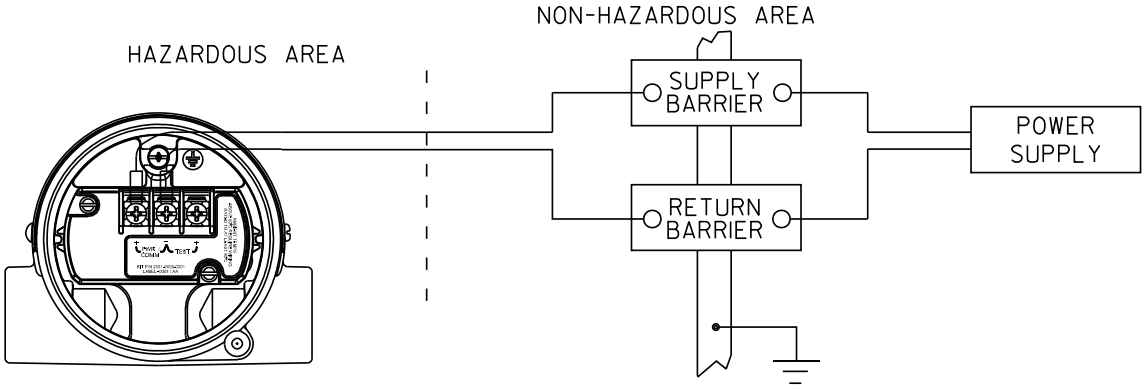
REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AA				

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



OUTPUT CODE A
MODELS INCLUDED
205IC, L, T

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



OUTPUT CODE A
MODELS INCLUDED
205IC, L, T

Rosemount Inc. 8200 Market Boulevard Chanhassen, MN 55317 USA			CAD MAINTAINED (MicroStation)
DR. Myles Lee Miller	SIZE A	FSCM NO	DWG NO. 02051-1009
ISSUED	SCALE N/A	WT. ———	SHEET 3 OF 13

Form Rev AC

REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AA				

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 (C_a) 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 (L_a) 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

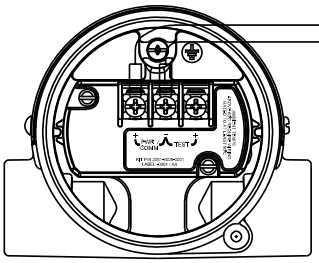
NOTE: ENTITY PARAMETERS LISTED APPLY ONLY TO ASSOCIATED APPARATUS WITH LINEAR OUTPUT.

CLASS I, DIV. 1, GROUPS A AND B

V_T = 30V	V_T OR V_{OC} IS LESS THAN OR EQUAL TO 30V
I_T = 200mA	I_T OR I_{SC} IS LESS THAN OR EQUAL TO 200mA
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 = .01µf	C_A IS GREATER THAN .01µf
L_I =10µH	L_A IS GREATER THAN 10µH

CLASS I, DIV. 1, GROUPS C AND D

V_T = 30V	V_T OR V_{OC} IS LESS THAN OR EQUAL TO 30V
I_T = 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 = .01µf	C_A IS GREATER THAN .01µf
L_I =10µH	L_A IS GREATER THAN 10µH



HAZARDOUS AREA | NON-HAZARDOUS AREA

ASSOCIATED APPARATUS

(SEE SHEET 3)

OUTPUT CODE A
MODELS INCLUDED
205IC, L, T

Rosemount Inc. 8200 Market Boulevard Chanhassen, MN 55317 USA			CAD MAINTAINED (MicroStation)
DR. Myles Lee Miller	SIZE A	FSCM NO	DWG NO. 02051-1009
ISSUED	SCALE N/A	WT. ———	SHEET 4 OF 13

Form Rev AC

REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AA				

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} = 200mA	I_T OR I_{SC} IS LESS THAN OR EQUAL TO 200mA
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 = .02μf	C_A IS GREATER THAN .02μf
L_I =10μH	L_A IS GREATER THAN 10μH

* FOR T1 OPTION:

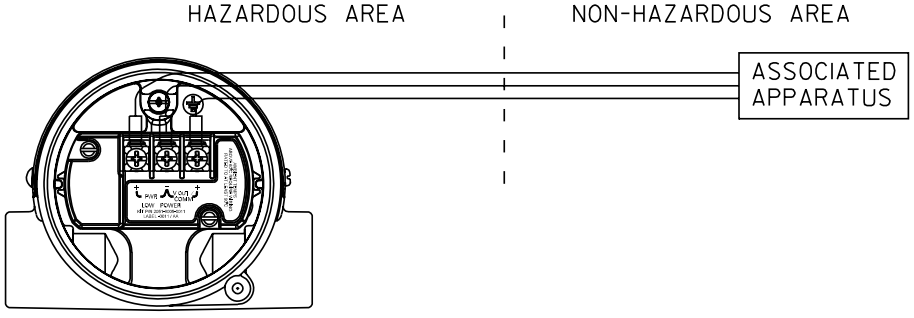
L_I =0.75mH	L_A IS GREATER THAN 0.75mH

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 = .02μf	C_A IS GREATER THAN .02μf
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

205IC 205IT
205IL

Rosemount Inc.
8200 Market Boulevard
Chanhassen, MN 55317 USA

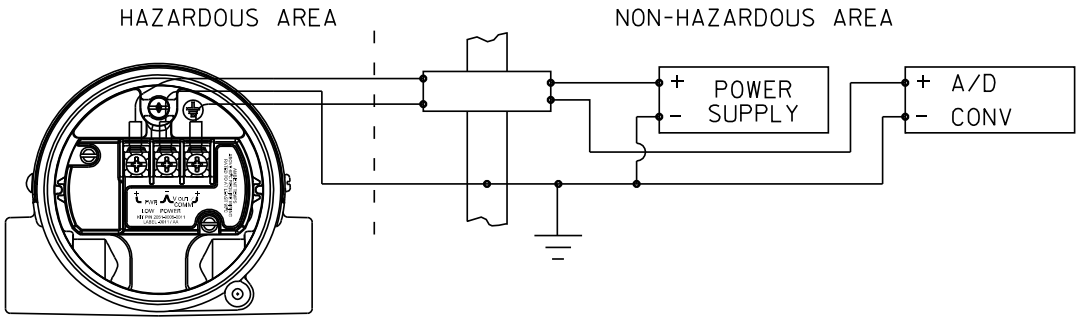
CAD MAINTAINED (MicroStation)

