Reference Manual
00809-0100-4101, Rev BB
March 2024

Rosemount™ 2051 Pressure Transmitter

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

HART COMMUNICATION PROTOCOL

ROSEMOUNT™

EMERSON™

⚠ WARNING

Read this manual before working with the product. For personal and system safety, and for optimum product performance, ensure the contents are thoroughly understood before installing, using, or maintaining this product.

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 representative.

⚠ 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 Approval Information 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/plameproof installation, do not remove the transmitter covers when power is applied to the unit.

Process leaks could result in death or serious injury.

Install and tighten process connectors before applying pressure.

Electrical shock could cause 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 could cause 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 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 as spare parts.

Refer to Spare Parts 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.

⚠ 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 Sales Representative.

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1 Introduction

1.1 Service support

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

Within the United States, contact Emerson.com/Contact. 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 representatives will explain the additional information and procedures necessary to return goods exposed to hazardous substances.

1.2 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

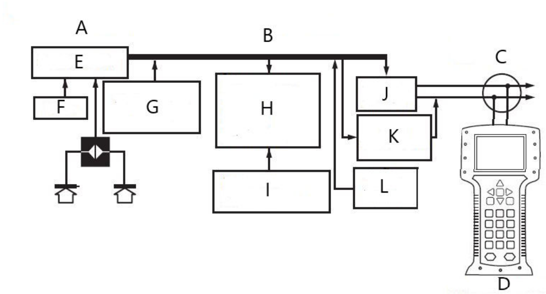
1.3 Transmitter overview

The Rosemount 2051C Coplanar design is offered for Differential Pressure (DP) and Gage Pressure (GP) measurements where it uses Emerson capacitance sensor technology. Piezoresistive sensor technology is used 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



A. *Sensor module*
B. *Electronics board*
C. *4-20 mA signal to control system*
D. *HART communicator*
E. *Signal processing*
F. *Temperature*
G. *Sensor module memory*
H. *Microcomputer*
    - *Sensor linearization*
    - *Rerange*
    - *Damping*
    - *Diagnostics*
    - *Engineering*
    - *Communication*
I. *Module memory*
J. *Digital-to-analog conversion*
K. *Digital communication*
L. *Local span and zero adjustment (optional)*

2 Installation

2.1 Overview

The information in this section covers installation considerations for the Rosemount 2051 with HART® protocols. A Quick Start Guide for HART protocol is shipped with every transmitter to describe basic pipe-fitting and wiring procedures for initial installation. Dimensional drawings for each Rosemount 2051 variation and mounting configuration are included in Dimensional Drawings.

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.

2.2 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.

Note
Install the enclosed pipe plug in unused conduit opening with a minimum of five threads engaged to comply with explosion-proof requirements.

For material compatibility considerations, see Corrosion and Its Effects data sheet.

2.3 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.

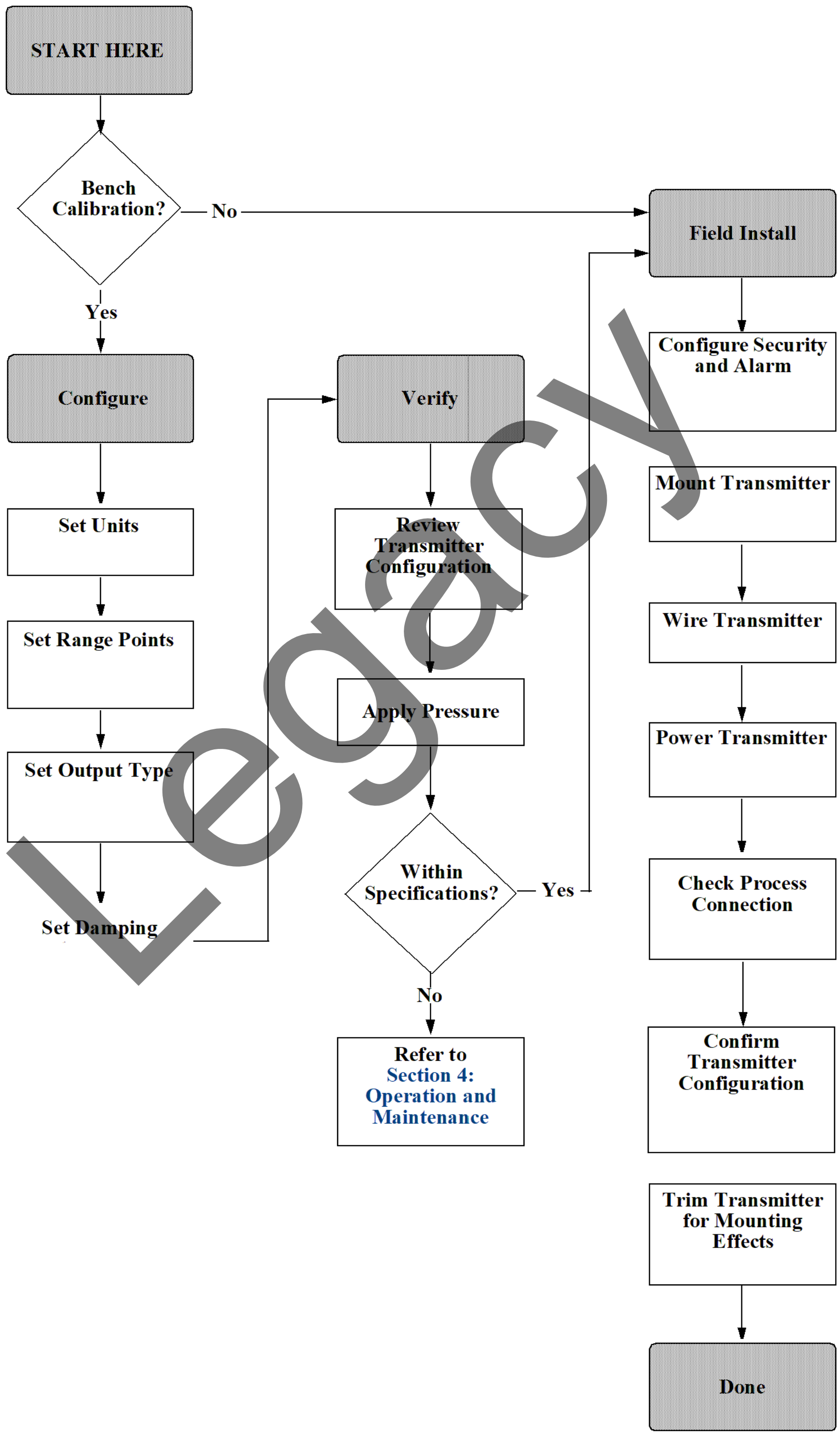
Note
When the transmitter is mounted on its side, position the Coplanar flange to ensure proper venting or draining. Mount the flange as shown in Installation examples , keeping drain/ vent connections on the bottom for gas service and on the top for liquid service.

2.4 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 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.

2.5 HART™ Installation Flowchart

Figure 2-1: HART Installation Flowchart



2.5.1 Installation Procedures

Dimensional Drawings

2.5.2 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.

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 2-1 for the complete offering and see Figure 2-2 through Figure 2-5 for dimensions and mounting configurations.

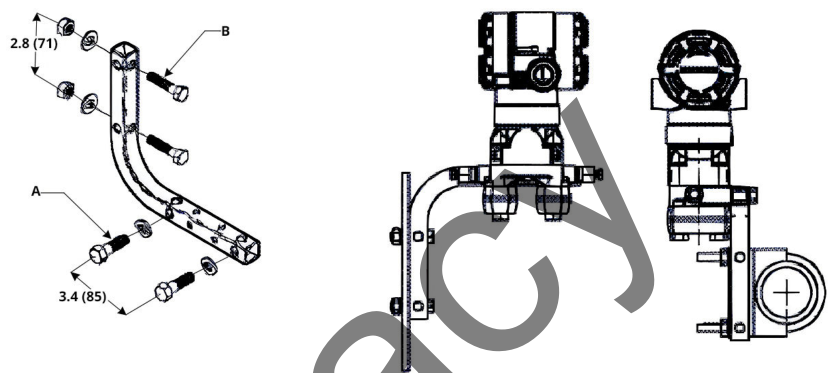
Table 2-1: Mounting Brackets

2051 brackets										
Option code	Process connections			Mounting			Materials			
	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

Table 2-1: Mounting Brackets *(continued)*

2051 brackets										
Option code	Process connections			Mounting			Materials			
	Coplanar	In-line	Traditional	Pipe mount	Panel mount	Flat panel mount	CS bracket	SST bracket	CS bolts	SST bolts
BC			X			X		X		X

Figure 2-2: Mounting Bracket Option Code B4



A. 3/8–16 3 11/4 bolts for mounting to transmitter
B. 5/16 3 11/2 bolts for panel mounting (not supplied)

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

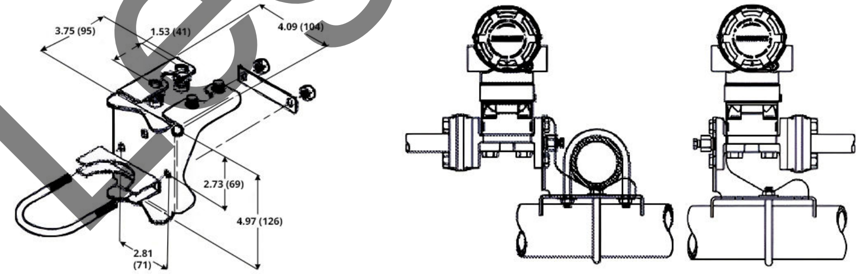
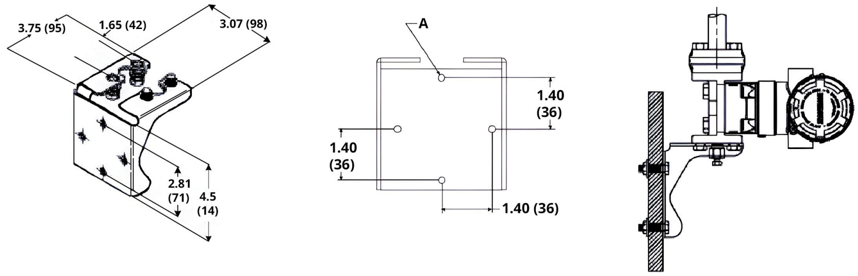


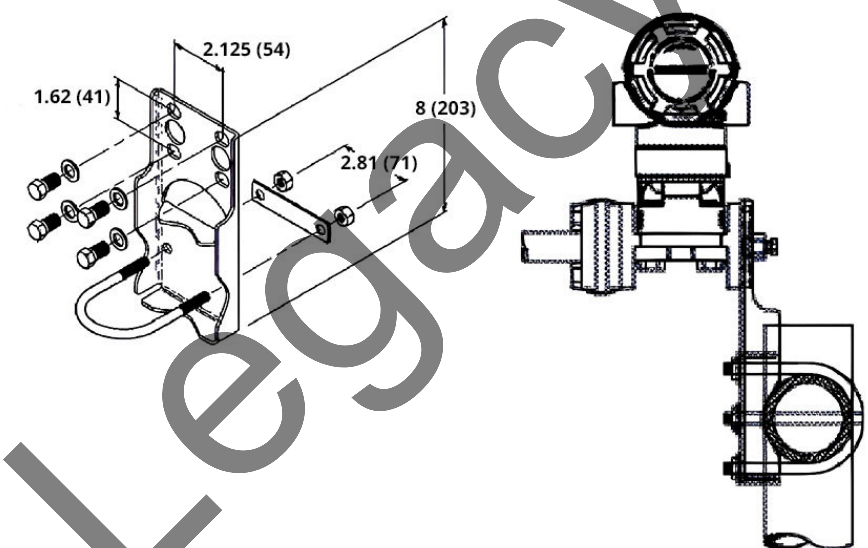
Figure 2-4: Panel Mounting Bracket Option Codes B2 and B8



A. *Mounting holes 0.375 diameter (10)*

Note
Dimensions are in inches (millimeters).

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



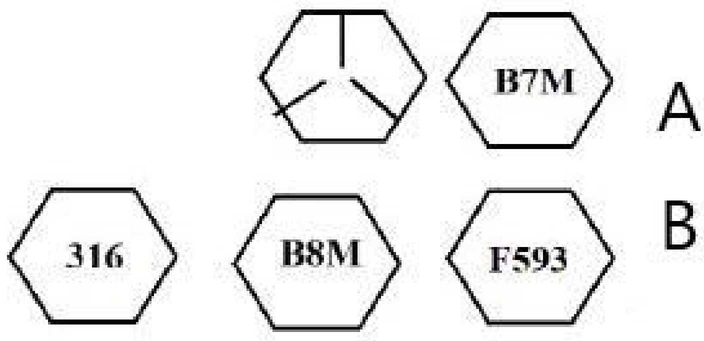
Note
Dimensions are in inches (millimeters).

Flange bolts

The 2051 is shipped with a Coplanar flange installed with four 1.75-in. (44 mm) flange bolts. See Traditional flange bolt configurations and Mounting bolts and bolt configurations for coplanar flange. 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:

Figure 2-6: Flange bolt head markings



A. *Carbon Steel (CS) head markings*
B. *Stainless Steel (SS) head markings*

Note
The last digit in the F593 head marking may be any letter between A - M.

Bolt installation

NOTICE

Only use bolts supplied with the 2051 or provided by Emerson 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).

Procedure

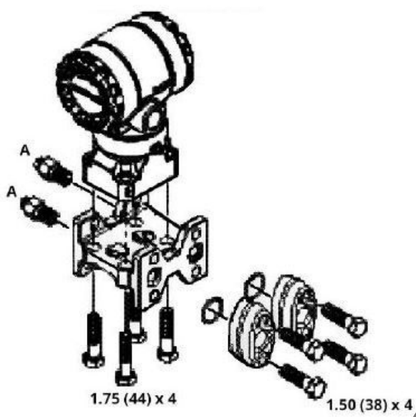
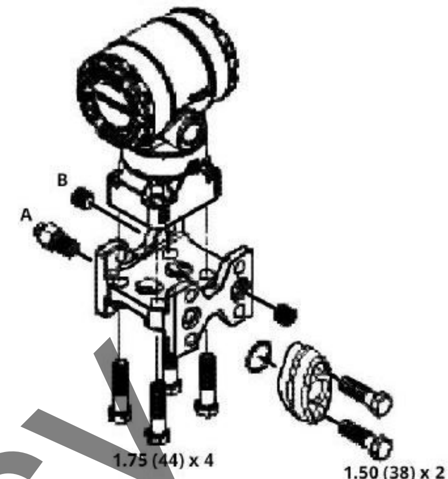
1. Finger-tighten the bolts.
2. Torque the bolts to the initial torque value using a crossing pattern.
3. Torque the bolts to the final torque value using the same crossing pattern.

