Reference Manual
00809-0300-4101, Rev BC
May 2024

Rosemount™ 2051 Pressure Transmitter

with PROFIBUS® PA Protocol

ROSEMOUNT™

EMERSON™

Safety messages

This guide provides basic guidelines for the Rosemount 2051 Pressure Transmitter. It does not provide instructions for configuration, diagnostics, maintenance, service, troubleshooting, explosion-proof, flameproof, or intrinsically safe (IS) installations.

⚠ 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 Quick Start Guide for any restrictions associated with a safe installation.

Before connecting a handheld communicator in an explosive atmosphere, ensure that 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 transmitter.

⚠ WARNING

Process leaks could result in death or serious injury.

Install and tighten process connectors before applying pressure.

Do not attempt to loosen or remove flange bolts while the transmitter is in service.

⚠ WARNING

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.

Before connecting a handheld communicator in an explosive atmosphere, ensure that 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 transmitter.

⚠ WARNING

Physical access

Unauthorized personnel may potentially cause significant damage to and/or misconfiguration of end users' equipment. This could be intentional or unintentional and needs to be protected against.

Physical security is an important part of any security program and fundamental in protecting your system. Restrict physical access by unauthorized personnel to protect end users' assets. This is true for all systems used within the facility.

⚠ WARNING

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

Use only bolts supplied or sold by Emerson as spare parts.

⚠ WARNING

Improper assembly of manifolds to traditional flange can damage sensor module.

For safe assembly of manifold to traditional flange, bolts must break back plane of flange web (bolt hole) but must not contact sensor module housing.

⚠ CAUTION

Improper assembly of manifolds to traditional flange can damage sensor module.

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

NOTICE

The products described in this document are NOT designed for nuclear-qualified applications. Using non-nuclear qualified products in applications that require nuclear-qualified hardware or products may cause inaccurate readings. For information on Rosemount nuclear-qualified products, contact your local Emerson Sales Representative.

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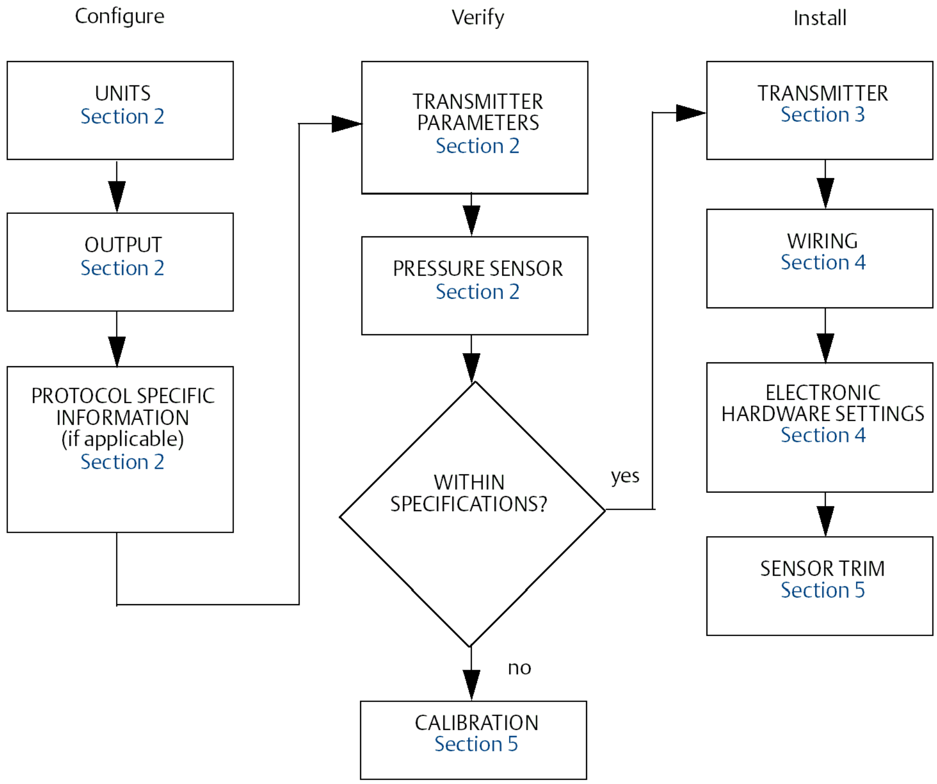
1 Introduction

1.1 Overview

Figure 1-1: Commissioning and Installation Flowchart



1.2 Models covered

The following Rosemount 2051 Transmitters are covered by this manual:

- Rosemount 2051C Coplanar™ Pressure Transmitter
- Rosemount 2051T In-Line Pressure Transmitter
  - Measures gauge/absolute pressure up to 10,000 psi (689.5 bar).
- Rosemount 2051L Level Transmitter
  - Measures level and specific gravity up to 300 psi (20.7 bar).
- Rosemount 2051CF Series Flow Meter
  - Measures flow in line sizes from ½-in. (15 mm) to 96 in. (2400 mm).

1.3 Device revisions

Table 1-1: Device Revisions

Date	Software revision	PROFIBUS profile	Compatible files	Manual revision
10/16	2.6.1	3.02	2051 GSD: rmt3333.gsd Profile 3.02 GSD: pa139700.gsd DD: ROPA3__TP_2051.ddl DTM: Pressure_Profibus_3.02_DTM_v1.0.8.exe	BB

1.4 Transmitter overview

The Rosemount 2051C Coplanar design is offered for Differential Pressure (DP), Gauge Pressure (GP) and Absolute Pressure (AP) measurements. The Rosemount 2051C utilizes Emerson capacitance sensor technology for DP and GP measurements. Piezoresistive sensor technology is utilized in the Rosemount 2051T.

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 (RTD), a memory module, and the capacitance to digital signal converter (C/D converter). The electrical signals from the sensor module are transmitted to the output electronics in the electronics housing. The electronics housing contains the output electronics board, the optional Local Operator Interface (LOI) buttons, and the terminal block.

For the Rosemount 2051C, design pressure is applied to the isolating diaphragms. The oil deflects the center diaphragm, which then changes the capacitance. This capacitance signal is then changed to a digital signal in the C/D converter. The microprocessor then takes the signals from the RTD and C/D converter calculates the correct output of the transmitter.

1.5 Product recycling/disposal

Consider recycling equipment and packaging.

Dispose of the product and packaging in accordance with local and national legislation.

2 Configuration

2.1 Hazardous locations certifications

Individual transmitters are clearly marked with a tag indicating the approvals they carry. Transmitters must be installed in accordance with all applicable codes and standards to maintain these certified ratings. Refer to the Rosemount 2051 Profibus® Quick Start Guide for information on these approvals.

2.2 Configuration guidelines

The Rosemount 2051 can be configured either before or after installation. Configuring the transmitter on the bench using the LOI or Class 2 Master ensures that all transmitter components are in working order prior to installation.

To configure on the bench, required equipment includes a power supply, an LOI (option M4) or a Class 2 Master with DP/PA coupler, proper cable and terminators.

Verify the security hardware jumper is set to the **OFF** position in order to proceed with configuration. See Figure 4-2 for jumper location.

2.2.1 Profile 3.02 identification number adaptation mode

Rosemount 2051 PROFIBUS® Profile 3.02 devices are set to identification number adaptation mode (0127) when shipped from the factory. This mode allows the transmitter to communicate with any PROFIBUS Class 1 Master with either the generic profile GSD (9700) or Rosemount 2051 specific GSD (3333).

2.2.2 Block modes

When configuring a device with the LOI, the output status will change to **Good – Function Check** to alert hosts that the transmitter is not in standard operation mode.

When configuring a device with a Class 2 Master, blocks must be set to **Out of Service** (OOS) in order to download parameters that could affect the output. This prevents the Class 1 Master from seeing a jump in output without a status change. Setting the blocks **OOS** and back into **Auto** might be done automatically using the Class 2 Master when using the Rosemount 2051 DD or DTM, if no additional action is required when configuring the device. Verify the block mode is set back to **Auto**.

2.2.3 Configuration tools

The Rosemount 2051 can be configured using two tools: LOI and/or Class 2 Master.

The LOI requires option code M4 to be ordered. To activate the LOI, push either configuration button located under the top tag of the transmitter. See Table 2-1 and Figure 2-1 for operation and menu information. See Local operator interface (LOI) menu for a complete LOI menu tree.

Class 2 Masters require either DD or DTM files for configuration. These files can be found at EmersonProcess.com/Rosemount or by contacting your local Emerson representative.

Some configurations steps may need to be completed in offline mode or using the LOI.

The remainder of this section will cover the configuration tasks using the applicable configuration tool.

Note
Instructions in this section use the language found in the Class 2 Master or LOI. See PROFIBUS® PA Block Information to cross reference parameters between the Class 2 Master, LOI and PROFIBUS specification.

2.3 Basic setup tasks

The following tasks are recommended for initial configuration of the Rosemount 2051 PROFIBUS® device.

2.3.1 Assign address

The Rosemount 2051 is shipped with a temporary address of 126. This must be changed to a unique value between 0 and 125 in order to establish communication with the Class 1 Master. Usually, addresses 0–2 are reserved for masters, therefore transmitter addresses between 3 and 125 are recommended for the device.

Address can be set using either:

- LOI: See Table 2-1 and Figure 2-1.
- Class 2 Master: See respective Class 2 Master manual for setting instrument addresses.

2.3.2 Pressure configuration

The Rosemount 2051 ships with the following settings:

- **Measurement type**: **Pressure**
- **Engineering units**: Inches H_2O
- **Linearization**: None
- **Scaling**: None

Each of these parameters can be set using:

- LOI: See Table 2-1 and Figure 2-1.
- Class 2 Master

Pressure unit parameters

The LOI was designed to automatically set the following parameters when selecting a pressure unit:

- **Measurement type: Pressure**
- **Linearization (Transducer Block):** None
- **Scaling:** None

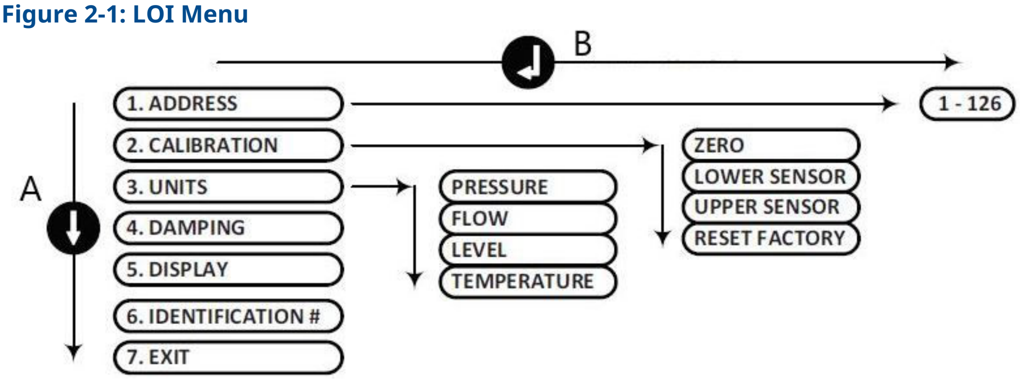
See Flow configuration or Square Root of DP Configuration for defaults when configuring with the LOI.

Table 2-1: LOI Operation

Button	Action	Navigation	Character entry	Save?
	Scroll	Moves down menu categories	Changes character value(1)	Changes between **Save** and **Cancel**
	Enter	Select menu category	Enters character and advances	**Saves**

(1) Characters flash when they can be changed.

Figure 2-1: LOI Menu



A. ***SCROLL** down list*
B. ***ENTER** into menu*

Note
See Local operator interface (LOI) menu for a more detailed LOI menu and unit list.

Pressure configuration using Class 2 Master

Procedure

1. From the **Basic Setup > Units > Primary Value > Primary Value Type** dropdown, select **Pressure**.
2. Select **Units**.

   Note
   Pressure units in steps Step 3, 3.a, and 3.b must match.

3. From the **Basic Setup > Units > Primary Value > Scale In (Transducer Block) > Unit (Secondary Value 1)** dropdown, select **Engineering Unit**.
   a) From the **Basic Setup > Units > Primary Value > Unit (PV)** dropdown, select **Engineering** unit.
   b) From the **Basic Setup > Units > Output Signal (Analog Input Block) > Unit (Out Scale)** dropdown, select **Engineering Unit**.
4. Enter scaling.

Note
Scaling is done in the Transducer Block.

5. In the **Basic Setup > Units > Primary Value > Scale In (Transducer Block)** field, enter upper and lower values (this value should correspond to the unit selected in step Step 3).
   a) In the **Basic Setup > Units > Primary Value > Scale Out (Transducer Block)** field, enter upper and lower values (this value should correspond to the unit selected in step 3.a).
6. Verify Analog Input (AI) Block.

Note
Scaling should not be repeated in the AI Block. To ensure no additional scaling is being done on the Al Block, set the lower values in steps Step 7 and 7.a to 0 and the upper values to 100.

7. In the **Basic Setup > Units > Process Value Scale (Analog Input Block)** field, enter upper and lower values (this value should correspond to the unit selected in step 3.a).
   a) In the **Basic Setup > Units > Output Signal (Analog Input Block)** field, enter upper and lower values (this value should correspond to the unit selected in step 3.b).
   b) From the **Basic Setup > Units > Output Signal (Analog Input Block) > Linearization Type** dropdown, select **No Linearization**.

2.4 Detailed setup tasks

The following tasks explain how to configure the Rosemount 2051 for Flow or Level measurement and how to configure additional parameters found in the device.

2.4.1 Flow configuration

LOI

To configure the Rosemount 2051 for flow measurement with the LOI, select **UNITS > FLOW**. When configuring flow units, the following parameters are set:

- **Measurement type: Flow**
- **Linearization (Transducer Block): Square Root**

During unit configuration, the user defines scaling, units and low flow cutoff per the application requirements. See Local operator interface (LOI) menu for detailed menu for further scaling help.

Note
The LOI assumes a zero based scaling (minimum pressure = minimum flow = zero) for Flow applications in order to improve configuration efficiency. Class 2 Masters can be used if non-zero based scaling is required. **Low Flow Cutoff** has a default value of 5.0%. **Low Flow Cutoff** can be set to 0% if required.

Class 2 Master

To configure the transmitter for a flow application, use the flow output in the Transducer Block.

Flow configuration using Class 2 Master:

Procedure

1. From the **Basic Setup > Units > Primary Value > Primary Value Type** dropdown, select **Flow**.
2. Select **Units**.

Note
Flow units in steps 3.a and 3.b must match.

3. From the **Basic Setup > Units > Primary Value > Scale In (Transducer Block) > Unit (Secondary Value 1)** dropdown, select **Engineering Unit**.
    a) From the **Basic Setup > Units > Primary Value > Unit (PV)** dropdown, select **Engineering Unit**.
    b) From the **Basic Setup > Units > Output Signal (Analog Input Block) > Unit (Out Scale)** dropdown, select **Engineering Unit**.
4. Enter scaling.

Note
Scaling is done in the Transducer Block.

5. In the **Basic Setup > Units > Primary Value > Scale In (Transducer Block)** field, enter upper and lower values (this value should correspond to the unit selected in step Step 3).
    a) In the **Basic Setup > Units > Primary Value > Scale Out (Transducer Block)** field, enter upper and lower values (this value should correspond to the unit selected in step 3.a).
6. Verify Analog Input (AI) Block.

Note
Scaling should always be done in the Transducer Block. Ensure the AI Block is always set to no linearization for flow applications. To ensure no additional scaling is being done on the AI Block, set the lower values in steps Step 7 and 7.a to 0 and the upper values to 100.

