

Rosemount™ 2051 Pressure Transmitter

with HART® Revision 5 and 7 Selectable Protocol

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Safety messages

NOTICE

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

See listed technical assistance contacts.

Customer Central

Technical support, quoting, and order-related questions.

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

Asia Pacific- 65 777 211

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

North American Response Center

Equipment service needs.

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

Outside of these areas, contact your local Emerson representative.

⚠ CAUTION

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

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

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

⚠ WARNING

Explosions can result in death or serious injury.

Do not remove the transmitter covers in explosive environments when the circuit is live.

Fully engage both transmitter covers to meet explosion-proof requirements.

Before connecting a communicator in an explosive atmosphere, make sure the instruments in the loop are installed in accordance with intrinsically safe or non-incendive field wiring practices.

Verify the operating atmosphere of the transmitter is consistent with the appropriate hazardous locations certifications.

Electrical shock could cause death or serious injury.

Avoid contact with the leads and terminals.

Process leaks could result in death or serious injury.

Install and tighten all four flange bolts before applying pressure.

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

Replacement equipment or spare parts not approved by Emerson or 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.

Improper assembly of manifolds to traditional flange can damage SuperModule™ Platform.

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.

⚠ WARNING

SuperModule and electronics housing must have equivalent approval labeling in order to maintain hazardous location approvals.

When upgrading, verify SuperModule and electronics housing certifications are equivalent. Differences in temperature class ratings may exist, in which case the complete assembly takes the lowest of the individual component temperature classes (for example, a T4/T5 rated electronics housing assembled to a T4 rated SuperModule is a T4 rated transmitter.)

Severe changes in the electrical loop may inhibit HART® Communication or the ability to reach alarm values. Therefore, Emerson cannot absolutely warrant or guarantee that the correct failure alarm level (HIGH or LOW) can be read by the host system at the time of annunciation.

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 to protecting your system. Restrict physical access by unauthorized personnel to protect end users' assets. This is true for all systems used within the facility.

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1 Introduction

1.1 Using this manual

The sections in this manual provides information on configuring, troubleshooting, operating, and maintaining the Rosemount 2051 Pressure Transmitter specifically with HART® Revision 5 and 7 Selectable Protocol.

The sections in this manual are organized as follows:

- [Configuration](#) provides instruction on configuration of the transmitter, information on software functions, configuration parameters, and other variables are also included.
- [Hardware Installation](#) contains mechanical installation instructions, and field upgrade options.
- [Electrical Installation](#) contains electrical installation instructions, and field upgrade options.
- [Operation and Maintenance](#) provides detailed information on calibrating and changing HART® Revisions.
- [Troubleshooting](#) provides troubleshooting techniques for the most common operating problems.
- [Safety Instrumented Systems Requirements](#) provides identification, installation, configuration, operation and maintenance, and inspection information for Safety Instrumented Systems.
- [Reference data](#) supplies links to updated specifications, ordering information, intrinsic safety approval information, European ATEX directive information, and approval drawings.
- [Field Communicator Menu Trees and Fast Keys](#) provides full menu trees and abbreviated Fast Key sequences for commissioning tasks.
- [Local Operator Interface \(LOI\) Menu](#) provides detailed LOI menu trees.

1.2 Models covered

The following 2051 Transmitters are covered by this manual:

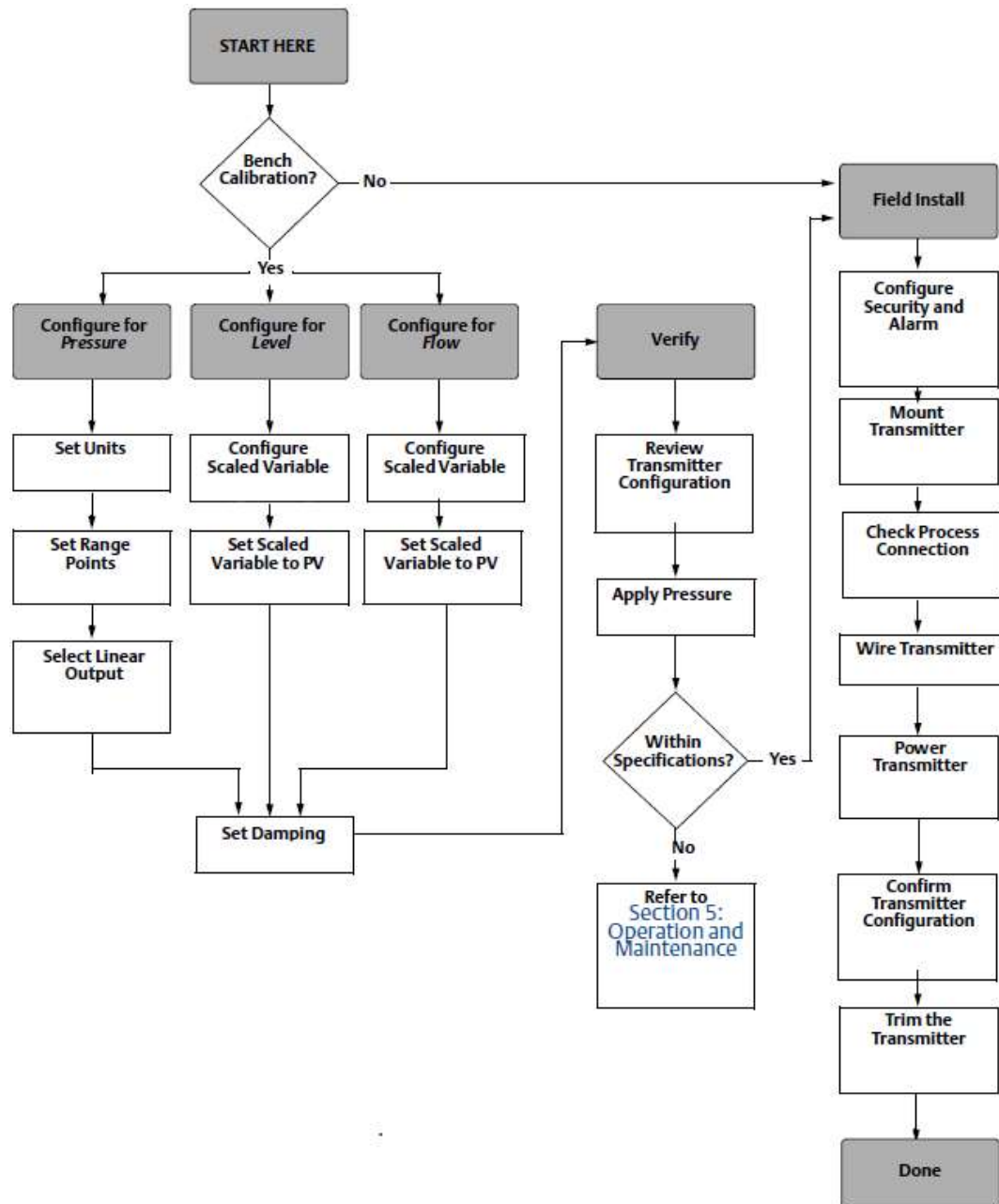
- Rosemount 2051C Coplanar™ Pressure Transmitter
 - Measures differential and gauge pressure up to 2000 psi (137.9 bar).
- Rosemount 2051T In-Line Pressure Transmitter
 - Measures gauge/absolute pressure up to 10000 psi (689.5 bar).
- Rosemount 2051L Level Transmitter
 - Measures level and specific gravity up to 300 psi (20.7 bar).
- Rosemount 2051CF Series Flowmeter
 - Measures flow in line sizes from -in. (15mm) to 96-in. (2400 mm).

Note

For Rosemount 2051 with FOUNDATION Fieldbus, see [Reference Manual](#). For Rosemount 2051 with PROFIBUS PA Protocol, see [Reference Manual](#).

1.3 HART installation flowchart

Figure 1-1: HART Installation Flowchart



1.4 Transmitter overview

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

The major components of the transmitter are the sensor module and the electronics housing. The sensor module contains the oil filled sensor system (isolating diaphragm, oil fill system, and sensor) and the sensor electronics. The sensor electronics are installed within the sensor module and include a temperature sensor, a memory module, and the analog-to-digital signal converter (A/D converter). The electrical signals from the sensor module are transmitted to the output electronics in the electronics housing. The electronics housing contains the output electronics board, the optional external configuration buttons, and the terminal block. The basic block diagram of the transmitter is illustrated in [Figure 1-3](#).

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

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

Note

LCD display utilizes a 5 × 6 character display and can display output and diagnostic messages. The LOI display uses an 8 × 6 character display and can display output, diagnostic messages, and LOI menu screens. The LOI display comes with two buttons mounted on the front of the display board. See [Figure 1-2](#).

Figure 1-2: LCD/LOI display

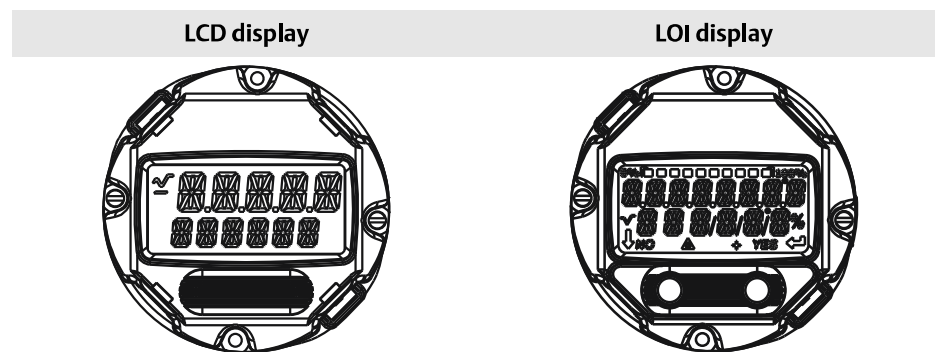
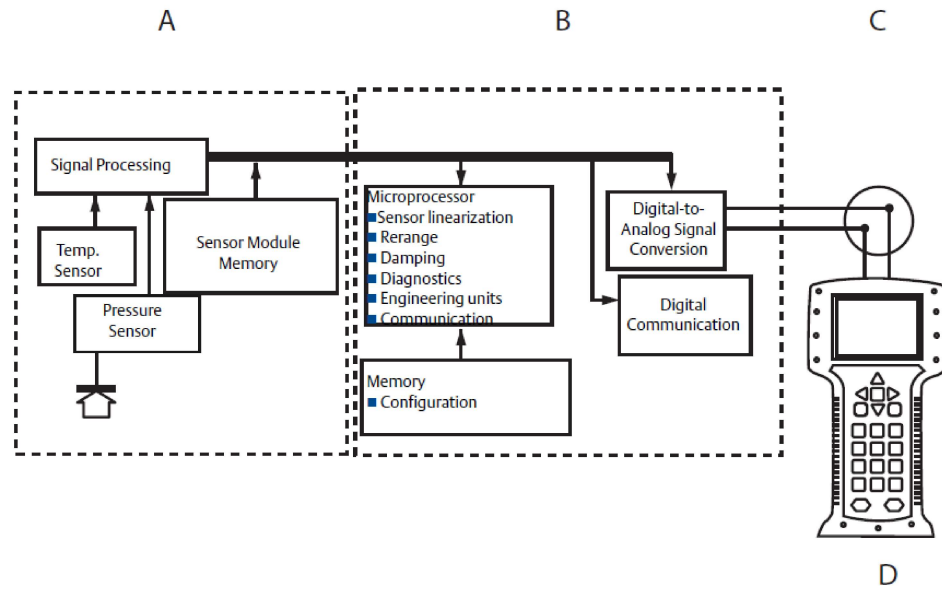


Figure 1-3: Block Diagram Of Operation



- A. Sensor Module
- B. Electronics Board
- C. 4-20 mA Signal to Control System
- D. Field Communicator

1.5 Product recycling/disposal

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

2 Configuration

2.1 Overview

This section contains information on commissioning and tasks that should be performed on the bench prior to installation, as well as tasks performed after installation as described in [Performing transmitter tests](#).

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

Full Field Communicator menu trees and Fast Key sequences are available in [Field Communicator Menu Trees and Fast Keys](#). LOI menu trees are available in [Local Operator Interface \(LOI\) Menu](#).

2.2 Safety messages

Procedures and instructions in this section may require special precautions to ensure the safety of the personnel performing the operation. Refer to the following safety messages before performing an operation preceded by this symbol.

⚠ WARNING

Explosions

Explosions could result in death or serious injury.

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

Before connecting a communicator in an explosive atmosphere, ensure the instruments in the segment are installed in accordance with intrinsically safe or non-incendive field wiring practices.

In an explosion-proof/flameproof installation, do not remove the transmitter covers when power is applied to the unit.

Process leaks

Process leaks may cause harm or result in death.

Install and tighten process connectors before applying pressure.

Electrical shocks

Electrical shock could cause death or serious injury.

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

⚠ WARNING

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.

Improper assembly of manifolds

Improper assembly of manifolds to traditional flange can damage the SuperModule™ Platform.

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

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 to protecting your system. Restrict physical access by unauthorized personnel to protect end users' assets. This is true for all systems used within the facility.

2.3 System readiness

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

2.3.1 Confirm correct Device Driver

Procedure

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

Example

Table 2-1: Rosemount 2051 Device Revisions and Files

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

- (1) NAMUR Software Revision is located on the hardware tag of the device
- (2) HART Software Revision can be read using a HART capable configuration tool.
- (3) Device Driver file names use Device and DD Revision, e.g. 10_01. HART Protocol is designed to enable legacy device driver revisions to continue to communicate with new HART devices. To access new functionality, the new Device Driver must be downloaded. It is recommended to download new Device Driver files to ensure full functionality.
- (4) HART Revision 5 and 7 Selectable, Safety Certified, LOI, Scaled Variable, Configurable Alarms, Expanded Engineering Units.

2.4 Configuration basics

⚠ CAUTION

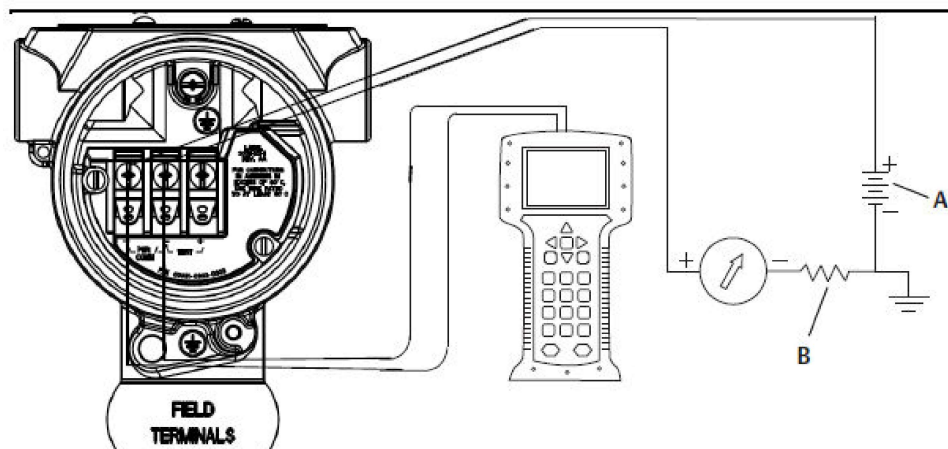
Set all transmitter hardware adjustments during commissioning to avoid exposing the transmitter electronics to the plant environment after installation.

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

2.4.1 Configuring on the bench

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

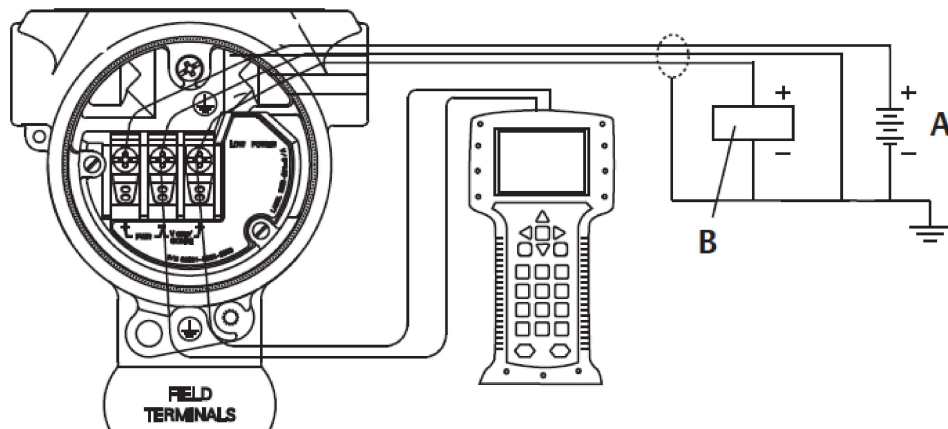
Figure 2-1: Wiring the Transmitter (4–20 mA HART)



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

2.4.2 Configuration tools

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



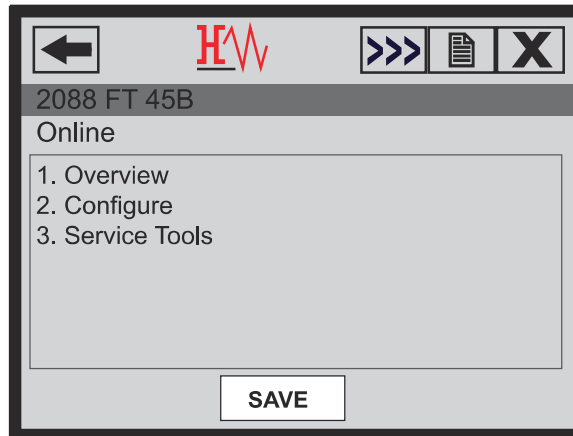
- A. DC power supply
- B. Voltmeter

Configuring with a Field Communicator

There are two interfaces available with the Field Communicator: Traditional and Dashboard interfaces. All steps using a Field Communicator will be described using Dashboard interfaces. HART® shows the Device Dashboard interface. As stated in [System readiness](#), it is critical that the latest DD's are loaded into the Field Communicator. Visit Emerson.com or FieldCommGroup.org to download latest DD library.

Field Communicator menu trees and Fast Keys are available in [Field Communicator Menu Trees and Fast Keys](#).

Figure 2-3: Device Dashboard



Configuring with AMS Device Manager

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

Note

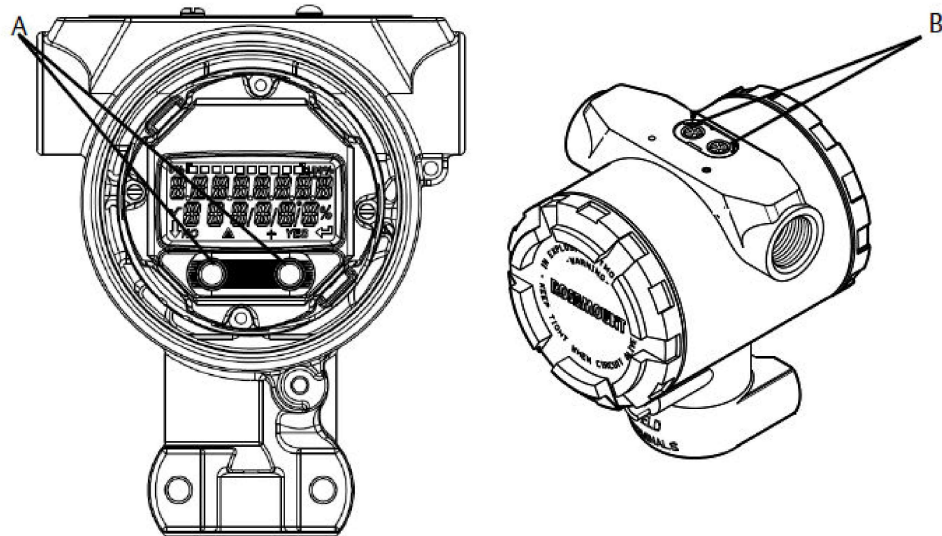
All steps using AMS Device Manager will be described using version 11.5.

Configuring with a LOI

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

LOI menu trees are available in [Local Operator Interface \(LOI\) Menu](#).

Figure 2-4: LOI Configuration Buttons



A. Internal configuration buttons B. External configuration buttons

Table 2-2: LOI Button Operation

Button	EXIT MENU? NO YES	EXIT MENU ↓ ↵
Left	No	SCROLL
Right	Yes	ENTER

2.4.3 Setting the loop to manual

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

2.5 Verify configuration

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

2.5.1 Verifying configuration with Field Communicator

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

Fast key sequences for the latest DD are shown in [Table 2-3](#). For Fast Key sequences for legacy DD's contact your local Emerson Representative.

Table 2-3: Device Dashboard Fast Key sequence

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

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

2.5.2 Verifying configuration with AMS Device Manager

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

2.5.3 Verifying configuration with LOI

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

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

2.5.4 Verifying process variables configuration

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

Verifying process variables with a Field Communicator

From the HOME screen, enter the Fast Key sequence.

Device Dashboard Fast Keys	3, 2, 1
----------------------------	---------

Verifying process variables with AMS Device Manager

Procedure

1. Right click the device and select **Overview** from the menu.
2. Select the **All Variables** button to display the primary, secondary, tertiary and quaternary variables.

2.6 Basic setup of the transmitter

This section goes through the necessary steps for basic setup of a pressure transmitter. When installing in DP level or DP flow applications, refer to [Configuring scaled variable](#) for setup instructions.