DR. Myles Lee Miller	SIZE A	FSCM NO	DWG NO. 02051-1009
ISSUED	SCALE N/A	WT. ———	SHEET 5 OF 13

Form Rev AC

REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AA				

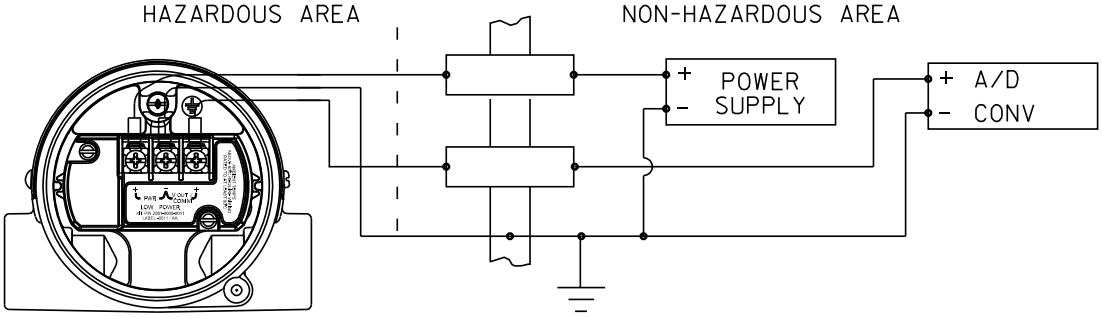
CIRCUIT DIAGRAM 3
ONE DUAL CHANNEL BARRIER



OUTPUT CODE M
AVAILABLE FOR THE MODELS LISTED

205IC 205IT
205IL

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



OUTPUT CODE M
AVAILABLE FOR THE MODELS LISTED

205IC 205IT
205IL

Rosemount Inc.
8200 Market Boulevard
Chanhassen, MN 55317 USA

CAD MAINTAINED (MicroStation)

DR. Myles Lee Miller	SIZE A	FSCM NO	DWG NO. 02051-1009
ISSUED	SCALE N/A	WT. ———	SHEET 6 OF 13

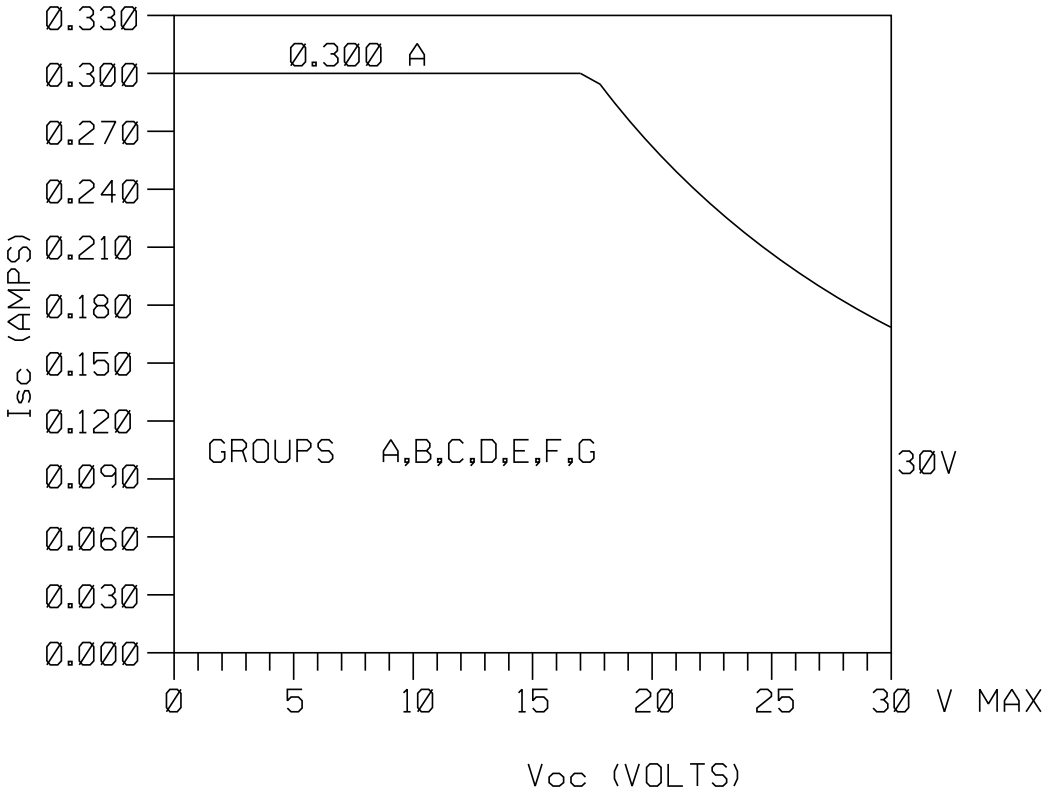
Form Rev AC

REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AA				

2051 WITH FOUNDATION FIELDBUS OR PROFIBUS. (OUTPUT CODE F OR W)

BARRIER PARAMETERS (APPLICABLE TO OUTPUT CODE F OR W)

Pmax = 1.3 WATT

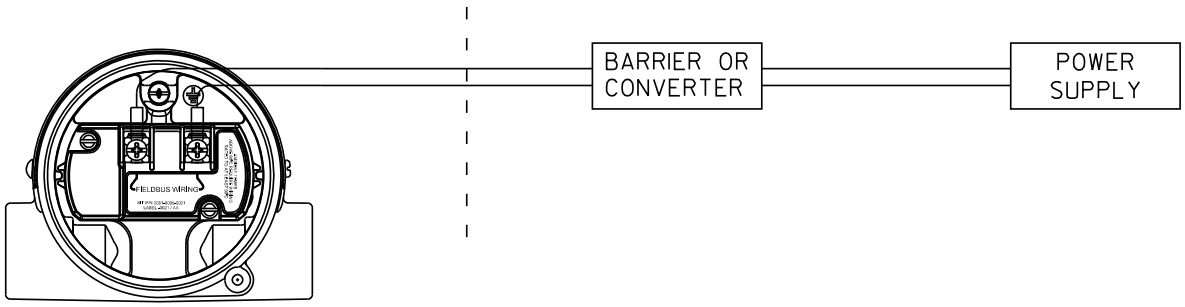


Rosemount Inc. 8200 Market Boulevard Chanhassen, MN 55317 USA			CAD MAINTAINED (MicroStation)	
DR. Myles Lee Miller	SIZE A	FSCM NO	DWG NO.	02051-1009
ISSUED	SCALE N/A	WT. ———	SHEET 7 OF 13	