7. In the **Basic Setup > Units > Process Value Scale (Analog Input Block)** field, enter upper and lower values (this value should correspond to the unit selected in step 3.a).
    a) In the **Basic Setup > Units > Output Signal (Analog Input Block)** field, enter upper and lower values (this value should correspond to the unit selected in Step 3.b).
    b) From the **Basic Setup > Units > Output Signal (Analog Input Block) > Linearization Type** dropdown, select **No Linearization**.

2.4.2 Square Root of DP Configuration

The Rosemount 2051 has two Pressure output settings: **Linear** and **Square Root**. Activate the **Square Root** output option to make output proportional to flow.

To configure the transmitter to output square root of differential pressure, a Class 2 Master must be used.

Square Root configuration using Class 2 Master:

Procedure

1. From the **Basic Setup > Units > Primary Value > Primary Value Type** dropdown menu, select **Pressure**.
2. Select **Units**.

   Note
   Pressure units in steps Step 3, 3.a, and 3.b must match.

3. From the **Basic Setup > Units > Primary Value > Scale In (Transducer Block) > Unit (Secondary Value 1)** dropdown, select **Engineering Unit**.
   a) From the **Basic Setup > Units > Primary Value > Unit (PV)** dropdown, select **Engineering Unit**.
   b) From the **Basic Setup > Units > Output Signal (Analog Input Block) > Unit (Out Scale)** dropdown, select **Engineering Unit**.
4. Enter scaling.

   Note
   Scaling is done in the Transducer Block. No scaling required for pressure measurement.

5. In the **Basic Setup > Units > Primary Value > Scale In (Transducer Block)** field, enter upper and lower values (this value should correspond to the unit selected in step Step 3).
   a) In the **Basic Setup > Units > Primary Value > Scale Out (Transducer Block)** field, enter upper and lower values (this value should correspond to the unit selected in step 3.a).
6. Verify Analog Input (AI) Block.

   Note
   Scaling should not be repeated in the Analog Input Block. To ensure no additional scaling is being done on the AI Block, set the lower values in steps Step 7 and 7.a to 0 and the upper values to 100.

7. In the **Basic Setup > Units > Process Value Scale (Analog Input Block)** field, enter upper and lower values (this value should correspond to the unit selected in step 3.a).
   a) In the **Basic Setup > Units > Output Signal (Analog Input Block)** field, enter upper and lower values (this value should correspond to the unit selected in step 3.b).
   b) From the **Basic Setup > Units > Output Signal (Analog Input Block) > Linearization Type** dropdown, select **Square Root**.

2.4.3 Level configuration

LOI

To configure the Rosemount 2051 for Level measurement with the LOI, select **UNITS > LEVEL**. When configuring level units, the following parameters are set:

- **Measurement type:** Level
- **Linearization (Transducer Block):** None

During unit configuration, the user defines scaling and units per the application requirements. See Local operator interface (LOI) menu for detailed menu for further scaling help.

Level configuration using Class 2 Master

To configure the transmitter for a level application, use the level output in the Transducer Block.

Procedure

1. From the **Basic Setup > Units > Primary Value > Primary Value Type** dropdown, select **Level**.
2. Select units.

   Note
   Level units in steps 3.a and 3.b must match.

3. From the **Basic Setup > Units > Primary Value > Scale In (Transducer Block) > Unit (Secondary Value 1)** dropdown, select **Engineering Unit**.
   a) From the **Basic Setup > Units > Primary Value > Unit (PV)** dropdown, select **Engineering Unit**.
   b) From the **Basic Setup > Units > Output Signal (Analog Input Block) > Unit (Out Scale)** dropdown, select **Engineering Unit**.
4. Enter scaling.

   Note
   Scaling is done in the Transducer Block.

5. In the **Basic Setup > Units > Primary Value > Scale In (Transducer Block)** field, enter upper and lower values (this value should correspond to the unit selected in step Step 3).
   a) In the **Basic Setup > Units > Primary Value > Scale Out (Transducer Block)** field, enter upper and lower values (this value should correspond to the unit selected in step 3.a).
6. Verify Analog Input (AI) Block.

   Note
   Scaling should not be repeated in the AI Block. To ensure no additional scaling is being done on the AI Block, set the lower values in steps Step 7 and 7.a to 0 and the upper values to 100.

7. In the **Basic Setup > Units > Process Value Scale (Analog Input Block)** field, enter upper and lower values (this value should correspond to the unit selected in step 3.a).
   a) In the **Basic Setup > Units > Output Signal (Analog Input Block)** field, enter upper and lower values (this value should correspond to the unit selected in step 3.b).
   b) From the **Basic Setup > Units > Output Signal (Analog Input Block) > Linearization Type** dropdown, select **No Linearization**.

2.4.4 Damping

User-selected damping will affect the transmitters ability to respond to changes in the applied process. The Rosemount 2051 has a default **damping** value of 0.0 seconds applied in the AI Block.

Damping can be set using:

- LOI – See Table 2-1 and Figure 2-1.
- Class 2 Master – See Damping configuration using Class 2 Master.

Damping configuration using Class 2 Master

Procedure

In the **Basic Setup > Damping > Filter Time Const** field, enter value (in seconds).

2.4.5 Process alerts

Process alerts activate an output alert status when the configured alert point is exceeded. A process alert will be transmitted continuously if the output set points are exceeded. The alert will reset once the value returns within range.

Process alert parameters are defined as follows:

- **Upper alarm:** Changes **Output Status to Good – Critical Alarm – Hi Limit**
- **Upper warning:** Changes **Output Status to Good – Advisory Alarm – Hi Limit**
- **Lower warning:** Changes **Output Status to Good – Advisory Alarm – Lo Limit**
- **Lower alarm:** Changes **Output Status to Good – Critical Alarm – Lo Limit**
- **Alarm hysteresis:** Amount the output value must pass back into range before alarm is cleared.

Upper alarm = 100 psi. **Alarm Hysteresis** = 0.5%. After activation at 100 psi, the alarm will clear once the output goes below 99.5 psi = 100 – 0.5 psi.

Process alerts can be set using a Class 2 Master.

Process alert configuration using Class 2 Master

Procedure

Enter process alerts:

a) In the **Basic Setup > Output > Output Limits > Upper Limit Alarm Limits** field, enter upper alarm value.

b) In the **Basic Setup > Output > Output Limits > Upper Limit Warning Limits** field, enter upper warning value.

c) In the **Basic Setup > Output > Output Limits > Lower Limit Alarm Limits** field, enter lower alarm value.

d) In the **Basic Setup > Output > Output Limits > Lower Limit Warning Limits** field, enter lower warning value.

e) In the **Basic Setup > Output > Output Limits > Limit Hysteresis** field, enter a percent of range value.

2.4.6 LCD display

The LCD display connects directly to the electronics board which maintains direct access to the signal terminals. A display cover is provided to accommodate the display.

The display always indicates the transmitter output (**Pressure**, **Flow**, or **Level**) as well as abbreviated diagnostic status when applicable. Sensor temperature and pressure are optional variables that can be configured using LOI or Class 2 Master. When turned on, the display will alternate between the selected variables.

For LCD display configuration using:

- LOI – See Table 2-1 and Figure 2-1.
- Class 2 Master – See LCD display configuration using Class 2 Master.

LCD display configuration using Class 2 Master

In **Basic Setup > Display Variables > Local Operator Interface (LOI) > Display Selection**, select the process variables to be shown on the local display.

2.4.7 Security

The Rosemount 2051 has a hierarchy of security features. The security jumper on the electronics board (or optional LCD display) provides the highest level of security. With the jumper in the **ON** position, all writes to the transmitter will be disabled (including writes from the LOI or a Class 2 Master).

See Figure 4-2 for details on jumper configuration.

2.4.8 LOI security

To prevent unauthorized changes, either set the security jumper to **ON** and/or set an LOI password (Refer to Configuring security and simulation). The LOI password requires a user to enter a non-zero four digit password at the transmitter in order to operate the LOI.

These parameters can be set using a Class 2 Master.

LOI security configuration using Class 2 Master

Procedure

1. To turn on the LOI password, enter value in the **Basic Setup > Display Variables > Local Operator Interface (LOI) > Password** field.
2. To turn off the LOI password, enter 0 in the **Basic Setup > Display Variables > Local Operator Interface (LOI) > Password** field.

Note
Security jumper must be in the **Off** position for the LOI to operate. The password appears after the LOI is activated using the local configuration buttons.

2.4.9 Simulation

The Rosemount 2051 has a simulation jumper located on the electronics board (or optional LCD display) that must be set to the **ON** position in order to simulate.

With the AI block simulation enabled, the actual measurement value has no impact on the **OUT** value or the status.

Simulation configuration using Class 2 Master

Procedure

1. Set the simulation jumper to **On**.
2. To enable simulation, select the following in **Basic Setup > Simulation**:
    a) Select **Enabled**.
    b) Enter **Simulation Value**.
    c) Select **Simulation Status**.
    d) Select **Transfer**.
3. To disable simulation, select the following in **Basic Setup > Simulation**:
    a) Select **Disabled**.
    b) Select **Transfer**.
4. Set the simulation jumper to **Off**.

3 Hardware installation

3.1 Overview

The information in this section covers installation considerations for the Rosemount 2051 with protocols. A Quick Start Guide (document number 00825-0200-4101) is shipped with every transmitter to describe recommended pipe-fitting and wiring procedures for initial installation. For dimensional drawing information, refer to the Dimensional Drawings section of the Rosemount 2051 Product Data Sheet.

Note
For transmitter disassembly and reassembly refer to the Dimensional Drawings section of the Rosemount 2051 Product Data Sheet and Reassembly procedures.

3.2 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.

NOTICE

Install the enclosed pipe plug in unused conduit opening. Engage a minimum of five threads to comply with explosion-proof requirements. For tapered threads, install the plug wrench tight. For material compatibility considerations, see Material Selection and Compatibility Considerations for Rosemount Pressure Transmitter Technical Note.

3.2.1 Mechanical considerations

Steam service

NOTICE

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.

Keep drain/vent connections on the bottom for gas service and on the top for liquid service.

3.2.2 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). Mount the transmitter so that it is not susceptible to vibration and mechanical shock and does not have external contact with corrosive materials.

3.3 Installation procedures

3.3.1 Mounting the transmitter

For dimensional drawing information refer to the *Dimensional Drawings* section of the Rosemount 2051 Product Data Sheet.

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.

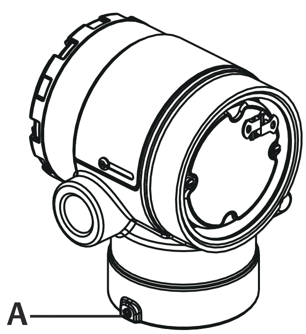
Rotate housing

You can rotate the electronics housing up to 180 degrees in either direction to improve field access to wiring or to better view the optional LCD display.

Procedure

1. Loosen the housing rotation set screw using a 5/64-inch hex wrench.

Figure 3-1: Housing rotation



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

2. Rotate the housing clockwise to the desired location.
3. If the desired location cannot be achieved due to thread limitation, rotate the housing counterclockwise to the desired location (up to 360° from thread limit).
4. Retighten the housing rotation set screw to no more than 7 in.-lbs. when desired location is reached.

Terminal side of electronics housing

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

Circuit side of electronics housing

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

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.

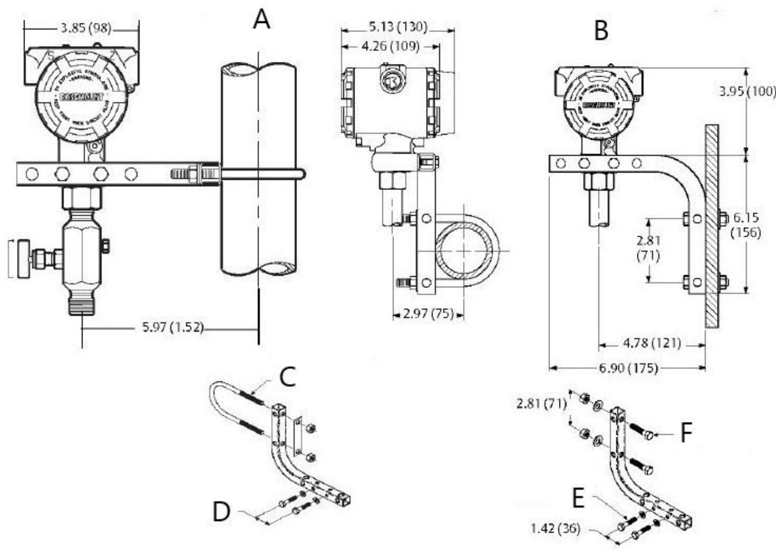
Mounting brackets

Transmitters 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 3-5 for dimensions and mounting configurations.

Table 3-1: Mounting Brackets

2051 brackets										
Option code	**Process connections**			**Mounting**			**Materials**			
	Coplanar	**In-line**	**Traditional**	**Pipe mount**	**Panel mount**	**Flat panel mount**	**CS bracket**	**SST bracket**	**CS bolts**	**SST bolts**
B4	✓	✓	N/A	✓	✓	✓	N/A	✓	N/A	✓
B1	N/A	N/A	✓	✓	N/A	N/A	✓	N/A	✓	N/A
B2	N/A	N/A	✓	N/A	✓	N/A	✓	N/A	✓	N/A
B3	N/A	N/A	✓	N/A	N/A	✓	✓	N/A	✓	N/A
B7	N/A	N/A	✓	✓	N/A	N/A	✓	N/A	N/A	✓
B8	N/A	N/A	✓	N/A	✓	N/A	✓	N/A	N/A	✓
B9	N/A	N/A	✓	N/A	N/A	✓	✓	N/A	N/A	✓
BA	N/A	N/A	✓	✓	N/A	N/A	N/A	✓	N/A	✓
BC	N/A	N/A	✓	N/A	N/A	✓	N/A	✓	N/A	✓

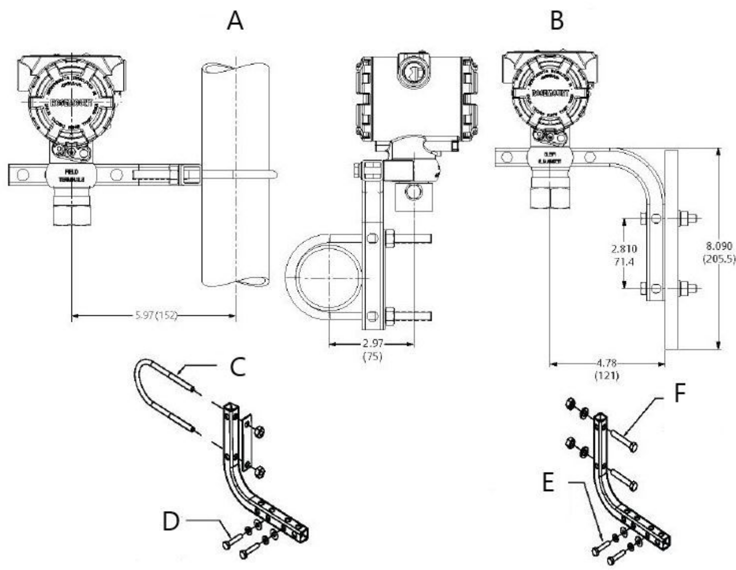
Figure 3-2: Mounting Bracket Option Code B4



A. Pipe mounting
B. Panel mounting
C. 2-in. U-Bolt for pipe mounting (clamp shown)
D. ¼ x 1 ¼ Bolts for transmitter mounting (not supplied)
E. ¼ x 1 ¼ Bolts for transmitt mounting (not supplied)
F. 5/16 x 1 ½ Bolts for panel mounting (not supplied)

Note
Dimensions are in inches (millimeters).

