Reference Manual
00809-0100-4107, Rev CA
July 2017

Rosemount™ 2051 Pressure Transmitter

with HART® Revision 5 and 7 Selectable Protocol

HART COMMUNICATION PROTOCOL

EMERSON™

Rosemount™ 2051 Pressure Transmitter

NOTICE

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

For technical assistance, contacts are listed below:

Customer Central

Technical support, quoting, and order-related questions.

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

Asia Pacific- 65 777 8211

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

North American Response Center

Equipment service needs.

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

Outside of these areas, contact your local Emerson™ representative.

⚠ CAUTION

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

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

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Section 1 Introduction

1.1 Using this manual

The sections in this manual provide information on installing, operating, and maintaining the Rosemount™ 2051Pressure Transmitter. The sections are organized as follows:

- Section 2: Configuration provides instruction on commissioning and operating Rosemount 2051. Information on software functions, configuration parameters, and online variables is also included.
- Section 3: Hardware Installation contains mechanical installation instructions, and field upgrade options.
- Section 4: Electrical Installation contains electrical installation instructions, and field upgrade options.
- Section 5: Operation and Maintenance provides detailed information on calibrating and changing HART® Revisions.
- Section 6: Troubleshooting provides troubleshooting techniques for the most common operating problems.
- Section 7: Safety Instrumented Systems Requirements provides identification, installation, configuration, operation and maintenance, and inspection information for Safety Instrumented Systems.
- Appendix A: Specifications and Reference Data supplies reference and specification data, as well as ordering information.
- Appendix B: Product Certifications contains intrinsic safety approval information, European ATEX directive information, and approval drawings.
- Appendix C: Field Communicator Menu Trees and Fast Keys provides full menu trees and abbreviated Fast Key sequences for commissioning tasks.
- Appendix D: Local Operator Interface provides detailed LOI menu trees.

1.2 Models covered

The following Rosemount 2051 are covered by this manual:

1.2.1 Rosemount 2051C Coplanar Pressure Transmitter

- Measures differential and gage pressure up to 2000 psi (137,9 bar).

1.2.2 Rosemount 2051T in-line Pressure Transmitter

- Measures gage/absolute pressure up to 10000 psi (689,5 bar).

1.2.3 Rosemount 2051L Level Transmitter

- Measures level and specific gravity up to 300 psi (20,7 bar).

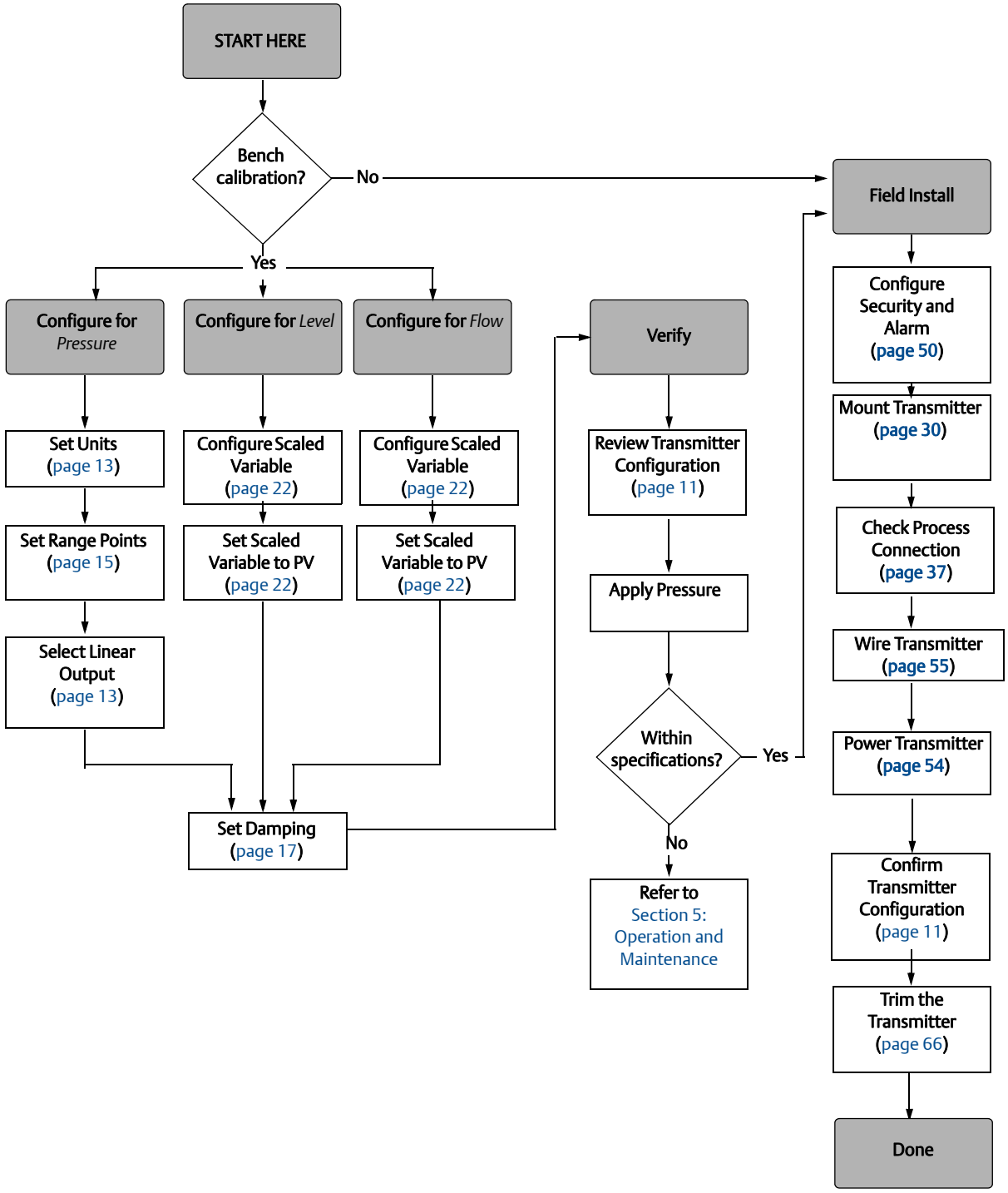
1.2.4 Rosemount 2051CF Series Flowmeter

- Measures flow in line sizes from 1/2-in. (15 mm) to 96-in. (2400 mm).

Note
For Rosemount 2051 with FOUNDATION™ Fieldbus, see Rosemount 2051 Pressure Transmitter with FOUNDATION Fieldbus Protocol Reference Manual. For Rosemount 2051 with PROFIBUS ® PA, see Rosemount 2051 Pressure Transmitter with PROFIBUS PA Protocol Reference Manual.

1.3 HART installation flowchart

Figure 1-1. HART Installation Flowchart



1.4 Transmitter overview

The Rosemount 2051C Coplanar™ design is offered for Differential Pressure (DP) and Gage Pressure (GP) measurements. The Rosemount 2051C utilizes capacitance sensor technology for DP and GP measurements. The Rosemount 2051T utilizes piezoresistive sensor technology for AP and GP measurements.

The major components of the Rosemount 2051 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, a memory module, and the analog to digital signal converter (A/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 optional external configuration buttons, and the terminal block. The basic block diagram of the Rosemount 2051CD is illustrated in Figure 1-3 on page 5.

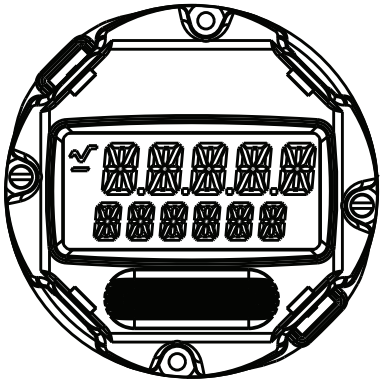
For the Rosemount 2051, pressure is applied to the isolating diaphragm(s). The oil deflects the sensor which then changes its capacitance or voltage signal. This signal is then changed to a digital signal by the Signal Processing. The microprocessor then takes the signals from the Signal Processing and calculates the correct output of the transmitter. This signal is then sent to the D/A converter, which converts the signal back to the analog signal, then superimposes the HART signal on the 4–20 mA output.

An optional LCD can be ordered that connects directly to the interface board which maintains direct access to the signal terminals. The display indicates output and abbreviated diagnostic messages. A glass display cover is provided. For 4–20 mA HART output, the LCD Display features a two-line display. The first line displays the actual measured value, the second line of six characters displays the engineering units. The LCD can also display diagnostic messages.

Note
LCD Display utilizes a 5 x 6 character display and can display output and diagnostic messages. The LOI Display uses an 8 x 6 character display and can display output, diagnostic messages, and LOI menu screens. The LOI Display comes with two buttons mounted on the front of the display board. See below figure.

Figure 1-2. LOI/LCD Display

LCD Display



LOI Display

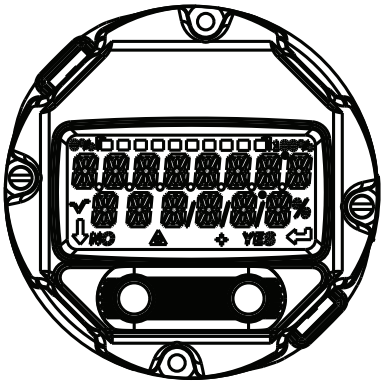
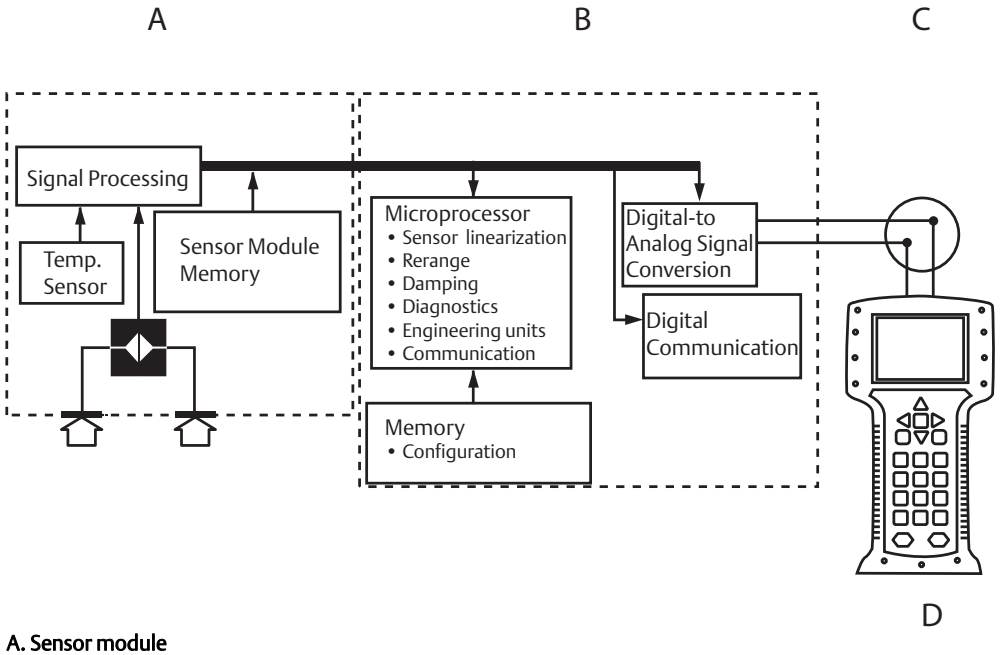


Figure 1-3. Block Diagram of Operation



A. Sensor module
B. Electronics board
C. 4–20 mA signal to control system
D. Field Communicator

1.5 Service support

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

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

For inquiries outside of the United States, contact the nearest Emerson representative for RMA instructions.

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

⚠ CAUTION

Individuals who handle products exposed to a hazardous substance can avoid injury if they are informed of and understand the hazard. The product being returned will require a copy of the required Material Safety Data Sheet (MSDS) for each substance must be included with the returned goods.

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

1.6 Product recycling/disposal

Recycling of equipment and packaging should be taken into consideration and disposed of in accordance with local and national legislation/regulations.

Section 2 Configuration

2.1 Configuration overview

This section contains information on commissioning and tasks that should be performed on the bench prior to installation, as well as tasks performed after installation as described in "Performing transmitter tests" on page 24.

Field Communicator, AMS™ Device Manager, and Local Operator Interface (LOI) instructions are given to perform configuration functions. For convenience, Field Communicator Fast Key sequences are labeled "Fast Keys," and abbreviated LOI menus are provided for each function below.

Full Field Communicator menu trees and Fast Key sequences are available in Appendix C: Field Communicator Menu Trees and Fast Keys. LOI menu trees are available in Appendix D: Local Operator Interface.

2.2 Safety messages

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

⚠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. Review the approvals section of the Rosemount™ 2051 reference manual for any restrictions associated with a safe installation.

- Before connecting a Field Communicator in an explosive atmosphere, ensure the instruments in the loop are installed in accordance with intrinsically safe or non-incendive field wiring practices.
- In an explosion-proof/flameproof installation, do not remove the transmitter covers when power is applied to the unit.

Process leaks may cause harm or result in death.

- Install and tighten process connectors before applying pressure.

Electrical shock can result in death or serious injury.

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

2.3 System readiness

- If using HART® based control or asset management systems, confirm the HART Protocol capability of such systems prior to commissioning and installation. Not all systems are capable of communicating with HART Revision 7 devices.
- For instructions on how to change the HART revision of your transmitter, see "Switching HART Revision" on page 72.

2.3.1 Confirm correct Device Driver

1. Verify the latest Device Driver (DD/DTM™) is loaded on your systems to ensure proper communications.
2. Reference Emerson.com or FieldCommGroup.org for the latest DD.
3. In the browse by member dropdown menu, select Rosemount business unit of Emerson™.
4. Select desired Product
   a. Within Table 2-1, use the HART Universal Revision and Device Revision numbers to find the correct Device Driver

Table 2-1. Rosemount 2051 Device Revisions and Files

Software release date	Identify device		Find Device Driver		Review instructions	Review functionality
	NAMUR software revision(1)	HART software revision(2)	HART universal revision	Device revision(3)	Reference manual	Changes to software
August 2012	1.0.0	01	7	10	Rosemount 2051 Reference Manual	(4)
			5	9		
January 1998	N/A	178	5	3	Rosemount 2051 Reference Manual	N/A

1. NAMUR Software Revision is located on the hardware tag of the device
2. HART Software Revision can be read using a HART capable configuration tool.
3. Device Driver file names use Device and DD Revision, e.g. 10_01. HART Protocol is designed to enable legacy device driver revisions to continue to communicate with new HART devices. To access new functionality, the new Device Driver must be downloaded. It is recommended to download new Device Driver files to ensure full functionality.

4. HART Revision 5 and 7 Selectable, Safety Certified, Local Operator Interface, Scaled Variable, Configurable Alarms, Expanded Engineering Units.

2.4 Configuration basics

⚠ CAUTION

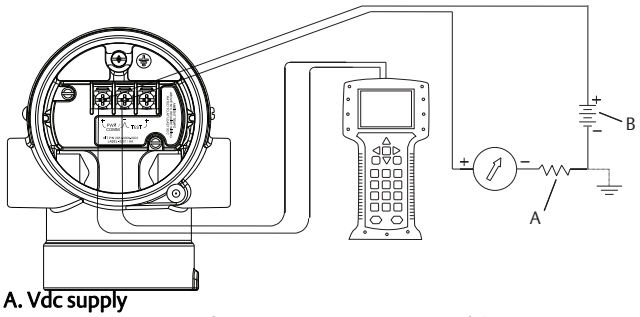
Set all transmitter hardware adjustments during commissioning to avoid exposing the transmitter electronics to the plant environment after installation.

The Rosemount 2051 can be configured either before or after installation. Configuring the transmitter on the bench using either a Field Communicator, AMS Device Manager, or LOI ensures all transmitter components are in working order prior to installation. Verify that the security switch is set in the unlock position ( ) in order to proceed with configuration. See Figure 4-2 on page 51 for switch location.

2.4.1 Configuring on the bench

To configure on the bench, required equipment includes a power supply, and a Field Communicator, AMS Device Manager, or an LOI (option M4). Wire equipment as shown in figure below. To ensure successful HART communication, a resistance of at least 250 Ωs must be present between the transmitter and the power supply, see "Power supply" on page 54 for details. Connect the Field Communicator leads to the terminals labeled "COMM" on the terminal block or 1–5 V configuration, wire as shown in Figure 2-1 on page 9. The Field communicator is connected to the terminals labeled VOUT/COMM.

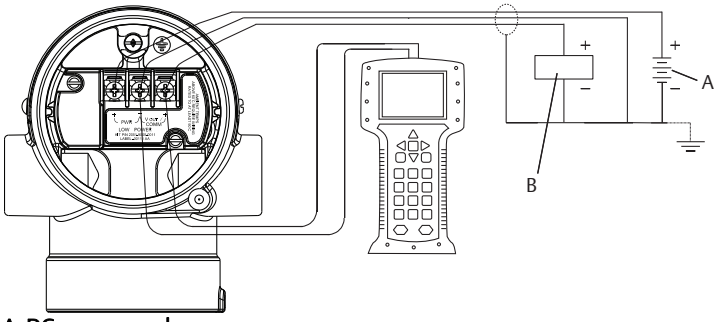
Figure 2-1. Wiring the Transmitter (4–20 mA HART Protocol)



A. Vdc supply
B. $R_L \geq 250$ (necessary for HART communication only)

2.4.2 Configuration tools

Figure 2-2. Wiring the Transmitter (1–5 Vdc Low Power)



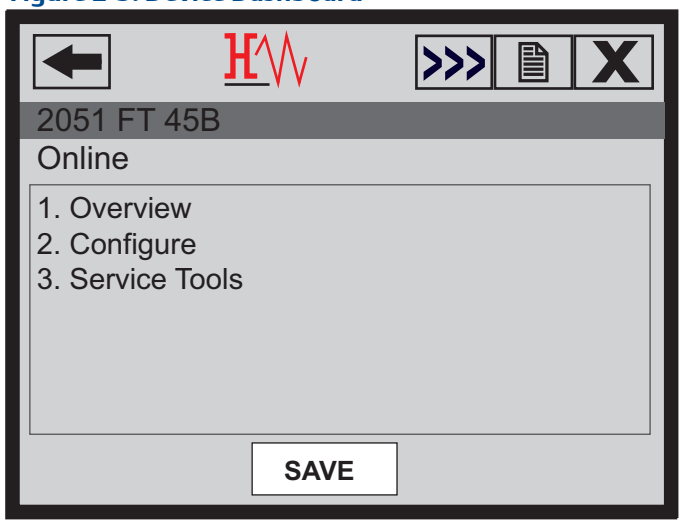
A. DC power supply
B. Voltmeter

Configuring with a Field Communicator

There are two interfaces available with the Field Communicator: Traditional and dashboard interfaces. All steps using a Field Communicator will be described using Dashboard interfaces. Figure 2-3 on page 10 shows the Device Dashboard interface. As stated in System readiness , it is critical that the latest DD's are loaded into the Field Communicator. Visit Emerson.com or FieldCommGroup.org to download latest DD library.

Field Communicator menu trees and Fast Keys are available in Appendix C: Field Communicator Menu Trees and Fast Keys.

Figure 2-3. Device Dashboard



Configuring with AMS Device Manager

Full configuration capability with AMS Device Manager requires loading the most current DD for this device. Download the latest DD at Emerson.com or FieldCommGroup.org.

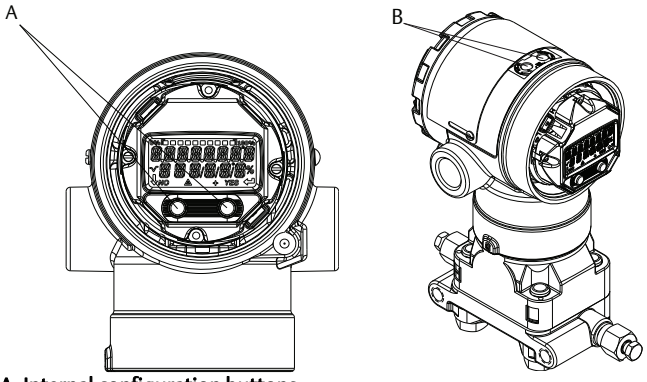
Note
All steps using AMS Device Manager will be described using version 11.5.

Configuring with a LOI

The LOI requires option code M4 to be ordered. To activate the LOI push either configuration button. Configuration buttons are located on the LCD display (must remove housing cover to access), or underneath the top tag of the transmitter. See Table 2-2 for configuration button functionality and Figure 2-4 for configuration button location. When using the LOI for configuration, several features require multiple screens for a successful configuration. Data entered will be saved on a screen-by-screen basis; the LOI will indicate this by flashing "SAVED" on the LCD display each time.

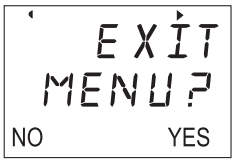
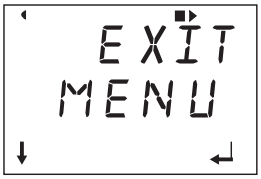
LOI menu trees are available in Appendix D: Local Operator Interface.

Figure 2-4. LOI Configuration Buttons



A. Internal configuration buttons
B. External configuration buttons

Table 2-2. LOI Button Operation

Button		
Left	No	SCROLL
Right	Yes	ENTER

2.4.3 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 control. The Field Communicator, AMS Device Manager, or the LOI will prompt you to set the loop to manual when necessary. The prompt is only a reminder; acknowledging this prompt does not set the loop to manual. It is necessary to set the loop to manual control as a separate operation.

2.5 Verify configuration

It is recommended that various configuration parameters are verified prior to installation into the process. The various parameters are detailed out for each configuration tool. Depending on what configuration tool(s) are available follow the steps listed relevant to each tool.

2.5.1 Verifying configuration with Field Communicator

Configuration parameters listed in Table 2-3 are to be reviewed prior to transmitter installation. A Full list of configuration parameters that can be reviewed and configured using a Field Communicator are located in Appendix C: Field Communicator Menu Trees and Fast Keys.

Fast Key sequences for the latest DD are shown in Table 2-3. For Fast Key sequences for legacy DD's contact your local Emerson.

Table 2-3. Rosemount 2051 Device Dashboard Fast Key Sequence

From the *HOME* screen, enter the Fast Key sequences listed

Function	Fast Key Sequence	
	HART 7	HART 5
Alarm and Saturation Levels	2, 2, 2, 5	2, 2, 2, 5
Damping	2, 2, 1, 1, 5	2, 2, 1, 1, 5
Primary Variable	2, 1, 1, 4, 1	2, 1, 1, 4, 1
Range Values	2, 1, 1, 4	2, 1, 1, 4
Tag	2, 2, 7, 1, 1	2, 2, 7, 1, 1
Transfer Function	2, 2, 1, 1, 6	2, 2, 1, 1, 6
Units	2, 2, 1, 1, 4	2, 2, 1, 1, 4

2.5.2 Verifying configuration with AMS Device Manager

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

2.5.3 Verifying configuration with LOI

Select any configuration button to activate the LOI. Select **VIEW CONFIG** to review the below parameters. Use the configuration buttons to navigate through the menu. The parameters to be reviewed prior to installation include:

- Tag
- Units
- Transfer function
- Alarm and saturation levels
- Primary variable
- Range values
- Damping

2.5.4 Verifying process variables configuration

This section describes how to verify that the correct process variables are selected.

Verifying process variables with a Field Communicator

From the *HOME* screen, enter the Fast Key sequence

Device Dashboard Fast Keys	3, 2, 1

Verifying process variables with AMS Device Manager

Right click on the device and select **Overview** from the menu.

1. Select the **All Variables** button to display the primary, secondary, tertiary and quaternary variables.

2.6 Basic setup of the transmitter

This section goes through the necessary steps for basic setup of a pressure transmitter. When installing in DP level or DP flow applications, refer to"Configuring Scaled Variable" on page 20 for setup instructions.

2.6.1 Setting pressure units

⚠ The pressure unit command sets the unit of measure for the reported pressure.

Setting pressure units with a Field Communicator

From the *HOME* screen, enter the Fast Key sequence

Device Dashboard Fast Keys	2, 2, 1, 1, 4

Setting pressure units with AMS Device Manager

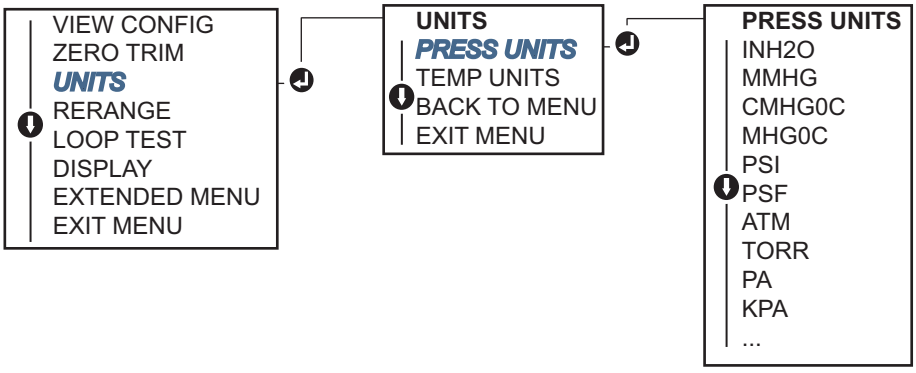
Right click on the device and select **Configure**.

1. Select **Manual Setup** and select desired units from *Pressure Units* dropdown menu.
2. Select **Send** when complete.

Setting pressure units with a LOI

Follow Figure 2-5 on page 13 to select desired pressure and temperature units. Use the **SCROLL** and **ENTER** buttons to select desired unit. Save by selecting **SAVE** as indicated on the LCD display.

Figure 2-5. Selecting Units with LOI



2.6.2 Setting transmitter output (transfer function)

⚠ The Rosemount 2051 has two output settings: Linear and square root. As shown in Figure 2-7 on page 14, activating the square root options makes analog output proportional to flow, and includes a fixed low flow cutoff at five percent.

However, for DP Flow and DP Level applications it is recommended to use scaled variable. Refer to "Configuring Scaled Variable" on page 20 for setup instructions.

Setting transmitter output with a Field Communicator

From the *HOME* screen, enter the Fast Key sequence

Device Dashboard Fast Keys	2, 2, 1, 1, 6

Setting transmitter output with AMS Device Manager

Right click on the device and select **Configure**.

1. Select **Manual Setup** and choose output type from analog output transfer function and select **Send**.
2. Carefully read the warning and select **Yes** if it is safe to apply the changes.

Setting transmitter output with a LOI

Reference Figure 2-6 on page 14 to select either linear or square root transfer function using the LOI.

Figure 2-6. Set Output with LOI

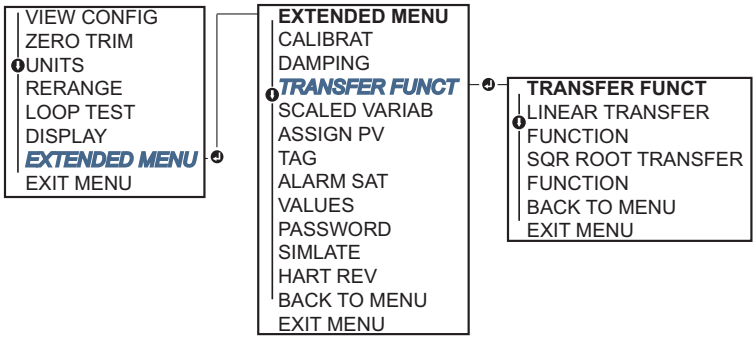
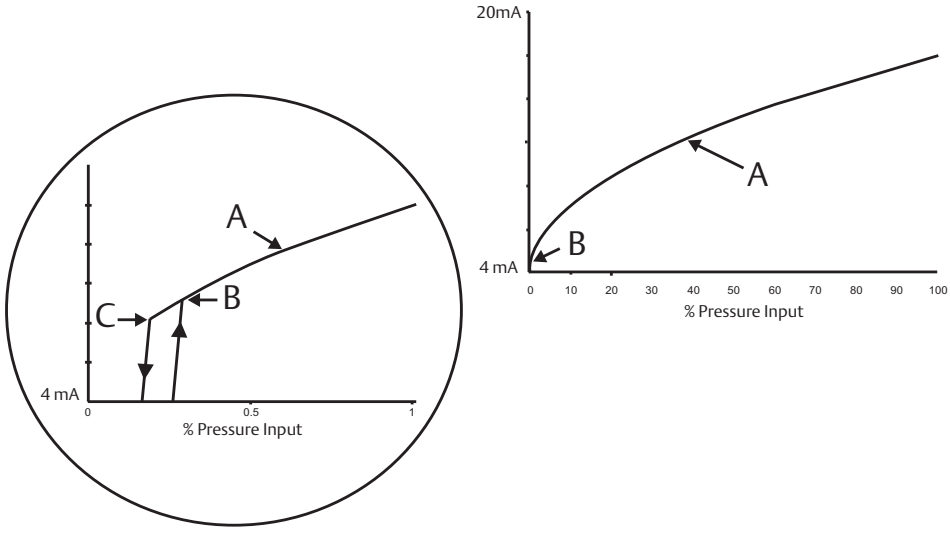


Figure 2-7. 4–20 mA HART Square Root Output Transition Point



A. Square root curve
B. Five percent transition point
C. Four percent transition point

2.6.3 Rerange the transmitter

The Range Values command sets each of the lower and upper range analog values (4 and 20 mA/1–5 Vdc points) to a pressure. The lower range point represents zero percent of range and the upper range point represents 100 percent 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" on page 95.

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 by manually setting range points with a Field Communicator, AMS Device Manager, or LOI.
- Rerange with a pressure input source and a Field Communicator, AMS Device Manager, LOI, or local zero and span buttons.

Manually rerange the transmitter by entering range points

Entering range points with a Field Communicator

From the *HOME* screen, enter the Fast Key sequence

Device Dashboard Fast Keys	2, 2, 2, 1

Entering range points with AMS Device Manager

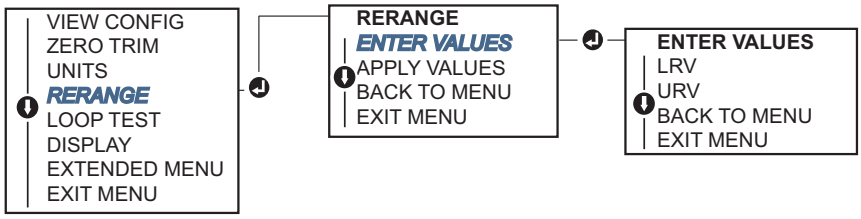
Right click on the device and select **Configure**:

1. Select **Manual Setup** and select **Analog Output**.
2. Enter upper and lower range values in the Range Limits box and select **Send**.
3. Carefully read the warning and select **Yes** if it is safe to apply the changes.

Entering range points with a LOI

Reference Figure 2-8 on page 15 to rerange the transmitter using the LOI. Enter values using **SCROLL** and **ENTER** buttons.

Figure 2-8. Rerange with LOI



Rerange the transmitter with applied pressure source

Reranging using an applied pressure source is a way of reranging the transmitter without entering specific 4 and 20 mA (1–5 Vdc) points.

Field Communicator

From the *HOME* screen, enter the Fast Key sequence

Device Dashboard Fast Keys	2, 2, 2, 2

Rerange with an applied pressure source using AMS Device Manager

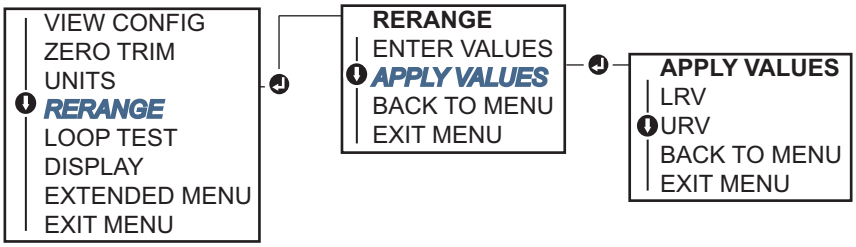
Right click on the device, select **Configure**.

1. Select the **Analog Output** tab.
2. Select **Range by Applying Pressure** button and follow the screen prompts range the transmitter.

Rerange with an applied pressure source using an LOI

Use Figure 2-9 to manually rerange the device using an applied pressure source with an LOI.

Figure 2-9. Rerange with Applied Pressure Using LOI



Rerange with an applied pressure source using local zero and span buttons

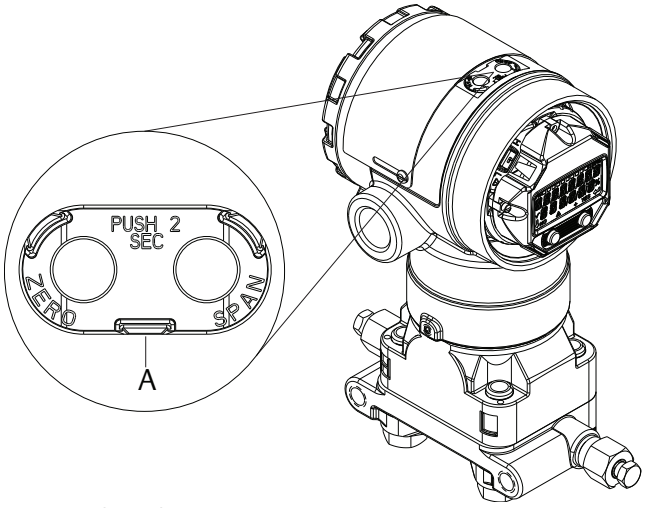
If ordered, local zero and span buttons (option code D4) can be used to rerange the transmitter with an applied pressure. Refer to Figure 2-10 on page 17 for analog zero and span button location.

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

1. Loosen the screw holding the top tag of the transmitter housing. Rotate the label to expose the zero and span buttons.
2. Confirm device has local zero and span buttons by verifying blue retainer under the tag.
3. Apply transmitter pressure.
4. Rerange the transmitter.
   a. To change the zero (4 mA/1 V point) while maintaining the span: press and hold zero button for at least two seconds then release.
   b. To change the span (20 mA/5 V point) while maintaining the zero point: press and hold the span button for at least two seconds and then release.

Note
4 mA and 20 mA points must maintain the minimum span defined in Appendix A: Specifications and Reference Data.

Figure 2-10. Analog Zero and Span Buttons



A. Zero and span buttons

- If the transmitter security is on, adjustments to the zero and span will not be able to be made. Refer to "Configure security and simulation" on page 50 for security information.
- The span is maintained when the 4 mA/1 V point is set. The span changes when the 20 mA/5 V 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.
- Regardless of the range points, the Rosemount 2051 will measure and report all readings within the digital limits of the sensor. For example, if the 4 and 20 mA(1–5 Vdc) 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.

2.6.4 Damping

⚠ The damping command changes the response time of the transmitter; higher values can smooth 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 damping command utilizes floating point configuration allowing the user to input any damping value within 0.0–60.0 seconds.

Damping with a Field Communicator

From the *HOME* screen, enter the Fast Key sequence

Device Dashboard Fast Keys	2, 2, 1, 1, 5

Enter desired Damping Value and select **APPLY**.

Damping with AMS Device Manager

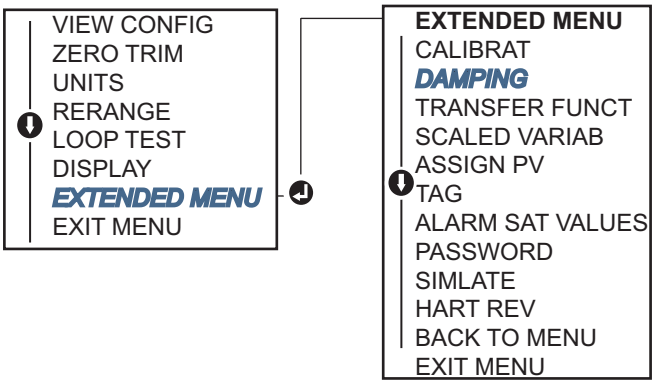
Right select on the device and select **Configure**.

1. Select **Manual Setup**.
2. Within the *Pressure Setup* box, enter desired damping value and select **Send**.
3. Carefully read the warning and select **Yes** if it is safe to apply the changes.

Damping with a LOI

Reference Figure 2-11 to enter damping values using an LOI.

Figure 2-11. Damping with LOI



2.7 Configuring the LCD display

The LCD display configuration command allows customization of the LCD display to suit application requirements. The LCD display will alternate between the selected items.

- Pressure units
- % of range
- Scaled variable
- Sensor temperature
- mA/Vdc output

In the following instructions, the LCD display can also be configured to display configuration information during the device startup. Select **Review Parameters at Startup** to enable or disable this functionality.

Reference Figure 1-2 on page 4 LCD display with LOI for image of LCD screen.

Configuring LCD Display with a Field Communicator

From the *HOME* screen, enter the Fast Key sequence

Device Dashboard Fast Keys	2, 2, 4

Configuring LCD display with AMS Device Manager

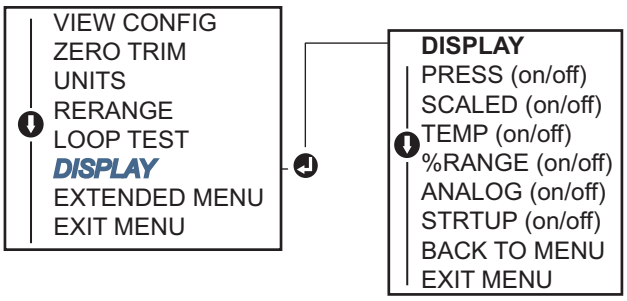
Right click on the device and select **Configure**.

1. Select **Manual Setup,** select the **Display tab.**
2. Select desired display options and select **Send.**

Configuring LCD display with a LOI

Refer to Figure 2-12 for LCD display configuration using a LOI.

Figure 2-12. Display with LOI



2.8 Detailed transmitter setup

2.8.1 Configuring alarm and saturation levels

In normal operation, the transmitter will drive the output in response to pressure from the lower to upper saturation points. If the pressure goes outside the sensor limits, or if the output would be beyond the saturation points, the output will be limited to the associated saturation point.

The Rosemount 2051 Transmitter automatically and continuously performs self-diagnostic routines. If the self-diagnostic routines detect a failure, the transmitter drives the output to configured alarm and value based on the position of the alarm switch. See "Setting transmitter alarm" on page 53.

Table 2-4. Rosemount Alarm and Saturation Values

Level	4–20 mA saturation	4–20 mA alarm
Low	3.9 mA (0.97 V)	≤ 3.75 mA (0.95 V)
High	20.8 mA (5.2 V)	≥ 21.75 mA (5.4 V)

Table 2-5. NAMUR-Compliant Alarm and Saturation Values

Level	4–20 mA saturation	4–20 mA alarm
Low	3.8 mA (0.95 V)	≤ 3.6 mA (0.9 V)
High	20.5 mA (5.125 V)	≥ 22.5 mA (5.625 V)

Table 2-6. Custom Alarm and Saturation Values

Level	4–20 mA saturation	4–20 mA alarm
Low	3.7 mA to 3.9 mA	3.6 mA to 3.8 mA
High	20.1 mA to 22.9 mA	20.2 mA to 23.0 mA

Failure mode alarm and saturation levels can be configured using a Field Communicator, AMS Device Manager, and the LOI. The following limitations exist for custom levels:

- Low alarm level must be less than the low saturation level
- High alarm level must be higher than the high saturation level
- Alarm and saturation levels must be separated by at least 0.1 mA

The configuration tool will provide an error message if the configuration rule is violated.

Note
Transmitters set to HART multidrop mode send all saturation and alarm information digitally; saturation and alarm conditions will not affect the analog output. See also "Establishing multidrop communication" on page 26.

Configuring alarm and saturation levels using a Field Communicator

From the *HOME* screen, enter the Fast Key sequence

Device Dashboard Fast Keys	2, 2, 2, 5

Configuring alarm and saturation levels with AMS Device Manager

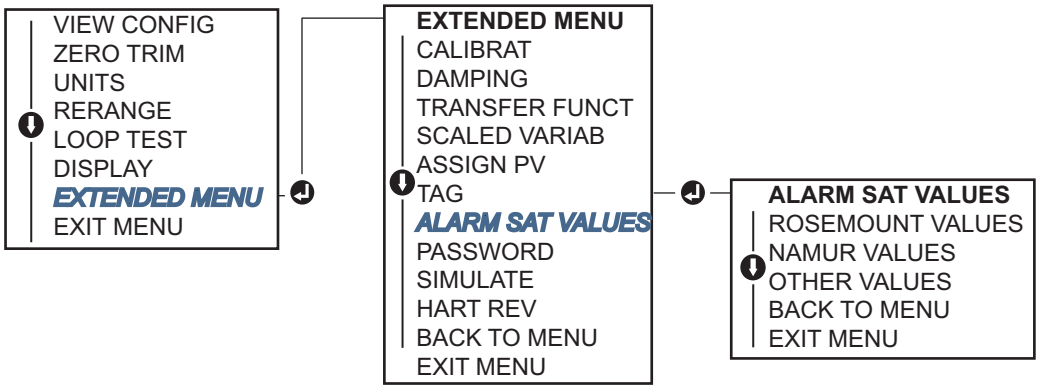
Right click on the device, and select **Configure**.

1. Select **Configure Alarm and Saturation Levels** button.
2. Follow screen prompts to configure Alarm and Saturation Levels.

Configuring alarm and saturation levels using LOI

Refer to Figure 2-13 for instructions to configure alarm and saturation levels.

Figure 2-13. Configuring Alarm and Saturation with LOI



2.8.2 Configuring Scaled Variable

The Scaled Variable configuration allows the user to create a relationship/conversion between the pressure units and user-defined/custom units. There are two use cases for scaled variable. The first use case is to allow custom units to be displayed on the transmitter's LOI/LCD display. The second use case is to allow custom units to drive the transmitter's 4–20 mA output.

If the user desires custom units to drive the 4–20 mA (1–5 Vdc) output, scaled variable must be re-mapped as the primary variable. Refer to "Re-mapping device variables" on page 23.

The scaled variable configuration defines the following items:

- Scaled Variable units - custom units to be displayed.
- Scaled data options - defines the transfer function for the application
  - Linear
  - Square root
- Pressure value position 1 - lower known value point with consideration of linear offset.
- Scaled Variable value position 1 - custom unit equivalent to the lower known value point.
- Pressure value position 2 - upper known value point.
- Scaled Variable value position 2 - custom unit equivalent to the upper known value point
- Linear offset - the value required to zero out pressures effecting the desired pressure reading.
- Low flow cutoff - point at which output is driven to zero to prevent problems caused by process noise. It is highly recommended to use the low flow cutoff function in order to have a stable output and avoid problems due to process noise at a low flow or no flow condition. A low flow cutoff value that is practical for the flow element in the application should be entered.

Configuring scaled variable using a Field Communicator

From the *HOME* screen, enter the Fast Key sequence

Device Dashboard Fast Keys	2, 1, 4, 7

1. Follow the screen prompts to configure Scaled Variable.
   a. When configuring for level, select **Linear** under *Select Scaled data options*.
   b. When configuring for flow, select **Square Root** under *Select Scaled data options*.

Configuring scaled variable using AMS Device Manager

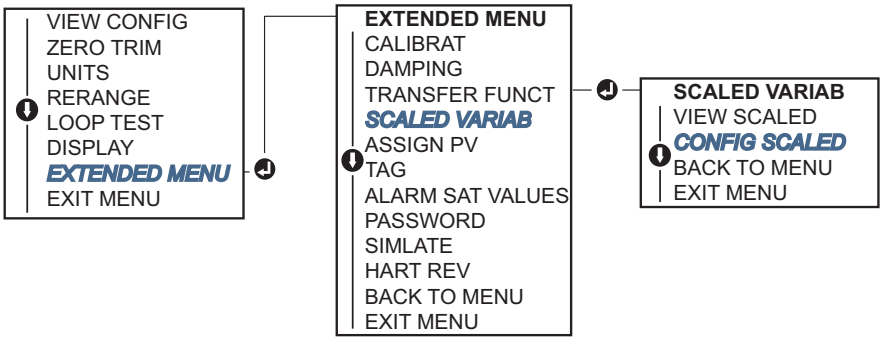
Right click on the device and, select **Configure**.

1. Select the **Scaled Variable** tab and select the **Scaled Variable** button.
2. Follow screen prompts to configure Scaled Variable
   a. When configuring for level applications, select **Linear** under *Select Scaled data options*.
   b. When configuring for flow applications, select **Square Root** under *Select Scaled data options*.

Configuring scaled variable using a LOI

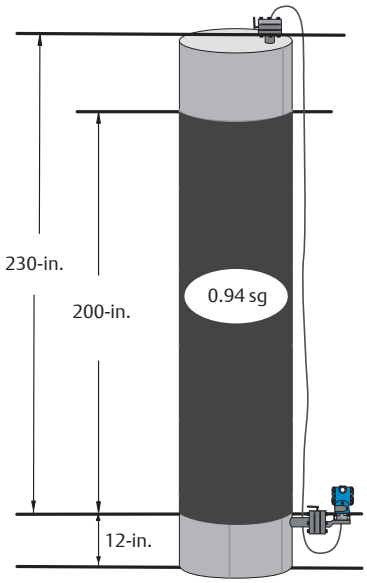
Refer to Figure 2-14 on page 21 for instructions to configure scaled variable using a LOI.

Figure 2-14. Configuring Scaled Variable using a Local Operator Interface



DP level example

Figure 2-15. Example Tank



A differential transmitter is used in a level application. Once installed on an empty tank and taps vented, the process variable reading is –209.4 inH_2O. The process variable reading is the head pressure created by fill fluid in the capillary. Based on Table 2-7 on page 22, the scaled variable configuration would be as follows:

Table 2-7. Scaled Variable Configuration for Tank Application

Scaled variable units:	inch
Scaled data 13:	linear
Pressure value position 1:	0 inH_2O
Scaled Variable position 1:	12-in.
Pressure value position 2:	188 inH_2O
Scaled Variable position 2:	212-in.
Linear offset:	–209.4 inH_2O

DP flow example

A differential pressure transmitter is used in conjunction with an orifice plate in a flow application where the differential pressure at full scale flow is 125 inH_2O. In this particular application, the flow rate at full scale flow is 20,000 gallons of water per hour. It is highly recommended to use the low flow cutoff function in order to have a stable output and avoid problems due to process noise at a low flow or no flow condition. A low flow cutoff value that is practical for the flow element in the application should be entered. In this particular example, the low flow cutoff value is 1000 gallons of water per hour. Based on this information, the Scaled Variable configuration would be as follows:

Table 2-8. Scaled Variable Configuration for Flow Application

Scaled Variable units:	gal/h
Scaled data options:	square root
Pressure value position 2:	125 inH_2O
Scaled Variable position 2:	20,000 gal/h
Low Flow Cutoff:	1000 gal/h

Note
Pressure value position 1 and Scaled Variable position 1 are always set to zero for a flow application. No configuration of these values is required.

2.8.3 Re-mapping device variables

⚠ The re-mapping function allows the transmitter primary, secondary, tertiary, and quaternary variables (PV, 2V, 3V, and 4V) to be configured as desired. The PV can be remapped with a Field Communicator, AMS Device Manager, or a LOI. Variables (2V, 3V, and 4V) can only be re-mapped via Field Communicator or AMS Device Manager.

Note
The variable assigned to the primary variable drives the 4–20 mA (1–5 Vdc) output. This value can be selected as pressure or scaled variable. The 2, 3, and 4 variables only apply if HART burst mode is being used.

Re-mapping using a Field Communicator

From the *HOME* screen, enter the Fast Key sequence

Fast Keys	2, 1, 1, 3

Re-mapping using AMS Device Manager

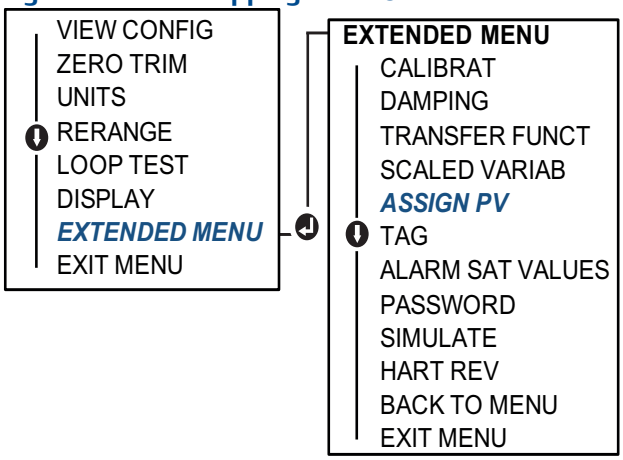
Right click on the device and select **Configure**.

1. Select **Manual Setup** and select on the **HART** tab.
2. Assign Primary, secondary, tertiary, and quaternary variables under *Variable Mapping*.
3. Select **Send**.
4. Carefully read the warning and select **Yes** if it is safe to apply the changes.

Re-mapping using LOI

Refer to Figure 2-16 for instructions to remap the primary variable using a LOI.

Figure 2-16. Re-Mapping with LOI



2.9 Performing transmitter tests

2.9.1 Verifying alarm level

If the transmitter electronics board, sensor module, or LOI/LCD display is repaired or replaced, verify the transmitter alarm level before returning the transmitter to service. This is useful in testing the reaction of the control system to a transmitter in an alarm state. Thus ensuring the control system recognizes the alarm when activated. To verify the transmitter alarm values, perform a loop test and set the transmitter output to the alarm value (see Table 2-4, 2-5, and 2-6 on page 19, and "Verifying alarm level" on page 24).

Note
Before returning transmitter to service, verify security switch is set to the correct position. Refer to "Verify configuration" on page 11.

2.9.2 Performing an analog loop test

⚠ The analog 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. It is recommended that the 4–20 mA (1–5 Vdc) points in addition to alarm levels when installing, repairing, or replacing a transmitter.

The host system may provide a current measurement for the 4–20 mA (1–5 Vdc) HART output. If not, 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.
For 1–5 V output, voltage measurement is directly measured from V_{out} to (–) terminals.

Performing a analog loop test using a Field Communicator

From the *HOME* screen, enter the Fast Key sequence

Device Dashboard Fast Keys	3, 5, 1

Performing a analog loop test using AMS Device Manager

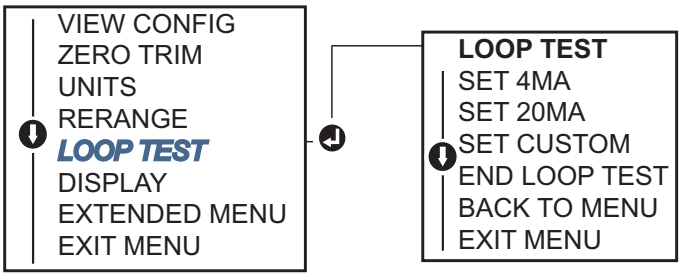
Right click on the device and, within the *Methods* dropdown menu, move cursor over *Diagnostics and Test*. In the *Diagnostics and Test* dropdown menu select **Loop Test**.