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

Table 2-2: 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)

Table 2-3: Traditional flange bolt configurations

<table>
<tr><th>Differential transmitter</th><th>Gauge transmitter</th></tr>
<tr><td>
</td><td>
</td></tr>
</table>

a. Drain/vent
b. Plug

Table 2-4: Mounting bolts and bolt configurations for coplanar flange

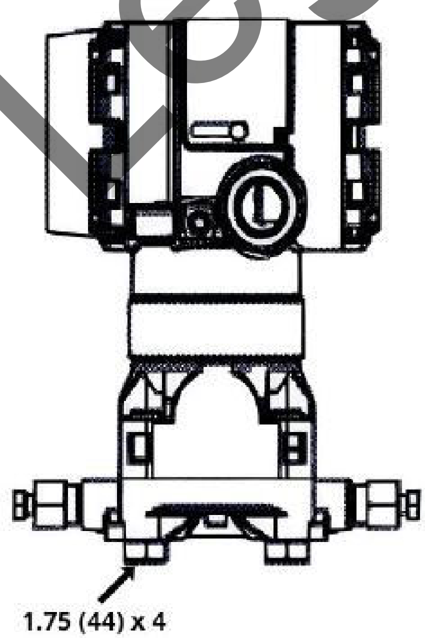
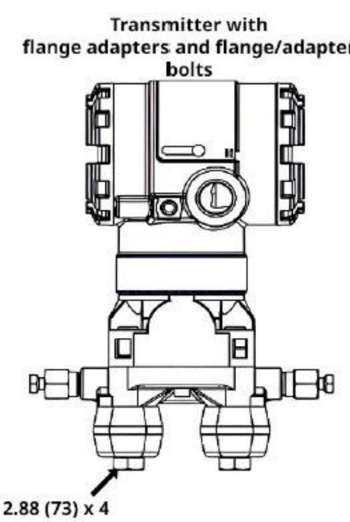
<table>
<tr><th>Transmitter with flange bolts</th><th>Transmitter with flange adapters and flange/adapter bolts</th></tr>
<tr><td>
</td><td>
</td></tr>
</table>

Table 2-5: Bolts

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

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

2.5.3 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
- 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.
- Ensure 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 Installation examples 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

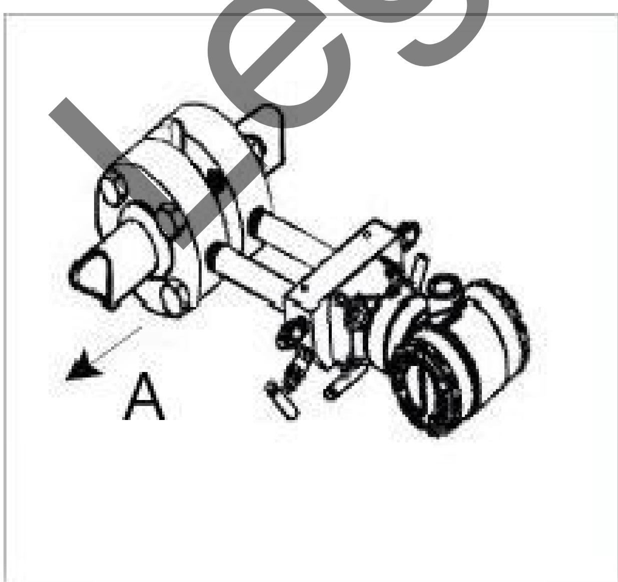
- Place taps to the side of the line.
- Mount the transmitter below the taps to ensure that impulse piping will remain filled with condensate.
- In steam service above 250 °F (121 °C), fill impulse lines with water to prevent steam from contacting the transmitter directly and to ensure accurate measurement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

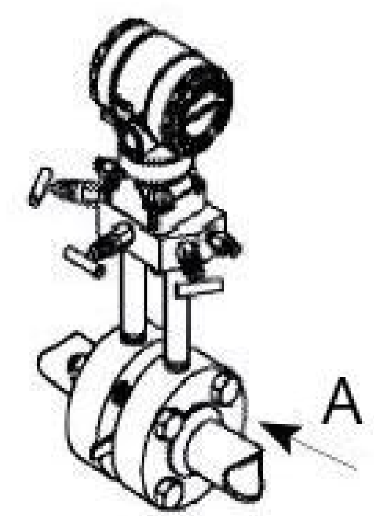
Installation examples

Figure 2-7: Liquid service



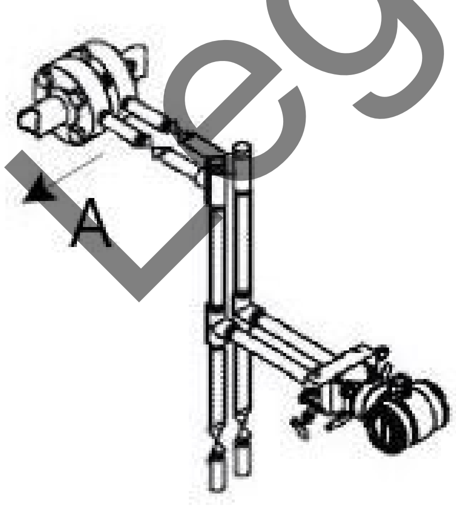
A. Flow

Figure 2-8: Gas service



A. Flow

Figure 2-9: Steam service



A. Flow

2.5.4 Process connections

⚠ WARNING

Failure to install proper flange adapter O-rings may cause process leaks, which can result in death or serious injury. The two flange adapters are distinguished by unique O-ring grooves. Only use the O-ring that is designed for its specific flange adapter.

NOTICE

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 adapters

Note
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 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:

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 for torque specifications.

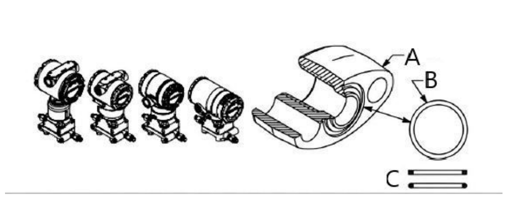
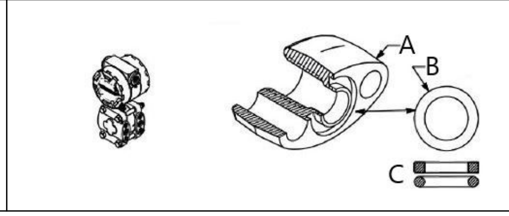
   Whenever you remove flanges or adapters, visually inspect the PTFE O-rings. Replace with O-ring designed for Rosemount transmitter if there are any signs of damage, such as nicks or cuts. Undamaged O-rings may be reused. If you replace the O-rings, retorque the flange bolts after installation to compensate for cold flow. Refer to the process sensor body reassembly procedure in Troubleshooting .

Process connections

O-rings

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

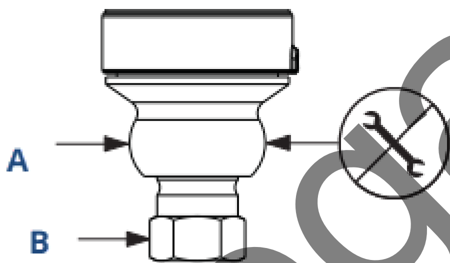
Table 2-6: O-rings

Rosemount 3051S/3051/2051/3001/3095/2024	Rosemount 1151
	

A. Flange adapter
B. O-ring
C. PTFE based elastomer

Note
When compressed, PTFE O-rings tend to "cold flow," which aids in their sealing capabilities. PTFE O-rings should be replaced if the flange adapter is removed.

Inline process connection



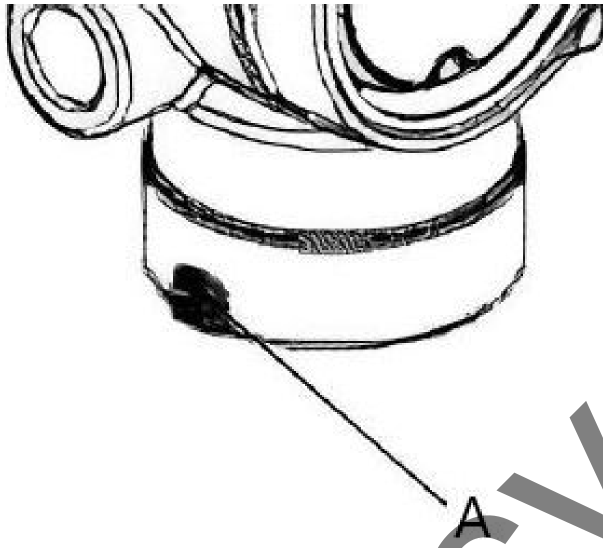
2.5.5 Housing rotation

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.

Procedure

1. Loosen the housing rotation set screw using a 5/64-in. hex wrench.
2. Turn the housing left or right up to 180 degrees from its original position. Over-rotating will damage the transmitter.
3. Re-tighten the housing rotation set screw.

Figure 2-10: Housing rotation

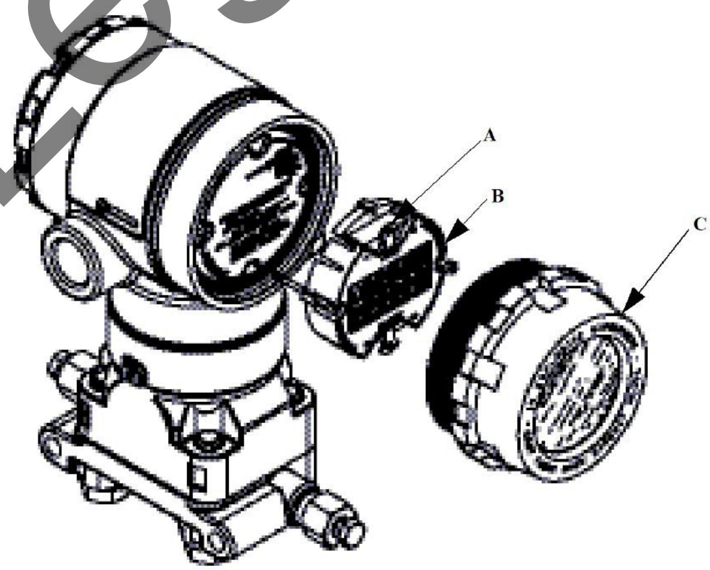


a. Housing rotation set screw (5/64-in)

2.5.6 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



A. Jumpers (top and bottom)
B. LCD display
C. Extended cover

2.5.7 Configure security and alarm

Security (Write protect)

There are three security methods with the Rosemount 2051 transmitter:

Procedure

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:

⚠ CAUTION

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.

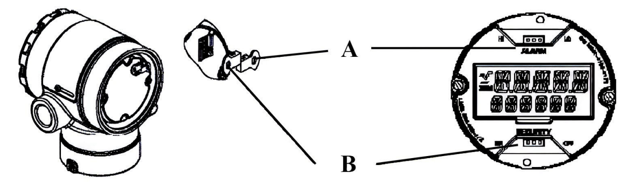
Procedure

1. Remove the housing cover opposite the field terminal side. Do not remove the transmitter covers in explosive atmospheres when the circuit is live.
2. 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.
3. 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

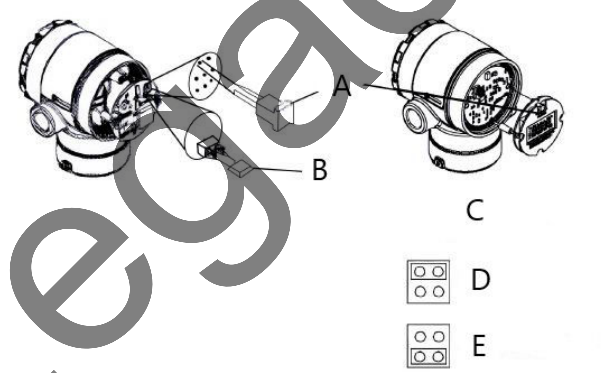
4-20 mA HART	
Without LCD meter	**With LCD display**



- A. *Alarm*
- B. *Security*

Figure 2-13: Low Power transmitter electronics boards

1-5 Vdc HART low power	
Without LCD meter	**With LCD display**



- A. *Alarm*
- B. *Security*
- C. *Transmitter security jumper positions*
- D. *Write protect ON*
- E. *Write protect OFF*

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

2.6 Electrical considerations

Note
Ensure all electrical installation is in accordance with national and local code requirements.

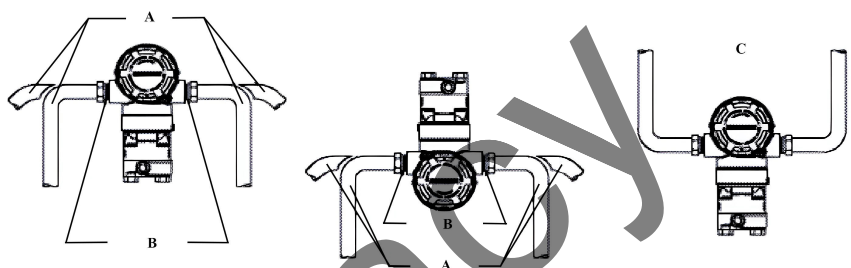
2.6.1 Conduit installation

⚠ CAUTION

If all connections are not sealed, excess moisture accumulation can damage the transmitter. Ensure 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



A. Possible conduit line positions
B. Sealing compound
C. Conduit lines

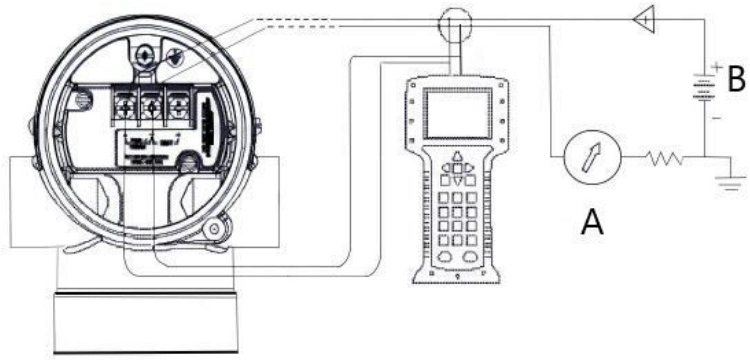
2.6.2 Wiring

⚠ 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.

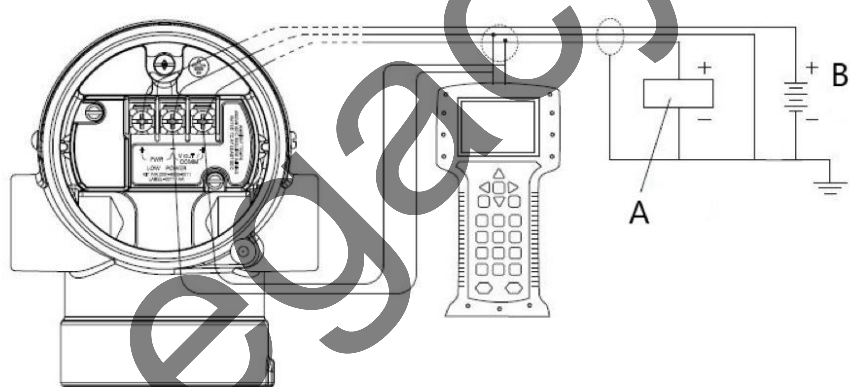
Note
Use shielded twisted pairs to yield best results. To ensure proper communication, use 24 AWG or larger wire, and do not exceed 5000 feet (1500 meters).

Figure 2-15: 4-20 mA HART wiring



A. $R_L \geq 250\Omega$
B. Power supply

Figure 2-16: 1-5 VDC low power wiring



A. Voltmeter
B. Power supply

Perform the following procedure to make wiring connections:

Procedure

1. Remove the housing cover on terminal compartment side.

⚠ CAUTION

Do not remove the cover in explosive atmospheres when the circuit is live. Signal wiring supplies all power to the transmitter.

   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 +.

2. 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.

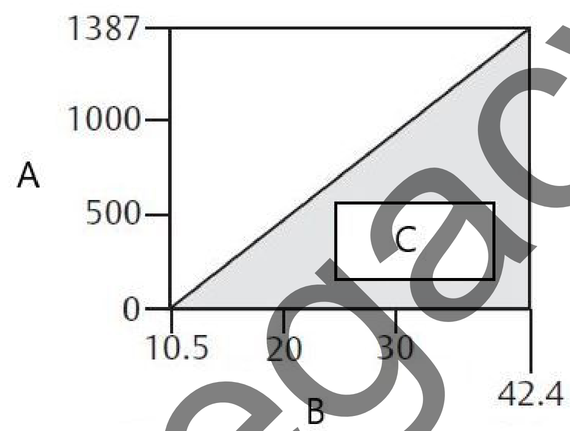
Power supply for 4-20 mA HART

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, must not have more than 20 ohms of impedance at 1200 Hz.

Figure 2-17: Load limitation



A. Load (Ωs)
B. Voltage (VDC)
C. Operating region

Note

Maximum Loop Resistance = 43.5 * (Power supply voltage – 10.5)

Communication requires a minimum loop resistance of 250 ohms.

The HART communicator requires a minimum loop resistance of 250 Ω 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

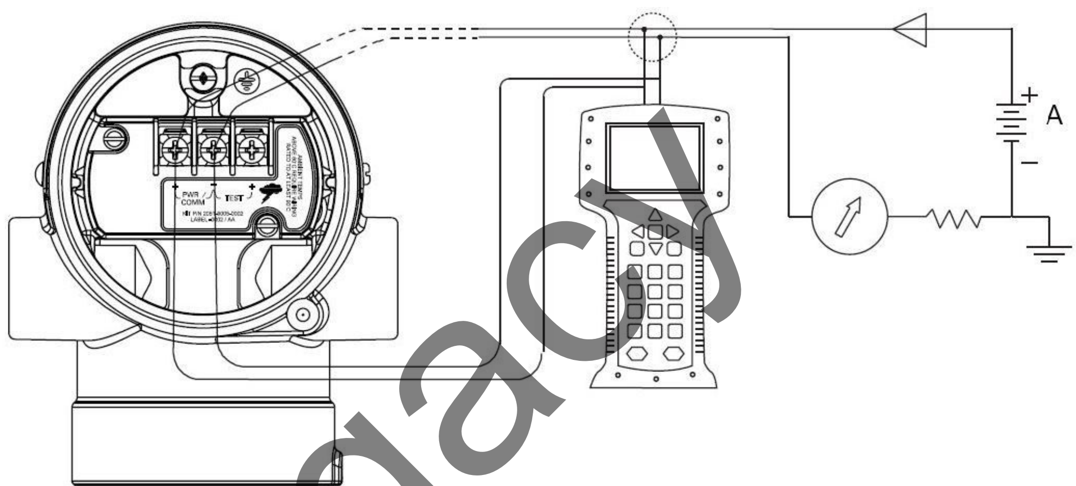
Low power transmitters operate on 9–28 Vdc. The dc power supply should provide power with less than two percent ripple. The V_{out} load should be 100 kΩ or greater.