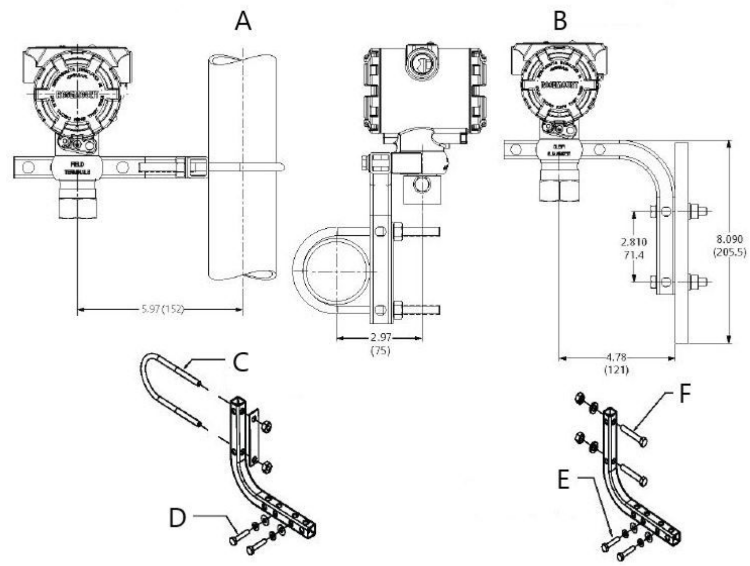
Figure 3-3: Mounting Bracket Option Code B4



A. Pipe mounting
B. Panel mounting
C. 2-in. U-Bolt for pipe mounting (clamp shown)
D. ¼ x 1 ¼ Bolts for transmitter mounting (not supplied)
E. ¼ x 1 ¼ Bolts for transmitt mounting (not supplied)
F. 5/16 x 1 ½ Bolts for panel mounting (not supplied)

Note
Dimensions are in inches (millimeters).

Figure 3-4: Mounting Bracket Option Code B4

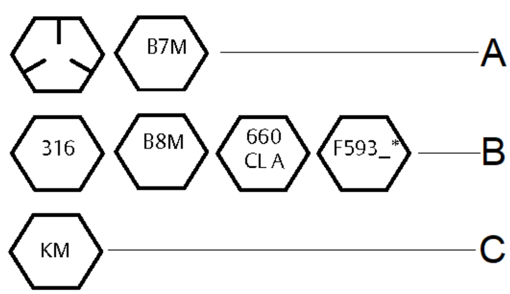


A. *Pipe mounting*
B. *Panel mounting*
C. *2-in. U-Bolt for pipe mounting (clamp shown)*
D. *¼ x 1 ¼ Bolts for transmitter mounting (not supplied)*
E. *¼ x 1 ¼ Bolts for transmitt mounting (not supplied)*
F. *5/16 x 1 ½ Bolts for panel mounting (not supplied)*

Note

Dimensions are in inches (millimeters).

Figure 3-5: Head Markings



* The last digit in the F593 heading marking may be any letter between A and M.

A. *Carbon Steel (CS) Head Markings*
B. *Stainless Steel (SST) Head Markings*
C. *Alloy K-500 Head Markings*

Flange bolts

The 2051 is shipped with a coplanar flange installed with four 1.75-in. (44 mm) flange bolts. See Figure 3-6 and Figure 3-8. Stainless steel bolts are coated with a lubricant to ease installation. Carbon steel bolts do not require lubrication. No additional lubricant should be applied when installing either type of bolt. Bolts are identified by their head markings:

Bolt installation

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

Procedure

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

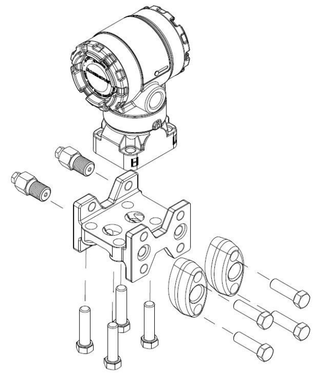
Example

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

Table 3-2: Bolt Installation Torque Values

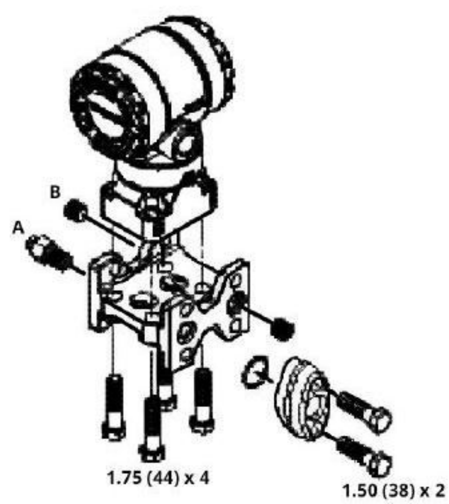
Bolt material	Initial torque value	Final torque value
CS-ASTM-A449 Standard	300 in-lb. (34 N-m)	650 in-lb. (73 N-m)
316 SST—Option L4	150 in-lb. (17 N-m)	300 in-lb. (34 N-m)
ASTM-A-193-B7M—Option L5	300 in-lb. (34 N-m)	650 in-lb. (73 N-m)
ASTM-A-193 Class 2, Grade B8M—Option L8	150 in-lb. (17 N-m)	300 in-lb. (34 N-m)

Figure 3-6: Traditional Flange Bolt Configurations - Differential transmitter



A. Drain/vent

Figure 3-7: Traditional Flange Bolt Configurations - Gauge transmitter

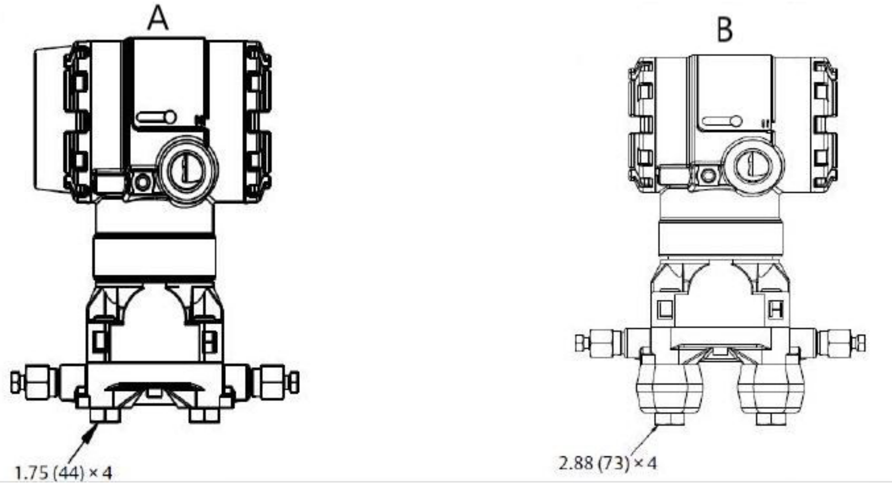


A. Drain/vent
B. Plug

Note

Dimensions are in inches (millimeters).

Figure 3-8: Mounting Bolts and Bolt Configurations for Coplanar Flange



A. *Transmitter with Flange Bolts*
B. *Transmitter with Flange Adapters a Flange/Adapter Bolts*

Note
Dimensions are in inches (millimeters).

Table 3-3:

Description	Size in inches (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.

3.3.2 Impulse piping

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

- Pressure transfer
- Leaks
- Friction loss (particularly if purging is used)
- Trapped gas in a liquid line
- Liquid in a gas line
- Density variations between the legs

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

- Keep impulse piping as short as possible.

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

Mounting requirements

Impulse piping configurations depend on specific measurement conditions.

Refer to Figure 3-9 for examples of the following mounting configurations:

Liquid flow measurement

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

Gas flow measurement

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

Steam flow measurement

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

NOTICE

For steam or other elevated temperature services, it is important that temperatures at the process connection do not exceed the transmitter's process temperature limits. See Temperature Limits in the 2051 Pressure Transmitter Product Data Sheet for details.

Figure 3-9: Liquid applications installation example

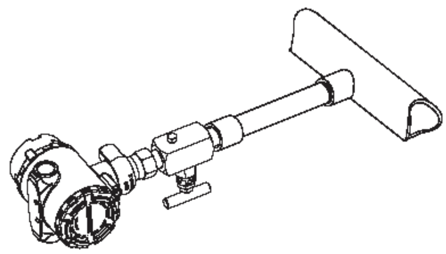


Figure 3-10: Gas applications installation example

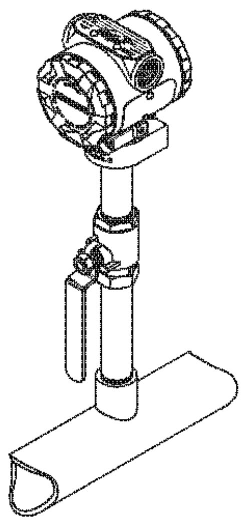


Figure 3-11: Steam applications installation example

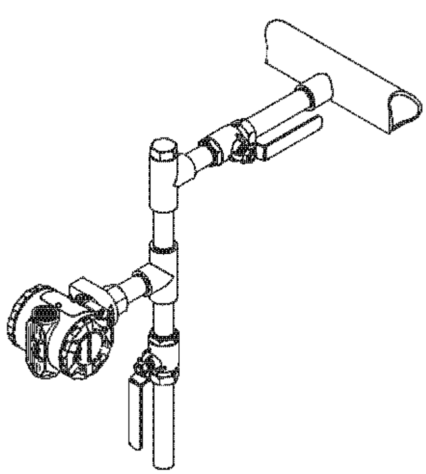
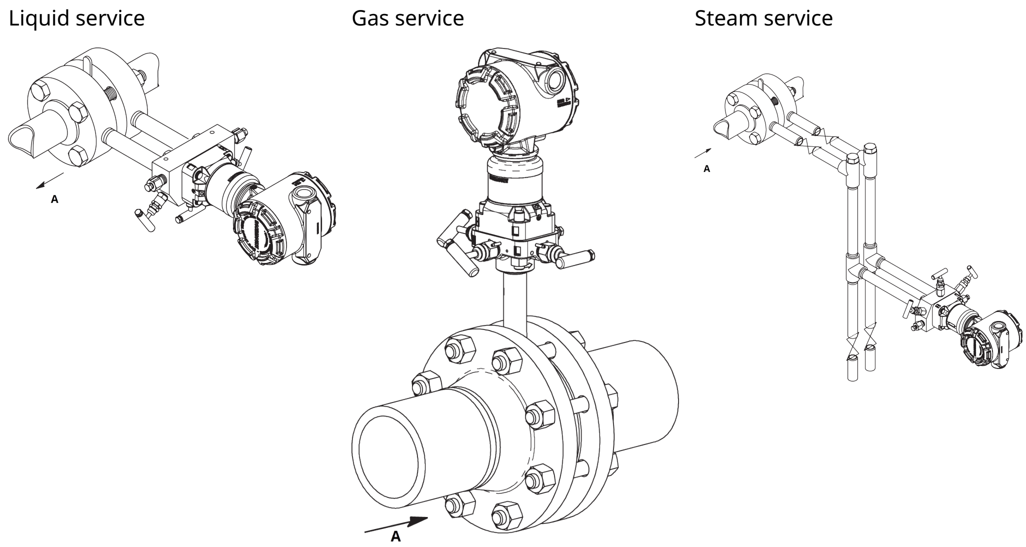


Figure 3-12: Installation examples



A. Flow

3.3.3 Process connections

Coplanar or traditional process connection

NOTICE

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.

⚠ CAUTION

Do not attempt to loosen or remove the flange bolts while the transmitter is in service.

Install flange adapters

Rosemount 2051DP and GP process connections on the transmitter flanges are ¼–18 NPT. Flange adapters are available with standard ½–14 NPT Class 2 connections. Use the flange adapters to disconnect from the process by removing the flange adapter bolts.

⚠ WARNING

Process leaks

Process leaks could result in death or serious injury.

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

Use plant-approved lubricant or sealant when making the process connections. This distance may be varied ±⅛ in. (3.2 mm) by rotating one or both of the flange adapters.

To install adapters to a coplanar flange:

Procedure

1. Remove the flange bolts.

   Whenever you remove flanges or adapters, visually inspect the PTFE O-rings. If there are any signs of damage, such as nicks or cuts, replace the O-rings with O-rings designed for Rosemount transmitters. You may reuse undamaged O-rings. If you replace the O-rings, retorque the flange bolts after installation to compensate for cold flow.
2. Leaving the flange in place, move the adapters into position with the O-rings installed.
3. Clamp the adapters and the coplanar flange to the transmitter sensor module using the larger of the bolts supplied.
4. Tighten the bolts. Refer to Flange bolts for torque specifications.

O-rings

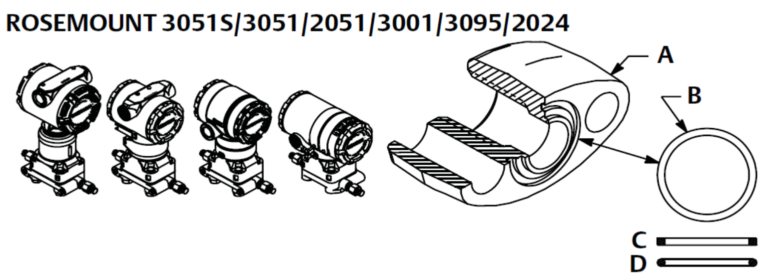
The two styles of Rosemount flange adapters (Rosemount 3051/2051/2024/3095) each require a unique O-ring (see Figure 3-13). Use only the O-ring designed for the corresponding flange adapter.

⚠ 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 that is designed for its specific flange adapter, as shown in Figure 3-13. When compressed, PTFE O-rings tend to cold flow, which aids in their sealing capabilities.

Figure 3-13: O-rings



A. *Flange adapter*
B. *O-ring*
C. *PFTE based*
D. *Elastomer*

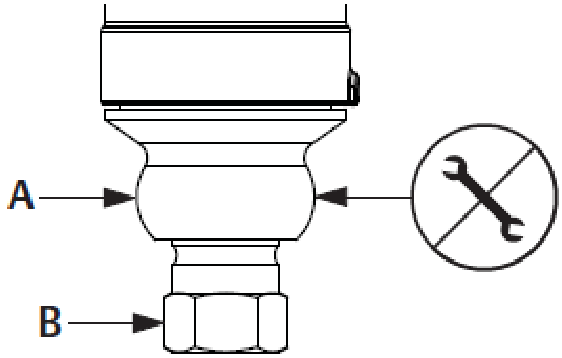
NOTICE

Replace PTFE O-rings if you remove the flange adapter.

3.3.4 Inline process connection

NOTICE

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



A. Sensor module

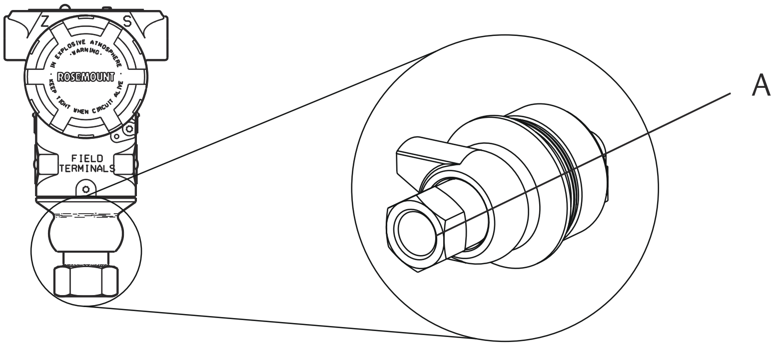
B. Process connection

Inline gauge transmitter orientation

The low side pressure port on the inline gauge 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 3-14.

