Rosemount™ 3051P In-Line Pressure Transmitter

with HART® Protocol

CE · **HART**
COMMUNICATION PROTOCOL

ROSEMOUNT™

EMERSON™

Contents

1   Introduction

1.1   Using this manual

The sections in this manual provide information on installing, operating, and maintaining the Rosemount 3051P. The sections are organized as follows:

Configuration provides instruction on commissioning and operating Rosemount 3051P Transmitters. It also includes information on software functions, configuration parameters, and online variables.

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.

Specifications and reference data provides information on how to access reference and specification data, as well as ordering information.

Field Communicator menu trees and Fast Keys provides the menu trees and HART Fast Keys used to operate the transmitter.

Local operator interface (LOI) provides menu trees and instructions on using the LOI.

1.2   Models covered

The following Rosemount Pressure Transmitters are covered by this manual:

- Rosemount 3051P In-Line Gage Pressure Transmitter: Measures gage pressure up to 4,000 psig (275.8 BarG).

- Rosemount 3051P In-Line Absolute Pressure Transmitter: Measures absolute pressure up to 4,000 psig (275.8 BarG).

1.3   Product recycling/disposal

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

2 Configuration

2.1 Safety messages

Procedures and instructions in this section may require special precautions to ensure the safety of the personnel performing the operations.

⚠ WARNING

Explosions could result in death or serious injury.

Installation of this transmitter in an explosive environment must be in accordance with the appropriate local, national, and international standards, codes, and practices. Review the Product Certifications section of the Rosemount 3051P Product Data Sheet for any restrictions associated with a safe installation.

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

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

⚠ WARNING

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

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.

⚠ 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 to traditional flange can damage sensor module.

> **⚠ WARNING**

Improper assembly of manifolds to traditional flange can damage the device.

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**

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.

2.2 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.

2.2.1 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. Select desired product and download the DD.
    a) Reference Table 2-1 for the correct DD.

Table 2-1: Device Revisions and Files

	Identify device			Find device driver files		Review instructions	Review functionality
Software release date	NAMUR hardware revision[1]	NAMUR software revision[1]	HART® software revision[2]	HART universal revision	Device revision[3]	Manual document number	Changes to software
August 2016	1.1.xx	1.0.xx	03	7	10	00809-0700-4001	• HART Revision 5 and 7 selectable

Table 2-1: Device Revisions and Files *(continued)*

	Identify device			Find device driver files		Review instructions	Review functionality
				5	9		• Local operator interface (LOI) • Scaled variable • Configurable alarms • Expanded engineering units • Updated electronics hardware design • Intrinsic Safety temperature classification change

(1) *NAMUR revision is located on the hardware tag of the device. Differences in level 3 changes, signified above by xx, represent minor product changes as defined per NE53. Compatibility and functionality are preserved, and products can be used interchangeably.*

(2) *HART software revision can be read using a HART capable configuration tool. Value shown is minimum revision that could correspond to NAMUR revisions.*

(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. Emerson recommends downloading new device driver files to ensure full functionality.*

2.3   HART® installation flowchart

START HERE

Bench Calibration? — No

Yes

Configure for Pressure

Set Units

Set Range Points

Select Linear Output

Set Damping

Verify

Review Transmitter Configuration

Apply Pressure

Within Specifications? — Yes

No

Refer to

Field Install

Configure Security and Alarm

Mount Transmitter

Check Process Connection

Wire Transmitter

Power Transmitter

Confirm Transmitter Configuration

Trim the Transmitter

Done

2.4 Transmitter overview

The Rosemount 3051P In-Line Pressure Transmitter is offered for gage pressure (GP) and absolute pressure (AP) measurements. The transmitter uses 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). The electronics board is located within the electronics housing. The electrical signals from the sensor module are transmitted to the electronics board which contains the memory module and the analog to digital signal converter (A/D converter). The signal is then converted to a 4–20mA analog output signal or HART® digital signal. 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 2-2.

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 and 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 uses a 5x6 character display and can display output and diagnostic messages. The local operator interface (LOI) display uses an 8x6 character display and can display output and diagnostic messages as well as and LOI menu screens. The LOI display comes with two buttons mounted on the front of the display board. See Figure 2-1.

Figure 2-1: LCD/LOI display

LCD display
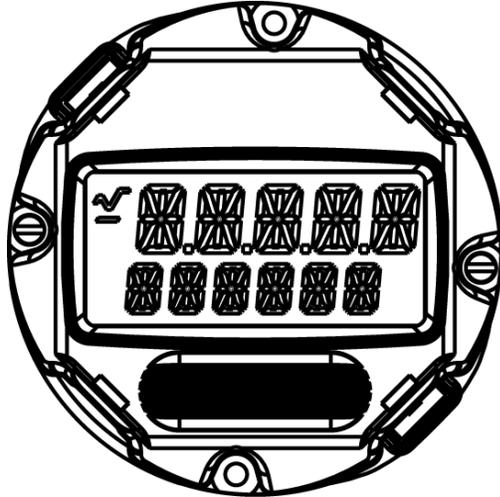
LOI display
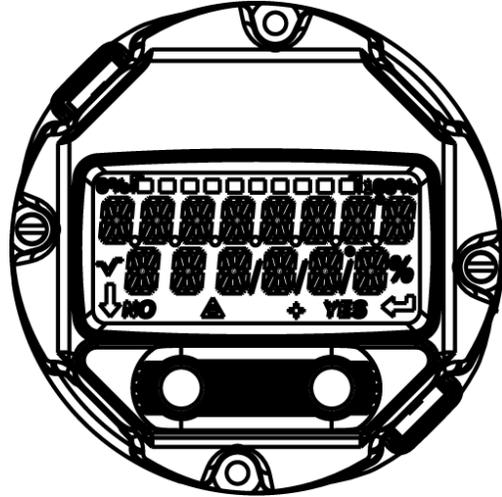
Figure 2-2: Block Diagram of Operation
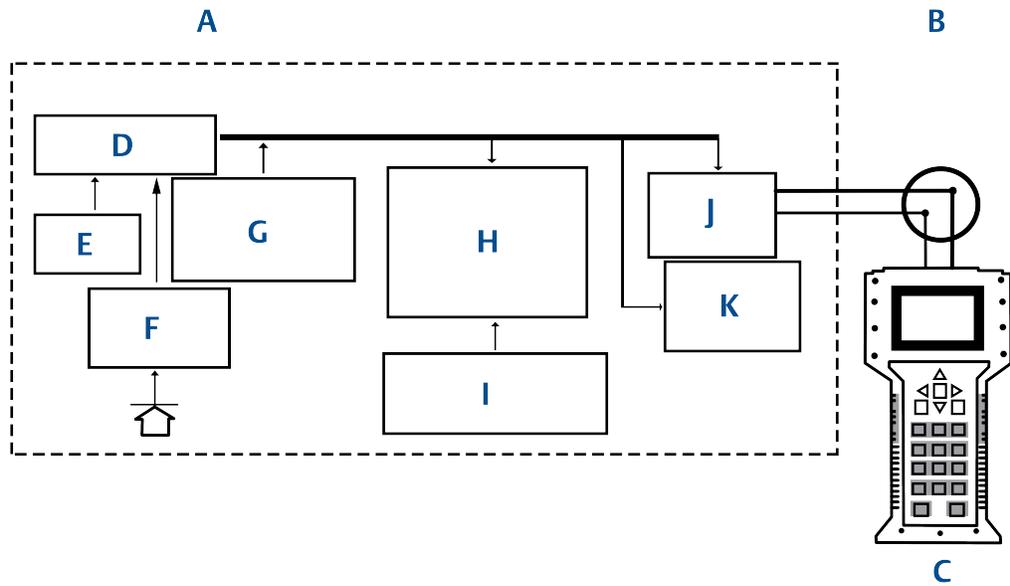
A. Sensor module and electronics
B. 4-20 mA signal to control system
C. Field Communicator
D. Signal processing
E. Temperature sensor
F. Pressure sensor
G. Sensor module memory
H. Microprocessor