2.6.1 Setting pressure units

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

Setting pressure units with a Field Communicator

From the HOME screen, enter the Fast Key sequence.

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

Setting pressure units with AMS Device Manager

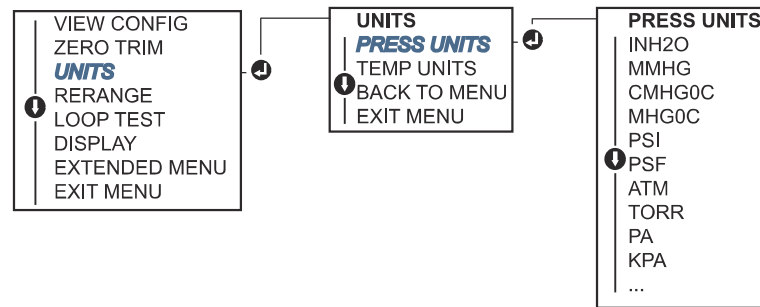
Procedure

1. Right select the device and select **Configure**.
2. Select **Manual Setup** and select desired units from Pressure Units dropdown menu.
3. Select **Send** when complete.

Setting pressure units with a LOI

Follow [Figure 2-5](#) to select desired pressure and temperature units. Use the SCROLL and ENTER buttons to select desired unit. Save by selecting SAVE as indicated on the LCD display screen.

Figure 2-5: Selecting Units with LOI



2.6.2 Setting transmitter output (transfer function)

The transmitter has two output settings: Linear and square root. As shown in [Figure 2-7](#), activating the square root options makes analog output proportional to flow, and includes a fixed low flow cutoff at five percent.

However, for DP Flow and DP Level applications it is recommended to use scaled variable. Refer to [Configuring scaled variable](#) for setup instructions.

Setting transmitter output with a Field Communicator

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

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

Setting transmitter output with AMS Device Manager

Procedure

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

Setting transmitter output with a LOI

Reference [Figure 2-6](#) to select either linear or square root transfer function using the LOI.

Figure 2-6: Set Output with LOI

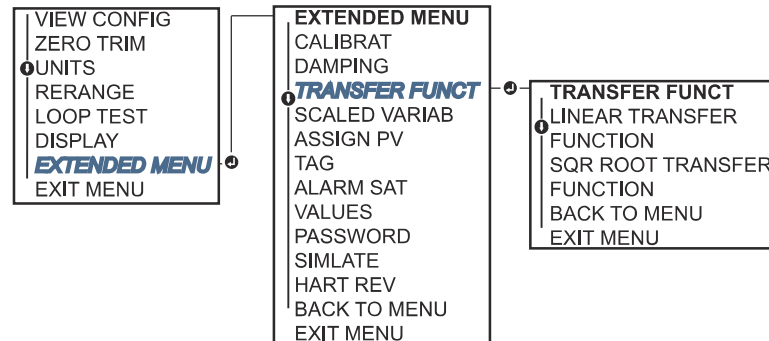
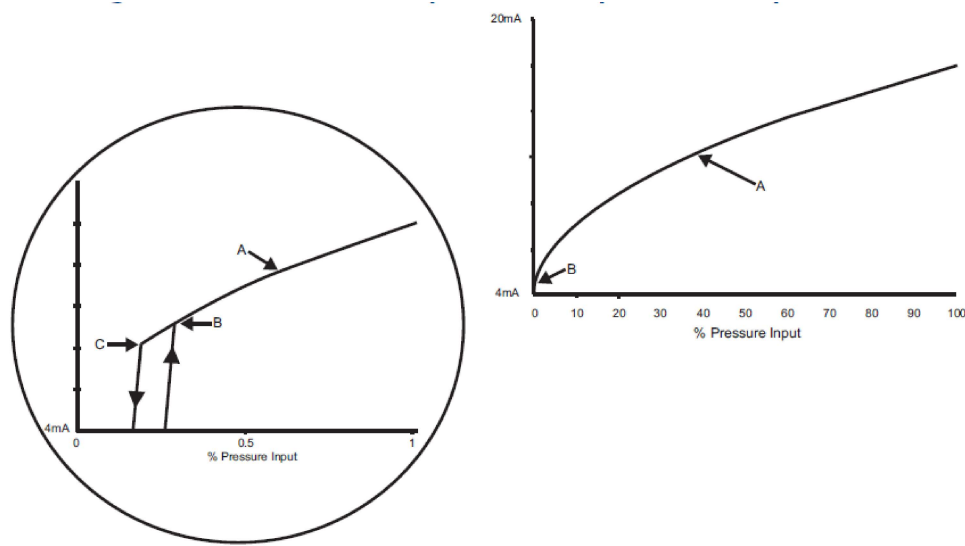


Figure 2-7: 4–20 mA HART Square Root Output Transition Point



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

2.6.3 Rerange the transmitter

The range values command sets each of the lower and upper range analog values (4 and 20 mA/1–5 Vdc points) to a pressure. The lower range point represents 0 percent of range and the upper range point represents 100 percent of range. In practice, the transmitter range values may be changed as often as necessary to reflect changing process requirements.

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

- Rerange by manually setting range points with a Field Communicator, AMS Device Manager, or LOI.

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

Manually rerange the transmitter by entering range points

Entering range points with a Field Communicator

From the HOME screen, enter the Fast Key sequence.

Device Dashboard Fast Keys	2, 2, 2, 1
----------------------------	------------

Entering range points with AMS Device Manager

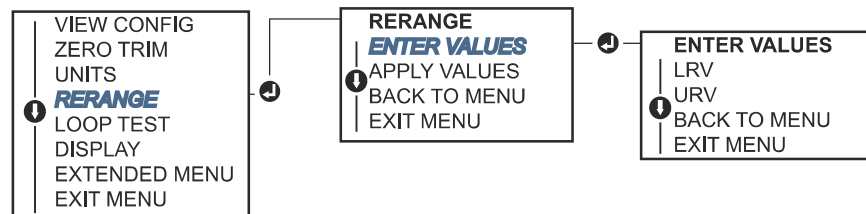
Procedure

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

Entering range points with a LOI

Reference [Figure 2-8](#) to rerange the transmitter using the LOI. Enter values using SCROLL and ENTER buttons.

Figure 2-8: Rerange with LOI



Rerange the transmitter with applied pressure source

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

Rerange with an applied pressure source using a Field Communicator

From the HOME screen, enter the Fast Key sequence

Device Dashboard Fast Keys	2, 2, 2, 2
----------------------------	------------

Rerange with an applied pressure source using AMS Device Manager

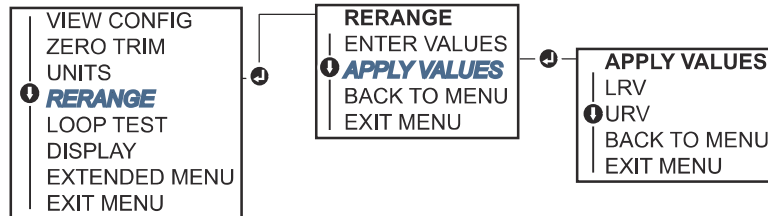
Procedure

1. Right select the device, select **Configure**.
2. Select the **Analog Output** tab.
3. Select Range by Applying Pressure button and follow the screen prompts range the transmitter.

Rerange with an applied pressure source using a Field Communicator

Use [Figure 2-9](#) to manually rerange the device using an applied pressure source with an LOI.

Figure 2-9: Rerange with Applied Pressure Using LOI



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

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

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

Procedure

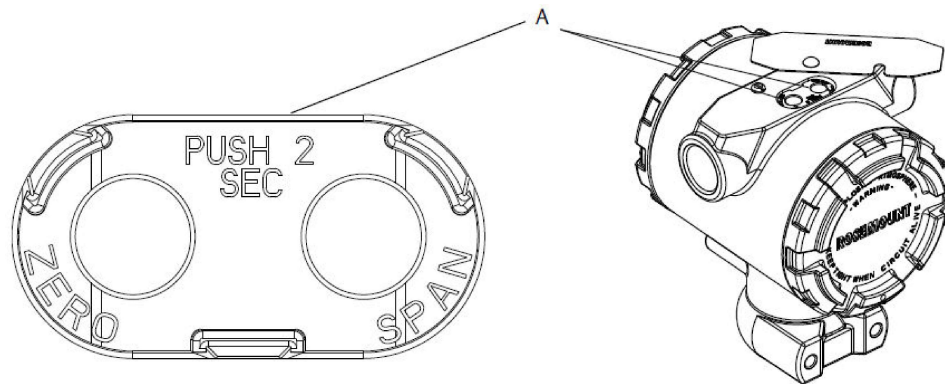
1. Loosen the screw holding the top tag of the transmitter housing. Rotate the label to expose the zero and span buttons.
2. Confirm device has local zero and span buttons by verifying blue retainer under the tag.
3. Apply transmitter pressure.
4. Rerange the transmitter.
 - a) To change the zero (4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

Example

Note

4 mA and 20 mA points must maintain the minimum span.

Figure 2-10: Analog Zero and Span Buttons



A. Zero and span buttons

Note

- If the transmitter security is on, adjustments to the zero and span will not be able to be made. Refer to [Configure security and simulation](#) for security information.
- The span is maintained when the 4 mA/1 V point is set. The span changes when the 20 mA 5 V point is set. If the lower range point is set to a value that causes the upper range point to exceed the sensor limit, the upper range point is automatically set to the sensor limit, and the span is adjusted accordingly.
- Regardless of the range points, the transmitter measure and report all readings within the digital limits of the sensor. For example, if the 4 and 20 mA(1–5 Vdc) points are set to 0 and 10 inH₂O, and the transmitter detects a pressure of 25 inH₂O, it digitally outputs the 25 inH₂O reading and a 250 percent of range reading.

2.6.4

Damping

The damping command changes the response time of the transmitter; higher values can smooth variations in output readings caused by rapid input changes. Determine the appropriate damping setting based on the necessary response time, signal stability, and other requirements of the loop dynamics within your system. The damping command utilizes floating point configuration allowing the user to input any damping value within 0.0–60.0 seconds.

Damping with a Field Communicator

Procedure

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

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

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

Damping with AMS Device Manager

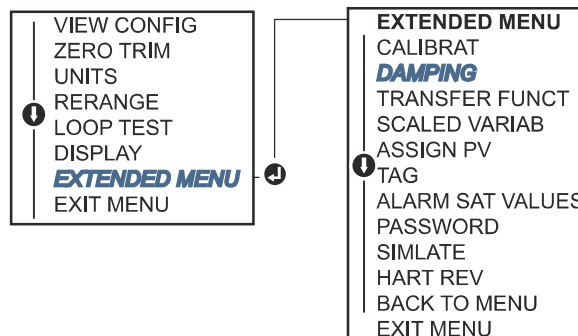
Procedure

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

Damping with a LOI

Reference [Figure 2-11](#) to enter damping values using an LOI.

Figure 2-11: Damping with LOI



2.7 Configuring the LCD display

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

- Pressure Units
- % of Range
- Scaled Variable
- Sensor Temperature
- mA/Vdc Output

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

Reference [Configuring the LCD display](#) with LOI for image of LCD display screen.

2.7.1 Configuring LCD display with a Field Communicator

From the HOME screen, enter the Fast Key sequence.

Device Dashboard Fast Keys	2, 2, 4
----------------------------	---------

2.7.2 Configuring LCD display with AMS Device Manager

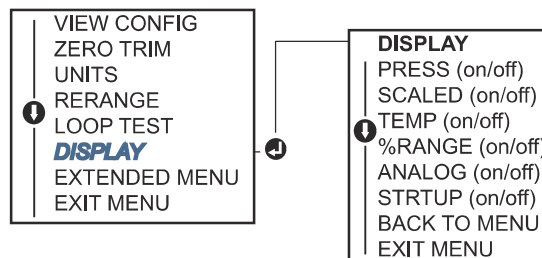
Procedure

1. Right select on the device and select **Configure**.
2. Select **Manual Setup**, select the **Display** tab.
3. Select desired display options and click **Send**.

2.7.3 Configuring LCD display with a LOI

Refer to [Figure 2-12](#) for LCD display configuration using a LOI.

Figure 2-12: Display with LOI



2.8 Detailed transmitter setup

2.8.1 Configuring alarm and saturation levels

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

The transmitter automatically and continuously performs self-diagnostic routines. If the self-diagnostic routines detect a failure, the transmitter drives the output to configured alarm and value based on the position of the alarm switch. See [Setting transmitter alarm](#).

Table 2-4: Rosemount Alarm and Saturation Values

Level	4–20 mA (1–5 Vdc) saturation	4–20 mA (1–5 Vdc) alarm
Low	3.90 mA (0.97 V)	≤ 3.75 mA (0.95 V)
High	20.80 mA (5.20 V)	≥ 21.75 mA (5.40 V)

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

Level	4–20 mA (1–5 Vdc) saturation	4–20 mA (1–5 Vdc) alarm
Low	3.80 mA (0.95 V)	≤ 3.60 mA (0.90 V) (.90 –.95 V)
High	20.50 mA (5.13 V)	≥22.50 mA (5.63 V) (5.05 –5.75 V)

Table 2-6: Custom Alarm and Saturation Values

Level	4–20 mA (1–5 Vdc) saturation	4–20 mA (1–5 Vdc) alarm
Low	3.70 mA– 3.90 mA (.90 –.95 V)	3.60–3.80 mA (.90 –.95 V)
High	20.10 mA –22.90 mA (5.025 –5.725 V)	20.20 mA – 23.00 mA (5.05 –5.75 V)

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

- Low alarm level must be less than the low saturation level
- High alarm level must be higher than the high saturation level
- Alarm and saturation levels must be separated by at least 0.1 mA (0.025 Vdc)

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

Note

Transmitters set to HART® multidrop mode send all saturation and alarm information digitally; saturation and alarm conditions will not affect the analog output. See also [Establishing multidrop communication](#).

Configuring alarm and saturation levels using a Field Communicator

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

Device Dashboard Fast Keys	2, 2, 2, 5
----------------------------	------------

Configuring alarm and saturation levels with AMS Device Manager

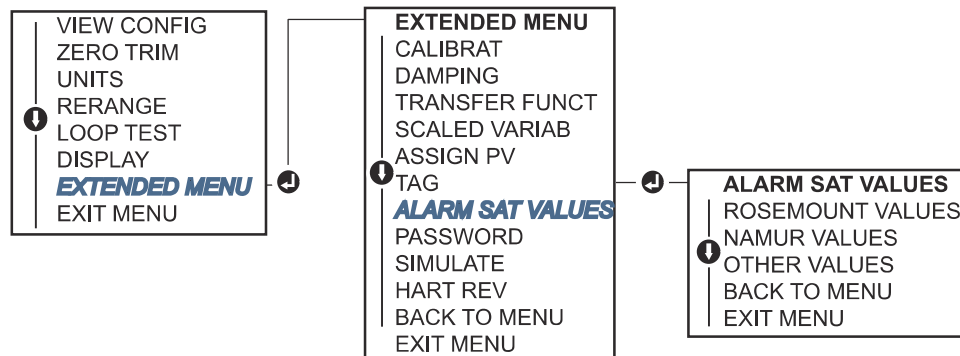
Procedure

1. Right select on the device, and select **Configure**.
2. Select **Configure Alarm and Saturation Levels** button.
3. Follow screen prompts to configure Alarm and Saturation Levels.

Configuring alarm and saturation levels using LOI

Refer to [Figure 2-13](#) for instructions to configure alarm and saturation levels.

Figure 2-13: Configuring Alarm and Saturation with LOI



2.8.2 Configuring scaled variable

The Scaled Variable configuration allows the user to create a relationship/conversion between the pressure units and user-defined/custom units. There are two use cases for Scaled Variable. The first use case is to allow custom units to be displayed on the transmitter's LCD/LOI display. The second use case is to allow custom units to drive the transmitter's 4–20 mA (1–5 Vdc) output.

If the user desires custom units to drive the 4–20 mA (1–5 Vdc) output, Scaled Variable must be re-mapped as the primary variable. Refer to [Re-mapping device variables](#).

The Scaled Variable configuration defines the following items:

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

Configuring scaled variable using a Field Communicator

From the HOME screen, enter the Fast Key sequence.

Device Dashboard Fast Keys	2, 1, 4, 7
----------------------------	------------

Procedure

Follow the screen prompts to configure Scaled Variable.

- a) When configuring for level, select **Linear** under Select Scaled data options.
- b) When configuring for flow, select **Square Root** under Select Scaled data options.

Configuring scaled variable using AMS Device Manager

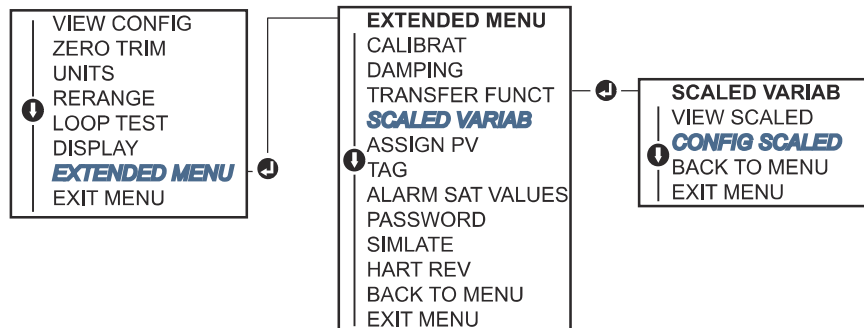
Procedure

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

Configuring scaled variable using a LOI

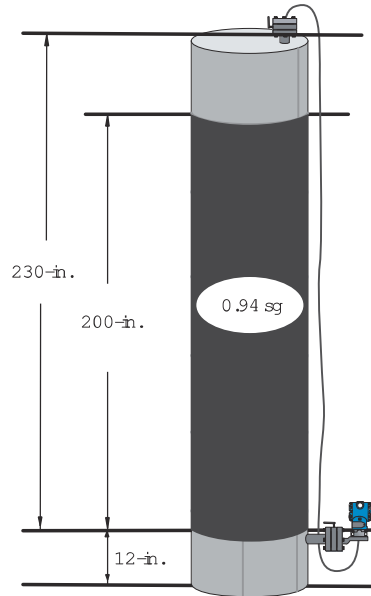
Refer to [Figure 2-14](#) for instructions to configure Scaled Variable using a LOI.

Figure 2-14: Configuring Scaled Variable Using a LOI



DP level example

Figure 2-15: Example Tank



A differential transmitter is used in a level application. Once installed on an empty tank and taps vented, the process variable reading is $-209.4 \text{ inH}_2\text{O}$. The process variable reading is the head pressure created by fill fluid in the capillary. Based on [Table 2-7](#), the scaled variable configuration would be as follows:

Table 2-7: Scaled Variable Configuration for Tank Application

Scaled variable units:	inch
Scaled data 13:	linear
Pressure value position 1:	0 inH ₂ O
Scaled Variable position 1:	12-in.
Pressure value position 2:	188 inH ₂ O
Scaled Variable position 2:	212-in.
Linear offset:	$-209.4 \text{ inH}_2\text{O}$

DP flow example

A differential pressure transmitter is used in conjunction with an orifice plate in a flow application where the differential pressure at full scale flow is $125 \text{ inH}_2\text{O}$. In this particular application, the flow rate at full scale flow is 20,000 gallons of water per hour. It is highly recommended to use the low flow cutoff function in order to have a stable output and avoid problems due to process noise at a low flow or no flow condition. A low flow cutoff value that is practical for the flow element in the application should be entered. In this

particular example, the low flow cutoff value is 1000 gallons of water per hour. Based on this information, the Scaled Variable configuration would be as follows:

Table 2-8: Scaled Variable Configuration for Flow Application

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

Note

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

2.8.3 Re-mapping device variables

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

Note

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

Re-mapping using a Field Communicator

From the HOME screen, enter the Fast Key sequence.

Fast Keys	2, 1, 1, 3
-----------	------------

Re-mapping using AMS Device Manager

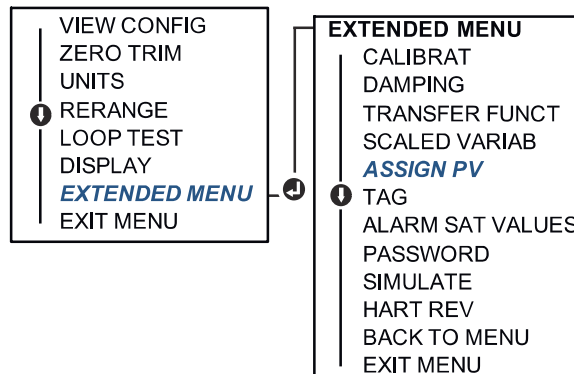
Procedure

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

Re-mapping using LOI

Refer to [Figure 2-16](#) for instructions to remap the primary variable using a LOI.

Figure 2-16: Re-mapping with LOI



2.9 Performing transmitter tests

2.9.1 Verifying alarm level

If the transmitter is repaired or replaced, verify the transmitter alarm level before returning the transmitter to service. This is useful in testing the reaction of the control system to a transmitter in an alarm state. Thus ensuring the control system recognizes the alarm when activated. To verify the transmitter alarm values, perform a loop test and set the transmitter output to the alarm value see [Configuring alarm and saturation levels](#).

Note

Before returning transmitter to service, verify security switch is set to the correct position. Refer to [Verify configuration](#).