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 3-14: Inline gauge low side pressure port



A. Low side pressure port (atmospheric reference)

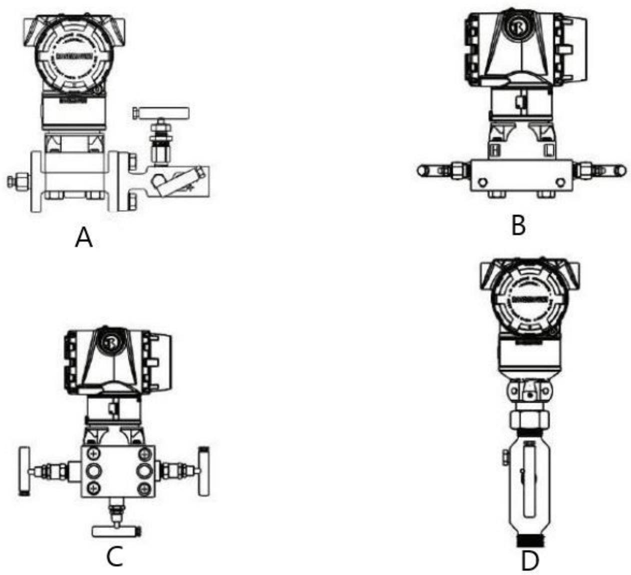
3.4 Rosemount 304, 305, and 306 Manifolds

The 305 Integral Manifold is available in two designs: Traditional and Coplanar.

You can mount the traditional 305 Integral Manifold to most primary elements with mounting adapters in the market today. The 306 Integral Manifold is used with the 2051T

In-Line Transmitters to provide block-and-bleed valve capabilities of up to 10,000 psi (690 bar).

Figure 3-15: Manifolds



A. 2051C and 304 Conventional
B. 2051C and 305 Integral Coplanar
C. 2051C and 305 Integral Traditional
D. 2051T and 306 In-Line

3.4.1 Install 305 Integral Manifold

Procedure

1. Inspect the PTFE sensor module O-rings.

   You may reuse undamaged O-rings. If the O-rings are damaged (if they have nicks or cuts, for example), replace with O-rings designed for Rosemount transmitters.

   NOTICE

   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 2¼-inch (57 mm) manifold bolts for alignment. Finger tighten the bolts; then tighten the bolts incrementally in a cross pattern to final torque value.
3. If you have replaced the PTFE sensor module O-rings, re-tighten the flange bolts after installation to compensate for cold flow of the O-rings.

   NOTICE

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

3.4.2 Install Rosemount 306 Integral Manifold

The 306 Manifold is for use only with in-line pressure transmitters, such as the 3051T and 2051T.

Assemble the 306 Manifold to the in-line transmitters with a thread sealant.

3.4.3 Install 304 Conventional Manifold

Procedure

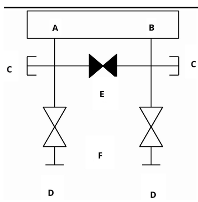
1. Align the conventional manifold with the transmitter flange. Use the four manifold bolts for alignment.
2. Finger tighten the bolts; then tighten the bolts incrementally in a cross pattern to the final torque value.
   When fully tightened, the bolts extend through the top of the sensor module housing.
3. Leak-check assembly to maximum pressure range of transmitter.

3.4.4 Integral manifold operation

Perform a zero trim on 3 and 5-valve manifolds

Perform zero trim at static line pressure.

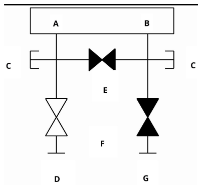
In normal operation, the two isolate (block) valves between the process ports and the transmitter will be open, and the equalize valve will be closed.



A. High
B. Low
C. Drain/vent valve
D. Isolate (open)
E. Equalize (closed)
F. Process

Procedure

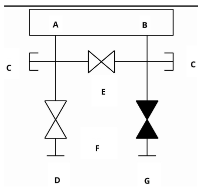
1. To zero trim the transmitter, close the isolate valve on the low side (downstream) side of the transmitter.



A. High
B. Low
C. Drain/vent valve
D. Isolate (open)
E. Equalize (closed)
F. Process
G. Isolate (closed)

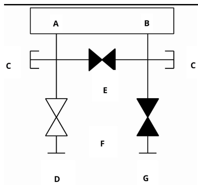
2. Open the equalize valve to equalize the pressure on both sides of the transmitter.

   The manifold is now in the proper configuration for performing a zero trim on the transmitter.



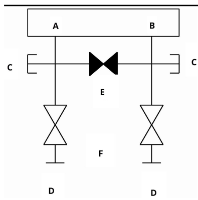
A. High
B. Low
C. Drain/vent valve
D. Isolate (open)
E. Equalize (open)
F. Process
G. Isolate (closed)

3. After zeroing the transmitter, close the equalize valve.



A. High
B. Low
C. Drain/vent valve
D. Isolate (open)
E. Equalize (closed)
F. Process
G. Isolate (closed)

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

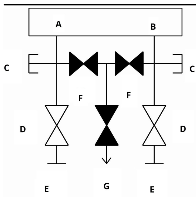


A. High
B. Low
C. Drain/vent valve
D. Isolate (open)
E. Equalize (closed)
F. Process

Zero a five-valve natural gas manifold

Perform zero trim at static line pressure.

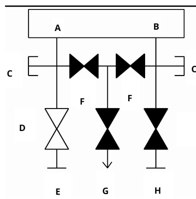
In normal operation, the two isolate (block) valves between the process ports and the transmitter will be open, and the equalize valves will be closed. Vent valves may be open or closed.



A. High
B. Low
C. Plugged
D. Isolate (open)
E. Process
F. Equalize (closed)
G. Drain vent (closed)

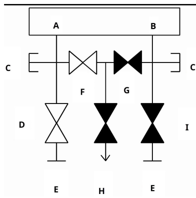
Procedure

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



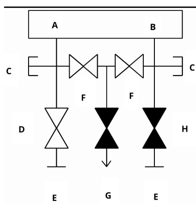
A. High
B. Low
C. Plugged
D. Isolate (open)
E. Process
F. Equalize (closed)
G. Drain vent (closed)
H. Isolate (closed)

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



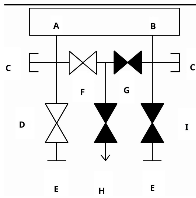
A. High
B. Low
C. Plugged
D. Isolate (open)
E. Process
F. Equalize (open)
G. Equalize (closed)
H. Drain vent (closed)
I. Isolate (closed)

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



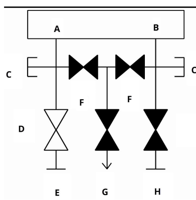
A. High
B. Low
C. Plugged
D. Isolate (open)
E. Process
F. Equalize (open)
G. Drain vent (closed)
H. Isolate (closed)

4. After zeroing the transmitter, close the equalize valve on the low pressure (downstream) side of the transmitter.



A. High
B. Low
C. Plugged
D. Isolate (open)
E. Process
F. Equalize (open)
G. Equalize (closed)
H. Drain vent (closed)
I. Isolate (closed)

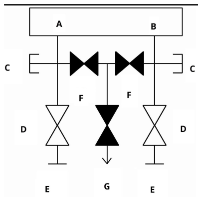
5. Close the equalize valve on the high pressure (upstream) side.



A. High
B. Low
C. Plugged
D. Isolate (open)
E. Process
F. Equalize (closed)
G. Drain vent (closed)
H. Isolate (closed)

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.



A. High
B. Low
C. Plugged
D. Isolate (open)
E. Process
F. Equalize (closed)
G. Drain vent (closed)

3.5 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.

3.5.1 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 3-16 shows a liquid level measurement example.

3.5.2 Closed vessels

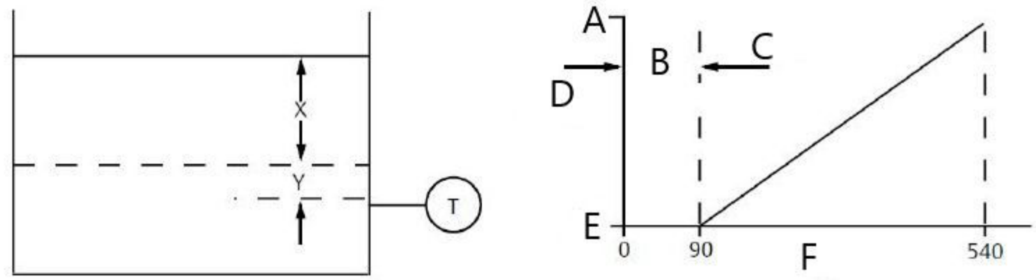
Pressure above a liquid affects the pressure measured at the bottom of a closed vessel. The liquid specific gravity multiplied by the liquid height plus the vessel pressure equals the pressure at the bottom of the vessel.

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 3-16.

Figure 3-16: Liquid Level Measurement Example



A. *H_i*
B. *Zero*
C. *Suppression*
D. *Range*
E. *L_o*
F. *inH_20*

Let X equal the vertical distance between the minimum and maximum measurable levels (500 in. [12700 mm]).

Let Y equal the vertical distance between the transmitter datum line and the minimum measurable level (100 in. [2540 mm]).

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

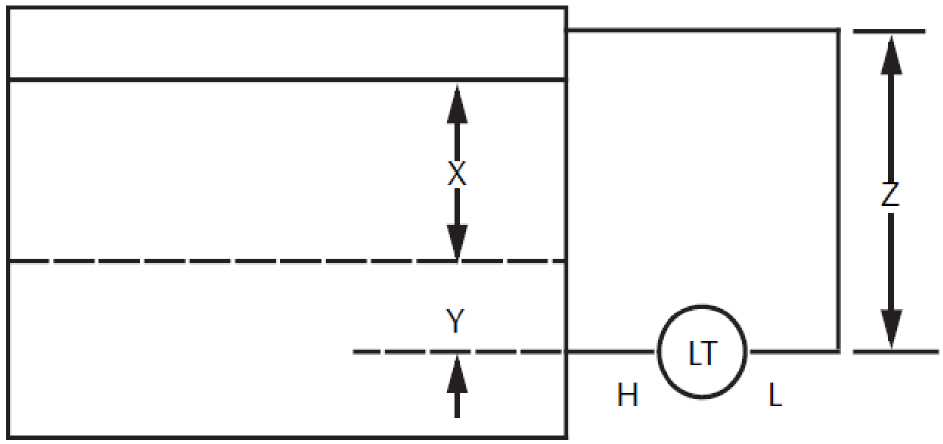
Range = 90 to 540 inH_2O

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. You must then make zero elevation of the range.

Figure 3-17: Wet Leg Example



Let X equal the vertical distance between the minimum and maximum measurable levels (500 in. [12700 mm]).

Let Y equal the vertical distance between the transmitter datum line and the minimum measurable level (50 in. [1270 mm]).

Let z equal the vertical distance between the top of the liquid in the wet leg and the transmitter datum line (600 in. [15240 mm]).

Let SG1 equal the specific gravity of the fluid (1.0).

Let SG2 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)(SG1)

= 500 x 1.0

= 500 in H_2O

e = (Y)(SG1)

= 50 x 1.0

= 50 in H_2O

s = (z)(SG2)

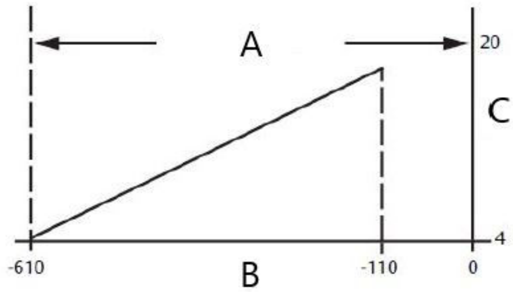
= 600 x 1.1

= 660 in H_20

Range = e – s to h + e – s.

= 50 – 660 to 500 + 50 – 660

= –610 to –110 in H_20



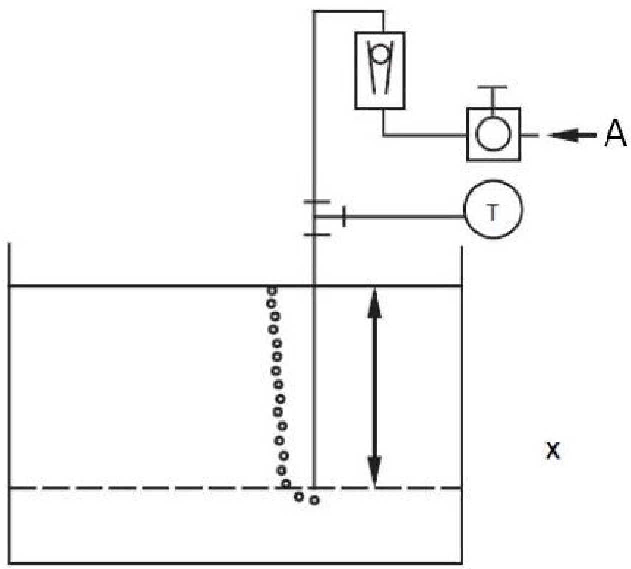
A. Zero elevation
B. inH$_2$0
C. mA DC

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 3-18 shows a bubbler liquid level measurement example.

Figure 3-18: Bubbler Liquid Level Measurement Example



A. Air

Let X equal the vertical distance between the minimum and maximum measurable levels (100 in. [2540 mm]).

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.

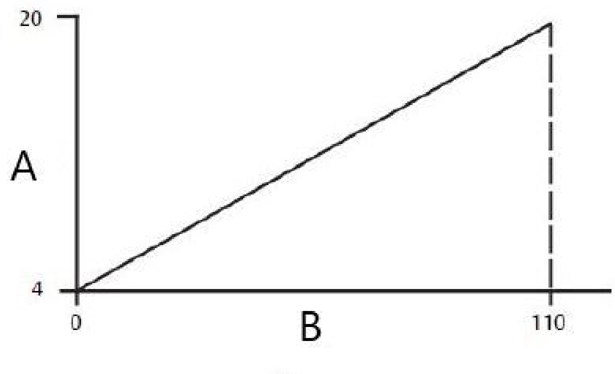
Let Range equal zero to h.