- Sensor linearization

- Rerange

- Damping

- Diagnostics

- Engineering units

- Communication

I. Memory
- Configuration

J. Digital-to-analog signal conversion
K. Digital communication

2.5   Configuration overview

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

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).

2.6   Configuration basics

⚠ CAUTION

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

You can configure the transmitter 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 (🔓) to proceed with configuration. See Figure 4-2 for switch location.

2.6.1   Configuring on the bench

To configure on the bench, you will need a power supply and a Field Communicator, AMS Device Manager, or local operator interface (LOI), option M4.

Wire equipment as shown in Figure 2-3. 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.

Figure 2-3: Wiring the Transmitter (4–20 mA HART)
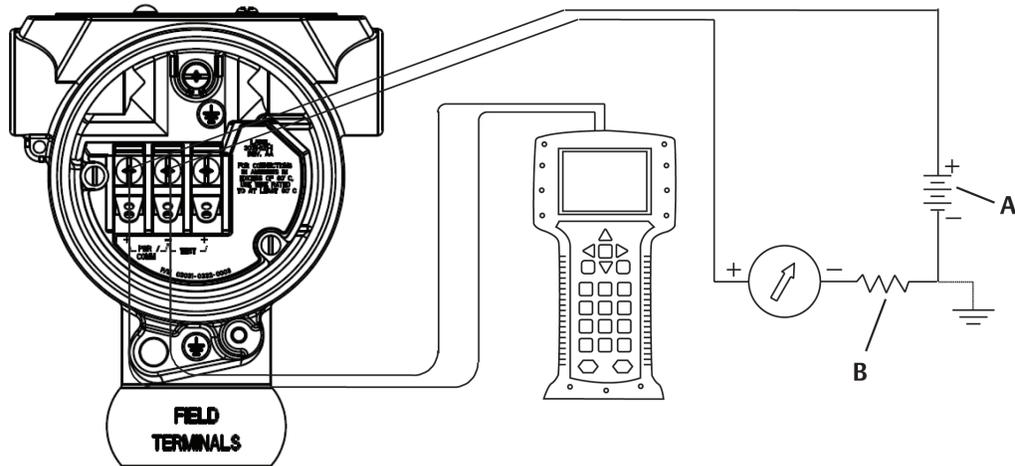
A. Vdc supply
B. $R_L \geq 250$ (necessary for HART communication only)

2.6.2   Configuration tools

Configuring with a Field Communicator

There are two interfaces available with the Field Communicator: traditional and dashboard.

This manual describes all steps using a Field Communicator using dashboard interfaces. Figure 2-4 shows the Device Dashboard interface. As stated in System readiness, it is critical that the latest device descriptors (DDs) are loaded into the Field Communicator. Visit Emerson.com or FieldCommGroup.org to download the latest DD library.

Field Communicator menu trees and Fast Keys are available in Field Communicator menu trees and Fast Keys.

Figure 2-4: Device Dashboard
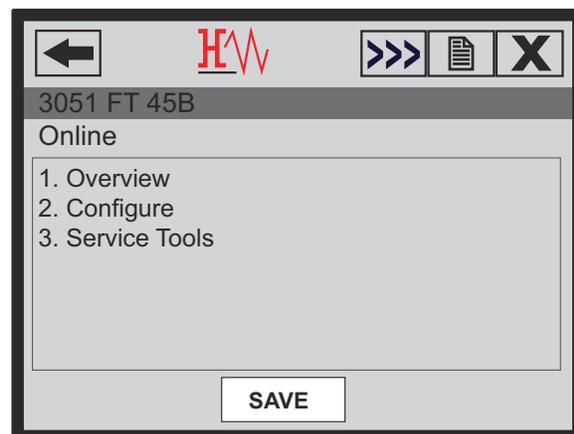
Configuring with AMS Device Manager

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
This manual describes all steps using AMS Device Manager version 11.5.

Configuring with a local operator interface (LOI)

To use the LOI, order the transmitter with option code M4. 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 2-5 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).

Figure 2-5: LOI Configuration Buttons
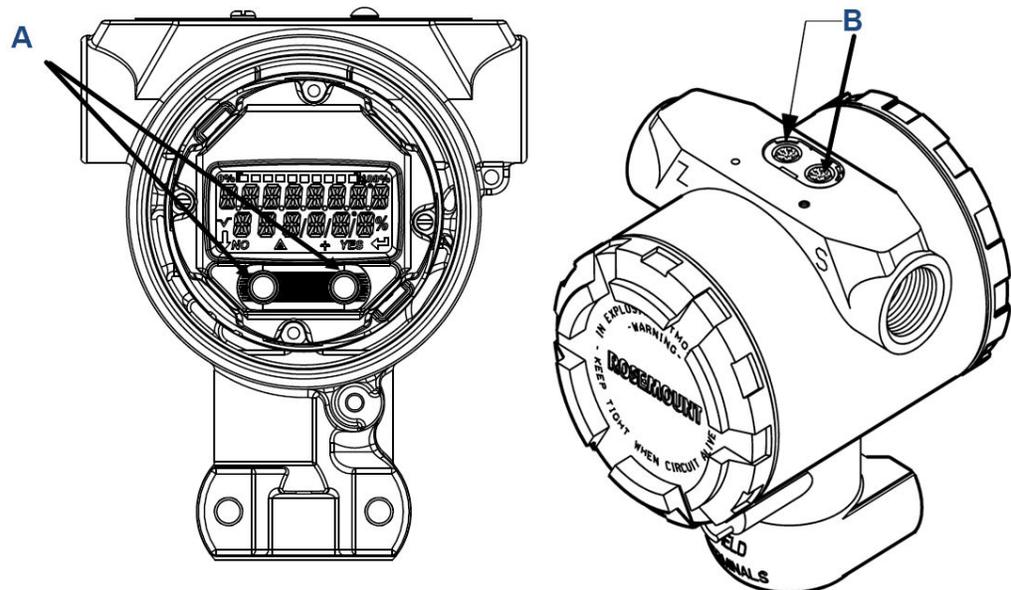
A. Internal configuration buttons
B. External configuration buttons