2.6.3 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.

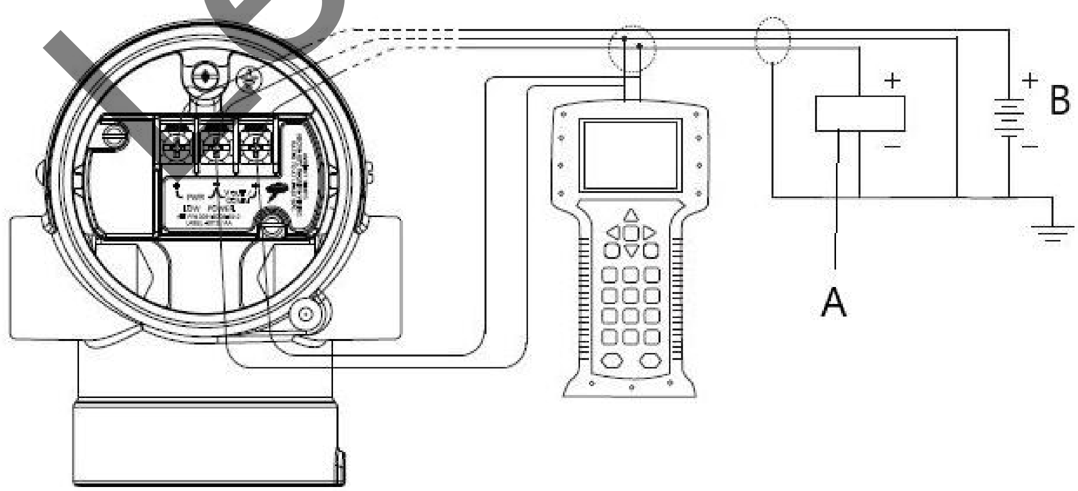
The transient protection terminal block can be ordered as an installed option (Option Code T1 in the transmitter model number) or as a spare part to retrofit existing 2051 transmitters in the field. See for spare part numbers. The lightning bolt symbol shown in Figure 2-18 and Figure 2-18 identifies the transient protection terminal block.

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



A. Power supply

Figure 2-19: 1-5 VDC low power wiring with transient protection



A. Voltmeter
B. Power supply

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

2.6.4 Grounding

NOTICE

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.

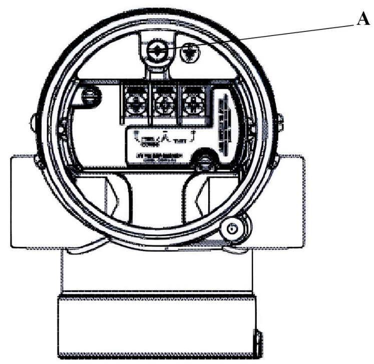
For 1-5 Vdc HART Low Power output, the power wires may be grounded at only one point or left ungrounded. The negative terminal of the power supply is a recommended grounding point.

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:

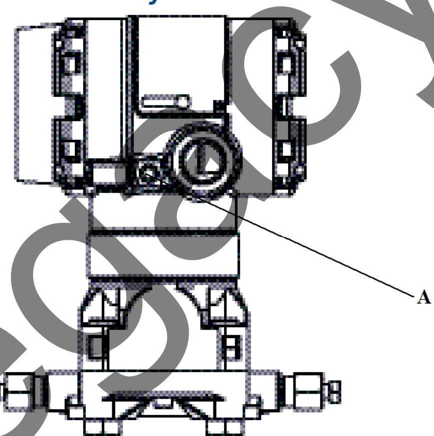
- **Internal Ground Connection**: The Internal Ground Connection screw is inside the FIELD TERMINALS side of the electronics housing. This screw is identified by a ground symbol (⏚). The ground connection screw is standard on all Rosemount 2051 transmitters. Refer to Figure 2-20.
- **External Ground 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 Figure 2-21 for location of the External Ground Screw.

Figure 2-20: Internal ground screw



A. Internal ground connection screw

Figure 2-21: External ground assembly



A. External ground assembly

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

2.7 Hazardous locations certifications

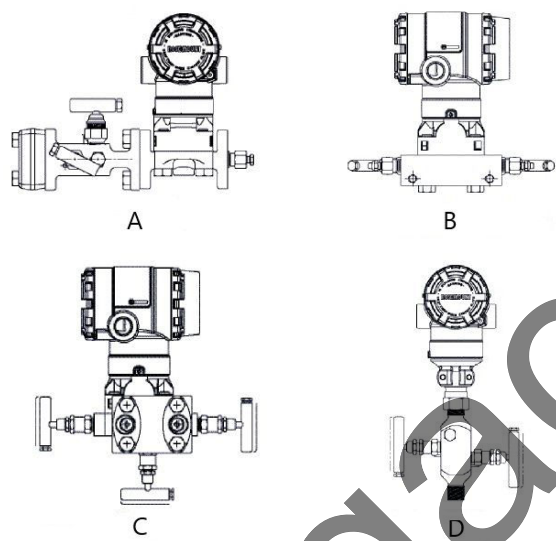
NOTICE

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 for information on these approvals.

2.8 Rosemount 304, 305, and 306 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



A. 2051C and 304 Conventional
B. 2051C and 305 Integral Coplanar
C. 2051C and 305 Integral Traditional
D. 2051T and 306 Inline

2.8.1 Rosemount 304 Conventional Manifold installation procedure

To install a 304 Conventional Manifold to a 2051 transmitter:

Procedure

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 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.

2.8.2 Rosemount 305 Integral Manifold installation procedure

To install a 305 Integral Manifold to a 2051 transmitter:

Procedure

1. Inspect the PTFE sensor module O-rings.

   Note
   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.

   Note
   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 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.

2.8.3 Rosemount 306 Integral Manifold installation procedure

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

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

2.8.4 Integral manifold operation

Table 2-7: Three-valve configuration

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

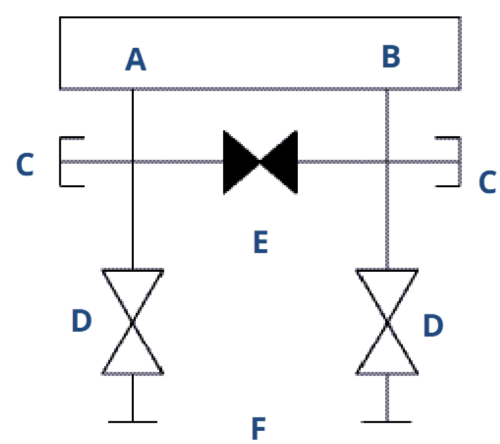
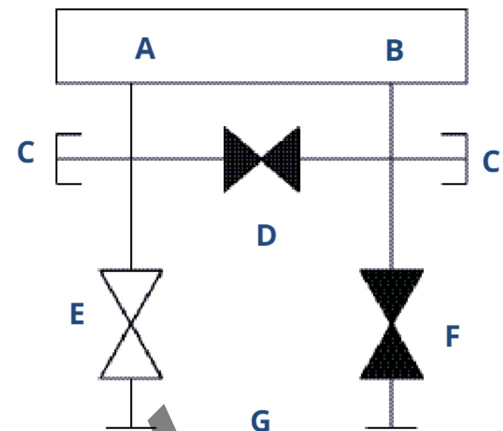
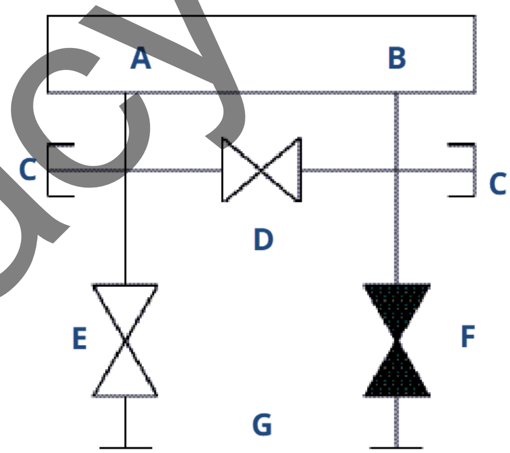


Table 2-7: Three-valve configuration *(continued)*

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.

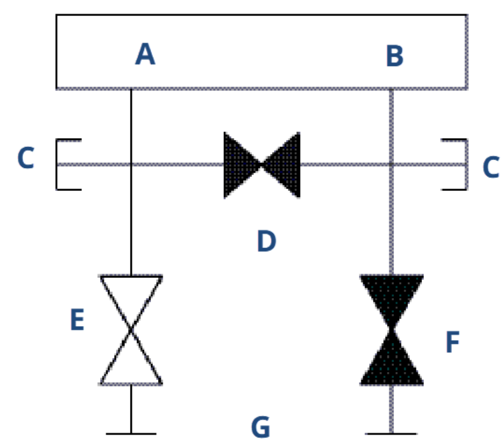
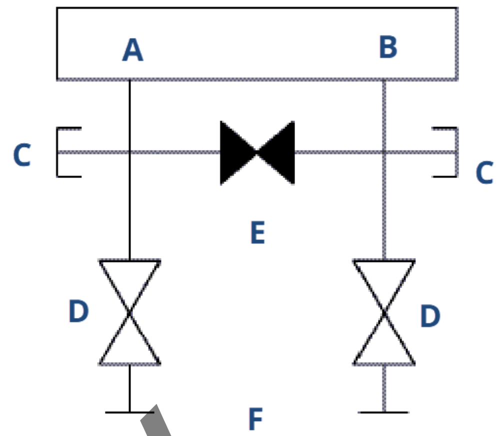


Table 2-7: Three-valve configuration *(continued)*

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

2.9 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.

2.9.1 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.

2.9.2 Closed vessels

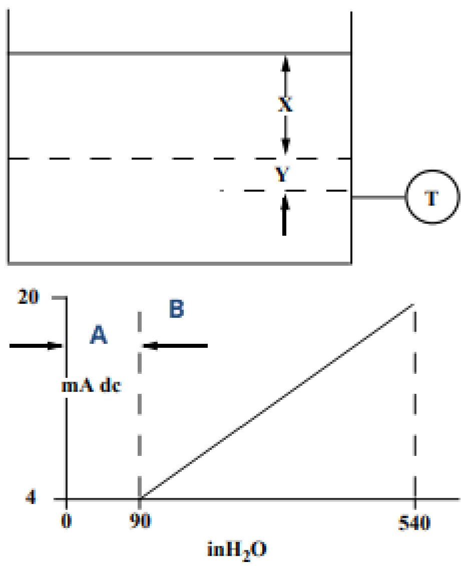
Pressure above a liquid affects the pressure measured at the bottom of a closed vessel. The liquid specific gravity multiplied by the liquid height plus the vessel pressure equals the pressure at the bottom of the vessel.

To measure true level, you must subtract the vessel pressure 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



A. *Zero*
B. *Suppression*

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.).

Leg *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

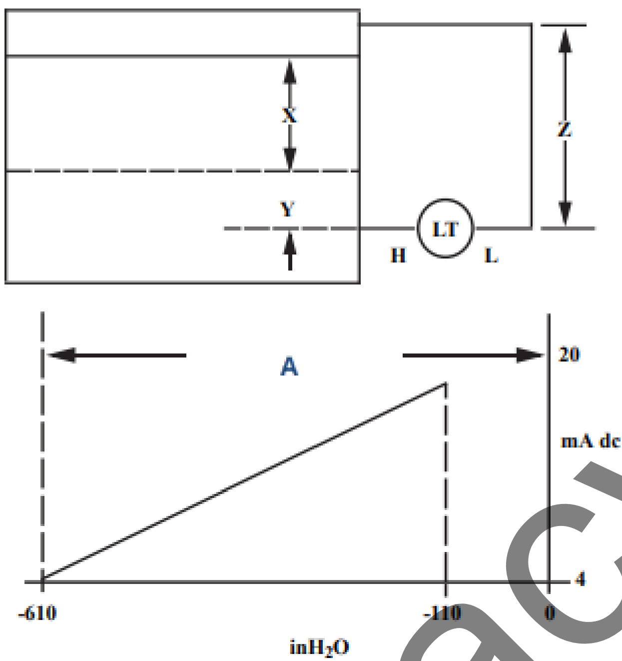
Range = 90 to 540 inH_2O

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 SG_1 equal the specific gravity of the fluid (1.0).

Let 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 $h = (X)(SG_1)$

= 500 x 1.0

= 500 inH_2O

$e = (Y)(SG_1)$

= 50 x 1.0

= 50 inH_2O

$s = (Z)(SG_2)$

= 600 x 1.1

= 600 inH_2O

Range = $e - s$ to $h + e - s$

= 50 - 660 to 500 + 50 - 660

= -610 to - 110 inH_2O

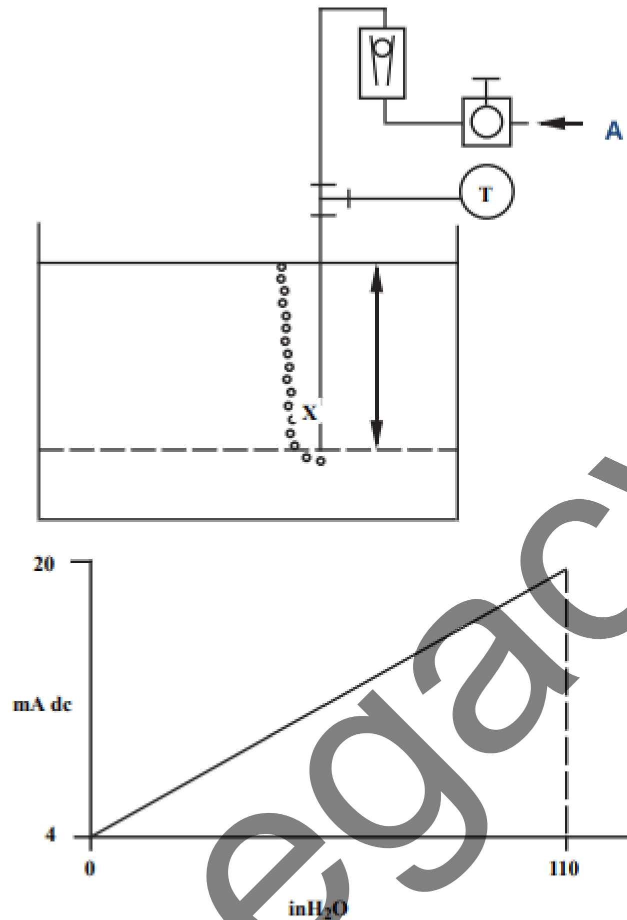
A. Zero elevation

Bubbler system in open vessel

You can use a bubbler system that has a top-mounted pressure transmitter 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



A. Air

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

3 Configuration

3.1 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.

3.2 Commissioning on the bench with HART

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

Note
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 3-2 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.

When using a Field Communicator, any configuration changes made must be sent to the transmitter by using the Send key (F2). AMS Device Manger configuration changes are implemented when the Apply button is selected.

For more information on the Field Communicator, see Emerson.com/global. AMS Device Manger help can be found in the AMS Device Manager online guides within the AMS system.

3.2.1 Setting the loop to Manual

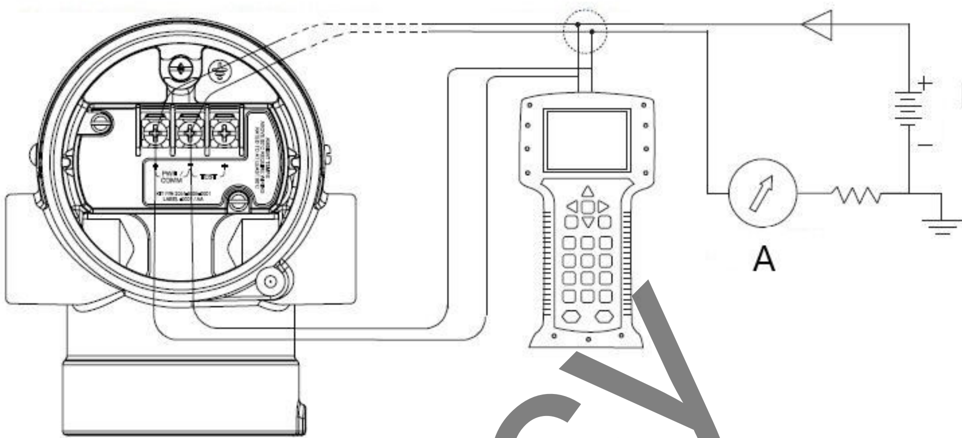
Whenever sending or requesting data that would disrupt the loop or change the output of the transmitter, set the process application loop to **Manual**. The Field Communicator or AMS Device Manager will prompt you to set the loop to **Manual** when necessary. Acknowledging this prompt does not set the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

3.2.2 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.