Form Rev AC

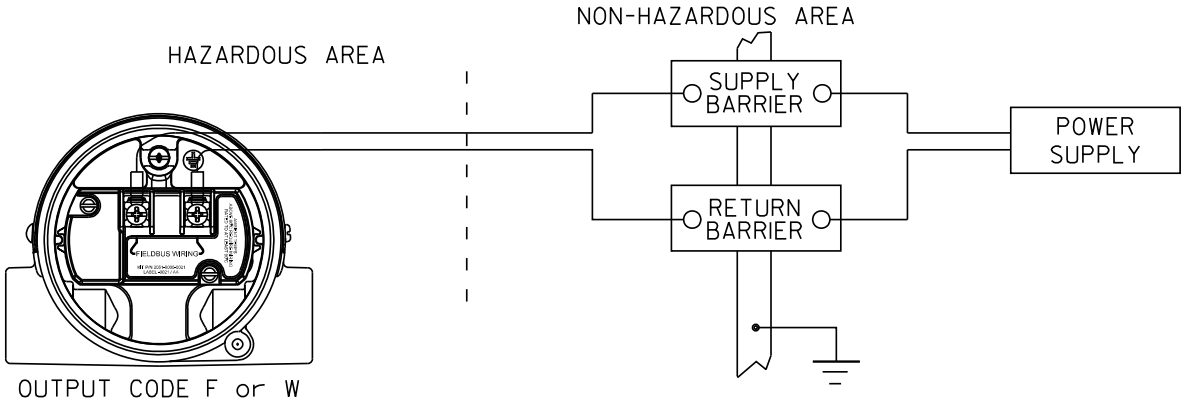
REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AA				

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



OUTPUT CODE F or W
MODELS INCLUDED
205IC, L, T

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



OUTPUT CODE F or W
MODELS INCLUDED
205IC, L, T

Rosemount Inc. 8200 Market Boulevard Chanhassen, MN 55317 USA			CAD MAINTAINED (MicroStation)	
DR. Myles Lee Miller	SIZE A	FSCM NO	DWG NO. 02051-1009	
ISSUED	SCALE N/A	WT. ———	SHEET 8 OF 13	

Form Rev AC

REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AA				

ENTITY CONCEPT APPROVALS

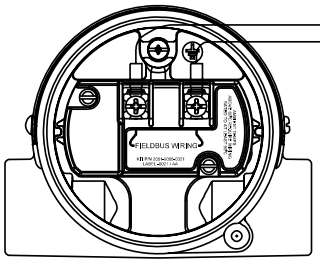
THE ENTITY CONCEPT ALLOWS INTERCONNECTION OF INTRINSICALLY SAFE APPARATUS TO ASSOCIATED APPARATUS NOT SPECIFICALLY EXAMINED IN COMBINATION AS A SYSTEM. THE APPROVED VALUES OF MAX. OPEN CIRCUIT VOLTAGE (Voc OR Vt) AND MAX. SHORT CIRCUIT CURRENT (Isc OR It) AND MAX. POWER (Voc X Isc/4) OR (Vt X It/4), 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 (C_a) 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 (L_a) 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
205IC, L, T

Rosemount Inc. 8200 Market Boulevard Chanhassen, MN 55317 USA			CAD MAINTAINED (MicroStation)	
DR. Myles Lee Miller	SIZE A	FSCM NO	DWG NO. 02051-1009	
ISSUED	SCALE N/A	WT. ———	SHEET 9 OF 13	

Form Rev AC

REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AA				

FISCO CONCEPT APPROVALS

THE FISCO CONCEPT ALLOWS INTERCONNECTION OF INTRINSICALY SAFE APPARATUS TO ASSOCIATED APPARATUS NOT SPECIALLY EXAMINED IN SUCH COMBINATION. FOR THIS INTERCONNECTION TO BE VALID THE VOLTAGE (U_i or Vmax), THE CURRENT (I_i or Imax), AND THE POWER (P_i or Pmax) THAT INTRINSICALLY SAVE APPARATUS CAN RECEIVE AND REMAIN INTRINSICALY SAFE, INCLUDING FAULTS, MUST BE EQUAL OR GREATER THAN THE VOLTAGE (Uo, Voc, or Vt), THE CURRENT (Io, Isc, or It), AND THE POWER (Po or Pmax) LEVELS WHICH CAN BE DELIVERED BY THE ASSOCIATED APPARATUS, CONSIDERING FAULTS AND APPLICABLE FACTORS. ALSO, THE MAXIMUM UNPROTECTED CAPACITANCE (C_i) AND THE INDUCTANCE (L_i) OF EACH APPARATUS (BESIDES THE TERMINATION) CONNECTED TO THE FIELDBUS MUST BE LESS THAN OR EQUAL TO 5nF AND 10μH RESPECTVELY.
ONLY ONE ACTIVE DEVICE IN EACH SECTION (USUALLY THE ASSOCIATED APPARATUS) IS ALLOWED TO CONTRIBUTE THE DESIRED ENERGY FOR THE FIELDBUS SYSTEM. THE ASSOCIATED APPARATUS' VOLTAGE Uo (or Voc or Vt) IS LIMITED TO A RANGE OF 14V TO 24 V.D.C. ALL OTHER EQUIPENT COMBINED IN THE BUS CABLE MUST BE PASSIVE (THEY CANNOT PROVIDE ENERGY TO THE SYSTEM, EXCEPT A LEAKAGE CURRENT OF 50 μA FOR EACH CONNECTED DEVICE) SEPARATELY POWERED EQUIPMENT REQUIRES A GALVANIC ISOLATION TO AFFIRM THAT THE INTRINSICALLY SAFE FIELDBUS CIRCUIT WILL REMAIN PASSIVE. THE PARAMETER OF THE CABLE USED TO INTERCONNECT THE DEVICES MUST BE IN THE FOLLOWING RANGE:

LOOP RESISTANCE R':	15...150 OHM/km
INDUCTANCE PER UNIT LENGTH L':	0.4...1mH/KM
CAPACITANCE PER UNLIT LENGTH C':	80...200nF

C' = C' LINE/LINE +0.5C' LINE/SCREEN, IF BOTH LINES ARE FLOATING, OR
C' = C' LINE/LINE +C' LINE/SCREEN, IF THE SCREEN IS CONNECTED TO ONE LINE

TRUNK CABLE LENGTH:	≤ 1000 m
SPUR CABLE LENGTH:	≤ 30 m
SPLICE LENGTH:	≤ 1 m

AN APPROVED INFALLIBLE LINE TERMINATION TO EACH END OF THE TRUNK CABLE, WITH THE FOLLOWING PARAMETERS IS APPROPRIATE:

R = 90...100 OHMS C = 2.2μF

AN ALLOWED TERMINATION MIGHT ALREADY BE LINKED IN THE ASSOCIATED APPARATUS. DUE TO I.S. REASONS, THE NUMBER OF PASSIVE APPARATUS CONNECTED TO THE BUS SEGMENT IS NOT LIMITED. IF THE RULES ABOVE ARE FOLLOWED, UP TO A TOTAL LENGTH OF 1000 m (THE SUMMATION OF TRUNK AND ALL SPUR CABLES), THE INDUCTANCE AND THE CAPACITANCE OF THE CABLE WILL NOT DAMAGE THE INTRINSIC SAFETY OF THE SYSTEM.

NOTES:
INTRINSICALLY SAFE CLASS I, DIV. 1, GROUPS A, B, C, D

1. THE MAXIMUM NON-HAZARDOUS AREA VOLTAGE MUST NOT EXCEED 250 V.
2. CAUTION: ONLY USE SUPPLY WIRES SUITABLE FOR 5°C ABOVE SURROUNDING TEMPERATURE.
3. WARNING: REPLACEMENT OF COMPONENTS MAY DAMAGE INTRINSIC SAFETY.

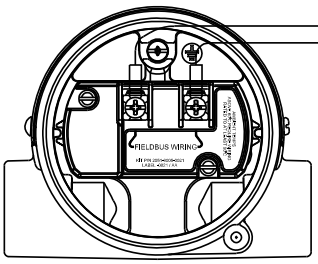
Rosemount Inc. 8200 Market Boulevard Chanhassen, MN 55317 USA			CAD MAINTAINED (MicroStation)
DR. Myles Lee Miller	SIZE A	FSCM NO	DWG NO. 02051-1009
ISSUED	SCALE N/A	WT. ———	SHEET 10 OF 13

Form Rev AC

REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AA				

HAZARDOUS (CLASSIFIED) LOCATION
CLASS I, DIVISION I, GROUPS A,B,C,D
CLASS II, DIVISION I, GROUPS E,F,G
CLASS III, DIVISION I

NON-HAZARDOUS AREA



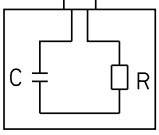
OUTPUT CODE F or W
MODELS INCLUDED
205IC, L, T

U_i = 17.5V
I_i = 380mA
P_i = 5.32W
C_i < 5nF
L_i < 10μH

ANY FM APPROVED ASSOCIATED APPARATUS SUITABLE FOR FISCO CONCEPT

ANY FM APPROVED INTRINSICALLY SAFE APPARATUS SUITABLE FOR FISCO CONCEPT

ANY FM APPROVED TERMINATION WITH R=90...100 Ohms C=0...2.2 uF



Rosemount Inc.
8200 Market Boulevard
Chanhassen, MN 55317 USA

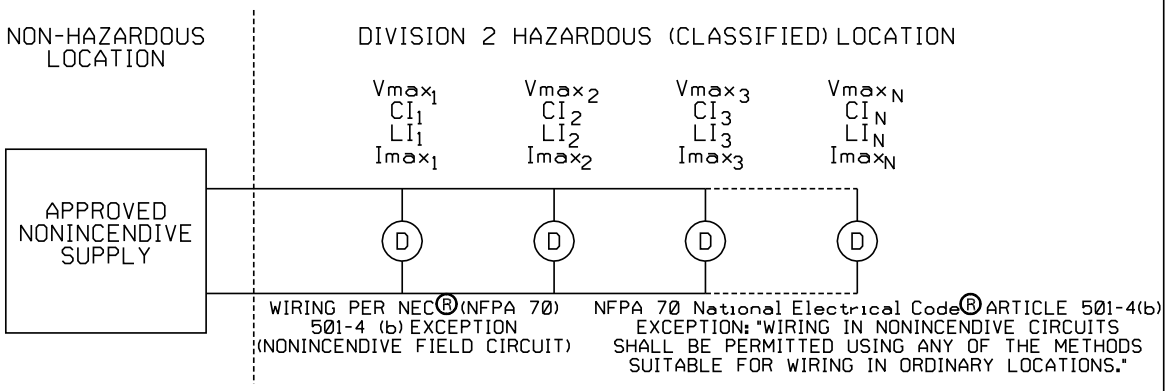
CAD MAINTAINED (MicroStation)

DR. Myles Lee Miller	SIZE A	FSCM NO	DWG NO. 02051-1009	
ISSUED	SCALE N/A	WT. ———	SHEET 11 OF 13	

Form Rev AC

REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AA				

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_{1_1} + C_{1_2} +... + C_{1_N} + Ccable

La <= L_{1_1} + L_{1_2} +... + L_{1_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 2051

	4-20mA/ HART	1-5 VDC/ HART	FIELDBUS (F or W)
Vmax	30v	30v	30v
Maximum normal operating current	22mA	3.1mA	27mA
Ca	.010uF	.020uF	0uF
La	10uH	10uH	0uH
La w/T1		.75mH	