Table 2-2: LOI Button Operation
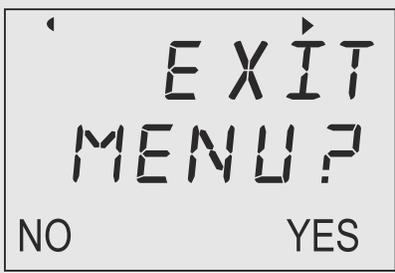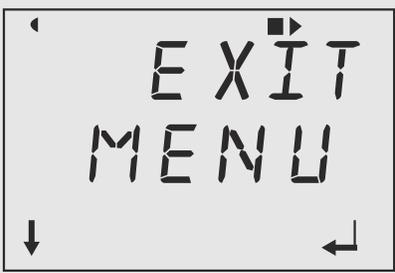
Button	◀ ▶ ⌐EXIT MENU? NO YES	◀ ■▶ EXIT MENU ↓ ↵
Left	No	SCROLL
Right	Yes	ENTER

2.6.3   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 local operator interface (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. You must set the loop to manual control as a separate operation.

2.7   Verifying configuration

Emerson recommends verifying various configuration parameters prior to installing them 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.

2.7.1   Verifying configuration with Field Communicator

Review configuration parameters listed in Table 2-3 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 device descriptor (DD) are shown in Table 2-3. For Fast Key sequences for legacy DDs, contact your local Emerson Representative.

Procedure

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

Table 2-3: Device Dashboard Fast Key Sequence

Function	Fast Key sequence	
	HART® 7	**HART 5**
Alarm and saturation levels	2, 2, 2, 5	2, 2, 2, 5

Table 2-3: Device Dashboard Fast Key Sequence *(continued)*

Function	Fast Key sequence	
	HART® 7	HART 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

2.7.2   Verifying configuration with AMS Device Manager

Procedure

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

2. Navigate the tabs to review the transmitter configuration data.

2.7.3   Verifying configuration with local operator interface (LOI)

Procedure

1. Press any configuration button to activate the LOI.
2. Select **VIEW CONFIG** to review the below parameters.
3. Use the configuration buttons to navigate through the menu.

    Review the following pareameters prior to installation:

    *   Tag

    *   Units

    *   Transfer Function

    *   Alarm and Saturation Levels

    *   Primary Variable

    *   Range Values

    *   Damping

2.7.4 Verifying process variables configuration

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

Verifying process variables with a Field Communicator

Procedure

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.

2.8 Basic setup of the transmitter

This section provides 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.

2.8.1 Setting pressure units

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

Setting pressure units with a Field Communicator

Procedure

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 click 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 local operator interface (LOI)

Procedure

1. Follow Figure 2-6 to select desired pressure and temperature units.
2. Use the **SCROLL** and **ENTER** buttons to select desired unit.
3. Save by selecting **SAVE** as indicated on the LCD display screen.

Example

Figure 2-6: Selecting Units with LOI
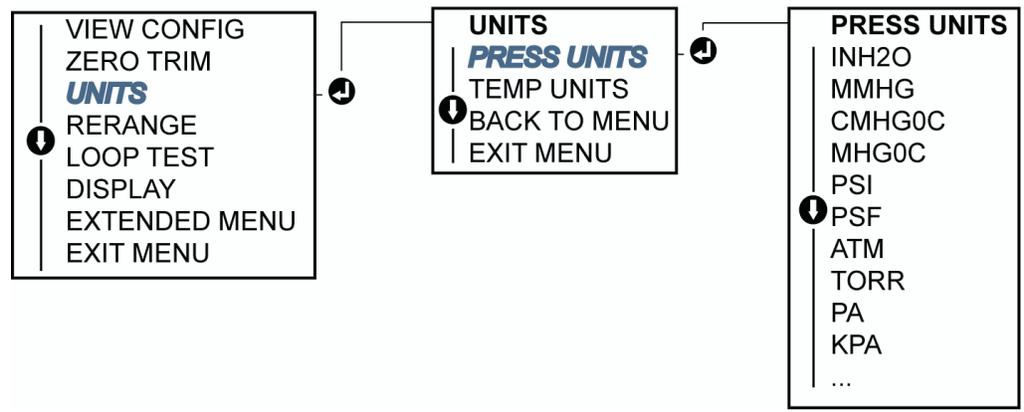
2.8.2   Reranging the transmitter

The range values command sets each of the lower and upper range analog values 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 local operator interface (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

Procedure

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 click 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 local operator interface (LOI)

See Figure 2-7 to rerange the transmitter using the LOI.

Procedure

Enter values using **SCROLL** and **ENTER** buttons.

Figure 2-7: Rerange with LOI
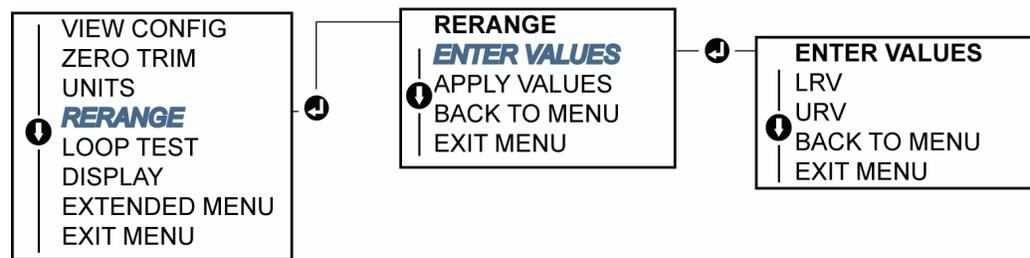
Rerange the transmitter with applied pressure source

Reranging using an applied pressure source is a way of reranging the transmitter without entering specific 4 and 20 mA points.