1. Select **Next** after setting the control loop to manual.
2. Follow screen prompts to perform a loop test.
3. Select **Finish** to acknowledge the method is complete.

Performing analog loop test using a LOI

To perform an analog loop test using the LOI, the 4 mA (1 V), 20 mA (5 V), and custom mA point may be set manually. Reference Figure 2-17 for instructions on how to perform a transmitter loop test using an LOI.

Figure 2-17. Performing an Analog Loop Test Using an LOI



2.9.3 Simulate device variables

It is possible to temporarily set the to a user-defined fixed value for testing purposes. Once the simulated variable method is left, the process variable will be automatically returned to a live measurement. Simulate device variables is only available in HART Revision 7 mode.

Simulate digital signal with a Field Communicator

From the *HOME* screen, enter the Fast Key sequence

Device Dashboard Fast Keys	3, 5

Simulate digital signal with AMS Device Manager

Right click on the device and select **Service Tools**.

1. Select **Simulate.**
2. Under *Device Variables* select a digital value to simulate.
   a. Pressure
   b. Sensor Temperature
   c. Scaled Variable
3. Follow the screen prompts to simulate selected digital value.

2.10 Configuring burst mode

Burst mode is compatible with the analog signal. Because the HART 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, Scaled Variable, and/or analog output), and does not affect the way other transmitter data is accessed. However, when activated, bust mode can slow down communication of non-dynamic data to the host by 50 percent.

Access to information other than dynamic transmitter data is obtained through the normal poll/response method of HART Protocol communication. A Field 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 Field Communicator, AMS Device Manager, or a control system to initiate a request.

Choosing burst mode options in HART 5

Message content options:

- PV only
- Percent of Range
- PV, 2V, 3V, 4V
- Process Variables
- Device Status

Choosing burst mode options in HART 7

Message content options:

- PV only
- Percent of Range
- PV, 2V, 3V, 4V
- Process Variables and Status
- Process Variables
- Device Status

Choosing a HART 7 Trigger Mode

When in HART 7 mode, the following trigger modes can be selected.

- Continuous (same as HART 5 burst mode)
- Rising
- Falling
- Windowed
- On Change

Note
Consult your host system manufacturer for burst mode requirements.

Configuring burst mode using a Field Communicator

From the *HOME* screen, enter the Fast Key sequence

Device Dashboard Fast Keys	2, 2, 5, 3

Configuring burst mode using AMS Device Manager

Right click on the device and select **Configure**.

1. Select the **HART** tab.
2. Enter the configuration in burst mode configuration fields.

2.11 Establishing multidrop communication

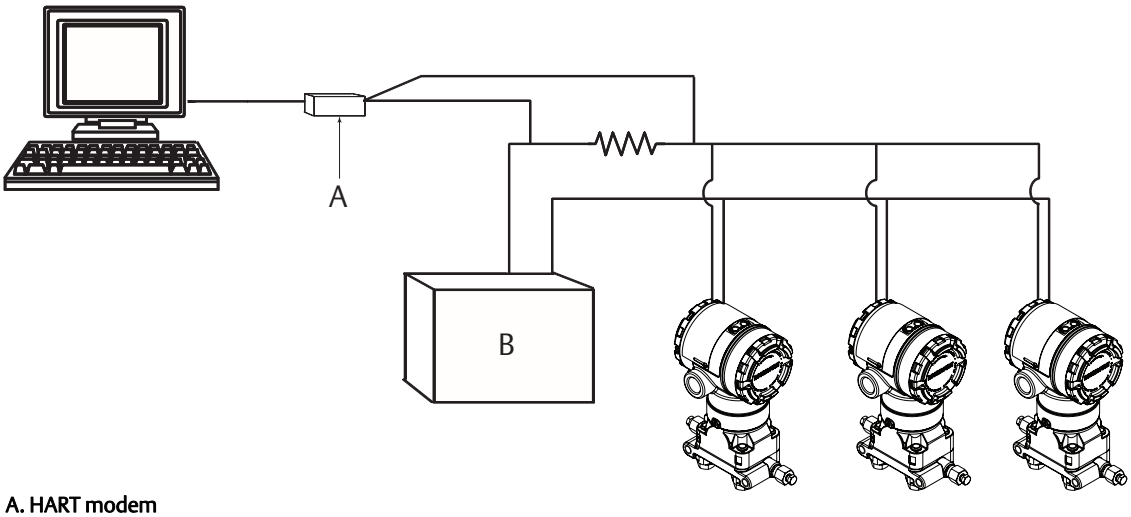
Multidropping transmitters refers to the connection of several transmitters to a single communications transmission line. Communication between the host and the transmitters takes place digitally with the analog output of the transmitters deactivated.

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 and responds to the commands defined in the HART Protocol. Field Communicators and AMS Device Manager can test, configure, and format a multidropped transmitter the same way as a transmitter in a standard point-to-point installation.

Figure 2-18 shows a typical multidrop network. This figure is not intended as an installation diagram.

Note
A multidrop transmitter in HART Revision 7 mode has a fixed analog output of 4 mA for all but one device. Only one device is allowed to have an active analog signal.

Figure 2-18. Typical Multidrop Network (4–20 mA only)



A. HART modem
B. Power supply

The Rosemount 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 for HART Revision 5, or 1 to 63 for HART Revision 7. 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.

2.11.1 Changing a transmitter address

To activate multidrop communication, the transmitter poll address must be assigned a number from 1 to 15 for HART Revision 5, and 1 to 63 for HART Revision 7. Each transmitter in a multidropped loop must have a unique poll address.

Changing transmitter address using a Field Communicator

From the *HOME* screen, enter the Fast Key sequence	HART Revision 5	HART Revision 7
Device Dashboard Fast Keys	2, 2, 5, 2, 1	2, 2, 5, 2, 2

Changing transmitter address using AMS Device Manager

Right click on the device and select **Configure**.

1. In HART Revision 5 mode:
   a. Select on **Manual Setup**, select the **HART** tab.
   b. In the Communication Settings box enter polling address in the **Polling Address** box, select **Send**.
2. In HART Revision 7 mode:
   a. Select on **Manual Setup**, select the **HART** tab and select the **Change Polling Address** button.
3. Carefully read the warning and select **Yes** if it is safe to apply the changes.

2.11.2 Communicating with a multidropped transmitter

To communicate with a multidrop transmitter, the Field Communicator or AMS Device Manager has to be set up for Polling.

Communicating with a multidropped transmitter using a Field Communicator

1. Select **Utility** and **Configure HART Application**.
2. Select **Polling Addresses.**
3. Enter **0-63.**

Communicating with a multidropped transmitter using AMS Device Manager

Select on the *HART modem icon* and select **Scan All Devices**.

Section 3 Hardware Installation

3.1 Overview

The information in this section covers installation considerations for the Rosemount™ 2051 Pressure Transmitter with PROFIBUS® PA. A Quick Start Guide is shipped with every transmitter to describe pipe-fitting, wiring procedures and basic configuration for initial installation.

3.2 Safety messages

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

⚠ 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. Review the approvals section of this reference manual for any restrictions associated with a safe installation.

- In an Explosion-Proof/Flameproof installation, do not remove the transmitter covers when power is applied to the unit.

Process leaks may cause harm or result in death.

- Install and tighten process connectors before applying pressure.

Electrical shock can result in death or serious injury.

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

3.3 Installation considerations

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

Important
Install the enclosed pipe plug (found in the box) in unused conduit opening. Engage a minimum of five threads to comply with explosion-proof requirements. See "Conduit entry threads" on page 31 for additional requirements.

For material compatibility considerations, see Material Selection Technical Note.

3.3.1 Mechanical considerations

Steam service

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.

Side mounted

When the transmitter is mounted on its side, position the coplanar flange to ensure proper venting or draining. Mount the flange as shown in Figure 3-8 on page 36, keeping drain/vent connections on the bottom for gas service and on the top for liquid service.

3.3.2 Environmental considerations

Best practice is to mount the transmitter in an environment that has minimal ambient temperature change. The transmitter electronics temperature operating limits are –40 to 185 °F (–40 to 85 °C). Refer to Appendix A: Specifications and 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.

3.4 Installation procedures

3.4.1 Mount the transmitter

For dimensional drawing information refer to "Dimensional drawings" on page 102.

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 need for a testing or calibration input.

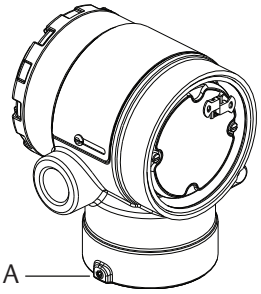
Housing rotation

To improve field access to wiring or to better view the optional LCD display:

1. Loosen the housing rotation set screw using a $^{5}/_{64}$-in. hex wrench.
2. Turn the housing left or right maximum up to 180° from its original position(1). Over rotating can damage the transmitter.
3. Re-tighten the housing rotation set screw to no more than 7 in-lb when desired location is reached.

1, The Rosemount 2051C original position aligns with "H" side; Rosemount 2051T original position is the opposite side of bracket holes.

Figure 3-1. Housing Rotation



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

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 in the unused conduit opening.

Circuit side of electronics housing

Provide 0.75-in. (19 mm) of clearance for units with out an LCD display. If LCD display is installed, mount for clear visibility. Three inches of clearance is required for LCD display cover removal.

Conduit entry threads

For NEMA® 4X, IP66, and IP68 requirements, use thread seal (PTFE) tape or paste on male threads to provide a watertight seal.

Environmental seal for housing

Thread sealing (PTFE) tape or paste on male threads of conduit is required to provide a water/dust tight conduit seal and meets requirements of NEMA Type 4X, IP66, and IP68. Consult factory if other ingress protection ratings are required.

For M20 threads, install conduit plugs to full thread engagement or until mechanical resistance is met.

Always ensure a proper seal by installing electronics housing cover(s) so that metal contacts metal. Use Rosemount O-rings.

Mounting brackets

Rosemount 2051 may be panel-mounted or pipe-mounted through an optional mounting bracket. Refer to Table 3-1 for the complete offering and see Figure 3-2 through Figure 3-6 on pages 32 and 34 for dimensions and mounting configurations.

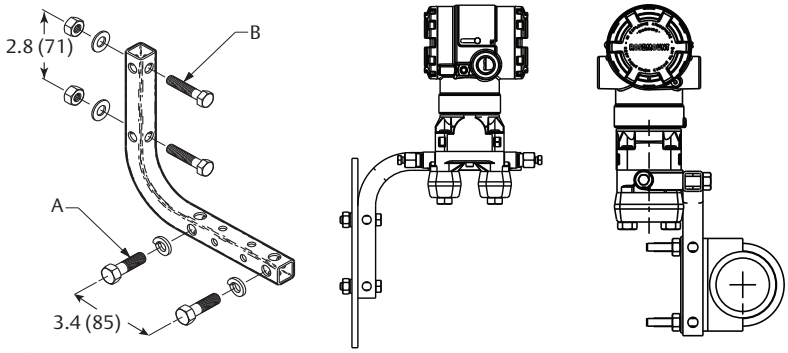
Table 3-1. Mounting Brackets

Rosemount 2051 Brackets										
Option code	Process connections			Mounting			Materials			
	Coplanar	In-line	Traditional	Pipe	Panel	Flat panel	Carbon steel bracket	Stainless steel bracket	Carbon steel bolts	Stainless steel bolts
B4	X	X	N/A	X	X	X	N/A	X	N/A	X
B1	N/A	N/A	X	X	N/A	N/A	X	N/A	X	N/A
B2	N/A	N/A	X	N/A	X	N/A	X	N/A	X	N/A

Table 3-1. Mounting Brackets

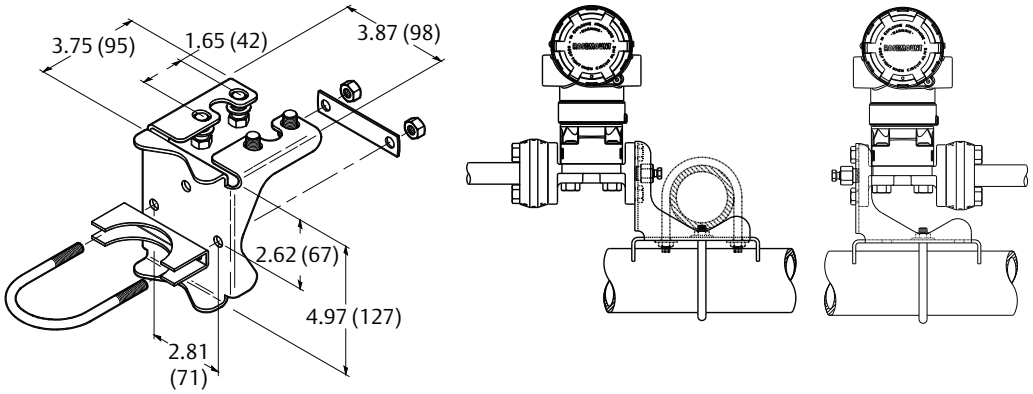
Rosemount 2051 Brackets										
Option code	Process connections			Mounting			Materials			
	Coplanar	In-line	Traditional	Pipe	Panel	Flat panel	Carbon steel bracket	Stainless steel bracket	Carbon steel bolts	Stainless steel bolts
B3	N/A	N/A	X	N/A	N/A	X	X	N/A	X	N/A
B7	N/A	N/A	X	X	N/A	N/A	X	N/A	N/A	X
B8	N/A	N/A	X	N/A	X	N/A	X	N/A	N/A	X
B9	N/A	N/A	X	N/A	N/A	X	X	N/A	N/A	X
BA	N/A	N/A	X	X	N/A	N/A	N/A	X	N/A	X
BC	N/A	N/A	X	N/A	N/A	X	N/A	X	N/A	X

Figure 3-2. Mounting Bracket Option Code B4



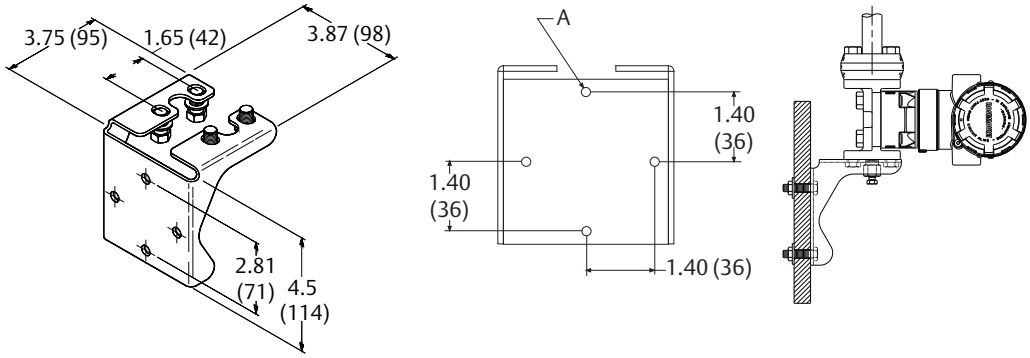
A. 3/8–16 x 1 1/4-in. bolts for mounting to transmitter
B. 5/16 x 1 1/2-in. bolts for panel mounting (not supplied)
Dimensions are in inches (millimeters).

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



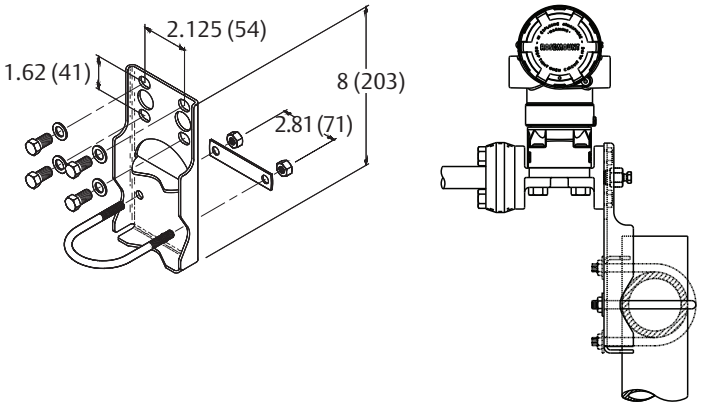
Dimensions are in inches (millimeters).

Figure 3-4. Panel Mounting Bracket Option Codes B2 and B8



A. Mounting holes 0.375 diameter (10)
Dimensions are in inches (millimeters).

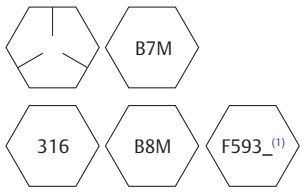
Figure 3-5. Flat Mounting Bracket Option Codes B3 and BC



Dimensions are in inches (millimeters).

Flange bolts

The Rosemount 2051 can be shipped with a coplanar flange or a traditional flange installed with four 1.75-inch flange bolts. Mounting bolts and bolting configurations for the coplanar and traditional flanges can be found on page 34. Stainless steel bolts supplied by Emerson™ are coated with a lubricant to ease installation. Carbon steel bolts do not require lubrication. No additional lubricant should be applied when installing either type of bolt. Bolts supplied by Emerson are identified by their head markings:



Carbon Steel (CS) Head Markings

Stainless Steel (SST) Head Markings

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

Bolt installation

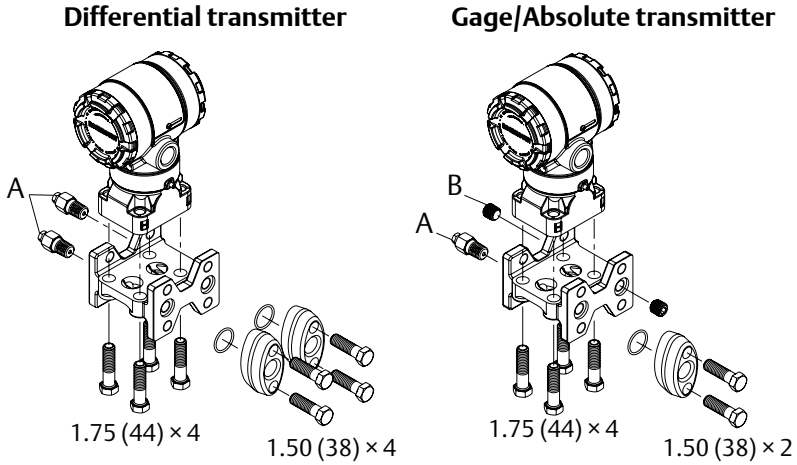
⚠ Only use bolts supplied with the Rosemount 2051 or sold by Emerson as spare parts for the Rosemount 2051 Transmitter. Use the following bolt installation procedure:

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

Table 3-2. Bolt Installation Torque Values

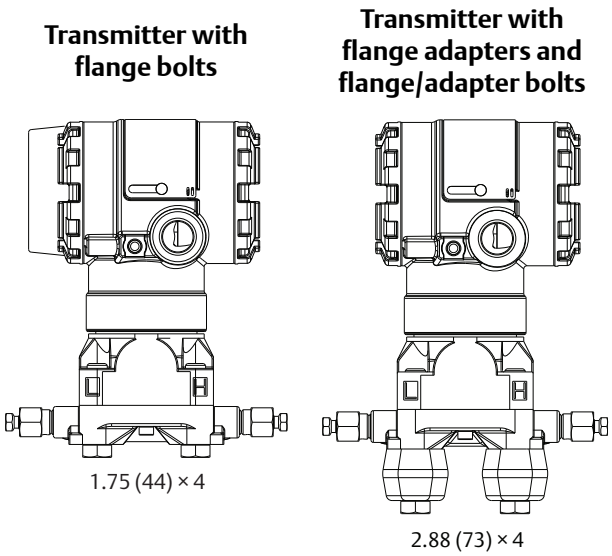
Bolt material	Initial torque value	Final torque value
Carbon steel -ASTM-A445 standard	300 in-lb (34 N-m)	650 in-lb (73 N-m)
316 stainless steel—option L4	150 in-lb (17 N-m)	300 in-lb (34 N-m)
ASTM-A-193-B7M—option L5	300 in-lb (34 N-m)	650 in-lb (73 N-m)
Alloy 400—option L6	300 in-lb (34 N-m)	650 in-lb (73 N-m)

Figure 3-6. Traditional Flange Bolt Configurations



A. Drain/vent
B. Plug
Dimensions are in inches (millimeters).

Figure 3-7. Mounting Bolts and Bolt Configurations for Coplanar Flange



Dimensions are in inches (millimeters).

Description	Size in. (mm)
Flange bolts	1.75 (44)
Flange/adapter bolts	2.88 (73)
Manifold/flange bolts	2.25 (57)

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

3.4.2 Impulse piping

Mounting requirements

Impulse piping configurations depend on specific measurement conditions. Refer to Figure 3-8 for examples of the following mounting configurations:

Liquid flow measurement

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

Gas flow measurement

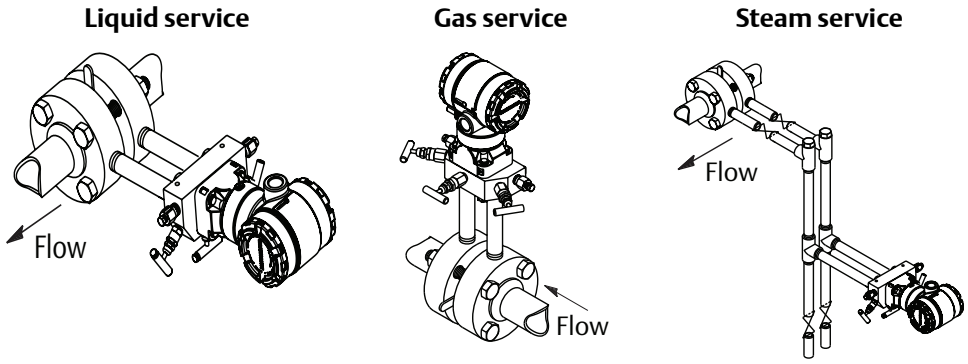
1. Place taps in the top or side of the line.
2. Mount the transmitter beside or above the taps so liquid will drain into the process line.

Steam flow measurement

1. Place taps to the side of the line.
2. Mount the transmitter below the taps to ensure that the impulse piping will stay filled with condensate.
3. 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.

Figure 3-8. Installation Examples



Best practices

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

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/ft (8 cm/m) upward from the transmitter toward the process connection.
- For gas service, slope the impulse piping at least 1-in/ft (8 cm/m) downward from the transmitter toward the process connection.
- Avoid high points in liquid lines and low points in gas lines.
- Make sure both impulse legs are the same temperature.
- Use impulse piping large enough to avoid friction effects and blockage.
- Vent all gas from liquid piping legs.
- When using a sealing fluid, fill both piping legs to the same level.
- When purging, make the purge connection close to the process taps and purge through equal lengths of the same size pipe. Avoid purging through the transmitter.
- Keep corrosive or hot (above 250 °F [121 °C]) process material out of direct contact with the sensor module and flanges.

- Prevent sediment deposits in the impulse piping.
- Maintain equal leg of head pressure on both legs of the impulse piping.
- Avoid conditions that might allow process fluid to freeze within the process flange.

3.4.3 Process connections

Coplanar or traditional process connection

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

⚠ Flange adapters

Rosemount 2051DP and GP process connections on the transmitter flanges are 1/4–18 NPT. Flange adapters are available with standard 1/2–14 NPT Class 2 connections. The flange adapters allow users to disconnect from the process by removing the flange adapter bolts. Use plant-approved lubricant or sealant when making the process connections. Refer to "Dimensional drawings" on page 102 for the distance between pressure connections. This distance may be varied ±1/8-in. (3.2 mm) by rotating one or both of the flange adapters.

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

1. Remove the flange bolts.
2. Leaving the flange in place, move the adapters into position with the O-ring installed.
3. Clamp the adapters and the coplanar flange to the transmitter sensor module using the larger of the bolts supplied.
4. Tighten the bolts. Refer to "Flange bolts" on page 33 for torque specifications.

Whenever you remove flanges or adapters, visually inspect the PTFE O-rings. Replace with O-ring designed for Rosemount transmitter if there are any signs of damage, such as nicks or cuts. Undamaged O-rings may be reused. If you replace the O-rings, retorque the flange bolts after installation to compensate for cold flow. Refer to the process sensor body reassembly procedure in Section 6: Trouble-shooting.

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

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

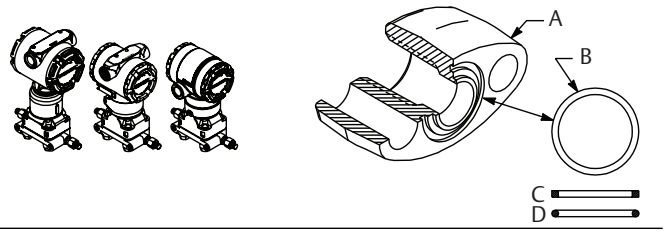
O-rings

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

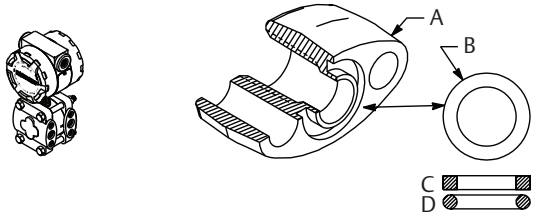
⚠WARNING

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 designed for its specific flange adapter, as shown below:

Rosemount 3051S/3051/2051



Rosemount 1151



A. Flange adapter
B. O-ring
C. PTFE-based profile (square)
D. Elastomer profile (round)

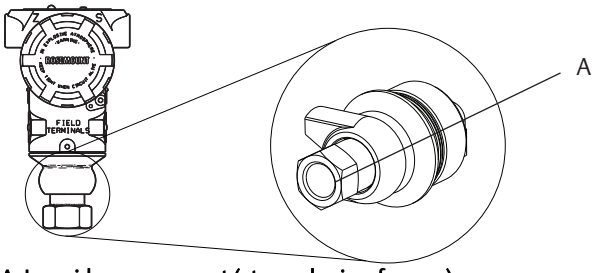
3.4.4 In-line process connection

In-line gage transmitter orientation

The low side pressure port on the in-line gage transmitter is located in the neck of the transmitter, behind the housing. The vent path is 360 degrees around the transmitter between the housing and sensor (See Figure 3-9).

Keep the vent path free of any obstruction, such as paint, dust, and lubrication by mounting the transmitter so that the process can drain away.

Figure 3-9. In-line Gage Low Side Pressure Port



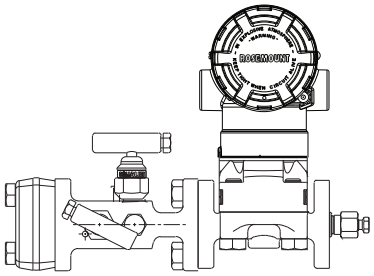
A. Low side pressure port (atmospheric reference)

3.5 Rosemount 305, 306, and 304 Manifolds

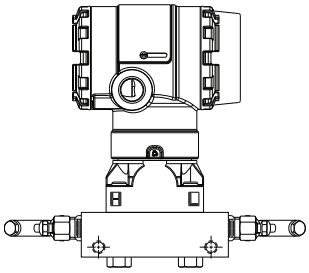
The Rosemount 305 Integral Manifold is available in two designs: traditional and coplanar. The traditional Rosemount 305 Integral Manifold can be mounted to most primary elements with mounting adapters in the market today. The Rosemount 306 Integral Manifold is used with the Rosemount 2051T In-line Transmitters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

Figure 3-10. Manifolds

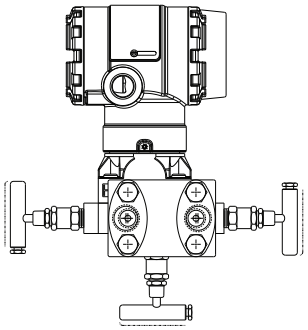
Rosemount 2051C and Rosemount 304 Conventional



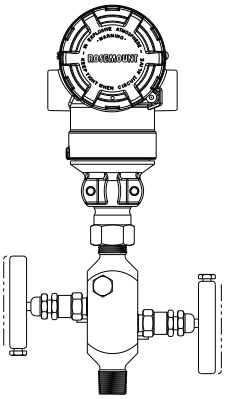
Rosemount 2051C and Rosemount 305 Integral Coplanar



Rosemount 2051C and Rosemount 305 Integral Traditional



Rosemount 2051T and Rosemount 306 In-line



3.5.1 Rosemount 305 Integral Manifold installation procedure

To install a Rosemount 305 Integral Manifold to a Rosemount 2051 Transmitter:

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

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

2. Install the Integral Manifold on the sensor module. Use the four 2 1/4-in. manifold bolts for alignment. Finger tighten the bolts, then tighten the bolts incrementally in a cross pattern to final torque value. See "Flange bolts" on page 33 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.

3.5.2 Rosemount 306 Integral Manifold installation procedure

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

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

3.5.3 Rosemount 304 Conventional Manifold installation procedure

To install a Rosemount 304 Conventional Manifold to a Rosemount 2051 Transmitter:

1. Align the conventional manifold with the transmitter flange. Use the four manifold bolts for alignment.
2. Finger tighten the bolts, then tighten the bolts incrementally in a cross pattern to final torque value. See "Flange bolts" on page 33 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.

3.5.4 Manifold operation

⚠WARNING

Improper installation or operation of manifolds may result in process leaks, which may cause death or serious injury.

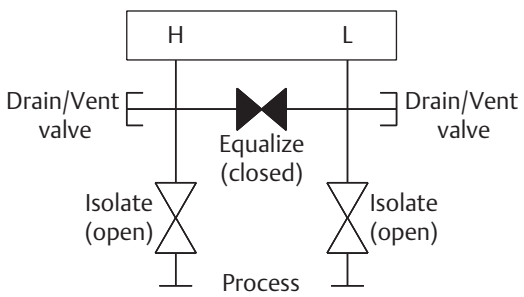
Always perform a zero trim on the transmitter/manifold assembly after installation to eliminate any shift due to mounting effects. See "Sensor trim overview" on page 66.

Coplanar transmitters

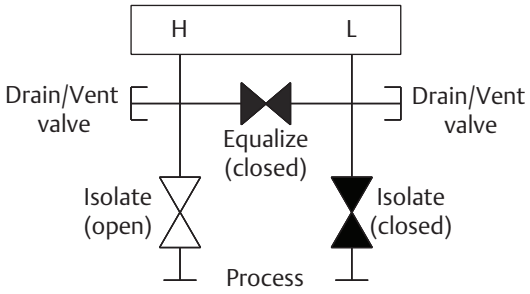
3-valve and 5-valve manifolds

Performing zero trim at static line pressure

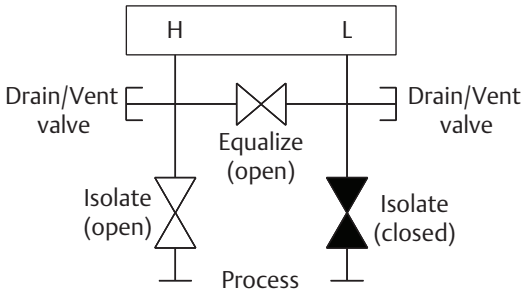
In normal operation the two isolate (block) valves between the process ports and transmitter will be open and the equalize valve will be closed.



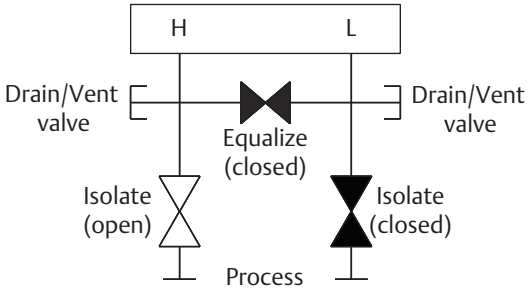
1. To zero trim the transmitter, close the isolate valve on the low side (downstream) side of the transmitter.



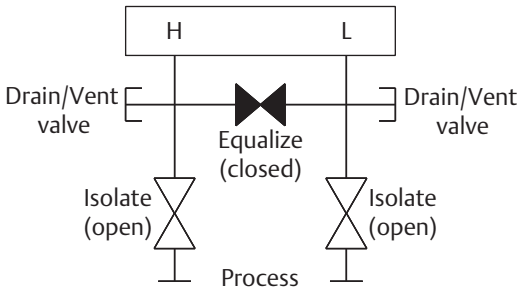
2. Open the equalize valve to equalize the pressure on both sides of the transmitter. The manifold is now in the proper configuration for performing a zero trim on the transmitter.



3. After performing a zero trim on the transmitter, close the equalize valve.



4. Finally, to return the transmitter to service, open the low side isolate valve.

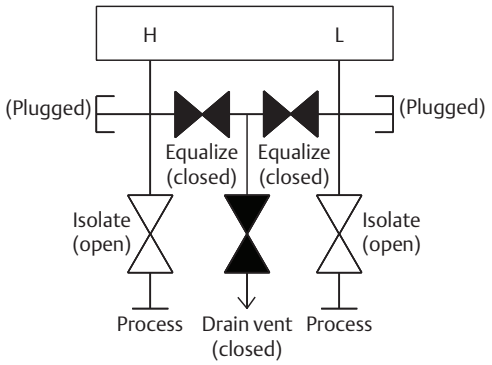


5-valve natural gas manifold

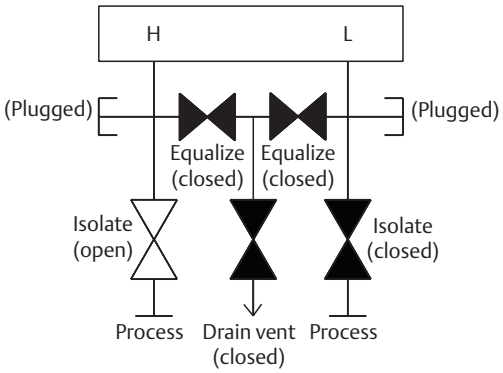
Performing zero trim at static line pressure

5-valve natural gas configurations shown:

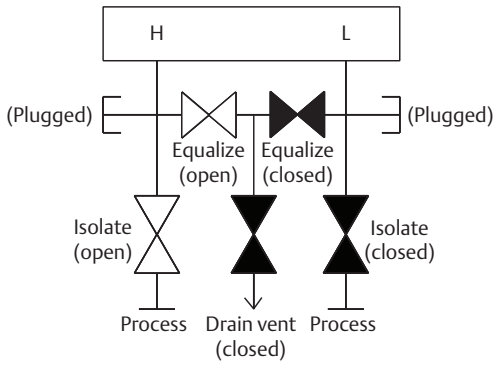
In normal operation, the two isolate (block) valves between the process ports and transmitter will be open, and the equalize valves will be closed. Vent valves may be opened or closed.



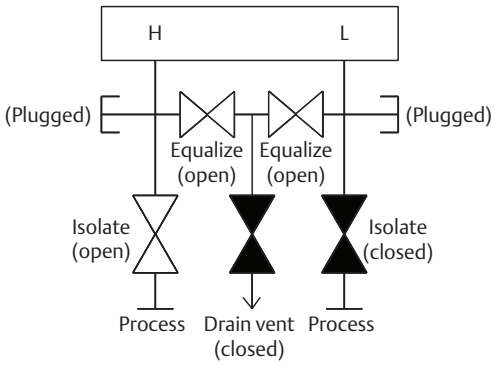
1. To zero trim the transmitter, first close the isolate valve on the low pressure (downstream) side of the transmitter and the vent valve.



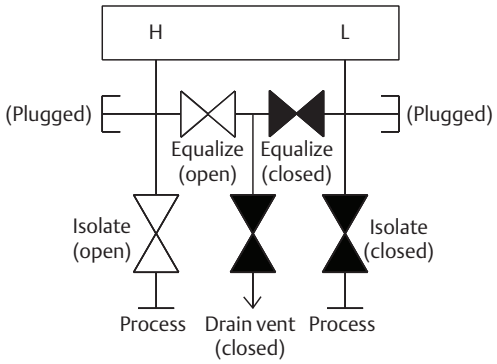
2. Open the equalize valve on the high pressure (upstream) side of the transmitter.



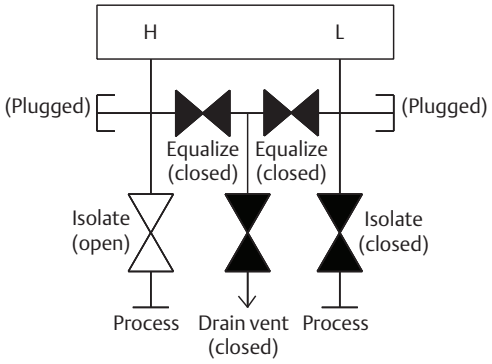
3. Open the equalize valve on the low pressure (downstream) side of the transmitter. The manifold is now in the proper configuration for performing a zero trim on the transmitter.



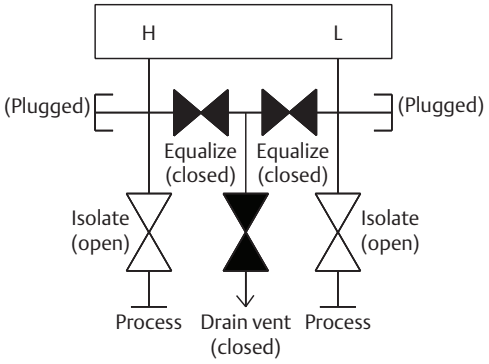
4. After performing a zero trim on the transmitter, close the equalize valve on the low pressure (downstream) side of the transmitter.



5. Close the equalize valve on the high pressure (upstream) side.



6. Finally, to return the transmitter to service, open the low side isolate valve and vent valve. The vent valve can remain open or closed during operation.

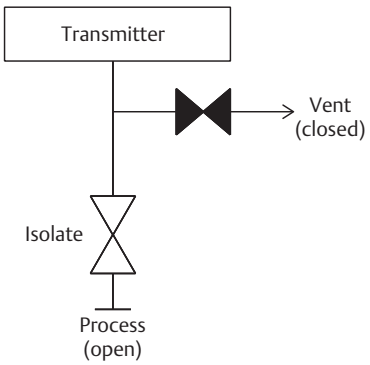


In-line transmitters

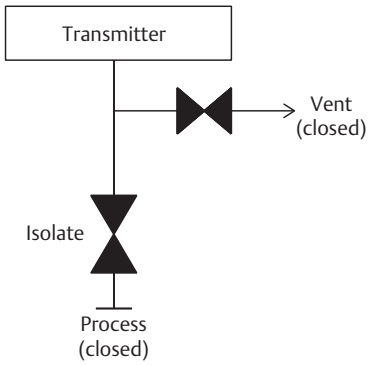
2-valve and block and bleed style manifolds

Isolating the transmitter

In normal operation the isolate (block) valve between the process port and transmitter will be open and the test/vent valve will be closed. On a block and bleed style manifold, a single block valve provides transmitter isolation and a bleed screw provides drain/vent capabilities.



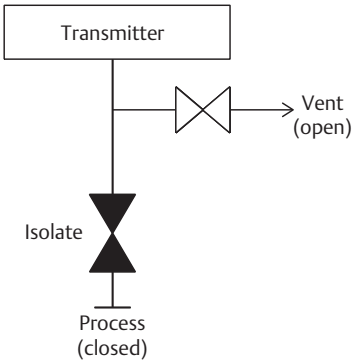
1. To isolate the transmitter, close the isolate valve.



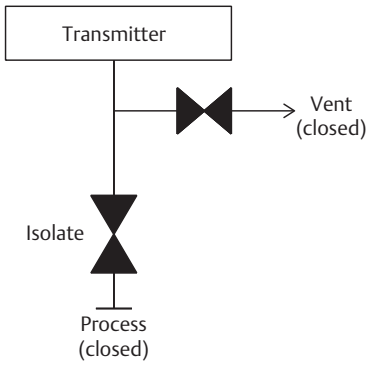
2. To bring the transmitter to atmospheric pressure, open the vent valve or bleed screw.

Note
A 1/4-in. male NPT pipe plug may be installed in the test/vent port and will need to be removed with a wrench in order to vent the manifold properly.

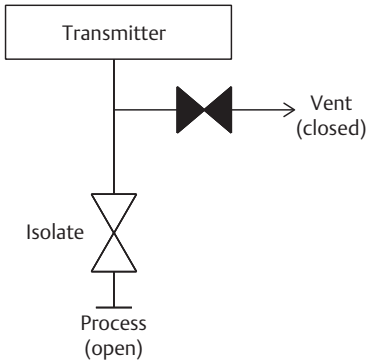
⚠ Always use caution when venting directly to atmosphere.



3. After venting to atmosphere, perform any required calibration and then close the test/vent valve or replace the bleed screw.



4. Open the Isolate (block) valve to return the transmitter to service.



Adjusting valve packing

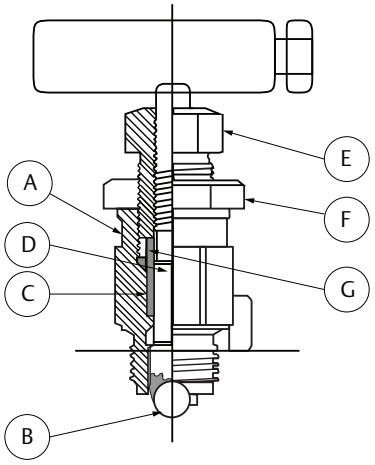
Over time, the packing material inside a Rosemount manifold may require adjustment in order to continue to provide proper pressure retention. Not all Rosemount manifolds have this adjustment capability. The Rosemount manifold model number will indicate what type of stem seal or packing material has been used.

The following steps are provided as a procedure to adjust valve packing:

1. Remove all pressure from device.
2. Loosen manifold valve jam nut.
3. Tighten manifold valve packing adjuster nut 1/4 turn.
4. Tighten manifold valve jam nut.
5. Re-apply pressure and check for leaks.
6. Above steps can be repeated, if necessary.

If the above procedure does not result in proper pressure retention, the complete manifold should be replaced.

Figure 3-11. Valve Components



A. Bonnet
B. Ball seat
C. Packing
D. Stem
E. Packing adjuster
F. Jam nut
G. Packing follower

3.6 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.

3.6.1 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 3-12 shows a liquid level measurement example.

3.6.2 Closed vessels

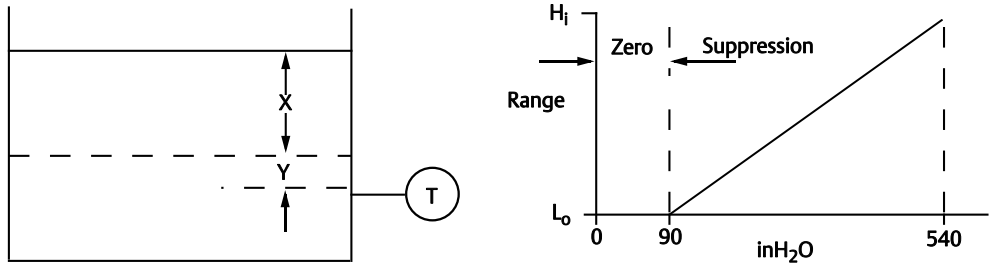
Pressure above a liquid affects the pressure measured at the bottom of a closed vessel. The liquid specific gravity multiplied by the liquid height plus the vessel pressure equals the pressure at the bottom of the vessel.

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

Dry leg condition

Low-side transmitter piping will remain empty if gas above the liquid does not condense. This is a dry leg condition. Range determination calculations are the same as those described for bottom-mounted transmitters in open vessels, as shown in Figure 3-12.

Figure 3-12. Liquid Level Measurement Example



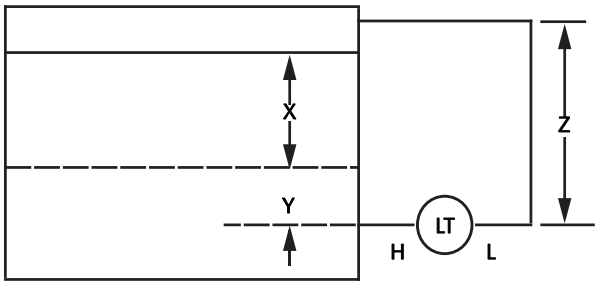
Let X equal the vertical distance between the minimum and maximum measurable levels (500-in.).
Let Y equal the vertical distance between the transmitter datum line and the minimum measurable level (100-in.).
Let SG equal the specific gravity of the fluid (0.9).
Let h equal the maximum head pressure to be measured in inches of water.
Let e equal head pressure produced by Y expressed in inches of water.
Let Range equal e to e + h.
Then h = (X)(SG)
= 500 x 0.9
= 450 inH_2O
e = (Y)(SG)
=100 x 0.9
= 90 inH_2O
Range = 90 to 540 inH_2O

Wet leg condition

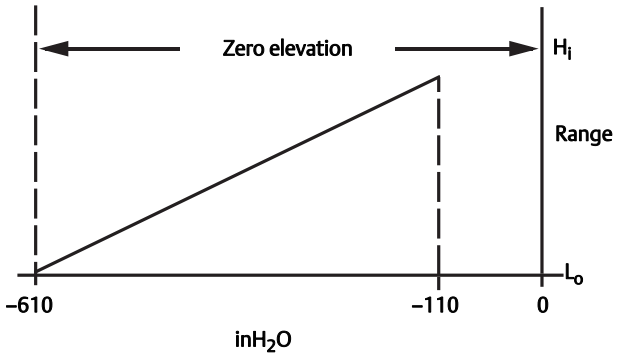
Condensation of the gas above the liquid slowly causes the low side of the transmitter piping to fill with liquid. The pipe is purposely filled with a convenient reference fluid to eliminate this potential error. This is a wet leg condition.

The reference fluid will exert a head pressure on the low side of the transmitter. Zero elevation of the range must then be made. See Figure 3-13.

Figure 3-13. 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 $h = (X)(SG_1)$
$= 500 \times 1.0$
$= 500$ in H_2O
$e = (Y)(SG_1)$
$= 50 \times 1.0$
$= 50$ in H_2O
$s = (z)(SG_2)$
$= 600 \times 1.1$
$= 660$ in H_2O
Range = e – s to h + e – s.
= 50 – 660 to 500 + 50 – 660
= –610 to –110 in H_2O

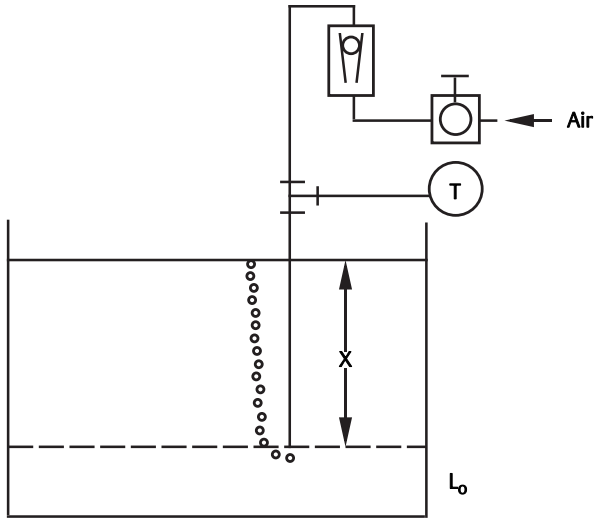


Bubbler system in open vessel

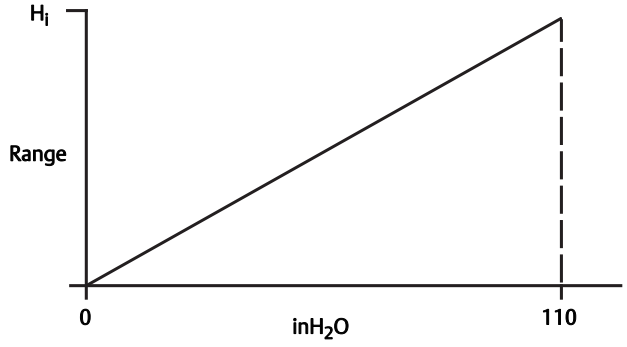
A bubbler system that has a top-mounted pressure transmitter can be used in open vessels. This system consists of an air supply, pressure regulator, constant flow meter, pressure transmitter, and a tube that extends down into the vessel.

Bubble air through the tube at a constant flow rate. The pressure required to maintain flow equals the liquid's specific gravity multiplied by the vertical height of the liquid above the tube opening. Figure 3-14 shows a bubbler liquid level measurement example.

Figure 3-14. Bubbler Liquid Level Measurement Example



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



Section 4 Electrical Installation

4.1 Overview

The information in this section covers installation considerations for the Rosemount™ 2051 Pressure Transmitter with HART® Protocol. A Quick Start Guide is shipped with every transmitter to describe pipe-fitting, wiring procedures and basic configuration for initial installation.

4.2 Safety messages

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

⚠ 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. Review the approvals section of this Reference Manual for any restrictions associated with a safe installation.

- In an Explosion-Proof/Flameproof installation, do not remove the transmitter covers when power is applied to the unit.

Process leaks may cause harm or result in death.

- Install and tighten process connectors before applying pressure.

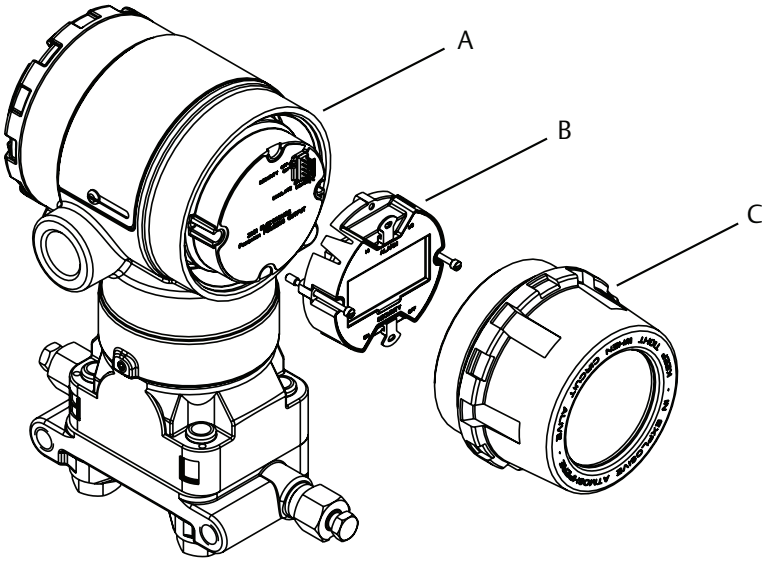
Electrical shock can result in death or serious injury.

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

4.3 Local Operating Interface (LOI)/LCD display

Transmitters ordered with the LCD display option (M5) or LOI option (M4) are shipped with the display installed. Installing the display on an existing transmitter requires a small instrument screwdriver. Carefully align the desired display connector with the electronics board connector. If connectors don't align, the display and electronics board are not compatible.