2.9.2 Performing an analog loop test

The **analog loop test** command verifies the output of the transmitter, the integrity of the loop, and the operations of any recorders or similar devices installed in the loop. It is recommended that the 4–20 mA (1–5 Vdc) points in addition to alarm levels when installing, repairing, or replacing a transmitter.

The host system may provide a current measurement for the 4–20 mA (1–5 Vdc) HART[®] output. If not, connect a reference meter to the transmitter by either connecting the meter to the test terminals on the terminal block, or shunting transmitter power through the meter at some point in the loop. For 1–5 V output, voltage measurement is directly measured from Vout to (–) terminals.

Performing an analog loop test using a Field Communicator

From the HOME screen, enter the Fast Key sequence.

Device Dashboard Fast Keys	3, 5, 1
----------------------------	---------

Performing an analog loop test using AMS Device Manager

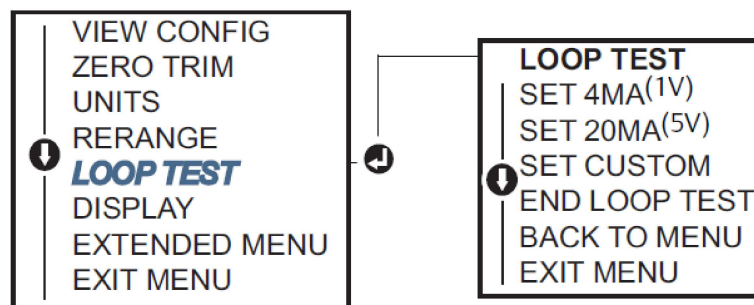
Procedure

1. Right select on the device and, within the Methods drop down menu, move cursor over Diagnostics and Test. In the Diagnostics and Test drop down menu select **Loop Test**.
2. Select **Next** after setting the control loop to manual.
3. Follow Screen prompts to perform a Loop Test.
4. Select **Finish** to acknowledge the method is complete.

Performing analog loop test using a LOI

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

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



2.9.3 Simulate device variables

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

Simulate digital signal with a Field Communicator

From the HOME screen, enter the Fast Key sequence.

Device Dashboard Fast Keys	3, 5
----------------------------	------

Simulate digital signal with AMS Device Manager

Procedure

1. Right select on the device and select **Service Tools**.
2. Select **Simulate**.
3. Under Device Variables select a digital value to simulate.
 - a) Pressure

- b) Sensor Temperature
 - c) Scaled Variable
4. Follow the screen prompts to simulate selected digital value.

2.10 Configuring burst mode

Burst mode is compatible with the analog signal. Because the HART® protocol features simultaneous digital and analog data transmission, the analog value can drive other equipment in the loop while the control system is receiving the digital information. Burst mode applies only to the transmission of dynamic data (pressure and temperature in engineering units, pressure in percent of range, Scaled Variable, and/or analog output), and does not affect the way other transmitter data is accessed. However, when activated, burst mode can slow down communication of non-dynamic data to the host by 50 percent.

Access to information other than dynamic transmitter data is obtained through the normal poll/response method of HART communication. A Field Communicator, AMS Device Manager, or the control system may request any of the information that is normally available while the transmitter is in burst mode. Between each message sent by the transmitter, a short pause allows the Field Communicator, AMS Device Manager, or a control system to initiate a request.

2.10.1 Choosing burst mode options in HART® 5

Message content options:

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

2.10.2 Choosing burst mode options in HART® 7

Message content options:

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

2.10.3 Choosing a HART® 7 trigger mode

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

- Continuous (same as HART5 burst mode)
- Rising
- Falling
- Windowed
- On Change

Note

Consult your host system manufacturer for burst mode requirements.

2.10.4 Configuring burst mode using a Field Communicator

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

Device Dashboard Fast Keys	2, 2, 5, 3
----------------------------	------------

2.10.5 Configuring burst mode using AMS Device Manager

Procedure

1. Right select on the device and select **Configure**.
2. Select the **HART** tab.
3. Enter the configuration in Burst Mode Configuration fields.

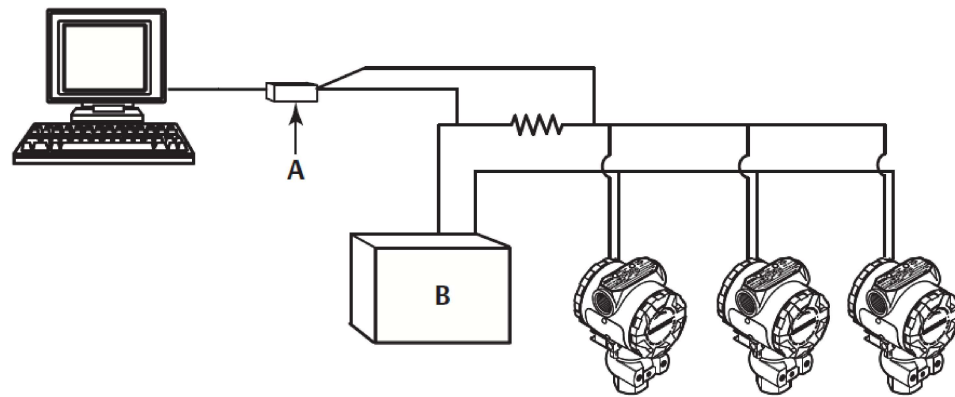
2.11 Establishing multidrop communication

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

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

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

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



- A. HART modem
- B. Power supply

The product is set to address zero (0) at the factory, which allows operation in the standard point-to-point manner with a 4–20 mA (1–5 Vdc) output signal. To activate multidrop communication, the transmitter address must be changed to a number from 1 to 15 for HART Revision 5, or 1–63 for HART Revision 7. This change deactivates the 4–20 mA (1–5 Vdc) analog output, sending it to 4 mA (1 Vdc). It also disables the failure mode alarm signal, which is controlled by the upscale/downscale switch position. Failure signals in multidropped transmitters are communicated through HART messages.

2.11.1 Changing a transmitter address

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

Changing transmitter address using a Field Communicator

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

	HART Revision 5	HART Revision 7
Device Dashboard Fast Keys	2, 2, 5, 2, 1	2, 2, 5, 2, 2

Changing transmitter address using AMS Device Manager

Procedure

1. Right select on the device and select **Configure**.
2. In HART Revision 5 mode:
 - a) Select **Manual Setup**, select the **HART** tab.
 - b) In the Communication Settings box enter polling address in the **Polling Address** box, select **Send**.
3. In HART Revision 7 mode:

- a) Select **Manual Setup**, select the **HART** tab and select the **Change Polling Address** button.
4. Carefully read the warning and click **Yes** if it is safe to apply the changes.

2.11.2 Communicating with a multidropped transmitter

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

Communicating with a multidropped transmitter using a Field Communicator

Procedure

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

Communicating with a multidropped transmitter using AMS Device Manager

Procedure

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

3 Hardware Installation

3.1 Overview

The information in this section covers installation considerations for the Rosemount 2051 with HART® protocols. A Quick Installation Guide is shipped with every transmitter to describe recommended pipe-fitting and wiring procedures for initial installation. Dimensional drawings for each transmitter variation and mounting configuration are included on [Bolt installation](#).

Note

For transmitter disassembly and reassembly refer to [Disassembly procedures](#), and [Reassembly procedures](#).

3.2 Safety messages

Procedures and instructions in this section may require special precautions to ensure the safety of the personnel performing the operation. Refer to the following safety messages before performing an operation preceded by this symbol.

WARNING

Explosions

Explosions could result in death or serious injury.

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

Before connecting a communicator in an explosive atmosphere, ensure the instruments in the segment are installed in accordance with intrinsically safe or non-incendive field wiring practices.

In an explosion-proof/flameproof installation, do not remove the transmitter covers when power is applied to the unit.

Process leaks

Process leaks may cause harm or result in death.

Install and tighten process connectors before applying pressure.

Electrical shocks

Electrical shock could cause death or serious injury.

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

⚠ WARNING

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.

Improper assembly of manifolds

Improper assembly of manifolds to traditional flange can damage the SuperModule™ Platform.

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

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 to protecting your system. Restrict physical access by unauthorized personnel to protect end users' assets. This is true for all systems used within the facility.

3.3 Considerations

3.3.1 Installation considerations

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

Important

Install the enclosed pipe plug (found in the box) in unused conduit opening. Engage a minimum of five threads to comply with explosion-proof requirements. For tapered threads, install the plug wrench tight. For material compatibility considerations, see Material Selection [Technical Note](#) on [Emerson.com/Rosemount](https://www.emerson.com/Rosemount).

3.3.2 Environmental considerations

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

3.3.3 Mechanical considerations

Steam service

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

Side mounted

When the transmitter is mounted on its side, position the coplanar flange to ensure proper venting or draining. Mount the flange as shown in [Mounting requirements](#), keeping drain/vent connections on the bottom for gas service and on the top for liquid service.

3.4 Installation procedures

3.4.1 Mount the transmitter

Process flange orientation

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

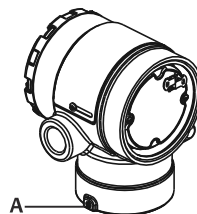
Note

Most transmitters are calibrated in the horizontal position. Mounting the transmitter in any other position will shift the zero point to the equivalent amount of liquid head pressure caused by the varied mounting position. To reset zero point, refer to [Trim the pressure signal](#).

Housing rotation

To improve field access to wiring or to better view the optional LCD display follow the procedure steps.

Figure 3-1: Housing Rotation



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

Procedure

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

2. Rotate the housing clockwise to the desired location.
3. If the desired location cannot be achieved due to thread limit, 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.

Electronics housing clearance

Mount the transmitter so the terminal side is accessible. Clearance of 0.75 in. (19 mm) is required for cover removal. Use a conduit plug in the unused conduit opening. Three inches of clearance is required for cover removal if a meter is installed.

Environmental seal for housing

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

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

Flange bolts

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

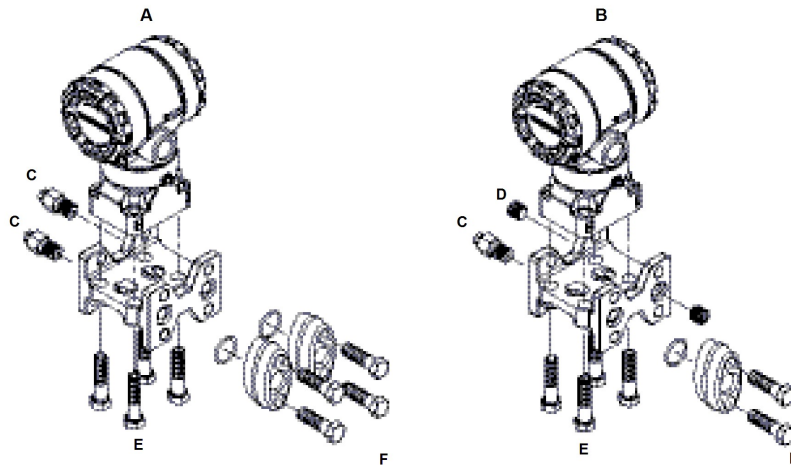
Bolt installation

Only use bolts supplied with the transmitter or sold by Emerson as spare parts. The use of non approved bolts could reduce pressure. Use the following bolt installation procedure:

Table 3-1: Bolt installation torque values

Bolt material	Initial torque value	Final torque value
CS-(ASTM-A445) Standard	300 in.-lb (34 N-m)	650 in.-lb (73 N-m)
Austemitic 316 SST—Option L4	150 in.-lb (17 N-m)	300 in.-lb (34 N-m)
ASTM A193 Grade B7M—Option L5	300 in.-lb (34 N-m)	650 in.-lb (73 N-m)
ASTM A 193 Class 2, Grade B8M option L8	300 in.-lb (34 N-m)	650 in.-lb (73 N-m)

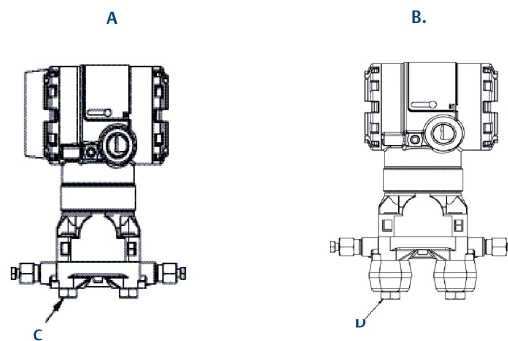
Figure 3-2: Traditional Flange Bolt Configurations



- A. Differential transmitter
- B. Gauge/Absolute transmitter
- C. Drain/vent
- D. Plug
- E. 1.75 (44) × 4
- F. 1.50 (38) × 4⁽¹⁾

Note: Dimensions are in inches (millimeters)

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



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

⁽¹⁾ Rosemount 2051T transmitters are direct mount and do not require bolts for process connection.

- A. Transmitter with flange bolts
- B. Transmitter with flange adapters and flange/adapters bolts
- C. 1.75 (44) × 4
- D. 2.88 (73) × 4

Dimensions are in inches (millimeters).

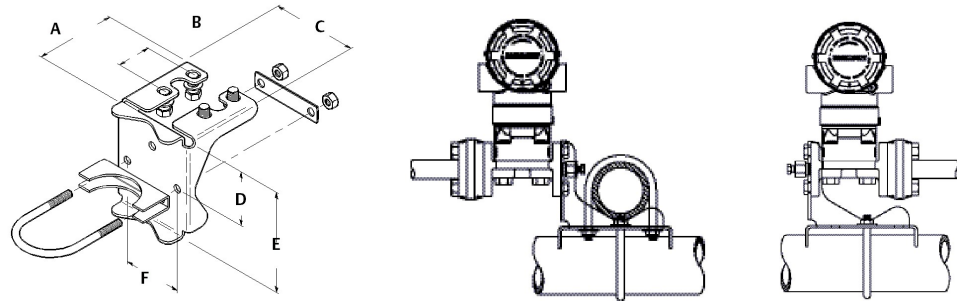
⁽¹⁾ For Gauge and Absolute Transmitters: 150 (38) × 2

Table 3-2: Bolt configurations values

Description	Quantity	Size in. (mm)
Differential pressure		
Flange bolts	4	1.75 (44)
Flange/adapter bolts	4	2.88 (73)
Gauge/Absolute pressure⁽¹⁾		
Flange bolts	4	1.75 (44)
Flange/adapter bolts	2	2.88 (73)

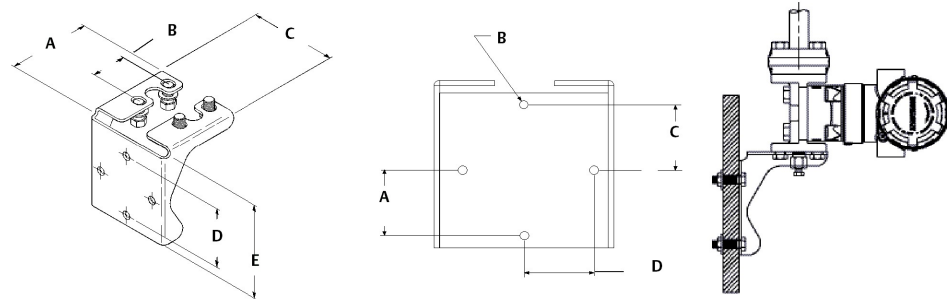
(1) Rosemount 2051T Transmitters are direct mount and do not require bolts for process connection.

Figure 3-4: Mounting Bracket Option Codes B1, B7, and BA



- A. 3.75 (95)
- B. 1.63 (41)
- C. 4.09 (104)
- D. 2.73 (69)
- E. 4.97 (126)
- F. 2.81 (71)

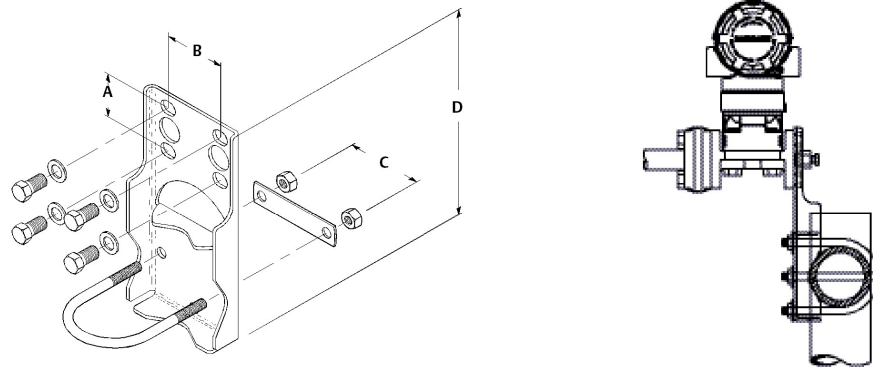
Figure 3-5: Panel Mounting Bracket Option Codes B2 and B8



- A. 3.75 (95)
- B. 1.63 (41)
- C. 4.09 (104)
- D. 2.81 (71)
- E. 4.5 (114)

- A. 1.40 (36)
- B. Mounting holes 0.375 diameter (10)
- C. 1.405 (35,7)
- D. 1.405 (35,7)

Figure 3-6: Flat Mounting Bracket Option Codes B3 and BC



- A. 1.625 (41)
- B. 2.125 (54)
- C. 2.81 (71)
- D. 8.00 (203)

Note: Dimensions are in inches (millimeters).

Procedure

1. Finger-tighten the bolts.
2. Torque the bolts to the initial torque value using a crossing pattern (see [Table 3.4.2](#) for torque values).
3. Torque the bolts to the final torque value using the same crossing pattern.

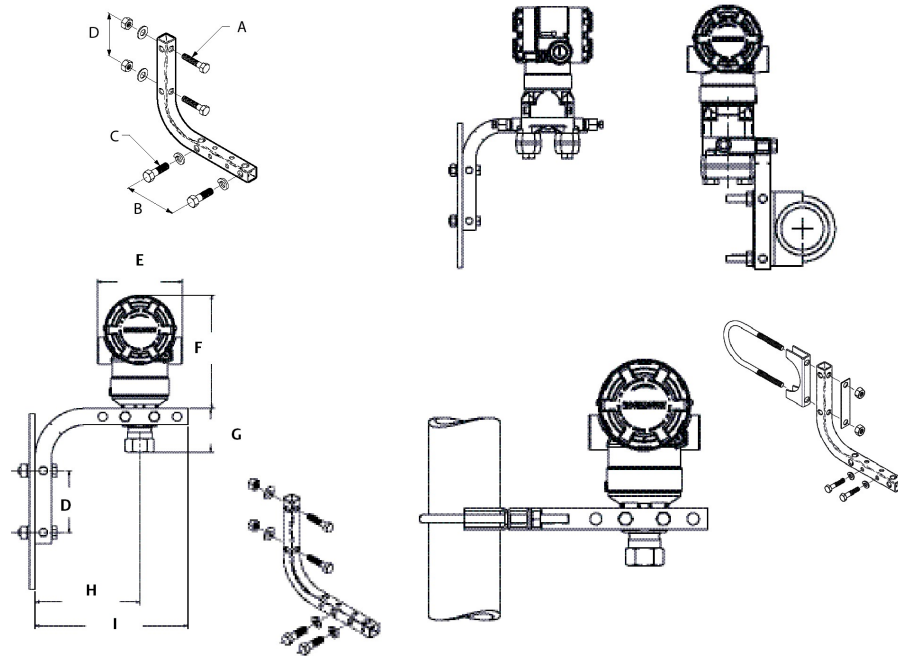
Mounting brackets

Rosemount 2051 transmitters may be panel-mounted or pipe-mounted via an optional mounting bracket. Refer to [Table 3-2](#) for the complete offering and see [Figure 3-7](#) through [Figure 3-6](#) on pages [Figure 3-7](#) and [39](#) for dimensional and mounting configuration information.

Table 3-3: Mounting brackets

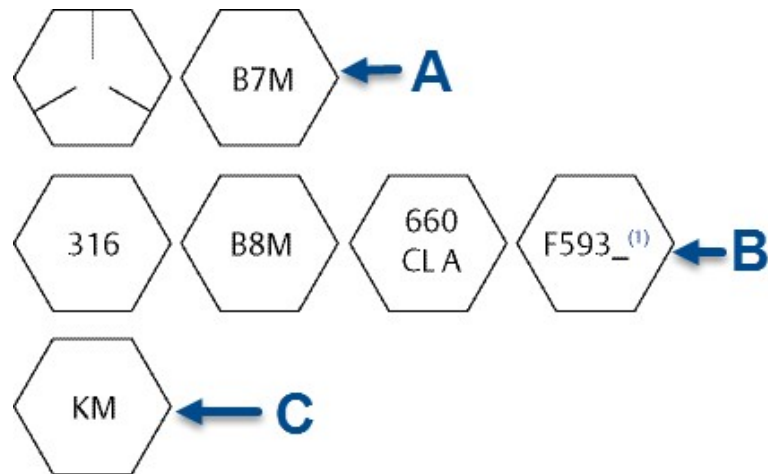
Option code	Process connections			Mounting			Materials			
	Coplanar	In-line	Traditional	Pipe mount	Panel mount	Flat panel mount	CS bracket	SST bracket	CS bolts	SST bolts
B4	X	X		X	X	X		X		X
B1			X	X			X		X	
B2			X		X		X		X	
B3			X			X	X		X	
B7			X	X			X			X
B8			X		X		X			X
B9			X			X	X			X
BA			X	X				X		X
BC			X			X		X		X

Figure 3-7: Mounting Bracket Option Code B4



- A. $5/16 \times 1\frac{1}{2}$ Bolts for panel mounting(not supplied)
- B. 3.4 (85)
- C. $3/8-16 \times 1\frac{1}{4}$ Bolts for mounting to transmitter
- D. 2.8 (71)
- E. 3.85 (98)
- F. 5.16 (131)
- G. 1.99 (51)
- H. 4.72 (120)
- I. 6.90 (175)

Note: Dimensions are in inches (millimeters).