Rerange with an applied pressure source using a Field Communicator

Procedure

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 click the device; select **Configure**.

2. Select the **Analog Output** tab.

3. Select **Range by Applying Pressure** and follow the screen prompts range the transmitter.

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

If you order local zero and span buttons (option code D4), you can use them to rerange the transmitter with an applied pressure. Refer to Figure 2-8 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) while maintaining the span: press and hold zero button for at least two seconds then release.
   b) To change the span (20 mA) 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 defined in Specifications and reference data.

Figure 2-8: Analog Zero and Span Buttons
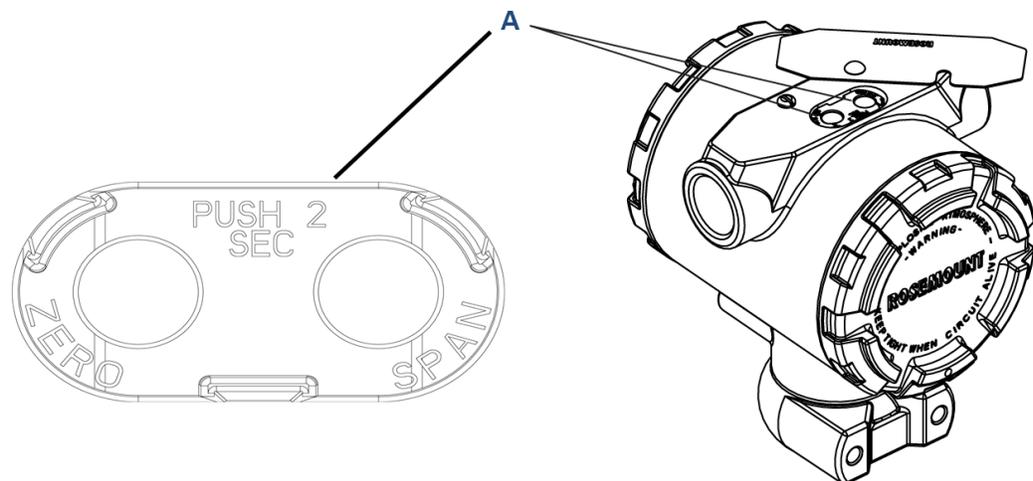
A. Zero and span buttons

Note

- If the transmitter security is on, you cannot make adjustments to the zero and span. Refer to Configuring transmitter security 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 measures and reports all readings within the digital limits of the sensor. For example, if the 4 and 20 mA points are set to 0 and 10 inH$_2$O, and the transmitter detects a pressure of 25 inH$_2$O, it digitally outputs the 25 inH$_2$O reading and a 250 percent of range reading.

2.8.3   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 you 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 click 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 local operator interface (LOI)

Procedure

Reference Figure 2-9 to enter damping values using an LOI.

Figure 2-9: Damping with LOI
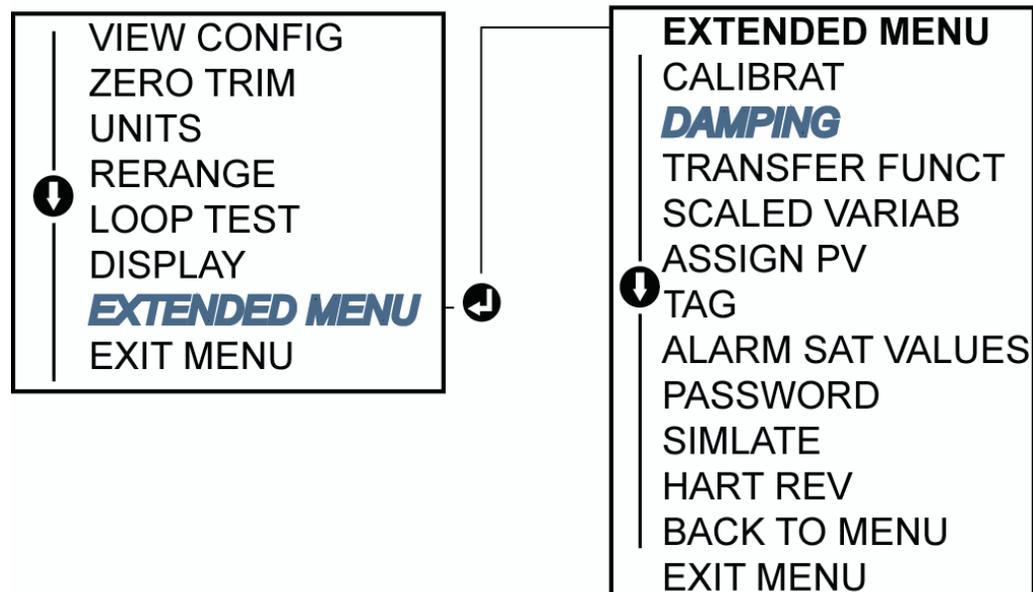
2.9 Configuring the LCD display

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

Use the following instructions to configure the LCD display to display configuration information during the device startup. Select **Review Parameters** at start-up to enable or disable this functionality.

See Table 2-2 for an image of the LCD display screen.

2.9.1 Configuring LCD display with a Field Communicator

Procedure

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

Device Dashboard Fast Keys	2, 2, 4

2.9.2   Configuring LCD display with AMS Device Manager

Procedure

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

2. Select **Manual Setup**; select the **Display** tab.

3. Select desired display options and click **Send**.

2.9.3   Configuring LCD display with a local operator interface (LOI)

Procedure

Refer to Figure 2-10 for LCD display configuration using an LOI.

Figure 2-10: Display with LOI
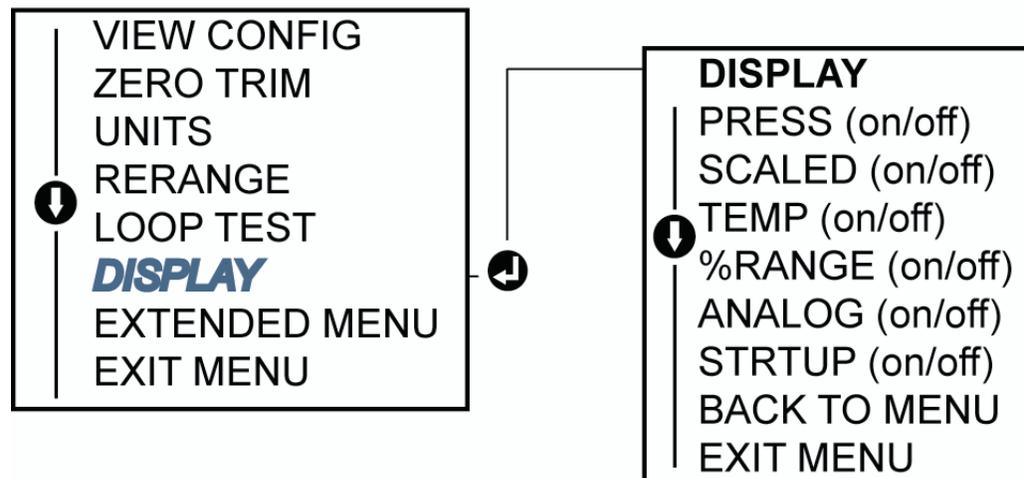
2.10   Detailed transmitter setup

2.10.1   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 Set transmitter alarm.