Figure 4-1. LCD Display



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

4.3.1 Rotating LOI/LCD display

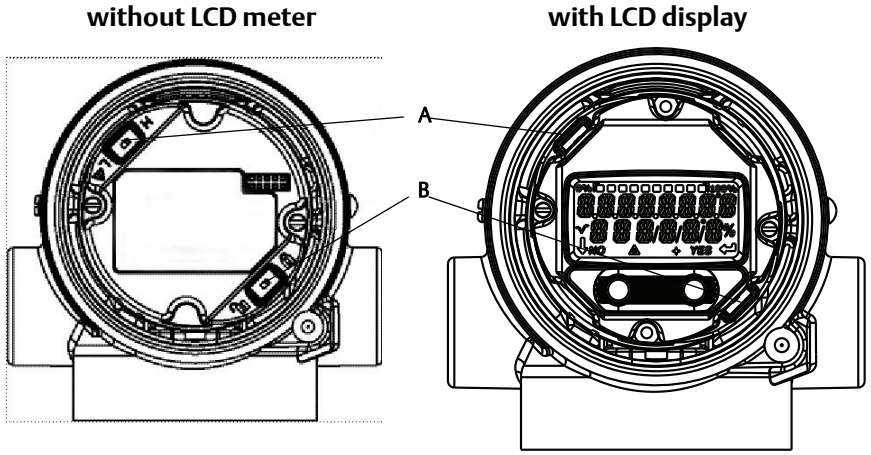
⚠ 1. Secure the loop to manual control and remove power to transmitter.
2. Remove transmitter housing cover.
3. Remove screws form the LCD/LOI display and rotate to desired orientation.
   a. Insert 10 pin connector into the display board for the correct orientation. Carefully align pins for insertion into the output board.
4. Re-insert screws.
5. Re-attach transmitter housing cover; cover must be fully engaged to comply with explosion proof requirements.
6. Re-attach power and return loop to automatic control.

4.4 Configure security and simulation

There are four security methods with the Rosemount 2051 Transmitter.

- Security switch
- HART Lock
- Configuration buttons lock
- LOI password

Figure 4-2. 4–20 mA Electronics Board



A. Alarm
B. Security

Note
1-5 Vdc Alarm and Security switches are located in the same location as 4-20 mA output boards.

4.4.1 Security switch

The security switch is used to prevent changes to the transmitter configuration data. If the security switch is set to the locked location (🔒), any transmitter configuration requests sent via HART, LOI, or local configuration buttons will be rejected by the transmitter and the transmitter configuration data will not be modified. See figure above for the location of the security switch. Follow the steps below to enable the security switch.

⚠ 1. Set loop to manual and remove power.

2. Remove transmitter housing cover.

3. Use a small screwdriver to slide the switch to the lock (🔒) position.

4. Replace transmitter housing cover; cover must be fully engaged to comply with explosion proof requirements.

4.4.2 HART Lock

The HART Lock prevents changes to the transmitter configuration from all sources; all changes requested via HART, LOI, and local configuration buttons will be rejected. The HART Lock can only be set via HART communication, and is only available in HART Revision 7 mode. The HART Lock can be enabled or disabled with a Field Communicator or AMS Device Manager.

Configuring HART Lock using Field Communicator

From the *HOME* screen, enter the fast key sequence

Device Dashboard Fast Keys	2, 2, 6, 4

Configuring HART Lock using AMS device Manager

1. Right click on the device and select **Configure.**
2. Under *Manual Setup* select the **Security** tab.
3. Select **Lock/Unlock** button under *HART Lock (Software)* and follow the screen prompts.

4.4.3 Configuration button lock

The configuration button lock disables all local button functionality. Changes to the transmitter configuration from the LOI and local buttons will be rejected. Local external keys can be locked via HART communication only.

Configuring configuration button lock using a Field Communicator

From the *HOME* screen, enter the fast key sequence

Device Dashboard Fast Keys	2, 2, 6, 3

Configuring configuration button lock using AMS device Manager

1. Right click on the device and select **Configure.**
2. Under *Manual Setup* select the **Security** tab.
3. Within the *Configuration Buttons* dropdown menu select **Disabled** to lock external local keys.
4. Select **Send**.
5. Confirm service reason and select **Yes**.

4.4.4 LOI password

A Local Operator Interface Password can be entered and enabled to prevent review and modification of device configuration via the LOI. This does not prevent configuration from HART or external keys (analog zero and span; Digital Zero Trim). The LOI password is a 4 digit code that is to be set by the user. If the password is lost or forgotten the master password is “9307”.

The LOI password can be configured and enabled/disabled by HART Communication via a Field Communicator, AMS Device Manager, or the LOI.

Configuring LOI password with Field Communicator

From the *HOME* screen, enter the Fast Key sequence

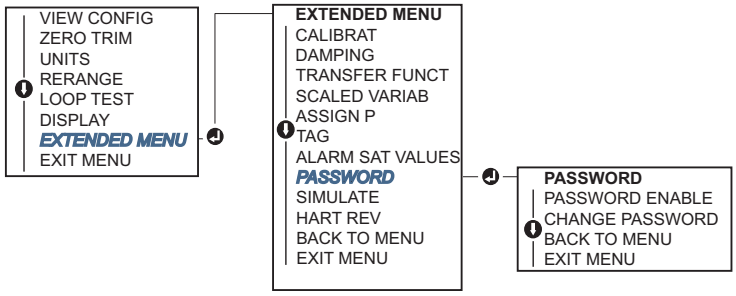
Device Dashboard Fast Keys	2, 2, 6, 5, 2

Configuring LOI password with AMS Device Manager

1. Right click on the device and select **Configure.**
2. Under *Manual Setup* select the **Security** tab.
3. Within the *Local Operator Interface* select the **Configure Password** button and follow the screen prompts.

Configuring LOI password using LOI

Figure 4-3. Local Operator Interface password



4.5 Setting transmitter alarm

On the electronics board is an alarm switch, reference Figure 4-2 on page 51 for switch location. Follow the steps below to change the alarm switch location:

1. Set loop to manual and remove power.
2. Remove transmitter housing cover.
3. Use a small screwdriver to slide switch to desired position.
4. Replace transmitter cover; cover must be fully engaged to comply with explosion proof requirements.

4.6 Electrical considerations

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

⚠CAUTION

Do not run signal wiring in conduit or open trays with power wiring or near heavy electrical equipment.

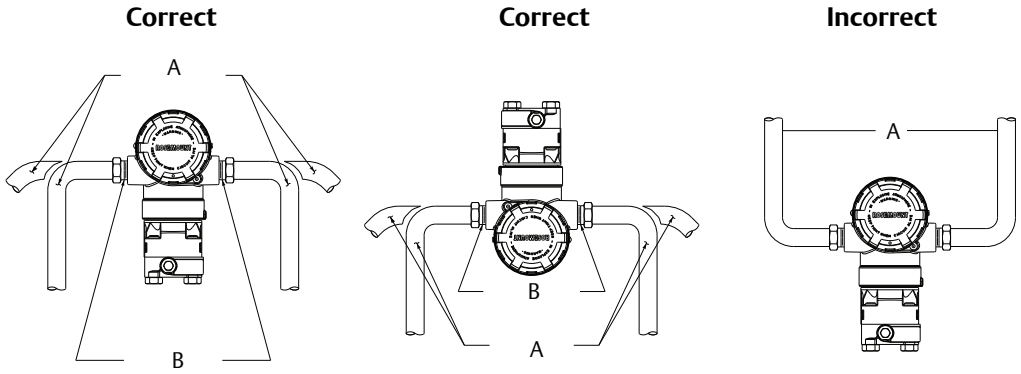
4.6.1 Conduit installation

Recommended conduit connections are shown in Figure 4-4.

⚠CAUTION

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

Figure 4-4. Conduit Installation



A. Possible conduit line positions
B. Sealing compound

4.6.2 Power supply

4–20 mA HART (option code A)

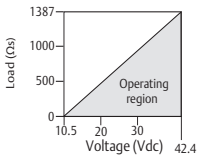
Transmitter operates on 10.5–42.4 Vdc at the terminal of the transmitter. The DC power supply should provide power with less than two percent ripple. A minimum of 16.6 V is required for loops with a 250 Ω resistance.

Note
A minimum loop resistance of 250 Ω is required to communicate with a Field Communicator. If a single power supply is used to power more than one Rosemount 2051 Transmitter, the power supply used, and circuitry common to the transmitters, should not have more that 20 Ω of impedance at 1200 Hz.

Figure 4-5. Load Limitation

Maximum loop resistance = 43.5 x (power supply voltage – 10.5)

The Field 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, I.S. Barriers, and related pieces. If intrinsic safety barriers are used, the resistance and voltage drop must be included.

1–5 Vdc low power HART (output code M)

Low power transmitters operate on 9–28 Vdc. The DC power supply should provide power with less than 2 percent ripple. The V_{out} load should be 100 kΩ or greater.

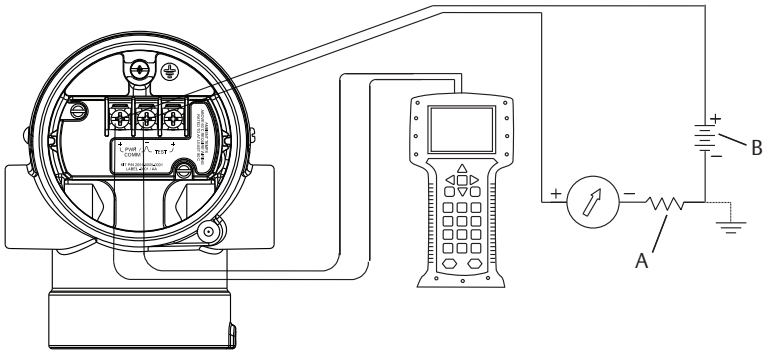
4.6.3 Wiring the transmitter

⚠ CAUTION

Do not connect the power signal wiring to the test terminals. Incorrect wiring can damage test circuit.

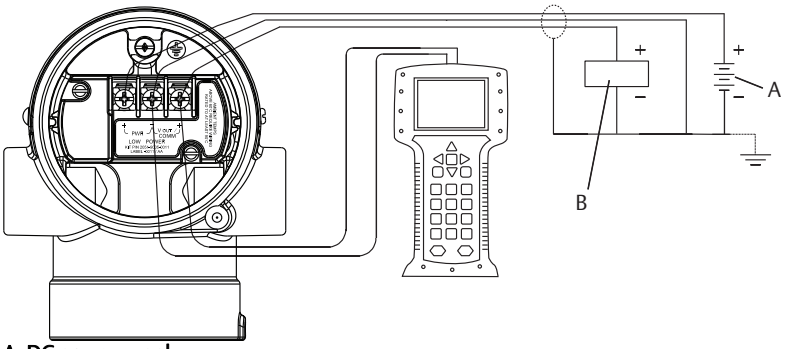
Note
Use shielded twisted pairs to yield best results. To ensure proper communication, use 24 AWG or larger wire and do not exceed 5000 ft. (1500 m). For 1–5 V 500 ft. (150 m) maximum are recommended. unpaired three conductor or two twisted pairs is recommended.

Figure 4-6. Wiring the Transmitter (4–20 mA HART)



A. DC power supply
B. $R_L \geq 250$ (necessary for HART Communication only)

Figure 4-7. Wiring the Transmitter (1–5 Vdc Low Power)



A. DC power supply
B. Voltmeter

Perform the following procedure to make wiring connections:

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

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

   a. For 1–5 Vdc HART Output, connect the positive lead to (PWR +) and the negative to the (PWR–). Do not connect the powered signal wiring to the test terminals. Power could damage the test diode.

3. Plug and seal unused conduit connection on the transmitter housing to avoid moisture accumulation in the terminal side.

4.6.4 Grounding the transmitter

Signal cable shield grounding

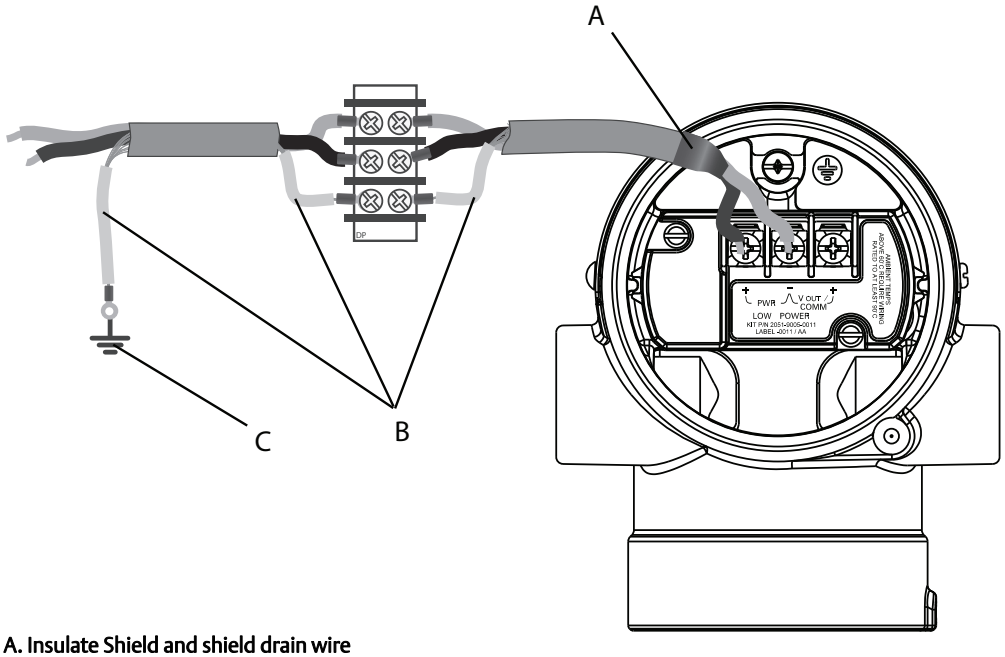
Signal cable shield grounding is summarized in Figure 4-8 on page 57. The signal cable shield and unused shield drain wire must be trimmed and insulated, ensuring that the signal cable shield and drain wire do not come in contact with the transmitter case. See "Transmitter case grounding" on page 57 for instructions on grounding the transmitter case. Follow the steps below to correctly ground the signal cable shield.

1. Remove the field terminals housing cover.
2. Connect the signal wire pair at the field terminals as indicated in Figure 4-6.
3. At the field terminals, the cable shield and shield drain wire should be trimmed close and insulated from transmitter housing.
4. Reattach the field terminals housing cover; cover must be fully engaged to comply with explosion proof requirements.
5. At terminations outside the transmitter housing, the cable shield drain wire should be continuously connected.

a. Prior to the termination point, any exposed shield drain wire should be insulated as shown in Figure 4-8 (B).

6. Properly terminate the signal cable shield drain wire to an earth ground at or near the power supply.

Figure 4-8. Wiring Pair and Ground



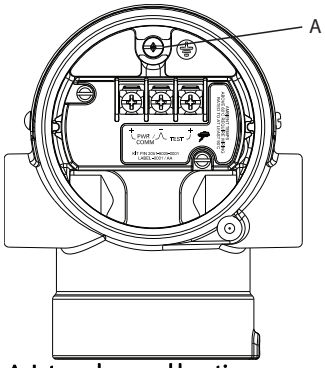
A. Insulate Shield and shield drain wire
B. Insulate exposed shield drain wire
C. Terminate cable shield drain wire to earth ground

Transmitter case grounding

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:

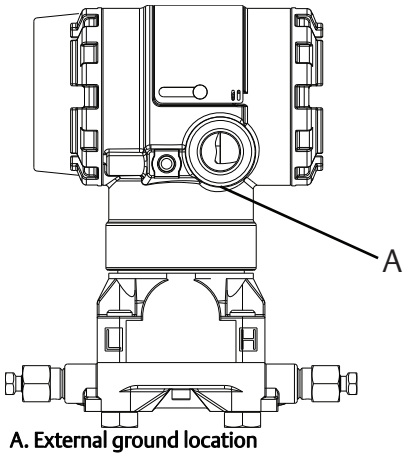
- Internal ground connection: The internal ground connection screw is inside the FIELD TERMINALS side of the electronics housing. This screw is identified by a ground symbol (⏚). The ground connection screw is standard on all Rosemount 2051 Transmitters. Refer to Figure 4-9 on page 58.
- External ground connection: The external ground connection is located on the exterior of the transmitter housing. Refer to Figure 4-10 on page 58. This connection is only available with option V5 and T1.

Figure 4-9. Internal Ground Connection



A. Internal ground location

Figure 4-10. External Ground Connection (Option V5 or T1)



A. External ground location

Note

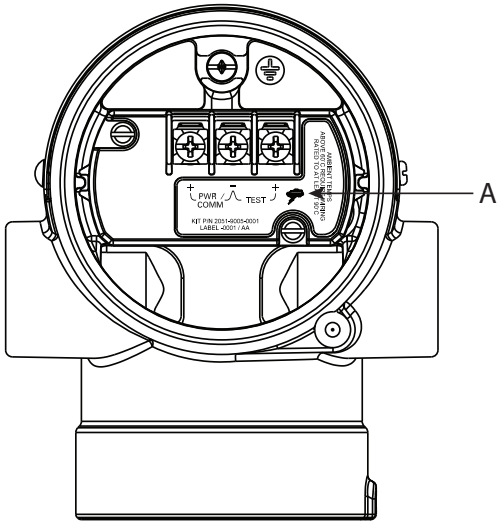
Grounding the transmitter case via threaded conduit connection may not provide sufficient ground continuity.

Transient protection terminal block grounding

The transmitter can 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 (code T1) or as a spare part to retrofit existing Rosemount 2051 Transmitters in the field. See "Spare parts" on page 145 for part numbers. The lightning bolt symbol shown in Figure 4-11 on page 59 identifies the transient protection terminal block.

Figure 4-11. Transient Protection Terminal Block



A. Lightning bolt location

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 Figure 4-11.

Section 5 Operation and Maintenance

5.1 Overview

This section contains information on calibrating Rosemount™ 2051 Pressure Transmitters.

Field Communicator, AMS™, Device Manager and Local Operator Interface (LOI) instructions are given to perform configuration functions.

5.2 Safety messages

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

⚠ 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. Review the approvals section of the Rosemount 2051 reference manual for any restrictions associated with a safe installation.

- Before connecting a Field Communicator in an explosive atmosphere, ensure the instruments in the loop are installed in accordance with intrinsically safe or non-incendive field wiring practices.
- In an Explosion-proof/flameproof installation, do not remove the transmitter covers when power is applied to the unit.

Process leaks may cause harm or result in death.

- Install and tighten process connectors before applying pressure.

Electrical shock can result in death or serious injury.

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

5.3 Recommended calibration tasks

⚠ CAUTION

Absolute pressure transmitters (Rosemount 2051CA and 2051TA) are 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.

Table 5-1. Basic and Full Calibration Tasks

Field installation tasks	Bench calibration tasks
1. Perform sensor zero/lower trim: Compensate for mounting pressure effects. a. Refer to Rosemount 305, 306, and 304 Manifolds for operation instructions to properly drain/vent valves 2. Set/check basic configuration parameters. a. Output units b. Range points c. Output type d. Damping Value	1. Perform optional 4–20 mA 1–5 Vdc output trim. 2. Perform a sensor trim. a. Zero/lower trim using line pressure effect correction. Reference Rosemount 305, 306, and 304 Manifolds for drain/vent valve operation instructions. b. Optional full scale trim. Sets the span of the device and requires accurate calibration equipment. c. Set/check basic configuration parameters.

Note
For Rosemount 2051CA, 2051TA range 0 and range 5 devices, an accurate absolute pressure source is required.

5.4 Calibration overview

The Rosemount 2051 Transmitter is an accurate instrument that is fully calibrated in the factory. Field calibration is provided to the user to meet plant requirements or industry standards. Complete calibration of the transmitter can be split into two halves: sensor calibration and analog output calibration.

Sensor calibration allows the user to adjust the pressure (digital value) reported by the transmitter to be equal to a pressure standard. The sensor calibration can adjust the pressure offset to correct for mounting conditions or line pressure effects. This correction is recommended. The calibration of the pressure range (pressure span or gain correction) requires accurate pressure standards (sources) to provide a full calibration.

Like the sensor calibration, the analog output can be calibrated to match the user measurement system. The analog output trim (4–20 mA/1–5 V output trim) will calibrate the loop at the 4 mA (1 V) and 20 mA (5 V) points.

The sensor calibration and the analog output calibration combine to match the transmitter's measurement system to the plant standard.

Calibrate the sensor

- Sensor trim (page 67)
- Zero trim (page 67)

Calibrate the 4–20 mA output

- 4–20 mA/1–5 V output trim (page 70)
- 4–20 mA/1–5V output trim using other scale (page 71)

5.4.1 Determining necessary sensor trims

Bench calibrations allow for calibrating the instrument for its desired range of operation. Straight forward connections to pressure source allow for a full calibration at the planned operating points. Exercising the Transmitter over the desired pressure range allows for verification of the analog output. "Trim the pressure signal" on page 66 discusses how the trim operations change the calibration. It is possible to degrade the performance of the transmitter if a trim is done improperly or with inaccurate equipment. The transmitter can be set back to factory settings using the recall factory trim command in "Recall factory trim—sensor trim" on page 68.

For transmitters that are field installed, the manifolds discussed in Section 3: Rosemount 305, 306, and 304 Manifolds allow the differential transmitter to be zeroed using the zero trim function. Both 3-valve and 5-valve manifolds are discussed. This field calibration will eliminate any pressure offsets caused by mounting effects (head effect of the oil fill) and static pressure effects of the process.

Determine the necessary trims with the following steps:

1. Apply pressure
2. Check digital pressure, if the digital pressure does not match the applied pressure, perform a digital trim. See "Perform a sensor trim" on page 67.
3. Check reported analog output against the live analog output. If they do not match, perform an analog output trim. See "Performing digital-to-analog trim (4–20 mA/1–5 V output trim)" on page 70.

Trimming with configuration buttons

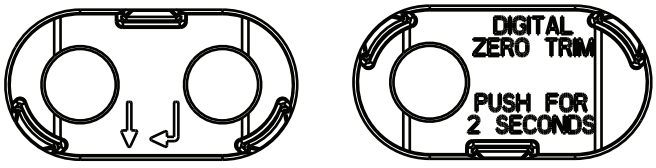
Local configuration buttons are external buttons located underneath the top tag of the transmitter. There are two possible sets of local configuration buttons that can be ordered and used to perform trim operations: Digital zero trim and LOI. To access the buttons, loosen screw and rotate top tag until buttons are visible.

- **LOI (M4):** Can perform both digital sensor trim and the 4–20mA output trim (analog output trim). Follow the same procedures listed in trimming with Field Communicator or AMS Device Manager listed below.
- **Digital zero trim (DZ):** Used for performing a sensor zero trim. See "Determining calibration frequency" on page 64 for trim instructions.

All configuration changes should be monitored by a display or by measuring the loop output. Figure 5-1 shows the physical differences between the two sets of buttons.

Figure 5-1. Local Configuration Button Options

LOI—green retainer **Digital zero trim—blue retainer**



5.4.2 Determining calibration frequency

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

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

Sample calculation for Rosemount 2051

Step 1: Determine the performance required for your application.

Required Performance:	0.30% of span

Step 2: Determine the operating conditions.

Transmitter:	Rosemount 2051CD, range 2 (URL=250 inH_2O[623 mbar])
Calibrated span:	150 inH_2O (374 mbar)
Ambient temperature change:	± 50 °F (28 °C)
Line pressure:	500 psig (34,5 bar)

Step 3: Calculate TPE.

$$TPE = \sqrt{(\text{Reference accuracy})^2 + (\text{Temperature effect})^2 + (\text{Static pressure effect})^2} = 0.189\% \text{ of span}$$

Where:

Reference accuracy = ± 0.065% of span

Ambient temperature effect = $\left(\frac{(0.025 \times URL)}{Span} + 0.125\right)$ % per 50 °F = ±0.167% of span

Span static pressure effect[1] = 0.1% reading per 1000 psi (69 bar) = ±0.05% of span at maximum span

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

Step 4: Calculate the stability per month.

$$Stability = \pm\left[\frac{(0.100 \times URL)}{Span}\right]\% \text{ of span for 2 years} = \pm 0.0069\% \text{ of URL for 1 month}$$

Step 5: Calculate calibration frequency.

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

Sample calculation for Rosemount 2051C with P8 option (0.05% accuracy and 5-year stability)

Step 1: Determine the performance required for your application.

Required performance:	0.30% of span

Step 2: Determine the operating conditions.

Transmitter:	Rosemount 2051CD, range 2 (URL=250 inH_2[623 mbar])
Calibrated span:	150 inH_2O (374 mbar)
Ambient temperature change:	±50 °F (28 °C)
Line pressure:	500 psig (34,5 bar)

Step 3: Calculate TPE.

$$\text{TPE} = \sqrt{(\text{Reference accuracy})^2 + (\text{Temperature effect})^2 + (\text{Static pressure effect})^2} = 0.117\% \text{ of span}$$

Where:

Reference accuracy = ± 0.05% of span

Ambient temperature effect = $\left(\frac{(0.025 \times \text{URL})}{\text{Span}} + 0.125\right)$% per 50 °F = ±0.0833% of span

Span static pressure effect[1] = 0.1% reading per 1000 psi (69 bar) = ±0.05% of span at maximum span

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

Step 4: Calculate the stability per month.

$$\text{Stability} = \pm\left[\frac{(0.125 \times \text{URL})}{\text{Span}}\right]\% \text{ of span for 5 years} = \pm 0.0035\% \text{ of URL for 1 month}$$

Step 5: Calculate calibration frequency.

$$\text{Cal. Freq.} = \frac{(\text{Req. Performance} - \text{TPE})}{\text{Stability per Month}} = \frac{(0.3\% - 0.117\%)}{0.0035\%} = 52 \text{months}$$

5.4.3 Compensating for span line pressure effects (range 4 and range 5)

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 transmitters (ranges 0 through 3) do not require this procedure because optimization occurs at the sensor.

The systematic span shift caused by the application of static line pressure is –0.95 percent of reading per 1000 psi (69 bar) for range 4 transmitters, and –1 percent of reading per 1000psi (69 bar) for range 5 transmitters. Using the following procedure, the span effect can be corrected to ±0.2 percent of reading per 1000 psi (69 bar) for line pressures from 0 to 3626 psi (0 to 250 bar).

Use the following example to compute correct input values.

Example

A range 4 differential pressure HART® transmitter (Rosemount 2051CD4...) will be used in an application with a static line pressure of 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 the corrected values for the high trim value.

High Trim Value:

HT = (URV – [S/100 x P/1000 x LRV])

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 =	–0.95%
P =	1200 psi
LT =	1500 – (–0.95%/100 x 1200 psi/1000 psi x 1500 inH_2O)
LT =	1517.1 inH_2O

Complete the upper sensor trim procedure as described in "Perform a sensor trim" on page 67. In the example above, at step 4, apply the nominal pressure value of 1500 inH_2O. However, enter the calculated correct upper sensor trim value of 1517.1 inH_2O with a Field Communicator.

Note
The range values for the 4 and 20 mA 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 of the Field Communicator. Modify, Safety Instrumented Systems Requirements, by following the steps in "Rerange the transmitter" on page 15.

5.5 Trim the pressure signal

5.5.1 Sensor trim overview

A sensor trim corrects the pressure offset and pressure range to match a pressure standard. The upper sensor trim corrects the pressure range and the lower sensor trim (zero trim) corrects the pressure offset. an accurate pressure standard is required for full calibration. a zero trim can be performed if the process is vented, or the high and low side pressure are equal (for differential pressure transmitters).

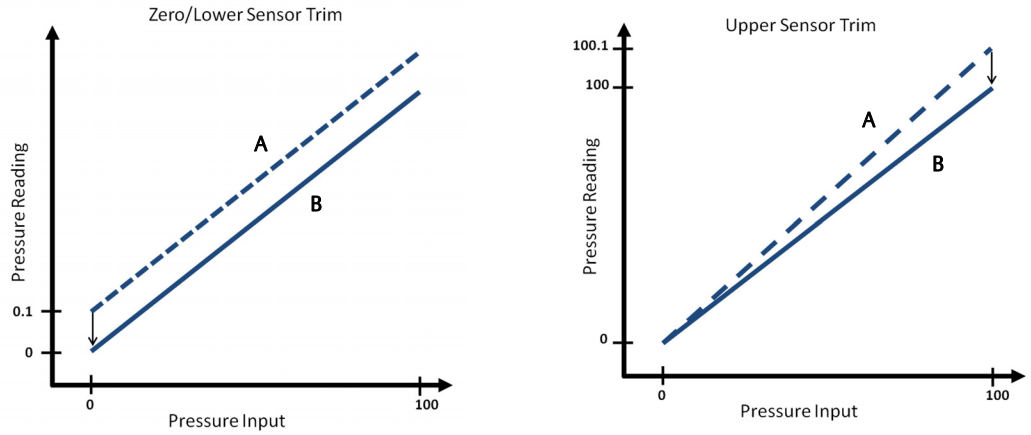
Zero trim is a single-point offset adjustment. It is useful for compensating for mounting position effects and is most effective when performed with the transmitter installed in its final mounting position. Since this correction maintains the slope of the characterization curve, it should not be used 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. Line pressure should be applied to the transmitter during a zero trim to eliminate line pressure errors. Refer to Section 3: Manifold operation.

Note
Do not perform a zero trim on Rosemount 2051T Absolute Pressure Transmitters. Zero trim is zero based, and absolute pressure transmitters reference absolute zero. To correct mounting position effects on a 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.

Upper and lower sensor trim is a two-point sensor calibration where two end-point pressures are applied, all output is linearized between them, and requires an accurate pressure source. 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 help optimize performance over a specific measurement range.

Figure 5-2. Sensor Trim Example



A. Before trim
B. After trim

5.5.2 Perform a sensor trim

When performing a sensor trim, but the upper and lower limits can be trimmed. If both upper and lower trims are to be performed, the lower trim must be done prior to the upper time.

⚠ **Note**
Use a pressure input source that is at least four times more accurate than the transmitter, and allow the input pressure to stabilize for 10 seconds before entering any values.

Performing a sensor trim with a Field Communicator

From the *HOME* screen, enter the Fast Key sequence and follow the steps within the Field Communicator to complete the Sensor Trim.

Device Dashboard Fast Keys	3, 4, 1

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

1. Select **Lower Sensor Trim**.

Note
Select pressure points so that lower and upper values are equal to or outside the expected process operation range. This can be done by going to "Rerange the transmitter" on page 15 of Section 2: Configuration.

2. Follow the commands provided by the Field Communicator to complete the adjustment of the lower value.
3. Repeat the procedure for the upper value, replacing 2: Lower Sensor Trim with 3: Upper Sensor Trim in Step 1.

Performing a sensor trim with AMS Device Manager

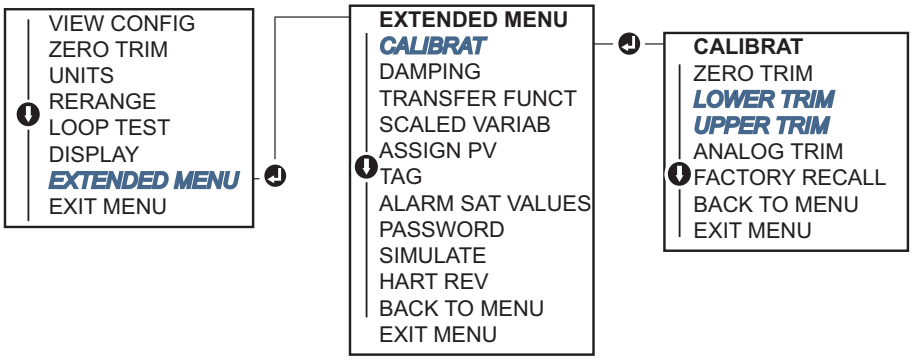
Right click on the device and, under the *Method* dropdown menu, move cursor over *Calibrate* and, under *Sensor Trim*, select **Lower Sensor Trim**.

1. Follow the screen prompts to perform a Sensor Trim using AMS Device Manager.
2. If desired, right click on the device and under the *Method* dropdown menu, move cursor over *Calibrate* and under *Sensor Trim* and select **Upper Sensor Trim**

Performing a sensor trim using LOI

Perform an upper and lower sensor trim by referencing Figure 5-3.

Figure 5-3. Sensor Trim with LOI



Performing a digital zero trim (option DZ)

A digital zero trim (option DZ) provides the same function as a zero/lower sensor trim, but can be completed in hazardous areas at any given time by simply pushing the zero trim button when the transmitter is at zero pressure. If the transmitter is not close enough to zero when the button is pushed, the command may fail due to excess correction. If ordered, a digital zero Trim can be performed by utilizing external configuration buttons located underneath the top tag of the transmitter, see Figure 5-1 on page 63 for DZ button location.

1. Loosen the top tag of the transmitter to expose buttons.
2. Press and hold the digital zero button for at least two seconds, then release to perform a digital zero trim.

5.5.3 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.

Recalling factory trim with a Field Communicator

From the *HOME* screen, enter the Fast Key sequence and follow the steps within the Field Communicator to complete the sensor trim.

Device Dashboard Fast Keys	3, 4, 3

Recalling factory trim with AMS Device Manager

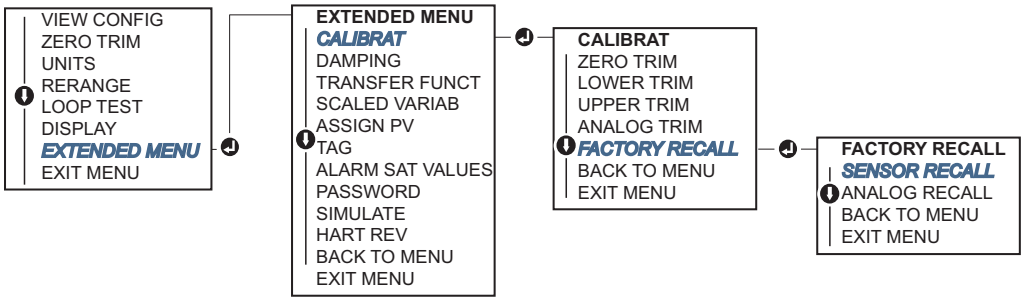
Right click on the device and, under the *Method* dropdown menu, move cursor over *Calibrate* and select **Restore Factory Calibration**.

1. Select **Next** after setting the control loop to manual.
2. Select **Sensor Trim** under *Trim to recall* and select **Next**.
3. Follow the screen prompts to recall sensor trim.

Recalling factory trim - sensor trim using LOI

Refer to Figure 5-4 to recall factory sensor trim.

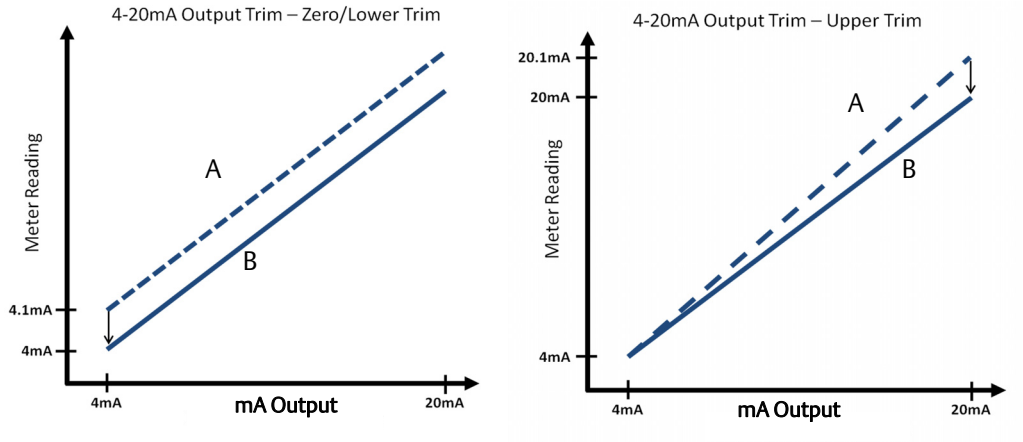
Figure 5-4. Recall Factory Trim - Sensor Trim with LOI



5.6 Trim the analog output

The analog output trim commands allow you to adjust the transmitter's current output at the 4 and 20 mA points to match the plant standards. This trim is performed after the digital to analog conversion so only the 4–20mA analog signal will be affected. Figure 5-5 graphically shows the two ways the characterization curve is affected when an analog output trim is performed.

Figure 5-5. Analog Output Trim Example



A. Before trim
B. After Trim

5.6.1 Performing digital-to-analog trim (4–20 mA/1–5 V output trim)

Note
If a resistor is added 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" on page 54.

Performing a 4–20 mA/1–5 V output trim with a Field Communicator

From the *HOME* screen, enter the Fast Key sequence and follow the steps within the Field Communicator to complete the 4–20 mA output trim.

Device Dashboard Fast Keys	3, 4, 2, 1

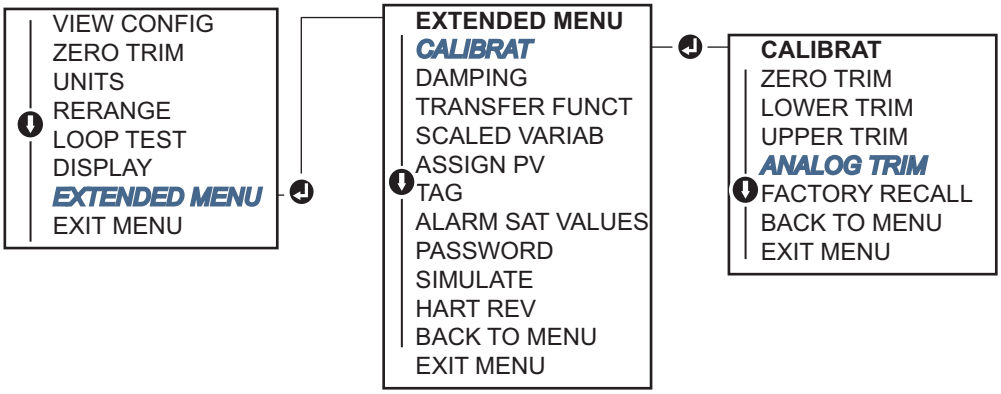
⚠ Performing a 4–20 mA/1–5 V output trim with AMS Device Manager

Right click on the device and, under the *Method* drop down menu, move cursor over *Calibrate* and select **Analog Calibration**.

1. Select **Digital to Analog Trim.**
2. Follow the screen prompts to perform a 4–20 mA output trim.

Performing 4–20mA/1–5 V output trim using LOI

Figure 5-6. 4–20mA Output Trim Using LOI



5.6.2 Performing digital-to-analog trim (4–20mA/1–5 V output trim) using other scale

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

Performing a 4–20/ 1–5 V mA output trim using other scale with a Field Communicator

From the *HOME* screen, enter the Fast Key sequence and follow the steps within the Field Communicator to complete the 4–20 mA output trim using other scale.

Device Dashboard Fast Keys	3, 4, 2, 2

⚠ Performing a 4–20 mA/1–5 V output trim using other scale with AMS Device Manager

Right click on the device and under the *Method* dropdown menu, move cursor over *Calibrate* and select **Analog Calibration**.

1. Select *Scaled Digital to Analog Trim.*
2. Follow screen prompts to perform a 4–20 mA/1–5 V output trim.

5.6.3 Recalling 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.

Recalling factory trim - analog output with a Field Communicator

From the *HOME* screen, enter the Fast Key sequence and follow the steps within the Field Communicator to complete the digital to analog trim using other scale.

Device Dashboard Fast Keys	3, 4, 3

Recalling factory trim - analog output with AMS Device Manager

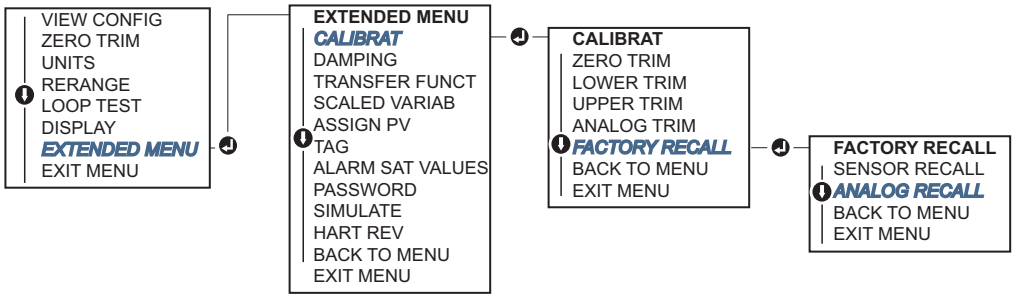
Right click on the device and, under the *Method* drop down menu, move cursor over *Calibrate* and select **Restore Factory Calibration**.

1. Select **Next** to set the control loop to manual.
2. Select **Analog Output Trim** under *Select trim to recall* and select **Next**.
3. Follow screen prompts to recall analog output trim.

Recalling factory trim - analog output with LOI

Reference Figure 5-7 for LOI instructions.

Figure 5-7. Recall Factory Trim – analog output with LOI



5.7 Switching HART Revision

Some systems are not capable of communicating with HART Revision 7 devices. The following procedures list how to change HART Protocol revisions between HART Revision 7 and HART Revision 5.

5.7.1 Switching HART Revision with generic menu

If the HART Protocol configuration tool is not capable of communicating with a HART Revision 7 device, it should load a generic menu with limited capability. The following procedures allow for switching between HART Revision 7 and HART Revision 5 from a generic menu.

1. Locate “Message” field
   a. To change to HART Revision 5, Enter: **HART5** in the message field
   b. To change to HART Revision 7, Enter: **HART7** in the message field

5.7.2 Switching HART Revision with Field Communicator

From the HOME screen, enter the Fast Key sequence and follow steps within the Field Communicator to complete the HART revision change.

From the *HOME* screen, enter the Fast Key sequence	HART5	HART7
Device Dashboard Fast Keys	2, 2, 5, 2, 4	2, 2, 5, 2, 3

5.7.3 Switching HART Revision with AMS Device Manager

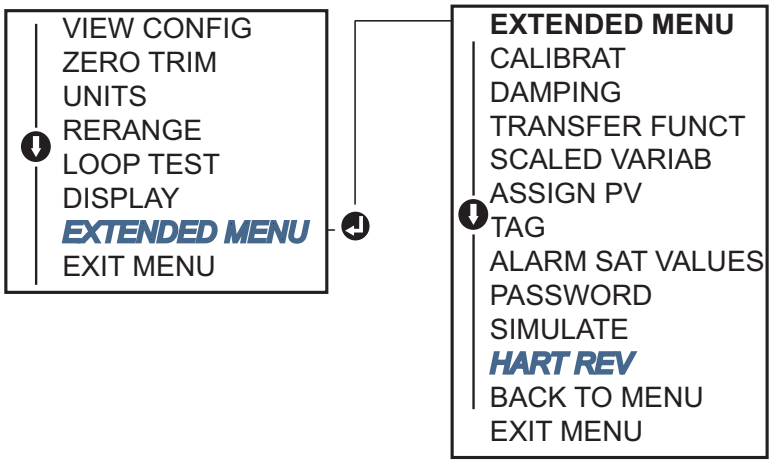
1. Select on *Manual Setup* and select *HART.*
2. Select *Change HART Revision* then follow the on screen prompts.

Note
AMS Device Manager versions 10.5 or greater are compatible with HART Revision 7.

5.7.4 Switching HART Revision with LOI

Navigate to *HART REV* within the extended menu and select if either *HART REV 5* or *HART REV 7*. Use Figure 5-8 below to change HART Revision:

Figure 5-8. Change HART Revision with LOI



Section 6 Troubleshooting

6.1 Overview

Table 6-1 provides summarized maintenance and troubleshooting suggestions for the most common operating problems.

If you suspect malfunction despite the absence of any diagnostic messages on the Field Communicator display, consider using Section 6: Diagnostic messages on page 77 to identify any potential problem.

6.2 Safety messages

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

⚠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. Review the approvals section of the Rosemount™ 2051 reference manual for any restrictions associated with a safe installation.

- Before connecting a Field Communicator in an explosive atmosphere, ensure the instruments in the loop are installed in accordance with intrinsically safe or non-incendive field wiring practices.
- In an Explosion-proof/flameproof installation, do not remove the transmitter covers when power is applied to the unit.

Process leaks may cause harm or result in death.

- Install and tighten process connectors before applying pressure.

Electrical shock can result in death or serious injury.

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

Table 6-1. Rosemount 2051 Troubleshooting Table for 4–20 mA Output

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

6.3 Diagnostic messages

Listed in the below sections are detailed table of the possible messages that will appear on either the LOI/LCD display, a Field Communicator, or an AMS® Device Manager system. Use the tables below to diagnose particular status messages.

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

6.3.1 Diagnostic message: Failed - fix now

Table 6-2. Status: Failed – Fix Now

Alert name	LCD screen	LOI screen	Problem	Recommended action
No Pressure Updates	NO P UPDATE	NO PRESS UPDATE	There are no pressure updates from the sensor to the electronics	1. Ensure the sensor cable connection to the electronics is tight. 2. Replace the pressure sensor.
Electronics Board Failure	FAIL BOARD	FAIL BOARD	A failure has been detected in the electronics circuit board	1. Replace the electronics board.
Critical Sensor Data Error	MEMRY ERROR	MEMORY ERROR	A user written parameter does not match the expected value	1. Confirm and correct all parameters listed in Device Information. 2. Perform a Device Reset. 3. Replace sensor module.
Critical Electronics Data Error			A user written parameter does not match the expected value	1. Confirm and correct all parameters listed in Device Information. 2. Perform a Device Reset. 3. Replace electronics board.
Sensor Failure	FAIL SENSOR	FAIL SENSOR	A failure has been detected in the pressure sensor	1. Replace the pressure sensor.
Incompatible Electronics and Sensor	XMTR MSMTCH	XMTR MSMTCH	The pressure sensor is incompatible with the attached electronics	1. Replace the electronics board or sensor with compatible hardware.

6.3.2 Diagnostic message: Maintenance - fix soon

Table 6-3. Status: Maintenance – Fix Soon

Alert name	LCD screen	LOI screen	Problem	Recommended action
No Temperature Updates	NO T UPDATE	NO TEMP UPDATE	There are no temperature updates from the sensor to the electronics	1. Ensure the sensor cable connection to the electronics is tight. 2. Replace the pressure sensor.
Pressure Out of Limits	PRES LIMITS	PRES OUT LIMITS	The pressure is either above or below the sensor limits	1. Check the transmitter pressure connection to ensure it is not plugged or the isolating diaphragms are not damaged. 2. Replace the pressure sensor.
Sensor Temperature Beyond Limits	TEMP LIMITS	TEMP OUT LIMITS	The sensor temperature has exceeded its safe operating range	1. Check the process and ambient conditions are within –85 to 194 °F (–65 to 90 °C). 2. Replace the pressure sensor.
Electronics Temperature Beyond Limits			The temperature of the electronics has exceeded its safe operating range.	1. Confirm electronics temperature is within limits of –85 to 194 °F (–65 to 90 °C). 2. Replace electronics board.
Electronics Board Parameter Error	MEMRY WARN (also in advisory)	MEMORY WARN (also in advisory)	A device parameter does not match the expected value. The error does not affect transmitter operation or analog output.	1. Replace the electronics board.
Configuration Buttons Operator Error	STUCK BUTTON	STUCK BUTTON	Device is not responding to button presses.	1. Check configuration buttons are not stuck. 2. Replace the electronics board.

6.3.3 Diagnostic message: Advisory

Table 6-4. Status: Advisory

Alert name	LCD screen	LOI screen	Problem	Recommended action
Non-Critical User Data Warning	MEMRY WARN	MEMORY WARN	A user written parameter does not match expected value.	1. Confirm and correct all parameters listed in Device Information. 2. Perform a Device Reset. 3. Replace Electronics Board.
Sensor Parameter Warning			A user written parameter does not match expected value.	1. Confirm and correct all parameters listed in Device Information. 2. Perform a Device Reset. 3. Replace pressure sensor.
LCD Display Update Failure	[If display is not updating]	[If display is not updating]	The LCD Display is not receiving updates from the pressure sensor.	1. Check the connection between the LCD display and the circuit board. 2. Replace the LCD display. 3. Replace the electronics board.
Configuration Changed	[none]	[none]	A recent change has been made the device by a secondary HART master such as a handheld device.	1. Verify that the configuration change of the device 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 it.
Analog Output Fixed	ANLOG FIXED	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.	1. Take action on any other notifications from the device. 2. If the device is in loop test, 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	[none]	[none]	The device is in simulation mode and may not be reporting actual information.	1. Verify that simulation is no longer required. 2. Disable simulation mode in service tools. 3. Perform a device reset.
Analog Output Saturated	ANLOG SAT	ANALOG SAT	The analog output is saturated either high or low due to the pressure either above or below the range values.	1. Check the pressure applied to ensure it is between the 4–20mA points. 2. Check the transmitter pressure connection to make sure it is not plugged or isolating diaphragms are not damaged. 3. Replace the pressure sensor.

6.4 Disassembly procedures

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

6.4.1 Removing from service

Follow these steps:

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.
   a. The Rosemount 2051C Transmitter is attached to the process connection by four bolts and two cap screws. Remove the bolts and screws and separate the transmitter from the process connection. Leave the process connection in place and ready for re-installation. Reference "Installation procedures" on page 30 for coplanar flange.
   b. The Rosemount 2051T Transmitter is attached to the process by a single hex nut process connection. Loosen the hex nut to separate the transmitter from the process. Do not wrench on neck of transmitter. See warning in "In-line process connection" on page 38.
6. Do not scratch, puncture, or depress the isolating diaphragms.
7. Clean isolating diaphragms with a soft rag and a mild cleaning solution, and rinse with clear water.
8. For the Rosemount 2051C, whenever you remove the process flange or flange adapters, visually inspect the PTFE O-rings. Replace the O-rings if they show any signs of damage, such as nicks or cuts. Undamaged O-rings may be reused.

6.4.2 Removing terminal block

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

1. Remove the housing cover from the field terminal side.
2. Loosen the two small screws located on the assembly in the 9 o'clock and 5 o'clock positions relative to the top of the transmitter.
3. Pull the entire terminal block out to remove it.

6.4.3 Removing the electronics board

The transmitter electronics board is located in the compartment opposite the terminal side. To remove the electronics board see Figure 4-2 on page 51 and perform following procedure:

1. Remove the housing cover opposite the field terminal side.
2. If you are disassembling a transmitter with a LOI/LCD display, loosen the two captive screws that are visible (See Figure 4-1 on page 50 for screw locations). The two screws anchor the LOI/LCD display to the electronics board and the electronics board to the housing.

Note
The electronics board is electrostatically sensitive; observe handling precautions for static-sensitive components

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.

Note
If an LOI/LCD display is installed, use caution as there is an electronic pin connector that interfaces between the LOI/LCD display and electronics board.

6.4.4 Removing sensor module from the electronics housing

1. Remove the electronics board. Refer to "Removing the electronics board" on page 80.

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

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

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

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

6.5 Reassembly procedures

1. Inspect all cover and housing (non-process wetted) O-rings and replace if necessary. Lightly grease with silicone lubricant to ensure a good seal.
2. Carefully tuck the cable connector completely inside the internal black cap. To do so, turn the black cap and cable counterclockwise one rotation to tighten the cable.
3. Lower the electronics housing onto the module. Guide the internal black cap and cable on the sensor module through the housing and into the external black cap.
4. Turn the module clockwise into the housing.

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

5. Thread the housing completely onto the sensor module. The housing must be no more than one full turn from flush with the sensor module to comply with explosion proof requirements.
6. Tighten the housing rotation set screw using a $^{5}/_{64}$-in. hex wrench.