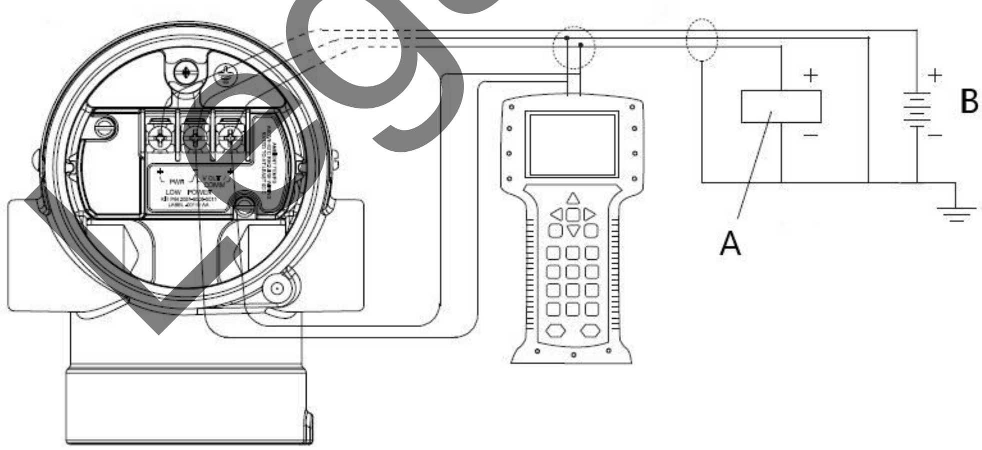
Turn on the HART Communicator by pressing the ON/OFF key or log into AMS Device Manager. The Field Communicator or AMS Device Manager will search for a HART-compatible device and indicate when the connection is made. If the Field Communicator or AMS Device Manager fail to connect, it indicates that no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

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



A. $R_L \geq 250\Omega$
B. Power supply

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



A. Voltmeter
B. Power supply

3.3 Review configuration data

Note
Information and procedures in this section that make use of Field Communicator Fast Key sequences and AMS Device Manager assume 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 Field Communicator or AMS Device Manager.

Field Communicator

Table 3-1: Fast keys

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

Enter the Fast Key sequence to view the configuration data.

Table 3-2: Configuration data

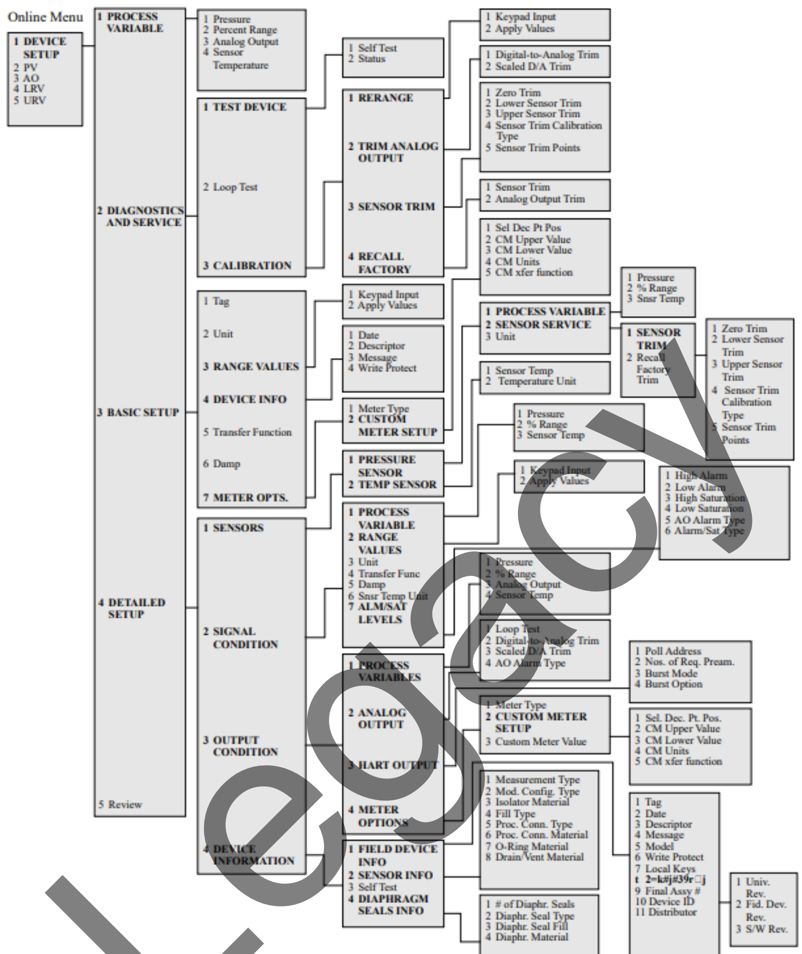
Transmitter Model	Type
Tag	Range
Date	Descriptor
Message	Minimum and Maximum Sensor Limits
Minimum Span	Units
4 and 20 mA points	Output (linear or sq. root)
Damping	Alarm Setting (high, low)
Security Setting (on, off)	Local Zero/Span Keys (enabled, disabled)
Integral Display	Sensor Fill
Isolator Material	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

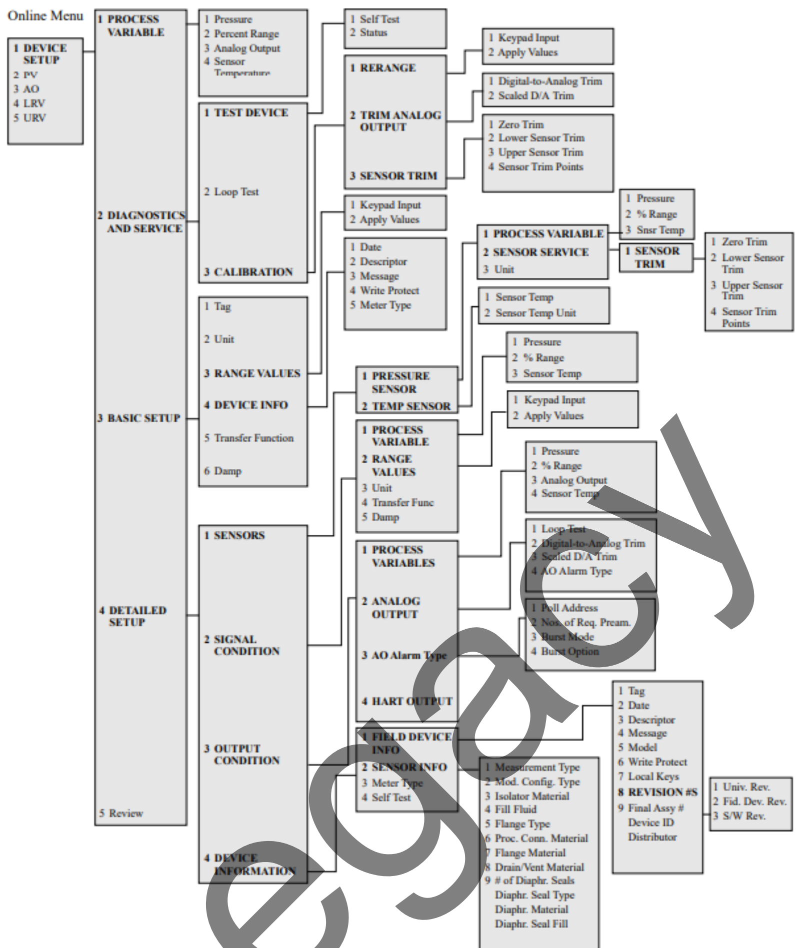
Right-click on the device and select **Configuration Properties** from the menu. Select the tabs to review the transmitter configuration data.

3.4 HART Communicator menu trees

Rosemount 2051 HART menu tree for 4-20 mA HART output



HART menu tree for 1–5 Vdc HART low power



3.5 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 3-3: Rosemount 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

Table 3-3: Rosemount 2051 Fast Key Sequence *(continued)*

	Function	4–20 mA HART	1–5 Vdc HART low power
	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

3.6 Check output

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

3.6.1 Process variables

The process variables for the Rosemount 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.

Field Communicator

Table 3-4: Fast keys

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

3.6.2 Sensor temperature

The Rosemount 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.

Field Communicator

Table 3-5: Fast keys

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.

3.7 Basic setup

3.7.1 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

Table 3-6: Fast keys

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
- inH_g
- 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 Properties** from the menu. In the **Basic Setup** tab, use **Unit** drop-down menu to select units.

3.7.2 Set output (transfer function)

The Rosemount 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 Rosemount 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 to 0.8 percent, curve slope equals 42 (y = 42x) to achieve continuous transition from linear to square root at the transition point.

Field Communicator

Table 3-7: Fast keys

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

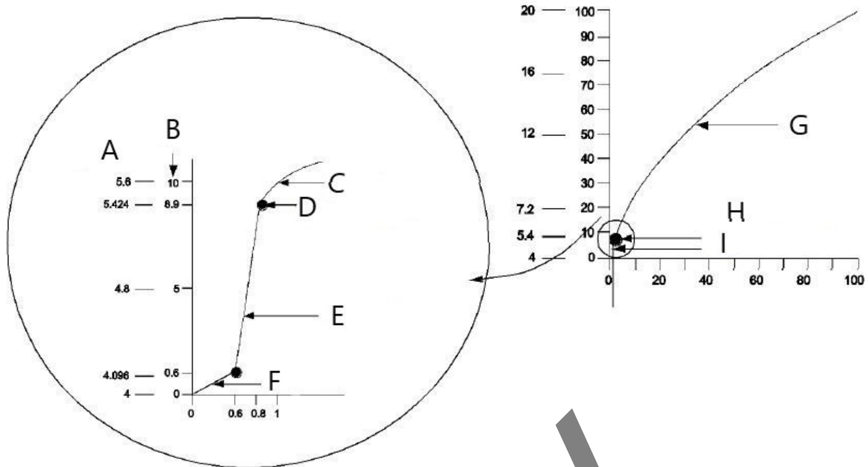
AMS device manager

Right-click on the device and select **Configure Properties** from the menu.

Procedure

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

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



A. Full scale output (mA dc)
B. Full scale flow (%)
C. Sq. root curve
D. Transition point
E. Slope = 42
F. Slope = 1
G. Sq. root curve
H. Transition point
I. Linear section

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.

3.7.3 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 and sensor limits, refer to Range and Sensor Limits.

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

Note
Regardless of the range points, Rosemount 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 percent 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 Field Communicator or AMS Device Manager only.
- Rerange with a pressure input source and a Field 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 for security information.

Rerange with a Field Communicator or AMS Device Manager only

The easiest and most popular way to rerange is to use the Field 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
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.

Field Communicator

Table 3-8: Fast keys

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*.

Rerange with AMS Device Manager only

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:

Procedure

1. Enter the Lower Range Value (LRV) and the Upper Range Value (URV) in the fields provided. Select **Apply**.
2. An Apply Parameter Modification screen appears, enter desired information and select **OK**.
3. After carefully reading the warning provided, select **OK**.

Rerange with a pressure input source and a Field Communicator or AMS Device Manager

Reranging using the Field 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.

Field Communicator

Table 3-9: Fast keys

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 the local zero and span buttons (option D4).

AMS device manager

Right-click on the device, choose **Calibrate**, then **Apply** values from the menu.

Procedure

1. Select **Next** after the control loop is set to Manual.
2. From the **Apply Values** menu, follow the online 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) 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.

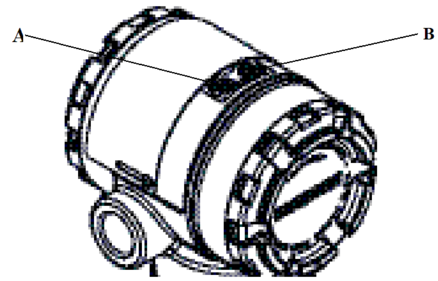
To rerange the transmitter using the span and zero buttons, perform the following procedure:

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



A. Span
B. Zero

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.

3.7.4 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 the following ten pre-configured damping values between 0 and 25.6 seconds:

- 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 Field Communicator Fast Keys or going to configure in AMS Device Manager.

Field Communicator

Table 3-10: Fast keys

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 Properties** from the menu.

Procedure

1. In the *Basic Setup* tab, enter the damping value in the *Damp* field, select **Apply**.
2. An *Apply Parameter Modification* screen appears, enter desired information and select **OK**.
3. After carefully reading the warning provided, select **OK**.

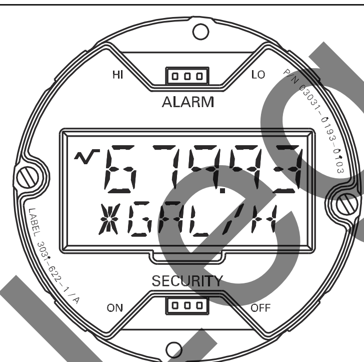
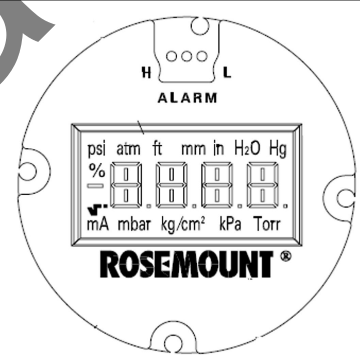
3.8 LCD display

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 display 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: LCD Display

4–20 mA HART	1–5 Vdc HART Low Power
	

3.8.1 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:

Table 3-11: Fast keys

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

Field Communicator

Table 3-12: Fast keys

4–20 mA Fast Keys	1, 3, 7

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

Procedure

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. Select **ENTER** → **SEND** → **HOME**.

AMS Device Manager

Right-click on the device and select **Configuration Properties** from the menu.

Procedure

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

3.8.2 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:

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

4. SEND.
5. 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.
6. 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.
7. 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.
8. 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.
9. Select **Send** to upload the configuration to the transmitter.

3.9 Detailed setup

3.9.1 Failure mode alarm and saturation

The Rosemount2051 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 3-13, Table 3-14, and Table 3-15 for failure mode and saturation output levels. To select alarm position, see Configure security and alarm.

Note
The failure mode alarm direction can also be configured using the Field Communicator or AMS Device Manager.

Note
Under some failure conditions, the transmitter will ignore user configured alarm conditions and drive the transmitter to low alarm.

Table 3-13: 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 3-14: 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 3-15: 1–5 Vdc HART Low Power Alarm and Saturation Values

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

⚠ CAUTION

Alarm level values will be affected by analog trim. Refer to Analog output trim.

Note
When a transmitter is in an alarm condition, the Field 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.

3.9.2 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

3.9.3 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

3.9.4 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.

Related information

Table 1
Table 2
Table 3
Loop test

3.10 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.

3.10.1 Transmitter test

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 can be performed either on the bench or in the field. The loop test feature is designed to verify proper loop wiring and transmitter output, and should only be performed after you install the transmitter

Field Communicator

Table 3-16: Fast keys

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. Select **Diagnostics**, **Test**, and **Self Test** from the menu.

Procedure

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

3.10.2 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

Table 3-17: Fast keys

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:

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).
4. Select a discrete milliamp level for the transmitter to output. At the **Choose analog output** prompt select *1: 4 mA (1 Vdc)*, select *2: 20 mA (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 Table 3-13, Table 3-14, and Table 3-15).

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. Select **Diagnostics and Test**, then *Loop test*.

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. Select **Next** after setting the control loop to **Manual**.
3. Select desired analog output level. Select **Next**.
4. Select **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** then **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.

3.11 Advanced functions

3.11.1 Saving, recalling, and cloning configuration data

Use the cloning feature of the Field Communicator or the AMS Device Manager "User Configuration" feature to configure several Rosemount 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. One common method is as follows:

Related information

Emerson.com/FieldCommunicator
Emerson.com/AMS

Field Communicator

Table 3-18: Fast keys

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

Procedure

1. Confirm and apply configuration changes to the first transmitter.

   Note
   If transmitter configuration has not been modified, **SAVE** option in Step 2 will be disabled.