1. Carbon steel (CS) head markings
2. Stainless steel (SST) head markings
3. Alloy K-500 head marking

Note

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

3.4.2 Impulse piping

Mounting requirements

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

Liquid flow measurement

- 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.

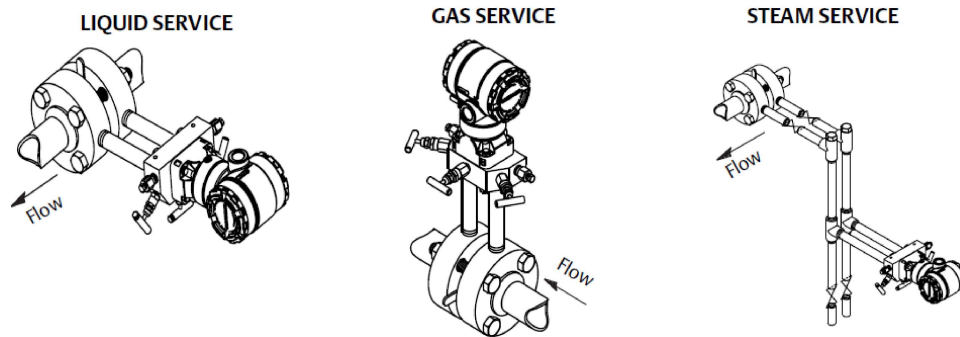
Steam flow measurement

- 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.

Note

For steam or other elevated temperature services, it is important that temperatures at the process connection do not exceed the transmitter's process temperature limits. See [Temperature limits](#) for details.

Figure 3-8: Installation Examples



Best practices

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

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

- Keep impulse piping as short as possible.
- For liquid service, slope the impulse piping at least 1 in./ft (8 cm/m) upward from the transmitter toward the process connection.
- For gas service, slope the impulse piping at least 1 in./ft (8 cm/m) downward from the transmitter toward the process connection.
- Avoid high points in liquid lines and low points in gas lines.
- Use impulse piping large enough to avoid friction effects and blockage.
- Vent all gas from liquid piping legs.
- 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.
- Avoid conditions that might allow process fluid to freeze within the process flange.

3.4.3 Process connections

Coplanar or traditional process connection

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

Flange adapters

Rosemount 2051DP and GP process connections on the transmitter flanges are ¼–18 NPT. Flange adapters are available with standard ½–14 NPT Class 2 connections. The flange adapters allow users to disconnect from the process by removing the flange adapter bolts. Use plant-approved lubricant or sealant when making the process connections. Refer to dimensional drawings on [page 113](#) for the distance between pressure connections. This distance may be varied $\pm 1/4$ in. (6.4 mm) by rotating one or both of the flange adapters.

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

Procedure

1. Remove the flange bolts.
2. Leaving the flange in place, move the adapters into position with the o-ring installed.
3. Clamp the adapters and the cCoplanar flange to the transmitter sensor module using the larger of the bolts supplied.
4. Tighten the bolts. Refer to [“Flange bolts” on page 36](#) for torque specifications.

Example

When removing flanges or adapters, visually inspect the PTFE o-rings. Replace with o-ring designed for Rosemount transmitter if there are any signs of damage, such as nicks or cuts. Undamaged o-rings may be reused. If you replace the O-rings, retorque the flange bolts after installation to compensate for cold flow. Refer to the process sensor body reassembly procedure in [Section 5: Troubleshooting](#).

Note

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

3.4.4 Inline process connection

Inline gauge transmitter orientation

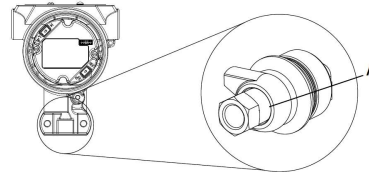
⚠ CAUTION

Interfering or blocking the atmospheric reference port will cause the transmitter to output erroneous pressure values.

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 3-9](#)).

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

Figure 3-9: Inline gauge low side pressure port



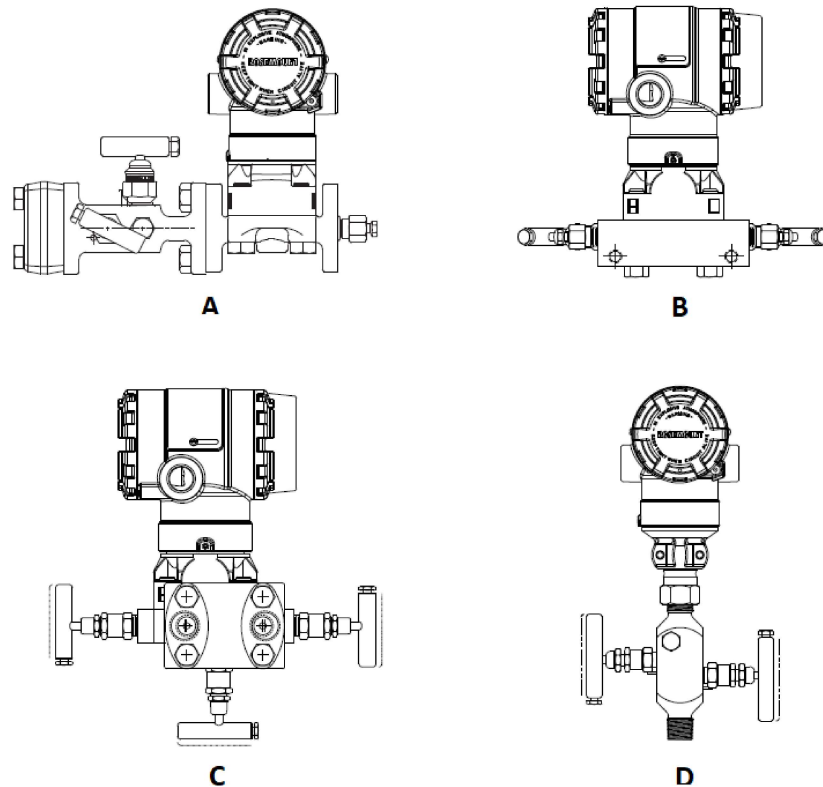
A. Low side pressure port (atmospheric reference)

⚠ WARNING

3.5 Rosemount 305, 306, and 304 Manifolds

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

Figure 3-10: Manifolds



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

3.5.1 Install Rosemount 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.

Important

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

2. Install the Integral Manifold on the sensor module. Use the four 2.25-in. (57.2 mm). manifold bolts for alignment. Finger tighten the bolts; then tighten the bolts incrementally in a cross pattern to final torque value.

See [Flange bolts](#) for complete bolt installation information and torque values. When fully tightened, the bolts should extend through the top of the sensor module housing.

3. If 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.

Note

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

3.5.2 Install Rosemount 306 integral manifold

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

Assemble the Rosemount 306 manifold to the Rosemount 3051T or 2051T In-Line Transmitters with a thread sealant.

3.5.3 Install Rosemount 304 Conventional Manifold

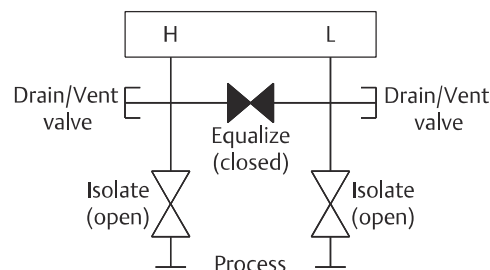
Procedure

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 final torque value.
See [Flange bolts](#) for complete bolt installation information and torque values. When fully tightened, the bolts should extend through the top of the sensor module housing.
3. Leak-check assembly to maximum pressure range of transmitter.

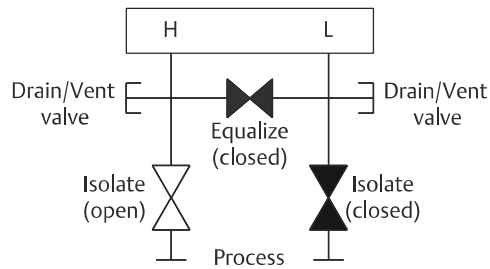
3.5.4 Integral manifold operation

Three-valve configuration shown.

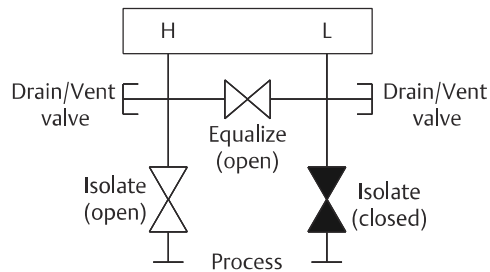
In normal operation the two isolate valves between the process and instrument ports will be open and the equalizing valve(s) will be closed.



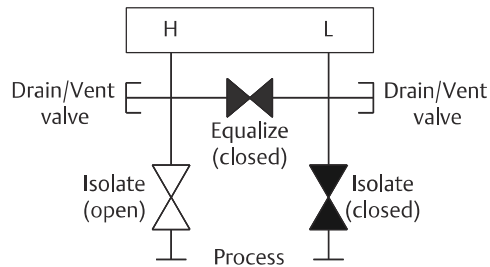
To zero the 2051, close the isolate valve to the low pressure (downstream side) of the transmitter first.



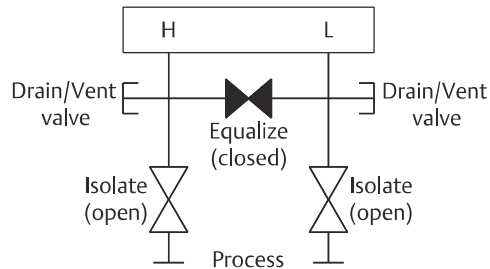
Next, open the center (equalize) valve(s) to equalize the pressure on both sides of the transmitter.



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

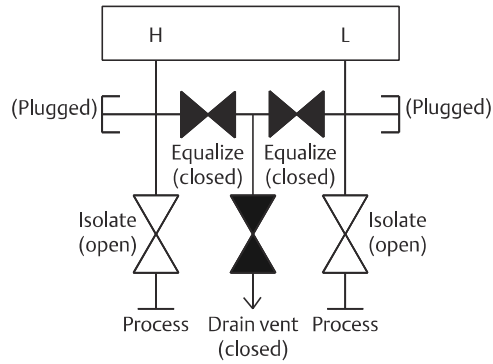


Next, open the isolate valve on the low pressure side of the transmitter.

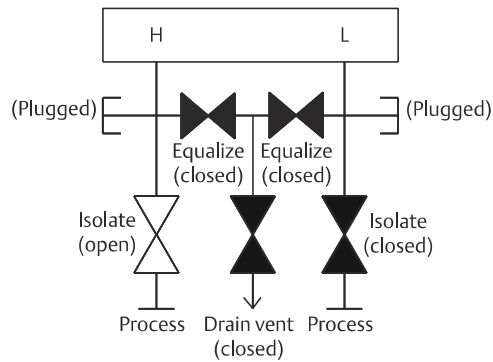


Five-valve Natural Gas configurations shown:

In normal operation, the two block valves between the process and instrument ports will be open, and the equalizing valves will be closed.



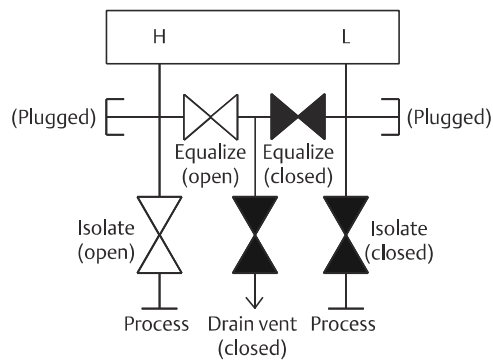
To zero the Rosemount 2051, first close the block valve on the low pressure (downstream) side of the transmitter.

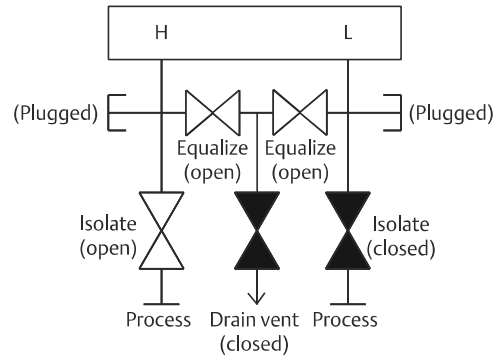


Note

Do not open the low side equalize valve before the high side equalize valve. Doing so will overpressure the transmitter.

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



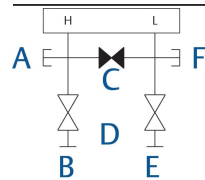


Open the equalize valve on the low pressure (downstream) side of the transmitter. The manifold is now in the proper configuration for zeroing the transmitter.

Operate three and five-valve manifolds

Performing zero trim at static line pressure

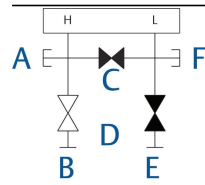
In normal operation, the two isolate (block) valves between the process ports and the transmitter will be open, and the equalize valve will be closed.



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

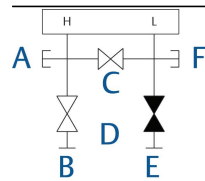
Procedure

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



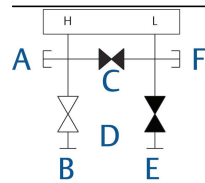
- A. Drain/vent valve
- B. Isolate (open)
- C. Equalize (closed)
- D. Process
- E. Isolate (closed)
- F. Drain/vent valve

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.



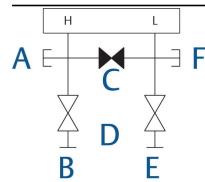
- A. Drain/vent valve
- B. Isolate (open)
- C. Equalize (open)
- D. Process
- E. Isolate (closed)
- F. Drain/vent valve

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



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

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



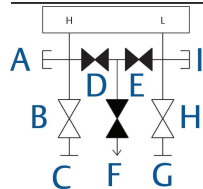
- A. Drain/vent valve
- B. Isolate (open)
- C. Equalize (closed)
- D. Process
- E. Isolate (open)
- F. Drain/vent valve

Operate five-valve natural gas manifold

Performing zero trim at static line pressure

Five-valve natural gas configurations shown:

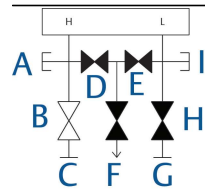
In normal operation, the two isolate (block) valves between the process ports and the transmitter will be open, and the equalize valves will be closed. Vent valves may be open or closed.



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

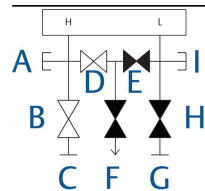
Procedure

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



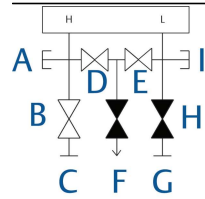
- A. (Plugged)
 - B. Isolate (open)
 - C. Process
 - D. Equalize (closed)
 - E. Equalize (closed)
 - F. Drain vent (closed)
 - G. Process
 - H. Isolate (closed)
 - I. (Plugged)
-

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



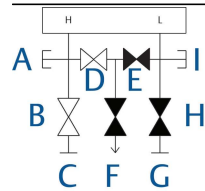
- A. (Plugged)
 - B. Isolate (open)
 - C. Process
 - D. Equalize (open)
 - E. Equalize (closed)
 - F. Drain vent (closed)
 - G. Process
 - H. Isolate (closed)
 - I. (Plugged)
-

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.



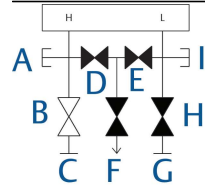
- A. (Plugged)
 - B. Isolate (open)
 - C. Process
 - D. Equalize (open)
 - E. Equalize (open)
 - F. Drain vent (closed)
 - G. Process
 - H. Isolate (closed)
 - I. (Plugged)
-

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



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

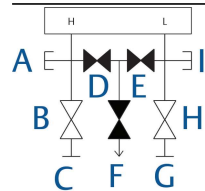
5. Close the equalize valve on the high pressure (upstream) side.



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

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

3.5.5 Adjusting valve packing

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

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

Procedure

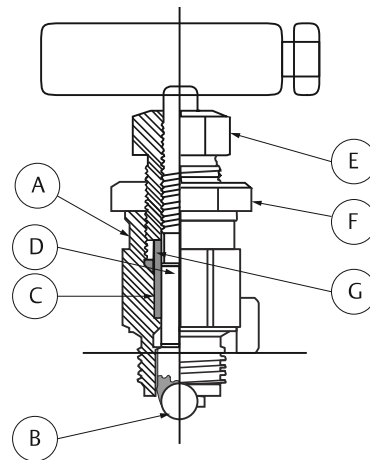
1. Remove all pressure from device.

2. Loosen manifold valve jam nut.
3. Tighten manifold valve packing adjuster nut turn.
4. Tighten manifold valve jam nut.
5. Re-apply pressure and check for leaks.

Example

Above steps can be repeated, if necessary. If the above procedure does not result in proper pressure retention, the complete manifold should be replaced.

Figure 3-11: Valve Components



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

3.6 Liquid level measurement

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

3.6.1 Open vessels

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

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

Zero range suppression is required if the transmitter lies below the zero point of the desired level range. [Figure 3-12](#) shows a liquid level measurement example.

3.6.2 Closed vessels

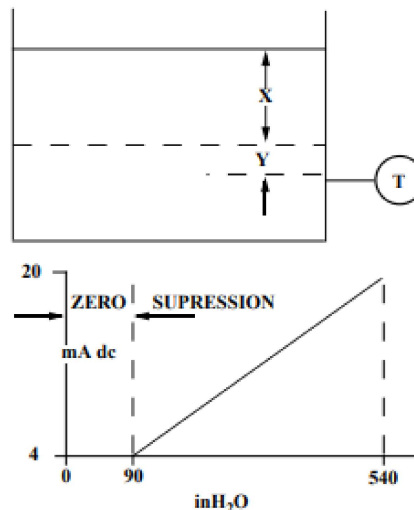
Pressure above a liquid affects the pressure measured at the bottom of a closed vessel. The liquid specific gravity multiplied by the liquid height plus the vessel pressure equals the pressure at the bottom of the vessel.

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

Dry leg condition

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

Figure 3-12: Liquid level measurement example



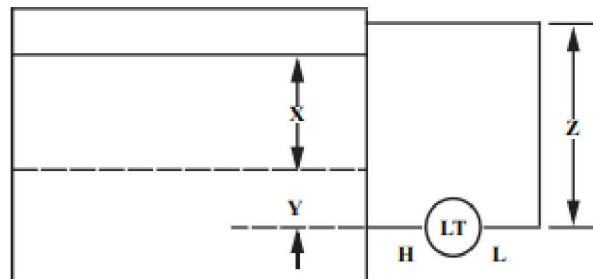
Let X equal the vertical distance between the minimum and maximum measurable levels (500 in.).
 Let Y equal the vertical distance between the transmitter datum line and the minimum measurable level (100 in.).
 Let SG equal the specific gravity of the fluid (0.9).
 Let h equal the maximum head pressure to be measured in inches of water.
 Let e equal head pressure produced by Y expressed in inches of water.
 Let Range equal e to e + h.
 Then $h = (X)(SG)$
 $= 500 \times 0.9$
 $= 450 \text{ inH}_2\text{O}$
 $e = (Y)(SG)$
 $= 100 \times 0.9$
 $= 90 \text{ inH}_2\text{O}$
 Range = 90 to 540 inH₂O

Wet leg condition

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

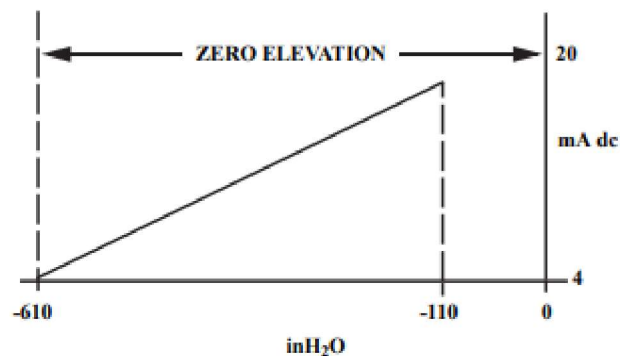
The reference fluid will exert a head pressure on the low side of the transmitter. Zero elevation of the range must then be made. See Figure 3-13.