ROSEMOUNT 2051 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.
8200 Market Boulevard
Chanhassen, MN 55317 USA

CAD MAINTAINED (MicroStation)

DR. Myles Lee Miller	SIZE A	FSCM NO	DWG NO. 02051-1009	
ISSUED	SCALE N/A	WT. ———	SHEET 12 OF 13	

Form Rev AC

REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AA				

NOTES:

1. NO REVISION TO THIS DRAWING WITHOUT PRIOR FM APPROVAL.
2. ASSOCIATED APPARATUS MANUFACTURER'S INSTALLATION DRAWING MUST BE FOLLOWED WHEN INSTALLING THIS EQUIPMENT.
3. DUST-TIGHT CONDUIT SEAL MUST BE USED WHEN INSTALLED IN CLASS II AND CLASS III ENVIRONMENTS.
4. CONTROL EQUIPMENT CONNECTED TO ASSOCIATED APPARATUS MUST NOT USE OR GENERATE MORE THAN 250 Vrms or Vdc.
5. RESISTANCE BETWEEN INTRINSICALLY SAFE GROUND AND EARTH GROUND MUST BE LESS THAN 1.0 OHM.
6. INSTALLATION SHOULD BE IN ACCORDANCE WITH ANSI/ISA-RP12.06.01 "INSTALLATION OF INTRINSICALLY SAFE SYSTEMS FOR HAZARDOUS (CLASSIFIED) LOCATIONS" AND THE NATIONAL ELECTRICAL CODE (ANSI/NFPA 70).
7. THE ASSOCIATED APPARATUS MUST BE FM APPROVED.
8. WARNING - SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY.
9. THE ENTITY CONCEPT ALLOWS INTERCONNECTION OF INTRINSICALLY SAFE APPARATUS WITH ASSOCIATED APPARATUS WHEN THE FOLLOWING IS TRUE:
   Vmax or U_i IS GREATER THAN or EQUAL TO Voc, Vt or Uo
   Imax or I_i IS GRETER THAN or EQUAL TO Isc, It or Io
   Pmax or P_i IS GRETER THAN or EQUAL TO Po
   Ca IS GREATER THAN or EQUAL TO THE SUM OF ALL C_i's PLUS Ccable
   La IS GREATER THAN or EQUAL TO THE SUM OF ALL L_i's PLUS Lcable
10. WARNING - TO PREVENT IGNITION OF FLAMMABLE OR COMBUSTIBLE ATMOSPHERES, DISCONNECT POWER BEFORE SERVICING.
11. THE ASSOCIATED APPARATUS MUST BE A RESISTIVELY LIMITED SINGLE OR MULTIPLE CHANNEL FM APPROVED BARRIER HAVEING PARAMETERS LESS THAN THOSE QUOTED, AND FOR WHICH THE OUTPUT AND THE COMBINATIONS OF OUTPUTS IS NON-IGNITION CAPABLE FOR THE CLASS, DIVISION AND GROUP OF USE.

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Canadian Standards Association (CSA)

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REVISIONS

REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AA	NEW RELEASE	RTC1025889	J.G.K.	4/21/08
AB	UPDATE PER CSA REQUIREMENT	RTC1026355	J.G.K.	6/18/08

APPROVALS FOR

2051C
2051L
2051T

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 5-7
OUTPUT CODES A,F,W I.S. ENTITY PARAMETERS SHEET 8-9

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 I.

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

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. Myles Lee Miller 4/15/08

CHK'D

APP'D.

APP'D. GOVT.

EMERSON. Process Management

ROSEMOUNT®
8200 Market Boulevard • Chanhassen, MN 55317 USA

TITLE INDEX OF I.S. CSA FOR 2051C/L/T

SIZE A | FSCM NO | DWG NO. 02051-1008

SCALE N/A | WT. ——— | SHEET 1 OF 9

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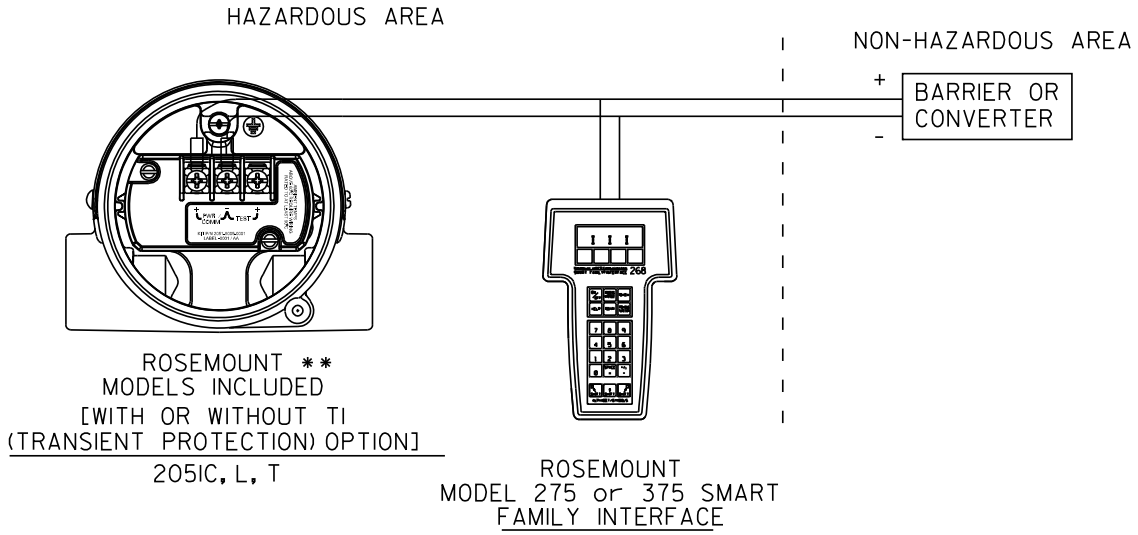
CSA INTRINSIC SAFETY APPROVALS

CIRCUIT CONNECTION WITH BARRIER OR CONVERTER

Ex ia

INTRINSICALLY SAFE/SECURITE INTRINSEQUE
4-20 mA, ("A" OUTPUT CODE)



** 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.

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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 275 or 375 SMART FAMILY INTERFACE.