6.5.1 Attaching electronics board

1. Remove the cable connector from its position inside of the internal black cap and attach it to the electronics board.
2. Using the two captive screws as handles, insert the electronics board into the housing. Make sure the power posts from the electronics housing properly engage the receptacles on the electronics board. Do not force. The electronics board should slide gently on the connections.
3. Tighten the captive mounting screws.
4. Replace the electronics housing cover. The transmitter covers must be engaged metal-to-metal to ensure a proper seal and to meet explosion-proof requirements.

6.5.2 Installing terminal block

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

6.5.3 Reassembling the Rosemount 2051C Process Flange

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

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

2. Install the process connection. Possible options include:
   a. Coplanar process flange:
   – Hold the process flange in place by installing the two alignment screws to finger tightness (screws are not pressure retaining). Do not overtighten as this will affect module-to-flange alignment.
   – Install the four 1.75-in. flange bolts by finger tightening them to the flange.
   b. Coplanar process flange with flange adapters:
   – Hold the process flange in place by installing the two alignment screws to finger tightness (screws are not pressure retaining). Do not overtighten as this will affect module-to-flange alignment.
   – Hold the flange adapters and adapter O-rings in place while installing (in the desired of the four possible process connection spacing configurations) using four 2.88-in. bolts to mount securely to the coplanar flange. For gage pressure configurations, use two 2.88-in. bolts and two 1.75-in. bolts.
   c. Manifold:
   – Contact the manifold manufacturer for the appropriate bolts and procedures.
3. Tighten the bolts to the initial torque value using a crossed pattern. See Table 6-5 on page 83 for appropriate torque values.
4. Using same cross pattern, tighten bolts to final torque values seen in Table 6-5 on page 83.

Table 6-5. Bolt Installation Torque Values

Bolt material	Initial torque value	Final torque value
Carbon steel—ASTM-A445 Standard	300 in-lb (34 N-m)	650 in-lb (73 N-m)
316 stainless steel—Option L4	150 in-lb (17 N-m)	300 in-lb (34 N-m)
ASTM-A-19 B7M—option L5	300 in-lb (34 N-m)	650 in-lb (73 N-m)
ASTM-A-193 Class 2, Grade B8M—option L8	150 in-lb (17 N-m)	300 in-lb (34 N-m)

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

Note
For range 1 transmitters: After replacing O-rings 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.

6.5.4 Installing drain/vent valve

1. Apply sealing tape to the threads on the seat. Starting at the base of the valve with the threaded end pointing toward the installer, apply five clockwise turns of sealing tape.
2. Tighten the drain/vent valve seat to 250 in-lb (28,25 N-m).
3. Take care to place the opening on the valve so that process fluid will drain toward the ground and away from human contact when the valve is opened.

Section 7 Safety Instrumented Systems Requirements

7.1 Safety Instrumented Systems (SIS) Certification

The safety-critical output of the Rosemount™ 2051 is provided through a two-wire, 4–20 mA signal representing pressure. The Rosemount 2051 safety certified pressure transmitter is certified to: Low Demand; Type B.
SIL 2 for random integrity @ HFT=0
SIL 3 for random integrity @ HFT=1
SIL 3 for systematic integrity

7.1.1 Rosemount 2051 safety certified identification

All Rosemount 2051 Transmitters must be identified as safety certified before installing into SIS systems.

To identify a safety certified Rosemount 2051C, Rosemount 2051T, Rosemount 2051L:

1. Check NAMUR Software Revision located on the metal device tag. "SW _._._".

NAMUR Software Revision Number	
SW(1)	1.0.x–1.4.x

1. NAMUR Software Revision: Located on the metal device tag

2. Transmitter output code “A” (4–20 mA HART Protocol).

7.1.2 Installation in SIS applications

Installations are to be performed by qualified personnel. No special installation is required in addition to the standard installation practices outlined in this document. Always ensure a proper seal by installing the electronics housing cover(s) so that metal contacts metal.

Environmental and operational limits are available in Appendix A: Specifications and Reference Data.

The loop should be designed so the terminal voltage does not drop below 10.5 Vdc when the transmitter output is set to 23 mA.

Position the security switch to the ( ) position to prevent accidental or deliberate change of configuration data during normal operation.

7.1.3 Configuring in SIS applications

Use any HART® Protocol capable configuration tool to communicate with and verify configuration of the Rosemount 2051.

Note
Transmitter output is not safety-rated during the following: Configuration changes, multidrop, and loop test. Alternative means should be used to ensure process safety during transmitter configuration and maintenance activities.

Damping

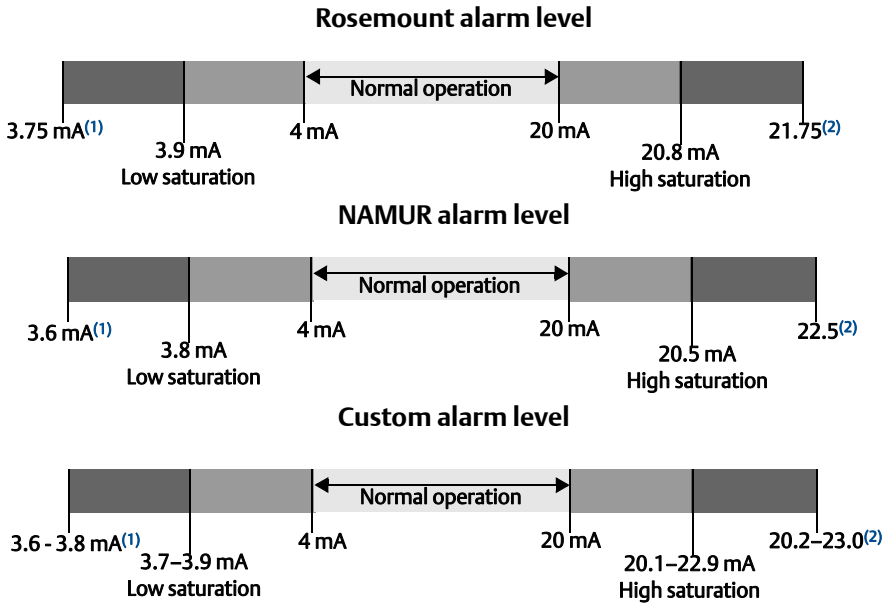
User-selected damping will affect the transmitters ability to respond to changes in the applied process. The damping value + response time must not exceed the loop requirements.

Reference "Damping" on page 17 to change damping value.

Alarm and saturation levels

DCS or safety logic solver should be configured to match transmitter configuration. Figure 7-1 identifies the three alarm levels available and their operation values.

Figure 7-1. Alarm Levels



1. Transmitter failure, hardware or software alarm in LO position.
2. Transmitter failure, hardware or software alarm in HI position.

7.1.4 Rosemount 2051 SIS operation and maintenance

Proof test

The following proof tests are recommended.
In the event that an error is found in the safety and functionality, proof test results and corrective actions taken can be documented at Emerson.com/Rosemount/Safety. All proof test procedures must be carried out by qualified personnel.

Use "Field Communicator Fast Keys" on page 184 to perform a loop test, analog output trim, or sensor trim. Security switch should be in the (🔓) position during proof test execution and repositioned in the (🔒) position after execution.

Simple proof test

The simple suggested proof test consists of a power cycle plus reasonability checks of the transmitter output. Reference the FMEDA Report for percent of possible DU failures in the device.

Required tools: Field Communicator and mA meter.

1. Bypass the safety function and take appropriate action to avoid a false trip.
2. Use HART communications to retrieve any diagnostics and take appropriate action.
3. Send a HART command to the transmitter to go to the high alarm current output and verify that the analog current reaches that value(1). See "Verifying alarm level" on page 24.
4. Send a HART command to the transmitter to go to the low alarm current output and verify that the analog current reaches that value(1).
5. Remove the bypass and otherwise restore the normal operation.
6. Place the Security switch in the (🔒) position.

Comprehensive proof test

The comprehensive proof test consists of performing the same steps as the simple suggested proof test but with a two point calibration of the pressure sensor in place of the reasonability check. Reference the FMEDA Report for percent of possible DU failures in the device.

1. *This tests for possible quiescent current related failures.*

Required tools: Field Communicator and pressure calibration equipment.

1. Bypass the safety function and take appropriate action to avoid a false trip.
2. Use HART communications to retrieve any diagnostics and take appropriate action.
3. Send a HART command to the transmitter to go to the high alarm current output and verify that the analog current reaches that value[1]. See "Verifying alarm level" on page 24.
4. Send a HART command to the transmitter to go to the low alarm current output and verify that the analog current reaches that value [1].
5. Perform a two-point calibration of the sensor (see "Trim the pressure signal" on page 66) over the full working range and verify the current output at each point.
6. Remove the bypass and otherwise restore the normal operation.
7. Place the Security switch in the ( ) position.

Note

- The user determines the proof test requirements for impulse piping.
- Automatic diagnostics are defined for the corrected % DU: The tests performed internally by the device during runtime without requiring enabling or programming by the user.

Calculation of average probability of failure on demand (PFD_{AVG})

PFD_{AVG} calculation can be found in the FMEDA Report.

7.1.5 Inspection

Visual inspection

Not required

Special tools

Not required

Product repair

The Rosemount 2051 is repairable by major component replacement.

All failures detected by the transmitter diagnostics or by the proof-test must be reported. Feedback can be submitted electronically at Emerson.com/Rosemount/Contact-Us.

All product repair and part replacement should be performed by qualified personnel.

Rosemount 2051 SIS reference

The Rosemount 2051 must be operated in accordance to the functional and performance specifications provided in Appendix A: Specifications and Reference Data.

1. *This tests for compliance voltage problems such as a low loop power supply voltage or increased wiring distance. This also tests for other possible failures.*

Failure rate data

The FMEDA Report includes failure rates and common cause Beta factor estimates.

Failure values

- Safety accuracy: ±2.0%
- Transmitter response time: 1.5 seconds
- Self-diagnostics test: At least once every 60 minutes

Product life

50 years - based on worst case component wear-out mechanisms - not based on wear-out of process wetted materials

Appendix A Specifications and Reference Data

A.1 Performance specifications

A.1.1 Conformance to specification (±3σ [Sigma])

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

A.1.2 Reference accuracy

Rosemount™ models	Standard	High performance option, P8[1]	
2051C			
Range 1	±0.10% of span For spans less than 15:1, accuracy = $\pm\left(0.025 + 0.005\left[\frac{URL}{Span}\right]\right)$ % of span	N/A	N/A
Ranges 2–4	±0.065% of span For spans less than 10:1, accuracy = $\pm\left(0.025 + 0.005\left[\frac{URL}{Span}\right]\right)$ % of span	Ranges 2–4	High accuracy option, P8 ±0.05% of span For spans less than 10:1[2], accuracy = $\pm\left(0.015 + 0.005\left[\frac{URL}{Span}\right]\right)$ % of span
Range 5	±0.075% of span For spans less than 10:1, accuracy= $\pm\left(0.025 + 0.005\left[\frac{URL}{Span}\right]\right)$ % of span	Range 5	High performance option, P8 ±0.065% of span For spans less than 10:1, accuracy= $\pm\left(0.015 + 0.005\left[\frac{URL}{Span}\right]\right)$ % of span

Rosemount™ models	Standard	High performance option, P8[1]	
2051T			
Ranges 1–4	±0.065% of span For spans less than 10:1, accuracy = $\pm\left(0.0075\left[\frac{URL}{Span}\right]\right)$ % of span	Ranges 1–4	High accuracy option, P8 ±0.05% of span For spans less than 10:1[2], accuracy = $\pm\left(0.0075\left[\frac{URL}{Span}\right]\right)$ % of span
Range 5	±0.075% of span For spans less than 10:1, accuracy = $\pm\left(0.0075\left[\frac{URL}{Span}\right]\right)$ % of span	N/A	N/A
2051L			
Ranges 2–4	±0.075% of span For spans less than 10:1, accuracy = $\pm\left(0.025 + 0.005\left[\frac{URL}{Span}\right]\right)$ % of span	N/A	N/A

1. Not available with output code W.
2. For protocol code F, accuracy specification is for spans less than 7:1.

A.1.3 Flow performance

Flow reference accuracy

Rosemount 2051CFA Annubar™ Flow Meter		
Ranges 2–3		±2.00% of flow rate at 5:1 flow turndown
Rosemount 2051CFC_A Compact Annubar Flow Meter — Rosemount Annubar option A		
Ranges 2–3	Standard	±2.60% of flow rate at 5:1 flow turndown
	Calibrated	±2.30% of flow rate at 5:1 flow turndown
Rosemount 2051CFC Compact Orifice Flow Meter — conditioning option C		
Ranges 2–3	β = 0.4	±2.25% of flow rate at 5:1 flow turndown
	β = 0.65	±2.45% of flow rate at 5:1 flow turndown
Rosemount 2051CFC Compact Orifice Flow Meter — orifice type option P[(1)]		
Ranges 2–3	β =0.4	±2.50% of flow rate at 5:1 flow turndown
	β =0.65	±2.50% of flow rate at 5:1 flow turndown
Rosemount 2051CFP Integral Orifice Flow Meter		
Ranges 2–3	Bore < 0.1	±3.10% of flow rate at 5:1 flow turndown
	0.1 < Bore < 0.2	±2.75% of flow rate at 5:1 flow turndown
	0.2 < Bore < 0.6	±2.25% of flow rate at 5:1 flow turndown
	0.6 < Bore < 0.8	±3.00% of flow rate at 5:1 flow turndown

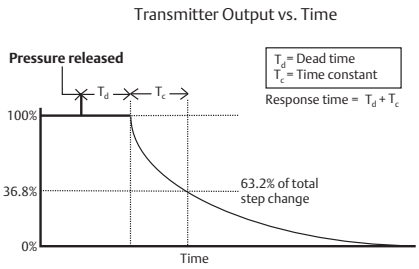
1. For smaller line sizes, see Rosemount Compact Orifice.

Long-term stability

±50 °F (28 °C) temperature changes and up to 1000 psi (6,9 MPa) line pressure.

Rosemount models	Standard	High performance option, P8
2051C		
Range 1 (CD)	±0.2% of URL for 1 year	±0.125% of URL for 5 years
Ranges 2–5	±0.1% of URL for 3 years	
2051T		
Ranges 1–5	±0.1% of URL for 3 years	±0.125% of URL for 5 years

A.1.4 Dynamic performance

	4–20 mA HART®[1] 1–5 Vdc HART low power	FOUNDATION™ Fieldbus and PROFIBUS PA Protocols[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 ms 270 ms 130 ms 100 ms See Instrument Toolkit™	152 ms 307 ms 152 ms 152 ms See Instrument Toolkit	
Dead time (T_d)	60 ms (nominal)	97 ms	
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. Transducer block response time, analog Input block execution time 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 Rosemount 2051 Reference Manual for HART, Rosemount 2051 Reference Manual for *Wireless*HART®, Rosemount 2051 Reference Manual for FOUNDATION Fieldbus, and Rosemount 2051 Reference Manual PROFIBUS® PA.

Rosemount models	Line pressure effect	
2051CD, 2051CF	**Zero error[1]**	**Span error**
Range 1	±0.25% of URL/ 1000 psi (68,9 bar)	±0.4% of reading/ 1,000 psi (68,9 bar)
Ranges 2–3	±0.05% of URL/ 1000 psi (68,9 bar) for line pressures from 0 to 2000 psi (0 to 13,7 MPa)	±0.1% of reading/ 1,000 psi (68,9 bar)

1. Can be calibrated out at line pressure.

Ambient temperature effect per 50 °F (28 °C)

Rosemount models	Ambient temperature effect
2051C, 2051CF	
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	±(0.1% URL + 0.25% span) from 1:1 to 30:1
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	±(0.1% URL + 0.15% span)
2051L	See Instrument Toolkit

Mounting position effects

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

Vibration effect

Less than ±0.1% of URL when tested per the requirements of IEC60770-1: 1999 field or pipeline with high vibration level (10–60 Hz 0.21 mm displacement peak amplitude/60–2000 Hz 3g).

Power supply effect

Less than ±0.005% of calibrated span per volt.(1)

Electromagnetic compatibility (EMC)

Meets all relevant requirements of EN 61326 and NAMUR NE-21.(2)

Maximum deviation < 1% Span during EMC disturbance.(3)

1. *Does not apply to wireless (output code X).*
2. *NAMUR NE-21 does not apply to wireless output code X.*
3. *During surge event device may exceed maximum EMC deviation limit or reset; however, device will self-recover and return to normal operation within specified start-up time.*

Transient protection (option code T1)

Meets IEEE C62.41, category location B

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

A.2 Functional specifications

A.2.1 Range and sensor limits

Table A-1. Range and Sensor Limits for Rosemount 2051CD, 2051CF, 2051CG, 2051L Models

Range	Minimum span	Upper (URL)	Lower (LRL)			
			Rosemount 2051C Differential and 2051CF Flow Meters	Rosemount 2051C Gage(1)	Rosemount 2051L Differential	Rosemount 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 (20,7 bar)	–300 psi (–20,7 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.

Table A-2. Range and Sensor Limits for Rosemount 2051T Model

Range	Minimum span	Upper (URL)	Lower (LRL)(Abs)	Lower[1] (LRL)(Gage)
1	0.3 psi (20,7 mbar)	30 psi (2,07 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	2,000 psi (137,9 bar)	10,000 psi (689,5 bar)	0 psia (0 bar)	–14.7 psig (–1,01 bar)

1. Assumes atmospheric pressure of 14.7 psig.

A.2.2 Service

Liquid, gas, and vapor application

A.2.3 4–20 mA (output code A)

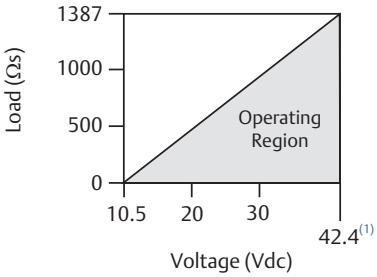
Power supply

External power supply required. Standard transmitter operates on 10.5–42.4 Vdc with no load.

Load limitations

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

Max. Loop Resistance = 43.5 (Power Supply Voltage – 10.5)



Communication requires a minimumloop resistance of 250 ohms.

1. For CSA approval, power supply must not exceed 42.4 V.

Indication

Optional two line LOI/LCD display.

Zero and span adjustment requirements

Zero and span values can be set anywhere within the range limits stated in Table A-1 and Table A-2.

Span must be greater than or equal to the minimum span stated in Table A-1 and Table A-2.

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 HART Protocol.

Rosemount 2051

Digital communications based on HART Revision 5 Protocol.

Rosemount 2051 with Selectable HART

The 2051 with Selectable HART comes with Selectable HART Revisions. Digital communications based on HART Revision 5 (default) or Revision 7 (option code HR7) Protocol can be selected. The HART revision can be switched in the field using any HART based configuration tool or the optional local operator interface (LOI).

LOI

The LOI utilizes a two-button menu with internal and external configuration buttons. Internal buttons are always configured for LOI. External buttons can be configured for either LOI, (option code M4), analog zero and span (option code D4) or digital zero trim (option code DZ). See Rosemount 2051 with Selectable HART Reference Manual for LOI configuration menu.

A.2.4 HART 1–5 Vdc 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.

Rosemount 2051

Digital communications based on HART Revision 5 protocol.

Rosemount 2051 with Selectable HART

The Rosemount 2051 with Selectable HART comes with Selectable HART Revisions. Digital communications based on HART Revision 5 (default) or Revision 7 (option code HR7) protocol can be selected.

The HART Revision can be switched in the field using any HART based configuration tool or the optional LOI.

LOI

The LOI utilizes a two button menu with internal and external configuration buttons. Internal buttons are always configured for LOI. External buttons can be configured for either LOI, (option code M4), analog zero and span (option code D4) or digital zero trim (option code DZ).

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 (meter input impedance)

Turn-on time

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

A.2.5 Overpressure limits

Transmitters withstand the following limits without damage:

Rosemount 2051C, 2051CF

- Ranges 2–5: 3,626 psig (250 bar)
  4,500 psig (310,3 bar) for option code P9
- Range 1: 2,000 psig (137,9 bar)

Rosemount 2051T

- Range 1: 750 psi (51,7 bar)
- Range 2: 1,500 psi (103,4 bar)
- Range 3: 1,600 psi (110,3 bar)
- Range 4: 6,000 psi (413,7 bar)
- Range 5: 15,000 psi (1034,2 bar)

Rosemount 2051L

Limit is flange rating or sensor rating, whichever is lower. See table below:

Table A-3. Rosemount 2051L Flange Rating

Standard	Type	Carbon steel rating	Stainless steel 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, per ANSI/ASME B16.5.			
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, per DIN 2401.			

A.2.6 Static pressure limit

Rosemount 2051CD, 2051CF

- 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.2.7 Burst pressure limits

Rosemount 2051C, 2051CF Coplanar or Traditional Process Flange

10,000 psig (689.5 bar)

Rosemount 2051T In-line

- Ranges 1–4: 11000 psi (758,4 bar)
- Range 5: 26000 psi (1792,6 bar)

A.2.8 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:

	High alarm	Low alarm
Default	≥ 21.75 mA	≤ 3.75 mA
NAMUR compliant[1]	≥ 22.5 mA	≥ 3.6 mA
Custom levels[2]	20.2–23.0 mA	3.6–3.8 mA

1. Analog output levels are compliant with NAMUR recommendation NE 43, see option codes C4 or C5.
2. Low alarm must be 0.1 mA less than low saturation and high alarm must be 0.1 mA greater than high saturation.

Temperature limits

Ambient

- –40 to 185 °F (–40 to 85 °C)
- with LCD display[1][2]: –40 to 175 °F (–40 to 80 °C)

Storage[1]

- –50 to 230 °F (–46 to 110 °C)
- with LCD display: –40 to 185 °F (–40 to 85 °C)
- with Wireless output: –40 °F to 185 °F (–40 °C to 85 °C)

1. *Rosemount 2051 LCD display may not be readable and LCD display updates may be slower at temperatures below –22 °F (–30 °C).*
2. *Wireless LCD display may not be readable and LCD display updates will be slower at temperatures below –4 °F (–20 °C).*

A.2.9 Process

At atmospheric pressures and above. See table below:

Table A-4. Process Temperature Limits

Rosemount 2051C, 2051CF	
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][3]
with level flange	–40 to 300 °F (–40 to 149 °C)[2]
with Rosemount 305 Integral Manifold	–40 to 300 °F (–40 to 149 °C)[2]
Inert fill sensor[1]	–40 to 185 °F (–40 to 85 °C)[3]
Rosemount 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]
Rosemount 2051L low side temperature limits	
Silicone fill sensor[1]	–40 to 250 °F (–40 to 121 °C)[2]
Inert fill Sensor[1]	–40 to 185 °F (–40 to 85 °C)[2]
Rosemount 2051L high side temperature limits (process fill fluid)	
SYLTHERM XLT	–102 to 293 °F (–75 to 145°C)
Silicone 704	32 to 401 °F (0 to 205 °C)
Silicone 200	–49 to 401 °F (–45 to 205 °C)
Inert	–49 to 320 °F (–45 to 160 °C)
Glycerin and water	5 to 203 °F (–15 to 95 °C)
Neobee M-20	5 to 401 °F (–15 to 205 °C)
Propylene glycol and water	5 to 203 °F (–15 to 95 °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.2.10 Humidity limits

0–100 percent relative humidity

A.2.11 Volumetric displacement

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

A.2.12 Damping

4–20 mA HART Protocol

Rosemount 2051 with Selectable HART

Analog output response to a step input change is user-enterable from 0 to 60 seconds for one time constant. This software damping is in addition to sensor module response time.

Rosemount 2051

Analog output response to a step input change is user-selectable from 0.4 to 60 seconds for one time constant. This software damping is in addition to sensor module response time.

A.3 Physical specifications

A.3.1 Material selection

Emerson provides a variety of Rosemount product with various product options and configurations including materials of construction that can be expected to perform well in a wide range of applications. The Rosemount product information presented is intended as a guide for the purchaser to make an appropriate selection for the application. It is the purchaser's sole responsibility to make a careful analysis of all process parameters (such as all chemical components, temperature, pressure, flow rate, abrasives, contaminants, etc.), when specifying product, materials, options and components for the particular application. Emerson is not in a position to evaluate or guarantee the compatibility of the process fluid or other process parameters with the product, options, configuration or materials of construction selected.

A.3.2 Electrical connections

1/2–14 NPT, G1/2, and M20 x 1.5 conduit

A.3.3 Process connections

Rosemount 2051C

- 1/4–18 NPT on 2 1/8-in. centers
- 1/2–14 NPT and RC 1/2 on 2-in.(50,8 mm), 2 1/8-in. (54,0 mm), or 2 1/4-in. (57,2 mm) centers (process adapters)

Rosemount 2051T

- 1/2–14 NPT female
- G1/2 A DIN 16288 male
  (available in stainless steel for range 1–4 transmitters only)
- Autoclave type F-250-C (pressure relieved 9/16–18 gland thread; 1/4 O.D. high pressure tube 60° cone; available in stainless steel for Range 5 transmitters only)

Rosemount 2051L

- High pressure side: 2-in.(50,8 mm), 3-in. (72 mm), or 4-in. (102 mm), 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

Rosemount 2051CF

- For Rosemount 2051CFA wetted parts, see Rosemount DP Flow Meters and Primary Elements Product Data Sheet in the 485 section
- For Rosemount 2051CFC wetted parts, see Rosemount DP Flow Meters and Primary Elements Product Data Sheet in the 405 section
- For Rosemount 2051CFP wetted parts, see Rosemount DP Flow Meters and Primary Elements Product Data Sheet in the 1195 section

A.3.4 Rosemount 2051C process wetted parts

Drain/vent valves

316 stainless steel, alloy C-276, or alloy 400 material (alloy 400 not available with Rosemount 2051L)

Process flanges and adapters

Plated carbon steel, stainless steel cast CF-8M (cast version of 316 stainless steel, material per ASTM-A743), C-Type cast alloy CW12MW, or cast alloy M30C

Wetted O-rings

Glass-filled PTFE or graphite-filled PTFE

Process isolating diaphragms

Isolating diaphragm material	Rosemount model		
	2051CD and 2051 CG	2051T	2051CA
315L stainless steel	?	?	?
Alloy C-276	?	?	?
Alloy 400	?		?
Tantalum	?		
Gold-plated alloy 400	?		?
Gold-plated stainless steel	?		?

A.3.5 Rosemount 2051L Process wetted parts

Flanged process connection (transmitter high side)

Process diaphragms, including process gasket surface

316L stainless steel, alloy C-276, or tantalum

Extension

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

Mounting flange

Zinc-cobalt plated carbon steel or stainless steel

Reference process connection (transmitter low side)

Isolating diaphragms

316L stainless steel or alloy C-276

Reference flange and adapter

CF-8M (cast version of 316 stainless steel, material per ASTM-A743)

A.3.6 Non-wetted parts

Electronics housing

Low-copper aluminum or CF-8M (cast version of 316 stainless steel). Enclosure type 4X, IP 65, IP 66, IP68

Coplanar sensor module housing

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

Bolts

- ASTM A449, Type 1 (zinc-cobalt plated carbon steel)
- ASTM F593G, Condition CW1 (Austenitic 316 stainless steel)
- ASTM A193, Grade B7M (zinc plated alloy steel)
- Alloy K-500

Sensor module fill fluid

- Silicone or inert halocarbon
- In-line series uses Fluorinert™ FC-43

Process fill fluid (2051L only)

SYLTHERM™ XLT, Silicone 704, 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-5. Transmitter Weights without Options

Rosemount transmitter	Add weight in-lb. (kg)
2051C	4.9 (2.2)
2051L	See Table A-6
2051T	3.1 (1.4)

Table A-6. Rosemount 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)	N/A	N/A	N/A
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)	N/A	N/A	N/A

Table A-6. Rosemount 2051L Weights without Options

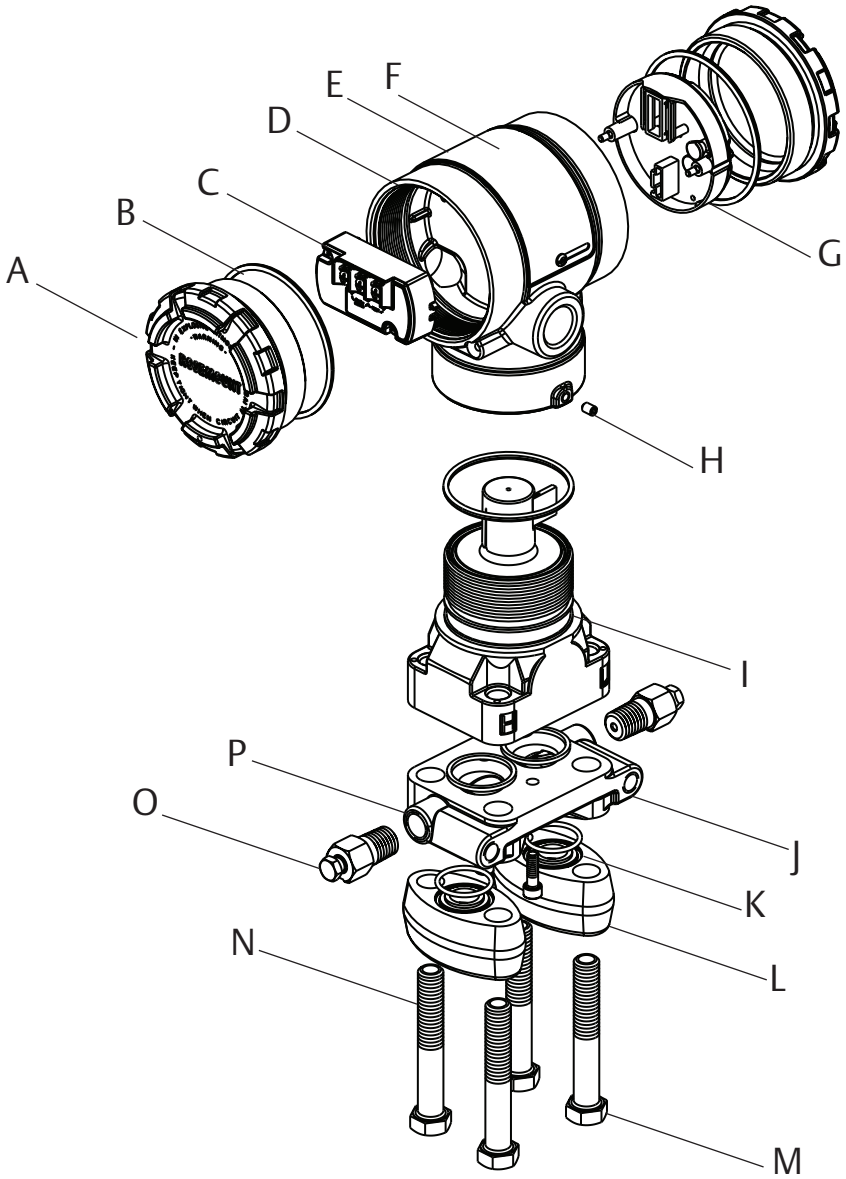
Flange	Flush lb (kg)	2-in. Ext. lb (kg)	4-in. Ext. lb (kg)	6-in. Ext. lb (kg)
3-in., 300	22.5 (10,2)	24.5 (11,1)	25.5 (11,6)	26.5 (12,0)
4-in., 300	32.5 (14,7)	35.5 (16,1)	37.5 (17,0)	39.5 (17,9)
DN 50/ PN 40	13.8 (6,2)	N/A	N/A	N/A
DN 80/ PN 40	19.5 (8,8)	21.5 (9,7)	22.5 (10,2)	23.5 (10,6)
DN 100/ PN 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-7. 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)
M5	LCD display for wireless output	0.1 (0,04)
B4	Stainless steel 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	Stainless steel 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., Class 150	12.7 (5,8)
FD	Level flange—3-in., Class 300	15.9 (7,2)
FA	Level flange—2-in., Class 150	8.0 (3,6)
FB	Level flange—2-in., Class 300	8.4 (3,3)
FP	DIN Level flange, stainless steel, DN 50, PN 40	7.8 (3,5)
FQ	DIN Level flange, stainless steel, DN 80, PN 40	12.7 (5,8)
WSM	Stainless steel sensor module	1.0 (0,45)
	Power module (701PGNKF)	0.4 (0,18)

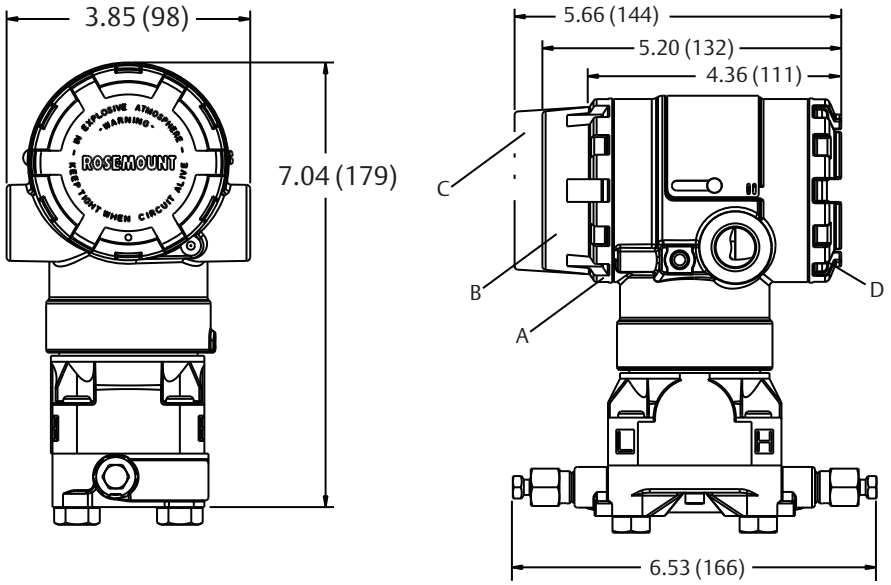
A.4 Dimensional drawings

Figure A-1. Rosemount2051C Exploded View



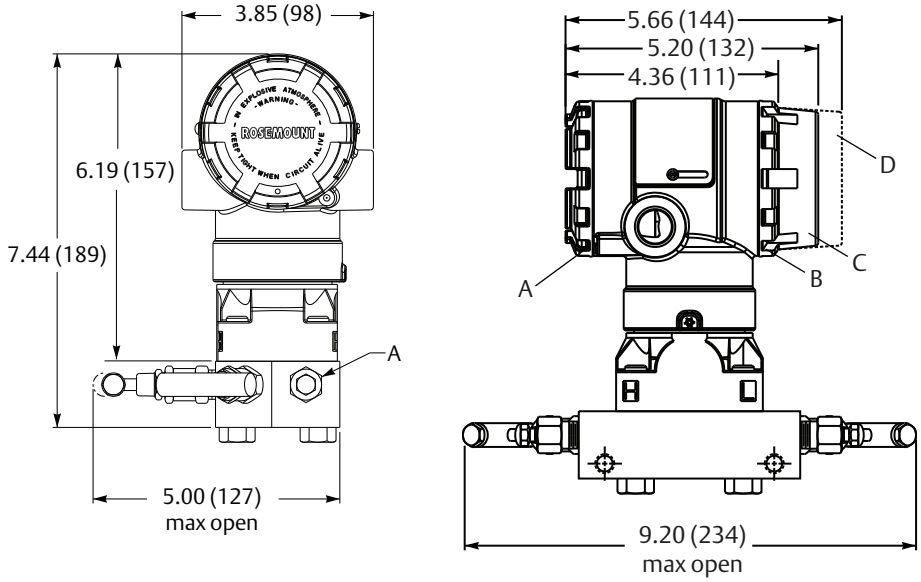
A. Cover
B. Cover O-ring
C. Terminal block
D. Electronics housing
E. Local configuration buttons
F. Nameplate
G. Electronic board
H. Housing rotation set screw (180 max. housing rotation without further disassembly)
I. Sensor module
J. Process O-ring
K. Flange adapter O-ring
L. Flange alignment screw (not pressure retaining)
M. Flange bolts
N. Flange adapters
O. Drain/vent valve
P. Coplanar flange

Figure A-2. Rosemount 2051C Coplanar Flange



A. Transmitter circuitry
B. HART display cover
C. FOUNDATION Fieldbus display cover
D. Terminal connection

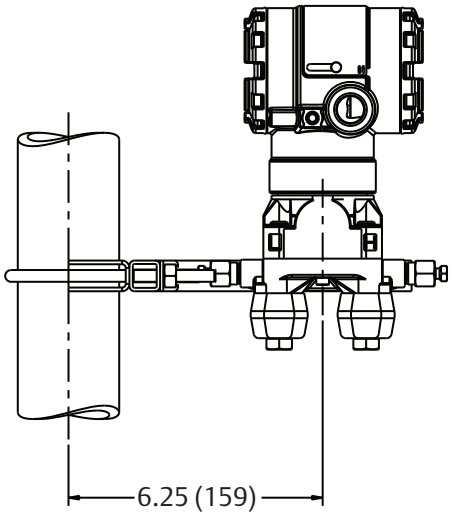
Figure A-3. Rosemount 2051C Coplanar with Rosemount 305 3-Valve Coplanar Integral Manifold



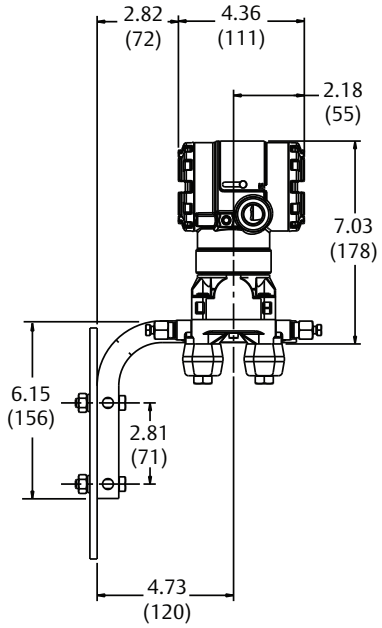
A. Terminal connections
B. Transmitter circuity
C. HART display cover
D. FOUNDATION Fieldbus display cover

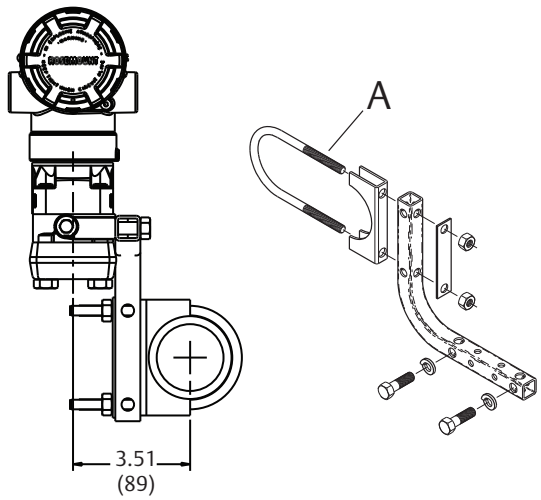
Figure A-4. Coplanar Flange Mounting Configurations with Optional Bracket (B4) for 2-in. Pipe or Panel Mounting

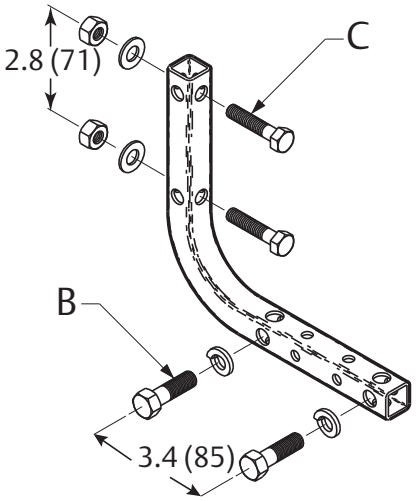
Pipe mounting



Panel mounting

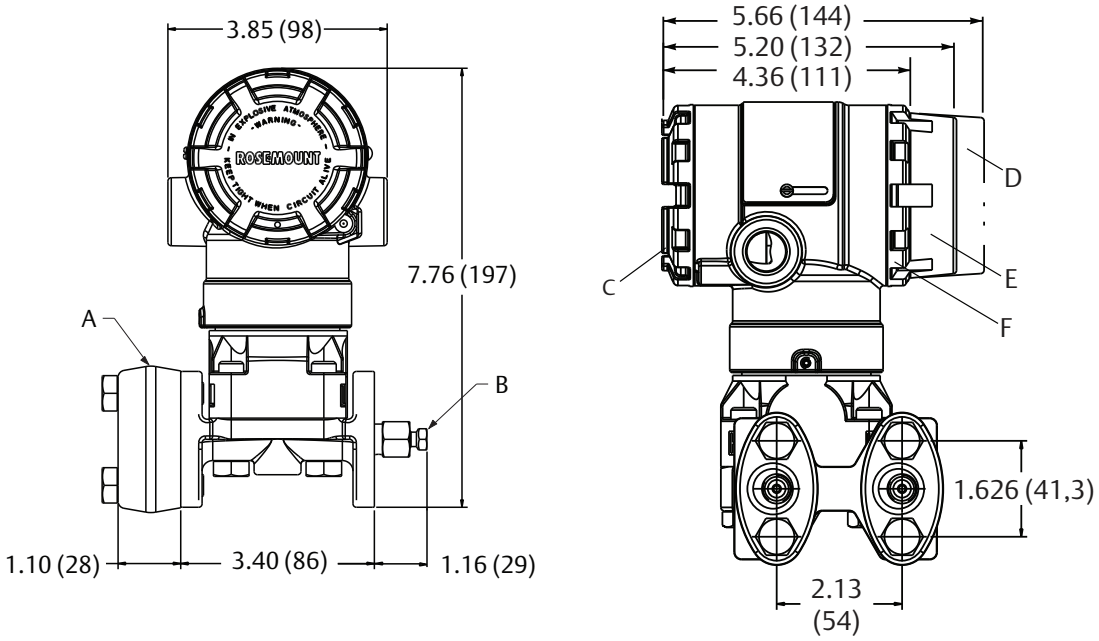






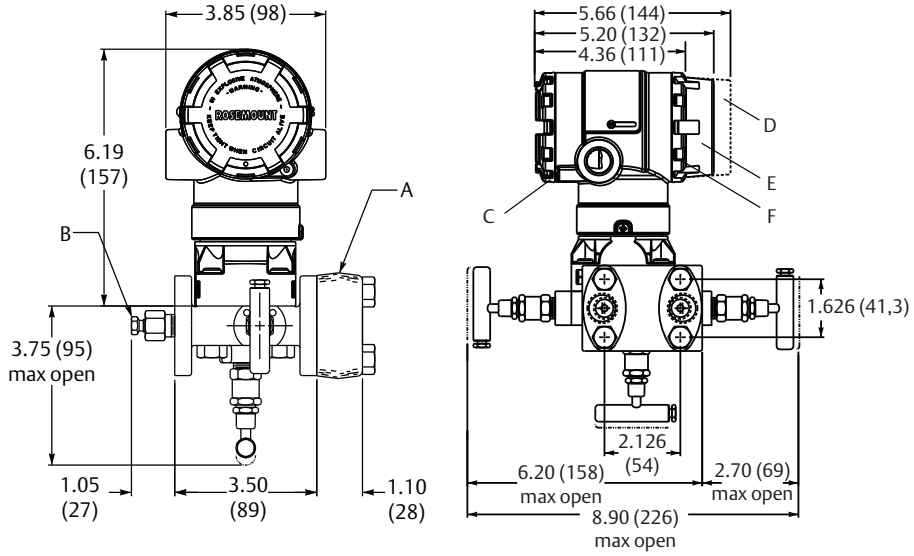
A. 2-in. U-bolt for pipe mounting
B. $^{3}/_{8}$-16 x 1 $^{1}/_{4}$ bolts for mounting to transmitter
C. $^{5}/_{16}$ x 1 $^{1}/_{2}$ bolts for panel mounting (not supplied)

Figure A-5. Rosemount 2051C Coplanar with Traditional Flange



A. 1/2–14 NPT flange adapter (optional)
B. Drain/vent valve
C. Terminal connection
D. FOUNDATION Fieldbus display cover
E. HART display cover
F. Transmitter circuitry

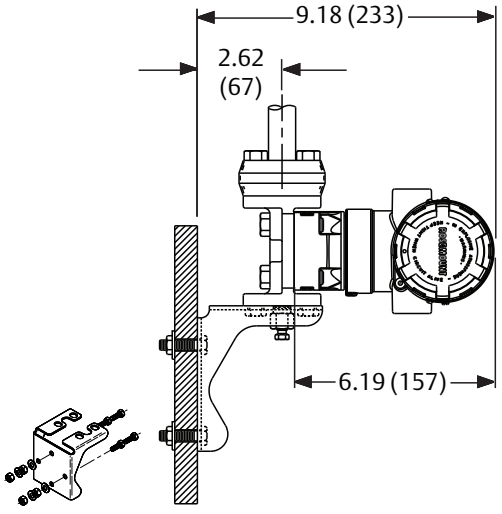
Figure A-6. Rosemount 2051C Coplanar with Rosemount 304 3-Valve Traditional Integral Manifold



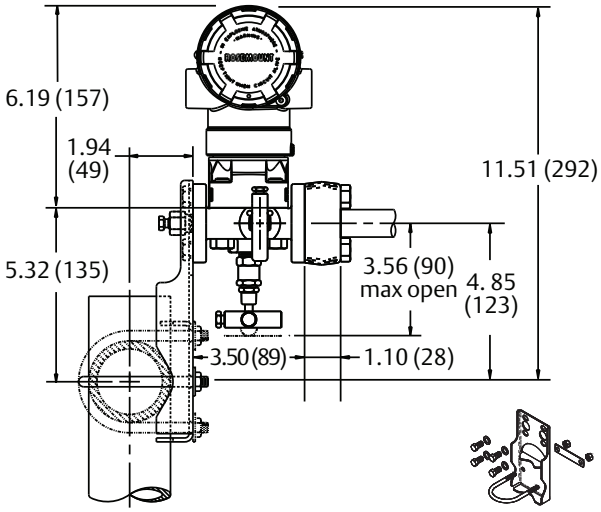
A. 1/2–4 NPT flange adapter (optional)
B. Drain/vent valve
C. Terminal connections
D. Fieldbus display cover
E. HART display cover
F. Transmitter circuitry

Figure A-7. Traditional Flange Mounting Configurations with Optional Brackets for 2-in. Pipe or Panel Mounting

Panel mount (bracket option B2/B8)



Pipe mount (bracket option B3/B9/BC)



Pipe mount (bracket option B1/B7/BA)

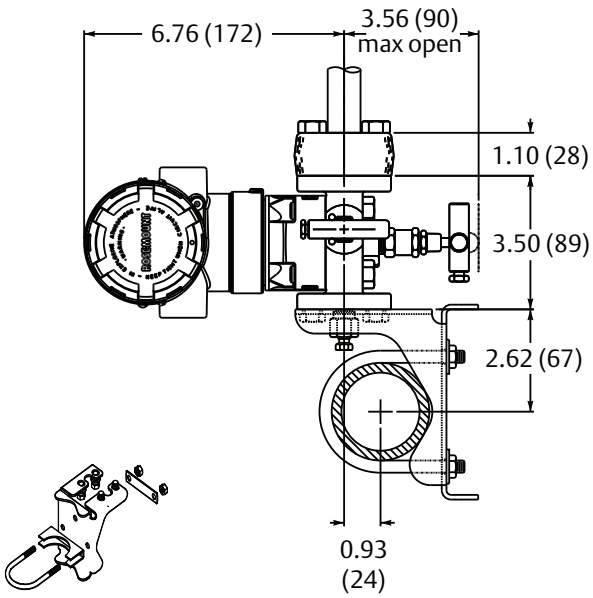
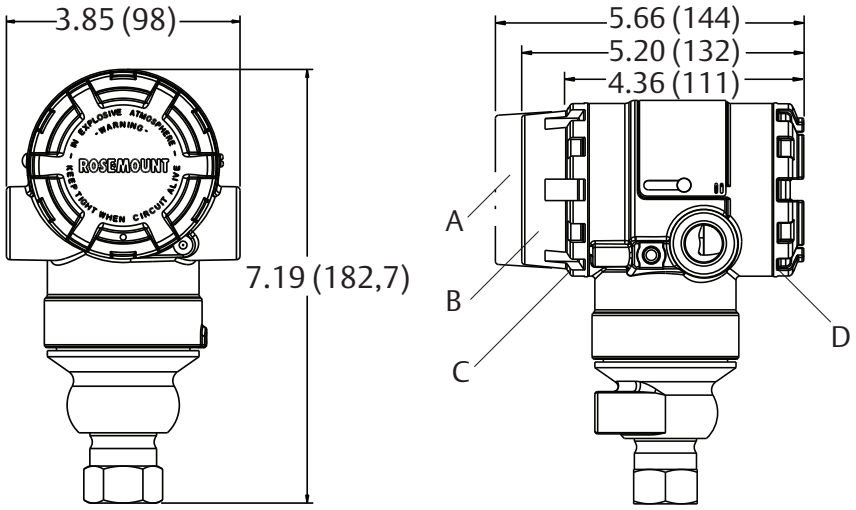
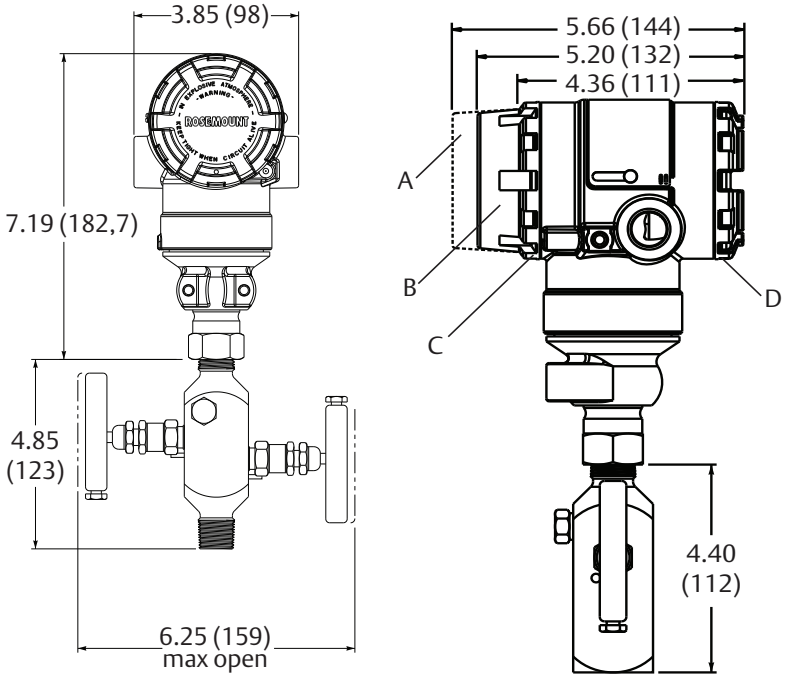