Figure 3-13: Wet leg example



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

$$\begin{aligned}
 \text{Then } h &= (X)(SG_1) \\
 &= 500 \times 1.0 \\
 &= 500 \text{ in H}_2\text{O} \\
 e &= (Y)(SG_1) \\
 &= 50 \times 1.0 \\
 &= 50 \text{ inH}_2\text{O} \\
 s &= (z)(SG_2) \\
 &= 600 \times 1.1 \\
 &= 660 \text{ inH}_2\text{O} \\
 \text{Range} &= e - s \text{ to } h + e - s \\
 &= 50 - 660 \text{ to } 500 + 50 - 660 \\
 &= -610 \text{ to } -110 \text{ inH}_2\text{O}
 \end{aligned}$$

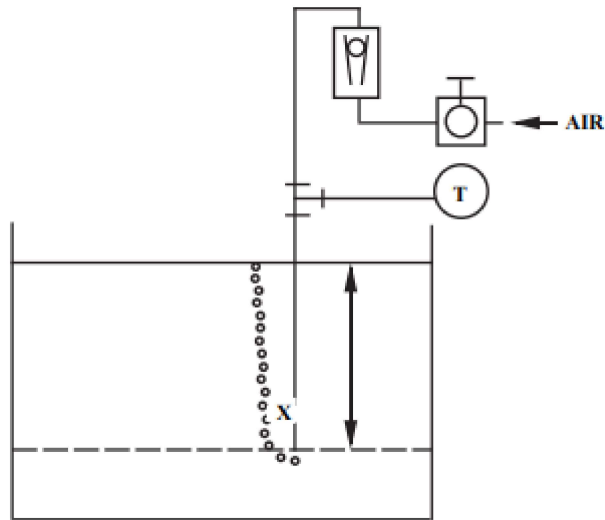


Bubbler system in open vessel

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

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

Figure 3-14: Bubbler liquid level measurement example



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

Let SG equal the specific gravity of the fluid (1.1).

Let h equal the maximum head pressure to be measured in inches of water.

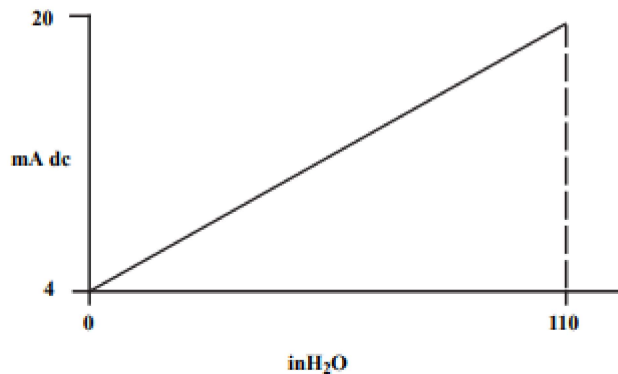
Let Range equal zero to h .

Then $h = (X)(SG)$

$= 100 \times 1.1$

$= 110 \text{ inH}_2\text{O}$

Range = 0 to 110 inH₂O



4 Electrical Installation

4.1 Overview

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

4.2 Safety messages

Procedures and instructions in this section may require special precautions to ensure the safety of the personnel performing the operation. Refer to the following safety messages before performing an operation preceded by this symbol.

⚠ WARNING

Explosions

Explosions could result in death or serious injury.

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

Before connecting a communicator in an explosive atmosphere, ensure the instruments in the segment are installed in accordance with intrinsically safe or non-incendive field wiring practices.

In an explosion-proof/flameproof installation, do not remove the transmitter covers when power is applied to the unit.

Process leaks

Process leaks may cause harm or result in death.

Install and tighten process connectors before applying pressure.

Electrical shocks

Electrical shock could cause death or serious injury.

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

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

Improper assembly of manifolds to traditional flange can damage the SuperModule™ Platform.

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

Physical access

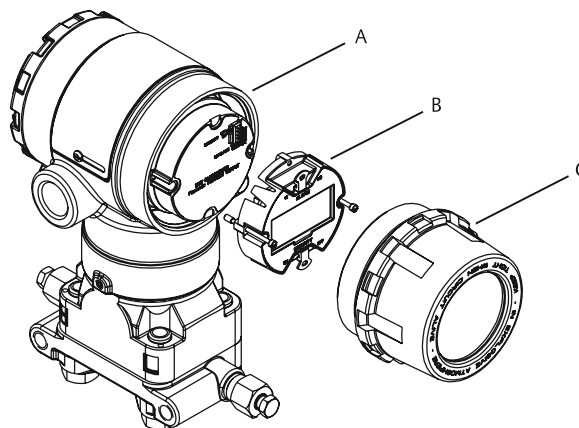
Unauthorized personnel may potentially cause significant damage to and/or misconfiguration of end users' equipment. This could be intentional or unintentional and needs to be protected against.

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

4.3 LOI/LCD display

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

Figure 4-1: LCD Display



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

4.3.1 Rotating LOI/LCD display

Procedure

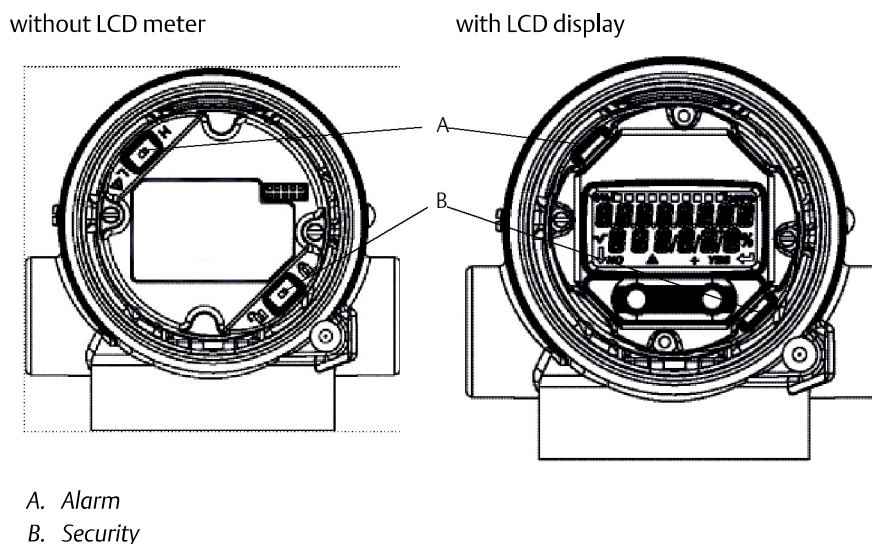
1. Secure the loop to manual control and remove power to transmitter.
2. Remove transmitter housing cover.
3. Remove screws from the LCD display and rotate to desired orientation.
 - a) Insert 10 pin connector into the display board for the correct orientation. Carefully align pins for insertion into the output board.
4. Re-insert screws.
5. Reattach transmitter housing cover; it is recommended the cover be tightened until there is no gap between the cover and housing to comply with explosion proof requirements.
6. Re-attach power and return loop to automatic control.

4.4 Configure security and simulation

There are four security methods with the Rosemount 2051 Transmitter.

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

Figure 4-2: 4–20 mA Electronics Board



Note

1-5 Vdc alarm and security switches are located in the same location as 4-20 mA output boards.

4.4.1 Setting security switch

The security switch is used to prevent changes to the transmitter configuration data. If the security switch is set to the locked (🔒) location, any transmitter configuration requests sent via HART®, LOI, or local configuration buttons will be rejected by the transmitter and the transmitter configuration data will not be modified. Reference [Figure 4-2](#) for the location of the security switch. Follow the steps below 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; cover must be fully engaged to comply with explosion proof requirements.

4.4.2 HART Lock

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

Configuring HART Lock using Field Communicator

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

Device Dashboard Fast Keys	2, 2, 6, 4
----------------------------	------------

Procedure

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

Configuring HART Lock using AMS Device Manager

Procedure

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

4.4.3 Configuration Button lock

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

Configuring configuration button lock using a Field Communicator

From the HOME screen, enter the fast key sequence

Device Dashboard Fast Keys	2, 2, 6, 3
----------------------------	------------

Procedure

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

Configuring configuration button lock using AMS Device Manager

Procedure

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

4.4.4 LOI Password

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

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

Configuring password with Field Communicator

From the HOME screen, enter the Fast Key sequence.

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

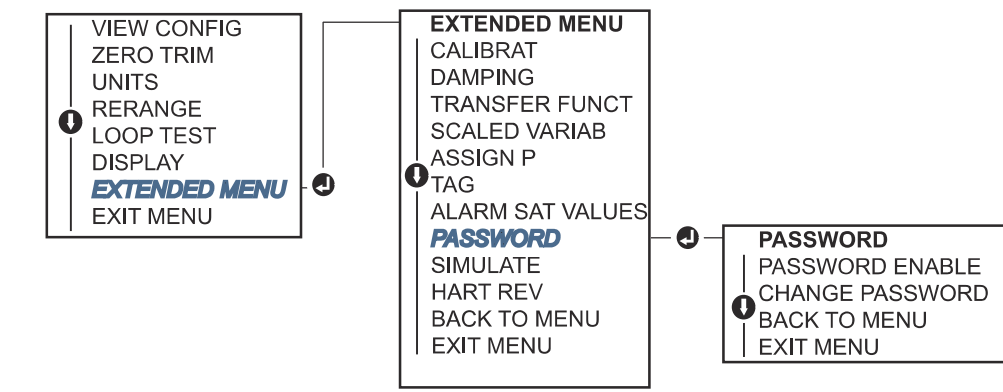
Configuring password with AMS Device Manager

Procedure

1. Right select the device and select **Configure**.
2. Under **Manual Setup** select the **Security** tab.
3. Within the LOI select the **Configure Password** button and follow the screen prompts.

Configuring LOI password using LOI

Figure 4-3: LOI Password



4.5 Setting transmitter alarm

On the electronics board is an alarm switch, reference [Figure 1](#) for switch location. Follow the steps below to change the alarm switch location:

Procedure

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

4.6 Electrical considerations

Note

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

⚠ 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.

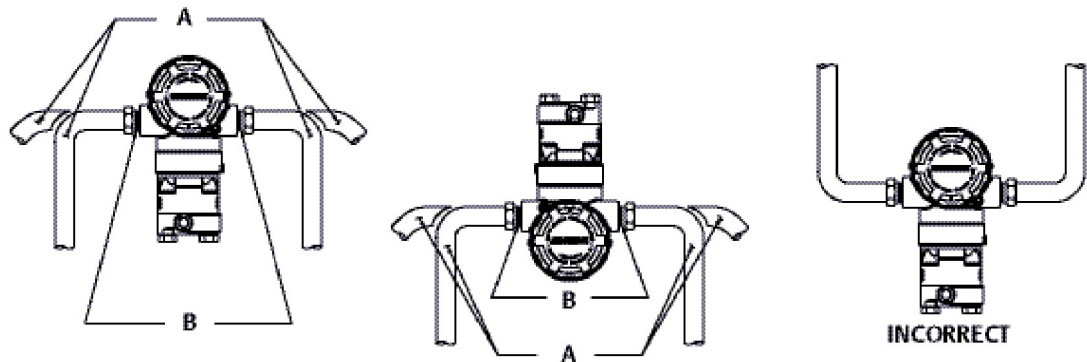
4.6.1 Conduit installation

⚠ CAUTION

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

Recommended conduit connections are shown in [Figure 4-4](#).

Figure 4-4: Conduit Installation Diagrams



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

4.6.2 Power supply

4–20 mA HART® (option code A)

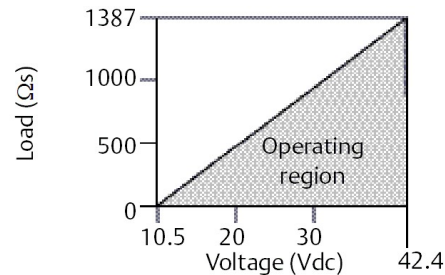
Transmitter operates on 10.5–42.4 Vdc at the terminal of the transmitter. The DC power supply should provide power with less than two percent ripple. A minimum of 16.6 V is required for loops with a 250 Ω resistance.

Note

A minimum loop resistance of 250 Ω is required to communicate with a Field Communicator. If a single power supply is used to power more than one Rosemount 2051

Transmitter, the power supply used, and circuitry common to the transmitters, should not have more than 20 Ω of impedance at 1200 Hz.

Figure 4-5: Load Limitation



- Maximum loop resistance = $43.5 \times (\text{power supply voltage} - 10.5)$
- The Field Communicator requires a minimum loop resistance of 250 Ω for communication.

The total resistance load is the sum of the resistance of the signal leads and the load resistance of the controller, indicator, I.S. Barriers, and related pieces. If intrinsic safety barriers are used, the resistance and voltage drop must be included.

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

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

4.6.3 Wiring the transmitter

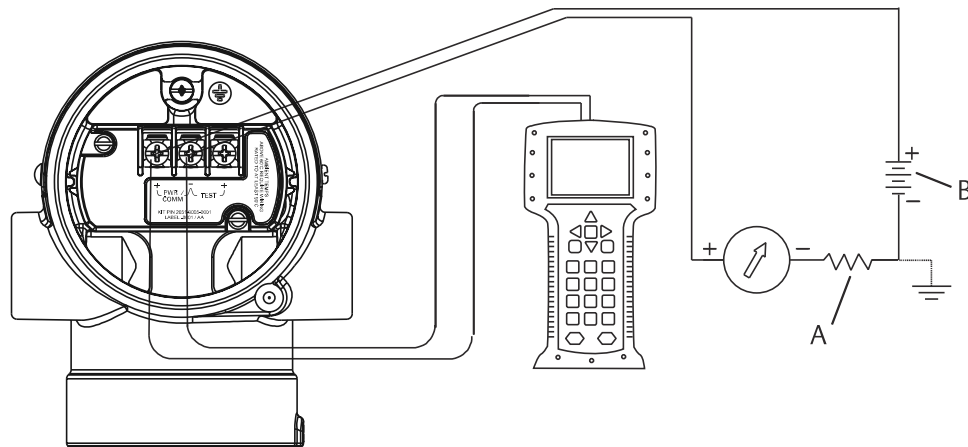
⚠ CAUTION

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

Note

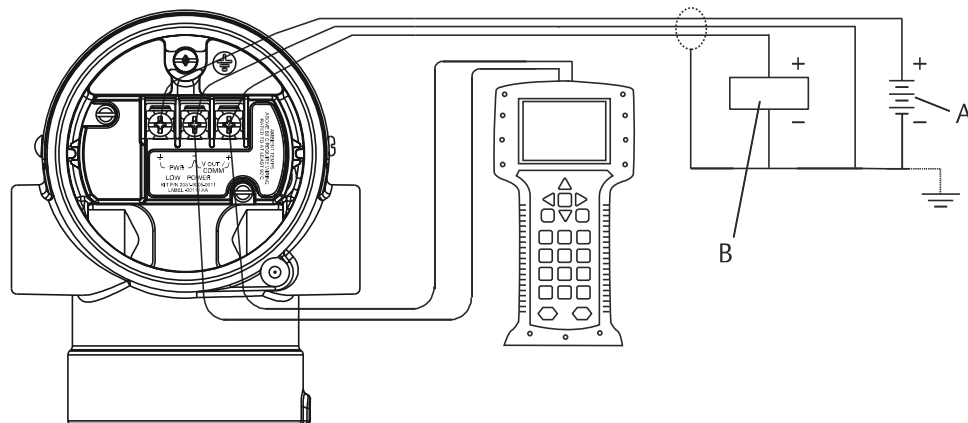
Use shielded twisted pairs to yield best results. To ensure proper communication, use 24 AWG or larger wire and do not exceed 5000 ft. (1500 m). For 1–5 V 500 ft. (150 m) maximum are recommended. unpaired three conductor or two twisted pairs is recommended.

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



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

Figure 4-7: Wiring the Transmitter (1–5 Vdc low power)



- A. DC power supply
- B. Voltmeter

Perform the following procedure to make wiring connections:

Procedure

1. Remove the housing cover on terminal compartment side. Do not remove the cover in explosive atmospheres when the circuit is live. Signal wiring supplies all power to the transmitter.
2. For 4–20 mA HART Output, connect the positive lead to the terminal marked (pwr/comm+) and the negative lead to the terminal marked (pwr/comm-). Do not connect the powered signal wiring to the test terminals. Power could damage the test diode.

- a) For 1–5 Vdc HART Output, connect the positive lead to (PWR +) and the negative to the (PWR–). Do not connect the powered signal wiring to the test terminals. Power could damage the test diode.
3. Plug and seal unused conduit connection on the transmitter housing to avoid moisture accumulation in the terminal side.

4.6.4 Grounding the transmitter

Signal cable shield grounding

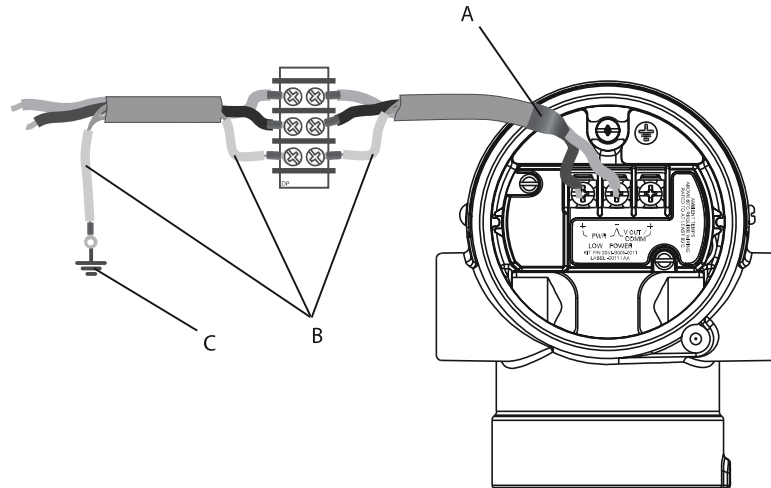
Signal cable shield grounding is summarized in [Figure 4-8](#). The signal cable shield and unused shield drain wire must be trimmed and insulated, ensuring the signal cable shield and drain wire do not come in contact with the transmitter case. See [Transmitter case grounding](#) for instructions on grounding the transmitter case. Follow the steps below 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 4-6](#).
3. At the field terminals, the cable shield and shield drain wire should be trimmed close and insulated from transmitter housing.
4. Reattach the field terminals housing cover; cover must be fully engaged to comply with explosion proof requirements.
5. At terminations outside the transmitter housing, the cable shield drain wire should be continuously connected.
 - a) Prior to the termination point, any exposed shield drain wire should be insulated as shown in [Figure 4-7 \(B\)](#).
6. Properly terminate the signal cable shield drain wire to an earth ground at or near the power supply.

Example

Figure 4-8: Wiring Pair and Ground



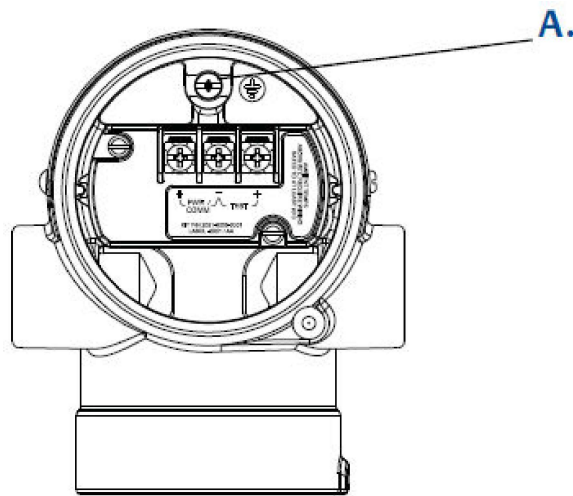
- A. Insulate Shield and shield drain wire
- B. Insulate exposed shield drain wire
- C. Terminate cable shield drain wire to earth ground

Transmitter case grounding

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

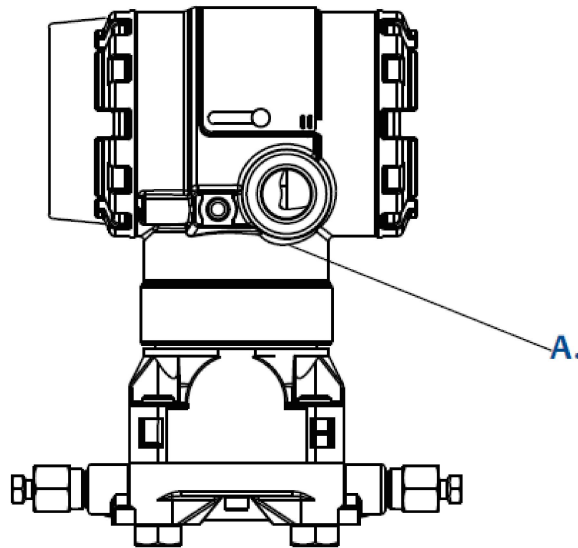
- Internal ground connection: The internal ground connection screw is inside the FIELD TERMINALS side of the electronics housing. This screw is identified by a ground symbol (⊕). The ground connection screw is standard on all Rosemount 2051 Transmitters. Refer to [Figure 4-9](#).
- External ground connection: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

Figure 4-9: Internal Ground Connection



A. Internal ground location

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



A. External ground location

Note

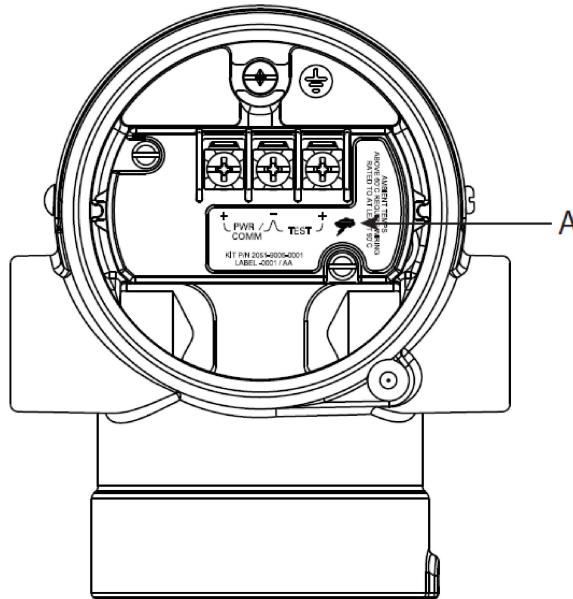
Grounding the transmitter case via threaded conduit connection may not provide sufficient ground continuity.