2. Save the configuration data:
   a) Select **SAVE** from the bottom of the Field Communicator screen.

   b) Select to save your configuration in either the *Internal Flash* (default) or the *Configuration EM* (Configuration Expansion Module).

   c) Enter the name for this configuration file. The default name is the transmitter tag number.

   d) Select **Save**.

3. Power the receiving transmitter and connect with Field Communicator.
4. Access the HART Application menu by selecting the LEFT ARROW from the *HOME/ ONLINE* screen.
5. Locate the saved transmitter configuration file:
   a) Select **Offline**.

   b) Select **Saved Configuration**.

   c) Select either **Internal Flash Contents** or **Configuration EM Content**, depending on where the configuration was stored per Step 2B.

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 desired configuration.
7. Select Send to transfer the configuration to the receiving transmitter.
8. Select OK after the control loop is set to manual.
9. After the configuration has been sent, select OK to acknowledge that the loop can be returned to automatic control. When finished, the Field Communicator informs you of the status. Repeat Step 3 through Step 9 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:

Procedure

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

   Note
   A device icon can also be copied by dragging and dropping a device template or any other device icon from AMS 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.

5. Transfer values from the current configuration to the user configuration as appropriate or enter values by typing the values into the available fields.
6. 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:

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.

3.11.2 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

Table 3-19: Fast keys

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.

Procedure

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**.

3.12 Multidrop communication

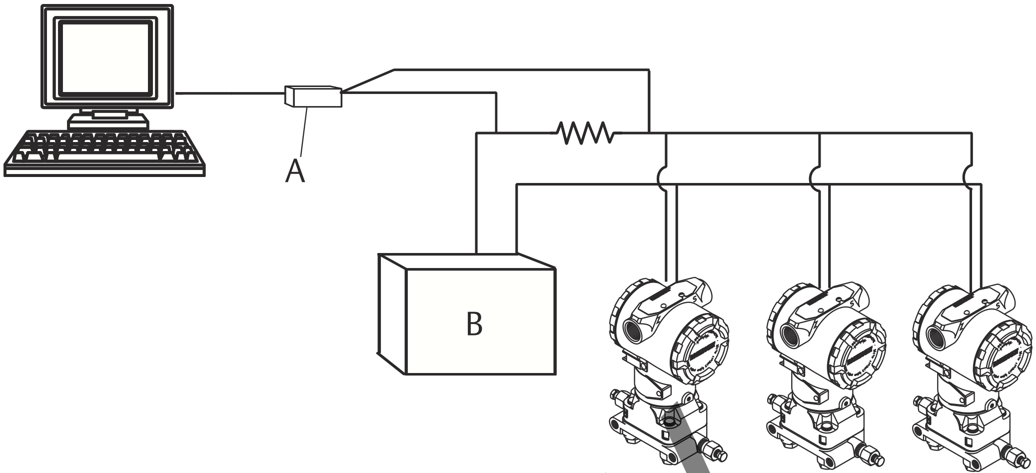
Multidropping transmitters refers to the connection of several transmitters to a single communications transmission line. Communication between the host and the transmitters takes place digitally with the analog output of the transmitters deactivated. With smart communications protocol, up to fifteen 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.

Multidrop communication 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



A. HART Modem
B. Power Supply

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.

3.12.1 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

Table 3-20: Fast keys

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**.

Procedure

1. In the **HART** tab, in **ID** box, enter poll address located in the **Poll addr** box.
2. Click **Apply**.
3. Read and understand the warning provided.
4. Select **Yes**.

3.12.2 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.

Procedure

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

Procedure

1. Click on the HART® modem icon.
2. Select **Scan All Devices**.

3.12.3 Polling a multidropped transmitter

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

HART communicator

Table 3-21: Fast keys

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

AMS device manager

Procedure

1. Click on the HART® modem icon.
2. Select **Scan All Devices**.

4 Operation and Maintenance

4.1 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.

4.2 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 Rerange.
- **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 Analog output trim.
  - — Digital-to-analog output trim on 4–20 mA HART® output (Digital-to-analog trim)
  - — Digital-to-analog output trim on 4–20 mA HART output Using Other Scale (Digital-to-analog trim using other scale)
- **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 Sensor trim.
  - — Zero trim
  - — Sensor trim

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

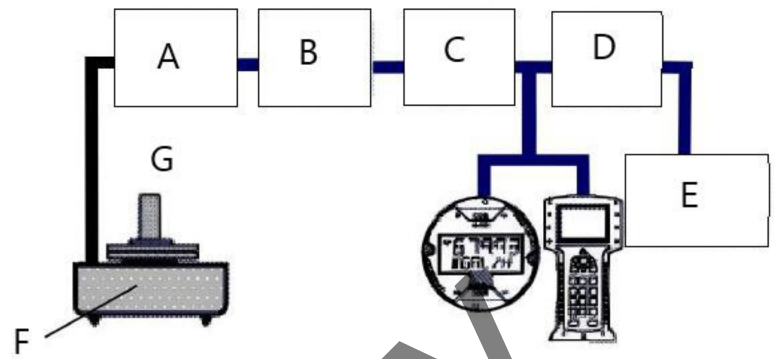
Procedure

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 display 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. Also, Figure 4-1 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



A. Step 1: Sensor
B. Step 2: A/D
C. Step 3: Micro
D. Step 4: D/A
E. Output: 20.00 mA
F. Pressure source
G. Output: 100 in. H_20

Note
Transmitter ranged 0 to 100 in H_20 (0 to 0.25 bar)

Table 4-1: Recommended Calibration Tasks

Transmitter	Bench calibration tasks	Field calibration tasks
2051CD 2051CG 2051L 2051TG, Range 1-4	a. Set output configuration parameters: 1. Set the range points. 2. Set the output units. 3. Set the output type. 4. Set the damping value. b. Optional: Perform a sensor trim. (accurate pressure source required.)	a. Reconfigure parameters if necessary. b. Zero trim the transmitter to compensate for mounting effects or static pressure effects. c. Optional: Perform an analog output trim. Accurate multimeter required.

Table 4-1: Recommended Calibration Tasks *(continued)*

Transmitter	Bench calibration tasks	Field calibration tasks
2051TA 2051TG, Range 5	a. Set output configuration parameters: 1. Set the range points. 2. Set the output units. 3. Set the output type. 4. Set the damping value. b. 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.	a. Reconfigure parameters if necessary. b. Perform low trim value section of the sensor trim procedure to correct for mounting position effects. c. Optional: Perform an analog output trim. Accurate multimeter required.

Note
The transmitter 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.

Related information

Compensating for line pressure

4.2.1 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.

Procedure

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 Rosemount 2051C

Procedure

1. Determine the performance required for your application.

   Required Performance: 0.30% of span

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)

3. Calculate total probable error (TPE).

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

   Where:

   Reference Accuracy = ± 0.075% of span

   Ambient Temperature Effect =

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

   Span Static Pressure Effect[1]= 0.1% reading per 1000 psi (69 bar) = ±0.05% of span at maximum span

4. Calculate the stability per month.

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

5. Calculate calibration frequency.

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

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

Procedure

1. Determine the performance required for your application.

   Required Performance: 0.30% of span

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)

3. Calculate total probable error (TPE).

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

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

Where:

Reference Accuracy = ± 0.065% of span

Ambient Temperature Effect =

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

Span Static Pressure Effect[2]= 0.1% reading per 1000 psi (69 bar) = ±0.05% of span at maxium span

4. Calculate the stability per month.

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

5. Calculate calibration frequency.

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

4.2.2 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:

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 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 to determine which trim to perform.
5. Compare the Analog Output (AO) line, on the HART Communicator or AMS, to the digital readout device.

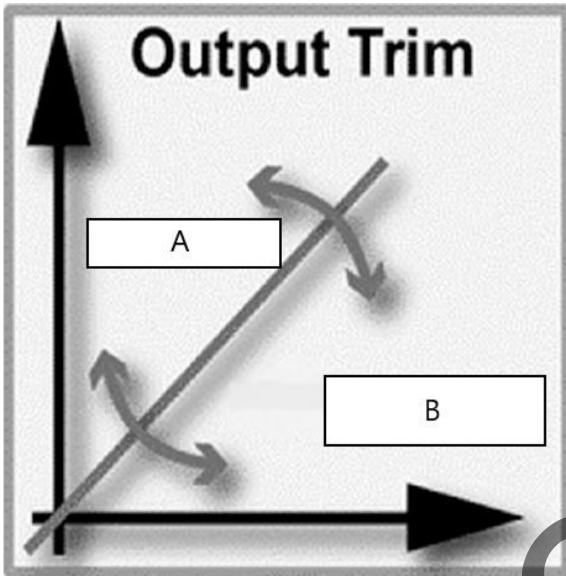
    If the AO reading does not match the digital readout device (with high-accuracy test equipment), perform an analog output trim. See Analog output trim.

4.3 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.

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

Figure 4-2: Output Trim



A. *Output trim*
B. *Characterization curve*

4.3.1 Digital-to-analog trim

HART communicator

Table 4-2: Fast keys

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:

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.
2. Choose the right configuration:
    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 v dc)* 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 Step 5 and Step 6 until the reference meter value equals the transmitter output value.
8. Select **OK** after the control loop is returned to automatic control.

AMS Device Manager

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

Procedure

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.

4.3.2 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.

HART communicator

Table 4-3: Fast keys

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

AMS Device Manager

Right-click on the device. Select **Calibrate** and then **Scaled D/A trim**.

Procedure

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.

4.3.3 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

Table 4-4: Fast keys

4–20 mA Fast Keys	1, 2, 3, 4, 2

AMS Device Manager

Right-click on the device. Select **Calibrate** and then **Recall Factory Trim**.

Procedure

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.

4.4 Sensor trim

4.4.1 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.

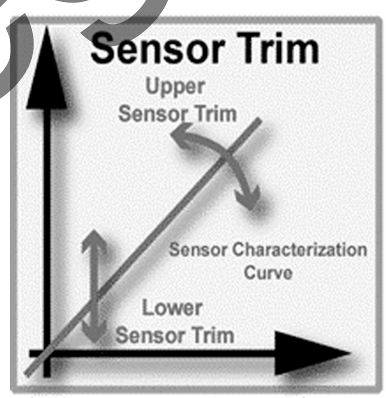
When performing a zero trim, ensure that the equalizing valve is open and all wet legs are filled to the correct levels.

NOTICE

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



4.4.2 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

Table 4-5: Fast keys

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:

Procedure

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 Device Manager

Right-click on the device. Select *Calibrate* and then **Zero trim**.

Procedure

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.

4.4.3 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

Table 4-6: Fast keys

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:

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 recommended lower sensor trim value is the sensor trim point that is closest to zero.

   Examples:

   Calibration: 0 to 100 inH_2O - lower trim = 0, upper trim = 100

   Calibration: -100 to 0 inH_2O - lower trim = 0, upper trim = -100

Calibration: -100 to 100 inH_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. 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 Device Manager

Right-click on the device. Select **Calibrate** and then **Sensor trim**.

Procedure

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**.
7. Select **Upper sensor trim** and repeat Step 2– Step 5.

4.4.4 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

Table 4-7: Fast keys

4–20 mA Fast Keys	1, 2, 3, 4, 1

AMS Device Manager

Right-click on the device. Select *Calibrate* and then **Recall Factory Trim**.

Procedure

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.

4.4.5 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 Rosemount 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 Rosemount 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.

The following specifications show the static pressure effect for Rosemount 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 × [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 × P/1000 × 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 × 1200 psi/1000 × 500 inH_2O)
LT =	506 inH_2O

High trim value

HT = (URV – (S/100 × P/1000 × 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 × 1200 psi/1000× 1500 in H_2O)
HT =	1518 in H_2O

Complete the sensor trim procedure as described on Sensor trim. 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.

5 Troubleshooting

5.1 Overview

The following sections provide summarized maintenance and troubleshooting suggestions for the most common operating problems.

5.2 Troubleshooting for 4-20 mA output

5.2.1 Transmitter milliamp reading is zero

Recommended actions

1. Verify terminal voltage is 10.5 to 42.4 Vdc at signal terminals.
2. Check power wires for reversed polarity.
3. Check that power wires are connected to signal terminals.
4. Check for open diode across test terminal.

5.2.2 Transmitter not communicating with communication device

Recommended actions

1. Verify terminal voltage is 10.5 to 42.2 Vdc.
2. Check loop resistance.

Note
(Power supply voltage - terminal voltage)/loop current must be 250 Ω minimum.

3. Check that power wires are connected to signal terminals and not test terminals.
4. Verify clean Dc power to transmitter.

Note
Maximum AC noise is 0.2 volts peak to peak.

5. Verify the output is between 4 and 20 mA or saturation levels.
6. Use the communication device to poll for all addresses.

5.2.3 Transmitter milliamp reading is low or high

Recommended actions

1. Verify applied pressure.
2. Verify 4 and 20 mA range points.
3. Verify **output** is not in **alarm** condition.
4. Perform **analog trim**.
5. Check that power wires are connected to the correct signal terminals (positive to positive, negative to negative) and not the test terminal.

5.2.4 Transmitter will not respond to changes in applied pressure

Recommended actions

1. Check impulse piping or manifold for blockage.
2. Verify applied pressure is between 4 and 20 mA points.
3. Verify the **output** is not in **Alarm** condition.
4. Verify transmitter is not in **Loop Test** mode.
5. Verify transmitter is not in **Multidrop** mode.
6. Check test equipment.

5.2.5 **Digital pressure** variable reading is low or high

Recommended actions

1. Check impulse piping for blockage or low fill in wet leg.
2. Verify transmitter is calibrated properly.
3. Check test equipment (verify accuracy).
4. Verify pressure calculations for application.

5.2.6 **Digital pressure** variable reading is erratic

Recommended actions

1. Check application for faulty equipment in pressure line.
2. Verify transmitter is not reacting directly to equipment turning On/Off.
3. Verify damping is set properly for application.

5.2.7 Milliamps reading is erratic

Recommended actions

1. Verify power source to transmitter has adequate voltage and current.
2. Check for external electrical interference.
3. Verify transmitter is properly grounded.
4. Verify shield for twisted pair is only grounded at one end.

5.3 Troubleshooting for 1-5 Vdc output

5.3.1 Transmitter voltage reading is zero

Recommended actions

1. Verify terminal voltage is 5.8 to 28.0 Vdc at signal terminals.
2. Check power wires for reversed polarity.
3. Check that power wires are connected to signal terminals.
4. Check for open diode across test terminal.

5.3.2 Transmitter not communicating with communication device

Recommended actions

1. Verify terminal voltage is 5.8 to 28.0 Vdc.
2. Check loop resistance.

   (Power supply voltage - transmitter voltage)/loop current should be 250 Ω minimum.
3. Check that power wires are connected to signal terminals and not test terminals.
4. Verify clean DC power to transmitter.

   Maximum AC noise is 0.2 volts peak to peak.
5. Verify the is output between 1-5 Vdc or saturation levels.
6. Use communication device to poll for all addresses.

5.3.3 Transmitter voltage reading is low or high

Recommended actions

1. Verify applied pressure.
2. Verify 1-5 Vdc range points.
3. Verify output is not in `Alarm` condition.
4. Perform analog trim.
5. Check that the power wires are connected to the correct signal terminals (positive to positive, negative to negative) and not the test terminal.

5.3.4 Transmitter will not respond to changes in applied pressure

Recommended actions

1. Check impulse piping or manifold for blockage.
2. Verify applied pressure is between the 1-5 Vdc points.
3. Verify the output is not in `Alarm` condition.
4. Verify transmitter is not in `Loop Test` mode.
5. Verify transmitter is not in `Multidrop` mode.
6. Check test equipment.

5.3.5 **Digital pressure** variable reading is low or high

Recommended actions

1. Check impulse piping for blockage or low fill in wet leg.
2. Verify transmitter is calibrated properly.
3. Check test equipment (verify accuracy).
4. Verify pressure calculations for application.

5.3.6 Digital pressure variable reading is erratic

Recommended actions

1. Check application for faulty equipment in pressure line.
2. Verify transmitter is not reacting directly to equipment turning On/Off.
3. Verify damping is set properly for application.

5.3.7 Voltage reading is erratic

Recommended actions

1. Verify power source to transmitter has adequate voltage and current.
2. Check for external electrical reference.
3. Verify transmitter is properly grounded.
4. Verify shield for twisted pair is only grounded at one end.

5.4 Diagnostic messages

Listed in the below sections are detailed descriptions of the possible messages that will appear on either the LCD/local operator interface (LOI) display, a communication device, or an AMS Device Manager system.