Table 2-4: Alarm and Saturation Values

Level	4–20 mA saturation	4–20 mA alarm
Low	3.90 mA	≤ 3.75 mA
High	20.80 mA	≥ 21.75 mA

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

Level	4–20 mA saturation	4–20 mA alarm
Low	3.80 mA	≤ 3.60 mA
High	20.50 mA	≥22.50 mA

Table 2-6: Custom Alarm and Saturation Values

Level	4–20 mA saturation	4–20 mA alarm
Low	3.50 mA– 3.90 mA	3.40–3.80 mA
High	20.10 mA –22.90 mA	20.20 mA – 23.00 mA

You can configure failure mode alarm and saturation levels using a Field Communicator, AMS Device Manager, or local operator interface (LOI). The following limitations exist for custom levels:

- Low alarm level must be less than the low saturation level.

- High alarm level must be higher than the high saturation level.

- Alarm and saturation levels must be separated by at least 0.1 mA.

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

Note

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

Configuring alarm and saturation levels using a Field Communicator

Procedure

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

2. Select **Configure Alarm and Saturation Levels**.

3. Follow screen prompts to configure alarm and saturation levels.

Configuring alarm and saturation levels using a local operator interface (LOI)

Procedure

Refer to Figure 2-11 for instructions to configure alarm and saturation levels.

Figure 2-11: Configuring Alarm and Saturation with LOI
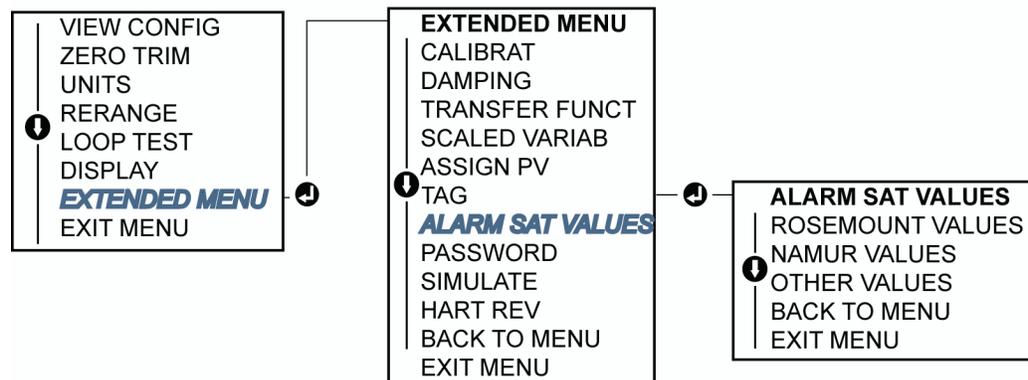
2.10.2   Configuring scaled variable

With the scaled variable, you can create a relationship/conversion between the pressure units and user-defined/custom units.

There are two use cases for scaled variable:

1. Allow custom units to be displayed on the transmitter's LCD/local operator interface (LOI) display.

2. Allow custom units to drive the transmitters 4-20 mA output.

If the you want custom units to drive the 4–20 mA output, re-map the scaled variable 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.
Pressure value position 1	Lower known value point with consideration of linear offset.
Scaled variable position 1	Custom unit equivalent to the lower known value point.
Pressure value position 2	Upper known value point.
Scaled variable position 2	Custom unit equivalent to the upper known value point.
Linear offset	The value required to zero out pressures affecting the desired pressure reading.

Configuring a scaled variable using a Field Communicator

Procedure

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

Device Dashboard Fast Keys	2, 1, 4, 7

2. Follow the screen prompts to configure scaled variable.

   a) Select **Linear** under Select Scaled data options.

Configuring a scaled variable using AMS Device Manager

Procedure

1. Right click 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) Select **Linear** under Select Scaled data options.

Configuring a scaled variable using a local operator interface (LOI)

Procedure

Refer to Figure 2-12 for instructions to configure a scaled variable using an LOI.

Figure 2-12: Configuring Scaled Variable Using an LOI
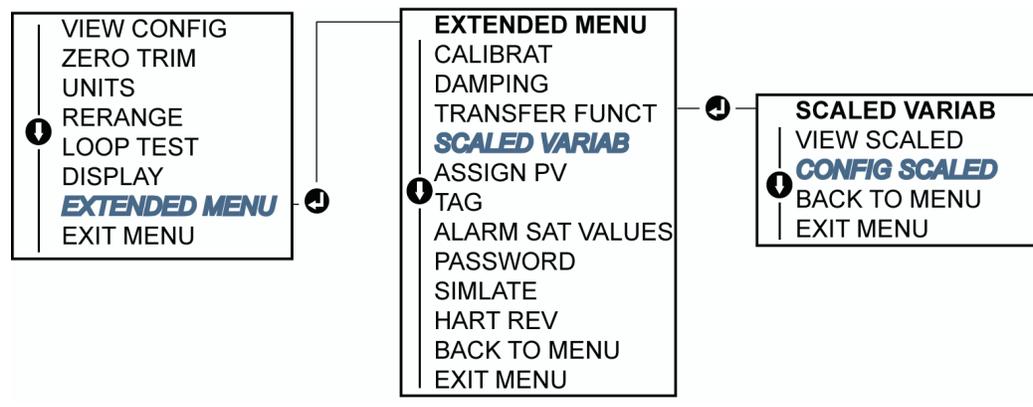
2.10.3   Re-mapping device variables

The re-mapping function allows you to configure the transmitter primary, secondary, tertiary, and quaternary variables (PV, 2V, 3V, and 4V) as desired.

You can re-map the PV with a Field Communicator, AMS Device Manager, or a local operator interface (LOI). You can only re-map variables 2V, 3V, and 4V via Field Communicator or AMS Device Manager.