Transient protection terminal block grounding

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

The transient protection terminal block can be ordered as an installed option (code T1) or as a spare part to retrofit existing transmitters in the field. See [Spare parts](#) for part numbers. The lightning bolt symbol shown in [Figure 4-11](#) identifies the transient protection terminal block.

Figure 4-11: Transient Protection Terminal Block



A. Lightning bolt location

Note

The transient protection terminal block does not provide transient protection unless the transmitter case is properly grounded. Use the guidelines to ground the transmitter case. Refer to [Figure 4-11](#).

5 Operation and Maintenance

5.1 Overview

This section contains information on operation and maintenance procedures.

Field Communicator and AMS Device Manager instructions are given to perform configuration functions.

5.2 Safety messages

Procedures and instructions in this section may require special precautions to ensure the safety of the personnel performing the operation. Refer to the following safety messages before performing an operation preceded by this symbol.

⚠ WARNING

Explosions

Explosions could result in death or serious injury.

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

Before connecting a communicator in an explosive atmosphere, ensure the instruments in the segment are installed in accordance with intrinsically safe or non-incendive field wiring practices.

In an explosion-proof/flameproof installation, do not remove the transmitter covers when power is applied to the unit.

Process leaks

Process leaks may cause harm or result in death.

Install and tighten process connectors before applying pressure.

Electrical shocks

Electrical shock could cause death or serious injury.

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

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

Improper assembly of manifolds to traditional flange can damage the SuperModule™ Platform.

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

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 to protecting your system. Restrict physical access by unauthorized personnel to protect end users' assets. This is true for all systems used within the facility.

5.3 Recommended calibration tasks

⚠ CAUTION

Absolute pressure transmitters are calibrated at the factory. Trimming adjusts the position of the factory characterization curve. It is possible to degrade performance of the transmitter if any trim is done improperly or with inaccurate equipment.

5.3.1 Field installation tasks

Procedure

1. Perform sensor zero/lower trim: Compensate for mounting pressure effects
 - a) Refer to [Install Rosemount 306 integral manifold](#) for manifold operation instructions to properly drain/vent valves.
2. Set/check basic configuration parameters.
 - a) Output units
 - b) Range points
 - c) Output type
 - d) Damping value

5.3.2 Bench calibration tasks

Procedure

1. Perform optional 4–20 mA 1–5 Vdc output trim.

2. Perform a sensor trim.
 - a) Zero/lower trim [Troubleshooting tables](#) using line pressure effect correction. Refer to [Install Rosemount 306 integral manifold](#) for manifold drain/vent valve operation instructions.
 - b) Optional full scale trim. Sets the span of the device and requires accurate calibration equipment.
 - c) Set/check basic configuration parameters.

5.4 Calibration overview

The pressure transmitter is an accurate instrument that is fully calibrated in the factory. Field calibration is provided to the user to meet plant requirements or industry standards. Complete calibration of the transmitter can be split into two tasks:

1. Sensor calibration
2. Analog output calibration

Sensor Calibration and Analog Output Calibration.

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

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

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

5.4.1 Calibrate the sensor

- Sensor trim: ([Perform a sensor trim](#))
- Zero trim: ([Performing a digital zero trim \(option DZ\)](#))

5.4.2 Calibrate the 4–20 mA output

- 4–20 mA/1–5V Output trim ([Performing digital-to-analog trim \(4–20 mA/1–5 V output trim\)](#))
- 4–20 mA/1–5V Output trim using other scale ([Performing digital-to-analog trim \(4–20 mA/1–5 V output trim\) using other scale](#))

5.4.3 Determining necessary sensor trims

Bench calibrations allow for calibrating the instrument for its desired range of operation. Straight forward connections to pressure source allow for a full calibration at the planned

operating points. Exercising the Transmitter over the desired pressure range allows for verification of the analog output. [Trim the pressure signal](#) discusses how the trim operations change the calibration. It is possible to degrade the performance of the transmitter if a trim is done improperly or with inaccurate equipment. The transmitter can be set back to factory settings using the [Recall factory trim—sensor trim](#).

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

Determine the necessary trims with the following steps.

Procedure

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

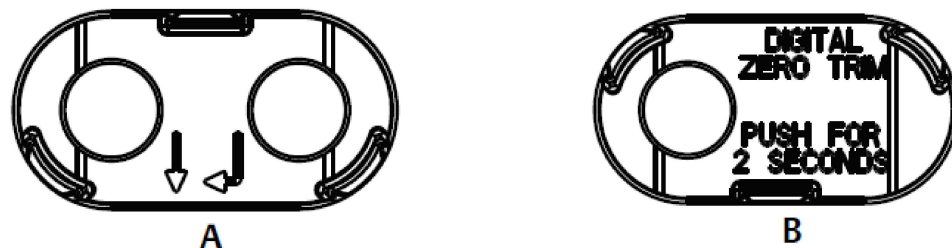
5.4.4 Trimming with configuration buttons

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

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

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

Figure 5-1: Local Configuration Button Options



- A. LOI - greb retainer
B. Digital zero trim - blue retainer

5.5 Determining calibration frequency

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

Procedure

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

5.5.1 Sample calculation for Rosemount 2051

Procedure

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 inH₂O(623 mbar)]

Calibrated Span 150 inH₂O (374 mbar)

Ambient Temperature Change ± 50 °F (28 °C)

Line Pressure 500 psig (34,5 bar)

3. Calculate total probable error (TPE).

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

Where:

Reference Accuracy = ± 0.065% of span

Ambient Temperature Effect = $\left(\frac{0.025 \times \text{URL}}{\text{Span}} + 0.125 \right) \% \text{ per } 50 \text{ }^\circ\text{F} = \pm 0.167\% \text{ of span}$

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

Note

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

4. Calculate the stability per month.

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

5. Calculate calibration frequency.

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

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

Procedure

1. Determine the performance required for your application.

Required Performance 0.30% of span

2. Determine the operating conditions.

Transmitter 2051CD, Range 2 [URL=250 inH₂O(623 mbar)]

Calibrated Span 150 inH₂O (374 mbar)

Ambient Temperature Change ± 50 °F (28 °C)

Line Pressure 500 psig (34,5 bar)

3. Calculate total probable error (TPE).

$$\text{TPE} = \sqrt{(\text{ReferenceAccuracy})^2 + (\text{TemperatureEffect})^2 + (\text{StaticPressureEffect})^2} = 0.117\% \text{ of span}$$

Where:

Reference Accuracy = ± 0.05% of span

$$\pm \left(\frac{0.025 \times \text{URL}}{\text{Span}} + 0.125 \right) \text{ per } 50 \text{ }^\circ\text{F} = \pm 0.0833\% \text{ of span}$$

Ambient Temperature Effect =

Span Static Pressure Effect=

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

Note

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

4. Calculate the stability per month.

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

5. Calculate calibration frequency.

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

5.6 Compensating for span line pressure effects (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 Differential Pressure Transmitters (ranges 1 through 3) do not require this procedure because optimization occurs at the sensor.

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

Use the following example to compute correct input values.

5.6.1 Example

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

High trim value

$$\text{HT} = (\text{URV} - [S/100 \times P/1000 \times \text{LRV}])$$

Where:	HT =	Corrected high trim value
	URV =	Upper range value
	S =	Span shift per specification (as a percent of reading)
	P =	Static Line Pressure in psi

In this example:

URV =	1500 inH ₂ O (3.74 bar)
S =	-0.95%

$$\begin{aligned} P &= 1200 \text{ psi} \\ LT &= 1500 - (-0.95\%/100 \times 1200 \text{ psi}/1000 \text{ psi} \times 1500 \text{ inH}_2\text{O}) \\ LT &= 1517.1 \text{ inH}_2\text{O} \end{aligned}$$

Complete the upper sensor trim procedure as described in [#unique_191](#). However, enter the calculated correct upper sensor trim value of 1517.1 inH₂O with a Field Communicator.

5.7 Trim the pressure signal

5.7.1 Sensor trim overview

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

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

When performing a zero trim, ensure the equalizing valve is open and all wet legs are filled to the correct levels. Line pressure should be applied to the transmitter during a zero trim to eliminate line pressure errors. Refer to [Integral manifold operation](#).

Note

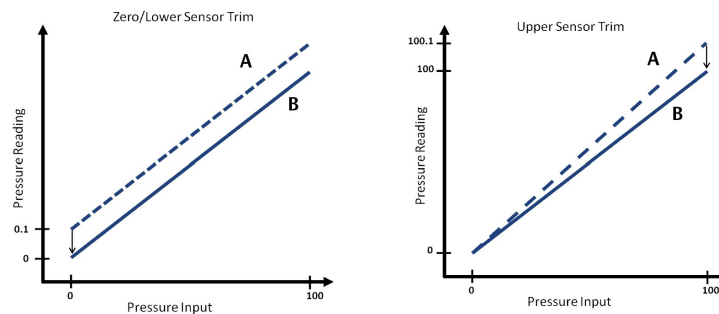
FOUNDATION Fieldbus has no analog signal that needs ranging. Therefore, ranging a new device prior to installation is usually not necessary or recommended.

Note

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

Upper and lower sensor trim is a two-point sensor calibration where two end-point pressures are applied, all output is linearized between them, and requires an accurate pressure source. Always adjust the low trim value first to establish the correct offset. Adjustment of the high trim value provides a slope correction to the characterization curve based on the low trim value. The trim values help optimize performance over a specific measurement range.

Figure 5-2: Sensor Trim Example



- A. Before Trim
- B. After Trim

5.7.2 Perform a sensor trim

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

Note

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

Performing a sensor trim with a Field Communicator

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

Device Dashboard Fast Keys	3, 4, 1
----------------------------	---------

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

Procedure

1. Select **2: Lower Sensor Trim**.

Note

Select pressure points so that lower and upper values are equal to or outside the expected process operation range. This can be done by going to [Rerange the transmitter](#).

2. Follow the commands provided by the Field Communicator to complete the adjustment of the lower value.
3. Select **3: Upper Sensor Trim**.
4. Follow the commands provided by the Field Communicator to complete the adjustment of the upper value.

Performing a sensor trim with AMS Device Manager

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

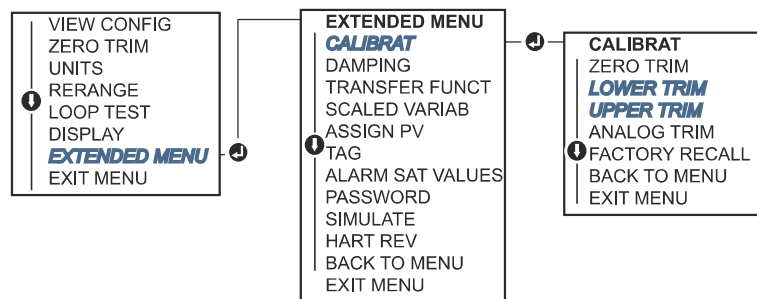
Procedure

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

Performing a sensor trim using LOI

Perform an upper and lower sensor trim by referencing [Figure 5-3](#).

Figure 5-3: Sensor trim with LOI



Performing a digital zero trim (option DZ)

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

Procedure

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

5.7.3 Recall factory trim—sensor trim

The recall factory trim-sensor trim command allows the restoration of the as-shipped factory settings of the Sensor Trim. This command can be useful for recovering from an inadvertent zero trim of an absolute pressure unit or inaccurate pressure source.

Recalling factory trim with a Field Communicator

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

Device Dashboard Fast Keys	3, 4, 3
----------------------------	---------

Recalling factory trim with AMS Device Manager

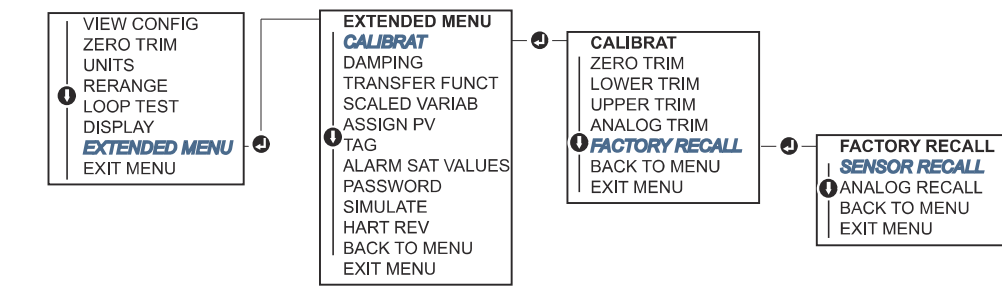
Procedure

1. Right select on the device and, under the Method drop down menu, move cursor over Calibrate and select **Restore Factory Calibration**.
2. Set the control loop to manual.
3. Select **Next**.
4. Select **Sensor Trim** under Trim to recall and click **Next**.
5. Follow the screen prompts to recall Sensor Trim.

Recalling factory trim with LOI

Refer to [Figure 5-4](#) to recall factory sensor trim.

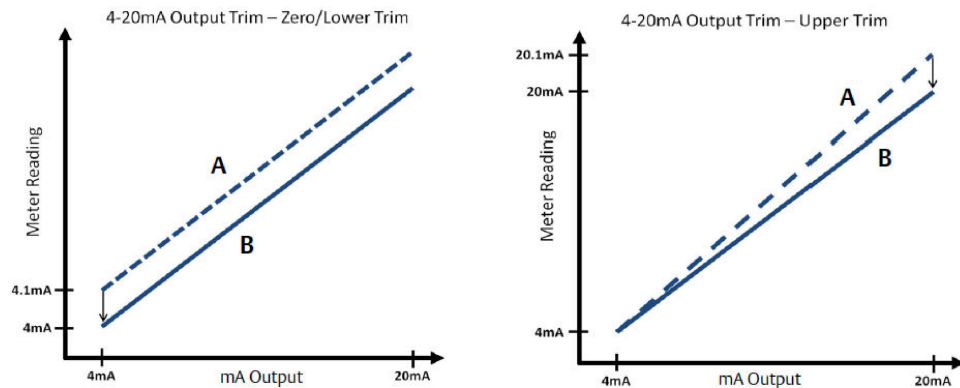
Figure 5-4: Recall Factory Trim with LOI



5.8 Trim the analog output

The Analog Output Trim commands allow you to adjust the transmitter's current output at the 4 and 20 mA (1 – 5 Vdc) points to match the plant standards. This trim is performed after the digital to analog conversion so only the 4–20 mA analog (1– 5 Vdc) signal will be affected. [Figure 5-5](#) graphically shows the two ways the characterization curve is affected when an analog output trim is performed.

Figure 5-5: Analog Output Trim Example



A. Before trim
B. After Trim

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

Note

If a resistor is added to the loop, ensure that the power supply is sufficient to power the transmitter to a 20 mA output with additional loop resistance. Refer to [Power supply](#).

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

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

Device Dashboard Fast Keys	3, 4, 2, 1
----------------------------	------------

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

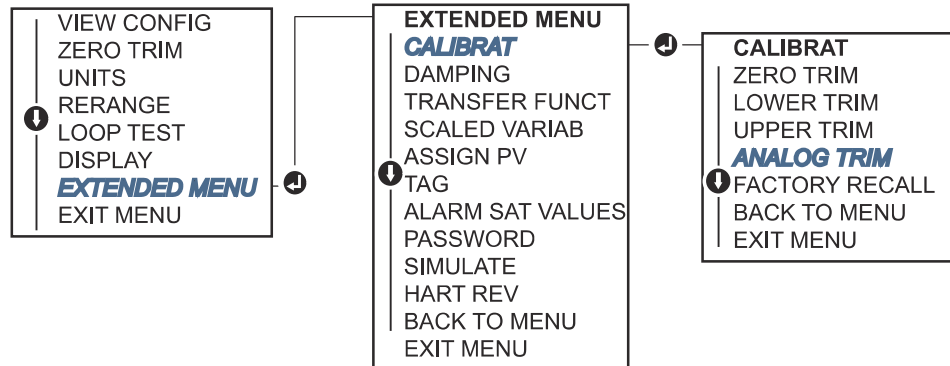
Right select the device and, under the Method drop down menu, move cursor over Calibrate and select **Analog Calibration**.

Procedure

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

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

Figure 5-6: 4–20 mA output trim using LOI



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

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

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

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

Device Dashboard Fast Keys	3, 4, 2, 2
----------------------------	------------

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

Procedure

1. Right select the device and under the Method drop down menu, move cursor over Calibrate and select **Analog Calibration**.
2. Select **Scaled Digital to Analog Trim**.
3. Follow screen prompts to perform a 4–20 mA/ 1–5 V Output Trim.

5.8.3 Recalling factory trim—analog output

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

Recalling factory trim - analog output with a Field Communicator

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

Device Dashboard Fast Keys	3, 4, 3
----------------------------	---------

Recalling factory trim - analog output with AMS Device Manager

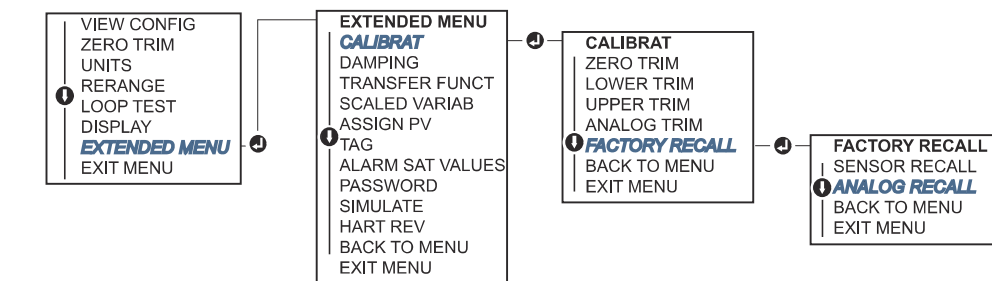
Procedure

1. Right select the device and, under the Method drop down menu, move cursor over Calibrate and select **Restore Factory Calibration**.
2. Select **Next** to set the control loop to manual.
3. Select **Analog Output Trim** under Select trim to recall and click **Next**.
4. Follow screen prompts to recall analog output trim.

Recalling factory trim - analog output with LOI

Reference [Figure 5-7](#) for LOI instructions.

Figure 5-7: Recall factory Trim – Analog Output with LOI



5.9 Switching HART revision

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

5.9.1 Switching HART revision with generic menu

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

Procedure

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

5.9.2 Switching HART revision with Field Communicator

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

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

5.9.3 Switching HART revision with AMS Device Manager

Procedure

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

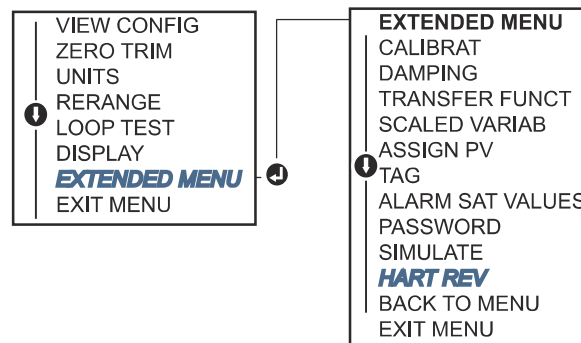
Note

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

5.9.4 Switching HART revision with LOI

Navigate to HART® REV within the extended menu and select either **HART REV 5** or **HART REV 7**. Use [Figure 5-8](#) below to change HART Revision:

Figure 5-8: Change HART Revision with LOI



6 Troubleshooting

6.1 Overview

Table 6-1 and Table 6-2 provide summarized maintenance and troubleshooting suggestions for the most common operating problems.

If you suspect malfunction despite the absence of any diagnostic messages on the Field Communicator display, consider using [Diagnostic messages](#) to identify any potential problem.

6.2 Safety messages

Procedures and instructions in this section may require special precautions to ensure the safety of the personnel performing the operation. Refer to the following safety messages before performing an operation preceded by this symbol.

⚠ WARNING

Explosions

Explosions could result in death or serious injury.

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

Before connecting a communicator in an explosive atmosphere, ensure the instruments in the segment are installed in accordance with intrinsically safe or non-incendive field wiring practices.

In an explosion-proof/flameproof installation, do not remove the transmitter covers when power is applied to the unit.

Process leaks

Process leaks may cause harm or result in death.

Install and tighten process connectors before applying pressure.

Electrical shocks

Electrical shock could cause death or serious injury.

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

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

Improper assembly of manifolds to traditional flange can damage the SuperModule™ Platform.

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

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 to protecting your system. Restrict physical access by unauthorized personnel to protect end users' assets. This is true for all systems used within the facility.