Figure A-8. Rosemount 2051T



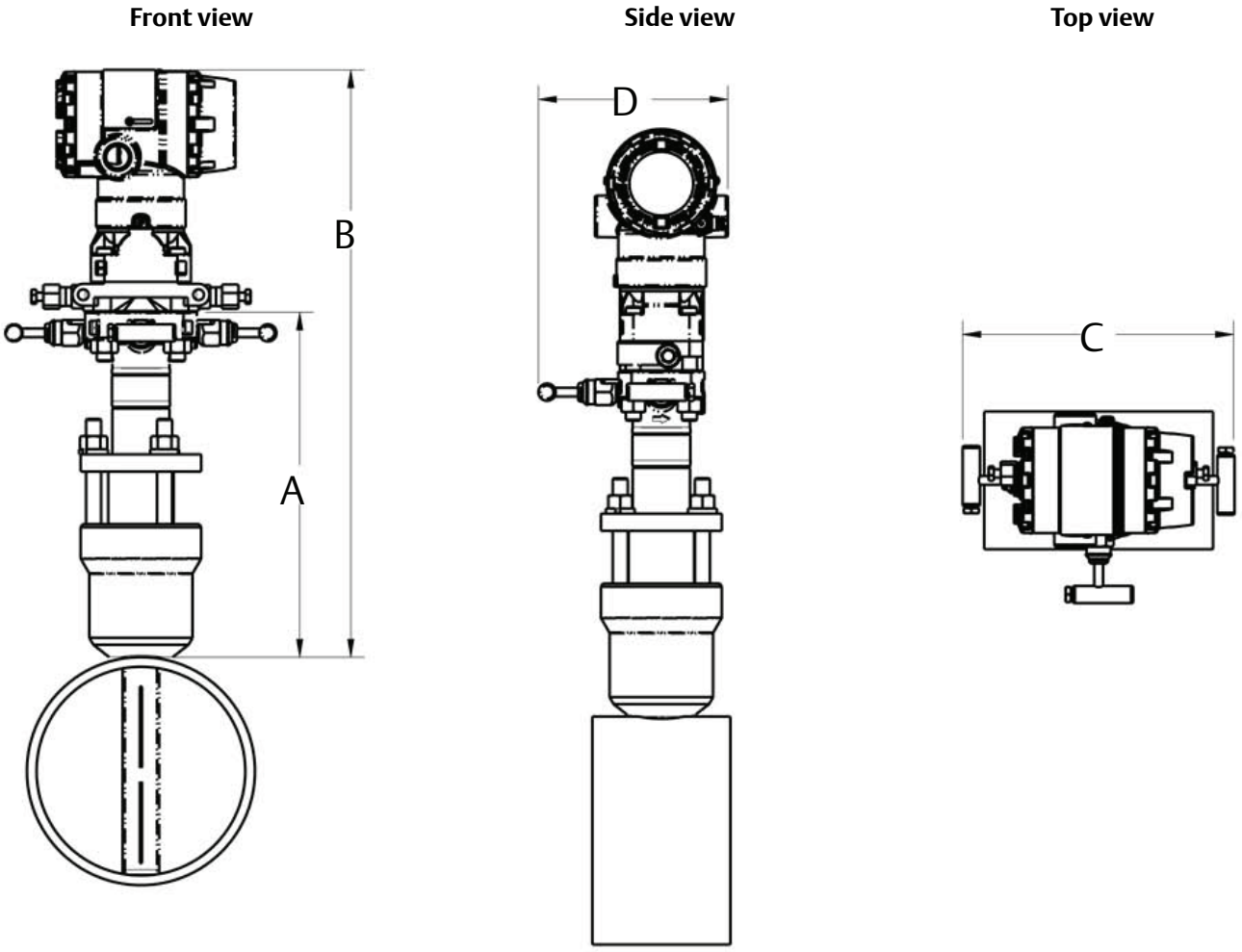
A. FOUNDATION Fieldbus display cover
B. HART display cover
C. Transmitter circuitry
D. Terminal connections

Figure A-9. Rosemount 2051T with Rosemount 306 2-Valve Integral Manifold



A. FOUNDATION Fieldbus display cover
B. HART display cover
C. Transmitter
D. Terminal connection

Figure A-10. Rosemount 2051CFA Pak-Lok Annubar Flow Meter(1)



1. The Rosemount Pak-Lok Annubar is available up to Class 600 ANSI (1,440 psig at 100 °F [99 bar at 38 °C]).

Table A-8. Rosemount 2051CFA Pak-Lok Annubar Flow Meter Dimensional Data

Sensor size	A (max)	B (max)	C (max)	D (max)
1	8.50 (215,9)	14.55 (369,6)	9.00 (228,6)	6.00 (152,4)
2	11.00 (279,4)	16.30 (414,0)	9.00 (228,6)	6.00 (152,4)
3	12.00 (304,8)	19.05 (483,9)	9.00 (228,6)	6.00 (152,4)
Dimensions are in inches (millimeters)				

Figure A-11. Rosemount 2051CFC Compact Orifice Flow Meter

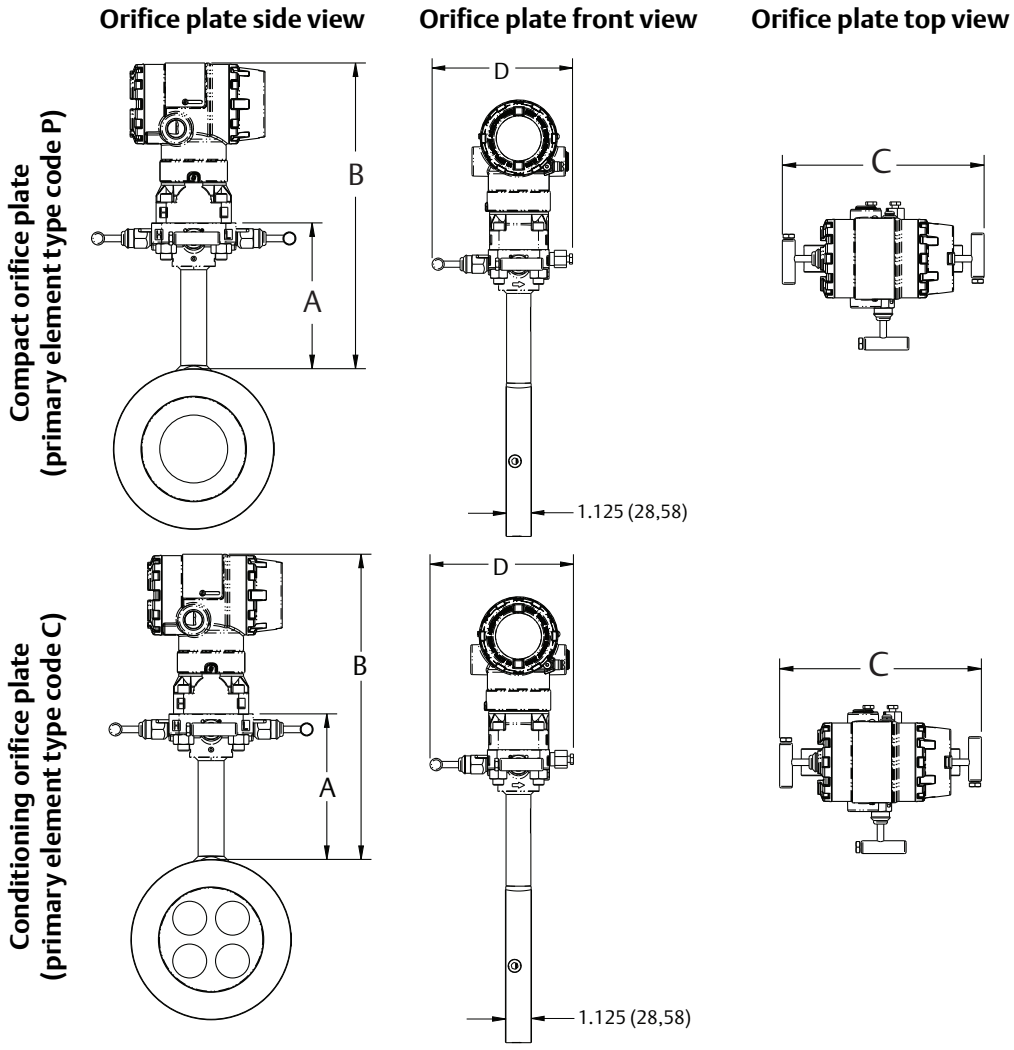


Table A-9. Rosemount 2051CFC Dimensions

Primary element type	A	B	Transmitter height	C	D
Type P and C	5.62 (143)	Transmitter height + A	6.27 (159)	7.75 (197) - closed 8.25 (210) - open	6.00 (152) - closed 6.25 (159) - open
Dimensions are in inches (millimeters).					

Figure A-12. Rosemount 2051CFP Integral Orifice Flow Meter

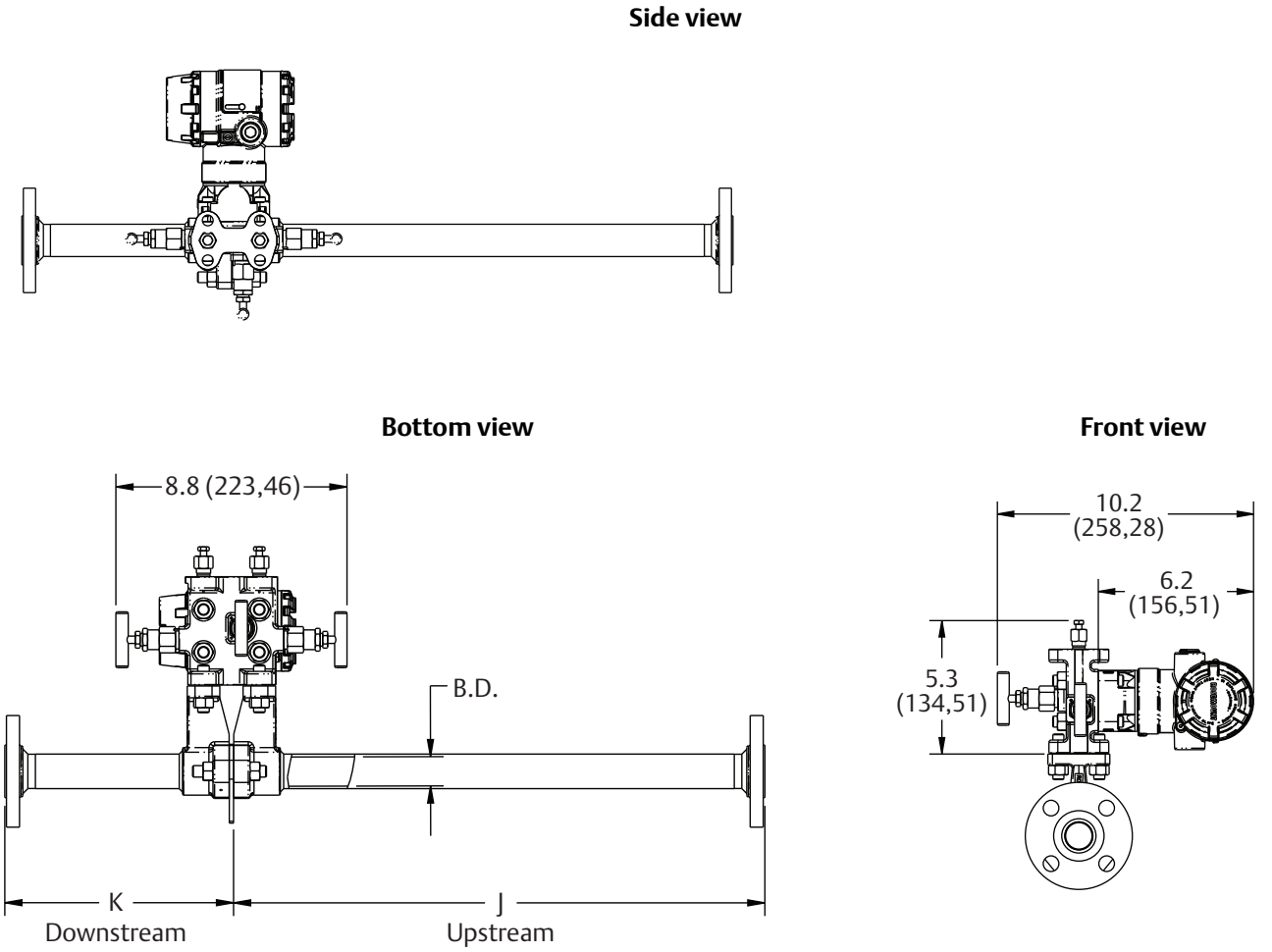


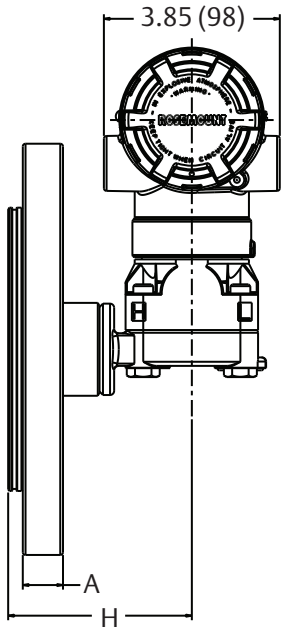
Table A-10. Rosemount 2051CFP Dimensions

Dimension	Line size		
	1/2-in. (15 mm)	1-in. (25 mm)	1 1/2-in. (40 mm)
J (beveled/threaded pipe ends)	12.54 (318,4)	20.24 (514,0)	28.44 (722,4)
J (RF slip-on, RTJ slip-on, RF-DIN slip on)	12.62 (320,4)	20.32 (516,0)	28.52 (724,4)
J (RF Class 150, weld neck)	14.37 (364,9)	22.37 (568,1)	30.82 (782,9)
J (RF Class 300, weld neck)	14.56 (369,8)	22.63 (574,7)	31.06 (789,0)
J (RF Class 600, weld neck)	14.81 (376,0)	22.88 (581,0)	31.38 (797,1)
K (beveled/threaded pipe ends)	5.74 (145,7)	8.75 (222,2)	11.91 (302,6)
K (RF slip-on, RTJ slip-on, RF-DIN slip on)(1)	5.82 (147,8)	8.83 (224,2)	11.99 (304,6)
K (RF Class 150, weld neck)	7.57 (192,3)	10.88 (276,3)	14.29 (363,1)
K (RF Class 300, weld neck)	7.76 (197,1)	11.14 (282,9)	14.53 (369,2)
K (RF Class 600, weld neck)	8.01 (203.4)	11.39 (289,2)	14.85 (377,2)
B.D. (bore diameter)	0.664 (16,87)	1.097 (27,86)	1.567 (39,80)

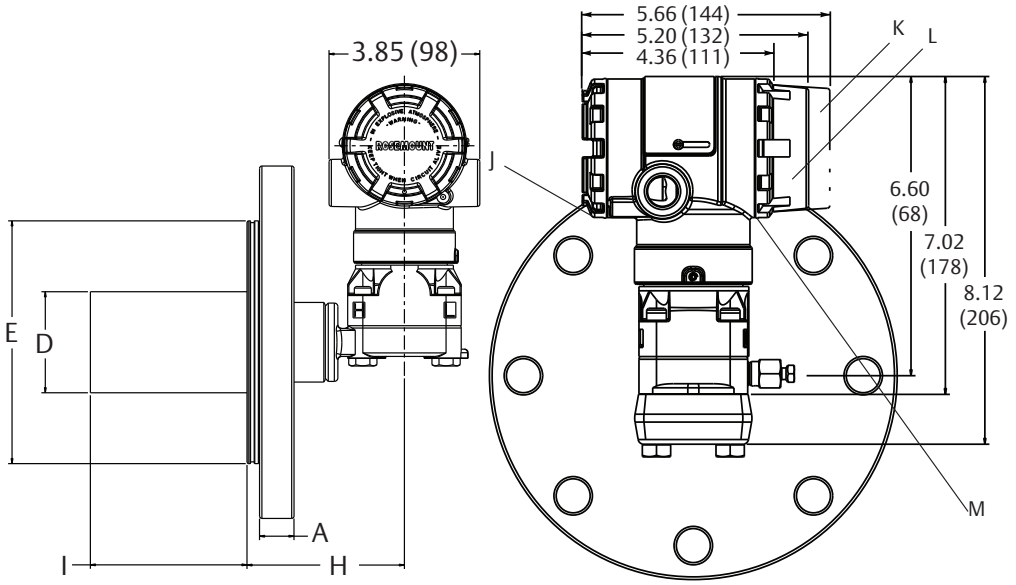
1. Downstream length shown here includes plate thickness of 0.162-in. (411 mm).

Figure A-13. Rosemount 2051L Liquid Level

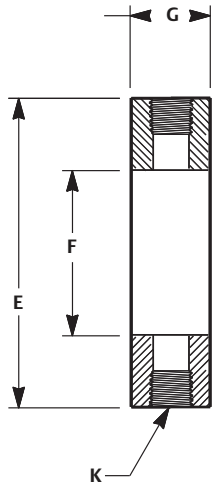
2-in. Flange Configuration (flush mount only)



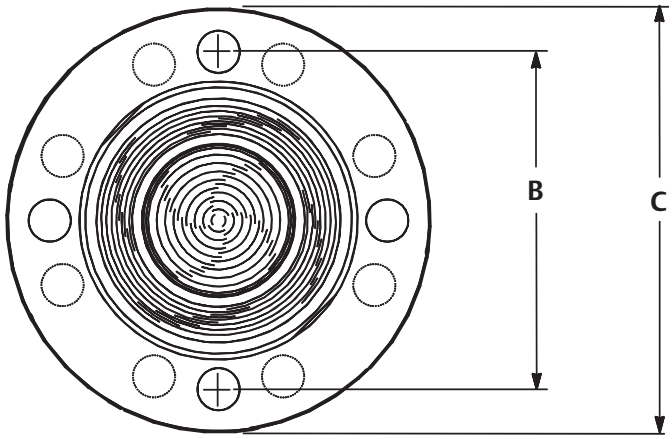
3- and 4-in. Flange Configuration



Optional flushing connection ring (lower housing)



Diaphragm assembly and mounting flange



I. 2-in., 4-in., or 6-in. extension
J. Terminal connections
K. FOUNDATION Fieldbus display cover
L. HART display cover
M. Transmitter circuitry

Table A-11. Rosemount 2051L Dimensional Specifications

Class	Pipe size	Flange thickness A	Bolt circle diameter B	Outside diameter C	No. of bolts	Bolt hole diameter	Extension diameter D[1]	O.D. gasket surface E
ASME B16.5 (ANSI) 150	2 (51)	0.69 (18)	4.75 (121)	6.0 (152)	4	0.75 (19)	NA	3.6 (92)
	3 (76)	0.88 (22)	6.0 (152)	7.5 (191)	4	0.75 (19)	2.58 (66)	5.0 (127)
	4 (102)	0.88 (22)	7.5 (191)	9.0 (229)	8	0.75 (19)	3.5 (89)	6.2 (158)
ASME B16.5 (ANSI) 300	2 (51)	0.82 (21)	5.0 (127)	6.5 (165)	8	0.75 (19)	NA	3.6 (92)
	3 (76)	1.06 (27)	6.62 (168)	8.25 (210)	8	0.88 (22)	2.58 (66)	5.0 (127)
	4 (102)	1.19 (30)	7.88 (200)	10.0 (254)	8	0.88 (22)	3.5 (89)	6.2 (158)
ASME B16.5 (ANSI) 600	2 (51)	1.00 (25)	5.0 (127)	6.5 (165)	8	0.75 (19)	NA	3.6 (92)
	3 (76)	1.25 (32)	6.62 (168)	8.25 (210)	8	0.88 (22)	2.58 (66)	5.0 (127)
DIN 2501 PN 10–40	DN 50	20 mm	125 mm	165 mm	4	18 mm	NA	4.0 (102)
DIN 2501 PN 25/40	DN 80	24 mm	160 mm	200 mm	8	18 mm	66 mm	5.4 (138)
	DN 100	24 mm	190 mm	235 mm	8	22 mm	89 mm	6.2 (158)
DIN 2501 PN 10/16	DN 100	20 mm	180 mm	220 mm	8	18 mm	89 mm	6.2 (158)

Class[1]	Pipe size	Process side F	Lower housing G		H
			¼ NPT	½ NPT	
ASME B16.5 (ANSI) 150	2 (51)	2.12 (54)	0.97 (25)	1.31 (33)	5.65 (143)
	3 (76)	3.6 (91)	0.97 (25)	1.31 (33)	5.65 (143)
	4 (102)	3.6 (91)	0.97 (25)	1.31 (33)	5.65 (143)
ASME B16.5 (ANSI) 300	2 (51)	2.12 (54)	0.97 (25)	1.31 (33)	5.65 (143)
	3 (76)	3.6 (91)	0.97 (25)	1.31 (33)	5.65 (143)
	4 (102)	3.6 (91)	0.97 (25)	1.31 (33)	5.65 (143)
ASME B16.5 (ANSI) 600	2 (51)	2.12 (54)	0.97 (25)	1.31 (33)	7.65 (194)
	3 (76)	3.6 (91)	0.97 (25)	1.31 (33)	7.65 (194)
DIN 2501 PN 10–40	DN 50	2.4 (61)	0.97 (25)	1.31 (33)	5.65 (143)
DIN 2501 PN 25/40	DN 80	3.6 (91)	0.97 (25)	1.31 (33)	5.65 (143)
	DN 100	3.6 (91)	0.97 (25)	1.31 (33)	5.65 (143)
DIN 2501 PN 10/16	DN 100	3.6 (91)	0.97 (25)	1.31 (33)	5.65 (143)

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

A.5 Ordering information

A.5.1 Rosemount 2051C Coplanar Pressure Transmitter

This ordering table contains the following Rosemount 2051C configurations:

Configuration	Transmitter output code
4–20 mA HART® Protocol • Rosemount 2051 • Enhanced Rosemount 2051[1]	A
FOUNDATION Fieldbus Protocol	F
PROFIBUS PA Protocol	W

1. The enhanced 4–20 mA HART device can be ordered with Transmitter output option code A plus any of the following new option codes: DA0, M4, QT, DZ, CR, CS, CT, HR5, HR7.

See Performance specifications and options for more details on each configuration.

Additional Information

Specifications: page 91
Certifications: page 149
Dimensional drawings: page 102

Table A-12. Rosemount 2051C Coplanar Pressure Transmitter Ordering Information

The starred offerings represent the most common options and should be selected for best delivery. The non-starred offerings are subject to additional delivery lead time.

Rosemount model	Transmitter type		
2051C	Coplanar pressure transmitter		
Measurement type			
D	Differential		★
G	Gage		★
Pressure range			
	2051CD	2051CG	
1	–25 to 25 inH_2O (–62,2 to 62,2 mbar)	–25 to 25 inH_2O (–62,2 to 62,2 mbar)	★
2	–250 to 250 inH_2O (–623 to 623 mbar)	–250 to 250 inH_2O (–623 to 623 mbar)	★
3	–1000 to 1000 inH_2O (–2,5 to 2,5 bar)	–393 to 1000 inH_2O (–0,98 to 2,5 bar)	★
4	–300 to 300 psi (–20,7 to 20,7 bar)	–14.2 to 300 psi (–0,98 to 20,7 bar)	★
5	–2000 to 2000 psi (–137,9 to 137,9 bar)	–14.2 to 2000 psi (–0,98 to 137,9 bar)	★
Transmitter output			
A[1]	4–20 mA with digital signal based on HART Protocol		★
F	FOUNDATION Fieldbus Protocol		★
W	PROFIBUS PA Protocol		★
M	Low-Power, 1–5 Vdc with digital signal based on HART Protocol		

Table A-12. Rosemount 2051C Coplanar Pressure Transmitter Ordering Information

The starred offerings represent the most common options and should be selected for best delivery. The non-starred offerings are subject to additional delivery lead time.

Materials of construction				
	Process flange type	**Flange material**	**Drain/vent**	
2	Coplanar	Stainless steel	Stainless steel	★
3[(2)]	Coplanar	Cast C-276	Alloy C-276	★
5	Coplanar	Plated CS	Stainless steel	★
7[(2)]	Coplanar	Stainless steel	Alloy C-276	★
8[(2)]	Coplanar	Plated CS	Alloy C-276	★
0	Alternate process connection			★
Isolating diaphragm				
2[(2)]	316L stainless steel			★
3[(2)]	Alloy C-276			★
5[(3)]	Tantalum			
O-ring				
A	Glass-filled PTFE			★
B	Graphite-filled PTFE			★
Sensor fill fluid				
1	Silicone			★
2	Inert			★
Housing material			**Conduit entry size**	
A	Aluminum		1/2–14 NPT	★
B	Aluminum		M20 x 1.5	★
J	Stainless steel		1/2–14 NPT	★
K[(4)]	Stainless steel		M20 x 1.5	★
D	Aluminum		G1/2	
M[(4)]	Stainless steel		G1/2	

Options (Include with selected model number)

PlantWeb control functionality		
A01	FOUNDATION Fieldbus advanced control function block suite	★

Table A-12. Rosemount 2051C Coplanar Pressure Transmitter Ordering Information

The starred offerings represent the most common options and should be selected for best delivery. The non-starred offerings are subject to additional delivery lead time.

Alternate flange[5]		
H2	Traditional flange, 316 stainless steel, stainless steel drain/vent	★
H3[2]	Traditional flange, cast C-276, alloy C-276 drain/vent	★
H7[2]	Traditional flange, 316 stainless steel, alloy C-276 drain/vent	★
HJ	DIN compliant traditional flange, stainless steel, 7/16-in. adapter/manifold bolting	★
FA	Level flange, stainless steel, 2-in., ANSI Class 150, vertical mount	★
FB	Level flange, stainless steel, 2-in., ANSI Class 300, vertical mount	★
FC	Level flange, stainless steel, 3-in., ANSI Class 150, vertical mount	★
FD	Level flange, stainless steel, 3-in., ANSI Class 300, vertical mount	★
FP	DIN level flange, stainless steel, DN 50, PN 40, vertical mount	★
FQ	DIN level flange, stainless steel, DN 80, PN 40, vertical mount	★
HK[6]	DIN compliant traditional flange, stainless steel, 10 mm adapter/manifold bolting	
HL	DIN compliant traditional flange, stainless steel, 12 mm adapter/manifold bolting	
Manifold assembly[6][7]		
S5	Assemble to Rosemount 305 Integral Manifold	★
S6	Assemble to Rosemount 304 Manifold or Connection System	★
Integral mount primary element[6][7]		
S4[8]	Assemble to Rosemount Annubar Flow Meter or Rosemount 1195 Integral Orifice	★
S3	Assemble to Rosemount 405 Primary Element	★
Seal assemblies[7]		
S1[9]	Assemble to one Rosemount 1199 Diaphragm Seal	★
S2[10]	Assemble to two Rosemount 1199 Diaphragm Seals	★
Mounting brackets		
B1	Traditional flange bracket for 2-in. pipe mounting, carbon steel bolts	★
B2	Traditional flange bracket for panel mounting, carbon steel bolts	★
B3	Traditional flange flat bracket for 2-in. pipe mounting, carbon steel bolts	★
B4	Coplanar flange bracket for 2-in. pipe or panel mounting, all stainless steel	★
B7	B1 bracket with series 300 stainless steel bolts	★
B8	B2 bracket with series 300 stainless steel bolts	★
B9	B3 bracket with series 300 stainless steel bolts	★
BA	Stainless steel B1 bracket with series 300 stainless steel bolts	★
BC	Stainless steel B3 bracket with series 300 stainless steel bolts	★

Table A-12. Rosemount 2051C Coplanar Pressure Transmitter Ordering Information

The starred offerings represent the most common options and should be selected for best delivery. The non-starred offerings are subject to additional delivery lead time.

Product Certifications		
E1[4]	ATEX Flameproof	★
E2[4]	INMETRO Flameproof	★
E3[4]	China Flameproof	★
E4[4]	TIIS Flameproof	★
E5	FM Explosion-proof, Dust Ignition-proof	★
E6	CSA Explosion-proof, Dust Ignition-proof, Division 2	★
E7[4]	IECEx Flameproof	★
EW	India (CCOE) Flameproof Approval	★
I1[4]	ATEX Intrinsic Safety	★
I2[4]	INMETRO Intrinsically Safe	★
I3[4]	China Intrinsic Safety	★
I5	FM Intrinsically Safe, Division 2	★
I6	CSA Intrinsically Safe	★
I7[4]	IECEx Intrinsic Safety	★
IA[11]	ATEX FISCO Intrinsic Safety	★
IE[12]	FM FISCO Intrinsically Safe	★
IF[12]	CSA FISCO Intrinsically Safe	★
IG[12]	IECEx FISCO Intrinsically Safe	★
IW[4]	India (CCOE) Intrinsically Safe	★
K1[4]	ATEX Flameproof, Intrinsic Safety, Type n, Dust	★
K2	INMETRO Flameproof and Intrinsic Safety	★
K5	FM Explosion-proof, Dust Ignition-proof, Intrinsically Safe, Division 2	★
K6	CSA Explosion-proof, Dust Ignition-proof, Intrinsically Safe, Division 2	★
K7[4]	IECEx Flameproof, Intrinsic Safety, Type n and Dust	★
KA[4]	ATEX and CSA Flameproof, Intrinsically Safe, Division 2	★
KB	FM and CSA Explosion-proof, Dust Ignition-proof, Intrinsically Safe, Division 2	★
KC[4]	FM and ATEX Explosion-proof, Intrinsically Safe, Division 2	★
KD[4]	FM, CSA, and ATEX Explosion-proof, Intrinsically Safe	★
N1[4]	ATEX Type n	★
N7[4]	IECEx Type n	★
ND[4]	ATEX Dust	★
Drinking Water Approval[13]		
DW	NSF Drinking Water Approval	★

Table A-12. Rosemount 2051C Coplanar Pressure Transmitter Ordering Information

The starred offerings represent the most common options and should be selected for best delivery. The non-starred offerings are subject to additional delivery lead time.

Shipboard approvals		
SBS	American Bureau of Shipping (ABS) Type Approval	★
SBV	Bureau Veritas (BV) Type Approval	★
SDN	Det Norske Veritas (DNV) Type Approval	★
SLL	Lloyds Register (LR) Type Approval	★
Bolting materials		
L4	Austenitic 316 stainless steel bolts	★
L5	ASTM A 193, grade B7M bolts	★
L6	Alloy K-500 bolts	★
L8	ASTM A 193 Class 2, grade B8M bolts	★
Display and interface options		
M4[(12)]	LCD display with LOI	★
M5	LCD display	★
Hardware adjustments[(14)]		
D4	Zero and span configuration buttons	★
DZ	Digital zero trim	★
Flange adapters[(15)]		
DF	1/2–14 NPT flange adapters	★
Conduit plug[(16)]		
DO	316 stainless steel conduit plug	★
RC1/4 RC1/2 process connection[(17)]		
D9	RC 1/4 flange with RC 1/2 flange adapter – stainless steel	
Ground screw[(18)]		
V5	External ground screw assembly	★
Performance[(19)]		
P8	High performance option	★
Transient protection[(20)]		
T1	Transient protection terminal block	★
Software configuration[(21)]		
C1	Custom software configuration (completed Rosemount 2051 Configuration Data Sheet required with order)	★

Table A-12. Rosemount 2051C Coplanar Pressure Transmitter Ordering Information

The starred offerings represent the most common options and should be selected for best delivery. The non-starred offerings are subject to additional delivery lead time.

Alarm limit[14]		
C4[22]	NAMUR alarm and saturation levels, high alarm	★
CN[22]	NAMUR alarm and saturation levels, high alarm	★
CR	Custom alarm and saturation signal levels, high alarm (requires C1 and Rosemount 2051 Configuration Data Sheet)	★
CS	Custom alarm and saturation signal levels, low alarm (requires C1 and Rosemount 2051 Configuration Data Sheet)	★
CT	Low alarm (standard Rosemount alarm and saturation levels)	★
Pressure testing		
P1	Hydrostatic testing with certificate	
Cleaning process area		
P2	Cleaning for special service	
P3	Cleaning for < 1 PPM chlorine/flourine	
Maximum static line pressure		
P9	4500 psig (310 bar) static pressure limit (Rosemount 2051CD ranges 2–5 only)	★
Calibration Certification		
Q4	Calibration Certificate	★
QG	Calibration Certificate and GOST Verification Certificate	★
QP	Calibration certification and tamper evident seal	★
Material Traceability Certification		
Q8	Material Traceability Certification per EN 10204 3.1.B	★
Quality Certification for Safety[21]		
QS	Prior-use certificate of FMEDA data	★
QT	Safety Certified to IEC 61508 with certificate of FMEDA	★
Surface finish		
Q16	Surface finish certification for sanitary remote seals	★
Toolkit total system performance reports		
QZ	Remote seal system performance calculation report	★
Conduit electrical connection		
GE	M12, 4-pin, male connector (eurorast®)	★
GM	A size mini, 4-pin, male connector (minifast®)	★

Table A-12. Rosemount 2051C Coplanar Pressure Transmitter Ordering Information

The starred offerings represent the most common options and should be selected for best delivery. The non-starred offerings are subject to additional delivery lead time.

HART Revision Configuration[14]		
HR5[23]	Configured for HART Revision 5	★
HR7[24]	Configured for HART Revision 7	★
Typical Model Number: 2051C D 2 A 2 2 A 1 A B4 M5		

1. HART Revision 5 is the default HART output. The Rosemount 2051 with Selectable HART can be factory or field configured to HART Revision 7. To order HART Revision 7 factory configured, add option code HR7.
2. 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.
3. Available in ranges 2–5 only.
4. Not available with low power output code M.
5. Requires 0 code in materials of construction for alternate process connection.
6. Not valid with optional code P9 for 4500 psi static pressure.
7. "Assemble-to" items are specified separately and require a completed model number.
8. Process flange limited to coplanar (codes 2, 3, 5, 7, 8) or traditional (H2, H3, H7).
9. Not valid with optional code D9 for RC1/2 adaptors.
10. Not valid with optional codes DF and D9 for adaptors.
11. Only valid with FOUNDATION Fieldbus output code F.
12. Not available with FOUNDATION Fieldbus output code F.
13. Not available with alloy C-276 isolator (3 code), tantalum isolator (5 code), all cast C-276 flanges, all plated carbon steel flanges, all DIN flanges, all Level flanges, assemble-to manifolds (S5 and S6 codes), assemble-to seals (S1 and S2 codes), assemble-to primary elements (S3 and S4 codes), surface finish certification (Q16 code), and remote seal system report (QZ code).
14. Only available with HART 4–20 mA (output codes A and M).
15. Not valid with alternate process connection options S3, S4, S5, S6.
16. Transmitter is shipped with 316 stainless steel conduit plug (uninstalled) in place of standard carbon steel conduit plug.
17. Not available with alternate process connection: DIN flanges and level flanges.
18. The V5 option is not needed with the T1 option; external ground screw assembly is included with the T1 option.
19. Available with 4–20 mA HART output code A, FOUNDATION Fieldbus output code F, Rosemount 2051C ranges 2–5 or 2051T ranges 1–4, stainless steel diaphragms and silicone fill fluid. High performance option includes 0.05 percent reference accuracy, five year stability and improved ambient temperature effect specifications. See "Performance specifications" on page 91 for details.
20. The T1 option is not needed with FISCO Product Certifications; transient protection is included in the FISCO product certification codes IA and IE.
21. Only available with HART 4–20 mA (output code A).
22. NAMUR-Compliant operation is pre-set at the factory and cannot be changed to standard operation in the field.
23. Configures the HART output to HART Revision 5. The device can be field configured to HART Revision 7 Safety Instrumented Systems Requirements.
24. Configures the HART output to HART Revision 7. The device can be field configured to HART Revision 5 Safety Instrumented Systems Requirements.

A.5.2 Rosemount 2051T In-Line Pressure Transmitter

This ordering table contains the following Rosemount 2051T configurations:

Configuration	Transmitter output code
4–20 mA HART Protocol • Rosemount 2051 • Enhanced Rosemount 2051(1)	A
FOUNDATION™ Fieldbus Protocol	F
PROFIBUS PA Protocol	W

1. The enhanced 4–20 mA HART device can be ordered with transmitter output option code A plus any of the following new option codes: DA0, M4, QT, DZ, CR, CS, CT, HR5, HR7.

See Performance specifications and Options for more details on each configuration.

Additional Information

Specifications: page 91
Certifications: page 149
Dimensional drawings: page 102

Table A-13. Rosemount 2051T In-Line Pressure Transmitter Ordering Information

The starred offerings represent the most common options and should be selected for best delivery. The non-starred offerings are subject to additional delivery lead time.

Rosemount model	Transmitter type		
2051T	In-line pressure transmitter		★
Pressure type			
G	Gage		★
A	Absolute		★
Pressure range			
	Rosemount 2051TG	**Rosemount 2051TA**	
1	–14.7 to 30 psi (–1,0 to 2.1 bar)	0 to 30 psi (0 to 2.1 bar)	★
2	–14.7 to 150 psi (–1,0 to 10.3 bar)	0 to 150 psi (0 to 10.3 bar)	★
3	–14.7 to 800 psi (–1,0 to 55 bar)	0 to 800 psi (0 to 55 bar)	★
4	–14.7 to 4000 psi (–1,0 to 276 bar)	0 to 4000 psi (0 to 276 bar)	★
5	–14.7 to 10000 psi (–1.0 to 689 bar)	0 to 10000 psi (0 to 689 bar)	★
Transmitter output			
A(1)	4–20 mA with digital signal based on HART Protocol		★
F	FOUNDATION Fieldbus Protocol		★
W	PROFIBUS PA Protocol		★
M	Low-power, 1–5 Vdc with digital signal based on HART Protocol		
Process connection style			
2B	1/2–14 NPT female		★
2C	G1/2 A DIN 16288 male (available in stainless steel for range 1-4 only)		★
2F	Coned and threaded, compatible with autoclave type F-250-C (range 5 only)		

Table A-13. Rosemount 2051T In-Line Pressure Transmitter Ordering Information

The starred offerings represent the most common options and should be selected for best delivery. The non-starred offerings are subject to additional delivery lead time.

Isolating diaphragm[2]		**Process connection wetted parts material**	
2	316L stainless steel	316L stainless steel	★
3	Alloy C-276	Alloy C-276	★
Sensor fill fluid			
1	Silicone		★
2	Inert		★
Housing material		**Conduit entry size**	
A	Aluminum	1/2–14 NPT	★
B	Aluminum	M20 x 1.5	★
J	Stainless steel	1/2–14 NPT	★
K[3]	Stainless steel	M20 x 1.5	★
D	Aluminum	G1/2	
M[3]	Stainless steel	G1/2	

Options (Include with selected model number)

PlantWeb control functionality		
A01	FOUNDATION Fieldbus Advanced Control Function Block Suite	★
Manifold assemblies[4]		
S5	Assemble to Rosemount 306 Integral Manifold	★
Seal assemblies[4]		
S1	Assemble to one Rosemount 1199 Diaphragm Seal	★
Mounting bracket		
B4	Bracket for 2-in. pipe or panel mounting, all stainless steel	★
Product Certifications		
E1[3]	ATEX Flameproof	★
E2[3]	INMETRO Flameproof	★
E3[3]	China Flameproof	★
E4[3]	TIIS Flameproof	★
E5	FM Explosion-proof, Dust Ignition-proof	★
E6	CSA Explosion-proof, Dust Ignition-proof, Division 2	★
E7[3]	IECEx Flameproof	★
EW[3]	India (CCOE) Flameproof Approval	★
I1[3]	ATEX Intrinsic Safety	★
I2[3]	INMETRO Intrinsically Safe	★
I3[3]	China Intrinsic Safety	★
I5	FM Intrinsically Safe, Division 2	★
I6	CSA Intrinsically Safe	★
I7[3]	IECEx Intrinsic Safety	★
IA[6]	ATEX FISCO Intrinsic Safety	★
IE[6]	FM FISCO Intrinsically Safe	★
IF[6]	CSA FISCO Intrinsically Safe	★

Table A-13. Rosemount 2051T In-Line Pressure Transmitter Ordering Information

The starred offerings represent the most common options and should be selected for best delivery. The non-starred offerings are subject to additional delivery lead time.

IG[6]	IECEx FISCO Intrinsically Safe	★
IW[3]	India (CCOE) Intrinsic Safety Approval	★
K1[3]	ATEX Flameproof, Intrinsic Safety, Type n, Dust	★
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 and Dust	★
KA[3]	ATEX and CSA Flameproof, Intrinsically Safe, Division 2	★
KB	FM and CSA Explosion-proof, Dust Ignition-proof, Intrinsically Safe, Division 2	★
KC[3]	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[3]	ATEX Dust	★
Drinking Water Approval[5]		
DW	NSF Drinking Water Approval	★
Shipboard Approvals		
SBS	American Bureau of Shipping (ABS) Type Approval	★
SBV	Bureau Veritas (BV) Type Approval	★
SDN	Det Norske Veritas (DNV) Type Approval	★
SLL	Lloyds Register (LR) Type Approval	★
Display and interface options		
M4[6]	LCD display with LOI	★
M5	LCD display	★
Hardware adjustments[7]		
D4	Zero and span configuration buttons	★
DZ	Digital zero trim	★
Conduit plug		
DO[8]	316 stainless steel conduit plug	★
Ground screw[9]		
V5	External ground screw assembly	★
Performance[10]		
P8	High performance option	★
Terminal blocks[11]		
T1	Transient protection terminal block	★
Software configuration[12]		
C1	Custom software configuration (completed Rosemount 2051 Configuration Data Sheet required with order)	★
Alarm limits[7]		
C4[13]	Analog output levels compliant with NAMUR Recommendation NE 43, alarm high	★
CN[13]	Analog output levels compliant with NAMUR Recommendation NE 43, alarm low	★
CR	Custom alarm and saturation signal levels, high alarm (requires C1 and Rosemount 2051 Configuration Data Sheet)	★
CS	Custom alarm and saturation signal levels, low alarm (requires C1 and Rosemount 2051 Configuration Data Sheet)	★
CT	Low alarm (standard Rosemount alarm and saturation levels)	★
Pressure testing		

Table A-13. Rosemount 2051T In-Line Pressure Transmitter Ordering Information

The starred offerings represent the most common options and should be selected for best delivery. The non-starred offerings are subject to additional delivery lead time.

P1	Hydrostatic testing with certificate	
Cleaning process area[14]		
P2	Cleaning for special service	
P3	Cleaning for <1 PPM chlorine/fluorine	
Calibration certification		
Q4	Calibration Certificate	★
QG	Calibration Certificate and GOST Verification Certificate	★
QP	Calibration Certificate and tamper evident seal	★
Material traceability certification		
Q8	Material Traceability Certification per EN 10204 3.1.B	★
Quality certification for safety[12]		
QS	Prior-use certificate of FMEDA data	★
QT	Safety Certified to IEC 61508 with certificate of FMEDA	★
Surface finish		
Q16	Surface finish certification for sanitary remote seals	★
Toolkit total system performance reports		
QZ	Remote seal system performance calculation report	★
Conduit electrical connector		
GE	M12, 4-pin, male connector (eurofast)	★
GM	A size Mini, 4-pin, male connector (minifast)	★
HART revision configuration[7]		
HR5[15]	Configured for HART Revision 5	★
HR7[16]	Configured for HART Revision 7	★
Typical model number:	**2051T G 3 A 2B 2 1 A B4 M5**	

1. HART Revision 5 is the default HART output. The Rosemount 2051 with Selectable HART can be factory or field configured to HART Revision 7. To order HART Revision 7 factory configured, add option code HR7.
2. 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.
3. Not available with low power output code M.
4. "Assemble-to" items are specified separately and require a completed model number.
5. Not available with coned and threaded connection (2F code), assemble-to manifold (S5 code), assemble-to seal (S1 code), surface finish certification (Q16 code), remote seal system report (QZ code).
6. Not available with FOUNDATION Fieldbus output code F.
7. Only Available with HART 4–20 mA (output codes A and M).
8. Transmitter is shipped with 316 stainless steel conduit plug (uninstalled) in place of standard carbon steel conduit plug.
9. The V5 option is not needed with the T1 option; external ground screw assembly is included with the T1 option.
10. Available with 4–20 mA HART output code A, FOUNDATION Fieldbus output code F, Rosemount 2051C ranges 2–5 or 2051T ranges 1–4, stainless steel diaphragms and silicone fill fluid. High performance option includes 0.05 percent reference accuracy, five year stability and improved ambient temperature effect specifications. See "Performance specifications" on page 91 for details.
11. The T1 option is not needed with FISCO Product Certifications; transient protection is included in the FISCO product certification codes IA and IE.
12. Only available with HART 4–20 mA output code A.
13. NAMUR-Compliant operation is pre-set at the factory and cannot be changed to standard operation in the field.
14. Not valid with Alternate Process Connection S5.
15. Configures the HART output to HART Revision 5. The device can be field configured to HART Revision 7 Safety Instrumented Systems Requirements.
16. Configures the HART output to HART Revision 7. The device can be field configured to HART Revision 5 Safety Instrumented Systems Requirements.

A.5.3 Rosemount 2051CF Flow Meter Series

This ordering table contains the following Rosemount 2051CF configurations:

Configuration	Transmitter output code
4–20 mA HART Protocol • Rosemount 2051 • Enhanced Rosemount 2051[1]	A
FOUNDATION™ Fieldbus Protocol	F
PROFIBUS PA Protocol	W

1. The enhanced 4–20 mA HART device can be ordered with Transmitter output option code A plus any of the following new option codes: DA0, M4, QT, DZ, CR, CS, CT, HR5, HR7.

See Performance specifications and options for more details on each configuration.

Rosemount 2051CFA Compact Flow Meter

Table A-14. Rosemount 2051CFA Annubar Flow Meter Ordering Information

The starred offerings represent the most common options and should be selected for best delivery. The non-starred offerings are subject to additional delivery lead time.

Rosemount model	Product description	
2051CFA	Rosemount Annubar Flow Meter	
Measurement type		
D	Differential Pressure	★
Fluid type		
L	Liquid	★
G	Gas	★
S	Steam	★
Line size		
020	2-in. (50 mm)	★
025	2 1/2-in. (63,5 mm)	★
030	3-in. (80 mm)	★
035	3 1/2-in. (89 mm)	★
040	4-in. (100 mm)	★
050	5-in. (125 mm)	★
060	6-in. (150 mm)	★
070	7-in. (175 mm)	★
080	8-in. (200 mm)	★
100	10-in. (250 mm)	★
120	12-in. (300 mm)	★
Pipe I.D. range		
C	Range C from the pipe I.D. table	★
D	Range D from the pipe I.D. table	★
A	Range A from the pipe I.D. table	
B	Range B from the pipe I.D. table	
E	Range E from the pipe I.D. table	
Z	Non-standard pipe I.D. range or line sizes greater than 12-in.	

Table A-14. Rosemount 2051CFA Annubar Flow Meter Ordering Information

The starred offerings represent the most common options and should be selected for best delivery. The non-starred offerings are subject to additional delivery lead time.

Pipe material/mounting assembly material		
C	Carbon steel (A105)	★
S	316 stainless steel	★
0[1]	No mounting (customer supplied)	
G	Chrome-moly grade F-11	
N	Chrome-moly grade F-22	
J	Chrome-moly grade F-91	
Piping orientation		
H	Horizontal piping	★
D	Vertical piping with downwards flow	★
U	Vertical piping with upwards flow	★
Rosemount Annubar type		
P	Pak-lok	★
F	Flanged with opposite side support	★
Sensor material		
S	316 stainless steel	★
Sensor size		
1	Sensor size 1 — line sizes 2- to 8-in. (50 to 200 mm)	★
2	Sensor size 2 — line sizes 6- to 96-in. (150 to 2400 mm)	★
3	Sensor size 3 — line sizes greater than 12-in. (300 mm)	★
Mounting type		
T1	Compression or threaded connection	★
A1	Class 150 RF ANSI	★
A3	Class 300 RF ANSI	★
A6	Class 600 RF ANSI	★
D1	DN PN16 flange	★
D3	DN PN40 flange	★
D6	DN PN100 flange	★
R1	Class 150 RTJ flange	
R3	Class 300 RTJ flange	
R6	Class 600 RTJ flange	
Opposite side support or packing gland		
0	No opposite side support or packing gland (required for pak-lok and flange-lok models)	★
	Opposite side support – required for flanged models	
C	NPT threaded opposite support assembly – extended tip	★
D	Welded opposite support assembly – extended tip	★
Isolation valve for flo-tap models		
0[1]	Not applicable or customer supplied	★
Temperature measurement		
T	Integral RTD – not available with flanged model greater than Class 600	★
0	No temperature sensor	★
R	Remote thermowell and RTD	
Transmitter connection platform		
3	Direct-mount, Integral 3-valve manifold– not available with flanged model greater than Class 600	★
5	Direct -mount, 5-valve manifold – not available with flanged model greater than Class 600	★
7	Remote-mount NPT connections (1/2-in. FNPT)	★
8	Remote-mount SW connections (1/2-in.)	

Table A-14. Rosemount 2051CFA Annubar Flow Meter Ordering Information

The starred offerings represent the most common options and should be selected for best delivery. The non-starred offerings are subject to additional delivery lead time.

Differential pressure range			
1	0 to 25 in H_2O (0 to 62,3 mbar)		★
2	0 to 250 in H_2O (0 to 623 mbar)		★
3	0 to 1000 in H_2O (0 to 2,5 bar)		★
Transmitter output			
A[2]	4–20 mA with digital signal based on HART Protocol		★
F	FOUNDATION Fieldbus Protocol		★
W	PROFIBUS PA Protocol		★
M	Low-power, 1–5 Vdc with digital signal based on HART Protocol		
Transmitter housing material		**Conduit entry size**	
A	Aluminum	1/2–14 NPT	★
B	Aluminum	M20 x 1,5	★
J	Stainless steel	1/2–14 NPT	★
K[3]	Stainless steel	M20 x 1,5	★
D	Aluminum	G1/2	
M[3]	Stainless steel	G1/2	
Transmitter performance class			
1	2.0 percent flow rate accuracy, 5:1 flow turndown, 2-year stability		★

Options (Include with selected model number)

Pressure testing[4]		
P1	Hydrostatic testing with certificate	
PX	Extended hydrostatic testing	
Special cleaning		
P2	Cleaning for special services	
PA	Cleaning per ASTM G93 level D (section 11.4)	
Material testing		
V1	Dye penetrant exam	
Material examination		
V2	Radiographic examination	
Special inspection		
QC1	Visual and dimensional inspection with certificate	★
QC7	Inspection and performance certificate	★
Surface finish		
RL	Surface finish for low pipe Reynolds number in gas and steam	★
RH	Surface finish for high pipe Reynolds number in liquid	★
Material Traceability Certification		
Q8[5]	Material Traceability Certification per EN 10474:2004 3.1	★
Code conformance		
J2	ANSI/ASME B31.1	
J3	ANSI/ASME B31.3	
Materials conformance[6]		
J5	NACE MR-0175/ISO 15156	

Table A-14. Rosemount 2051CFA Annubar Flow Meter Ordering Information

The starred offerings represent the most common options and should be selected for best delivery. The non-starred offerings are subject to additional delivery lead time.