Possible statuses are:

- Good
- Failed – fix now
- Maintenance – fix soon
- Advisory

5.4.1 Status: Failed - fix now

No Pressure Updates

There are no pressure updates from the sensor to the electronics.

LCD display	NO P UPDATE
Local Operator Interface (LOI)	NO PRESS UPDATE

Recommended actions

1. Ensure the sensor cable connection to the electronics is tight.
2. Replace the transmitter.

Electronics Board Failure

A failure has been detected in the electronics circuit board.

LCD display	FAIL BOARD
Local Operator Interface (LOI)	FAIL BOARD

Recommended action

Replace the pressure transmitter.

Critical Sensor Data Error

LCD display screen	MEMRY ERROR
Local Operator Interface (LOI) screen	MEMORY ERROR

A user-written parameter does not match the expected value.

Recommended actions

1. Confirm and correct all parameters listed in ***Device Information***.
2. Perform a device reset.
3. Replace pressure transmitter.

Critical Electronics Data Error

LCD display screen	MEMRY ERROR
Local Operator Interface (LOI) screen	MEMORY ERROR

A user-written parameter does not match the expected value.

Recommended actions

1. Confirm and correct all parameters listed in ***Device Information***.
2. Perform a device reset.
3. Replace pressure transmitter.

Sensor Failure

LCD display screen	FAIL SENSOR
Local operator interface (LOI) screen	FAIL SENSOR

A failure has been detected in the pressure sensor.

Recommended action

Replace pressure transmitter.

Incompatible Electronics and Sensor

LCD display screen	XMTR MSMTCH
Local operator interface (LOI) screen	XMTR MSMTCH

The pressure sensor is incompatible with the attached electronics.

Recommended action

Replace the pressure transmitter.

5.4.2 Status: Maintenance - fix soon

No Temperature Updates

There are no temperature updates from the sensor to the electronics.

LCD display	NO T UPDATE
Local Operator Interface (LOI)	NO TEMP UPDATE

Recommended actions

1. Ensure the sensor cable connection to the electronics is tight.
2. Replace the pressure transmitter.

Pressure Out of Limits

LCD display screen	PRES LIMITS
Local operator interface (LOI) screen	PRES OUT LIMITS

The pressure is either above or below the sensor limits.

Recommended actions

1. Check the transmitter pressure connection to ensure it is not plugged and that the isolating diaphragms are not damaged.
2. Replace the pressure transmitter.

Sensor Temperature Beyond Limits

LCD display screen	TEMP LIMITS
Local Operator Interface (LOI) screen	TEMP OUT LIMITS

The sensor temperature has exceeded its safe operating range.

Recommended actions

1. Check the process and ambient conditions are within -85 to 194 °F (-65 to 90 °C).
2. Replace the pressure transmitter.

Electronics Temperature Beyond Limits

LCD display screen	TEMP LIMITS
Local operator interface (LOI) screen	TEMP OUT LIMITS

The electronics temperature has exceeded its safe operating range.

Recommended actions

1. Confirm electronics temperature is within limits of -85 to +194 °F (-65 to +90 °C).
2. Replace the pressure transmitter.

Electronics Board Parameter Error

LCD display screen	**MEMRY WARN** (also in advisory)
Local Operator Interface (LOI) screen	**MEMORY WARN** (also in advisory)

A device parameter does not match the expected value. The error does not affect transmitter operation or analog output.

Recommended action

Replace the pressure transmitter.

Configuration Buttons Operator Error

LCD display screen	**STUCK BUTTON**
Local Operator Interface (LOI) screen	**STUCK BUTTON**

Device is not responding to button presses.

Recommended actions

1. Check configuration buttons are not stuck.
2. Replace the pressure transmitter.

5.4.3 Status: Advisory

Non-Critical User Data Warning

LCD display screen	**MEMRY WARN**
Local Operator Interface (LOI) screen	**MEMORY WARN**

A user-written parameter does not match expected value.

Recommended actions

1. Confirm and correct all parameters listed in ***Device Information***.
2. Perform a device reset.
3. Replace the pressure transmitter.

Sensor Parameter Warning

LCD display screen	MEMRY WARN
Local Operator Interface (LOI) screen	MEMORY WARN

A user-written parameter does not match expected value.

Recommended actions

1. Confirm and correct all parameters listed in ***Device Information***.
2. Perform a device reset.
3. Replace pressure transmitter.

LCD Display Update Failure

LCD display screen	(Not updating)
Local Operator Interface (LOI) screen	(Not updating)

The LCD display is not receiving updates from the pressure sensor.

Recommended actions

1. Check the connection between the LCD display and the circuit board.
2. Replace the LCD display.
3. Replace the pressure transmitter.

Configuration Changed

LCD display screen	(None)
Local Operator Interface (LOI) screen	(None)

A recent change has been made to the device by a secondary HART® master, such as a communication device.

Recommended actions

1. Verify that the device's configuration change was intended and expected.
2. Clear this alert by selecting **Clear Configuration Changed Status**.
3. Connect a HART master, such as AMS Device Manager or similar, which will automatically clear the alert.

Analog Output Fixed

LCD display screen	ANLOG FIXED
Local Operator Interface (LOI) screen	ANALOG FIXED

The analog output is fixed and does not represent the process measurement.

This may be caused by other conditions in the device or because the device has been set to **Loop Test** or **Multidrop** mode.

Recommended actions

1. Take action on any other notifications from the device.
2. If the device is in **Loop Test** mode and should no longer be, disable or momentarily remove power.
3. If the device is in **Multidrop** mode and should not be, re-enable loop current by setting the polling address to `0`.

Simulation Active

The device is in **Simulation** mode and may not be reporting actual information.

Recommended actions

1. Verify that simulation is no longer required.
2. Disable **Simulation** mode in ***Service Tools***.
3. Reset the device.

Analog Output Saturated

LCD display screen	ANLOG SAT
Local operator interface (LOI) screen	ANALOG SAT

The analog output is saturated either high or low due to the pressure either above or below the range values.

Recommended actions

1. Check the applied pressure to ensure it is between 4 and 20 mA points.
2. Check the transmitter pressure connection to make sure it is not plugged and isolating diaphragms are not damaged.
3. Replace the pressure transmitter.

5.5 Disassembly procedures

⚠ WARNING

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

5.5.1 Remove from service

1. Follow all plant safety rules and procedures.
2. Power down device.
3. Isolate and vent the process from the transmitter before removing the transmitter from service.

4. Remove all electrical leads and disconnect conduit.
5. 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 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.

    NOTICE

    Do not wrench the transmitter's neck.
6. Clean isolating diaphragms with a soft rag and a mild cleaning solution, and rinse with clear water.

    NOTICE

    Do not scratch, puncture, or depress the isolating diaphragms.
7. 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 can be reused.

5.5.2 Remove terminal block

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

Procedure

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 (270 degree angle) and 3 o'clock (90 degree angle) positions.
3. Pull the entire terminal block out to remove it.

5.5.3 Remove the electronics board

The transmitter electronics board is located in the compartment opposite the terminal side.

To remove the electronics board:

Procedure

1. Remove the housing cover opposite the field terminal side.
2. If you are disassembling a transmitter with an LCD display, loosen the two captive screws that are visible on the right and left side of the meter display.

NOTICE

The two screws anchor the LCD display to the electronics board and the electronics 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.

3. 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.

5.5.4 Remove the sensor module from the electronics housing

Procedure

1. Remove the electronics board.

NOTICE

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

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

NOTICE

The black cap protects the ribbon cable from damage that can occur when you rotate the housing.

Do not remove the housing until after you tuck the cable connector completely inside of the internal black cap.

3. Using a $_{5/64}$-inch hex wrench, loosen the housing rotation set screw one full turn.
4. Unscrew the module from the housing.

Note
Ensure the black cap and sensor cable do not catch on the housing.

5.6 Reassembly procedures

5.6.1 Replace the electronics housing in the sensor module

Procedure

1. Inspect all cover and housing (non-process wetted) O-rings. Replace damaged O-rings.
2. Lightly grease with silicone lubricant to ensure a good seal.
3. Carefully tuck the cable connector completely inside the internal black cap.

   a) To tuck the cable connector, turn the black cap and cable counterclockwise one rotation to tighten the cable.

4. Lower the electronics housing onto the module.
5. Guide the internal black cap and cable through the housing and into the external black cap.
6. Turn the module clockwise into the housing.

NOTICE

Damage can occur to the cable if the internal black cap and ribbon cable become hung up and rotate with the housing.

Ensure the sensor ribbon cable and internal black cap remain completely free of the housing as you rotate it.

7. Thread the housing completely onto the sensor module.

⚠ WARNING

The housing must be no more than one full turn from flush with the sensor module to comply with explosion proof requirements.

8. Using a $_{5/64}$-inch hex wrench, tighten the housing rotation set screw .

Note
Tighten to a maximum of 7 in.-lb. when the desired location is reached.

5.6.2 Attach the electronics board

Procedure

1. Remove the cable connector from its position inside of the internal black cap.
2. Attach it to the electronics board.
3. Using the two captive screws as handles, insert the electronics board into the housing.

Note
Ensure 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.

4. Tighten the captive mounting screws.
5. Replace the electronics housing cover.

⚠ WARNING

The transmitter covers must be engaged metal-to-metal to ensure a proper seal and to meet explosion-proof requirements.

5.6.3 Install the terminal block

Procedure

1. Gently slide the terminal block into place.

   Note
   Ensure 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.

   ⚠ WARNING

   The transmitter covers must be fully engaged to meet explosion-proof requirements.

5.6.4 Reassemble the Rosemount 2051C process flange

Procedure

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.

   NOTICE

   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:
   - Coplanar™ process flange:
     a. Hold the process flange in place by installing the two alignment screws to finger tightness (screws are not pressure retaining).

        ⚠ WARNING

        Do not over-tighten as this will affect module-to-flange alignment.

     b. Install the four 1-.75-inch flange bolts to the flange by finger-tightening.
   - Coplanar process flange with flange adapters:
     a. To secure process flange placement, finger tighten the two alignment screws. Screws are not pressure retaining.

        ⚠ WARNING

        Do not over-tighten as this will affect module-to-flange alignment.

     b. Hold the flange adapters and adapter O-rings in place while installing (in one of the four possible process connection spacing connections), using four 2.88-inch bolts to mount securely to the coplanar flange. For gauge pressure configurations, use two 2.88-inch bolts and two 1.75-inch bolts.

- 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 5-1 for appropriate torque values.

Table 5-1: 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 stainless steel (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)

NOTICE

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.

4. Using the same cross pattern, tighten bolts to the final torque values seen in Table 5-1.

5.6.5 Install the drain/vent valve

Procedure

1. Beginning at the valve base with the threaded end pointing at the installer, apply two clockwise turns of sealing tape to the threads on the seat.
2. Tighten the drain/vent valve to 250 in.-lb. (28.25 N-m).
3. Ensure the opening is placed on the valve so that process fluid will drain toward the ground and away from human contact when the valve is opened.

A Reference Data

A.1 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.

A.1.1 Conformance To Specification (±3σ (Sigma))

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

Reference Accuracy

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

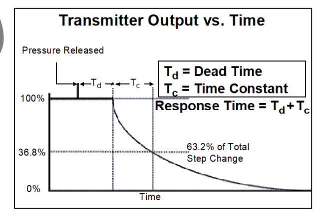
(1) For Foundation fieldbus transmitters, use calibrated range in place of span.

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[(2)]	Typical HART Transmitter Response Time
Total Response Time ($T_d + T_c$)[(3)]:			
2051C, Range 3-5: Range 1: Range 2: 2051T: 2051L:	115 milliseconds 270 milliseconds 130 milliseconds 100 milliseconds See Instrument Toolkit®	152 milliseconds 307 milliseconds 152 milliseconds 152 milliseconds 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) Transmitter fieldbus output only, segment macro-cycle not included
(3) Nominal total response time at 75 °F (24 °C) reference conditions.

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.

A.1.2 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).

A.1.3 Power Supply Effect

Less than ±0.005% of calibrated span per volt.

A.1.4 Electromagnetic Compatibility (EMC)

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

A.1.5 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)

A.2 Functional Specifications

Range and Sensor Limits

Range	2051CD, 2051CG, 2051L					
	Minimum Span	Range and Sensor Limits				
		Upper (URL)	Lower (LRL)			
			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			
	Minimum Span	Range and Sensor Limits		
		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.*

A.2.1 Service

Liquid, gas, and vapor applications

A.2.2 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 Vdc with no load.

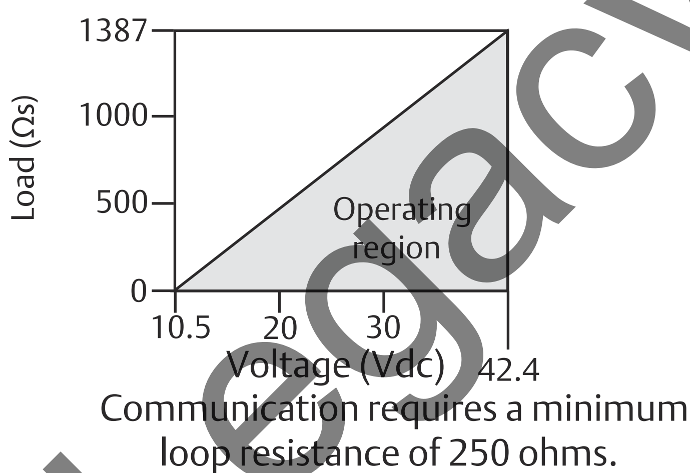
Turn-On Time

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:

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.

Table A-1: Foundation fieldbus Function Block Execution Times

Block	Execution Time
Resource	-

Table A-1: Foundation fieldbus Function Block Execution Times *(continued)*

Block	Execution Time
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.

A.2.3 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.			

A.2.4 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)

A.2.5 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)

A.2.6 Temperature Limits

Ambient

–40 to 185 °F (–40 to 85 °C)

With LCD display(3): –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)

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)
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)

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

Table A-3: 2051 Process Temperature Limits *(continued)*

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.

A.2.7 Humidity Limits

0–100% relative humidity

A.2.8 Volumetric Displacement

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

A.2.9 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.

A.2.10 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 ≤ I ≤ 20.8	I ≥ 21.75 mA	I ≤ 3.75 mA
M	0.97 ≤ V ≤ 5.2	V ≥ 5.4 V	V ≤ 0.95V
NAMUR-Compliant Operation			
Output Code	**Linear Output**	**Fail High**	**Fail Low**
A	3.8 ≤ I ≤ 20.5	I ≥ 22.5 mA	I ≤ 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.

A.3 Physical Specifications

A.3.1 Electrical Connections

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

A.3.2 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
- G 1/2 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

A.3.3 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

A.3.4 2051T Process Wetted Parts

Process Connections

- 316L SST or Alloy C-276

Process Isolating Diaphragms

- 316L SST or Alloy C-276

A.3.5 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)

A.3.6 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

A.3.7 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)

A.4 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$_2$O/0.5 inH$_2$O (–62,2 to 62,2 mbar/1,2 mbar)	–25 to 25 inH$_2$O/0.5 inH$_2$O (–62,1 to 62,2 mbar/1,2 mbar)		•	•
2	–250 to 250 inH$_2$O/2.5 inH$_2$O (–623 to 623 mbar/6,2 mbar)	–250 to 250 inH$_2$O/2.5 inH$_2$O (–623 to 623 mbar/6,2 mbar)		•	•
3	–1000 to 1000 inH$_2$O/10 inH$_2$O (–2,5 to 2,5 bar/25 mbar)	–393 to 1000 inH$_2$O/10 inH$_2$O (–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)			•	•
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	G 1/2 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$_2$O/2.5 inH$_2$O (–0,6 to 0,6 bar/6,2 mbar)
3	–1000 to 1000 inH$_2$O/10 inH$_2$O (–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			
	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	Two 1/2-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.

A.5 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

A.6 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	**Part Number**
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

(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.*

Zero and Span Hardware Adjustments (D4 option)	**Part Number**
Zero and Span Kit for 4-20 mA HART(1)	
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(2)	
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(2)	
Zero and Span Kit for Aluminum Housing	02051-9010-1001
Zero and Span Kit for SST Housing	02051-9010-1002

(1) *Kit includes zero and span hardware adjustments and electronics board.*
(2) *Kit includes zero and span hardware adjustments only.*

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

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	Part Number
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	Part Number
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

Bolt Kits	**Part Number**
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	**Part Number**
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

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

Miscellaneous	**Part Number**
External ground screw assembly (option V5)	03031-0398-0001

B Approval Information

B.1 Overview

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

B.2 Approved Manufacturing Locations

Rosemount Inc. — Chanhassen, Minnesota USA

Emerson GmbH & Co. — Wessling, Germany

Emerson Asia Pacific Private Limited — Singapore

Beijing Rosemount Far East Instrument Co., LTD — Beijing, China

B.3 European Directive Information

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

B.4 HART Protocol

B.4.1 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 II 1 G Ex ia IIC T4 (–60 ≤ T_a ≤ +70 °C) IP66 IP68 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 II 3 G Ex nAnL IIC T4 (–40 ≤ T_a ≤ +70 °C) U_i = 42.4 Vdc max IP66 IP68

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 II 1/2 G Ex d IIC T6 (–50 ≤ T_a ≤ 65 °C) Ex d IIC T5 (–50 ≤ T_a ≤ 80 °C) IP66 IP68 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 for information on the dimensions of flameproof joints.