Note
The variable assigned to the primary variable drives the 4–20 mA output. This value can be selected as Pressure or Scaled Variable. The 2, 3, and 4 variables only apply if using HART® burst mode.

Re-map device variables using a Field Communicator

Procedure

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

| Fast Keys | 2, 1, 1, 3 |

Re-map device variables using AMS Device Manager

Procedure

1. Right click 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-map device variables using local operator interface (LOI)

Procedure

Refer to Figure 2-13 for instructions on re-mapping the primary variable using an LOI.

Figure 2-13: Re-mapping with LOI

```
┌─────────────────────┐     ┌──────────────────────────┐
│ VIEW CONFIG         │     │ EXTENDED MENU            │
│ ZERO TRIM           │     │   CALIBRAT               │
│ UNITS               │     │   DAMPING                │
│ ↓ RERANGE           │     │   TRANSFER FUNCT         │
│ LOOP TEST           │     │   SCALED VARIAB          │
│ DISPLAY             │     │   ASSIGN PV              │
│ EXTENDED MENU       │──↵──│ ↓ TAG                    │
│ EXIT MENU           │     │   ALARM SAT VALUES       │
└─────────────────────┘     │   PASSWORD               │
                            │   SIMULATE               │
                            │   HART REV               │
                            │   BACK TO MENU           │
                            │   EXIT MENU              │
                            └──────────────────────────┘
```
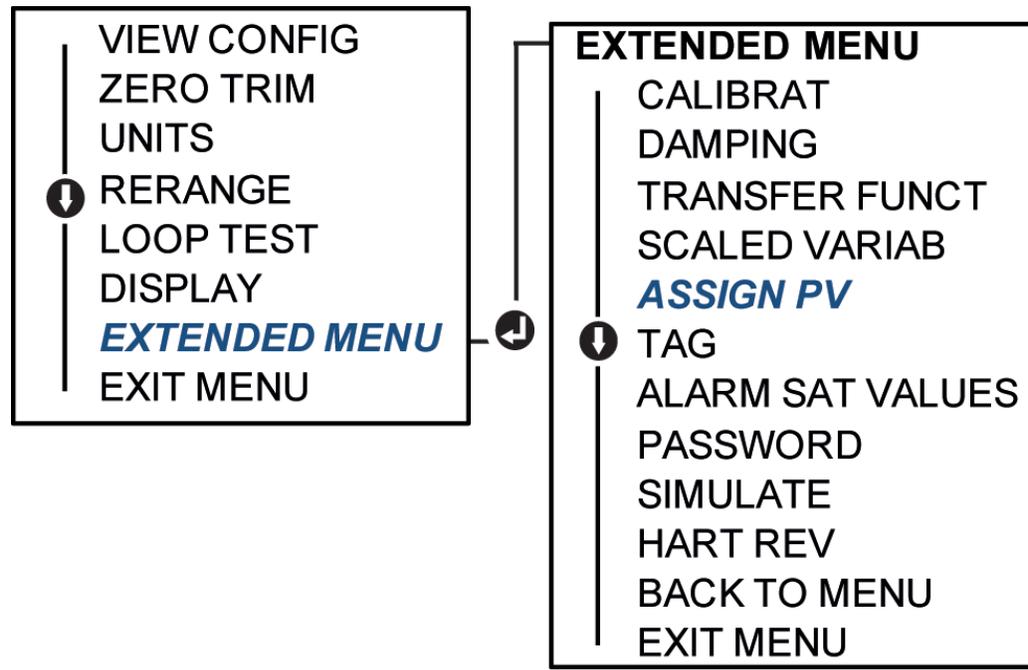
2.11 Performing transmitter tests

2.11.1 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. It ensures that the control system recognizes the alarm when activated. To verify the transmitter alarm values, perform a loop test and set the transmitter output to the alarm value (see Table 2-4, Table 2-5, and Table 2-6).

Note
Before returning transmitter to service, verify security switch is set to the correct position. Refer to Verifying configuration.

2.11.2 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. Emerson recommends testing the 4-20 mA 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 HART® output. If it does 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.

Performing an analog loop test using a Field Communicator

Procedure

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 click on the device and hover the cursor over **Diagnostics and Test** in the *Methods* dropdown menu. From the *Diagnostics and Test* dropdown 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 an analog loop test using a local operator interface (LOI)

To perform an analog loop test using the LOI, manually set the 4 mA, 20 mA, and custom mA point.

Procedure

Reference Figure 2-14 for instructions on how to perform a transmitter loop test using an LOI.

Figure 2-14: Performing an Analog Loop Test Using an LOI
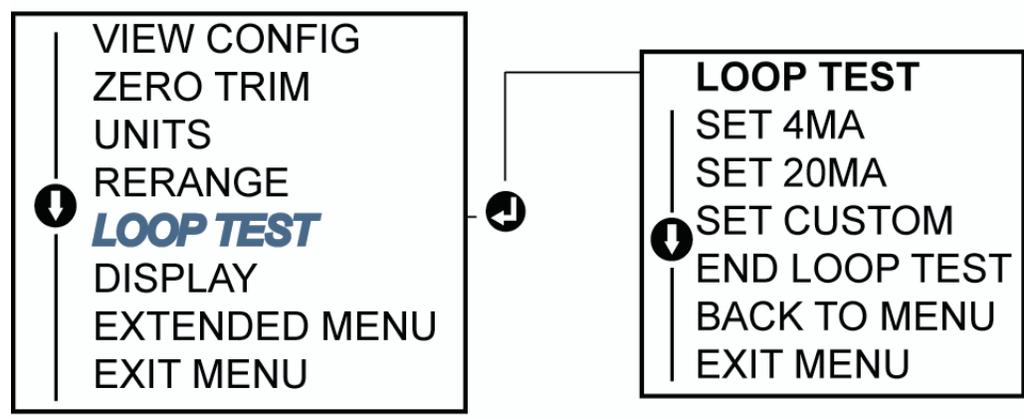
2.11.3   Simulate device variables

You can 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.

You can only simulate device variables in HART® Revision 7 mode.

Simulate digital signal with a Field Communicator

Procedure

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 click 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.

2.12   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 Vvariable, 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.

Choosing burst mode options in HART 5

Message content options:

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

Choosing burst mode options in HART 7

Message content options:

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

Choosing a HART 7 trigger mode

When in HART 7, you can select the following trigger modes:

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

Note
Consult your host system manufacturer for burst mode requirements.

2.12.1 Configuring burst mode using a Field Communicator

Procedure

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

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

2.12.2 Configuring burst mode using AMS Device Manager

Procedure

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

2.13 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. Use HART® modems and a host implementing HART protocol to communicate with transmitters. 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 2-15 shows a typical multidrop network. This figure is not intended as an installation diagram.