Country Certification		
J6	European Pressure Directive (PED)	★
J1	Canadian Registration	
Instrument connections for remote mount options		
G2	Needle valves, stainless steel	★
G6	OS&Y gate valve, stainless steel	★
G1	Needle valves, carbon steel	
G3	Needle valves, alloy C-276	
G5	OS&Y gate valve, carbon steel	
G7	OS&Y gate valve, alloy C-276	
Special shipment		
Y1	Mounting hardware shipped separately	★
Product certifications		
E1[3]	ATEX Flameproof	★
E2	INMETRO Flameproof	★
E3[3]	China Flameproof	★
E4[3]	TIIS Flameproof	★
E5	FM Explosion-proof, Dust Ignition-proof	★
E6	CSA Explosion-proof, Dust Ignition-proof, Division 2	★
E7	IECEx Flameproof, Dust Ignition-proof	★
I1[3]	ATEX Intrinsic Safety	★
I2	INMETRO Intrinsic Safety	★
I3[3]	China Intrinsic Safety	★
I5[3]	FM Intrinsically Safe, Division 2	★
I6	CSA Intrinsically Safe	★
I7[3]	IECEx Intrinsic Safety	★
IA[7]	ATEX FISCO Intrinsic Safety; for FOUNDATION Fieldbus protocol only	★
IE[7]	FM FISCO Intrinsically Safe	★
IF[7]	CSA FISCO Intrinsically Safe	★
IG[7]	IECEx FISCO Intrinsically Safe	★
K1[3]	ATEX Flameproof, Intrinsic Safety, Type n, Dust	★
K2[3]	INMETRO Flameproof and Intrinsic Safety	★
K5	FM Explosion-proof, Dust Ignition-proof, Intrinsically Safe, Division 2 (combination of E5 and I5)	★
K6	CSA Explosion-proof, Dust Ignition-proof, Intrinsically Safe, Division 2 (combination of E6 and I6)	★
K7[3]	IECEx Flameproof, Dust Ignition-proof, Intrinsic Safety, Type n (combination of E7, I7, and N7)	★
KA[3]	ATEX and CSA Flameproof, Intrinsically Safe, Division 2	★
KB	FM and CSA Explosion-proof, Dust Ignition-proof, Intrinsically Safe, Division 2 (combination of E5, E6, I5, and I6)	★
KC[3]	FM and ATEX Explosion-proof, Intrinsically Safe, Division 2	★
KD[3]	FM, CSA, and ATEX Explosion-proof, Intrinsically Safe (combination of E5, I5, E6, I6, E1, and I1)	★
N1[3]	ATEX Type n	★
N7[3]	IECEx Type n	★
ND[3]	ATEX Dust	★
Sensor fill fluid and O-ring options		
L1	Inert sensor fill fluid	★
L2	Graphite-filled (PTFE) O-ring	★
LA	Inert sensor fill fluid and graphite-filled (PTFE) O-ring	★
Display and interface options		
M4[8]	LCD display with LOI	★
M5	LCD display	★

Table A-14. Rosemount 2051CFA Annubar Flow Meter Ordering Information

The starred offerings represent the most common options and should be selected for best delivery. The non-starred offerings are subject to additional delivery lead time.

Transmitter Calibration Certification		
Q4	Calibration Certificate for Transmitter	★
Quality Certification for Safety[9]		
QS	Prior-use certificate of FMEDA data	★
QT	Safety Certified to IEC 61508 with certificate of FMEDA	★
Transient protection[10]		
T1	Transient terminal block	★
Manifold for remote mount option		
F6	5-valve manifold, stainless steel	★
F1	3-valve manifold, carbon steel	
F5	5-valve manifold, carbon steel	
PlantWeb control functionality		
A01[7]	FOUNDATION Fieldbus advanced control function block suite	★
Hardware adjustments[11]		
D4	Zero and span hardware adjustments	★
DZ	Digital zero trim	★
Alarm limit[11]		
C4[12]	NAMUR alarm and saturation levels, high alarm	★
CN[12]	NAMUR alarm and saturation levels, low alarm	★
CR	Custom alarm and saturation signal levels, high alarm (requires C1 and Rosemount 2051 Configuration Data Sheet)	★
CS	Custom alarm and saturation signal levels, low alarm (requires C1 and Rosemount 2051 Configuration Data Sheet)	★
CT	Low alarm (standard Rosemount alarm and saturation levels)	★
Ground screw[13]		
V5	External ground screw assembly	★
HART revision configuration[11]		
HR5[14]	Configured for HART Revision 5	★
HR7[15]	Configured for HART Revision 7	★
Typical model number: 2051CFA D L 060 D C H P S 2 T1 0 0 0 3 2A A 1A 3		

1. Provide the "A" dimension for flanged and pak-lok.
2. HART Revision 5 is the default HART output. The Rosemount 2051 with Selectable HART can be factory or field configured to HART Revision 7. To order HART Revision 7 factory configured, add option code HR7.
3. Not available with low power output code M.
4. Applies to assembled flow meter only, mounting not tested.
5. Instrument connections for remote mount options and isolation valves for flo-tap models are not included in the Material Traceability Certification.
6. Materials of construction comply with metallurgical requirements within NACE MR0175/ISO 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.
7. Only valid with FOUNDATION Fieldbus output code F.
8. Not available with FOUNDATION Fieldbus (output code F).
9. Only available with 4–20 mA HART (output code A).
10. Not available with housing code 00, 5A or 7J. The T1 option is not needed with FISCO Product Certifications, transient protection is included with the FISCO Product Certification code IA.
11. Only available with 4–20 mA HART (output codes A and M).
12. NAMUR-Compliant operation is pre-set at the factory and cannot be changed to standard operation in the field.
13. The V5 option is not needed with the T1 option; external ground screw assembly is included with the T1 option.
14. Configures the HART output to HART Revision 5. The device can be field configured to HART Revision 7 Safety Instrumented Systems Requirements.
15. Configures the HART output to HART Revision 7. The device can be field configured to HART Revision 5 Safety Instrumented Systems Requirements.

Rosemount 2051CFC Compact Flow Meter

Additional information

Specifications: page 91
Certifications: page 149
Dimensional drawings: page 102

Table A-15. Rosemount 2051CFC Compact Flow Meter Ordering Information

The starred offerings represent the most common options and should be selected for best delivery. The non-starred offerings are subject to additional delivery lead time.

Rosemount model	Product description	
2051CFC	Compact flow meter	
Measurement type		
D	Differential Pressure	★
Primary Element technology		
C	Conditioning orifice plate	★
P	Orifice plate	★
Material type		
S	316 stainless steel	★
Line size		
005(1)	1/2-in. (15 mm)	★
010(1)	1-in. (25 mm)	★
015(1)	1 1/2-in. (40 mm)	★
020	2-in. (50 mm)	★
030	3-in. (80 mm)	★
040	4-in. (100 mm)	★
060	6-in. (150 mm)	★
080	8-in. (200 mm)	★
100	10-in. (250 mm)	★
120	12-in. (300 mm)	★
Primary element style		
N	Square edged	★
Primary element type		
040	0.40 beta ratio	★
065(2)	0.65 beta ratio	★
Temperature measurement		
0	No temperature sensor	★
R	Remote thermowell and RTD	
Transmitter connection platform		
3	Direct-mount, Integral 3-valve manifold	★
7	Remote-mount, 1/4-in. NPT connections	★
Differential pressure range		
1	0 to 25 in H_2O (0 to 62,3 mbar)	★
2	0 to 250 in H_2O (0 to 623 mbar)	★
3	0 to 1000 in H_2O (0 to 2,5 bar)	★

Table A-15. Rosemount 2051CFC Compact Flow Meter Ordering Information

The starred offerings represent the most common options and should be selected for best delivery. The non-starred offerings are subject to additional delivery lead time.

Transmitter output			
A[3]	4–20 mA with digital signal based on HART Protocol		★
F	FOUNDATION Fieldbus Protocol		★
W	PROFIBUS PA Protocol		★
M	Low-power, 1–5 Vdc with digital signal based on HART Protocol		
Transmitter housing material		**Conduit entry size**	
A	Aluminum	1/2–14 NPT	★
B	Aluminum	M20 x 1,5	★
J	Stainless steel	1/2-14 NPT	★
K[4]	Stainless steel	M20 x 1,5	★
D	Aluminum	G1/2	
M[4]	Stainless steel	G1/2	
Transmitter performance Class			
1	up to ±2.25% flow rate accuracy, 5:1 flow turndown, 2-year stability		★

Options (Include with selected model number)

Installation accessories		
AB	ANSI alignment ring (Class 150) (only required for 10- and 12-in. (250 and 300 mm) line sizes)	★
AC	ANSI alignment ring (Class 300) (only required for 10- and 12-in. (250 and 300 mm) line sizes)	★
AD	ANSI alignment ring (Class 600) (only required for 10- and 12-in. (250 and 300 mm) line sizes)	★
DG	DIN alignment ring (PN16)	★
DH	DIN alignment ring (PN40)	★
DJ	DIN alignment ring (PN100)	★
JB	JIS alignment ring (10K)	
JR	JIS alignment ring (20K)	
JS	JIS alignment ring (40K)	
Remote adapters		
FE	Flange adapters 316 stainless steel (1/2-in. NPT)	★
High temperature application		
HT	Graphite valve packing (T_{max} = 850 °F)	
Flow [5]		
WC	Flow calibration certification (3 point)	
WD	Discharge coefficient verification (full 10 point)	
Pressure testing		
P1	Hydrostatic Testing with Certificate	
Special cleaning		
P2	Cleaning for special services	
PA	Cleaning per ASTM G93 level D (section 11.4)	
Special inspection		
QC1	Visual and Dimensional Inspection with Certificate	★
QC7	Inspection and Performance Certificate	★
Transmitter Calibration Certification		
Q4	Calibration Certificate for Transmitter	★
Quality Certification for Safety[6]		
QS	Prior-use certificate of FMEDA data	★
QT	Safety Certified to IEC 61508 with certificate of FMEDA	★

Table A-15. Rosemount 2051CFC Compact Flow Meter Ordering Information

The starred offerings represent the most common options and should be selected for best delivery. The non-starred offerings are subject to additional delivery lead time.

Material Traceability Certification		
Q8	Material Traceability Certification per EN 10204:2004 3.1	★
Code conformance		
J2	ANSI/ASME B31.1	
J3	ANSI/ASME B31.3	
J4	ANSI/ASME B31.8	
Materials conformance[7]		
J5	NACE MR-0175/ISO 15156	
Country Certification		
J1	Canadian Registration	
Product Certifications		
E1[3]	ATEX Flameproof	★
E2	INMETRO Flameproof	★
E3[3]	China Flameproof	★
E4[3]	TIIS Flameproof	★
E5	FM Explosion-proof, Dust Ignition-proof	★
E6	CSA Explosion-proof, Dust Ignition-proof, Division 2	★
E7	IECEx Flameproof, Dust Ignition-proof	★
I1[3]	ATEX Intrinsic Safety	★
I2	INMETRO Intrinsic Safety	★
I3[4]	China Intrinsic Safety	★
I5[4]	FM Intrinsically Safe, Division 2	★
I6	CSA Intrinsically Safe	★
I7[4]	IECEx Intrinsic Safety	★
IA[8]	ATEX FISCO Intrinsic Safety; for FOUNDATION Fieldbus protocol only	★
IE[7]	FM FISCO Intrinsically Safe	★
IF[7]	CSA FISCO Intrinsically Safe	★
IG[7]	IECEx FISCO Intrinsically Safe	★
K1[4]	ATEX Flameproof, Intrinsic Safety, Type n, Dust	★
K2[4]	INMETRO Flameproof and Intrinsic Safety	★
K5	FM Explosion-proof, Dust Ignition-proof, Intrinsically Safe, Division 2 (combination of E5 and I5)	★
K6	CSA Explosion-proof, Dust Ignition-proof, Intrinsically Safe, Division 2 (combination of E6 and I6)	★
K7[4]	IECEx Flameproof, Dust Ignition-proof, Intrinsic Safety, Type n (combination of E7, I7, and N7)	★
KA[4]	ATEX and CSA Flameproof, Intrinsically Safe, Division 2	★
KB	FM and CSA Explosion-proof, Dust Ignition-proof, Intrinsically Safe, Division 2 (combination of E5, E6, I5, and I6)	★
KC[4]	FM and ATEX Explosion-proof, Intrinsically Safe, Division 2	★
KD[4]	FM, CSA, and ATEX Explosion-proof, Intrinsically Safe (combination of E5, I5, E6, I6, E1, and I1)	★
N1[4]	ATEX Type n	★
N7[4]	IECEx Type n	★
ND[4]	ATEX Dust	★
Sensor fill fluid and O-ring options		
L1	Inert sensor fill fluid	★
L2	Graphite-filled (PTFE) O-ring	★
LA	Inert sensor fill fluid and graphite-filled (PTFE) O-ring	★
Display and interface options		
M4[6]	LCD display with LOI	★
M5	LCD display	★
Transient protection		
T1[9]	Transient terminal block	★

Table A-15. Rosemount 2051CFC Compact Flow Meter Ordering Information

The starred offerings represent the most common options and should be selected for best delivery. The non-starred offerings are subject to additional delivery lead time.

Manifold for remote mount option		
F2	3-valve manifold, stainless steel	★
F6	5-valve manifold, stainless steel	★
Alarm limit[10]		
C4[11]	NAMUR alarm and saturation levels, high alarm	★
CN[11]	NAMUR alarm and saturation levels, low alarm	★
CR	Custom alarm and saturation signal levels, high alarm (requires C1 and Rosemount 2051 Configuration Data Sheet)	★
CS	Custom alarm and saturation signal levels, low alarm (requires C1 and Rosemount 2051 Configuration Data Sheet)	★
CT	Low alarm (standard Rosemount alarm and saturation levels)	★
PlantWeb control functionality[8]		
A01	FOUNDATION Fieldbus advanced control function block suite	★
Hardware adjustments[10]		
D4	Zero and span hardware adjustments	★
DZ	Digital zero trim	★
Ground screw[12]		
V5	External ground screw assembly	★
HART Revision configuration[10]		
HR5[13]	Configured for HART Revision 5	★
HR7[14]	Configured for HART Revision 7	★
Typical Model Number: 2051CFC D C S 060 N 065 0 3 2 A A 1 WC E5 M5		

1. Not available for Primary Element technology C.
2. For 2-in. (50 mm) line sizes the Primary Element type is 0.6 for Primary Element technology code C.
3. HART Revision 5 is the default HART output. The Rosemount 2051 with Selectable HART can be factory or field configured to HART Revision 7. To order HART Revision 7 factory configured, add option code HR7.
4. Not available with low power output code M.
5. Not available with Primary Element technology P.
6. Only available wit 4–20 mA HART (output code A).
7. Materials of Construction comply with metallurgical requirements within NACE MR0175/ISO 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.
8. Only valid with FOUNDATION Fieldbus output code F.
9. Not available with Housing code 00, 5A or 7J. The T1 option is not needed with FISCO Product Certifications, transient protection is included with the FISCO Product Certification code IA.
10. Only available with 4–20 mA HART (output codes A and M).
11. NAMUR-Compliant operation is pre-set at the factory and cannot be changed to standard operation in the field.
12. The V5 option is not needed with the T1 option; external ground screw assembly is included with the T1 option.
13. Configures the HART output to HART Revision 5. The device can be field configured to HART Revision 7 Safety Instrumented Systems Requirements.
14. Configures the HART output to HART Revision 7. The device can be field configured to HART Revision 5 if 14 needed.

Rosemount 2051CFP Integral Orifice Flow Meter

Additional information

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Certifications: page 149
Dimensional drawings: page 102

Table A-16. Rosemount 2051CFP Integral Orifice Flow Meter Ordering Information

The starred offerings represent the most common options and should be selected for best delivery. The non-starred offerings are subject to additional delivery lead time.

Rosemount model	Product description	
2051CFP	Integral orifice flow meter	
Measurement type		
D	Differential Pressure	★
Material type		
S	316 stainless steel	★
Line size		
005	1/2-in. (15 mm)	★
010	1-in. (25 mm)	★
015	1 1/2-in. (40 mm)	★
Process connection		
T1	NPT female body (not available with remote thermowell and RTD)	★
S1(1)	Socket weld body (not available with remote thermowell and RTD)	★
P1	Pipe ends: NPT threaded	★
P2	Pipe ends: beveled	★
D1	Pipe ends: flanged, DIN PN16, slip-on	★
D2	Pipe ends: flanged, DIN PN40, slip-on	★
D3	Pipe ends: flanged, DIN PN100, slip-on	★
W1	Pipe ends: flanged, RF, ANSI Class 150, weld-neck	★
W3	Pipe ends: flanged, RF, ANSI Class 300, weld-neck	★
W6	Pipe ends: Flanged, RF, ANSI Class 600, weld-neck	★
A1	Pipe ends: flanged, RF, ANSI Class 150, slip-on	
A3	Pipe ends: flanged, RF, ANSI Class 300, slip-on	
A6	Pipe ends: flanged, RF, ANSI Class 600, slip-on	
R1	Pipe ends: flanged, RTJ, ANSI Class 150, slip-on	
R3	Pipe ends: flanged, RTJ, ANSI Class 300, slip-on	
R6	Pipe ends: flanged, RTJ, ANSI Class 600, slip-on	
Orifice plate material		
S	316 stainless steel	★
Bore size option		
0066	0.066-in. (1,68 mm) for 1/2-in. pipe	★
0109	0.109-in. (2,77 mm) for 1/2-in. pipe	★
0160	0.160-in. (4,06 mm) for 1/2-in. pipe	★
0196	0.196-in. (4,98 mm) for 1/2-in. pipe	★
0260	0.260-in. (6,60 mm) for 1/2-in. pipe	★
0340	0.340-in. (8,64 mm) for 1/2-in. pipe	★
0150	0.150-in. (3,81 mm) for 1-in. pipe	★
0250	0.250-in. (6,35 mm) for 1-in. pipe	★
0345	0.345-in. (8,76 mm) for 1-in. pipe	★

Table A-16. Rosemont 2051CFP Integral Orifice Flow Meter Ordering Information

The starred offerings represent the most common options and should be selected for best delivery. The non-starred offerings are subject to additional delivery lead time.

0500	0.500-in. (12,70 mm) for 1-in. pipe	★
0630	0.630-in. (16,00 mm) for 1-in. pipe	★
0800	0.800-in. (20,32 mm) for 1-in. pipe	★
0295	0.295-in. (7,49 mm) for 1 1/2-in. pipe	★
0376	0.376-in. (9,55 mm) for 1 1/2-in. pipe	★
0512	0.512-in. (13,00 mm) for 1 1/2-in. pipe	★
0748	0.748-in. (19,00 mm) for 1 1/2-in. pipe	★
1022	1.022-in. (25,96 mm) for 1 1/2-in. pipe	★
1184	1.184-in. (30,07 mm) for 1 1/2-in. pipe	★
0010	0.010-in. (0,25 mm) for 1/2-in. pipe	
0014	0.014-in. (0,36 mm) for 1/2-in. pipe	
0020	0.020-in. (0,51 mm) for 1/2-in. pipe	
0034	0.034-in. (0,86 mm) for 1/2-in. pipe	
Transmitter connection platform		
D3	Direct-mount, 3-valve manifold, stainless steel	★
D5	Direct-mount, 5-valve manifold, stainless steel	★
R3	Remote-mount, 3-valve manifold, stainless steel	★
R5	Remote-mount, 5-valve manifold, stainless steel	★
Differential pressure ranges		
1	0 to 25 in H_2O (0 to 62,3 mbar)	★
2	0 to 250 in H_2O (0 to 623 mbar)	★
3	0 to 1000 in H_2O (0 to 2,5 bar)	★
Transmitter output		
A[2]	4–20 mA with digital signal based on HART Protocol	★
F	FOUNDATION Fieldbus Protocol	★
W	PROFIBUS PA Protocol	★
M	Low-power, 1–5 Vdc with digital signal based on HART Protocol	
Transmitter housing material	**Conduit entry size**	
A	Aluminum	1/2–14 NPT ★
B	Aluminum	M20 x 1,5 ★
J	Stainless steel	1/2–14 NPT ★
K[3]	Stainless steel	M20 x 1,5 ★
D	Aluminum	G1/2
M[3]	Stainless steel	G1/2
Transmitter performance Class		
1	up to ±2.25% flow rate accuracy, 5:1 flow turndown, 2-year stability	★

Options (Include with selected model number)

Temperature sensor[4]		
RT	Thermowell and RTD	
Optional connection		
G1	DIN 19213 transmitter connection	★
Pressure testing[5]		
P1	Hydrostatic Testing with Certificate	
Special cleaning		
P2	Cleaning for special services	
PA	Cleaning per ASTM G93 level D (section 11.4)	

Table A-16. Rosemount 2051CFP Integral Orifice Flow Meter Ordering Information

The starred offerings represent the most common options and should be selected for best delivery. The non-starred offerings are subject to additional delivery lead time.

Material testing		
V1	Dye penetrant exam	
Material examination		
V2	Radiographic examination	
Flow calibration[6]		
WD	Discharge coefficient verification	
Special inspection		
QC1	Visual and Dimensional Inspection with Certificate	★
QC7	Inspection and Performance Certificate	★
Material Traceability Certification		
Q8	Material Traceability Certification per EN 10204:2004 3.1	★
Code conformance[7]		
J2	ANSI/ASME B31.1	
J3	ANSI/ASME B31.3	
J4	ANSI/ASME B31.8	
Materials conformance[8]		
J5	NACE MR-0175 / ISO 15156	
Country Certification		
J6	European Pressure Directive (PED)	★
J1	Canadian Registration	
Transmitter Calibration Certification		
Q4	Calibration Certificate for Transmitter	★
Quality Certification for Safety[9]		
QS	Prior-use certificate of FMEDA data	★
QT	Safety Certified to IEC 61508 with certificate of FMEDA	★
Product Certifications		
E1[3]	ATEX Flameproof	★
E2	INMETRO Flameproof	★
E3[3]	China Flameproof	★
E4[3]	TIIS Flameproof	★
E5	FM Explosion-proof, Dust Ignition-proof	★
E6	CSA Explosion-proof, Dust Ignition-proof, Division 2	★
E7	IECEx Flameproof, Dust Ignition-proof	★
I1[3]	ATEX Intrinsic Safety	★
I2	INMETRO Intrinsic Safety	★
I3[3]	China Intrinsic Safety	★
I5[3]	FM Intrinsically Safe, Division 2	★
I6	CSA Intrinsically Safe	★
I7[3]	IECEx Intrinsic Safety	★
IA[10]	ATEX FISCO Intrinsic Safety; for FOUNDATION Fieldbus Protocol only	★
IE[7]	FM FISCO Intrinsically Safe	★
IF[7]	CSA FISCO Intrinsically Safe	★
IG[7]	IECEx FISCO Intrinsically Safe	★
K1[3]	ATEX Flameproof, Intrinsic Safety, Type n, Dust	★
K2[3]	INMETRO Flameproof and Intrinsic Safety	★
K5	FM Explosion-proof, Dust Ignition-proof, Intrinsically Safe, Division 2 (combination of E5 and I5)	★

Table A-16. Rosemount 2051CFP Integral Orifice Flow Meter Ordering Information

The starred offerings represent the most common options and should be selected for best delivery. The non-starred offerings are subject to additional delivery lead time.

K6	CSA Explosion-proof, Dust Ignition-proof, Intrinsically Safe, Division 2 (combination of E6 and I6)	★
K7[3]	IECEx Flameproof, Dust Ignition-proof, Intrinsic Safety, Type n (combination of E7, I7, and N7)	★
KA[3]	ATEX and CSA Flameproof, Intrinsically Safe, Division 2	★
KB	FM and CSA Explosion-proof, Dust Ignition-proof, Intrinsically Safe, Division 2 (combination of E5, E6, I5, and I6)	★
KC[3]	FM and ATEX Explosion-proof, Intrinsically Safe, Division 2	★
KD[3]	FM, CSA, and ATEX Explosion-proof, Intrinsically Safe (combination of E5, I5, E6, I6, E1, and I1)	★
N1[3]	ATEX Type n	★
N7[3]	IECEx Type n	★
ND[3]	ATEX Dust	★
Sensor fill fluid and O-ring options		
L1	Inert sensor fill fluid	★
L2	Graphite-filled (PTFE) O-ring	★
LA	Inert sensor fill fluid and graphite-filled (PTFE) O-ring	★
Display and interface options		
M4[9]	LCD display with LOI	★
M5	LCD display	★
Transient protection[11]		
T1	Transient terminal block	★
Alarm limit[12][13]		
C4[14]	NAMUR alarm and saturation levels, high alarm	★
CN[14]	NAMUR alarm and saturation levels, low alarm	★
CR	Custom alarm and saturation signal levels, high alarm (requires C1 and Rosemount 2051 Configuration Data Sheet)	★
CS	Custom alarm and saturation signal levels, low alarm (requires C1 and Rosemount 2051 Configuration Data Sheet)	★
CT	Low alarm (standard Rosemount alarm and saturation levels)	★
PlantWeb control functionality[10]		
A01	FOUNDATION Fieldbus Advanced Control Function Block Suite	★
Hardware adjustments[12]		
D4	Zero and span hardware adjustments	★
DZ	Digital zero trim	★
Ground screw[15]		
V5	External ground screw assembly	★
HART revision configuration[12]		
HR5[16]	Configured for HART Revision 5	★
HR7[17]	Configured for HART Revision 7	★
Typical Model Number: 2051CFP D S 010 W1 S 0500 D3 2 A A 1 E5 M5		

1. To improve pipe perpendicularity for gasket sealing, socket diameter is smaller than standard pipe O.D.
2. HART Revision 5 is the default HART output. The Rosemount 2051 with Selectable HART can be factory or field configured to HART Revision 7. To order HART Revision 7 factory configured, add option code HR7.
3. Not available with low power Output Code M.
4. Thermowell material is the same as the body material.
5. Does not apply to process connection codes T1 and S1.
6. Not available for bore sizes 0010, 0014, 0020, or 0034.
7. Not available with DIN Process Connection codes D1, D2, or D3.
8. Materials of Construction comply with metallurgical requirements within NACE MR0175/ISO 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.
9. Only available with 4–20 mA HART (Output Code A).
10. Only valid with FOUNDATION Fieldbus Output Code F.
11. Not available with Housing code 00, 5A or 7J. The T1 option is not needed with FISCO Product Certifications, transient protection is included with the FISCO Product Certification code IA.
12. Only available with 4–20 mA HART (output codes A and M).
13. Only available with 4–20 mA HART (output codes A and M).
14. NAMUR-Compliant operation is pre-set at the factory and cannot be changed to standard operation in the field.
15. The V5 option is not needed with the T1 option; external ground screw assembly is included with the T1 option.
16. Configures the HART output to HART Revision 5. The device can be field configured to HART Revision 7 Safety Instrumented Systems Requirements.
17. Configures the HART output to HART Revision 7. The device can be field configured to HART Revision 5 Safety Instrumented Systems Requirements.

A.5.4 Rosemount 2051L Level Transmitter

This ordering table contains the following Rosemount 2051L configurations:

Configuration	Transmitter output code
4–20 mA HART Protocol • Rosemount 2051 • Enhanced Rosemount 2051[1]	A
FOUNDATION Fieldbus Protocol	F
PROFIBUS PA Protocol	W

1. The enhanced 4–20 mA HART device can be ordered with transmitter output option code A plus any of the following new option codes: DA0, M4, QT, DZ, CR, CS, CT, HR5, HR7.

See Performance specifications and Options for more details on each configuration.

Additional information

Specifications: page 91
Certifications: page 149
Dimensional Drawings: page 102

Table A-17. Rosemount 2051L Liquid Level Transmitter Ordering Information

The starred offerings represent the most common options and should be selected for best delivery. The non-starred offerings are subject to additional delivery lead time.

Rosemount model	Transmitter type		
2051L	Liquid level transmitter		★
Pressure range			
2	–250 to 250 inH_2O (–0,6 to 0,6 bar)		★
3	–1000 to 1000 inH_2O (–2,5 to 2,5 bar)		★
4	–300 to 300 psi (–20,7 to 20,7 bar)		★
Transmitter output			
A[1]	4–20 mA with digital signal Based on HART Protocol		★
F	FOUNDATION Fieldbus Protocol		★
W	PROFIBUS PA Protocol		★
M	Low-power, 1–5 V dc with digital signal based on HART Protocol		
Process connection size, diaphragm material (high side)			
	Process connection size	**Diaphragm**	
G[2]	2-in./DN 50	316L stainless steel	★
H[2]	2-in./DN 50	Alloy C-276	★
J	2-in./DN 50	Tantalum	★
A[2]	3-in./DN 80	316L stainless steel	★
B[2]	4-in./DN 100	316L stainless steel	★
C[2]	3-in./DN 80	Alloy C-276	★
D[2]	4-in./DN 100	Alloy C-276	★
E	3-in./DN 80	Tantalum	★
F	4-in./DN 100	Tantalum	★

Table A-17. Rosemount 2051L Liquid Level Transmitter Ordering Information

The starred offerings represent the most common options and should be selected for best delivery. The non-starred offerings are subject to additional delivery lead time.

Extension length (high side)				
0	None, flush mount			★
2	2-in./50 mm			★
4	4-in./100 mm			★
6	6-in./150 mm			★
Mounting flange size, rating, material (high side)				
	Size	**Rating**	**Material**	
M	2-in.	ANSI/ASME B16.5 Class 150	Carbon steel	★
A	3-in.	ANSI/ASME B16.5 Class 150	Carbon steel	★
B	4-in.	ANSI/ASME B16.5 Class 150	Carbon steel	★
N	2-in.	ANSI/ASME B16.5 Class 300	Carbon steel	★
C	3-in.	ANSI/ASME B16.5 Class 300	Carbon steel	★
D	4-in.	ANSI/ASME B16.5 Class 300	Carbon steel	★
X[2]	2-in.	ANSI/ASME B16.5 Class 150	Stainless steel	★
F[2]	3-in.	ANSI/ASME B16.5 Class 150	Stainless steel	★
G[2]	4-in.	ANSI/ASME B16.5 Class 150	Stainless steel	★
Y[2]	Displayed	ANSI/ASME B16.5 Class 300	Stainless steel	★
H[2]	3-in.	ANSI/ASME B16.5 Class 300	Stainless steel	★
J[2]	4-in.	ANSI/ASME B16.5 Class 300	Stainless steel	★
Q	DN50	PN 10–40 per EN 1092-1	Carbon steel	★
R	DN80	PN 40 per EN 1092-1	Carbon steel	★
K[2]	DN50	PN 10-40 per EN 1092-1	Stainless steel	★
T[2]	DN80	PN 40 per EN 1092-1	Stainless steel	★

Seal fill fluid (high side)		**Specific gravity**	**Temperature limits (ambient temperature of 70 °F [21 °C])**	
A	Syltherm XLT	0.85	–102 to 293 °F (–75 to 145 °C)	★
C	Silicone 704	1.07	32 to 401 °F (0 to 205 °C)	★
D	Silicone 200	0.93	–49 to 401 °F (–45 to 205 °C)	★
H	Inert (halocarbon)	1.85	5 to 401 °F (–15 to 205 °C)	★
G	Glycerin and water	1.13	–49 to 320 °F (–45 to 160 °C)	★
N	Neobee M-20	0.92	5 to 401 °F (–15 to 205 °C)	★
P	Propylene glycol and water	1.02	5 to 203 °F (–15 to 95 °C)	★

Sensor module configuration, flange adapter (low side)[2]				
	Configuration	**Flange adapter**		
1	Gage	Stainless steel		★
2	Differential	Stainless steel		★
3[3]	Tuned-system with remote seal	None		★
Sensor module diaphragm material, sensor fill fluid (low side)[2]				
	Diaphragm material	**Sensor fill fluid**		
1	316L stainless steel	Silicone		★
2	Alloy C-276 (stainless steel valve seat)	Silicone		★
7	Alloy C-276 (alloy C-276 valve seat)	Silicone		★

Table A-17. Rosemount 2051L Liquid Level Transmitter Ordering Information

The starred offerings represent the most common options and should be selected for best delivery. The non-starred offerings are subject to additional delivery lead time.

A	316L stainless steel	Inert (halocarbon)		★
B	Alloy C-276 (stainless steel valve seat)	Inert (halocarbon)		★
G	Alloy C-276 (Alloy C-276 valve seat)	Inert (halocarbon)		★
O-ring				
A	Glass-filled PTFE			★
Housing material			**Conduit entry size**	
A	Aluminum		1/2–14 NPT	★
B	Aluminum		M20 x 1,5	★
J	Stainless steel		1/2–14 NPT	★
K[4]	Stainless steel		M20 x 1,5	★
D	Aluminum		G1/2	
M[4]	Stainless steel		G1/2	

Options (Include with selected model number)

PlantWeb control functionality[5]		
A01	FOUNDATION Fieldbus advanced control function block suite	★
Seal assemblies[6]		
S1	Assemble to one Rosemount 1199 Seal (requires Rosemount 1199M)	★
Product Certifications		
E1[4]	ATEX Flameproof	★
E2[4]	INMETRO Flameproof	★
E3[4]	China Flameproof	★
E4[4]	TIIS Flameproof	★
E5	FM Explosion-proof, Dust Ignition-proof	★
E6	CSA Explosion-proof, Dust Ignition-proof, Division 2	★
E7[4]	IECEx Flameproof	★
EW	India (CCOE) Flameproof Approval	★
I1[4]	ATEX Intrinsic Safety	★
I2[4]	INMETRO Intrinsically Safe	★
I3[4]	China Intrinsic Safety	★
I5	FM Intrinsically Safe, Division 2	★
I6	CSA Intrinsically Safe	★
I7[4]	IECEx Intrinsic Safety	★
IA[5]	ATEX FISCO Intrinsic Safety	★
IE[5]	FM FISCO Intrinsically Safe	★
IF[5]	CSA FISCO Intrinsically Safe	★
IG[5]	IECEx FISCO Intrinsically Safe	★
IW	India (CCOE) Intrinsically Safety Approval	★
K1[4]	ATEX Flameproof, Intrinsic Safety, Type n, Dust	★
K2	INMETRO Flameproof and Intrinsic Safety	★
K5	FM Explosion-proof, Dust Ignition-proof, Intrinsically Safe, Division 2	★
K6	CSA Explosion-proof, Dust Ignition-proof, Intrinsically Safe, Division 2	★
K7[4]	IECEx Flameproof, Intrinsic Safety, Type n and Dust	★

Table A-17. Rosemount 2051L Liquid Level Transmitter Ordering Information

The starred offerings represent the most common options and should be selected for best delivery. The non-starred offerings are subject to additional delivery lead time.

KA[4]	ATEX and CSA Flameproof, Intrinsically Safe, Division 2	★
KB	FM and CSA Explosion-proof, Dust Ignition-proof, Intrinsically Safe, Division 2	★
KC[4]	FM and ATEX Explosion-proof, Intrinsically Safe, Division 2	★
KD[4]	FM, CSA, and ATEX Explosion-proof, Intrinsically Safe	★
N1[4]	ATEX Type n	★
N7[4]	IECEx Type n	★
ND[4]	ATEX Dust	★
Shipboard Approvals		
SBS	American Bureau of Shipping (ABS) Type Approval	★
SBV	Bureau Veritas (BV) Type Approval	★
SDN	Det Norske Veritas (DNV) Type Approval	★
SLL	Lloyds Register (LR) Type Approval	★
Display and interface options		
M4[7]	LCD display with LOI	★
M5	LCD display	★
Hardware adjustments[8]		
D4	Zero and span configuration buttons	★
DZ	Digital zero trim	★
Flange adapters[9]		
DF	1/2–14 NPT flange adapters	★
Conduit plug[10]		
DO	316 stainless steel conduit plug	★
Ground screw[11]		
V5	External ground screw assembly	★
Transient protection[12]		
T1	Transient terminal block	★
Software configuration[13]		
C1	Custom software configuration (completed Rosemount 2051 Configuration Data Sheet required with order)	★
Alarm limit		
C4[8][14]	NAMUR alarm and saturation levels, high alarm	★
CN[8][14]	NAMUR alarm and saturation levels, low alarm	★
CR[8]	Custom alarm and saturation signal levels, high alarm (requires C1 and Rosemount 2051 Configuration Data Sheet)	★
CS[8]	Custom alarm and saturation signal levels, low alarm (requires C1 and Rosemount 2051 Configuration Data Sheet)	★
CT[8]	Low alarm (standard Rosemount alarm and saturation levels)	★
Calibration Certification		
Q4	Calibration Certificate	★
QG	Calibration Certificate and GOST Verification Certificate	★
GP	Calibration Certificate and tamper evident seal	★
Material Traceability Certification		
Q8	Material Traceability Certification per EN 10204 3.1.B	★

Table A-17. Rosemount 2051L Liquid Level Transmitter Ordering Information

The starred offerings represent the most common options and should be selected for best delivery. The non-starred offerings are subject to additional delivery lead time.

Quality Certification for Safety[13]				
QS	Prior-use certificate of FMEDA data			★
QT	Safety Certified to IEC 61508 with certificate of FMEDA			★
Toolkit total system performance reports				
QZ	Remote seal system performance calculation report			★
Conduit electrical connector				
GE	M12, 4-pin, male connector (eurofast)			★
GM	A size Mini, 4-pin, male connector (minifast)			★
Lower housing flushing connection options				
	Ring material	**Number**	**Size (NPT)**	
F1	316 stainless steel	1	1/4–18 NPT	★
F2	316 stainless steel	2	1/4–18 NPT	★
F3[15]	Alloy C-276	1	1/4–18 NPT	★
F4[15]	Alloy C-276	2	1/4–18 NPT	★
F7	316 stainless steel	1	1/2–14 NPT	★
F8	316 stainless steel	2	1/2–14 NPT	★
F9	Alloy C-276	1	1/2–14 NPT	★
F0	Alloy C-276	2	1/2–14 NPT	★
HART Revision configuration[8]				
HR5[16]	Configured for HART Revision 5			★
HR7[17]	Configured for HART Revision 7			★
Typical Model Number:	**2051L 2 A A0 X D 21 A A B4 M5 F1**			

1. HART Revision 5 is the default HART output. The Rosemount 2051 with Selectable HART can be factory or field configured to HART Revision 7. To order HART Revision 7 factory configured, add option code HR7.
2. Materials of Construction comply with metallurgical requirements highlighted within 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.
3. Requires option code S1.
4. Not available with low power output code M.
5. Only valid with FOUNDATION Fieldbus output code F.
6. "Assemble-to" items are specified separately and require a completed model number.
7. Not valid with FOUNDATION Fieldbus output code F.
8. Only available with 4–20 mA HART (output codes A and M).
9. Not available with remote mount seal assembly option S1.
10. Transmitter is shipped with 316 stainless steel conduit plug (uninstalled) in place of standard carbon steel conduit plug.
11. The V5 option is not needed with the T1 option; external ground screw assembly is included with the T1 option.
12. The T1 option is not needed with FISCO Product Certifications; transient protection is included in the FISCO product certification codes IA, IE, IF, and IG.
13. Only available with HART 4–20 mA (output code A).
14. NAMUR-Compliant operation is pre-set at the factory.
15. Not available with option codes A0, B0, and G0.
16. Configures the HART output to HART Revision 5. The device can be field configured to HART Revision 7 Safety Instrumented Systems Requirements.
17. Configures the HART output to HART Revision 7. The device can be field configured to HART Revision 5 Safety Instrumented Systems Requirements.

A.6 Options

Standard configuration

Unless otherwise specified, transmitter is shipped as follows:

Engineering units differential/gage: **Absolute/Rosemount 2051TA:**	 inH_2O (Range 0, 1, 2, and 3) psi (range 4 and 5) psi (all ranges)
4 mA:	0 (engineering units above)
20 mA:	Upper range limit
Output:	Linear
Flange type:	Specified model code option
Flange material:	Specified model code option
O-ring material:	Specified model code option
Drain/vent:	Specified model code option
LCD display:	Installed or none
Alarm:	High
Software tag:	(Blank)

Custom configuration

If option code C1 is ordered, the customer may specify the following data in addition to the standard configuration parameters.

- Output Information
- Transmitter Information
- LCD display configuration
- Hardware selectable information
- Signal selection

Refer to the Rosemount 2051 Configuration Data Sheet.

Tagging (three options available)

- Standard stainless steel hardware tag is wired to the transmitter. Tag character height is 0.125-in. (3,18 mm), 56 characters maximum.
- Tag may be permanently stamped on transmitter nameplate upon request, 56 characters maximum.
- Tag may be stored in transmitter memory. Character limit is dependent on protocol.
  - HART Revision 5: 8 characters
  - HART Revision 7: 32 characters

Optional Rosemount 304, 305, or 306 Integral Manifolds

Factory assembled to Rosemount 2051C and Rosemount 2051T transmitters. Refer to the Rosemount Manifold Product Data Sheet for Rosemount 304, 305, and 306 for additional information.

Other seals

Refer to Rosemount DP Level Transmitters and1199 Diaphragm Seal System Product Data Sheet for additional information.

Output information

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

Pressure			
atm	inH_2O@4 °C	g/cm^2	psi
mbar	mmH_2O	kg/cm^2	torr
bar	mmHg	Pa	cmH_20@4 °C
inH_20	mmH_2O@4 °C	kPa	cmHG@0 °C
inHg	ftH_20	MPa	ftH_20@60 °F
hPa	inH_20@60 °F	kg/SqM	mH_20@4 °C
mHg@0 °C	Psf	ftH_2O@4 °C	

Display and interface options

Both display options provide diagnostic messages for local troubleshooting and have 90-degree rotation capability for easy viewing.

M4 Digital display with LOI(1)

- Commission the device with internal and external Local Configuration Buttons(1)

M5 Digital display

- 2-Line, 5-Digit LCD for 4–20 mA HART

Configuration buttons

Enhanced Rosemount 2051 requires option D4 (analog zero and span), DZ (digital zero), or M4 (LOI) for local configuration buttons.

Transient protection

T1 Integral Transient Protection Terminal Block
Meets IEEE C62.41, category location B

6 kV crest (0.5 ms–100 kHz)

3 kA crest (8 x 20 microseconds)

6 kV crest (1.2 x 50 microseconds)

1. *LOI configuration buttons will be internal when either D4 or DZ option codes are ordered.*

Bolts for flanges and adapters

- Options permit bolts for flanges and adapters to be obtained in various materials
- Standard material is plated carbon steel per ASTM A449, Type 1

L4 Austenitic 316 stainless steel bolts
L5 ASTM A 193, grade B7M bolts
L6 Alloy K-500 bolts

Conduit plug

DO 316 stainless steel conduit plug

Single 316 stainless steel conduit plug replaces carbon steel plug

Rosemount 2051C Coplanar Flange and Rosemount 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 stainless steel bolts

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

B8 B2 bracket with stainless steel bolts

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

B9 B3 bracket with stainless steel bolts

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

BA Stainless steel B1 bracket with stainless steel bolts

B1 bracket in stainless steel with Series 300 stainless steel bolts

BC Stainless steel B3 bracket with stainless steel bolts

B3 bracket in stainless steel with Series 300 stainless steel bolts

Shipping weights

Table A-18. Transmitter Weights without Options

Transmitter	Add weight In lb (kg)
Rosemount 2051C	6.0 (2,7)
Rosemount 2051L	Table A-19
Rosemount 2051T	3.0 (1,4)

Table A-19. Rosemount 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)	N/A	N/A	N/A
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)	N/A	N/A	N/A
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)
2-in., 600	15.3 (6,9)	N/A	N/A	N/A
3-in., 600	25.2 (11,4)	27.2 (12,3)	28.2 (12,8)	29.2 (13,2)
DN 50/ PN 40	13.8 (6,2)	N/A	N/A	N/A
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-20. Transmitter Options Weights

Code	Option	Add lb (kg)
J, K, L, M	Stainless steel housing (T)	3.9 (1,8)
J, K, L, M	Stainless steel housing (C, L, H, P)	3.1 (1,4)
M5	LCD display for aluminum housing	0.5 (0,2)
M6	LCD display for stainless steel housing	1.25 (0,6)
B4	Stainless steel 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	Stainless steel bracket for traditional flange	2.3 (1,0)
H2	Traditional flange	2.4 (1,1)
H3	Traditional flange	2.7 (1,2)
H4	Traditional flange	2.6 (1,2)
H7	Traditional flange	2.5 (1,1)
FC	Level flange—3-in., 150	10.8 (4,9)
FD	Level flange—3-in., 300	14.3 (6,5)
FA	Level flange—2-in., 150	10.7 (4,8)
FB	Level flange—2-in., 300	14.0 (6,3)
FP	DIN level flange, stainless steel, DN 50, PN 40	8.3 (3,8)
FQ	DIN level flange, stainless steel, DN 80, PN 40	13.7 (6,2)

A.7 Spare parts

Rosemount 2051 upgrade kits	Part number
The following come with electronics board and configuration buttons (if applicable).	
Aluminum/stainless steel	
4–20 mA HART with no configuration buttons	02021-0020-2100
4–20 mA HART with digital zero trim	02021-0020-2110
4–20 mA HART with analog zero and span	02021-0020-2120
Rosemount 2051 LOI upgrade kit	
The following come with electronics board, LOI display, and LOI configuration buttons. Order display cover safety instrumented systems requirements.	
4–20 mA HART with LOI	02021-0020-2139
Rosemount 2051 LOI/LCD display	
LCD display only. *LCD display is only compatible with enhanced Rosemount 2051 electronics*	
4–20mA HART - aluminum	03031-0199-0012
4–20 mA HART - 316 stainless steel	03031-0199-0022

Terminal block, HART Protocol	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 Protocol	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 Protocol	02051-9001-1001

LCD display, HART Protocol	Part number
LCD display kit[1]	
4–20 mA with aluminum housing	03031-0193-0101
4–20 mA with stainless steel housing	03031-0193-0111
1–5 Vdc with aluminum housing	03031-0193-0001
1–5 Vdc with stainless steel 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
Stainless steel display cover assembly[3]	03031-0193-0012
O-ring package for electronics housing cover, pkg of 12	03031-0232-0001
Zero and span hardware adjustments (D4 option)	
Zero and span kit for 4–20 mA HART Protocol[4]	
Zero and span kit for aluminum housing	02051-9010-0001
Zero and span kit for stainless steel housing	02051-9010-0002
Zero and span kit for 4–20 mA HART NAMUR compliant (C4/CN) option[5]	
Zero and span kit for aluminum housing	02051-9010-1001
Zero and span Kit for stainless steel housing	02051-9010-1002
Zero and span kit for 1–5 Vdc HART low power[5]	
Zero and span kit for aluminum housing	02051-9010-1001
Zero and span kit for stainless steel housing	02051-9010-1002
O-ring packages (package of 12)	
Electronic housing, cover (standard and meter)	03031-0232-0001
Electronics housing, module	03031-0233-0001
Process flange, glass-filled PTFE	03031-0234-0001
Process flange, graphite-filled PTFE	03031-0234-0002
Flange adapter, glass-filled PTFE	03031-0242-0001
Flange adapter, graphite-filled PTFE	03031-0242-0002

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

Flanges	Part number
Differential coplanar flange	
Nickel-plated carbon steel	03031-0388-0025
316 stainless steel	03031-0388-0022
Cast C-276	03031-0388-0023
Gage coplanar flange	
Nickel-plated carbon steel	03031-0388-1025
316 stainless steel	03031-0388-1022
Cast C-276	03031-0388-1023
Coplanar flange alignment screw (package of 12)	03031-0309-0001
Traditional flange	
316 stainless steel	03031-0320-0002
Cast C-276	03031-0320-0003
Level flange, vertical mount	
2 in., Class 150, stainless steel	03031-0393-0221
2 in., Class 300, stainless steel	03031-0393-0222
3 in., Class 150, stainless steel	03031-0393-0231
3 in., Class 300, stainless steel	03031-0393-0232
DIN, DN 50, PN 40	03031-0393-1002
DIN, DN 80, PN 40	03031-0393-1012
Flange adapter	
Nickel-plated carbon steel	02024-0069-0005
316 stainless steel	02024-0069-0002
Cast C-276	02024-0069-0003
Drain/vent valve kits (each kit contains parts for one transmitter)	
Differential drain/vent kits	
316 stainless steel stem and seat kit	01151-0028-0022
Alloy C-276 stem and seat kit	01151-0028-0023
316 stainless steel ceramic ball drain/vent kit	03031-0378-0022
Alloy C-276 ceramic ball drain/vent kit	01151-0028-0123
Gage drain/vent kits	
316 stainless steel stem and seat kit	01151-0028-0012
Alloy C-276 stem and seat kit	01151-0028-0013
316 stainless steel ceramic ball drain/vent kit	03031-0378-0012
Alloy C-276 ceramic ball drain/vent kit	01151-0028-0113

Mounting brackets	
Rosemount 2051C and 2051L coplanar flange bracket kit	
B4 bracket, stainless steel, 2-in. pipe mount, stainless steel bolts	03031-0189-0003
Rosemount 2051T bracket kit	
B4 bracket, stainless steel, 2-in. pipe mount, stainless steel bolts	03031-0189-0004
Rosemount 2051C Traditional Flange bracket kits	
B1 bracket, 2-in. pipe mount, carbon steel bolts	03031-0313-0001
B2 bracket, panel mount, carbon steel bolts	03031-0313-0002
B3 flat bracket for 2-in. pipe mount, carbon steel bolts	03031-0313-0003
B7 (B1 style bracket with stainless steel bolts)	03031-0313-0007
B8 (B2 style bracket with stainless steel bolts)	03031-0313-0008
B9 (B3 style bracket with stainless steel bolts)	03031-0313-0009
BA (stainless steel B1 bracket with stainless steel bolts)	03031-0313-0011
BC (stainless steel B3 bracket with stainless steel bolts)	03031-0313-0013
Bolt kits	
Coplanar flange	
Flange bolt kit (44 mm [1.75-in.]) (set of 4)	
Carbon steel	03031-0312-0001
316 stainless steel	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 stainless steel	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 stainless steel	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 stainless steel	03031-0307-0002
ASTM A 193, Grade B7M	03031-0307-0003
ASTM A 193, Class 2, Grade B8M	03031-0307-0005
Gage flange and adapter bolt Kit (set of 6)	
Carbon steel	03031-0307-1001
316 stainless steel	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 stainless steel	Use bolts supplied with manifold
Level flange, vertical mount	
Flange bolt kit (set of 4)	
Carbon steel	03031-0395-0001
316 stainless steel	03031-0395-0002
Covers	
Aluminum field terminal cover + O-ring	03031-0292-0001[1]
Stainless steel field terminal cover + O-ring	03031-0292-0002[1]
Aluminum HART electronics cover: cover + O-ring	03031-0292-0001[1]
316 stainless steel HART electronics cover: cover + O-ring	03031-0292-0002[1]
Aluminum electronics/LCD display cover assembly: cover + O-ring	03031-0193-0002
Stainless steel electronics/LCD display cover assembly: cover + O-ring	03031-0193-0012
Miscellaneous	
External ground screw assembly (option V5)	03031-0398-0001

1. Covers are blind, not for use with LCD display. Refer to LCD display section for LCD covers.

Appendix B Product Certifications

Rev 1.5

B.1 European Directive Information

A copy of the EU Declaration of Conformity can be found at the end of the Quick Start Guide. The most recent revision of the EU Declaration of Conformity can be found at Emerson.com/Rosemount.