Then h = (X)(SG)

= 100 x 1.1

= 110 inH_2O

Range = 0 to 110 inH_2O



A. mA DC
B. in$H_2$0

4 Electrical installation

4.1 Overview

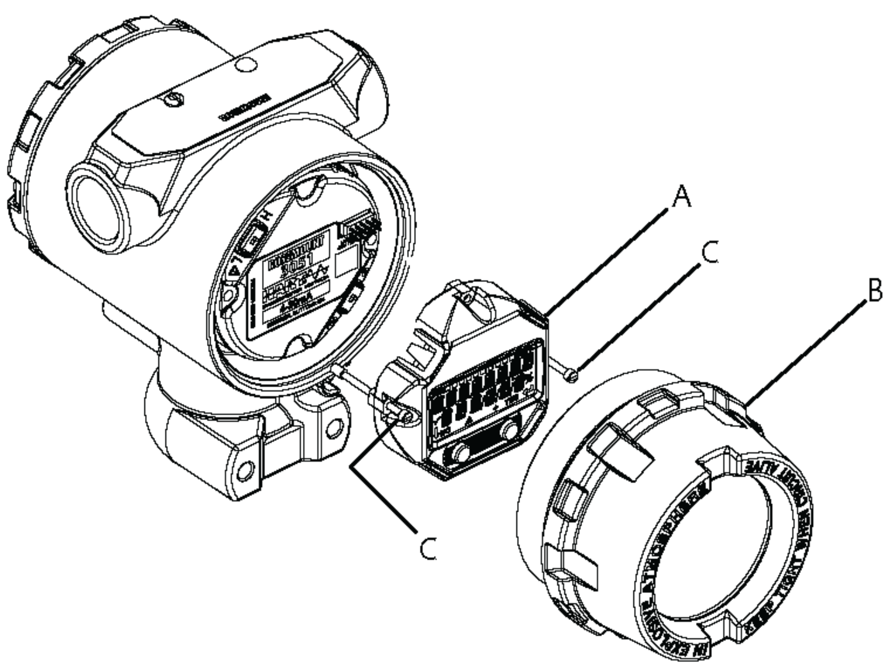
The information in this section covers installation considerations for the Rosemount 2051. A Quick Start Guide is shipped with every transmitter to describe pipe-fitting, wiring procedures and basic configuration for initial installation.

Note
For transmitter disassembly and reassembly refer to sections Disassembly procedures, and Reassembly procedures.

4.2 LCD display

Transmitters ordered with the LCD display option (M5) are shipped with the display installed. Installing the display on an existing 2051 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 Assembly



A. LCD display
B. Extended Cover
C. Captive Screws

4.3 LCD display with local operator interface (LOI)

Transmitters ordered with the LCD display with LOI option (M4) are shipped with the display and local configuration buttons installed. The configuration buttons are located under the top tag as indicated by the sticker. See Table 2-1 for LOI operation. Upgrading to an LOI transmitter requires installation of a new electronics board, configuration buttons and LCD display (if not previously ordered).

4.4 Configuring security and simulation

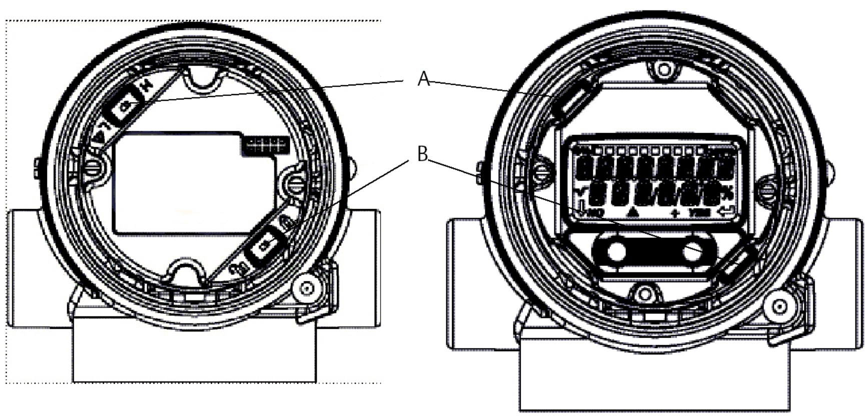
The Rosemount 2051 has four security methods:

- **Security** switch
- **HART lock**
- **Configuration buttons lock**
- Local operator interface (LOI) password

Figure 4-2: 4–20 mA electronics board

Without LCD display

With LCD display



*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 Set Security switch

Use the **Security** switch to prevent changes to the transmitter configuration data.

If the **Security** switch is set to the locked (🔒) location, the transmitter will reject any transmitter configuration requests sent via HART®, the local operator interface (LOI), or local configuration buttons, and the transmitter configuration data will not be modified. Reference Figure 4-2 for the location of the security switch. To enable the **Security** switch:

Procedure

1. Set loop to **Manual** and remove power.
2. Remove transmitter housing cover.
3. Use a small screwdriver to slide the switch to the locked (🔒) position.
4. Replace transmitter housing cover.

⚠ WARNING

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; the transmitter will reject all changes requested via HART, the Local Operator Interface (LOI), and local configuration buttons.

You can only set the **HART Lock** via HART communication, and the **HART Lock** is only available in HART Revision 7 mode. Use a communication device or AMS Device Manager to enable or disable the **HART Lock**.

Configure HART® Lock using a communication device

Procedure

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

Fast keys	2, 2, 6, 4

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.

Configure Configuration Button Lock using a communication device

Procedure

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

Fast keys	2, 2, 6, 3

4.4.4 Local operator interface (LOI) password

You can enter and enable an LOI password 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 communication device, AMS Device Manager, or the LOI.

4.5 Electrical considerations

⚠ WARNING

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

⚠ WARNING

Electrical shock

Electrical shock can result in death or serious injury.

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

4.5.1 Conduit installation

NOTICE

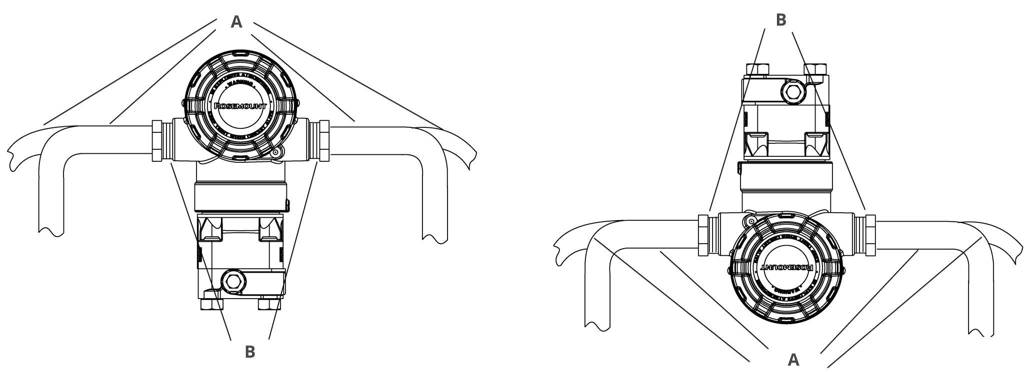
If all connections are not sealed, excess moisture accumulation can damage the transmitter.

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 of the transmitter housing.

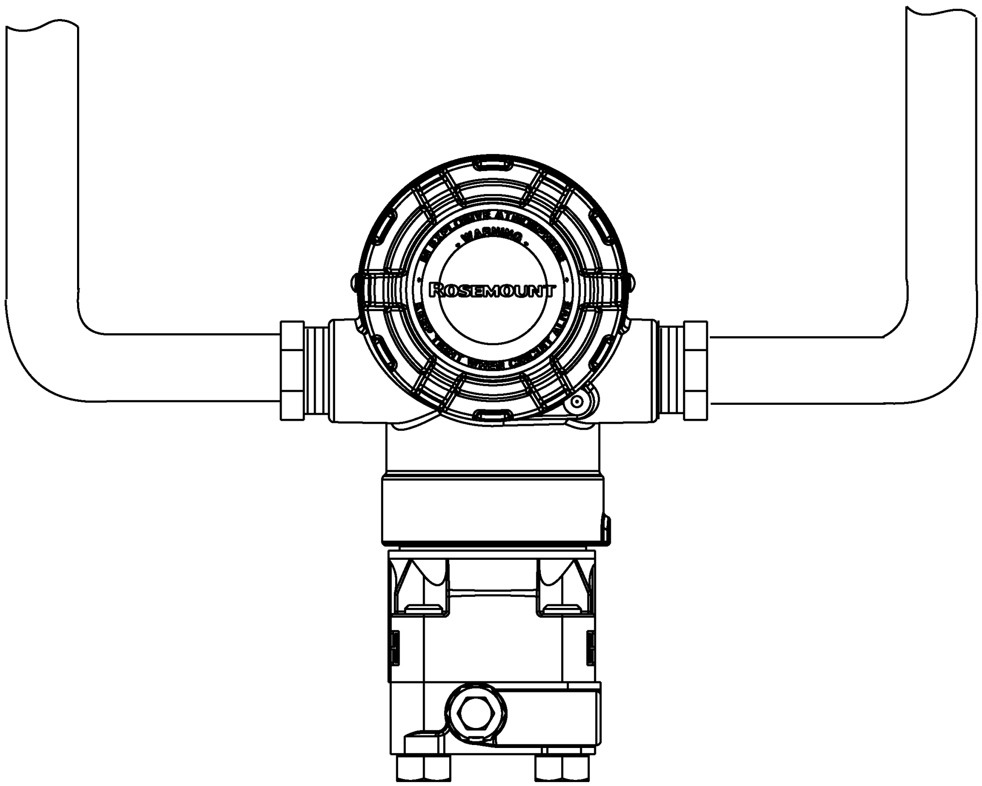
Figure 4-3 shows recommended conduit connections.

Figure 4-3: Conduit installation diagrams



A. *Possible conduit line positions*
B. *Sealing compound*

Figure 4-4: Incorrect conduit installation



4.5.2 Power supply

The DC power supply should provide power with less than two percent ripple. The transmitter requires between 9 and 32 Vdc (between 9 and 17.5 Vdc for FISCO) at the terminals to operate and provide complete functionality.

4.5.3 Wiring the transmitter

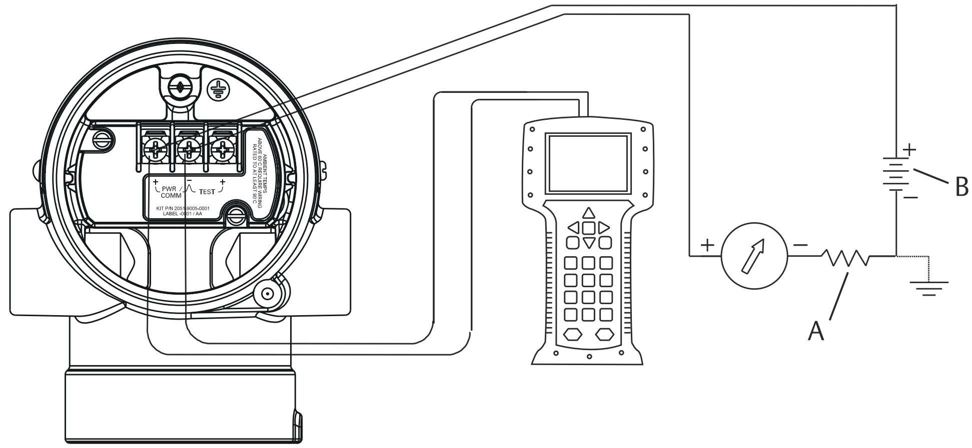
NOTICE

Incorrect wiring can damage the circuit.

Do not connect the power signal wiring to the test terminals.

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, Emerson recommends unpaired three conductors or two twisted pairs.

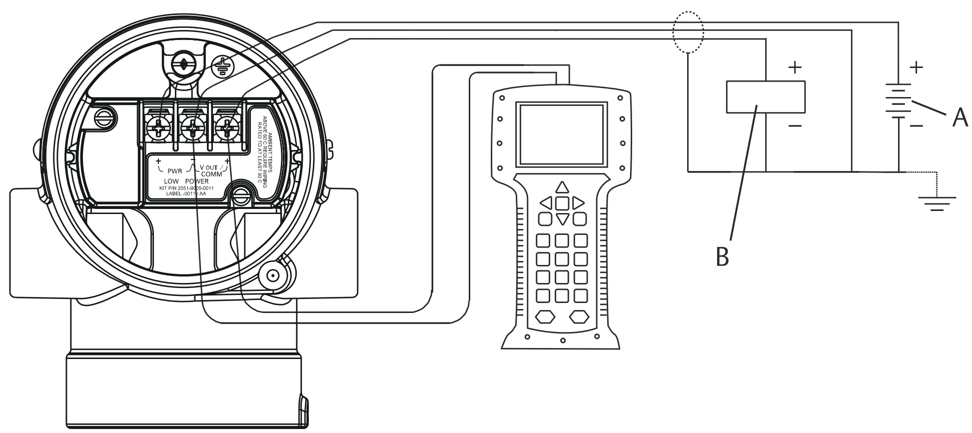
Figure 4-5: Wiring the transmitter (4–20 mA HART®)



A. Dc power supply

B. R_L≥ 250 (necessary for HART communication only)

Figure 4-6: Wiring the transmitter (1–5 Vdc low power)



A. Dc power supply

B. Voltmeter

To connect wiring:

Procedure

1. Remove the housing cover on terminal compartment side. Signal wiring supplies all power to the transmitter.

   ⚠ WARNING

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

2. Connect the leads.

NOTICE

Power could damage the test diode.

Do not connect the powered signal wiring to the test terminals.

- 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–**).
- For 1–5 Vdc HART output, connect the positive lead to (**PWR+**) and the negative to the (**PWR–**).

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

4.5.4 Grounding the transmitter

Ground signal cable shield

Figure 4-7 summarizes signal cable shield grounding. Trim and insulate the signal cable shield and unused shield drain wire to ensure that the signal cable shield and drain wire do not come in contact with the transmitter case.

To correctly ground the signal cable shield:

Procedure

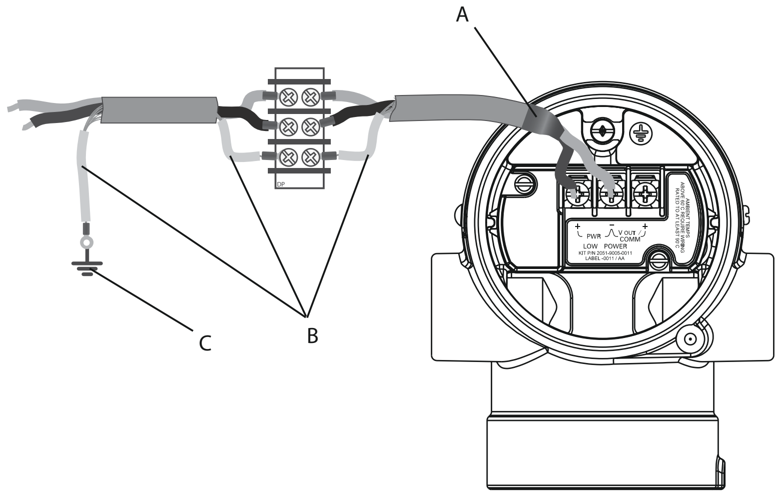
1. Remove the field terminals housing cover.
2. Connect the signal wire pair at the field terminals as indicated in Figure 4-5.
3. At the field terminals, trim the cable shield and shield drain wire closely and insulate them from the transmitter housing.
4. Reattach the field terminals housing cover.

⚠ WARNING

Cover must be fully engaged to comply with explosion-proof requirements.

5. At terminations outside the transmitter housing, make sure the cable shield drain wire is continuously connected.
   a) Prior to the termination point, insulate any exposed shield drain wire as shown in Figure 4-6 (B).
6. Properly terminate the signal cable shield drain wire to an earth ground at or near the power supply.