Figure 2-15: Typical Multidrop Network (4–20 mA Only)

A. HART modem
B. Power supply
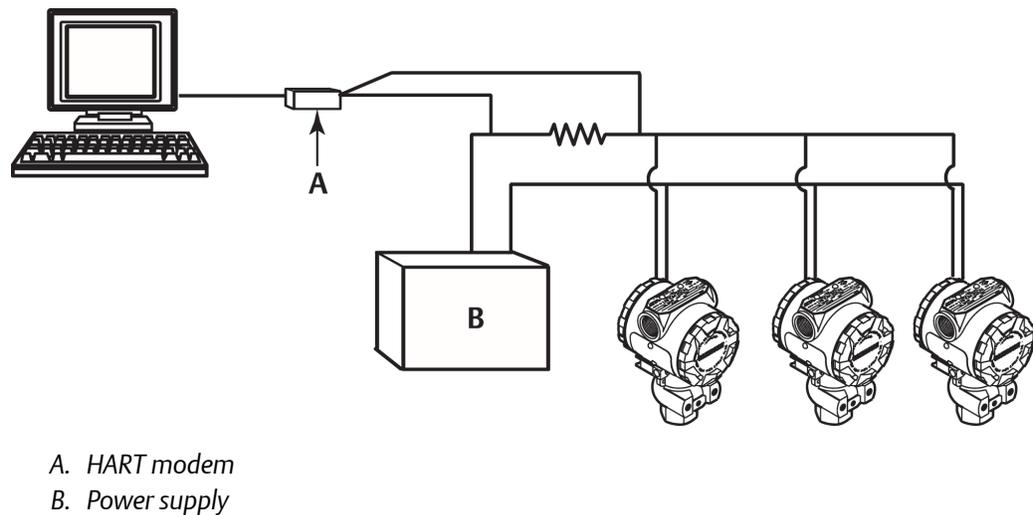
The Rosemount 3051P is set to address zero at the factory, which allows operation in the standard point-to-point manner with a 4–20 mA output signal. To activate multidrop communication, change the transmitter address to a number from 1 to 15 for HART Revision 5, or 1 to 63 for HART Revision 7. This change deactivates the 4–20 mA analog output, sending it to 4 mA . It also disables the failure mode alarm signal, which is controlled by the upscale/downscale switch position. Failure signals in multidropped transmitters are communicated through HART messages.

2.13.1   Changing a transmitter address

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

Changing transmitter address using a Field Communicator

Procedure

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 click the device and select **Configure**.

2. In HART® Revision 5 mode:

   a) Select **Manual Setup** and then select the *HART* tab.

   b) In the *Communication Settings* box enter **polling address** in the Polling Address box and then 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.

2.13.2   Communicating with a multidropped transmitter

To communicate with a multidrop transmitter you must set up the Field Communicator or AMS Device Manager 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 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 transmitter with HART® protocol.

Emerson ships a Quick Start Guide 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 in Mounting brackets.

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 operations.

⚠ WARNING

Explosions could result in death or serious injury.

Installation of this transmitter in an explosive environment must be in accordance with the appropriate local, national, and international standards, codes, and practices. Review the Product Certifications section of the Rosemount 3051P Product Data Sheet for any restrictions associated with a safe installation.

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

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

⚠ WARNING

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

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.

> **⚠ 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 to traditional flange can damage sensor module.

> **⚠ WARNING**
>
> Improper assembly of manifolds to traditional flange can damage the device.
>
> 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**
>
> **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.

> **⚠ WARNING**
>
> Install the enclosed pipe plug (found in the box) in an unused housing conduit opening with a minimum of five threads of engagement to comply with explosion-proof requirements.
> Always ensure a proper seal by installing the electronics housing cover(s) so that metal contacts metal.
> Use Rosemount O-rings.

3.3.2　Environmental considerations

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

Refer to the Rosemount 3051P Product Data Sheet for the sensing element operating limits. Mount the transmitter so that it is not susceptible to vibration and mechanical shock and does not have external contact with corrosive materials.

3.3.3　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.

Refer to Figure 3-3 through Figure 3-5 for correct mounting orientation.

3.4　Installation procedures

3.4.1　Mount the transmitter

The approximate weight of the transmitter is 2.44 lb. (1.11 kg).

In many cases its compact size and light weight makes it possible to mount directly to the respective apparatus without using an additional mounting bracket. When this is not desirable, mount directly to a wall, panel, or 2-in. (50.8 mm) pipe using the optional mounting bracket (see Mounting brackets).

For dimensional drawing information refer to the Rosemount 3051P Product Data Sheet.

Note
Most transmitters are calibrated in the upright position. Mounting the transmitter in any other position will shift the zero point to the equivalent amount of liquid head pressure caused by the varied mounting position. To reset zero point, refer to Sensor trim overview.

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. 3 in. (76.2 mm) of clearance is required for cover removal if a meter is installed.

Environmental seal for housing

Thread sealing (PTFE) tape or paste on male threads of conduit is required to provide a water/dust tight conduit seal and meets requirements of NEMA® Type 4X, IP66, and IP68.

Consult factory if other Ingress Protection ratings are required.

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

Mounting brackets

You can panel mount or pipe mount the transmitter via an optional mounting bracket (option code B4).

See Figure 3-1 and for dimensional and mounting configuration information.

Figure 3-1: Mounting Bracket Option Code B4

Dimensions are in inches (millimeters).