B.2 Ordinary Location Certification

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

B.3 North America

E5 USA Explosionproof (XP) and Dust-Ignitionproof (DIP)
Certificate: FM16US0232
Standards: FM Class 3600 - 2011, FM Class 3615 - 2006, FM Class 3616 - 2011, FM Class 3810 - 2005, ANSI/NEMA 250 - 2008. ANSI/IEC 60529 2004
Markings: XP CL I, DIV 1, GP B, C, D; DIP CL II, DIV 1, GP E, F, G; CL III; T5(–50 °C ≤ T_a ≤ +85 °C); Factory Sealed; Type 4X

I5 USA Intrinsic Safety (IS) and Nonincendive (NI)
Certificate: FM16US0231X
Standards: FM Class 3600 - 2011, FM Class 3610 - 2010, FM Class 3611 - 2004, FM Class 3810 - 2005, ANSI/NEMA 250 - 2008
Markings: IS CL I, DIV 1, GP A, B, C, D; CL II, DIV 1, GP E, F, G; Class III; DIV 1 when connected per Rosemount drawing 02051-1009; Class I, Zone 0; AEx ia IIC T4; NI CL 1, DIV 2, GP A, B, C, D; T4(–50 °C ≤ T_a ≤ +70 °C); Type 4X

Special Condition for Safe Use (X):

1. The Rosemount 2051 Transmitter housing contains aluminum and is considered a potential risk of ignition by impact or friction. Care must be taken into account during installation and use to prevent impact and friction.

IE USA FISCO
Certificate: 3033457
Standards: FM Class 3600 – 2011, FM Class 3610 – 2010, FM Class 3611 – 2004, FM Class 3810 – 2005
Markings: IS CL I, DIV 1, GP A, B, C, D when connected per Rosemount drawing 02051-1009 (–50 °C ≤ T_a ≤ +60 °C); Type 4X

Special Condition for Safe Use (X):

The Rosemount 2051 Transmitter housing contains aluminum and is considered a potential risk of ignition by impact or friction. Care must be taken into account during installation and use to prevent impact and friction.

E6 Canada Explosion-Proof, Dust Ignition Proof
Certificate: 2041384
Standards: CAN/CSA C22.2 No. 0-10,
CSA Std C22.2 No. 25-1966,
CSA Std C22.2 No. 30-M1986,
CAN/CSA-C22.2 No. 94-M91,
CSA Std C22.2 No.142-M1987,
CAN/CSA-C22.2 No.157-92,
CSA Std C22.2 No. 213-M1987,
CAN/CSA-E60079-0:07,
CAN/CSA-E60079-1:07,
CAN/CSA-E60079-11-02,
CAN/CSA-C22.2 No. 60529:05,
ANSI/ISA-12.27.01–2003
Markings: Explosion-Proof for Class I, Divisions 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. Class I Zone 1 Ex d IIC T5. Enclosure type 4X, factory sealed. Single Seal

I6 Canada Intrinsic Safety
Certificate: 2041384
Standards: CSA Std. C22.2 No. 142 - M1987,
CSA Std.C22.2 No. 213 - M1987,
CSA Std. C22.2 No.157 - 92,
CSA Std. C22.2 No. 213 - M1987,
ANSI/ISA 12.27.01 – 2003,
CAN/CSA-E60079-0:07,
CAN/CSA-E60079-11:02
Markings: Intrinsically safe for Class I, Division 1, Groups A,B, C, and D when connected in accordance with Rosemount drawing 02051-1008. Ex ia IIC T3C. Single Seal. Enclosure Type 4X

B.4 Europe

E1 ATEX Flameproof
Certificate: KEMA 08ATEX0090X
Standards: EN 60079-0:2012 + A11:2013, EN 60079-1:2014, EN 60079-26:2015
Markings: Ⓔx II 1/2 G Ex db IIC Ga/Gb
T6 (–60 °C ≤ T_a ≤ 70 °C);
T4/T5 (–60 °C ≤ T_a ≤ 80 °C)

Table B-1. Process Connection Temperature

Temperature class	Process temperature	Ambient temperature
T6	–60 °C to +70 °C	–60 °C to +70 °C
T5	–60 °C to +80 °C	–60 °C to +80 °C
T4	–60 °C to +120 °C	–60 °C to +80 °C

Special Conditions for Safe Use (X):

1. Appropriate cable, glands and plugs need to be suitable for a temperature of 5 °C greater than maximum specified temperature for location where installed.
2. Non- standard paint options may cause risk from electrostatic discharge. Avoid installations that could cause electrostatic build-up on painted surfaces, and only clean the painted surfaces with a damp cloth. If paint is ordered through a special option code, contact the manufacturer for more information.
3. The device contains a thin wall diaphragm less than 1 mm thickness that forms a boundary between zone 0 (process connection) and zone 1 (all other parts of the equipment). The model code and datasheet are to be consulted for details of the diaphragm material. Installation, maintenance and use shall take into account the environmental conditions to which the diaphragm shall be subjected. The manufacturer's instructions for installation and maintenance shall be followed in detail to assure safety during its expected lifetime.
4. Flameproof joints are not intended for repair.

I1 ATEX Intrinsic Safety
Certificate: Baseefa08ATEX0129X
Standards: EN60079-0:2012, EN60079-11:2012
Markings: Ex II 1 G Ex ia IIC T4 Ga (–60 °C ≤ T_a ≤ +70 °C)

Table B-2. Input Parameters

Parameter	HART	Fieldbus/PROFIBUS
Voltage U_i	30 V	30 V
Current I_i	200 mA	300 mA
Power P_i	1.0 W	1.3 W
Capacitance C_i	0.012 µF	0 µF
Inductance L_i	0 mH	0 mH

Special Condition for Safe Use (X):

1. If the equipment is fitted with an optional 90 V transient suppressor, it is incapable of withstanding the 500 V isolation from earth test and this must be taken into account during installation.
2. The enclosure may be made of aluminum alloy and given a protective polyurethane paint finish; however care should be taken to protect it from impact and abrasion when located in Zone 0.

IA ATEX FISCO
Certificate: Baseefa08ATEX0129X
Standards: EN60079-0:2012, EN60079-11:2012
Markings: Ex II 1 G Ex ia IIC T4 Ga (–60 °C ≤ T_a ≤ +60 °C)

Table B-3. Input Parameters

Parameter	FISCO
Voltage U_i	17.5 V
Current I_i	380 mA
Power P_i	5.32 W
Capacitance C_i	0 µF
Inductance L_i	0 mH

Special Conditions for Safe Use (X):

1. If the equipment is fitted with an optional 90 V transient suppressor, it is incapable of withstanding the 500 V isolation from earth test and this must be taken into account during installation.
2. The enclosure may be made of aluminum alloy and given a protective polyurethane paint finish; however care should be taken to protect it from impact and abrasion when located in Zone 0.

N1 ATEX Type n
Certificate: Baseefa08ATEX0130X
Standards: EN60079-0:2012, EN60079-15:2010
Markings: Ex II 3G Ex nA IIC T4 Gc (–40 °C ≤ T_a ≤ +70 °C)

Special Condition for Safe Use (X):

1. If the equipment is fitted with an optional 90 V transient suppressor, it is incapable of withstanding the 500 V electrical strength test as defined in clause 6.5.1 of by EN 60079-15:2010. This must be taken into account during installation.

ND ATEX Dust
Certificate: Baseefa08ATEX0182X
Standards: EN60079-0:2012, EN60079-31:2009
Markings: ⟨Ex⟩ II 1 D Ex ta IIIC T95 °C T_{500} 105 °C Da (–20 °C ≤ T_a ≤ +85 °C)

Special Condition for Safe Use (X):

1. If the equipment is fitted with an optional 90 V transient suppressor, it is incapable of withstanding the 500 V isolation from earth test and this must be taken into account during installation.

B.5 International

E7 IECEx Flameproof
Certificate: IECExKEM08.0024X
Standards: IEC 60079-0:2011, IEC 60079-1:2014-06, IEC 60079-26:2014-10
Markings: Ex db IIC T6...T4 Ga/Gb
T6(–60 °C ≤ T_a ≤ +70 °C),
T4/T5(–60 °C ≤ T_a ≤ +80 °C)

Table B-4. Process Connection Temperature

Temperature class	Process temperature	Ambient temperature
T6	–60 °C to +70 °C	–60 °C to +70 °C
T5	–60 °C to +80 °C	–60 °C to +80 °C
T4	–60 °C to +120 °C	–60 °C to +80 °C

Special Conditions for Safe Use (X):

1. The device contains a thin wall diaphragm less than 1 mm thickness that forms a boundary between zone 0 (process connection) and zone 1 (all other parts of the equipment). The model code and datasheet are to be consulted for details of the diaphragm material. Installation, maintenance and use shall take into account the environmental conditions to which the diaphragm shall be subjected. The manufacturer's instructions for installation and maintenance shall be followed in detail to assure safety during its expected lifetime.
2. Appropriate cable, glands and plugs need to be suitable for a temperature of 5 °C greater than maximum specified temperature for location where installed.
3. Flameproof joints are not intended for repair.
4. Non-standard paint options may cause risk from electrostatic discharge. Avoid installations that could cause electrostatic build-up on painted surfaces, and only clean the painted surfaces with a damp cloth. If paint is ordered through a special option code, contact the manufacturer for more information.

I7 IECEx Intrinsic Safety
Certificate: IECExBAS08.0045X
Standards: IEC60079-0:2011, IEC60079-11:2011
Markings: Ex ia IIC T4 Ga (–60 °C ≤ T_a ≤ +70 °C)

Table B-5. Input Parameters

Parameter	HART	Fieldbus/PROFIBUS
Voltage U_i	30 V	30 V
Current I_i	200 mA	300 mA
Power P_i	1.0 W	1.3 W
Capacitance C_i	0.012 µF	0 µF
Inductance L_i	0 mH	0 mH

Special Condition for Safe Use (X):

1. If the equipment is fitted with an optional 90 V transient suppressor, it is incapable of withstanding the 500 V isolation from earth test and this must be taken into account during installation.
2. The enclosure may be made of aluminum alloy and given a protective polyurethane paint finish; however care should be taken to protect it from impact and abrasion when located in Zone 0.

IG IECEx FISCO
Certificate: IECExBAS08.0045X
Standards: IEC60079-0:2011, IEC60079-11:2011
Markings: Ex ia IIC T4 Ga (–60 °C ≤ T_a ≤ +60 °C)

Table B-6. Input Parameters

Parameter	FISCO
Voltage U_i	17.5 V
Current I_i	380 mA
Power P_i	5.32 W
Capacitance C_i	0 nF
Inductance L_i	0 µH

Special Condition for Safe Use (X):

1. If the equipment is fitted with an optional 90 V transient suppressor, it is incapable of withstanding the 500 V isolation from earth test and this must be taken into account during installation.
2. The enclosure may be made of aluminum alloy and given a protective polyurethane paint finish; however care should be taken to protect it from impact and abrasion when located in Zone 0.

N7 IECEx Type n
Certificate: IECExBAS08.0046X
Standards: IEC60079-0:2011, IEC60079-15:2010
Markings: Ex nA IIC T4 Gc (–40 °C ≤ T_a ≤ +70 °C)

Special Condition for Safe Use (X):

1. If fitted with a 90 V transient suppressor, the equipment is not capable of withstanding the 500 V electrical strength test as defined in clause 6.5.1 of IEC60079-15:2010. This must be taken into account during installation.

B.6 Brazil

E2 INMETRO Flameproof
Certificate: UL-BR 14.0375X
Standards: ABNT NBR IEC60079-0:2008 + Errata 1:2011, ABNT NBR IEC 60079-1:2009 + Errata 1:2011,ABNT NBR IEC 60079-26:2008 + Errata 1:2009
Markings: Ex d IIC T6/T5 Gb IP66, T6(–50 °C ≤ T_a ≤ +65 °C), T5(–50 °C ≤ T_a ≤ +80 °C)

Special Condition for Safe Use (X):

1. The device contains a thin wall diaphragm. Installation, maintenance and use shall take into account the environmental conditions to which the diaphragm will be subjected. The manufacturer's instructions for installation and maintenance shall be followed in detail to assure safety during its expected lifetime.
2. The Ex d blanking elements, cable glands, and wiring shall be suitable for a temperature of 90 °C.
3. In case of repair, contact the manufacturer for information on the dimensions of the flameproof joints.

I2 INMETRO Intrinsic Safety
Certificate: UL-BR 14.0759X
Standards: ABNT NBR IEC 60079-0:2008 + Errata 1:2011; ABNT NBR IEC 60079-11:2009
Markings: Ex ia IIC T4 Ga (–60 °C ≤ T_a ≤ +70 °C)

Table B-7. Input Parameters

Parameter	HART	Fieldbus/PROFIBUS
Voltage U_i	30 V	30 V
Current I_i	200 mA	300 mA
Power P_i	1 W	1.3 W
Capacitance C_i	0.012 µF	0 nF
Inductance L_i	0 mH	0 µH

Special Conditions for Safe Use (X):

1. If the equipment is fitted with an optional 90 V transient suppressor, it is incapable of withstanding the 500 V insulation from earth test and this must be taken into account during installation.
2. The enclosure may be made of aluminium alloy and given a protective polyurethane paint finish; however care should be taken to protect it from impact and abrasion when located in atmospheres that require ELP Ga.

IB INMETRO FISCO
Certificate: UL-BR 14.0759X
Standards: ABNT NBR IEC 60079-0:2008 + Errata 1:2011; ABNT NBR IEC 60079-11:2009
Markings: Ex ia IIC T4 Ga (–60 °C ≤ T_a ≤ +60 °C)

Table B-8. Input Parameters

Parameter	FISCO
Voltage U_i	17.5 V
Current I_i	380 mA
Power P_i	5.32 W
Capacitance C_i	0 nF
Inductance L_i	0 µH

Special Condition for Safe Use (X):

1. If the equipment is fitted with an optional 90 V transient suppressor, it is incapable of withstanding the 500 V insulation from earth test and this must be taken into account during installation.
2. The enclosure may be made of aluminium alloy and given a protective polyurethane paint finish; however care should be taken to protect it from impact and abrasion when located in atmospheres that require ELP Ga.

B.7 China

E3 China Flameproof
Certificate: GYJ13.1386X; GYJ5.1366X [Flowmeters]
Standards: GB3836.1-2010, GB3836.2-2010, GB3836.20-2010-2010
Markings: Pressure Transmitter: Ex d IIC Gb, T6(–50 °C ≤ T_a ≤ +65 °C), T5(–50 °C ≤ T_a ≤ +80 °C)
Flowmeter: Ex d IIC Ga/Gb, T6(–50 °C ≤ T_a ≤ +65 °C), T5(–50 °C ≤ T_a ≤ +80 °C)

Special Conditions for Safe Use (X):

1. Symbol "X" is used to denote specific conditions of use:
   - The Ex d blanking elements, cable glands, and wiring shall be suitable for a temperature of 90 °C.
   - This device contains a thin wall diaphragm. Installation, maintenance and use shall take into account the environment conditions to which the diaphragm will be subjected.
2. The relation between T code and ambient temperature range is:

T_a	Temperature class
–50 °C ≤ T_a ≤ +80 °C	T5
–50 °C ≤ T_a ≤ +65 °C	T6

3. The earth connection facility in the enclosure should be connected reliably.
4. During installation, use and maintenance of the product, observe the warning "Don't open the cover when the circuit is alive."
5. During installation, there should be no mixture harmful to flameproof housing.
6. Cable entry and conduit, certified by NEPSI with type of protection Ex d IIC and appropriate thread form, should be applied when installed in a hazardous location. Blanking elements should be used on the redundant cable entries.
7. End users are not permitted to change any internal components, but to settle the problem in conjunction with the manufacturer to avoid damage to the product.
8. Maintenance should be done in a non-hazardous location.
9. During installation, use and maintenance of this product, observe the following standards: GB3836.13-2013, GB3836.15-2000, GB3836.16-2006, GB50257-2014.

I3 China Intrinsic Safety
Certificate: GYJ12.1295X; GYJ15.1365X [Flowmeters]
Standards: GB3836.1-2010, GB3836.4-2010, GB3836.20-2010
Markings: Ex ia IIC T4 Ga (–60 °C ≤ T_a ≤ +70 °C)

Special Conditions for Safe Use (X):

1. Symbol "X" is used to denote specific conditions of use:
   a. If the apparatus is fitted with an optional 90 V transient suppressor, it is not capable of withstanding the 500 V insulation test for 1 minute. This must be taken into account when installing the apparatus.
   b. The enclosure may be made of aluminum alloy and given a protective polyurethane paint finish; however, care should be taken to protect it from impact or abrasion if located in Zone 0.
2. The relation between T code and ambient temperature range is:

Model	T code	Temperature range
HART, Fieldbus, PROFIBUS, and Low Power	T4	$-60\ °C \leq T_a \leq +70\ °C$

3. Intrinsically safe parameters:

Parameter	HART	Fieldbus/ PROFIBUS	FISCO
Voltage U_i	30 V	30 V	17.5 V
Current I_i	200 mA	300 mA	380 mA
Power P_i	1 W	1.3 W	5.32 W
Capacitance C_i	0.012 µF	0 µF	0 nF
Inductance L_i	0 mH	0 mH	0 µF

Note
FISCO parameters comply with the requirements for FISCO field devices in GB3836.19-2010.

[For Flowmeters] When Rosemount 644 Temperature Transmitter is used, the transmitter should be used with Ex-certified associated apparatus to establish explosion protection system that can be used in explosive gas atmospheres. Wiring and terminals should comply with the instruction manual of both Rosemount 644 and associated apparatus. The cables between Rosemount 644 and associated apparatus should be shielded cables (the cables must have insulated shield). The shielded cable has to be grounded reliably in a non-hazardous area.

4. The product should be used with Ex-certified associated apparatus to establish explosion protection system that can be used in explosive gas atmospheres. Wiring and terminals should comply with the instruction manual of the product and associated apparatus.
5. The cables between this product and associated apparatus should be shielded cables (the cables must have insulated shield). The shielded cable has to be grounded reliably in a non-hazardous area.
6. End users are not permitted to change any internal components, and needs to settle the problem in conjunction with the manufacturer to avoid damage to the product.
7. During installation, use and maintenance of this product, observe the following standards: GB3836.13-2013, GB3836.15-2000, GB3836.16-2006, GB3836.18-2010, GB50257-2014.

B.8 Japan

E4 Japan Flameproof
Certificate: TC20598, TC20599, TC20602, TC20603 [HART]; TC20600, TC20601, TC20604, TC20605 [Fieldbus]
Markings: Ex d IIC T5

B.9 Technical Regulations Customs Union (EAC)

EM EAC Flameproof
Certificate: RU C-US.GB05.B.01199
Markings: Ga/Gb Ex d IIC T5/T6 X, $T5(-50\ °C \leq T_a \leq +80\ °C)$, $T6(-50\ °C \leq T_a \leq +65\ °C)$

Special Condition for Safe Use (X):

1. See certificate for special conditions.

IM EAC Intrinsically Safe
Certificate: RU C-US.GB05.B.01199
Markings: 0Ex ia IIC T4 Ga X $(-60\ °C \leq T_a \leq +70\ °C)$

Special Condition for Safe Use (X):

1. See certificate for special conditions.

B.9.1 Combinations

K1 Combination of E1, I1, N1, and ND
K2 Combination of E2 and I2
K5 Combination of E5 and I5
K6 Combination of E6 and I6

K7 Combination of E7, I7, N7 and IECEx Dust

IECEx Type n
Certificate: IECExBAS08.0058X
Standards: IEC60079-0:2011, IEC60079-15:2010
Markings: Ex nA IIIC T95 °C T_{500} 105 °C Da
(–20 °C ≤ T_a ≤ +85 °C)

Special Condition for Safe Use (X):

1. If the equipment is fitted with an optional 90 V transient suppressor, it is incapable of withstanding a 500 V isolation from earth test and this must be taken into account during installation.

KA Combination of E1, I1, and K6

KB Combination of K5 and K6

KC Combination of E1, I1, and K5

KD Combination of K1, K5, and K6

KM Combination of EM and IM

B.10 Additional Certifications

SBS American Bureau of Shipping (ABS) Type Approval
Certificate: 09-HS446883B-3-PDA
Intended Use: Marine and Offshore Applications
Measurement of either Gauge or Absolute Pressure for Liquid, Gas, and Vapor
ABS Rules: 2013 Steel Vessels Rules 1-1-4/7.7, 1-1-Appendix 3, 4-8-3/1.7, 4-8-3/13.1

SBV Bureau Veritas (BV) Type Approval
Certificate: 23157/B0 BV
BV Rules: Bureau Veritas Rules for the Classification of Steel Ships
Application: Class notations: AUT-UMS, AUT-CCS, AUT-PORT and AUT-IMS; Pressure transmitter type 2051 cannot be installed on diesel engines

SDN Det Norske Veritas (DNV) Type Approval
Certificate: TAA00004F
Intended Use: DNV GL Rules for Classification — Ships and offshore units
Application:

Locations classes	
Type	2051
Temperature	D
Humidity	B
Vibration	A
EMC	B
Enclosure	D

SLL Lloyds Register (LR) Type Approval
Certificate: 11/60002
Application: Environmental categories ENV1, ENV2, ENV3, and ENV5

B.11 Approval drawings

Figure B-1. Factory mutual 02051-1009

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

REVISIONS

REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AB	ADD AMBIENT TEMP LIMITS	RTC1026995	J.G.K.	9/24/08
AC	REMOVE LOW POWER	RTC1027021	J.G.K.	10/2/08
AD	ADD LOW POWER	RTC1027539	J.G.K.	12/22/08

ENTITY APPROVALS FOR
2051C
2051L
2051T

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

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

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

CAD MAINTAINED (MicroStation)

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

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

DO NOT SCALE PRINT

CONTRACT NO.

DR. Myles Lee Miller 4/16/08

CHK'D

APP'D.

APP'D. GOVT.

EMERSON. Process Management

ROSEMOUNT®
8200 Market Boulevard • Chanhassen, MN 55317 USA

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

SIZE A | FSCM NO | DWG NO. 02051-1009

SCALE N/A | WT. | SHEET 1 OF 13

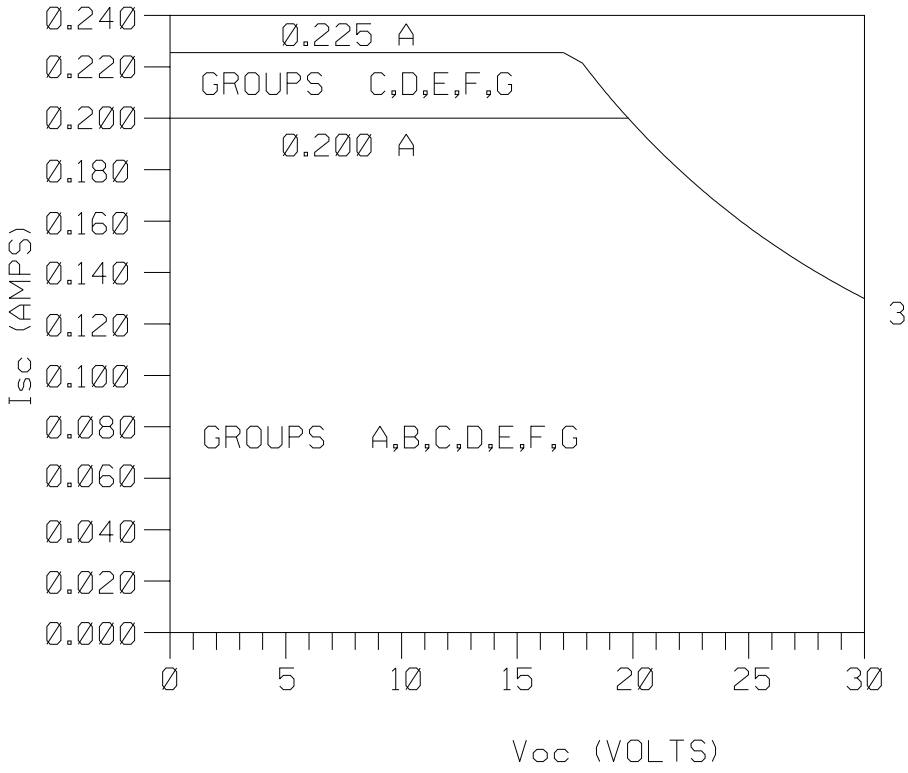
Form Rev AC

Electronic Master – PRINTED COPIES ARE UNCONTROLLED – Rosemount Proprietary

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

BARRIER PARAMETERS (APPLICABLE TO OUTPUT CODES A & M)

Pmax = 1WATT



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

Form Rev AC

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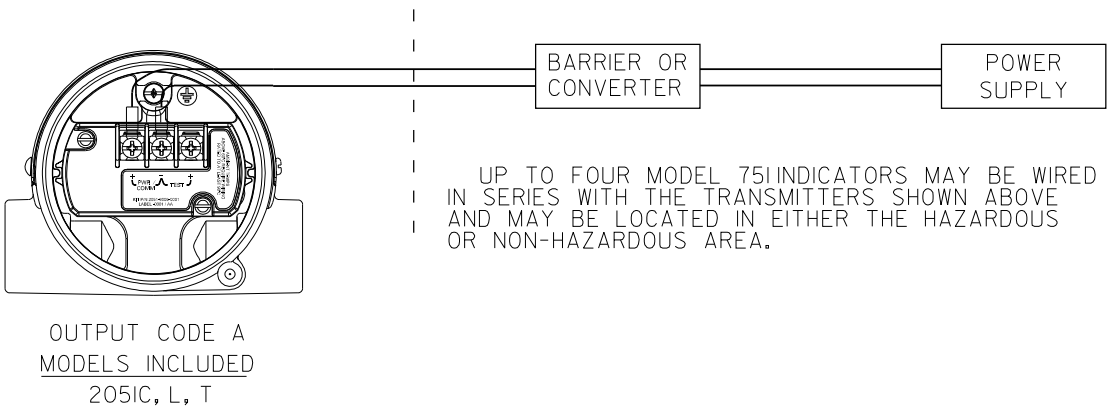
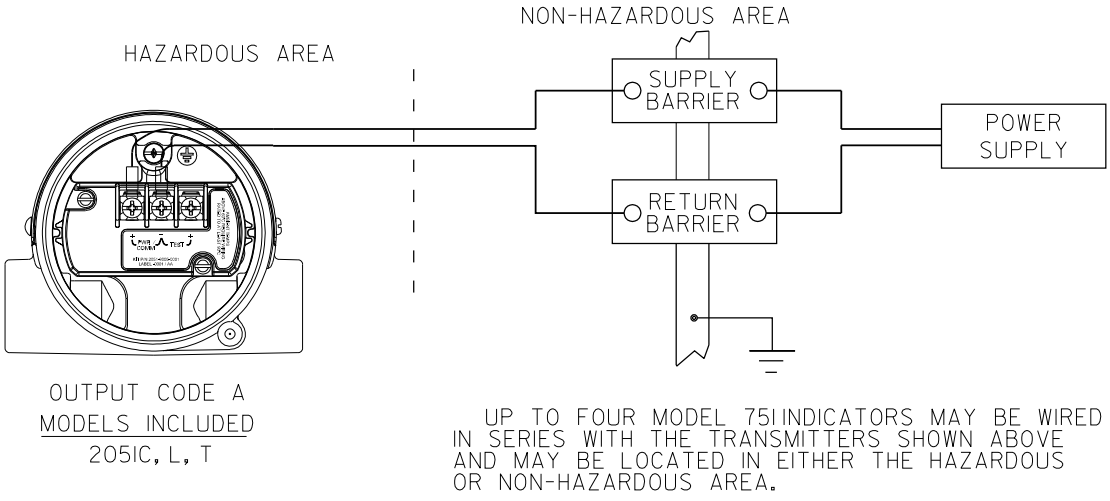
REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AD				

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



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



Rosemount Inc.
8200 Market Boulevard
Chanhassen, MN 55317 USA

CAD MAINTAINED (MicroStation)

DR. Myles Lee Miller	SIZE A	FSCM NO	DWG NO. 02051-1009
ISSUED	SCALE N/A	WT. ———	SHEET 3 OF 13

Form Rev AC

Electronic Master – PRINTED COPIES ARE UNCONTROLLED – Rosemount Proprietary

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

ENTITY CONCEPT APPROVALS

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

FOR OUTPUT CODE A

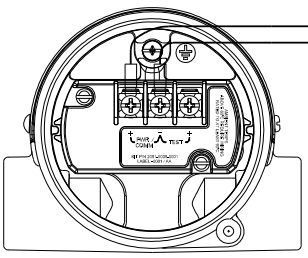
NOTE: ENTITY PARAMETERS LISTED APPLY ONLY TO ASSOCIATED APPARATUS WITH LINEAR OUTPUT.

CLASS I, DIV. 1, GROUPS A AND B

V_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	$(\frac{V_T X I_T}{4})$ 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
T4 (Ta=-50°C to +70°C)	

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	$(\frac{V_T X I_T}{4})$ 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
T4 (Ta=-50°C to +70°C)	



HAZARDOUS AREA | NON-HAZARDOUS AREA

ASSOCIATED APPARATUS

(SEE SHEET 3)

OUTPUT CODE A
MODELS INCLUDED
205IC, L, T

Rosemount Inc.
8200 Market Boulevard
Chanhassen, MN 55317 USA

DR. Myles Lee Miller

ISSUED

CAD MAINTAINED (MicroStation)

SIZE	FSCM NO	DWG NO.	
A		02051-1009	
SCALE N/A	WT. ———	SHEET 4 OF 13	

Form Rev AC

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

FOR OUTPUT CODE M

CLASS I, DIV. 1, GROUPS A AND B

V_{MAX} = 30V	V_T OR V_{OC} IS LESS THAN OR EQUAL TO 30V
I_{MAX} = 200mA	I_T OR I_{SC} IS LESS THAN OR EQUAL TO 200mA
P_{MAX} = 1 WATT	$(\frac{V_T \times I_T}{4})$ OR $(\frac{V_{OC} \times I_{SC}}{4})$ IS LESS THAN OR EQUAL TO 1 WATT
C_I = .02µf	C_A IS GREATER THAN .02µf
L_I =10µH	L_A IS GREATER THAN 10µH
T4 (Ta=-50°C to +70°C)	

* FOR T1 OPTION:

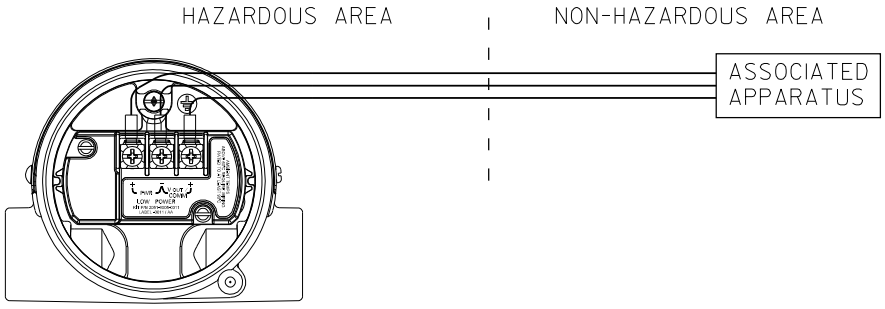
L_I =0.75mH	L_A IS GREATER THAN 0.75mH

CLASS I, DIV. 1, GROUPS C AND D

V_{MAX} = 30V	V_T OR V_{OC} IS LESS THAN OR EQUAL TO 30V
I_{MAX} = 225mA	I_T OR I_{SC} IS LESS THAN OR EQUAL TO 225mA
P_{MAX} = 1 WATT	$(\frac{V_T \times I_T}{4})$ OR $(\frac{V_{OC} \times I_{SC}}{4})$ IS LESS THAN OR EQUAL TO 1 WATT
C_I = .02µf	C_A IS GREATER THAN .02µf
L_I =10µH	L_A IS GREATER THAN 10µH
T4 (Ta=-50°C to +70°C)	

* FOR T1 OPTION:

L_I =0.75mH	L_A IS GREATER THAN 0.75mH



OUTPUT CODE M
AVAILABLE FOR THE MODELS LISTED

205IC
205IL
205IT

Rosemount Inc.
8200 Market Boulevard
Chanhassen, MN 55317 USA

DR. Myles Lee Miller
ISSUED

CAD MAINTAINED (MicroStation)

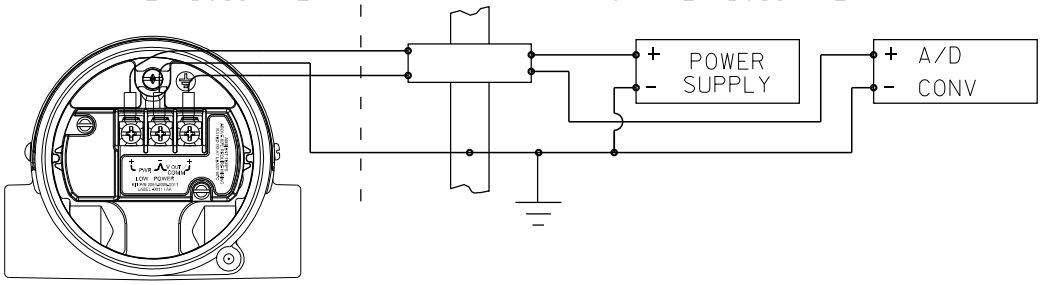
SIZE	FSCM NO	DWG NO.	
A		02051-1009	
SCALE N/A	WT. ———	SHEET 5 OF 13	

Form, Rev AC

Electronic Master – PRINTED COPIES ARE UNCONTROLLED – Rosemount Proprietary

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

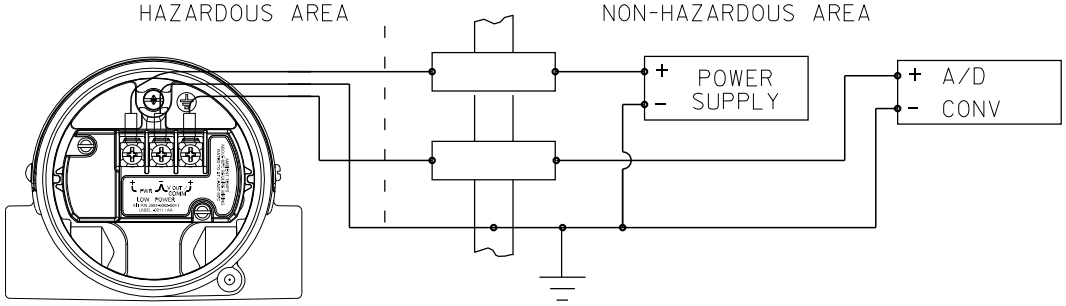
CIRCUIT DIAGRAM 3
ONE DUAL CHANNEL BARRIER



OUTPUT CODE M
AVAILABLE FOR THE MODELS LISTED

205IC 205IT
205IL

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



OUTPUT CODE M
AVAILABLE FOR THE MODELS LISTED

205IC 205IT
205IL

Rosemount Inc. 8200 Market Boulevard Chanhassen, MN 55317 USA			CAD MAINTAINED (MicroStation)
DR. Myles Lee Miller	SIZE A	FSCM NO	DWG NO. 02051-1009
ISSUED	SCALE N/A	WT. ———	SHEET 6 OF 13

Form Rev AC

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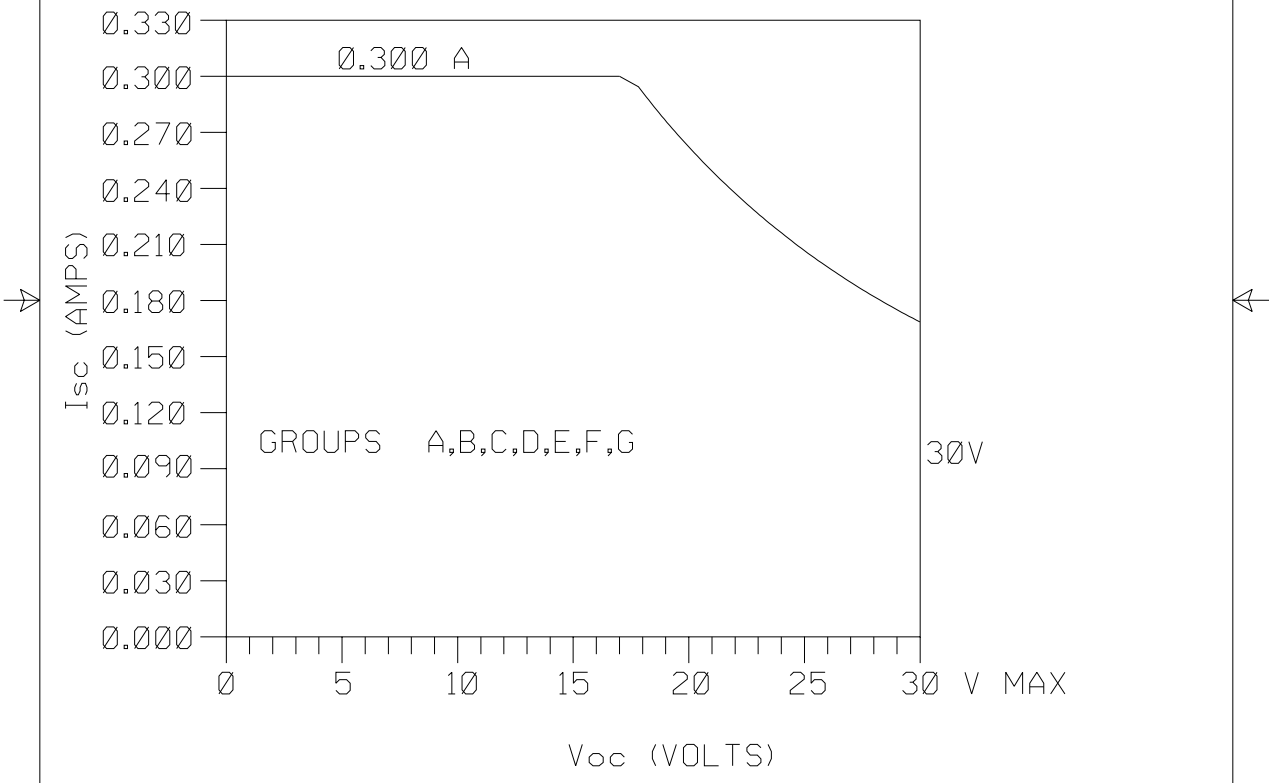
REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AD				

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

BARRIER PARAMETERS (APPLICABLE TO OUTPUT CODE F OR W)

Pmax = 1.3 WATT



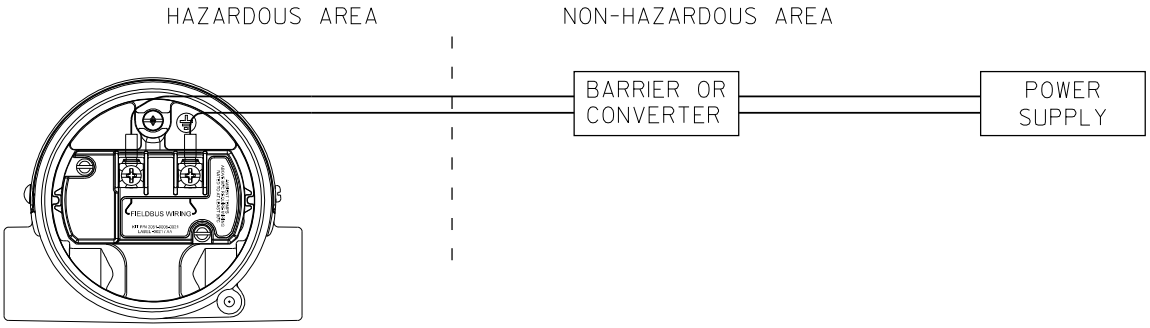
Rosemount Inc. 8200 Market Boulevard Chanhassen, MN 55317 USA			CAD MAINTAINED (MicroStation)
DR. Myles Lee Miller	SIZE A	FSCM NO	DWG NO. 02051-1009
ISSUED	SCALE N/A	WT. ———	SHEET 7 OF 13

Form Rev AC

Electronic Master – PRINTED COPIES ARE UNCONTROLLED – Rosemount Proprietary

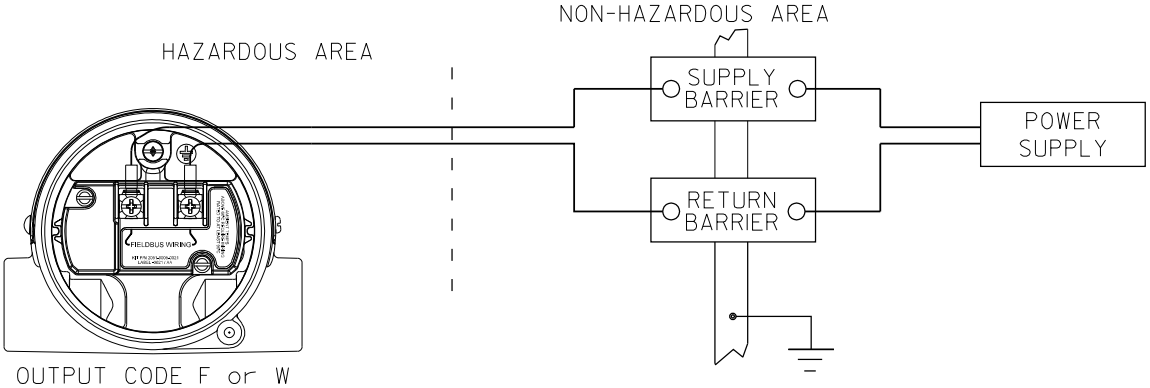
REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AD				

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



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

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



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

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

Form Rev AC

Electronic Master – PRINTED COPIES ARE UNCONTROLLED – Rosemount Proprietary

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

ENTITY CONCEPT APPROVALS

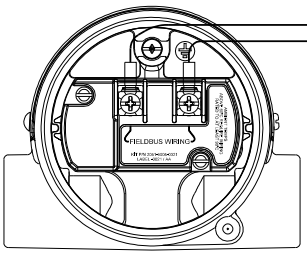
THE ENTITY CONCEPT ALLOWS INTERCONNECTION OF INTRINSICALLY SAFE APPARATUS TO ASSOCIATED APPARATUS NOT SPECIFICALLY EXAMINED IN COMBINATION AS A SYSTEM. THE APPROVED VALUES OF MAX. OPEN CIRCUIT VOLTAGE (Voc OR Vt) AND MAX. SHORT CIRCUIT CURRENT (Isc OR It) AND MAX.POWER (Voc X Isc/4) OR (Vt X It/4), FOR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

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

FOR OUTPUT CODE F or W

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

V_{MAX} = 30V	V_T OR V_{OC} IS LESS THAN OR EQUAL TO 30V
I_{MAX} = 300mA	I_T OR I_{SC} IS LESS THAN OR EQUAL TO 300mA
P_{MAX} = 1.3 WATT	$(\frac{V_T \times I_T}{4})$ OR $(\frac{Voc \times Isc}{4})$ IS LESS THAN OR EQUAL TO 1.3 WATT
C_I = 0µf	C_A IS GREATER THAN 0µf
L_I = 0µH	L_A IS GREATER THAN 0µH
T4 (Ta=-50°C to +70°C)	
T4 (Ta=-50°C to +60°C) FISCO	



HAZARDOUS AREA | NON-HAZARDOUS AREA

ASSOCIATED APPARATUS

(SEE SHEET 3)

OUTPUT CODE F
MODELS INCLUDED
205IC, L, T

Rosemount Inc.
8200 Market Boulevard
Chanhassen, MN 55317 USA

DR. Myles Lee Miller

ISSUED

CAD MAINTAINED (MicroStation)

SIZE	FSCM NO	DWG NO.	
A		02051-1009	
SCALE N/A	WT. ———	SHEET 9 OF 13	

Form Rev AC

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

FISCO CONCEPT APPROVALS

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

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

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

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

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

R = 90...100 OHMS C = 2.2µF

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

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

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

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

Form Rev AC

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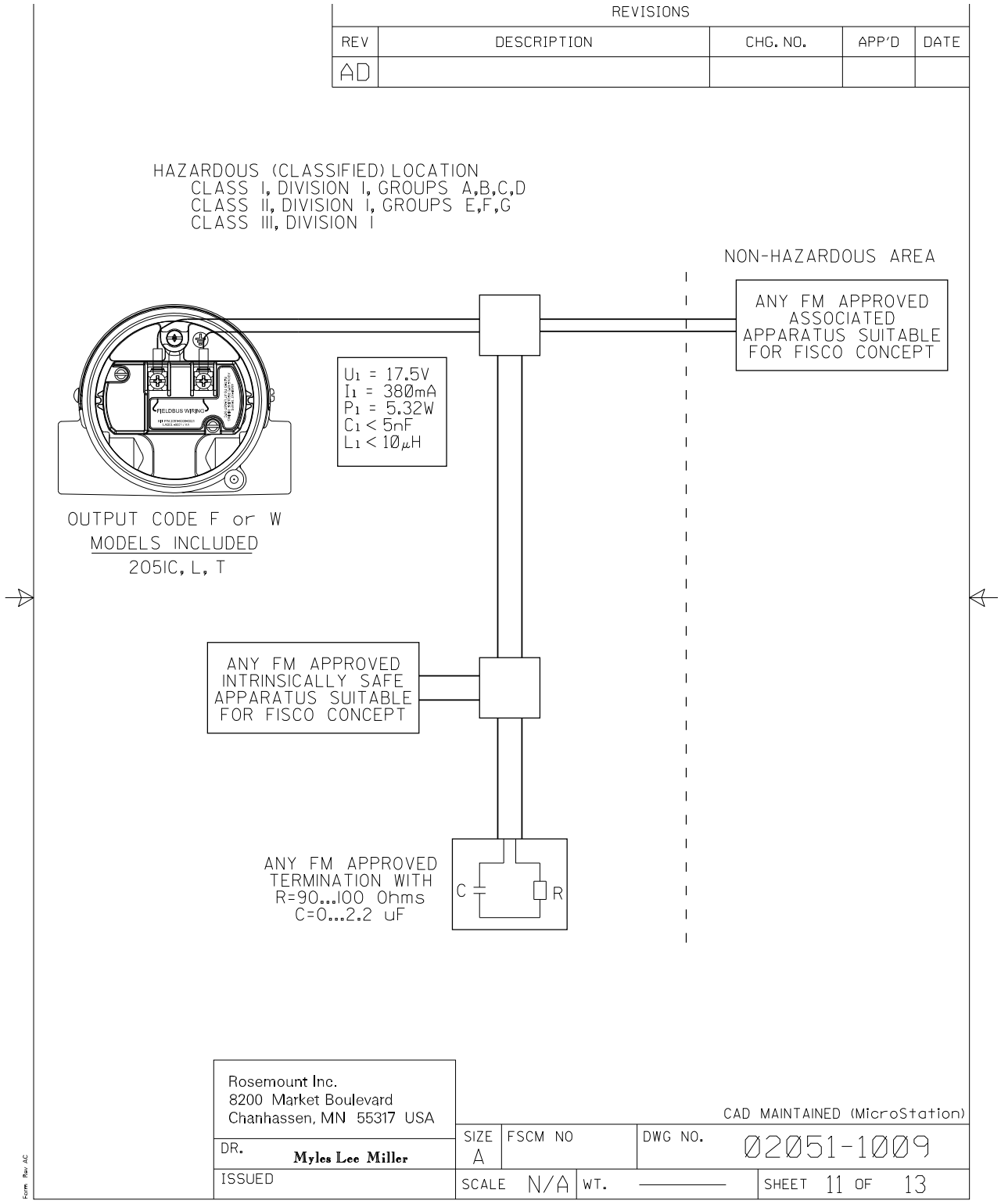
REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AD				



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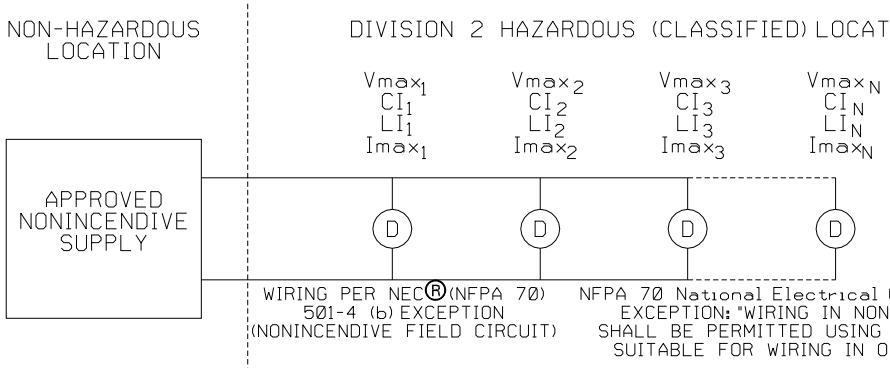
REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AD				

NONINCENDIVE FIELD CIRCUIT
CLASS I, DIV. 2 LOCATIONS



IN NORMAL OPERATION

DEVICES CONTROL THROUGH–CURRENT

PARAMETERS DEVICE

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

$Imax_1$ >= Iq_1 + $Isignal_1$

$Imax_2$ >= Iq_1 + $Isignal_2$

.

.

.

$Imax_N$ >= Iq_N + $Isignal_N$

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

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

Imax for an individual device = Iq + Isignal

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

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

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

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

ROSEMOUNT 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/T_1		.75mH	

ROSEMOUNT 2051 TRANSMITTERS ARE CURRENT CONTROLLERS ON INDIVIDUAL PARALLEL BRANCHES WITH RESPECT TO THE POWER SUPPLY. IN NONINCENDIVE INSTALLATIONS THE Imax FOR EACH TRANSMITTER IS NOT RELATED TO THE MAXIMUM CURRENT OF THE POWER SUPPLY (Isc) IN THE SAME MANNER AS FOR TRANSMITTER INSTALLED PER I.S. REQUIREMENTS, BECAUSE NONINCENDIVE REQUIREMENTS INCLUDE ONLY NORMAL OPERATING CONDITIONS.

REFERENCE: APPENDIX A7.3 (FM3611)

Rosemount Inc.
8200 Market Boulevard
Chanhassen, MN 55317 USA

CAD MAINTAINED (MicroStation)

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

Form Rev AC

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

NOTES:

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

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Figure B-2. Canadian standards association (CSA) 02051-1008

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REVISIONS

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

APPROVALS FOR
2051C
2051L
2051T

OUTPUT CODE A (4-20 mA HART) I.S. SEE SHEETS 2-3
OUTPUT CODE M (LOW POWER) I.S. SEE SHEETS 3-4
OUTPUT CODE F/W (FIELDBUS) I.S. SEE SHEETS 5-7
OUTPUT CODES A,F,W I.S. ENTITY PARAMETERS SHEET 8-9

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

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

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

CAD MAINTAINED (MicroStation)

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

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

DO NOT SCALE PRINT

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CONTRACT NO.