Figure 4-7: Wiring pair and ground



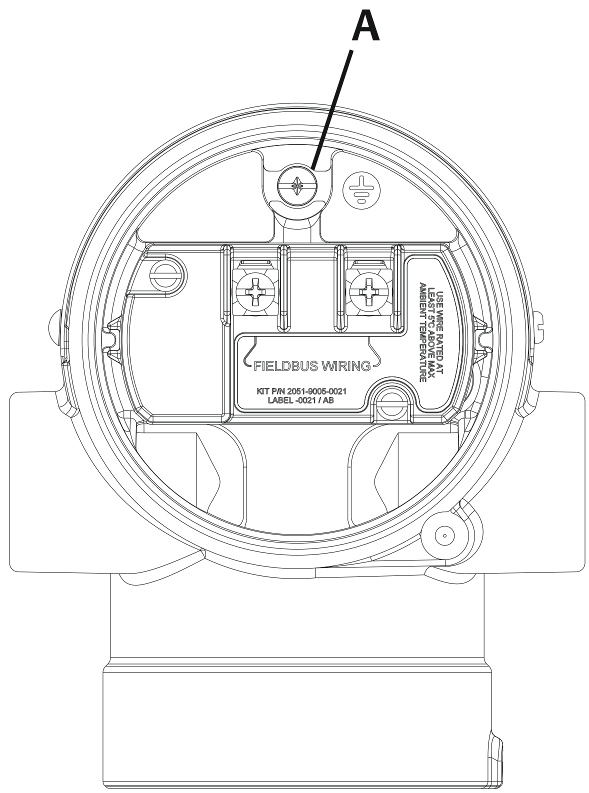
A. Insulate shield and shield drain wire
B. Insulate exposed shield drain wire
C. Terminate cable shield drain wire to earth ground

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:

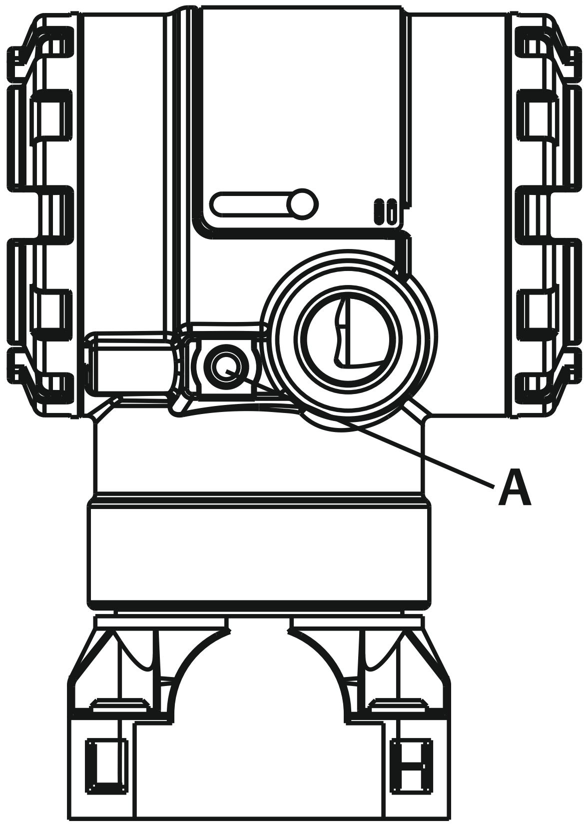
- Internal ground connection: The internal ground connection screw is inside the **FIELD TERMINALS** side of the electronics housing. This screw is identified by a ground symbol (⏚). The ground connection screw is standard on all Rosemount 2051 Transmitters. Refer to Figure 4-8.
- External ground connection: The external ground connection is located on the exterior of the transmitter housing. Refer to Figure 4-9. This connection is only available with option V5 and T1.

Figure 4-8: Internal Ground Connection



A. Internal ground location

Figure 4-9: External Ground Connection (Option V5 or T1)



A. External ground location

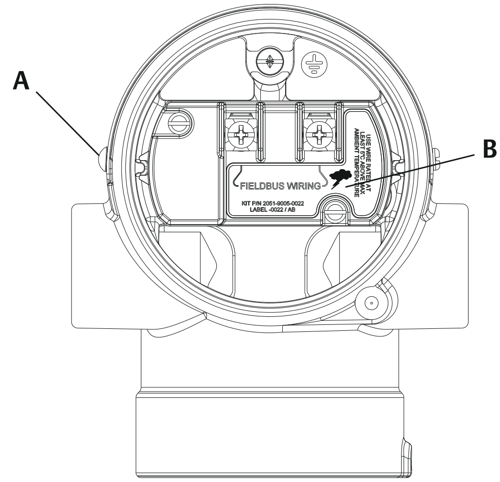
Note
Grounding the transmitter case via threaded conduit connection may not provide sufficient ground continuity.

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 (Option Code T1) or as a spare part to retrofit existing 2051 Transmitters in the field. See for part numbers. The lightning bolt symbol shown in Figure 4-10 identifies the transient protection terminal block.

Figure 4-10: Transient Protection Terminal Block



A. External ground connection location
B. 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 4-10.

5 Calibration

5.1 Overview

This section contains information on calibrating the Rosemount™ 2051 Pressure Transmitter with PROFIBUS® PA Protocol using either the local operator interface (LOI) or a Class 2 Master.

5.2 Calibration overview

Calibration is defined as the process required to optimize transmitter accuracy over a specific range by adjusting the factory sensor characterization curve located in the micro-processor. This is done by performing one of the following procedures,

Zero trim

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.

When performing a zero trim with a manifold, refer to Integral manifold operation.

Note
Do not perform a zero trim on absolute pressure transmitters. Zero trim is zero based, and absolute pressure transmitters reference absolute zero. To correct mounting position effects on absolute pressure transmitters, perform a lower trim within the sensor trim function. The lower trim function provides an offset correction similar to the zero trim function, but it does not require zero-based input.

Sensor trim

A two-point sensor calibration where two end-point pressures are applied, and all output is linearized between them. Always adjust the lower trim value first to establish the correct offset. Adjustment of the upper trim value provides a slope correction to the characterization curve based on the lower trim value. The trim values allow you to optimize performance over your specified measuring range at the calibration temperature. Sensor trimming requires an accurate pressure input – at least four times more accurate than the transmitter – in order to optimize performance over a specific pressure range.

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

Note
Rosemount 2051C Range 4 and Range 5 Transmitters require a special calibration procedure when used in differential pressure applications under high static line pressure. See Compensating for line pressure .

Recall factory trim

A command that 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.

5.3 Determine calibration frequency

Calibration frequency can vary greatly depending on the application, performance requirements, and process conditions.

To determine the calibration frequency that meets the needs of your application:

Procedure

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

5.3.1 Sample calculation for a standard Rosemount 2051C

1. Determine the performance required for your application.

Required performance:	0.30% of span

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)

3. Calculate Total Probable Error (TPE).

TPE =

$$\sqrt{(\text{ReferenceAccuracy})^2 + (\text{TemperatureEffect})^2 + (\text{StaticPressureEffect})^2} =$$

0.189% of span

Where:

Reference accuracy = ± 0.065% of span

Ambient temperature effect =

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

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

4. Calculate the stability per month.

Stability = $\pm\left(\frac{0.100\%\ \text{URL}}{\text{Span}}\right)$ % of span for 3 years = ±0.0046% span per month

5. Calculate calibration frequency.

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

5.4 Zero trim

Note
The transmitter PV at zero pressure must be within 10% × Upper Sensor Limit (USL) of zero in order to calibrate using the zero trim function.

5.4.1 LOI

Procedure

Enter **Calibration > Zero**.

a) Verify measurement is within 10% × USL of zero.

b) Save.

5.4.2 Class 2 Master

Procedure

1. To set the Transducer Block to Out of Service, select the following:
   a) From the Basic Setup > Mode > Transducer Block > Target dropdown, select Out of Service.
   b) Select Transfer.
2. To calibrate the sensor, select the following in Basic Setup > Calibration:
   a) In the Lower Calibration Point field, enter 0.
   b) Adjust pressure source to zero pressure.
   c) Verify Pressure Trimmed Value is stable and within 10% × LSL of zero.
   d) Select Transfer.
3. To set Transducer Block to Auto, select the following:
   a) From the Basic Setup > Mode > Transducer Block > Target dropdown, select Auto.
   b) Select Transfer.

5.5 Sensor trim

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 ten seconds before entering any values.

5.5.1 LOI

Procedure

1. Enter **Calibration > Lower** menu.
   a) Enter trim unit and value.
   b) Verify measurement is stable.

    c) Save.

2. Enter **Calibration > Upper** menu.
    a) Enter trim unit and value.
    b) Verify measurement is stable.
    c) Save.

5.5.2 Class 2 Master

Procedure

1. To set the Transducer Block to **Out of Service**, select the following:
    a) From the **Basic Setup > Mode > Transducer Block > Target Mode** dropdown, select **Out of Service**.
    b) Select **Transfer**.
2. Set the lower sensor calibration, select the following in **Basic Setup > Calibration**:
    a) In the **Lower Calibration Point** field, enter value.
    b) Adjust **pressure source** to desired pressure.
    c) Verify **Pressure Trimmed Value** is stable.
    d) Select **Transfer**.
3. Set the upper sensor calibration, select the following in **Basic Setup > Calibration**:
    a) In the **Upper Calibration Point** field, enter value.
    b) Adjust pressure source to desired pressure.
    c) Verify **Pressure Trimmed Value** is stable.
    d) Select **Transfer**.
4. To set **Transducer Block** to **Auto**, select the following:
    a) From the **Basic Setup > Mode > Transducer Block > Target Mode** dropdown, select **Auto**.
    b) Select **Transfer**.

5.6 Recall factory trim

5.6.1 LOI

Procedure

1. Enter **Calibration > Reset**.
2. Save.

5.6.2 Class 2 Master

Procedure

1. To set the Transducer Block to **Out of Service**, select the following:
    a) From the **Basic Setup > Mode > Transducer Block > Target** dropdown, select **Out of Service**.
    b) Select **Transfer**.
2. To Recall the Factory Trim, select the following in **Basic Setup > Calibration > Factory Recall**:
    a) Select **Factory Settings**.
    b) Select **Transfer**.
3. To set Transducer Block to **AUTO**, select the following:
    a) From the **Basic Setup > Mode > Transducer Block > Target** dropdown, select **Auto**.
    b) Select **Transfer**.

5.7 Compensating for line pressure

5.7.1 Range 2 and 3

The following specifications show the static pressure effect for the Rosemount 2051 Range 2 and 3 Pressure Transmitters used in differential pressure applications where line pressure exceeds 2000 psi (138 bar).

Zero effect

±0.1% of the upper range limit plus an additional ±0.1% of upper range limit error for each 1000 psi (69 bar) of line pressure above 2000 psi (138 bar).

Example Line pressure is 3000 psi (207 bar). Zero effect error calculation:

±(0.01 + 0.1 × [3 kpsi –2 kpsi]) = ±0.2% of the upper range limit

Span effect

Refer to Range 4 and 5.

5.7.2 Range 4 and 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 Rosemount 2051 Differential Pressure Transmitters (Ranges 1, 2, and 3) do not require this procedure because optimization occurs in the sensor.

Applying high static pressure to Rosemount 2051 Range 4 and 5 Pressure Transmitters causes a systematic shift in the output. This shift is linear with static pressure; correct it by performing the Sensor trim.

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

Zero effect

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

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

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

±(0.2 + 0.2 × [3 kpsi – 2 kpsi]) = ±0.4% of the upper range limit

Span effect

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

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

6 Troubleshooting

6.1 Overview

This section contains information on how to troubleshoot the Rosemount 2051 Pressure Transmitter with PROFIBUS® PA Protocol.

6.2 Diagnostics identification and recommended action

The Rosemount 2051 PROFIBUS® device diagnostics can be used to warn a user about a potential transmitter error. There is a transmitter error if the **Output Status** reads anything but **Good** or **Good - Function Check**, or the LCD display reads **SNSR** or **ELECT**.

Use Diagnostics identification and recommended action to identify what diagnostic condition exists based on the combination of errors under the **How to Identify** columns. Start with the **Physical** block diagnostic extension and use **Primary** value and **Temperature** status to identify the diagnostic condition. If a box is blank, it is not necessary to identify that diagnostic condition. Once condition is identified, use the **Recommended actions** to remedy the error.

6.2.1 PV Simulation Enabled

How to identify

Class 1 or 2 Master **Physical block diagnostic extension**	**Simulate Active**
Class 2 Master **Primary value status**	N/A
Temperature status	N/A

Recommended actions

1. Check the **simulation** switch.
2. Replace the electronics.

6.2.2 Pressure beyond sensor limit

How to identify

Class 1 or 2 Master **Physical block diagnostic extension**	**Sensor Transducer Block Error**

Class 2 Master **Primary value status**	Bad, sensor failure, underflow/ overflow
Temperature status	N/A

Recommended actions

1. Verify the applied pressure is within the range of the pressure sensor.
2. Check for impulse line plugging or leaks.
3. Replace the sensor module.

6.2.3 Module Temperature Beyond limits

How to identify

Class 1 or 2 Master **Physical block diagnostic extension**	Sensor Transducer Block Error
Class 2 Master **Primary value status**	N/A
Temperature status	Uncertain

Recommended actions

1. Verify the sensor temperature is between -49 and 194 °F (-45 and 90 °C).
2. Replace the sensor module.

6.2.4 Sensor Module Memory Failure

How to identify

Class 1 or 2 Master **Physical block diagnostic extension**	Sensor Transducer Block Error
Class 2 Master **Primary value status**	Bad, Out of Service (OOS)
Temperature status	N/A

Recommended actions

Replace the sensor module.

6.2.5 No Sensor Module Pressure Updates

How to identify

Class 1 or 2 Master **Physical block diagnostic extension**	Sensor Transducer Block Error
Class 2 Master **Primary value status**	Bad, sensor failure, constant
Temperature status	N/A

Recommended actions

1. Check cable connection between sensor module and electronics.
2. Replace electronics.
3. Replace the sensor module.

6.2.6 No Device Temperature Updates

How to identify

Class 1 or 2 Master **Physical block diagnostic extension**	Sensor Transducer Block Error
Class 2 Master **Primary value status**	N/A
Temperature status	Bad

Recommended actions

1. Check cable connection between sensor module and electronics.
2. Replace electronics.
3. Replace the sensor module.

6.2.7 Circuit Board Memory Failure

How to identify

Class 1 or 2 Master **Physical block diagnostic extension**	Memory Failure Non Volatile Memory Integrity Error

Class 2 Master **Primary value status**	N/A
Temperature status	N/A

Recommended actions

Replace electronics.

6.2.8 LOI button stuck

How to identify

Class 1 or 2 Master **Physical block diagnostic extension**	**LOI Button Malfunction**
Class 2 Master **Primary value status**	N/A
Temperature status	N/A

Recommended actions

1. Check if button is stuck under housing.
2. Replace buttons.
3. Replace electronics.

6.2.9 Extended diagnostics identification with Class 1 Master

If using a Class 1 Master to identify Physical Block Diagnostic Extensions, see Figure 6-1 and Figure 6-2 for diagnostic bit information. Table 6-1 and Table 6-2 list the diagnostic description for each bit.

Note
A Class 2 Master will automatically decode bits and provide diagnostic names.

Figure 6-1: Extended Diagnostics Identification

Standard Diagnostic Response 6 Bytes	Extended Diagnostic Data
	Device Related

Header byte	Status, Slot Number, Status Specifier	Diagnosis	Extended Diagnosis (Vendor Specific)
0 0 x x x x x x	3 Bytes	4 Bytes	3 Bytes

Figure 6-2: Diagnoses and Extended Diagnoses Bit Identification

	Diagnosis															
	Byte 1								**Byte 2**							
Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Unit_Diag_Bit(1)	31	30	29	28	27	26	25	24	39	38	37	36	35	34	33	32
	Byte 3								**Byte 4**							
	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
	47	46	45	44	43	42	41	40	55	54	53	52	51	50	49	48
	Extended Diagnosis															
	Byte 1								**Byte 2**							
Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Unit_Diag_Bit(1)	63	62	61	60	59	58	57	56	71	70	69	68	67	66	65	64
	Byte 3															
	7	6	5	4	3	2	1	0								
	79	78	77	76	75	74	73	72								

(1) Unit_Diag_Bit is located in GSD file.