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DR. Myles Lee Miller	SIZE A	FSCM NO	DWG NO. 02051-1008	
ISSUED	SCALE N/A	WT. ———	SHEET 3 OF 9	

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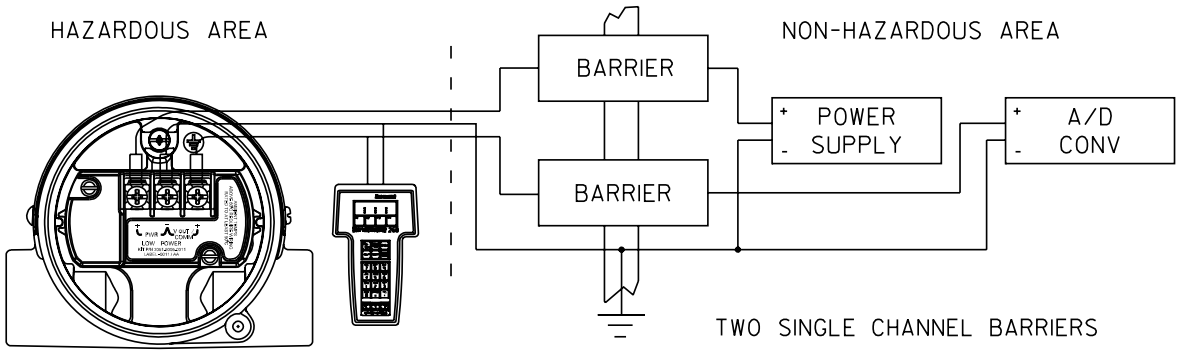
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AB				

CSA INTRINSIC SAFETY APPROVALS

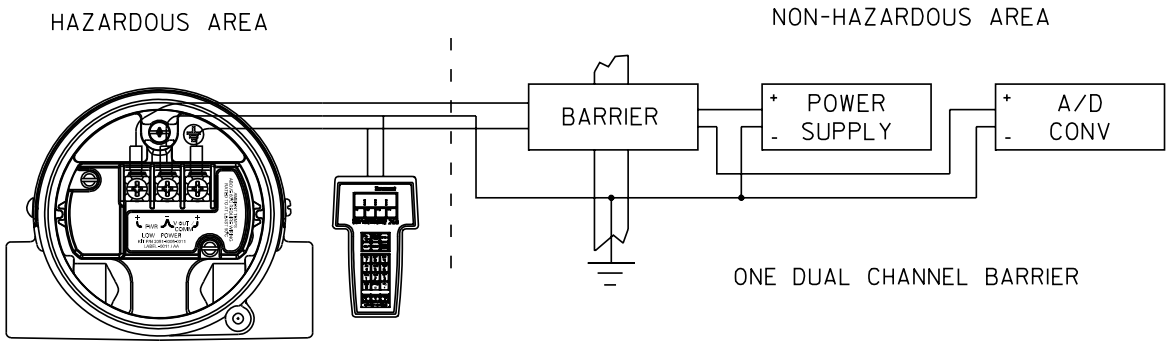
205IC LOW POWER CIRCUIT CONNECTION WITH INTRINSIC SAFETY BARRIERS

Ex ia

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



ROSEMOUNT MODEL 275 or 375



ROSEMOUNT MODEL 275 or 375

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.

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

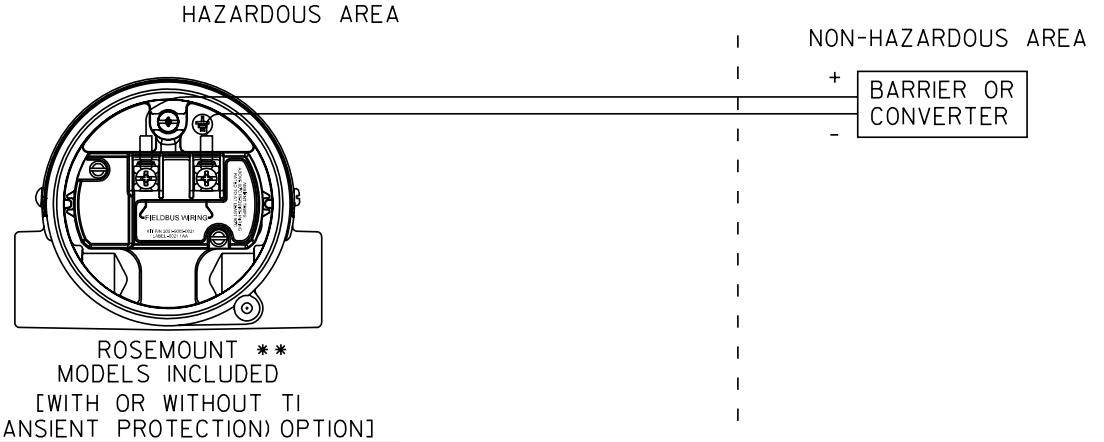
DEVICE	PARAMETERS	APPROVED FOR CLASS I, DIV.I
CSA APPROVED SAFETY BARRIER	30 V OR LESS 300 OHMS OR MORE 28 V OR LESS 235 OHMS OR MORE 25 V OR LESS 160 OHMS OR MORE 22 V OR LESS 100 OHMS OR MORE	GROUPS A, B, C, D

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]