ND ATEX Dust Certification No. Baseefa08ATEX0182X II 1 D Dust Rating: T80 °C (–20 ≤ T_a ≤ 40 °C) IP66 IP68 Vmax = 42.4 V dc A = 22 mA 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 II 1 GD Ex ia IIC T4 (–60 ≤ T_a ≤ +70 °C) Dust Rating: T80 °C (–20 ≤ T_a ≤ 40 °C) IP66 IP68 1180

Table B-2: 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 II 1/2 G Ex d IIC T6 (–50 ≤ T_a ≤ 65 °C) Ex d IIC T5 (–50 ≤ T_a ≤ 80 °C) 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 for information on the dimensions of flameproof joints.

N7 IECEx Type n Certification No. IECExBAS08.0046X II 3 G Ex nAnL IIC T4 (–40 ≤ T_a ≤ +70 °C) U_i = 42.4 Vdc max

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

B.5 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

Form Rev AC

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

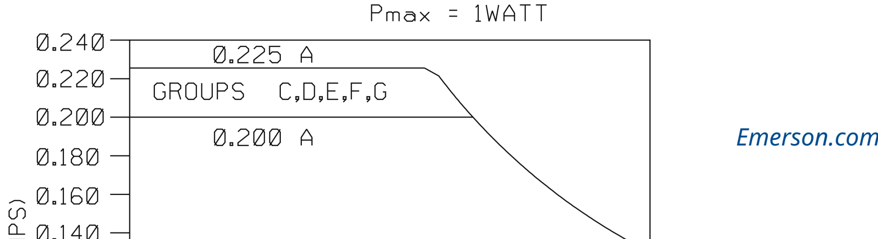
SCALE N/A WT. ——— SHEET 1 OF 13

REVISIONS

REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AA				

BARRIER PARAMETERS (APPLICABLE TO OUTPUT CODES A & M)

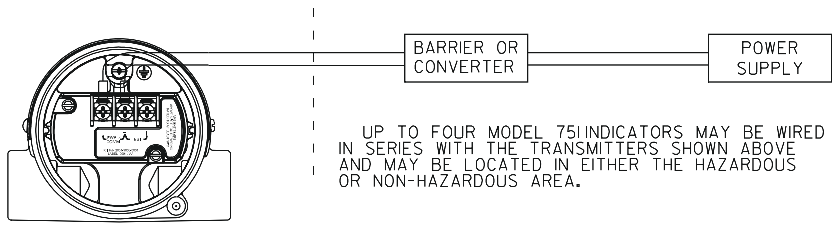
Pmax = 1WATT



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

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

HAZARDOUS AREA NON-HAZARDOUS AREA

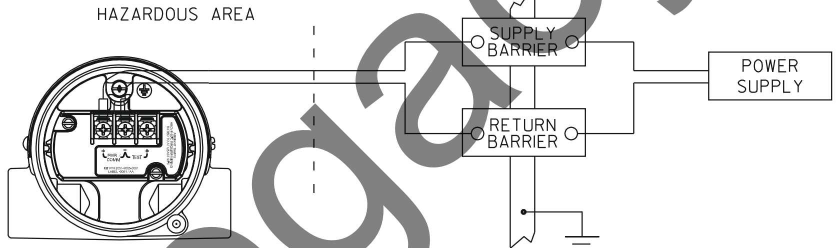


UP TO FOUR MODEL 751 INDICATORS MAY BE WIRED IN SERIES WITH THE TRANSMITTERS SHOWN ABOVE AND MAY BE LOCATED IN EITHER THE HAZARDOUS OR NON-HAZARDOUS AREA.

OUTPUT CODE A
MODELS INCLUDED
2051C, L, T

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

HAZARDOUS AREA NON-HAZARDOUS AREA



OUTPUT CODE A
MODELS INCLUDED
2051C, L, T

UP TO FOUR MODEL 751 INDICATORS MAY BE WIRED IN SERIES WITH THE TRANSMITTERS SHOWN ABOVE AND MAY BE LOCATED IN EITHER THE HAZARDOUS OR NON-HAZARDOUS AREA.

Rosemount Inc.
8200 Market Boulevard
Chanhassen, MN 55317 USA

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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 (Ca) OF THE ASSOCIATED APPARATUS MUST BE GREATER THAN THE SUM OF THE INTERCONNECTING CABLE CAPACITANCE AND THE UNPROTECTED INTERNAL CAPACITANCE (Ci) OF THE INTRINSICALLY SAFE APPARATUS, AND THE APPROVED MAX. ALLOWABLE CONNECTED INDUCTANCE (La) OF THE ASSOCIATED APPARATUS MUST BE GREATER THAN THE SUM OF THE INTERCONNECTING CABLE INDUCTANCE AND THE UNPROTECTED INTERNAL INDUCTANCE (Li) 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 $(\frac{Voc \times Isc}{4})$ IS LESS THAN OR EQUAL TO 1 WATT
C_I = .01μf	C_A IS GREATER THAN .01μf
L_I = 10μH	L_A IS GREATER THAN 10μH

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 $(\frac{Voc \times Isc}{4})$ IS LESS THAN OR EQUAL TO 1 WATT

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	$(\frac{V_T X I_T}{4})$ OR $(\frac{V_{oc} x I_{sc}}{4})$ 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:

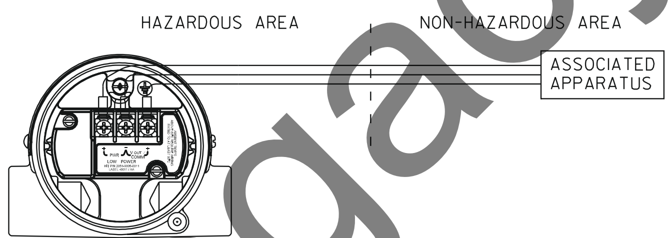
L_I =0.75mH	L_A IS GREATER THAN 0.75mH

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	$(\frac{V_T X I_T}{4})$ OR $(\frac{V_{oc} x I_{sc}}{4})$ 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

DR. Myles Lee Miller
ISSUED

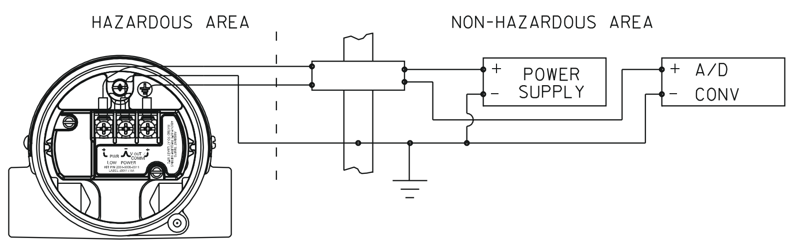
CAD MAINTAINED (MicroStation)

SIZE	FSCM NO	DWG NO.
A		02051-1009

SCALE N/A WT. SHEET 5 OF 13

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

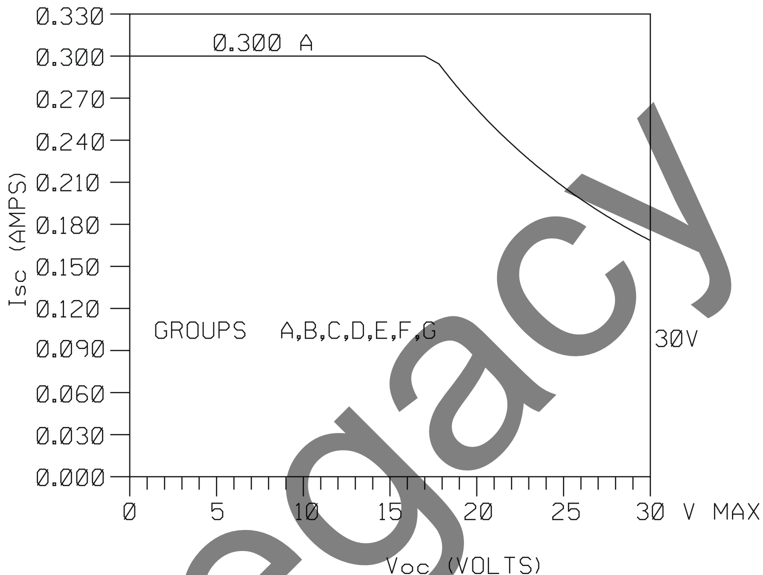
CIRCUIT DIAGRAM 4
TWO SINGLE CHANNEL BARRIERS
(ONLY FOR USE WITH BARRIERS APPROVED
IN THIS CONFIGURATION)

HAZARDOUS AREA NON-HAZARDOUS AREA

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



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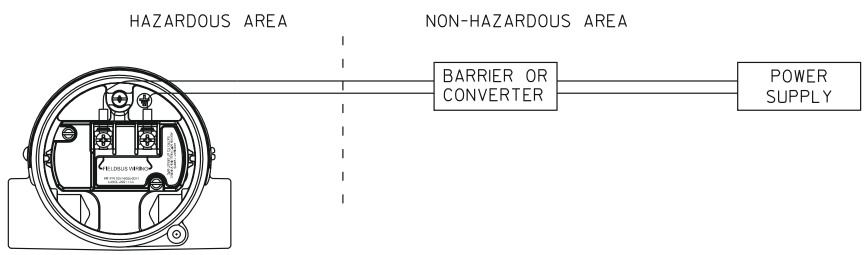
CAD MAINTAINED (MicroStation)

DR. Myles Lee Miller	SIZE A	FSCM NO	DWG NO. 02051-1009
ISSUED	SCALE N/A	WT.	SHEET 7 OF 13

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)

NON-HAZARDOUS AREA

HAZARDOUS AREA

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

ENTITY CONCEPT APPROVALS

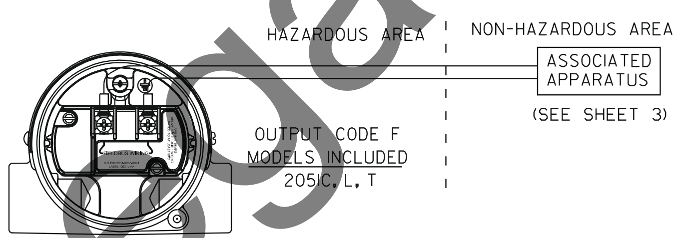
THE ENTITY CONCEPT ALLOWS INTERCONNECTION OF INTRINSICALLY SAFE APPARATUS TO ASSOCIATED APPARATUS NOT SPECIFICALLY EXAMINED IN COMBINATION AS A SYSTEM. THE APPROVED VALUES OF MAX. OPEN CIRCUIT VOLTAGE (Voc OR Vt) AND MAX. SHORT CIRCUIT CURRENT (Isc OR It) AND MAX.POWER (Voc X Isc/4) OR (Vt X It/4), FOR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



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CAD MAINTAINED (MicroStation)

DR. Myles Lee Miller	SIZE A	FSCM NO	DWG NO. 02051-1009
ISSUED	SCALE N/A	WT.	SHEET 9 OF 13

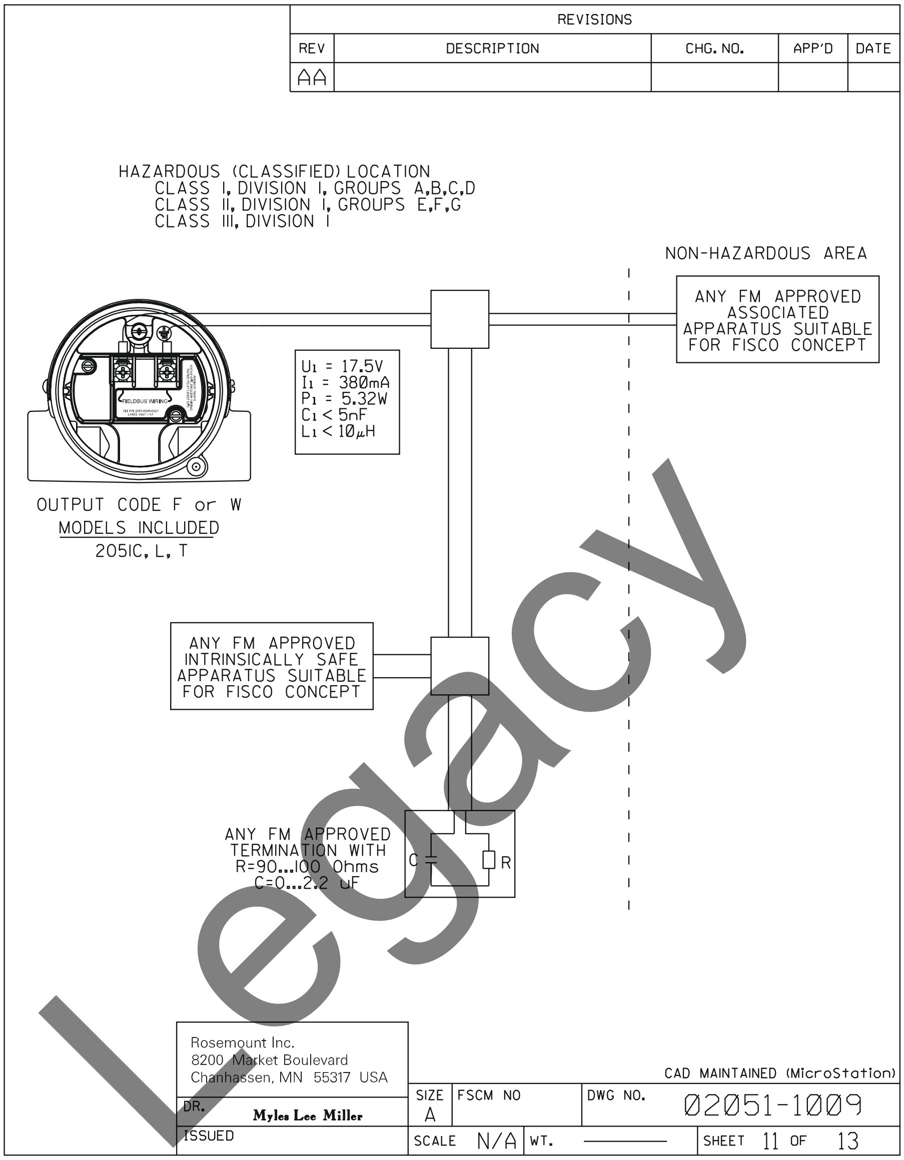
REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AA				

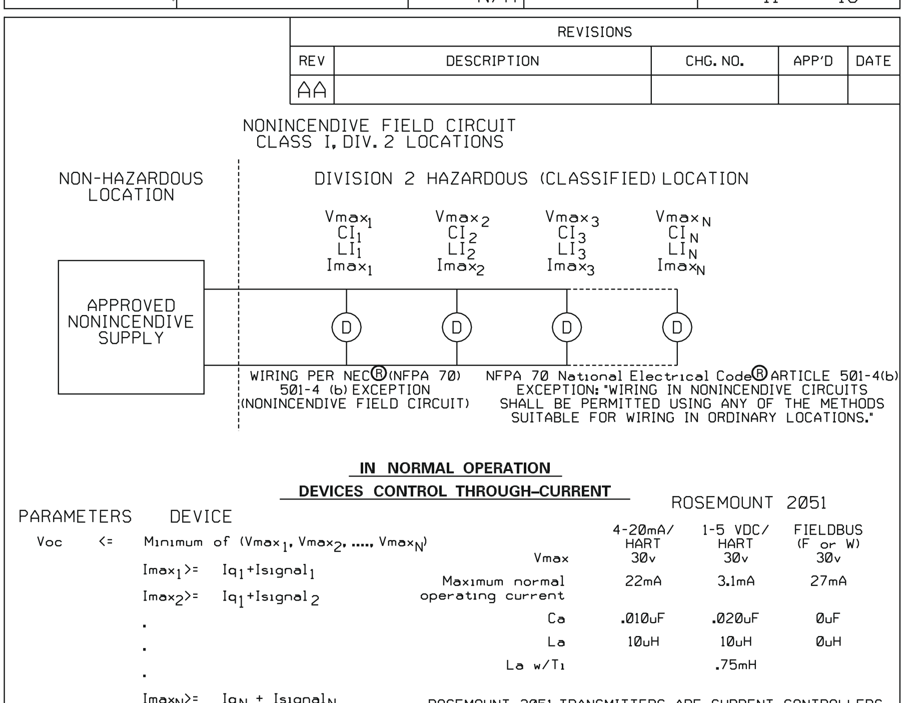
FISCO CONCEPT APPROVALS

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 (Ui or Vmax), THE CURRENT (Ii or Imax), AND THE POWER (Pi 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 (Ci) AND THE INDUCTANCE (Li) 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