Table 6-1: Diagnosis Descriptions

Device related diagnosis		
Byte-bit	**Unit_Diag_Bit (1)**	**Diagnostic description**
2-4	36	Cold Start
2-3	35	Warm Start
3-2	42	Function Check
3-0	40	Maintenance Alarm
4-7	55	More Information Available

(1) Unit_Diag_Bit is located in GSD file.

Table 6-2: Extended Diagnosis Descriptions

Diagnostic extension Byte-Bit		
Byte-bit	**Unit_Diag_Bit (1)**	**Diagnostic description**
1-4	28	Simulate Active
1-7	63	Other
2-0	64	Out-of-Service
2-1	65	Power-Up
2-2	66	Device Needs Maintenance now
2-4	68	Lost NV Data
2-5	69	Lost Static Data

Table 6-2: Extended Diagnosis Descriptions *(continued)*

Diagnostic extension Byte-Bit		
Byte-bit	**Unit_Diag_Bit (1)**	**Diagnostic description**
2-6	70	**Memory Failure**
3-1	73	**ROM Integrity Error**
3-3	75	**Non-Volatile Memory Integrity Error**
3-4	76	**Hardware/Software Incompatible**
3-5	77	**Manufacturing Block Integrity Error**
3-6	78	**Sensor Transducer Block Error**
3-7	79	**LOI Button Malfunction is detected**

(1) Unit_Diag_Bit is located in GSD file.

6.3 Plantweb™ and NE107 diagnostics

Table 6-3 describes the recommended status of each diagnostic condition based on Plantweb and NAMUR NE107 recommendations.

Table 6-3: Output Status

Name	PlantWeb alert category	NE107 category
PV Simulation Enabled	Advisory	Check
LOI button pressed	Advisory	Good
Pressure beyond sensor limits	Maintenance	Failure
Module Temperature Beyond limits	Maintenance	Out of spec
Sensor Module Memory Failure	Failure	Failure
No Sensor Module Pressure Updates	Failure	Failure
No Device Temperature Updates	Failure	Out of spec
Circuit Board Memory Failure	Failure	Failure
LOI button stuck	Failure	Failure

6.4 Alert messages and fail safe type selection

Table 6-4 defines the output status and LCD display messages that will be driven by a diagnostic condition. This table can be used to determine what type of fail safe value setting is preferred. Fail safe type can be set with a Class 2 Master under **Fail Safe > Fail Safe Mode**.

Table 6-4: Alert Messages

Diagnostic	Output status (based on fail safe type)			LCD display status
Name	**Use fail safe value**	**Use last good value**	**Use wrong calculated value**	
PV Simulation Enabled	Depends on simulated value/ status	Depends on simulated value/ status	Depends on simulated value/status	N/A

Table 6-4: Alert Messages *(continued)*

Diagnostic	Output status (based on fail safe type)			LCD display status
Name	Use fail safe value	Use last good value	Use wrong calculated value	
LOI button pressed	Good, function check	Good, function check	Good, function check	N/A
Pressure beyond sensor limits	Uncertain, substitute set	Uncertain, substitute set	Bad, process related, maintenance alarm	SNSR
Module Temperature Beyond limits	Uncertain, substitute set	Uncertain, process related, no maintenance	Uncertain, process related, no maintenance	SNSR
Sensor Module Memory Failure	Bad, passivated	Uncertain, substitute set	Bad, maintenance alarm	SNSR
No Sensor Module Pressure Updates	Uncertain, substitute set	Uncertain, substitute set	Bad, process related, maintenance alarm	SNSR
No Device Temperature Updates	Uncertain, process related, no maintenance	Uncertain, process related, no maintenance	Uncertain, process related, no maintenance	SNSR
Circuit Board Memory Failure	Bad, passivated	Bad, passivated	Bad, passivated	ELECT
LOI button stuck	Bad, passivated	Bad, passivated	Bad, passivated	ELECT

Table 6-5: Output Status Bit Definition

Description	HEX	DECIMAL
Bad - passivated	0x23	35
Bad, maintenance alarm, more diagnostics available	0x24	36
Bad, process related - no maintenance	0x28	40
Uncertain, substitute set	0x4B	75
Uncertain, process related, no maintenance	0x78	120
Good, ok	0x80	128
Good, update event	0x84	132
Good, advisory alarm, low limit	0x89	137
Good, advisory alarm, high limit	0x8A	138
Good, critical alarm, low limit	0x8D	141
Good, critical alarm, high limit	0x8E	142
Good, function check	0xBC	188

6.5 Disassembly procedures

⚠ WARNING

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

6.5.1 Removing from service

Procedure

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 2051 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 for coplanar flange.
    b) The Rosemount 2051 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 Inline process connection.

NOTICE

Do not wrench on neck of transmitter.

6. Clean isolating diaphragms with a soft rag and a mild cleaning solution, and rinse with clear water.

    Do not scratch, puncture, or depress the isolating diaphragms.
7. For the 2051C, whenever you remove the process flange or flange adapters, visually inspect the PTFE O-rings. Replace the O-rings if they show any signs of damage, such as nicks or cuts. Undamaged O-rings may be reused.

6.5.2 Removing terminal block

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

Procedure

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

6.5.3 Removing electronics board

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

Procedure

1. Remove the housing cover opposite the field terminal side.
2. If you are disassembling a transmitter with a LCD display, loosen the two captive screws that are visible (See Overview for screw locations) on the front of the meter

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

NOTICE

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.

NOTICE

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.

6.5.4 Removing sensor module from the electronics housing

Procedure

1. Remove the electronics board. Refer to Removing electronics board.

NOTICE

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.

NOTICE

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

6.6 Reassembly procedures

Procedure

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.

NOTICE

Ensure 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 to no more than 7 in-lbs when desired location is reached.

6.6.1 Attaching electronics board

Procedure

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. Ensure the power posts from the electronics housing properly engage the receptacles on the electronics board.

NOTICE

Do not force. The electronics board will slide gently onto the connections.

3. Tighten the captive mounting screws.
4. Replace the housing cover. Emerson recommends tightening the cover until there is no gap between the cover and the housing.

6.6.2 Installing terminal block

Procedure

1. Gently slide the terminal block into place, ensuring 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.

⚠ WARNING

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

6.6.3 Reassembling the 2051C process flange

Procedure

1. Inspect the sensor module PTFE O-rings.

Note
Undamaged O-rings may be reused. Replace O-rings that show any signs of damage, such as nicks, cuts, or general wear.
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).

        NOTICE

        Do not over-tighten 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).

        NOTICE

        Do not over-tighten 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-inch bolts to mount securely to the coplanar flange. For gauge pressure configurations, use two 2.88-inch bolts and two 1.75-inch bolts.

   a) 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 6-6 for appropriate torque values.
4. Using same cross pattern, tighten bolts to final torque values seen in Table 6-6.

Table 6-6: Bolt Installation Torque Values

Bolt material	Initial torque value	Final torque value
CS-ASTM-A445 Standard	300 in-lb. (34 N-m)	650 in-lb. (73 N-m)
316 SST—Option L4	150 in-lb. (17 N-m)	300 in-lb. (34 N-m)
ASTM-A-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 of the O-ring material.

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.

6.6.4 Installing drain/vent valve

Procedure

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 to 250 in-lb. (28.25 N-m).

⚠ CAUTION

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.

7 Reference data

7.1 Ordering information, specifications, and drawings

To view current Rosemount 2051 Pressure Transmitter ordering information, specifications, and drawings:

Procedure

1. Go to the Rosemount 2051 Coplanar™ Pressure Transmitter Product Detail Page.
2. Scroll as needed to the green menu bar and click **Documents & Drawings**.
3. For installation drawings, click **Drawings & Schematics** and select the appropriate document.
4. For ordering information, specifications, and dimensional drawings, click **Data Sheets & Bulletins** and select the appropriate Product Data Sheet.

7.2 Product certifications

To view current Rosemount 2051 Pressure Transmitter product certifications:

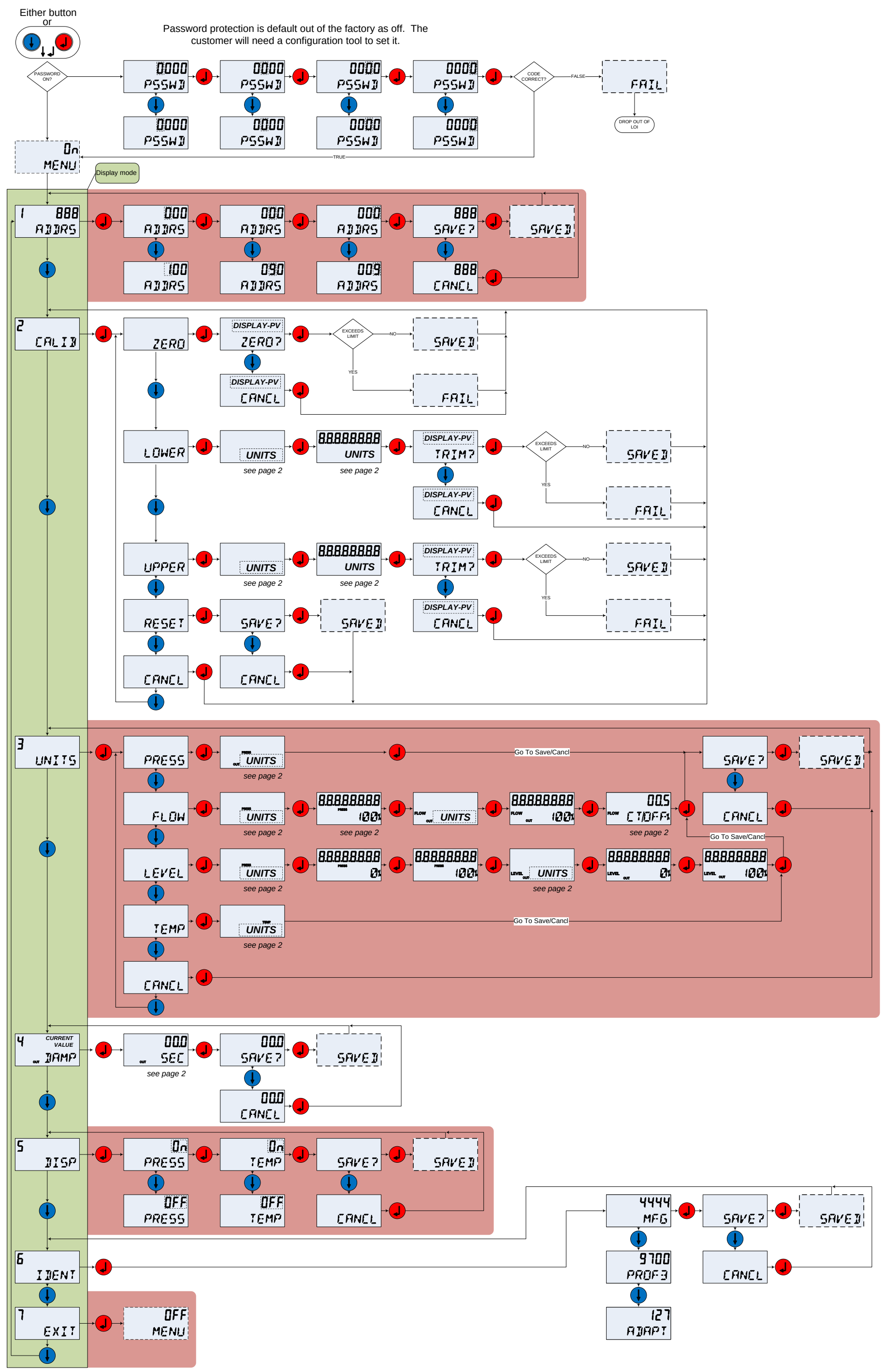
Procedure

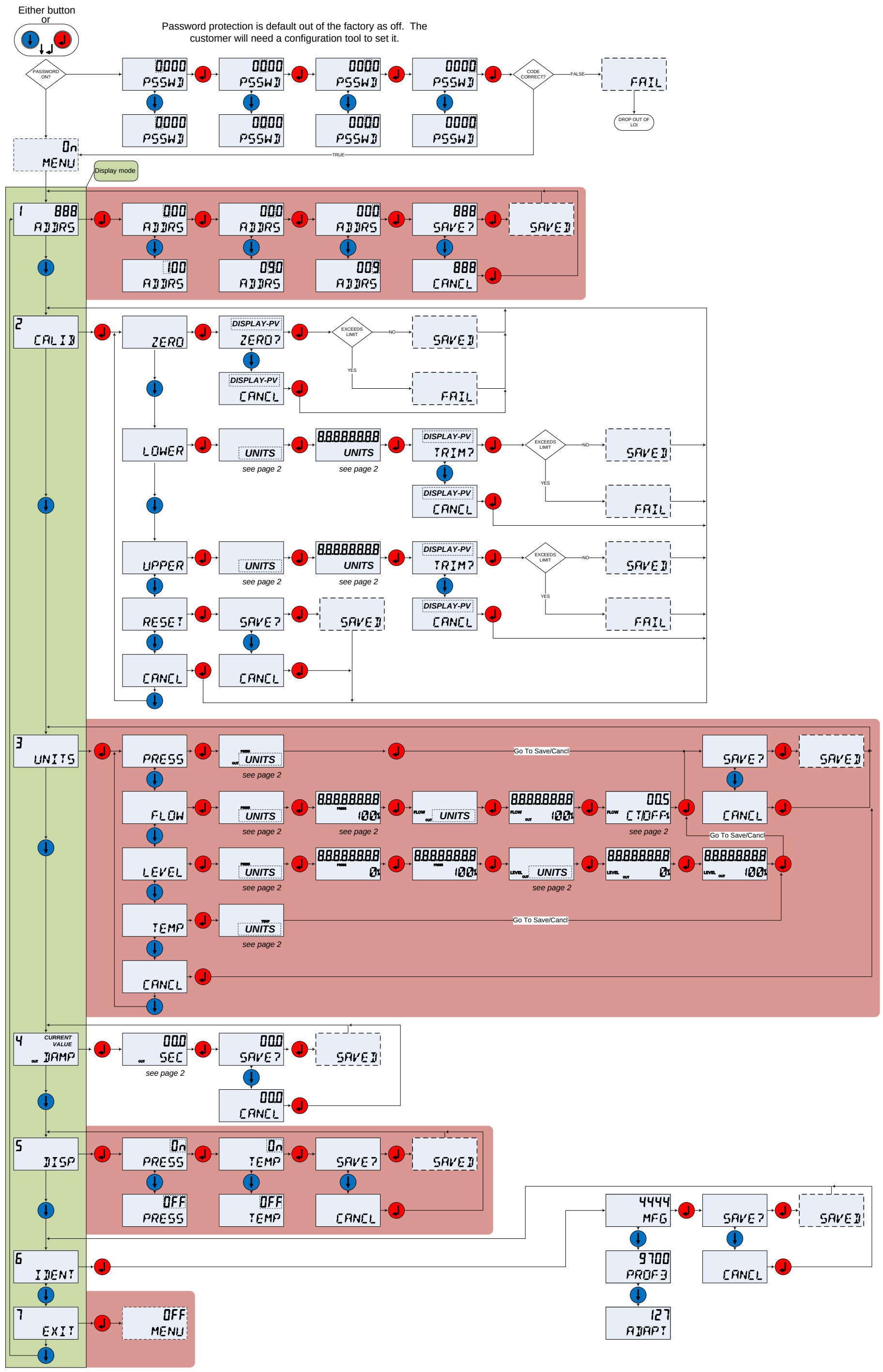
1. Go to the Rosemount 2051 Coplanar™ Pressure Transmitter Product Detail Page.
2. Scroll as needed to the green menu bar and click **Documents & Drawings**.
3. Click **Manuals & Guides**.
4. Select the appropriate Quick Start Guide.