205IC, L, T

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

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

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FISCO CONCEPT APPROVALS

THE FISCO CONCEPT ALLOWS INTERCONNECTION OF INTRINSICALY SAFE APPARATUS TO ASSOCIATED APPARATUS NOT SPECIALLY EXAMINED IN SUCH COMBINATION. FOR THIS INTERCONNECTION TO BE VALID THE VOLTAGE (U_1 or Vmax), THE CURRENT (I_1 or Imax), AND THE POWER (P_1 or Pma) THAT INTRINSICALLY SAVE APPARATUS CAN RECEIVE AND REMAIN INTRINSICALY SAFE, INCLUDING FAULTS, MUST BE EQUAL OR GREATER THAN THE VOLTAGE (Uo, Voc, or Vt), THE CURRENT (Io, Isc, or It), AND THE POWER (Po or Pmax) LEVELS WHICH CAN BE DELIVERED BY THE ASSOCIATED APPARATUS, CONSIDERING FAULTS AND APPLICABLE FACTORS. ALSO, THE MAXIMUM UNPROTECTED CAPACITANCE (C_1) AND THE INDUCTANCE (L_1) OF EACH APPARATUS (BESIDES THE TERMINATION) CONNECTED TO THE FIELDBUS MUST BE LESS THAN OR EQUAL TO 5nF AND 10μH RESPECTVELY.
ONLY ONE ACTIVE DEVICE IN EACH SECTION (USUALLY THE ASSOCIATED APPARATUS) IS ALLOWED TO CONTRIBUTE THE DESIRED ENERGY FOR THE FIELDBUS SYSTEM. THE ASSOCIATED APPARATUS' VOLTAGE Uo (or Voc or Vt) IS LIMITED TO A RANGE OF 14V TO 24 V.D.C. ALL OTHER EQUIPENT COMBINED IN THE BUS CABLE MUST BE PASSIVE (THEY CANNOT PROVIDE ENERGY TO THE SYSTEM, EXCEPT A LEAKAGE CURRENT OF 50 μA FOR EACH CONNECTED DEVICE) SEPARATELY POWERED EQUIPMENT REQUIRES A GALVANIC ISOLATION TO AFFIRM THAT THE INTRINSICALLY SAFE FIELDBUS CIRCUIT WILL REMAIN PASSIVE. THE PARAMETER OF THE CABLE USED TO INTERCONNECT THE DEVICES MUST BE IN THE FOLLOWING RANGE:

LOOP RESISTANCE R':	15...150 OHM/km
INDUCTANCE PER UNIT LENGTH L':	0.4...1mH/KM
CAPACITANCE PER UNLIT LENGTH C':	80...200nF

C' = C' LINE/LINE +0.5C' LINE/SCREEN, IF BOTH LINES ARE FLOATING, OR
C' = C' LINE/LINE +C' LINE/SCREEN, IF THE SCREEN IS CONNECTED TO ONE LINE

TRUNK CABLE LENGTH:	$\leq$ 1000 m
SPUR CABLE LENGTH:	$\leq$ 30 m
SPLICE LENGTH:	$\leq$ 1 m

AN APPROVED INFALLIBLE LINE TERMINATION TO EACH END OF THE TRUNK CABLE, WITH THE FOLLOWING PARAMETERS IS APPROPRIATE:

R = 90...100 OHMS C = 2.2μF

AN ALLOWED TERMINATION MIGHT ALREADY BE LINKED IN THE ASSOCIATED APPARATUS. DUE TO I.S. REASONS, THE NUMBER OF PASSIVE APPARATUS CONNECTED TO THE BUS SEGMENT IS NOT LIMITED. IF THE RULES ABOVE ARE FOLLOWED, UP TO A TOTAL LENGTH OF 1000 m (THE SUMMATION OF TRUNK AND ALL SPUR CABLES), THE INDUCTANCE AND THE CAPACITANCE OF THE CABLE WILL NOT DAMAGE THE INTRINSIC SAFETY OF THE SYSTEM.

NOTES:
INTRINSICALLY SAFE CLASS I, DIV. 1, GROUPS A, B, C, D

1. THE MAXIMUM NON-HAZARDOUS AREA VOLTAGE MUST NOT EXCEED 250 V.
2. CAUTION: ONLY USE SUPPLY WIRES SUITABLE FOR 5°C ABOVE SURROUNDING TEMPERATURE.
3. WARNING: REPLACEMENT OF COMPONENTS MAY DAMAGE INTRINSIC SAFETY.

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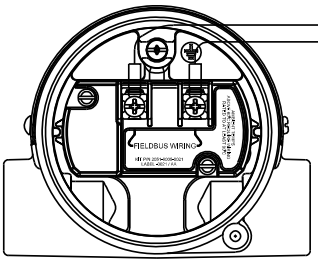
HAZARDOUS (CLASSIFIED) LOCATION
CLASS I, DIVISION 1, GROUPS A,B,C,D
CLASS II, DIVISION 1, GROUPS E,F,G
CLASS III, DIVISION 1