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
ANY FM APPROVED ASSOCIATED APPARATUS SUITABLE FOR FISCO CONCEPT
Uı = 17.5V
Iı = 380mA
Pı = 5.32W
Cı < 5nF
Lı < 10µH
OUTPUT CODE F or W
MODELS INCLUDED
2051C, L, T
ANY FM APPROVED INTRINSICALLY SAFE APPARATUS SUITABLE FOR FISCO CONCEPT
ANY FM APPROVED TERMINATION WITH
R=90...100 Ohms
C=0...2.2 uF
C
R
Rosemount Inc.
8200 Market Boulevard
Chanhassen, MN 55317 USA
CAD MAINTAINED (MicroStation)
DR. Myles Lee Miller
ISSUED
SIZE A
FSCM NO
DWG NO. 02051-1009
SCALE N/A
WT.
SHEET 11 OF 13


REVISIONS
REV
DESCRIPTION
CHG. NO.
APP'D
DATE
AA
NONINCENDIVE FIELD CIRCUIT
CLASS I, DIV. 2 LOCATIONS
NON-HAZARDOUS LOCATION
DIVISION 2 HAZARDOUS (CLASSIFIED) LOCATION
Vmax1 CI1 LI1 Imax1
Vmax2 CI2 LI2 Imax2
Vmax3 CI3 LI3 Imax3
VmaxN CIN LIN ImaxN
APPROVED NONINCENDIVE SUPPLY
D
WIRING PER NEC® (NFPA 70) 501-4 (b) EXCEPTION (NONINCENDIVE FIELD CIRCUIT)
NFPA 70 National Electrical Code® ARTICLE 501-4(b) EXCEPTION: "WIRING IN NONINCENDIVE CIRCUITS SHALL BE PERMITTED USING ANY OF THE METHODS SUITABLE FOR WIRING IN ORDINARY LOCATIONS."
IN NORMAL OPERATION
DEVICES CONTROL THROUGH-CURRENT
PARAMETERS DEVICE
Voc <= Minimum of (Vmax1, Vmax2, ..., VmaxN)
Imax1 >= Iq1+Isignal1
Imax2 >= Iq1+Isignal2
ImaxN >= IqN + IsignalN
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/Tı .75mH

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:
   - V_{max} or U_i IS GREATER THAN or EQUAL TO V_{oc}, V_t or U_o
   - I_{max} or I_i IS GRETER THAN or EQUAL TO I_{sc}, I_t or I_o
   - P_{max} or P_i IS GRETER THAN or EQUAL TO P_o
   - C_a IS GREATER THAN or EQUAL TO THE SUM OF ALL C_i's PLUS C_{cable}
   - L_a IS GREATER THAN or EQUAL TO THE SUM OF ALL L_i's PLUS L_{cable}
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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ISSUED	SCALE N/A	WT.	SHEET 13 OF 13

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Canadian Standards Association (CSA)

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
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.

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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

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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

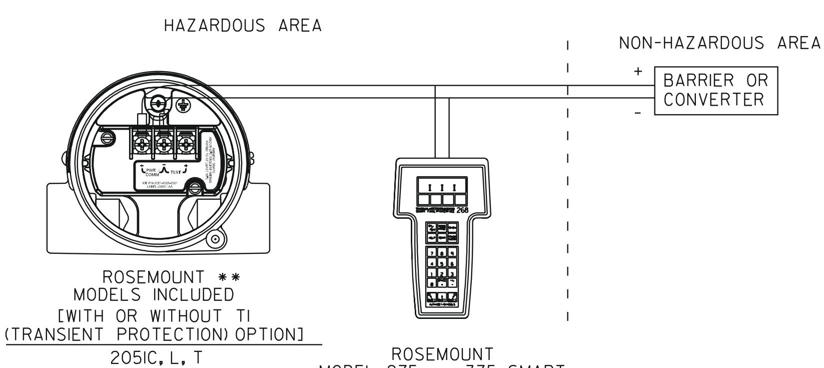
SIZE	FSCM NO	DWG NO.
A		02051-1008

SCALE N/A WT. ———— SHEET 1 OF 9

REVISIONS

REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AB				

CSA INTRINSIC SAFETY APPROVALS
CIRCUIT CONNECTION WITH BARRIER OR CONVERTER
Ex ia
INTRINSICALLY SAFE/SECURITE INTRINSEQUE
4-20 mA, ("A" OUTPUT CODE)



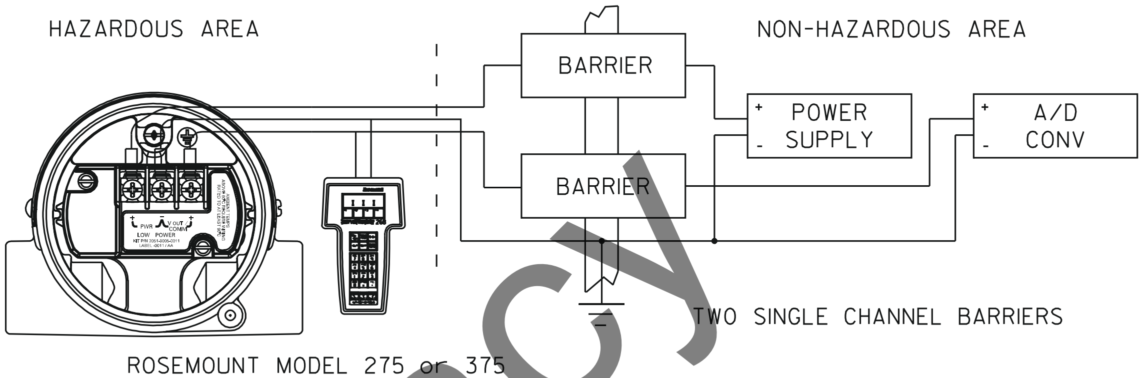
REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AB				

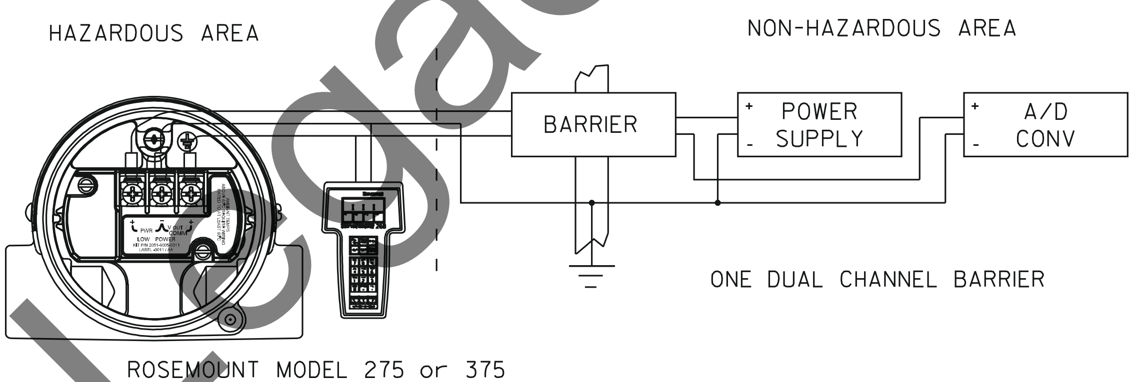
CSA INTRINSIC SAFETY APPROVALS

205IC LOW POWER CIRCUIT CONNECTION WITH INTRINSIC SAFETY BARRIERS

Ex ia

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





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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ISSUED	SCALE N/A	WT. ————	SHEET 4 OF 9		

Form Rev AC

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

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	GROUPS A, B, C, D

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

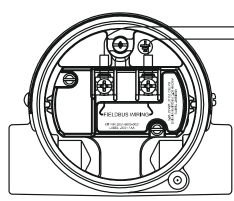
FIELDBUS, ("F" or "W" OUTPUT CODE)

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)

HAZARDOUS AREA

NON-HAZARDOUS AREA



\+
BARRIER OR CONVERTER
\-

ROSEMOUNT **
MODELS INCLUDED
[WITH OR WITHOUT TI
(TRANSIENT PROTECTION) OPTION]
2051C, 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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ISSUED	SCALE N/A	WT.	SHEET 5 OF 9

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

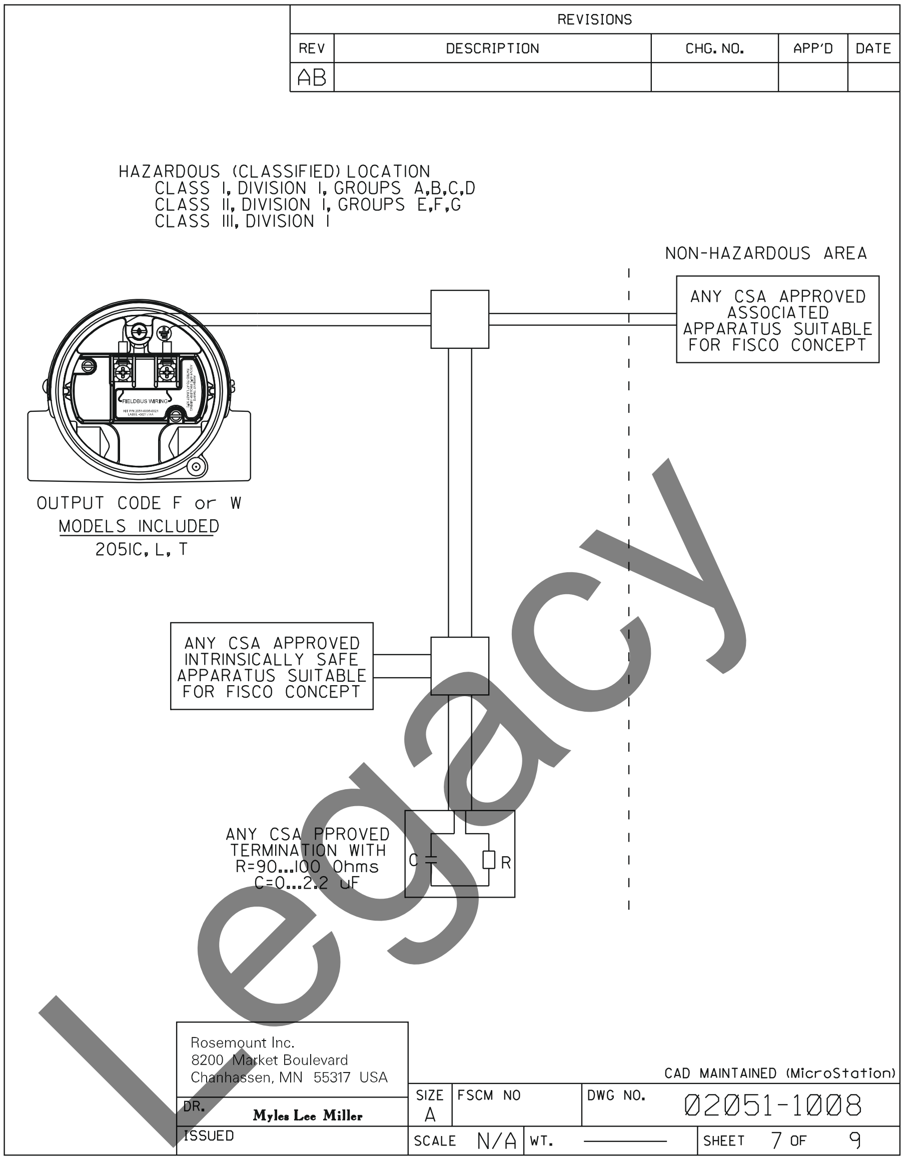
FISCO CONCEPT APPROVALS

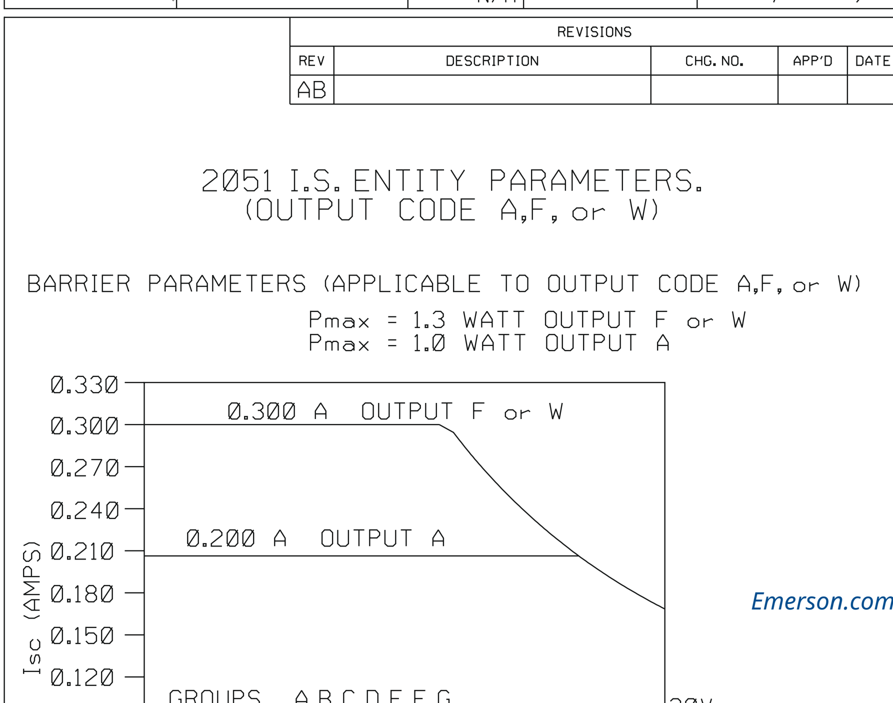
THE FISCO CONCEPT ALLOWS INTERCONNECTION OF INTRINSICALY SAFE APPARATUS TO ASSOCIATED APPARATUS NOT SPECIALLY EXAMINED IN SUCH COMBINATION. FOR THIS INTERCONNECTION TO BE VALID THE VOLTAGE (U_i or Vmax), THE CURRENT (I_i or Imax), AND THE POWER (P_i or Pma) THAT INTRINSICALLY SAVE APPARATUS CAN RECEIVE 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_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 RESPECTIVELY.
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


REVISIONS
REV
DESCRIPTION
CHG. NO.
APP'D
DATE
AB
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
ANY CSA APPROVED ASSOCIATED APPARATUS SUITABLE FOR FISCO CONCEPT
OUTPUT CODE F or W
MODELS INCLUDED
2051C, L, T
ANY CSA APPROVED INTRINSICALLY SAFE APPARATUS SUITABLE FOR FISCO CONCEPT
ANY CSA APPROVED TERMINATION WITH R=90...100 Ohms C=0...2.2 uF
C
R
Rosemount Inc.
8200 Market Boulevard
Chanhassen, MN 55317 USA
DR.
Myles Lee Miller
ISSUED
CAD MAINTAINED (MicroStation)
SIZE
A
FSCM NO
DWG NO.
02051-1008
SCALE
N/A
WT.
SHEET
7 OF 9


REVISIONS
REV
DESCRIPTION
CHG. NO.
APP'D
DATE
AB
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
0.330
0.300
0.270
0.240
0.210
0.180
0.150
0.120
Isc (AMPS)
0.300 A OUTPUT F or W
0.200 A OUTPUT A

REVISIONS				
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AB				

ENTITY CONCEPT APPROVALS

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

FOR OUTPUT CODE A

CLASS I, DIV. 1, GROUPS A, B, C AND D: CLASS I, ZONE 0, 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 0, 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 = 0μf	C_A IS GREATER THAN 0μf + C CABLE
L_I = 0μH	L_A IS GREATER THAN 0μH + L CABLE

FOR OUTPUT CODE M

CLASS I, DIV. 1, GROUPS A, B, C AND D: CLASS I, ZONE 0, 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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DR. Myles Lee Miller	SIZE A	FSCM NO	DWG NO. 02051-1008
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C Glossary

Some of the terms used in this manual relate specifically to the operation of Rosemount transmitters, handheld 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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2024

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