DR. Myles Lee Miller 4/15/08

CHK'D

APP'D.

APP'D. GOVT.

EMERSON. Process Management

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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

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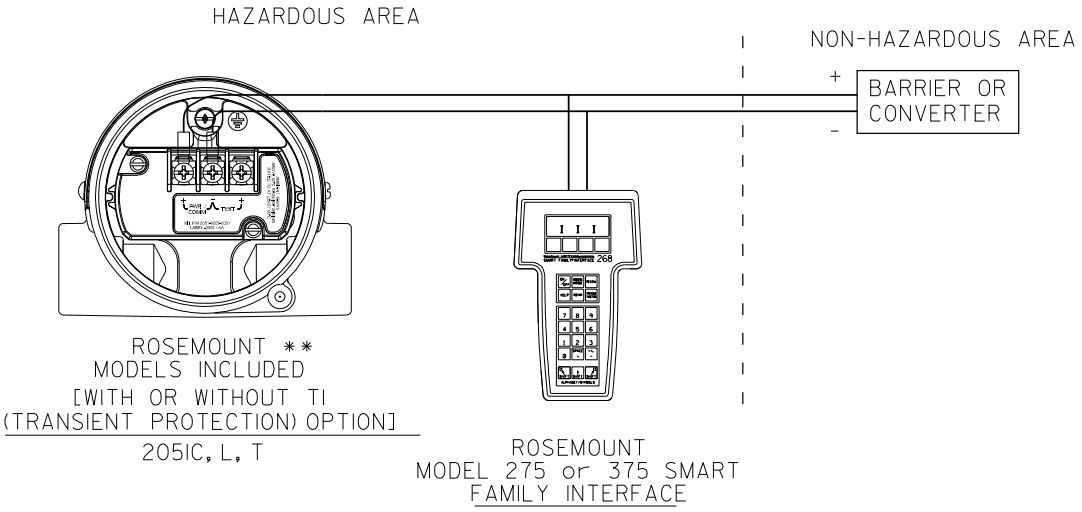
REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AB				

CSA INTRINSIC SAFETY APPROVALS

CIRCUIT CONNECTION WITH BARRIER OR CONVERTER

Ex ia

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



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

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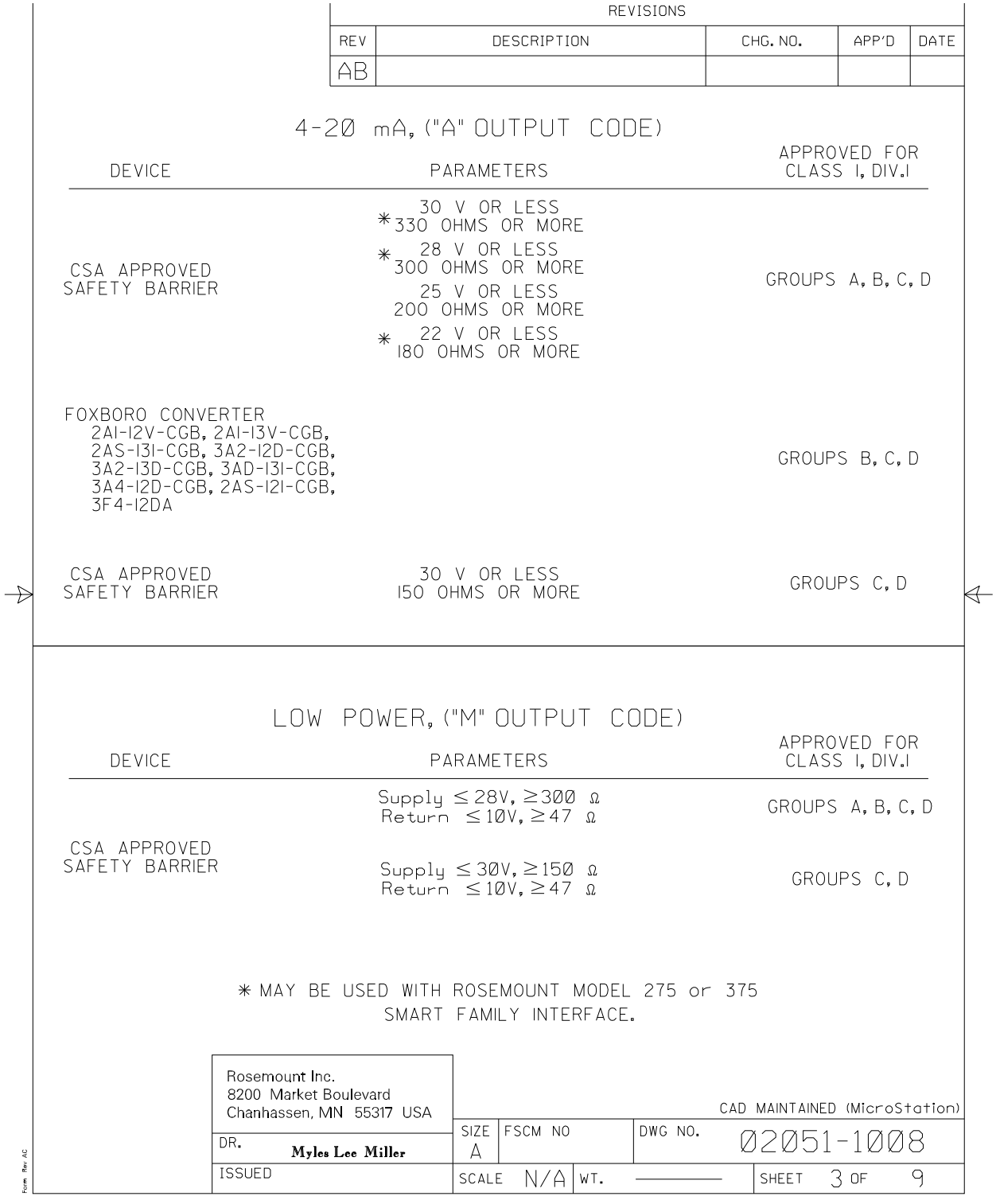

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AB				

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 * 22 V OR LESS 180 OHMS OR MORE	GROUPS A, B, C, D
FOXBORO CONVERTER 2AI-I2V-CGB, 2AI-I3V-CGB, 2AS-I3I-CGB, 3A2-I2D-CGB, 3A2-I3D-CGB, 3AD-I3I-CGB, 3A4-I2D-CGB, 2AS-I2I-CGB, 3F4-I2DA		GROUPS B, C, D
CSA APPROVED SAFETY BARRIER	30 V OR LESS 150 OHMS OR MORE	GROUPS C, D

LOW POWER, ("M" OUTPUT CODE)

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

* MAY BE USED WITH ROSEMOUNT MODEL 275 or 375 SMART FAMILY INTERFACE.

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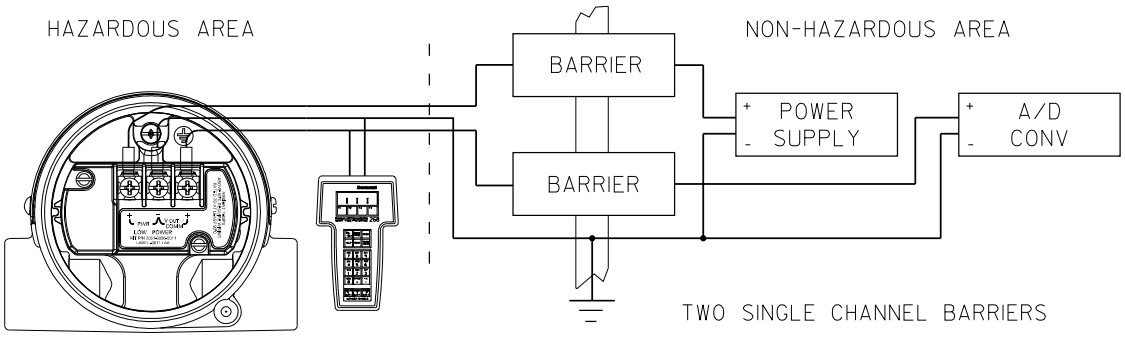
REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AB				

CSA INTRINSIC SAFETY APPROVALS

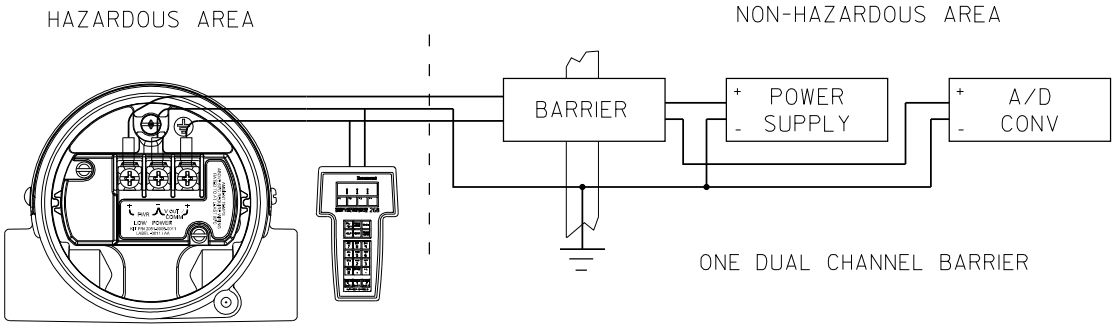
205IC LOW POWER CIRCUIT CONNECTION WITH INTRINSIC SAFETY BARRIERS

Ex ia

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



ROSEMOUNT MODEL 275 or 375



ROSEMOUNT MODEL 275 or 375

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

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

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AB				

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

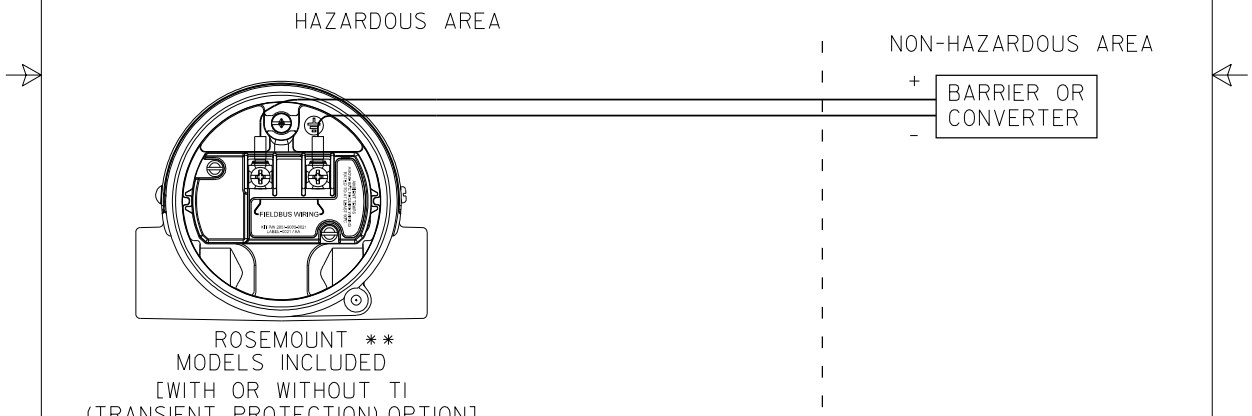
DEVICE	PARAMETERS	APPROVED FOR CLASS I, DIV.I
CSA APPROVED SAFETY BARRIER	30 V OR LESS 300 OHMS OR MORE 28 V OR LESS 235 OHMS OR MORE 25 V OR LESS 160 OHMS OR MORE 22 V OR LESS 100 OHMS OR MORE	GROUPS A, B, C, D

CSA INTRINSIC SAFETY APPROVALS

CIRCUIT CONNECTION WITH BARRIER OR CONVERTER

Ex ia

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



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

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

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

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

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

R = 90...100 OHMS C = 2.2µF

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

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

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

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REV	DESCRIPTION	CHG. NO.	APP'D	DATE
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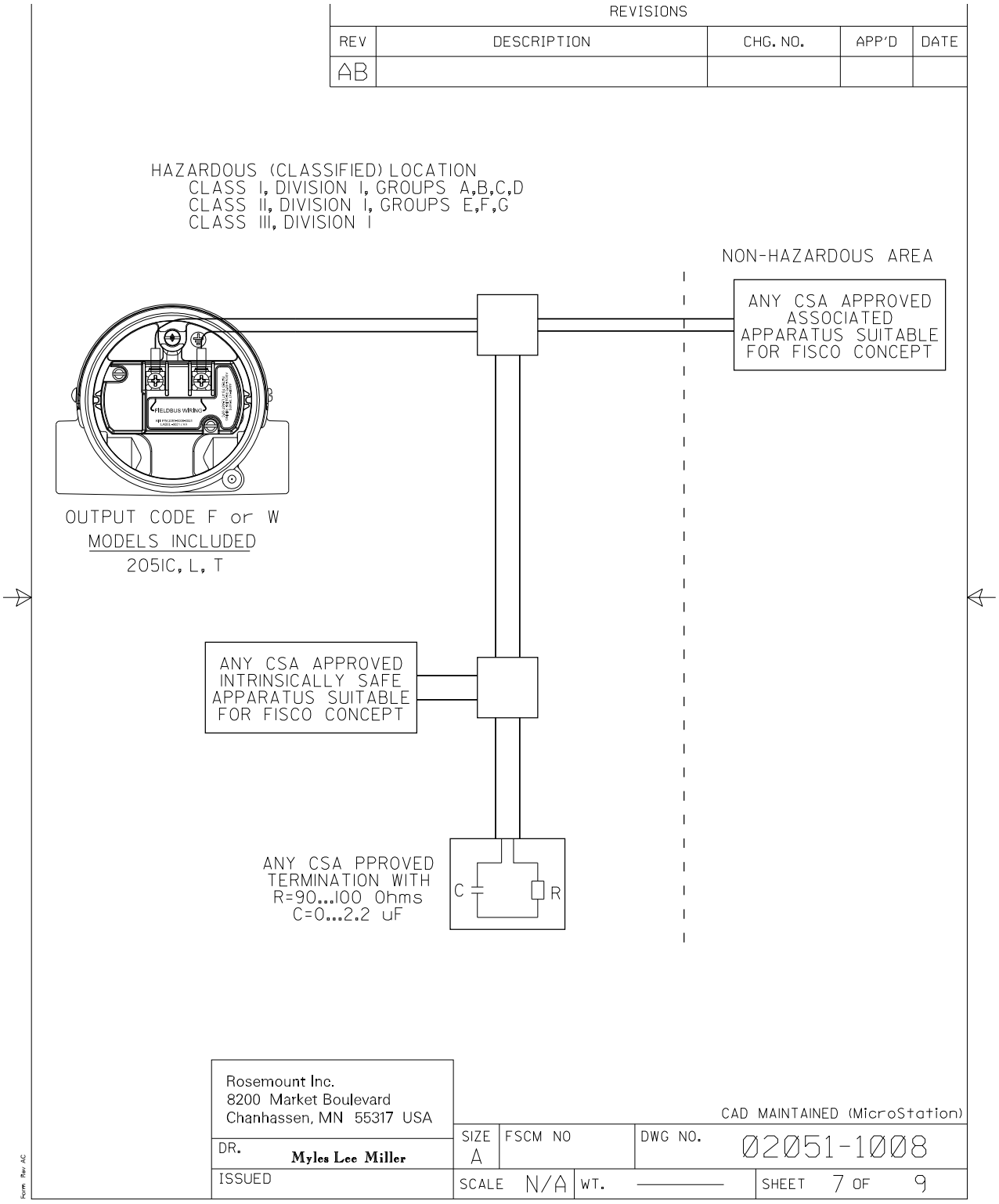

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REV	DESCRIPTION	CHG. NO.	APP'D	DATE
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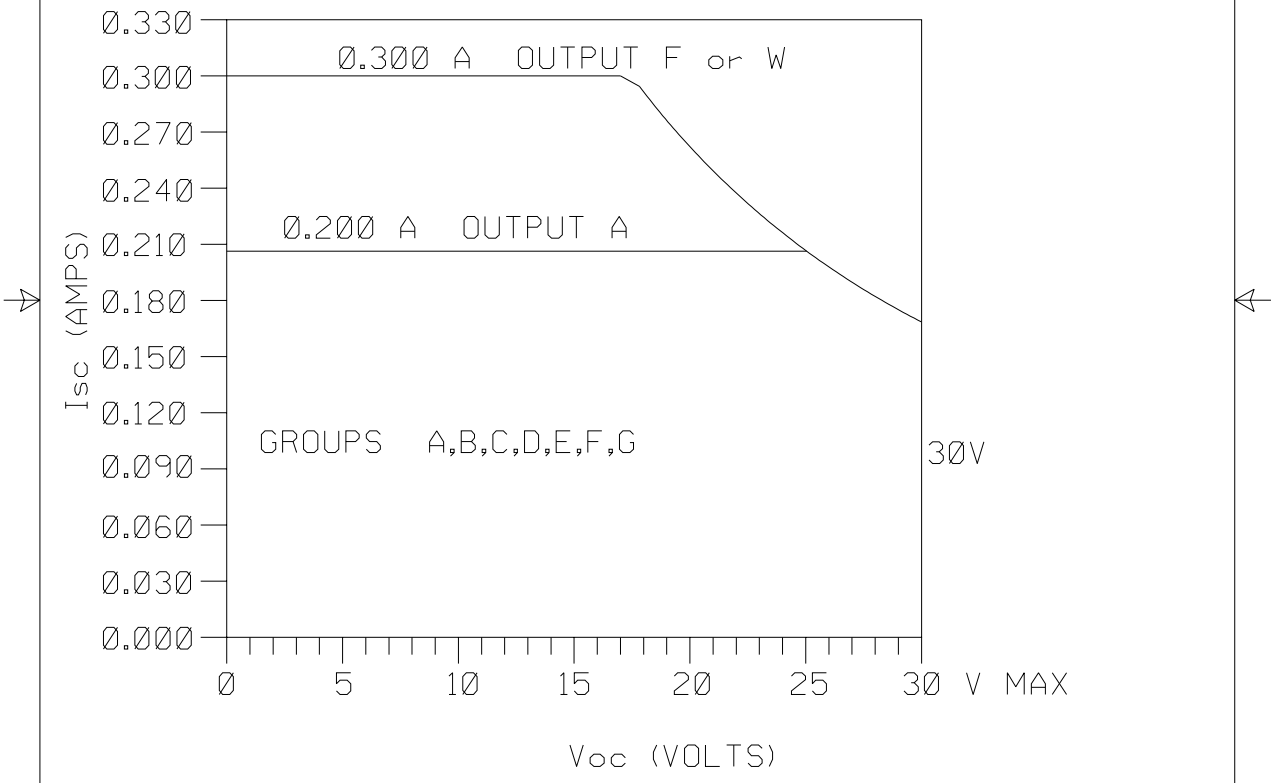
2051 I.S. ENTITY PARAMETERS. (OUTPUT CODE A,F, or W)

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

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



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REV	DESCRIPTION	CHG. NO.	APP'D	DATE
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_i) OF THE INTRINSICALLY SAFE APPARATUS, AND THE APPROVED MAX. ALLOWABLE CONNECTED INDUCTANCE (La) OF THE ASSOCIATED APPARATUS MUST BE GREATER THAN THE SUM OF THE INTERCONNECTING CABLE INDUCTANCE AND THE UNPROTECTED INTERNAL INDUCTANCE (L_i) OF THE INTRINSICALLY SAFE APPARATUS.

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

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

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

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

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

V_T = 30V	V_{OC} IS LESS THAN OR EQUAL TO 30V
I_T = 200mA	I_{SC} IS LESS THAN OR EQUAL TO 200mA
P_{MAX} = 1 WATT	$(\frac{Voc \times Isc}{4})$ IS LESS THAN OR EQUAL TO 1 WATT
C_I = .02µf	C_A IS GREATER THAN .01µf + C CABLE
L_I =10µH	L_A IS GREATER THAN 10µH + L CABLE

* FOR T1 OPTION:

L_I =Ø.75mH	

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

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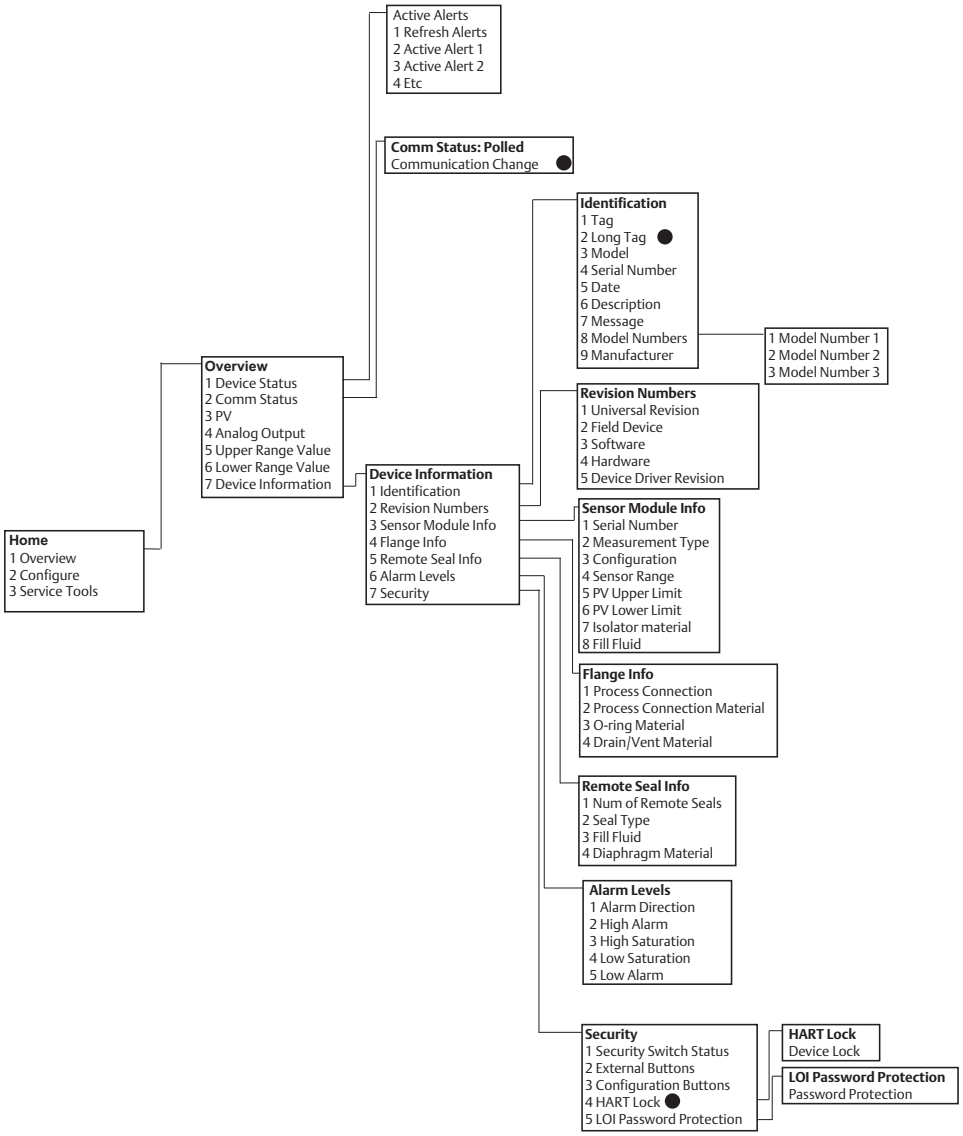
Appendix C Field Communicator Menu Trees and Fast Keys

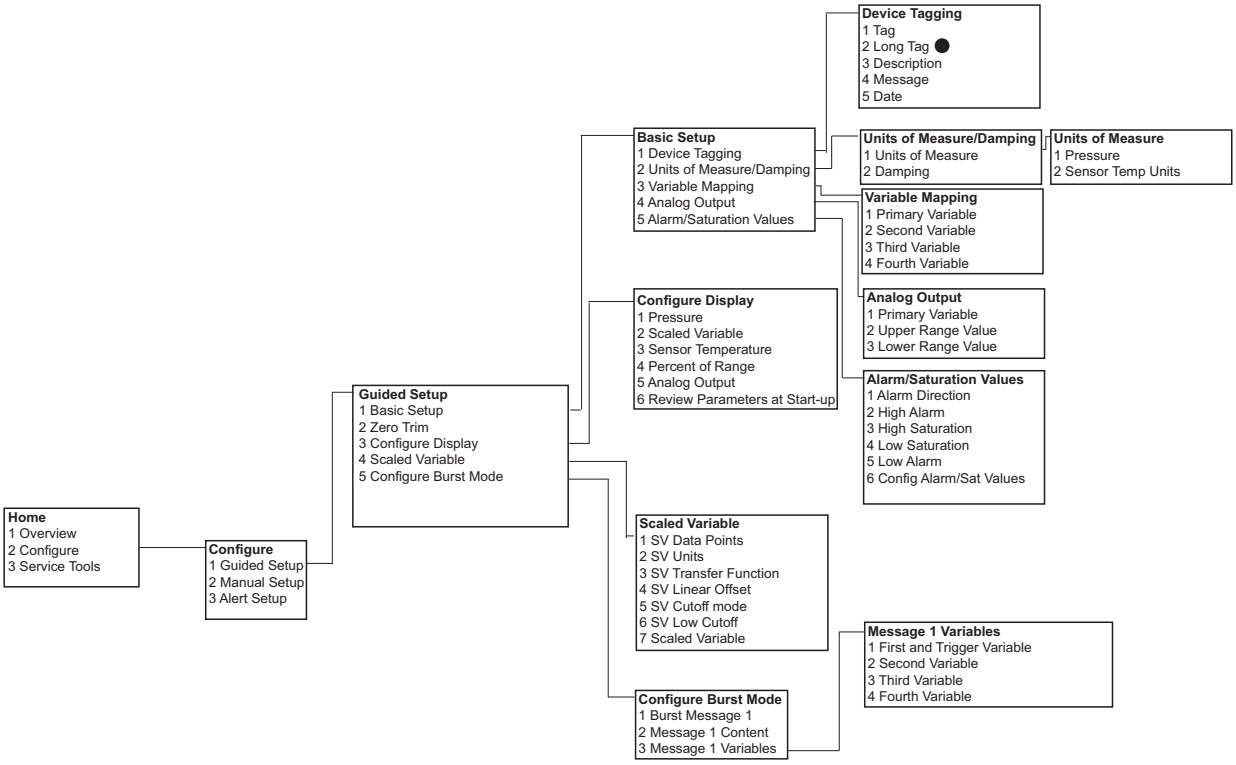
C.1 Field Communicator menu trees

Figure C-1. Rosemount™ 2051 Field Communicator Menu Tree: Overview



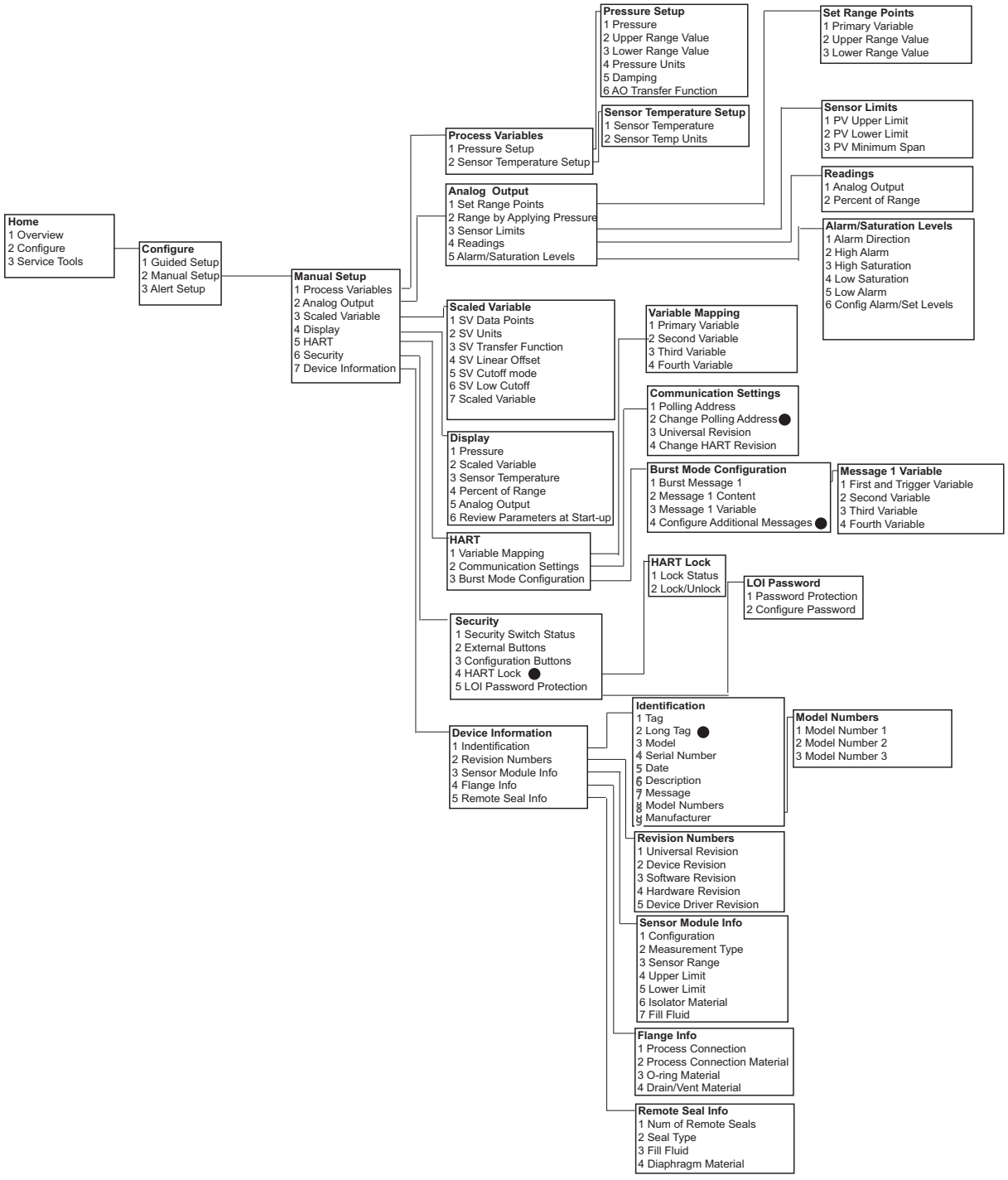
Selections with black circle are only available in HART® Revision 7 mode. Selection will not appear in HART Revision 5 DD.

Figure C-2. Rosemount 2051 Field Communicator menu tree: Configure - Guided Setup



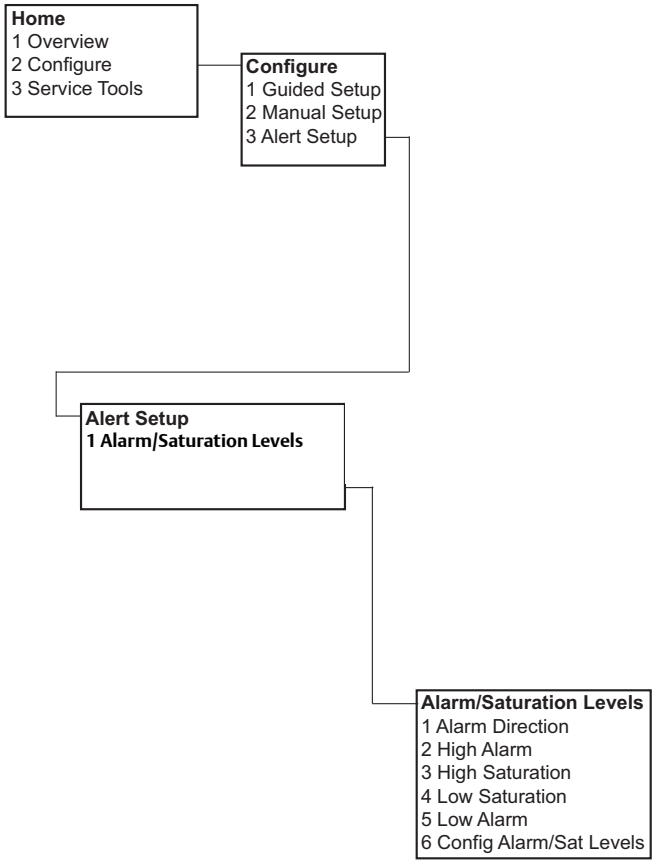
Selections with black circle are only available in HART Revision 7 mode. Selection will not appear in HART Revision 5 DD.

Figure C-3. Rosemount 2051 Field Communicator menu tree: Configure - Manual Setup



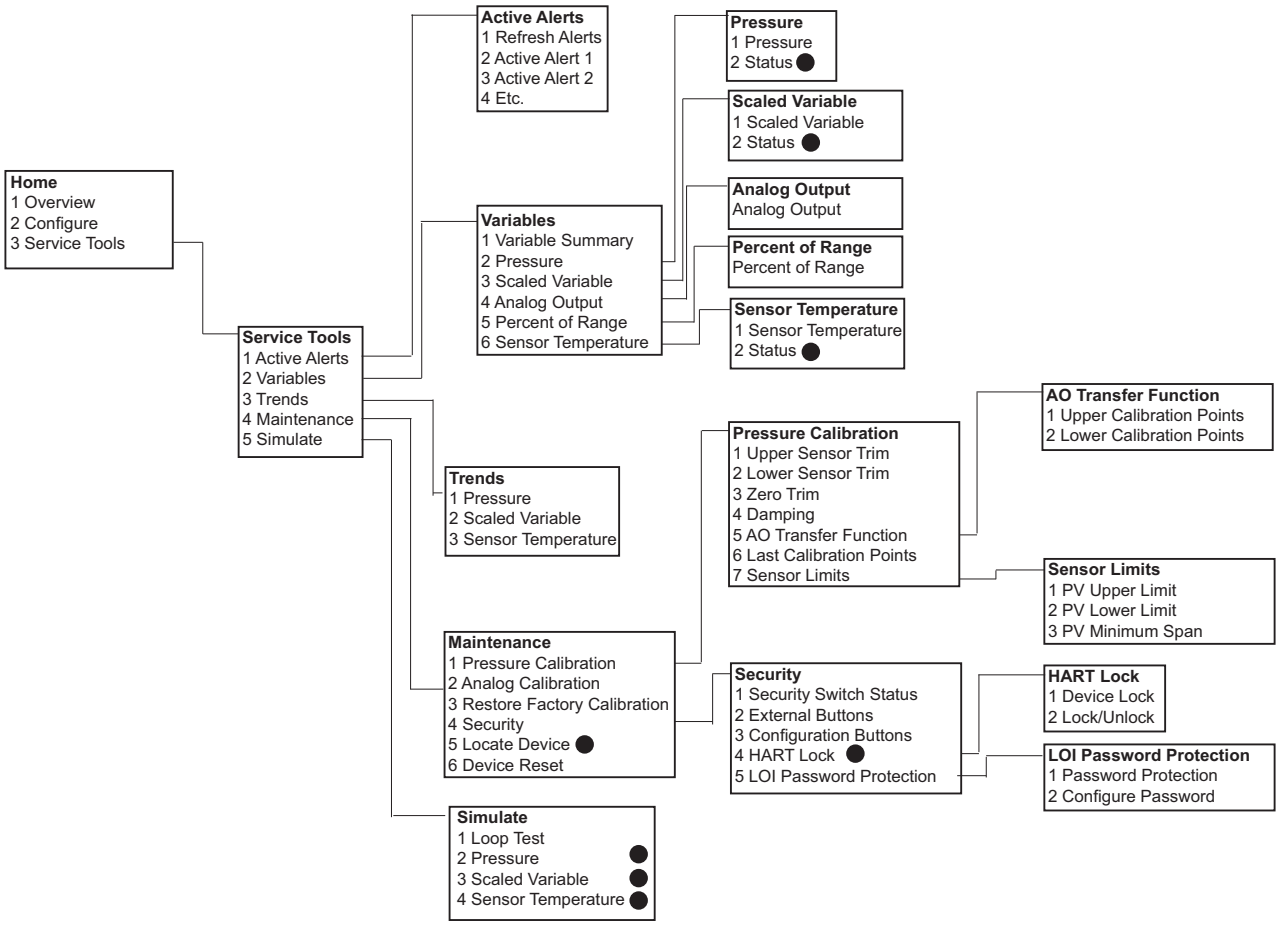
Selections with black circle are only available in HART Revision 7 mode. Selection will not appear in HART Revision 5 DD.

Figure C-4. Rosemount 2051 Field Communicator menu tree: Configure - Alert Setup



Selections with black circle are only available in HART Revision 7 mode. Selection will not appear in HART Revision 5 DD.

Figure C-5. Rosemount 2051 Field Communicator menu tree - Service Tools



Selections with black circle are only available in HART Revision 7 mode. Selection will not appear in HART Revision 5 DD.

C.2 Field Communicator Fast Keys

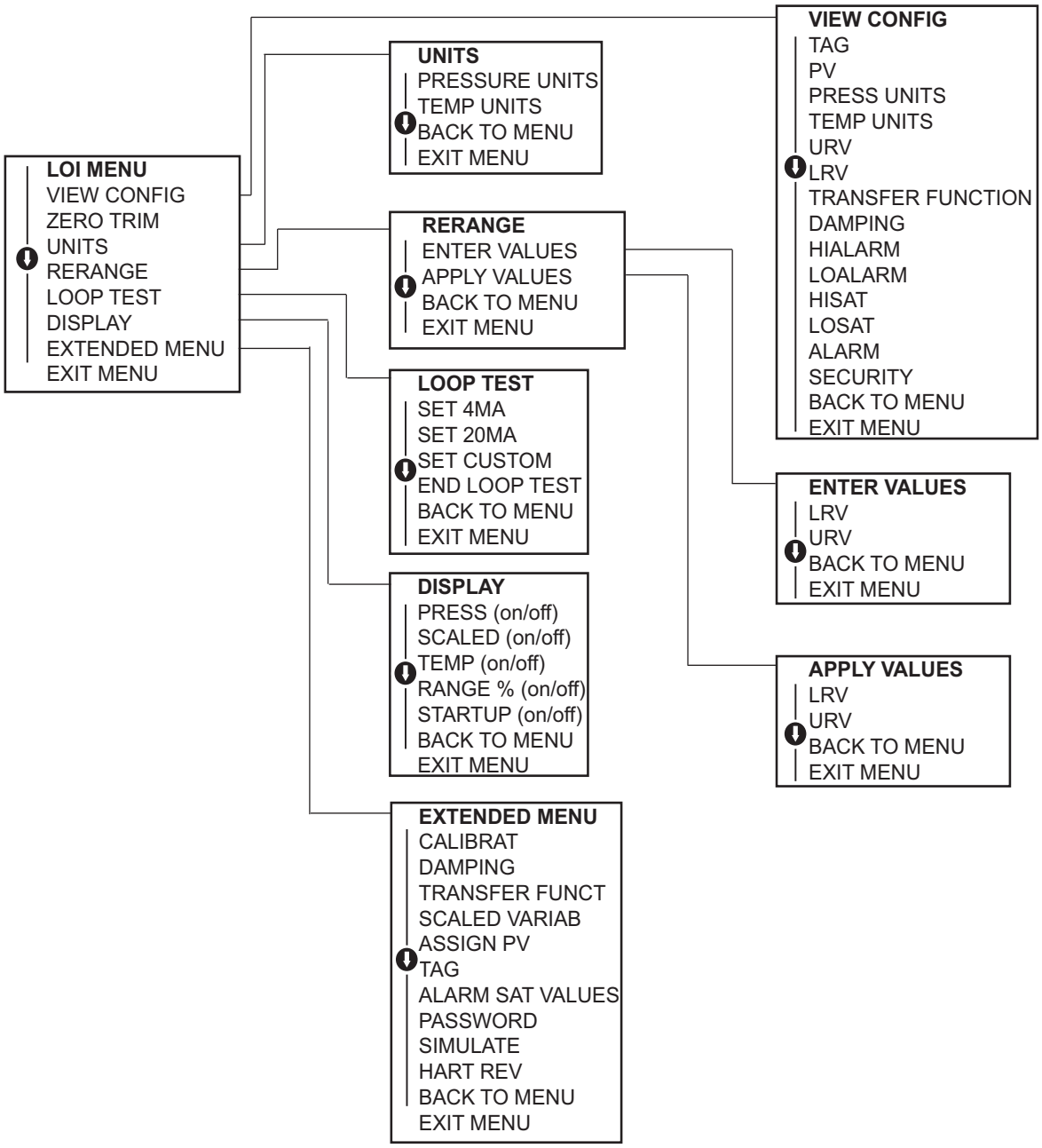
- A (✓) indicates the basic configuration parameters. At minimum these parameters should be verified as a part of configuration and startup.
- A (7) indicates availability only in HART revision 7 mode.

Table C-1. Device Revision 9 and 10 (HART7), DD Revision 1 Fast Key Sequence

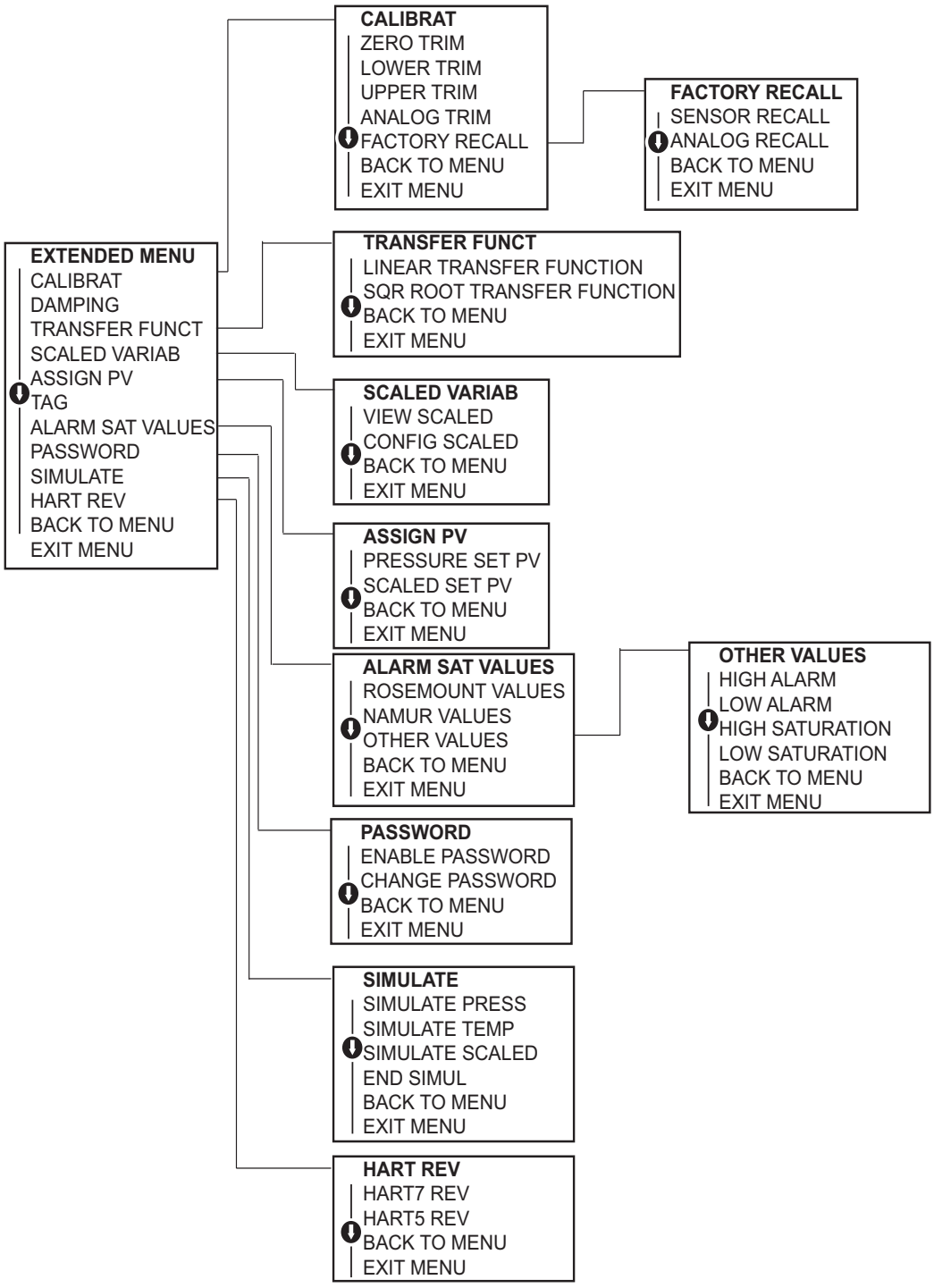
Function		Fast Key sequence	
		HART 7	HART 5
✓	Alarm and Saturation Levels	2, 2, 2, 5	2, 2, 2, 5
✓	Damping	2, 2, 1, 1, 5	2, 2, 1, 1, 5
✓	Primary Variable	2, 2, 5, 1, 1	2, 2, 5, 1, 1
✓	Range Values	2, 2, 2, 1	2, 2, 2, 1
✓	Tag	2, 2, 7, 1, 1	2, 2, 7, 1, 1
✓	Transfer Function	2, 2, 1, 1, 6	2, 2, 1, 1, 6
✓	Pressure Units	2, 2, 1, 1, 4	2, 2, 1, 1, 4
	Date	2, 2, 7, 1, 5	2, 2, 7, 1, 4
	Descriptor	2, 2, 7, 1, 6	2, 2, 7, 1, 5
	Digital to Analog Trim (4–20 mA / 1–5 V output)	3, 4, 2, 1	3, 4, 2, 1
	Digital Zero Trim	3, 4, 1, 3	3, 4, 1, 3
	Display Configuration	2, 2, 4	2, 2, 4
	LOI Password Protection	2, 2, 6, 5	2, 2, 6, 4
	Loop Test	3, 5, 1	3, 5, 1
	Lower Sensor Trim	3, 4, 1, 2	3, 4, 1, 2
	Message	2, 2, 7, 1, 7	2, 2, 7, 1, 6
	Pressure Trend	3, 3, 1	3, 3, 1
	Rerange with Keypad	2, 2, 2, 1	2, 2, 2, 1
	Scaled D/A Trim (4–20 mA / 1–5 V) output)	3, 4, 2, 2	3, 4, 2, 2
	Scaled Variable	2, 2, 3	2, 2, 3
	Sensor Temperature Trend	3, 3, 3	3, 3, 3
	Switch HART Revision	2, 2, 5, 2, 4	2, 2, 5, 2, 3
	Upper Sensor Trim	3, 4, 1, 1	3, 4, 1, 1
7	Long Tag	2, 2, 7, 1, 2	
7	Locate Device	3, 4, 5	
7	Simulate Digital Signal	3, 5	

Appendix D Local Operator Interface

D.1 LOI Menu Tree



D.2 LOI Menu Tree - Extended Menu



D.3 Number entry

Floating-point numbers can be entered with the LOI. All eight number locations on the top line can be used for number entry. Refer to Table 2-2 on page 11 for LOI button operation. Below is a floating-point number entry example for changing a value of “-0000022” to “000011.2”

Step	Instruction	Current position (indicated by underline)
1	When the number entry begins, the left most position is the selected position. In this example, the negative symbol, “-“, will be flashing on the screen.	-0000022
2	Press the scroll button until the “0” is blinking on the screen in the selected position.	00000022
3	Press the enter button to select the “0” as an entry. The second digit from the left will be blinking.	00000022
4	Press the enter button to select “0” for second digit. The third digit from the left will be blinking.	00000022
5	Press the enter button to select “0” for the third digit. The fourth digit from the left will now be blinking.	00000022
6	Press the enter button to select “0” for the fourth digit. The fifth digit from the left will now be blinking.	00000022
7	Press scroll to navigate through the numbers until the “1” is on the screen.	00001022
8	Press the enter button to select the “1” for the fifth digit. The sixth digit from the left will now be blinking.	00001022
9	Press scroll to navigate through the numbers until the “1”, is on the screen.	00001122
10	Press the enter button to select the “1” for the sixth digit. The seventh digit from the left will now be blinking.	00001122
11	Press scroll to navigate through the numbers until the decimal, “.”, is on the screen.	000011.2
12	Press the enter button to select the decimal, “.”, for the seventh digit. After pressing enter, all digits to the right of the decimal will now be zero. The eighth digit from the left will now be blinking.	000011.0
13	Press the scroll button to navigate through the numbers until the "2", is on the screen.	000011.2
14	Press the enter button to select the “2” for the eighth digit. The number entry will be complete and a “SAVE” screen will be shown.	000011.2

Usage notes:

- It is possible to move backwards in the number by scrolling to the left arrow symbol and pressing enter.
- The negative symbol is only allowed in the left most position.
- Numbers can be entered in scientific notation by placing an “E” in the 7th position.

D.4 Text entry

1. Text can be entered with the LOI. Depending on the edited item, up to eight locations on the top line can be used for text entry. Text entry follows the same rules as the number entry rules in "LOI Menu Tree" on page 185, except the following characters are available in all locations: A–Z, 0–9, –, /, space.

Usage note:

If the current text contains a character the LOI cannot display, it will be shown as an asterisk "*".

Global Headquarters
Emerson Automation Solutions
6021 Innovation Blvd.
Shakopee, MN 55379, USA
+1 800 999 9307 or +1 952 906 8888
+1 952 949 7001
RFQ.RMD-RCC@Emerson.com

North America Regional Office
Emerson Automation Solutions
8200 Market Blvd.
Chanhassen, MN 55317, USA
+1 800 999 9307 or +1 952 906 8888
+1 952 949 7001
RMT-NA.RCCRFQ@Emerson.com

Latin America Regional Office
Emerson Automation Solutions
1300 Concord Terrace, Suite 400
Sunrise, FL 33323, USA
+1 954 846 5030
+1 954 846 5121
RFQ.RMD-RCC@Emerson.com

Europe Regional Office
Emerson Automation Solutions Europe GmbH
Neuhofstrasse 19a P.O. Box 1046
CH 6340 Baar
Switzerland
+41 (0) 41 768 6111
+41 (0) 41 768 6300
RFQ.RMD-RCC@Emerson.com

Asia Pacific Regional Office
Emerson Automation Solutions Asia Pacific Pte Ltd
1 Pandan Crescent
Singapore 128461
+65 6777 8211
+65 6777 0947
Enquiries@AP.Emerson.com

Middle East and Africa Regional Office
Emerson Automation Solutions
Emerson FZE P.O. Box 17033
Jebel Ali Free Zone - South 2
Dubai, United Arab Emirates
+971 4 8118100
+971 4 8865465
RFQ.RMTMEA@Emerson.com

Linkedin.com/company/Emerson-Automation-Solutions

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