A Local operator interface (LOI) menu

A.1 LOI Menu

Figure A-1: Detailed LOI Menu





Either button
or
Password protection is default out of the factory as off. The customer will need a configuration tool to set it.
PASSWORD ON?
0000 PSSWD
CODE CORRECT?
FALSE
FAIL
DROP OUT OF LOI
TRUE
On MENU
Display mode
1 888 ADDRS
000 ADDRS
888 SAVE?
SAVED
100 ADDRS
090 ADDRS
009 ADDRS
888 CANCL
2 CALID
ZERO
DISPLAY-PV ZERO?
DISPLAY-PV CANCL
EXCEEDS LIMIT
NO
YES
SAVED
FAIL
LOWER
UNITS
see page 2
88888888 UNITS
DISPLAY-PV TRIM?
DISPLAY-PV CANCL
UPPER
RESET
SAVE?
CANCL
3 UNITS
PRESS
TEMP
FLOW
LEVEL
CT OFF
Go To Save/Cancl
4 CURRENT VALUE DAMP
00.0 SEC
00.0 SAVE?
00.0 CANCL
5 DISP
On PRESS
On TEMP
OFF PRESS
OFF TEMP
6 IDENT
4444 MFG
9700 PROF3
127 ADAPT
7 EXIT
OFF MENU

B PROFIBUS® PA Block Information

B.1 PROFIBUS® block parameters

Table B-1 through Table B-3 can be used to cross reference parameters from the PROFIBUS® specification, Class 2 Master, and Local Operator Interface (LOI).

Table B-1: Physical Block Parameters

Index	Parameter name	DTM™ name	LOI location[1]	Definition
0	**BLOCK OBJECT**	Block Object	N/A	N/A
1	**ST_REV**	Static Revision No.	N/A	The revision level of the static data associated with block; the revision value will be incremented each time a static parameter value in the block is changed.
2	**TAG_DESC**	Tag	N/A	The user description of the intended block application.
3	**STRATEGY**	Strategy	N/A	Grouping of function blocks.
4	**ALERT_KEY**	Alert Key	N/A	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
5	**TARGET_MODE**	Target Mode	N/A	Contains desired mode of the block normally set by the operator or a control specification.
6	**MODE_BLK**	Actual Mode	N/A	Contains the actual, permitted, and normal modes of the block.
7	**ALARM_SUM**	N/A	N/A	Contains the current states of the block alarms
8	**SOFTWARE REVISION**	Software Revision	N/A	Software revision, includes a major, minor, and build revision.
9	**HARDWARE_REVISION**	Hardware Revision	N/A	Hardware revision
10	**DEVICE_MAN_ID**	Manufacturer	N/A	Identification code of the manufacturer of the field device
11	**DEVICE_ID**	Device ID	N/A	Identification of the device (Rosemount 2051)
12	**DEVICE_SER_NUM**	Device Serial Num	N/A	Serial number of the device (output board serial number).
13	**DIAGNOSIS**	Diagnosis	N/A	Detailed information of the device bitwise coded. MSB (bit 31) represents more information available in Diagnosis extension.
14	**DIAGNOSIS_EXTENSION**	Diagnosis Extension	N/A	Additional manufacturer diagnoses information (See **DIAGNOSIS_EXTENSION** table below).
15	**DIAGNOSIS_MASK**	N/A	N/A	Definition of supported **DIAGNOSIS** information bits

Table B-1: Physical Block Parameters *(continued)*

Index	Parameter name	DTM™ name	LOI location[1]	Definition
16	**DIAGNOSIS_MASK_EXTENSION**	N/A	N/A	Definition of supported **DIAGNOSIS_EXTENSION** information bits
18	**WRITE_LOCKING**	Write Locking	N/A	Software write protection
19	**FACTORY_RESET**	Factory Reset	N/A	Command for restarting device
20	**DESCRIPTOR**	Descriptor	N/A	User-definable text to describe the device.
21	**DEVICE_MESSAGE**	Message	N/A	User-definable message to the device or application in plant.
22	**DEVICE_INSTAL_DATE**	Installation Date	N/A	Date of installation of the device.
23	**LOCAL_OP_ENA**	LOI Enable	N/A	Disable/enable the optional LOI
24	**IDENT_NUMBER_SELECTOR**	Ident Number Selector	IDENT	Specifies the cyclic behavior of a device which is described in the corresponding GSD file
25	**HW_WRITE_PROTECTION**	HW Write Protection	N/A	Status of the security jumper
26	**FEATURE**	Optional Device Features	N/A	Indicates optional features implemented in the device
27	**COND_STATUS_DIAG**	N/A	N/A	Indicates the mode of a device that can be configured for status and diagnostic behavior
33	**FINAL_ASSEMBLY_NUM**	Final Assembly Number	N/A	The same final assembly number placed on the neck label
34	**DOWNLOAD_MODE**	Factory Upgrade	N/A	Puts the device into a manufacturer mode for upgrading the device
35	**PASSCODE_LOI**	Password	PSSWD	Password for the LOI
36	**LOI_DISPLAY_SELECTIO**N	Display Selection	DISP	Indicates process variables shown on the local display
37	**LOI_BUTTON_STATE**	Button State	N/A	Status of the optional LOI buttons
38	**VENDOR_IDENT_NUMBER**	Vendor Ident Number	IDENT	0x3333
39	**LOI_PRESENT**	LOI Present	N/A	Parameter written during manufacturing to indicate if an optional LOI is present
40	**HW_SIMULATE_PROTECTION**	HW Simulation Protection	N/A	Status of hardware simulation jumper

(1) If blank, parameter is not applicable to LOI.

Table B-2: Transducer Block Parameters

Index	Parameter name	DTM name	LOI location[1]	Definition
1	**ST_REV**	Static Revision No.	N/A	The revision level of the static data associated with block; the revision value will be incremented each time a static parameter value in the block is changed.

Table B-2: Transducer Block Parameters *(continued)*

Index	Parameter name	DTM name	LOI location[1]	Definition
2	**TAG_DESC**	Tag	N/A	The user description of the intended block application.
3	**STRATEGY**	Strategy	N/A	Grouping of function blocks.
4	**ALERT_KEY**	Alert Key	N/A	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
5	**TARGET_MODE**	Target Mode	N/A	Contains desired mode of the block normally set by the operator or a control specification.
6	**MODE_BLK**	Actual Mode	N/A	Contains the actual, permitted, and normal modes of the block.
7	**ALARM_SUM**	N/A	N/A	Contains the current states of the block alarms
8	**SENSOR_VALUE**	Pressure raw value	N/A	Raw sensor value, untrimmed, in **SENSOR_UNIT**
9	**SENSOR_HI_LIM**	Upper Sensor Limit	N/A	Upper sensor range value, in **SENSOR_UNIT**
10	**SENSOR_LO_LIM**	Lower Sensor Limit	N/A	Lower sensor range value, in **SENSOR_UNIT**
11	**CAL_POINT_HI**	Upper Calibration Point	**CALIB-> UPPER**	The value of the sensor measurement used for the high calibration point. Unit is derived from **SENSOR_UNIT**.
12	**CAL_POINT_LO**	Lower Calibration Point	**CALIB-> LOWER**	The value of the sensor measurement used for the low calibration point. Unit is derived from **SENSOR_UNIT**.
13	**CAL_MIN_SPAN**	Calibration Min Span	N/A	The minimum span that is allowed between the calibration high and low points.
14	**SENSOR_UNIT**	Sensor Unit	**UNITS**	Engineering units for the calibration values
15	**TRIMMED_VALUE**	Pressure Trimmed Value	**UNITS**	Contains the sensor value after the trim processing. Unit is derived from **SENSOR_UNIT**.
16	**SENSOR_TYPE**	Sensor Type	N/A	Sensor type (capacitance, strain gauge)
18	**SENSOR_SERIAL_NUMBER**	Sensor Serial Number	N/A	Sensor serial number
19	**PRIMARY_VALUE**	Primary Value	N/A	Measured value and status available to the Function Block. The unit of **PRIMARY_VALUE** is the **PRIMARY_VALUE_UNIT**.
20	**PRIMARY_VALUE_UNIT**	Unit (PV)	N/A	Engineering units for the primary value
21	**PRIMARY_VALUE_TYPE**	Primary Value Type	N/A	Type of pressure application (pressure, flow, level)
22	**SENSOR_DIAPHRAGM_MATERIAL**	Isolator Material	N/A	Type of material of the sensor isolator
23	**SENSOR_FILL_FLUID**	Module Fill Fluid	N/A	Type of fill fluid used in sensor

Table B-2: Transducer Block Parameters *(continued)*

Index	Parameter name	DTM name	LOI location(1)	Definition
24	**SENSOR_O_RING_MATERIAL**	O-ring Material	N/A	Type of material of the flange O-rings
25	**PROCESS_CONNECTION_TYPE**	Process Connection Type	N/A	Type of flange that is attached to the device
26	**PROCESS_CONNECTION_MATERIAL**	Process Connection Material	N/A	Type of material of the flange
27	**TEMPERATURE**	Temperature	N/A	Sensor temperature, in **TEMPERATURE_UNIT**
28	**TEMPERATURE_UNIT**	Temperature Unit	**UNITS**	Engineering units of the sensor temperature
29	**SECONDARY_VALUE_1**	Secondary Value 1	**UNITS**	Trimmed pressure value, unscaled, in **SECONDARY_VALUE_1_UNIT**
30	**SECONDARY_VALUE_1_UNIT**	Unit (Secondary Value 1)	**UNITS**	Engineering unit of **SECONDARY_VALUE_1**
31	**SECONDARY_VALUE_2**	Secondary Value 2	**UNITS**	Measured value after input scaling
33	**LIN_TYPE**	Characterization type	**UNITS**	Linearization type
34	**SCALE_IN**	Scale in	**UNITS**	Input scaling in **SECONDARY_VALUE_1_UNIT**
35	**SCALE_OUT**	Scale out	**UNITS**	Output scaling in **PRIMARY_VALUE_UNIT**
36	**LOW_FLOW_CUT_OFF**	Low Flow Cut Off	**UNITS-> FLOW**	This is the point in percent of flow until the output of the flow function is set to zero. It is used for suppressing low flow values
59	**FACT_CAL_RECALL**	Restore Calibration Factory	**CALIB-> RESET**	Recalls the sensor calibration set at the factory
60	**SENSOR_CAL_METHOD**	Sensor Calibration Factor	N/A	The method of last sensor calibration.
61	**SENSOR_VALUE_TYPE**	Transmitter Type	N/A	Type of pressure measurement (differential, absolute, gauge)

(1) If blank, parameter is not applicable to LOI.

Table B-3: Analog Input Block Parameters

Index	Parameter name	DTM name	LOI location(1)	Definition
1	**ST_REV**	Static Revision No.	N/A	The revision level of the static data associated with block; the revision value will be incremented each time a static parameter value in the block is changed.
2	**TAG_DESC**	Tag	N/A	The user description of the intended block application.
3	**STRATEGY**	Strategy	N/A	Grouping of function blocks.

Table B-3: Analog Input Block Parameters *(continued)*

Index	Parameter name	DTM name	LOI location(1)	Definition
4	**ALERT_KEY**	Alert Key	N/A	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
5	**TARGET_MODE**	Target Mode	N/A	Contains desired mode of the block normally set by the operator or a control specification.
6	**MODE_BLK**	Actual Mode	N/A	Contains the actual, permitted, and normal modes of the block.
7	**ALARM_SUM**	Alarm Summary	N/A	Contains the current states of the block alarms
8	**BATCH**	Batch Information	N/A	Used in Batch applications according to IEC 61512-1
10	**OUT**	Value (Output)	N/A	Value and status of the block output.
11	**PV_SCALE**	PV Scale	N/A	Conversion of the Process Variable into percent using the high and low scale value, in **TB.PRIMARY_VALUE_UNIT**
12	**OUT_SCALE**	Output Scale	N/A	The high and low scale values, units code, and number of digits to the right of the decimal point associated with **OUT**.
13	**LIN_TYPE**	Characterization Type	N/A	Linearization type
14	**CHANNEL**	Channel	N/A	Used to select the Transducer Block measurement value. Always 0x112.
16	**PV_FTIME**	Filter Time Const	**DAMP**	The time constant of the first order PV filter. Time required for a 63% change in the input value (seconds).
17	**FSAFE_TYPE**	Fail Safe Mode	N/A	Defines the reaction of the device, if a fault is detected
18	**FSAFE_VALUE**	Fail Safe Default Value	N/A	Default value for the **OUT** parameter, in **OUT_SCALE** units, if a sensor or sensor electronic fault is detected
19	**ALARM_HYS**	Limit Hysteresis	N/A	The amount the alarm value must return within the alarm limit before the associated active alarm condition clears.
21	**HI_HI_LIM**	Upper Limit Alarm Limits	N/A	The setting of the alarm limit used to detect the **HI_HI** alarm condition.
23	**HI_LIM**	Upper Limit Warning Limits	N/A	The setting of the alarm limit used to detect the **HI** alarm condition.
25	**LO_LIM**	Lower Limit Warning Limits	N/A	The setting of the alarm limit used to detect the **LO** alarm condition.
27	**LO_LO_LIM**	Lower Limit Alarm Limits	N/A	The setting of the alarm limit used to detect the **LO_LO** alarm condition.
30	**HI_HI_ALM**	Upper Limit Alarm	N/A	The **HI_HI** alarm data.
31	**HI_ALM**	Upper Limit Warning	N/A	The **HI** alarm data

Table B-3: Analog Input Block Parameters *(continued)*

Index	Parameter name	DTM name	LOI location(1)	Definition
32	**LO_ALM**	Lower Limit Warning	N/A	The **LO** alarm data.
33	**LO_LO_ALM**	Lower Limit Alarm	N/A	The **LO_LO** alarm data.
34	**SIMULATE**	Simulation	N/A	A group of data that contains the simulated transducer value and status, and the enable/disable bit.

(1) If blank, parameter is not applicable to LOI.

B.2 Condensed status

The Rosemount 2051 device utilizes condensed status as recommended by the Profile 3.02 specification and NE 107. Condensed status has some additional bits and changed bit assignments from classic status. Confirm bit assignment using Table B-4 and Table B-5.

Table B-4: Diagnosis Descriptions

Device related diagnosis		
Byte-bit	**Unit_Diag_Bit**	**Diagnostic description**
2-4	36	**Cold Start**
2-3	35	**Warm Start**
3-2	42	**Function Check**
3-0	40	**Maintenance Alarm**
4-7	55	**More Information Available**

Table B-5: Output Status Bit Definition

Description	HEX	DECIMAL
Bad - passivated	0x23	35
Bad, maintenance alarm, more diagnostics available	0x24	36
Bad, process related - no maintenance	0x28	40
Uncertain, substitute set	0x4B	75
Uncertain, process related, no maintenance	0x78	120
Good, ok	0x80	128
Good, update event	0x84	132
Good, advisory alarm, low limit	0x89	137
Good, advisory alarm, high limit	0x8A	138
Good, critical alarm, low limit	0x8D	141
Good, critical alarm, high limit	0x8E	142
Good, function check	0xBC	188

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