6.3 Service support

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

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

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

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

⚠ CAUTION

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

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

6.4 Troubleshooting tables

Table 6-1: Rosemount troubleshooting table for 4–20 mA output

Symptom	Corrective actions
Transmitter milliamp reading is zero	Verify terminal voltage is 10.5 to 42.4 Vdc at signal terminals
	Check power wires for reversed polarity
	Check that power wires are connected to signal terminals
	Check for open diode across test terminal
Transmitter not communicating with Field Communicator	Verify terminal voltage is 10.5 to 42.4 Vdc
	Check loop resistance, 250 Ω minimum (PS voltage -transmitter voltage/loop current)
	Check that power wires are connected to signal terminals and not test terminals
	Verify clean DC Power to transmitter (Max AC noise 0.2 volts peak to peak)
	Verify the output is between 4 and 20 mA or saturation levels
	Have Field Communicator poll for all addresses
Transmitter milliamps reading is low or high	Verify applied pressure
	Verify 4 and 20 mA range points
	Verify output is not in alarm condition
	Perform analog trim
	Check that power wires are connected to the correct signal terminals (positive to positive, negative to negative) and not the test terminal
Transmitter will not respond to changes in applied pressure	Check impulse piping or manifold for blockage
	Verify applied pressure is between the 4 and 20 mA points
	Verify the output is not in alarm condition
	Verify transmitter is not in loop test mode
	Verify transmitter is not in multidrop mode
	Check test equipment
Digital pressure variable reading is low or high	Check impulse piping for blockage or low fill in wet leg
	Verify transmitter is calibrated properly
	Check test equipment (verify accuracy)
	Verify pressure calculations for application

Table 6-1: Rosemount troubleshooting table for 4–20 mA output (continued)

Symptom	Corrective actions
Digital pressure variable reading is erratic	Check application for faulty equipment in pressure line
	Verify transmitter is not reacting directly to equipment turning on/off
	Verify damping is set properly for application
Milliamps reading is erratic	Verify power source to transmitter has adequate voltage and current
	Check for external electrical interference
	Verify transmitter is properly grounded
	Verify shield for twisted pair is only grounded at one end

Table 6-2: Rosemount troubleshooting for 1–5 Vdc output

Symptom	Corrective actions
Transmitter voltage reading is zero	Verify terminal voltage is 5.8 to 28.0 Vdc at signal terminals
	Check power wires for reversed polarity
	Check that power wires are connected to signal terminals
	Check for open diode across test terminal
Transmitter not communicating with Field Communicator	Verify terminal voltage is 5.8 to 28.0 Vdc
	Check loop resistance, 250 Ω minimum (PS voltage - transmitter voltage / loop current)
	Check that power wires are connected to signal terminals and not test terminals
	Verify clean DC Power to transmitter (Max AC noise 0.2 volts peak to peak)
	Verify the output is between 1–5 Vdc or saturation levels
	Have Field Communicator poll for all addresses
Transmitter voltage reading is low or high	Verify applied pressure
	Verify 1–5 Vdc range points
	Verify output is not in alarm condition
	Perform analog trim
	Check that power wires are connected to the correct signal terminals (positive to positive, negative to negative) and not the test terminal
Transmitter will not respond to changes in applied pressure	Check impulse piping or manifold for blockage

Table 6-2: Rosemount troubleshooting for 1–5 Vdc output (continued)

Symptom	Corrective actions
	Verify applied pressure is between the 1–5 Vdc points
	Verify the output is not in alarm condition
	Verify transmitter is not in loop test mode
	Verify transmitter is not in multidrop mode
	Check test equipment
Digital pressure variable reading is low or high	Check impulse piping for blockage or low fill in wet leg
	Verify transmitter is calibrated properly
	Check test equipment (verify accuracy)
	Verify pressure calculations for application
Digital pressure variable reading is erratic	Check application for faulty equipment in pressure line
	Verify transmitter is not reacting directly to equipment turning on/off
	Verify damping is set properly for application
Voltage reading is erratic	Verify power source to transmitter has adequate voltage and current
	Check for external electrical interference
	Verify transmitter is properly grounded
	Verify shield for twisted pair is only grounded at one end

6.5 Diagnostic messages

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

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

Table 6-3: Status: Failed – Fix Now

Alert name	LCD display screen	LOI screen	Problem	Recommended action
No Pressure Updates	NO P UPDATE	NO PRESS UPDATE	There are no pressure updates from the sensor to the electronics	<ul style="list-style-type: none"> Ensure the sensor cable connection to the electronics is tight. Replace the transmitter.
Electronics Board Failure	FAIL BOARD	FAIL BOARD	A failure has been detected in the electronics circuit board	<ul style="list-style-type: none"> Replace the pressure transmitter.
Critical Sensor Data Error	MEMRY ERROR	MEMORY ERROR	A user written parameter does not match the expected value	<ul style="list-style-type: none"> Confirm and correct all parameters listed in Device Information. Perform a Device Reset. Replace Pressure Transmitter.
Critical Electronics Data Error			A user written parameter does not match the expected value	<ul style="list-style-type: none"> Confirm and correct all parameters listed in Device Information. Perform a Device Reset. Replace pressure transmitter.
Sensor Failure	FAIL SENSOR	FAIL SENSOR	A failure has been detected in the pressure sensor	<ul style="list-style-type: none"> Replace pressure transmitter.
Incompatible Electronics and Sensor	XMTR MSMTCH	XMTR MSMTCH	The pressure sensor is incompatible with the attached electronics	<ul style="list-style-type: none"> Replace the pressure transmitter.

Table 6-4: Status: Maintenance – Fix Soon

Alert name	LCD display screen	LOI screen	Problem	Recommended action
No Temperature Updates	NO T UPDATE	NO TEMP UPDATE	There are no temperature updates from the sensor to the electronics	<ul style="list-style-type: none"> Ensure the sensor cable connection to the electronics is tight. Replace the pressure transmitter.
Pressure Out of Limits	PRES LIMITS	PRES OUT LIMITS	The pressure is either above or below the sensor limits	<ul style="list-style-type: none"> Check the transmitter pressure connection to ensure it is not plugged or the isolating diaphragms are not damaged. Replace the pressure transmitter.
Sensor Temperature Beyond Limits	TEMP LIMITS	TEMP OUT LIMITS	The sensor temperature has exceeded its safe operating range	<ul style="list-style-type: none"> Check the process and ambient conditions are within –85 to 194 °F (–65 to 90 °C). Replace the pressure transmitter.

Table 6-4: Status: Maintenance – Fix Soon (continued)

Alert name	LCD display screen	LOI screen	Problem	Recommended action
Electronics Temperature Beyond Limits			The temperature of the electronics has exceeded its safe operating range.	<ul style="list-style-type: none"> Confirm electronics temperature is within limits of –85 to 194 °F (–65 to 90 °C). Replace the pressure transmitter.
Electronics Board Parameter Error	MEMRY WARN (also in advisory)	MEMORY WARN (also in advisory)	A device parameter does not match the expected value. The error does not affect transmitter operation or analog output.	<ul style="list-style-type: none"> Replace the pressure transmitter.
Configuration Buttons Operator Error	STUCK BUTTON	STUCK BUTTON	Device is not responding to button presses.	<ul style="list-style-type: none"> Check configuration buttons are not stuck. Replace the pressure transmitter.

Table 6-5: Status: Advisory

Alert name	LCD display screen	LOI screen	Problem	Recommended action
Non-Critical User Data Warning	MEMRY WARN	MEMORY WARN	A user written parameter does not match expected value.	<ul style="list-style-type: none"> Confirm and correct all parameters listed in Device Information. Perform a Device Reset. Replace the pressure transmitter.
Sensor Parameter Warning			A user written parameter does not match expected value.	<ul style="list-style-type: none"> Confirm and correct all parameters listed in Device Information. Perform a Device Reset. Replace pressure transmitter.
LCD Display Update Failure	[If display is not updating]	[If display is not updating]	The LCD display is not receiving updates from the pressure sensor.	<ul style="list-style-type: none"> Check the connection between the LCD display and the circuit board. Replace the LCD display. Replace the pressure transmitter.
Configuration Changed	[none]	[none]	A recent change has been made the device by a secondary HART® master such as a handheld device.	<ul style="list-style-type: none"> Verify that the configuration change of the device was intended and expected. Clear this alert by selecting Clear Configuration Changed Status. Connect a HART master such as AMS Device Manager or similar which will automatically clear it.

Table 6-5: Status: Advisory (continued)

Alert name	LCD display screen	LOI screen	Problem	Recommended action
Analog Output Fixed	ANLOG FIXED	ANALOG FIXED	The analog output is fixed and does not represent the process measurement. This may be caused by other conditions in the device, or because the device has been set to loop test or multidrop mode.	<ul style="list-style-type: none"> Take action on any other notifications from the device. If the device is in loop test, and should no longer be, disable or momentarily remove power. If the device is in multidrop mode and should not be, re-enable loop current by setting the polling address to 0.
Simulation Active	[none]	[none]	The device is in simulation mode and may not be reporting actual information.	<ul style="list-style-type: none"> Verify that simulation is no longer required. Disable simulation mode in service tools. Perform a Device Reset.
Analog Output Saturated	ANLOG SAT	ANALOG SAT	The analog output is saturated either high or low due to the pressure either above or below the range values.	<ul style="list-style-type: none"> Check the pressure applied to ensure it is between the 4–20mA points. Check the transmitter pressure connection to make sure it is not plugged or isolating diaphragms are not damaged. Replace the pressure transmitter.

6.6 Disassembly procedures

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

6.6.1 Removing from service

Follow these steps:

Procedure

- Follow all plant safety rules and procedures.
- Power down device.
- Isolate and vent the process from the transmitter before removing the transmitter from service.
- Remove all electrical leads and disconnect conduit.
- Remove the transmitter from the process connection.
 - The Rosemount 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.
 - 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](#).

Note

Do not wrench on neck of transmitter.

6. Do not scratch, puncture, or depress the isolating diaphragms.
7. Clean isolating diaphragms with a soft rag and a mild cleaning solution, and rinse with clear water.
8. For the 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.

6.6.2 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.

6.6.3 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 [Figure 4-1](#) 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.

Note

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

3. Using the two captive screws, slowly pull the electronics board out of the housing. The sensor module ribbon cable holds the electronics board to the housing. Disengage the ribbon cable by pushing the connector release.

Note

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

6.6.4 Removing sensor module from the electronics housing

Procedure

1. Remove the electronics board. Refer to [Removing electronics board](#).

Important

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

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

Note

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

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

6.7 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.

Important

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

5. Thread the housing completely onto the sensor module. The housing must be no more than one full turn from flush with the sensor module to comply with explosion proof requirements.
6. Tighten the housing rotation set screw to no more than 7 in-lbs when desired location is reached.

6.7.1 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. Make sure the power posts from the electronics housing properly engage the receptacles on the electronics board. Do not force. The electronics board should slide gently on the connections.
3. Tighten the captive mounting screws.
4. Replace the housing cover. It is recommended the cover be tightened until there is no gap between the cover and the housing.

6.7.2 Installing terminal block

Procedure

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

6.7.3 Reassembling the 2051C process flange

Procedure

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

Note

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

2. Install the process connection. Possible options include:
 - a) Coplanar process flange:
 - Hold the process flange in place by installing the two alignment screws to finger tightness (screws are not pressure retaining). Do not 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). 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](#).

Example

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.

Note

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

6.7.4 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).
3. Take care to place the opening on the valve so that process fluid will drain toward the ground and away from human contact when the valve is opened.

7 Safety Instrumented Systems Requirements

Safety Instrumented Systems (SIS) Certification

The safety-critical output of the Rosemount 2051 is provided through a two-wire, 4–20 mA signal representing pressure. The Rosemount 2051 safety certified pressure transmitter is certified to: Low Demand; Type B.

- SIL 2 for random integrity @ HFT=0
- SIL 3 for random integrity @ HFT=1
- SIL 3 for systematic integrity

7.1 Safety certified identification

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

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

Procedure

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

NAMUR Software Revision Number

SW 1.0.x - 1.4.x

Note

NAMUR Software Revision: Located on the metal device tag.

2. Transmitter output code "A" (4–20 mA HART® Protocol).

7.2 Installation in SIS applications

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

Environmental and operational limits are available in the [Product Data Sheet](#).

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

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

7.3 Configuring in SIS applications

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

Note

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

7.3.1 Damping

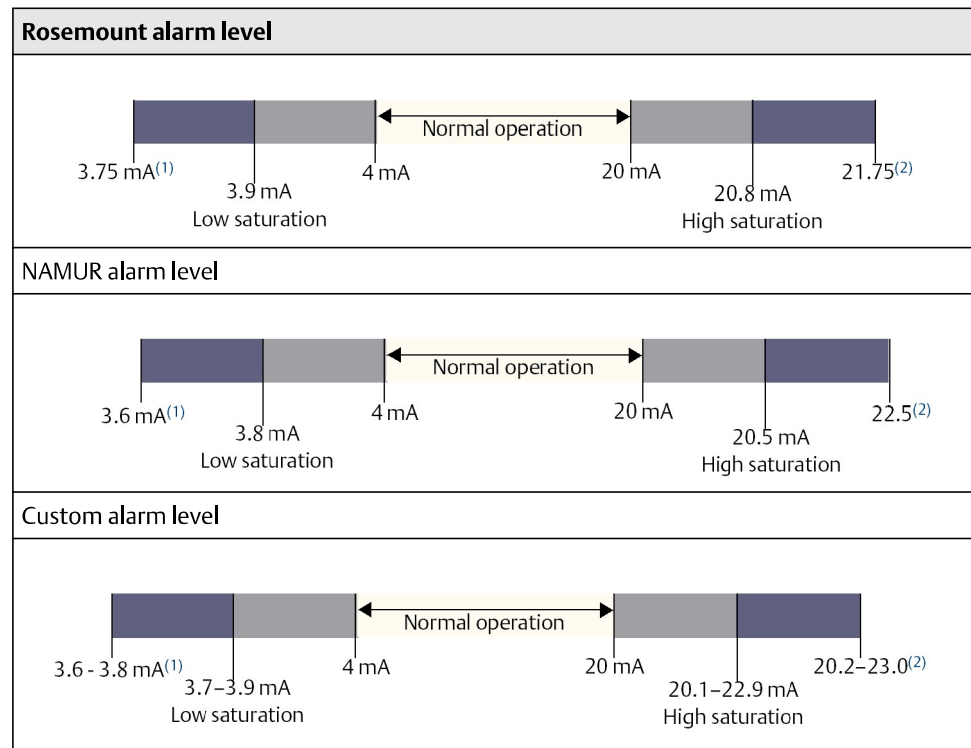
User-selected damping will affect the transmitters ability to respond to changes in the applied process. The damping value + response time must not exceed the loop requirements.

Reference [Damping](#) to change damping value.

7.3.2 Alarm and saturation levels

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

Figure 7-1: Alarm Levels



Rosemount alarm level
A. Transmitter failure, hardware or software alarm in LO position.
B. Transmitter failure, hardware or software alarm in HI position.

7.4 SIS operation and maintenance

7.4.1 Proof test

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

Use [Field communicator Fast Keys](#) to perform a loop test, analog output trim, or sensor trim. Security switch should be in unlocked (🔓) position during proof test execution and repositioned in locked (🔒) position after execution.

7.4.2 Simple proof test

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

Required tools: Field Communicator and mA meter.

Procedure

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

7.4.3 Comprehensive proof test

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

Required tools: Field Communicator and pressure calibration equipment.

⁽²⁾ This tests for possible quiescent current related failures.

Procedure

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

Example

Note

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

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

PFD_{AVG} calculation can be found in the [FMEDA Report](#).

7.5 Inspection

7.5.1 Visual inspection

Not required

7.5.2 Special tools

Not required

7.5.3 Product repair

The product is repairable by major component replacement.

All failures detected by the transmitter diagnostics or by the proof-test must be reported. Feedback can be submitted electronically at [Emerson.com/Rosemount/Contact-Us](https://www.emerson.com/Rosemount/Contact-Us).

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

⁽³⁾ This tests for compliance voltage problems such as a low loop power supply voltage or increased wiring distance. This also tests for other possible failures.

7.5.4 SIS reference

The product must be operated in accordance to the functional and performance specifications provided in the [Product Data Sheet](#).

7.5.5 Failure rate data

The [FMEDA Report](#) includes failure rates and common cause Beta factor estimates.

7.5.6 Failure values

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

7.5.7 Product life

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

A Reference data

A.1 Product certifications

To view current Rosemount 2051 Pressure Transmitter product certifications, follow these steps:

Procedure

1. Go to [Emerson.com/Rosemount/Rosemount-2051](https://emerson.com/Rosemount/Rosemount-2051).
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.2 Ordering information, specifications, and drawings

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

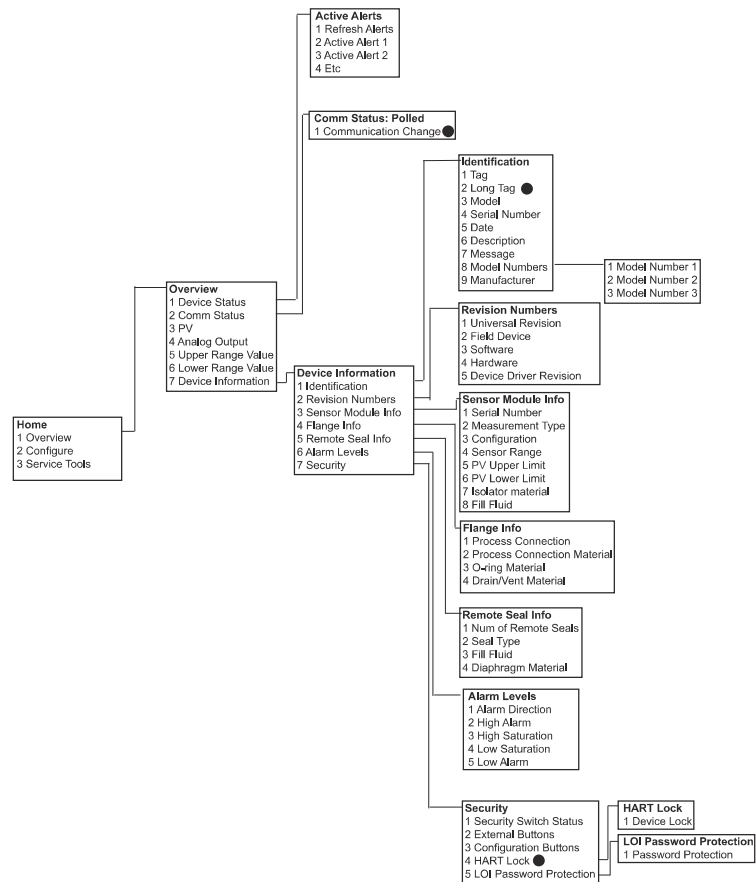
Procedure

1. Go to [Emerson.com/Rosemount/Rosemount-2051](https://emerson.com/Rosemount/Rosemount-2051).
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.

B Field Communicator Menu Trees and Fast Keys

B.1 Field Communicator menu trees

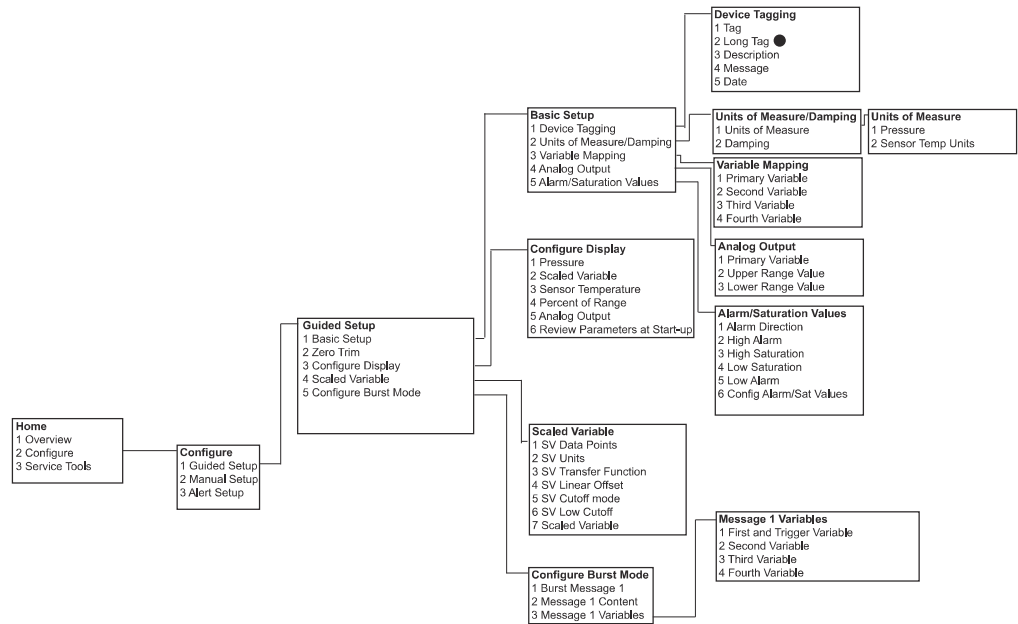
Figure B-1: Overview



Note

Selections with black circle are only available in HART® Revision 7 mode. Selection will not appear in HART Revision 5 DD.