NON-HAZARDOUS AREA

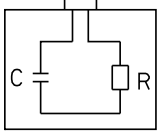
ANY CSA APPROVED ASSOCIATED APPARATUS SUITABLE FOR FISCO CONCEPT



OUTPUT CODE F or W
MODELS INCLUDED
205IC, L, T

ANY CSA APPROVED INTRINSICALLY SAFE APPARATUS SUITABLE FOR FISCO CONCEPT

ANY CSA PPROVED TERMINATION WITH
R=90...100 Ohms
C=0...2.2 uF



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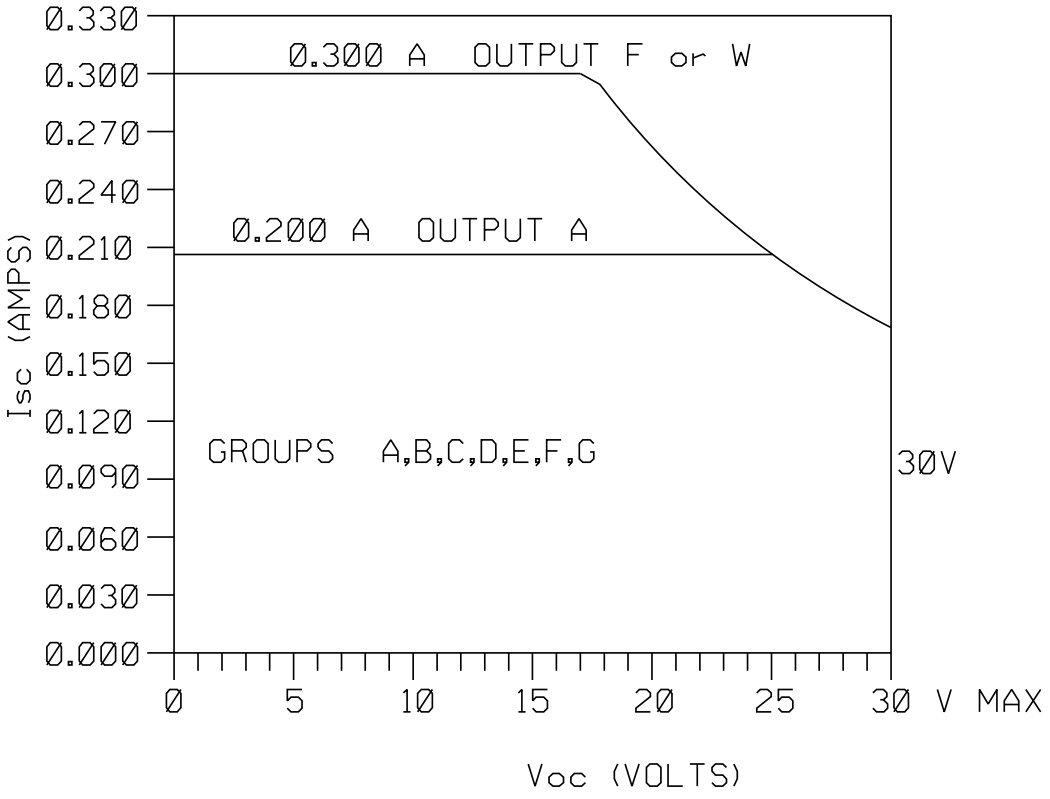
2051 I.S. ENTITY PARAMETERS. (OUTPUT CODE A,F, or W)

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

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



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ISSUED	SCALE N/A	WT. ———	SHEET 8 OF 9

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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 (C_a) 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 (L_a) 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
CLASS I, DIV. 1, GROUPS A, B, C AND D: CLASS I, ZONE Ø, GROUP IIC

V_T = 30V	V_{OC} IS LESS THAN OR EQUAL TO 30V
I_T = 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 OUTPUT CODE F or W
CLASS I, DIV. 1, GROUPS A, B, C AND D: CLASS I, ZONE Ø, GROUP IIC

V_T = 30V	V_{OC} IS LESS THAN OR EQUAL TO 30V
I_T = 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 = Ø µf	C_A IS GREATER THAN Ø µf + C CABLE
L_I = Ø µH	L_A IS GREATER THAN Ø µH + L CABLE

FOR OUTPUT CODE M
CLASS I, DIV. 1, GROUPS A, B, C AND D: CLASS I, ZONE Ø, GROUP IIC

V_T = 30V	V_{OC} IS LESS THAN OR EQUAL TO 30V
I_T = 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 = .02µf	C_A IS GREATER THAN .01µf + C CABLE
L_I =10µH	L_A IS GREATER THAN 10µH + L CABLE

* FOR T1 OPTION:

L_I =0.75mH	

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

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Appendix C Glossary

Some of the terms used in this manual relate specifically to the operation of Rosemount transmitters, hand-held HART Communicators, and other Rosemount products. The following list provides brief definitions. See the sections listed for additional information.

Analog Output Trim
Digital trim operation that allows adjustment of the output electronics to conform to the plant standard of current. Two types of analog output trim are available: 4–20 mA output trim and 4–20 mA other scale.

Cloning
Off-line operation that uses a HART-based communicator to copy configuration data from one transmitter to one or more other transmitters that require the same data.

Commissioning
Functions performed with the HART-based communicator and the transmitter that test the transmitter and test the loop, and verify transmitter configuration data.

Configuration
Process of setting parameters that determine how the transmitter operates.

Damping
Output function that increases the response time of the transmitter to smooth the output when there are rapid input variations.

Descriptor
Sixteen-character field for additional identification of the transmitter, its use, or location. The descriptor is stored in the transmitter and can be changed using the HART-based communicator.

Digital Trim
Format function that allows you to adjust the transmitter characterization for purposes of digital calibration to plant standards. Digital trim includes two separate operations: sensor trim and analog output trim.

Failure Mode Alarm
Transmitter function that drives the analog output to a jumper-selectable high or low value in the event of an electronics failure.

Factory Characterization
Factory process during which each sensor module is subjected to pressures and temperatures covering the full operating range.
The sensor module memory stores data generated from this process for use by the microprocessor in correcting the transmitter output during operation.

Full Trim
Sensor trim function in which two accurate, end-point pressures are applied and all output is linearized between them. The selected end points should always be equal to or outside the LRV and URV.

HART (Highway Addressable Remote Transducer) Protocol
Communications standard that provides simultaneous analog and digital signal transmission between control rooms and field devices such as transmitters.

Lower Range Limit (LRL) Lowest value of the measured variable that the transmitter can be configured to measure.

Lower Range Value (LRV) Lowest value of the measured variable that the analog output of the transmitter is currently configured to measure.

Multidropping The connection of several transmitters to a single communications transmission line. Communication between the host and the transmitters takes place digitally with the analog output of the transmitters deactivated.

Reranging Configuration function that changes the transmitter 4 and 20 mA settings.

Send Data HART-based communicator command that transfers configuration data from the hand-held communicator's memory to the transmitter memory.

Sensor Trim Digital trim function that allows you to adjust the digital process variable reading to a precise pressure input. Zero trim and sensor trim are the two sensor trim functions.

Smart Term used to describe instruments that are microprocessor-based and feature advanced communications capabilities.

Span Algebraic difference between the upper and lower range values.

Tag Eight-character field for identifying the transmitter. The tag is stored in the transmitter and can be changed using the HART Communicator and the transmitter information function.

Transmitter Address Unique number (1-15) used to identify a multidropped transmitter. Transmitters that are not multidropped have 0 as an address.

Transmitter Security Jumper-selectable feature that prevents accidental or deliberate changes to configuration data.

Upper Range Limit (URL) Highest value of the measured variable that the transmitter can be configured to measure.

Upper Range Value (URV) Highest value of the measured variable that the analog output of the transmitter is currently configured to measure.

Zero Trim A zero-based, one-point adjustment used in differential pressure applications to compensate for mounting position effects or zero shifts caused by static pressure.

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Reference Manual
00809-0100-4101, Rev AA
July 2008

Rosemount 2051

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Emerson Process Management

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