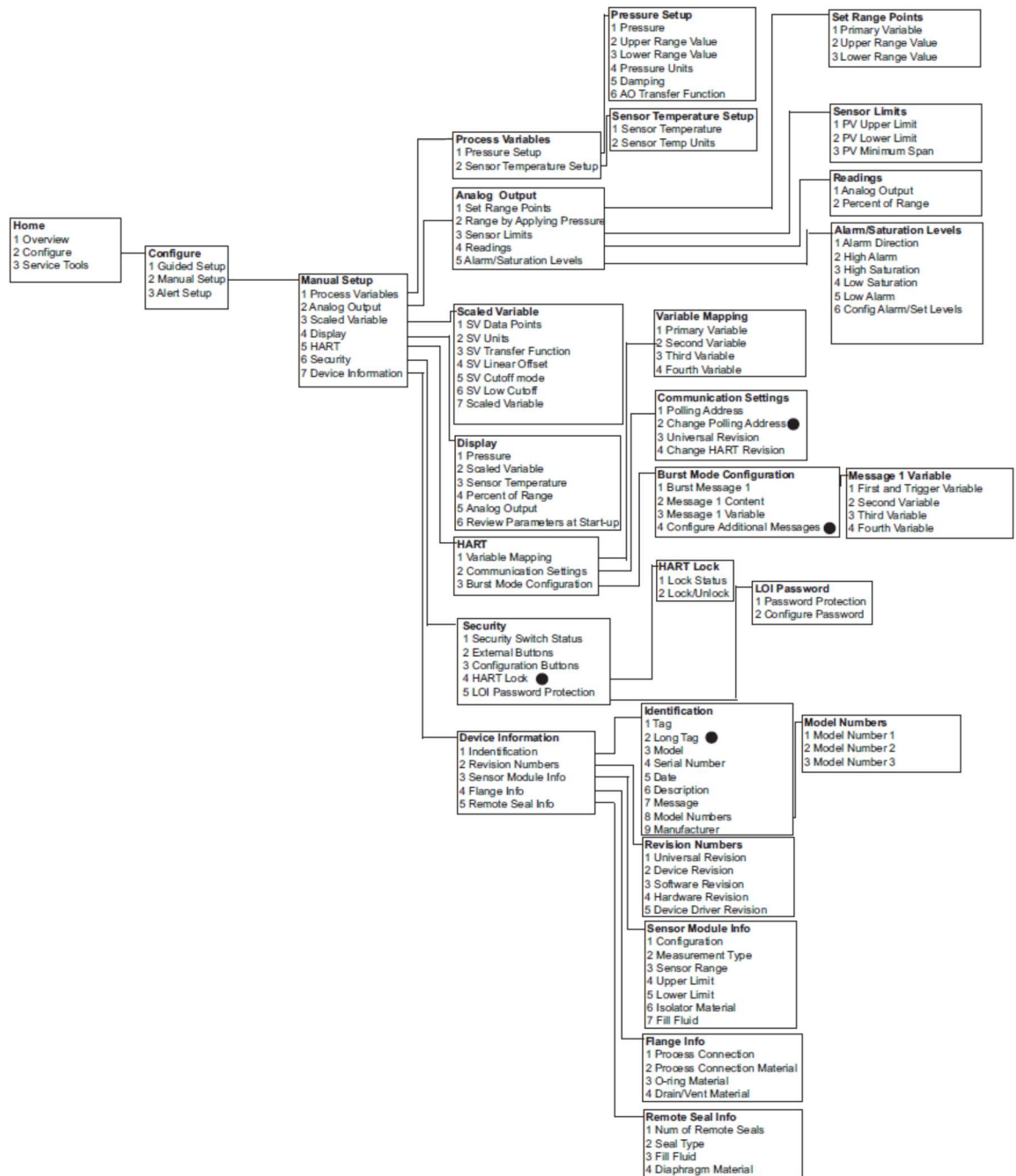
Figure B-2: Configure - Guided Setup



Note

Selections with black circle are only available in HART Revision 7 mode. Selection will not appear in HART Revision 5 DD.

Figure B-3: Configure - Manual Setup



Note

Selections with black circle are only available in HART Revision 7 mode. Selection will not appear in HART Revision 5 DD.

Figure B-4: Configure - Alert Setup

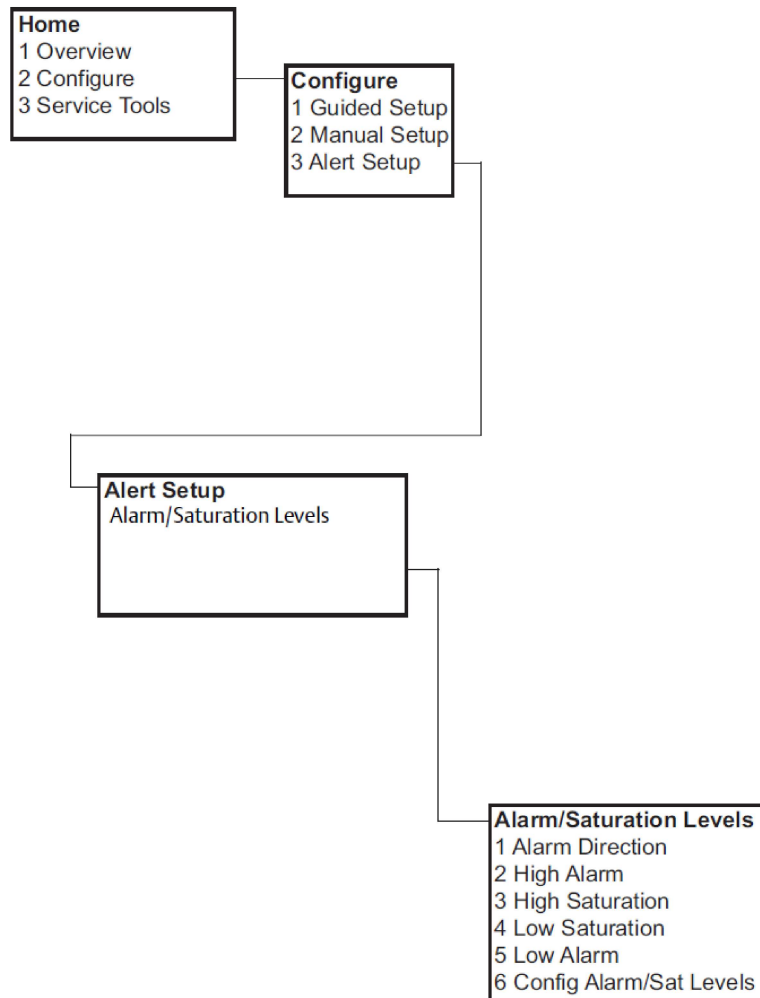
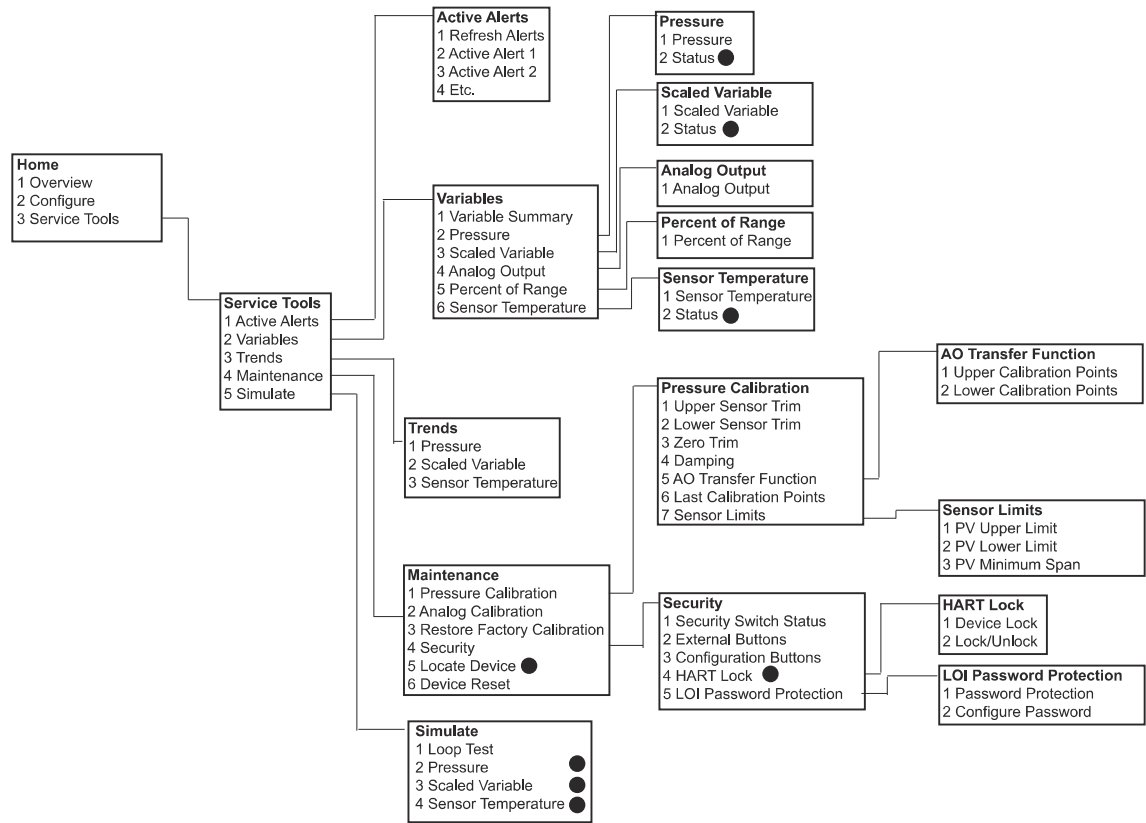


Figure B-5: Service Tools



Note

Selections with black circle are only available in HART Revision 7 mode. Selection will not appear in HART Revision 5 DD.

B.2 Field communicator Fast Keys

- A (✓) indicates the basic configuration parameters. At minimum these parameters should be verified as a part of configuration and startup.
- A (7) indicates availability only in HART revision 7 mode.

Table B-1: Device Revision 9 and 10 (HART7), DD Revision 1 Fast Key Sequence

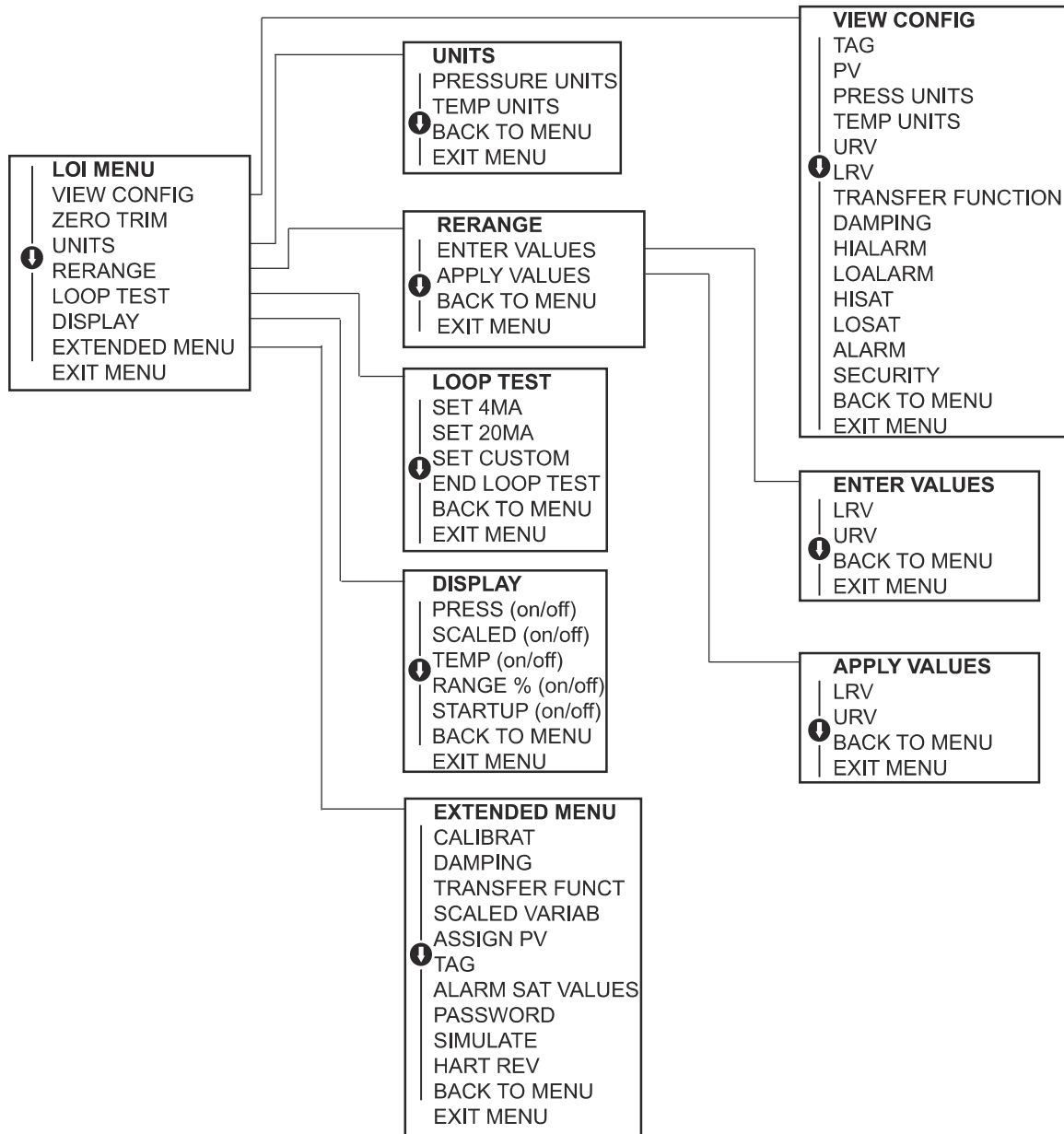
	Function	Fast Key sequence	
		HART 7	HART 5
✓	Alarm and Saturation Levels	2, 2, 2, 5	2, 2, 2, 5
✓	Damping	2, 2, 1, 1, 5	2, 2, 1, 1, 5
✓	Primary Variable	2, 2, 5, 1, 1	2, 2, 5, 1, 1
✓	Range Values	2, 2, 2, 1	2, 2, 2, 1
✓	Tag	2, 2, 7, 1, 1	2, 2, 7, 1, 1

Table B-1: Device Revision 9 and 10 (HART7), DD Revision 1 Fast Key Sequence
(continued)

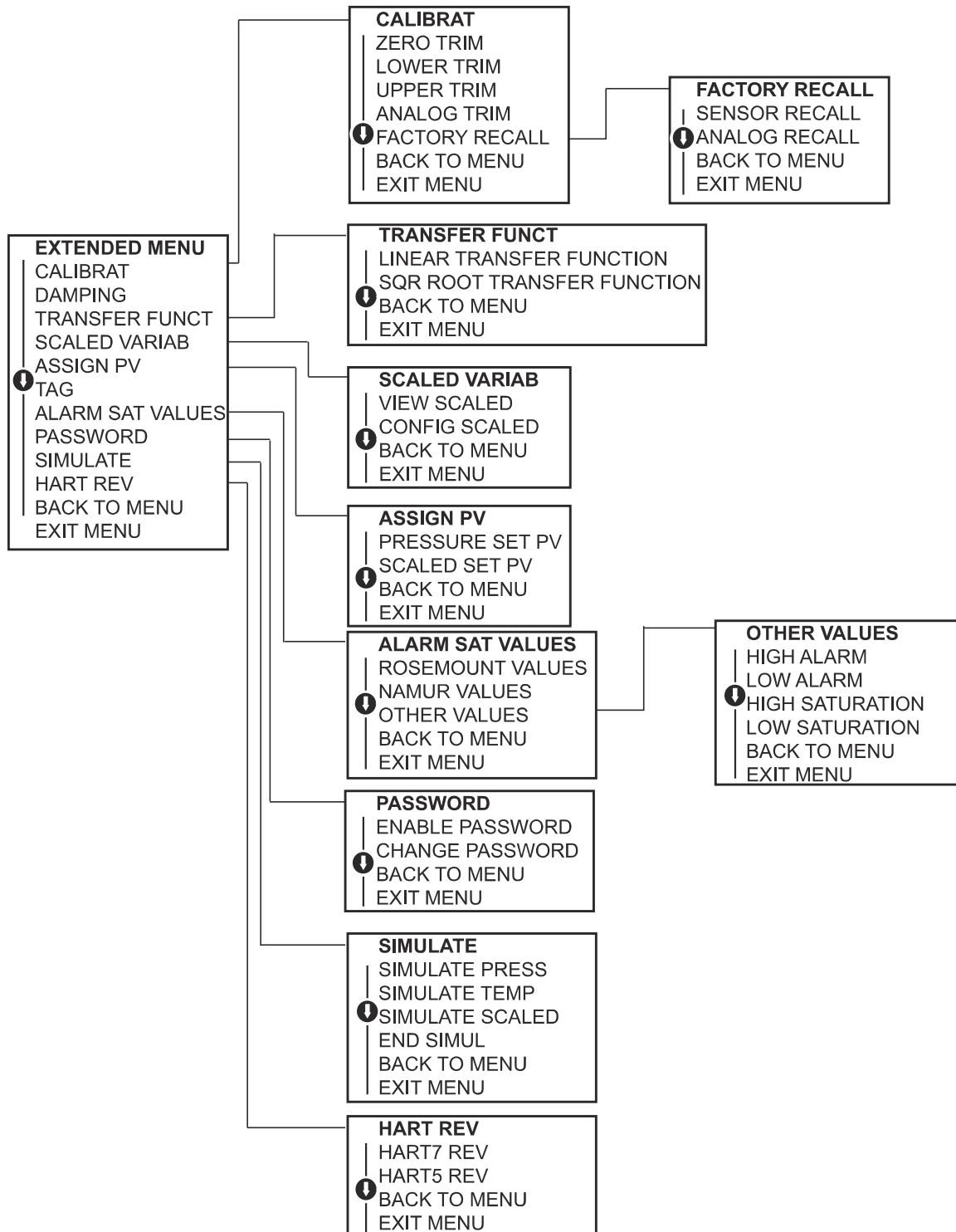
	Function	Fast Key sequence	
		HART 7	HART 5
✓	Transfer Function	2, 2, 1, 1, 6	2, 2, 1, 1, 6
✓	Pressure Units	2, 2, 1, 1, 4	2, 2, 1, 1, 4
	Date	2, 2, 7, 1, 5	2, 2, 7, 1, 4
	Descriptor	2, 2, 7, 1, 6	2, 2, 7, 1, 5
	Digital to Analog Trim (4 - 20 mA / 1-5 V Output)	3, 4, 2, 1	3, 4, 2, 1
	Digital Zero Trim	3, 4, 1, 3	3, 4, 1, 3
	Display Configuration	2, 2, 4	2, 2, 4
	LOI Password Protection	2, 2, 6, 5	2, 2, 6, 4
	Loop Test	3, 5, 1	3, 5, 1
	Lower Sensor Trim	3, 4, 1, 2	3, 4, 1, 2
	Message	2, 2, 7, 1, 7	2, 2, 7, 1, 6
	Pressure Trend	3, 3, 1	3, 3, 1
	Rerange with Keypad	2, 2, 2, 1	2, 2, 2, 1
	Scaled D/A Trim (4 - 20 mA / 1-5 V) Output)	3, 4, 2, 2	3, 4, 2, 2
	Scaled Variable	2, 2, 3	2, 2, 3
	Sensor Temperature Trend	3, 3, 3	3, 3, 3
	Switch HART Revision	2, 2, 5, 2, 4	2, 2, 5, 2, 3
	Upper Sensor Trim	3, 4, 1, 1	3, 4, 1, 1
7	Long Tag	2, 2, 7, 1, 2	
7	Locate Device	3, 4, 5	
7	Simulate Digital Signal	3, 5	

C Local Operator Interface (LOI) Menu

C.1 LOI menu tree



C.2 LOI menu tree - extended menu



C.3 Number entry

Floating-point numbers can be entered with the LOI. All eight number locations on the top line can be used for number entry. Refer to [Configuring with a LOI](#) for LOI button operation. Below is a floating-point number entry example for changing a value of “-0000022” to “000011.2”.

Step	Instruction	Current position (indicated by underline)
1	When the number entry begins, the left most position is the selected position. In this example, the negative symbol, “-”, will be flashing on the screen.	-0000022
2	Press the scroll button until the “0” is blinking on the screen in the selected position.	00000022
3	Press the enter button to select the “0” as an entry. The second digit from the left will be blinking.	00000022
4	Press the enter button to select “0” for second digit. The third digit from the left will be blinking.	00000022
5	Press the enter button to select “0” for the third digit. The fourth digit from the left will now be blinking.	00000022
6	Press the enter button to select “0” for the fourth digit. The fifth digit from the left will now be blinking.	00000022
7	Press scroll to navigate through the numbers until the “1” is on the screen.	00001022
8	Press the enter button to select the “1” for the fifth digit. The sixth digit from the left will now be blinking.	00001022
9	Press scroll to navigate through the numbers until the “1”, is on the screen.	00001122
10	Press the enter button to select the “1” for the sixth digit. The seventh digit from the left will now be blinking.	00001122
11	Press scroll to navigate through the numbers until the decimal, “.”, is on the screen.	000011.2
12	Press the enter button to select the decimal, “.”, for the seventh digit. After pressing enter, all digits to the right of the decimal will now be zero. The eighth digit from the left will now be blinking.	000011.0
13	Press the scroll button to navigate through the numbers until the “2”, is on the screen.	000011.2
14	Press the enter button to select the “2” for the eighth digit. The number entry will be complete and a “SAVE” screen will be shown.	000011.2

Usage notes:

- It is possible to move backwards in the number by scrolling to the left arrow symbol and pressing enter.

- The negative symbol is only allowed in the left most position.
- Numbers can be entered in scientific notation by placing an “E” in the 7th position.

C.4 Text entry

Text can be entered with the LOI. Depending on the edited item, up to eight locations on the top line can be used for text entry. Text entry follows the same rules as the number entry rules in [LOI menu tree](#), except the following characters are available in all locations: A-Z, 0-9, -, /, space.

Usage note:

If the current text contains a character the LOI cannot display, it will be shown as an asterisk “*”.