Pipe mounting   Panel mounting
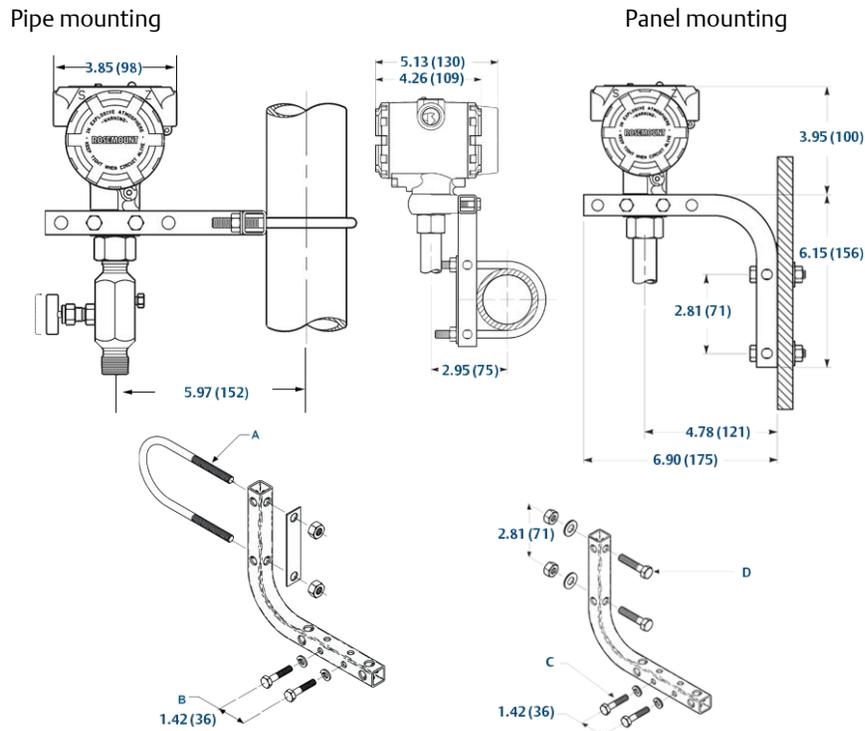
A. 2-in. (50.8 mm) U-bolt for pipe mounting (clamp shown)
B. ¼ x 1¼ bolts for transmitter mounting (not supplied)
C. ¼ x 1¼ bolts for transmitter mounting (not supplied)
D. 5/16 x 1½ bolts for panel mounting (not supplied)

Figure 3-2: Head Markings
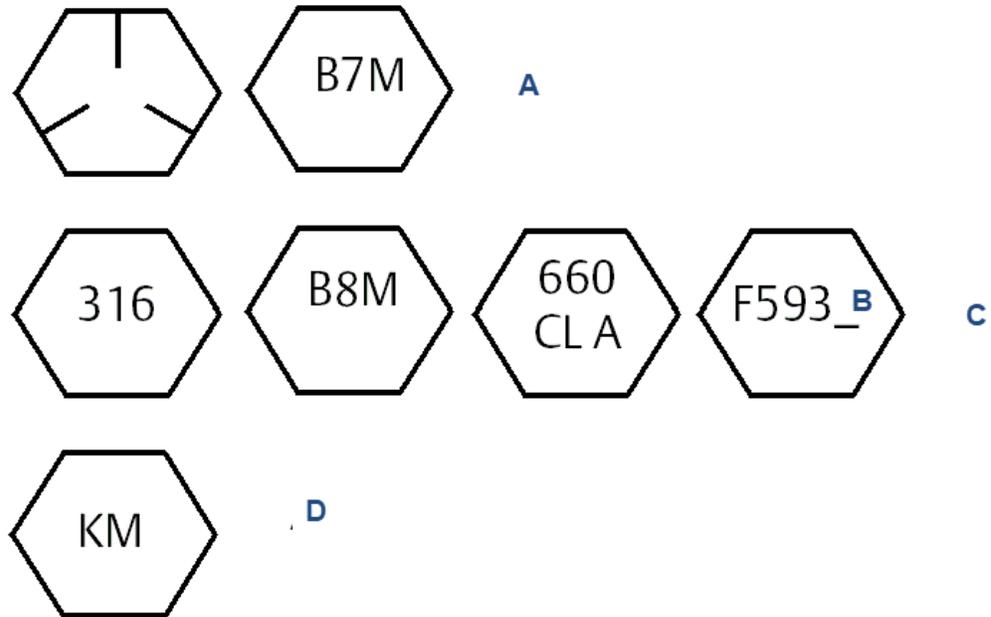
A. *Carbon steel (CS) head markings*
B. *The last digit in the F593_ head marking may be any letter between A and M.*
C. *Stainless steel (SST) head markings*
D. *Alloy K-500 head marking*

3.4.2   Impulse piping

Mounting requirements

Impulse piping configurations depend on specific measurement conditions.

Refer to Figure 3-3 through Figure 3-5 for examples of the following mounting configurations:

Liquid measurement

* Place taps to the side of the line to prevent sediment deposits on the transmitter's process isolator.

* Mount the transmitter beside or below the taps so gases can vent into the process line.

* Mount drain/vent valve upward to allow gases to vent.

Figure 3-3: Liquid Applications Installation Example
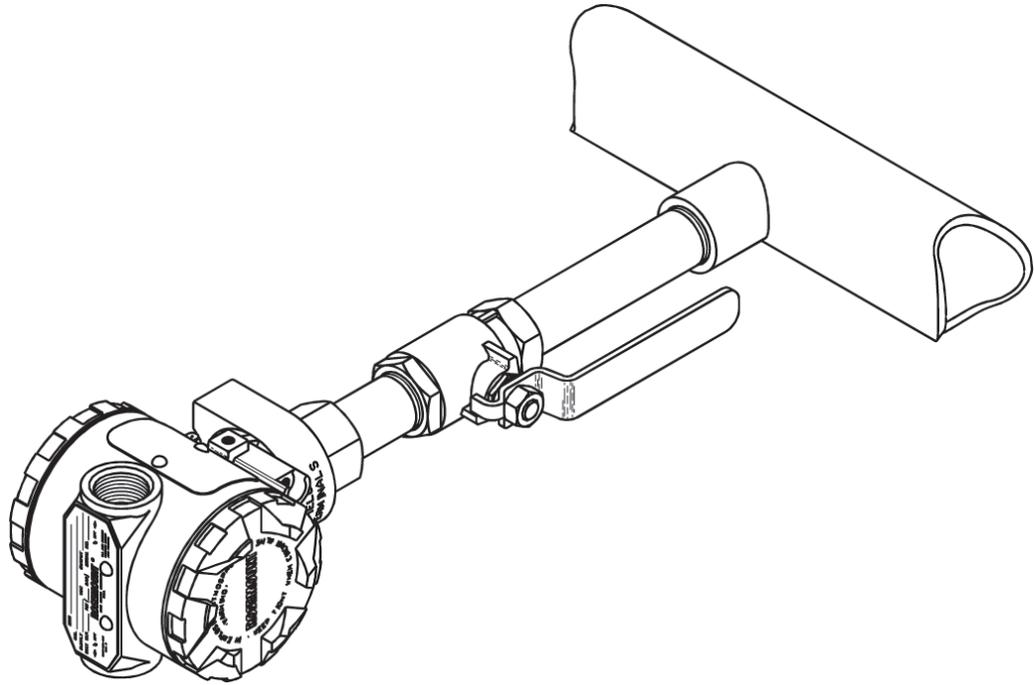
Gas measurement

- Place tap in the top or side of the line.

- Mount the transmitter beside or above the tap so liquid will drain into the process line.

Figure 3-4: Gas Applications Installation Example
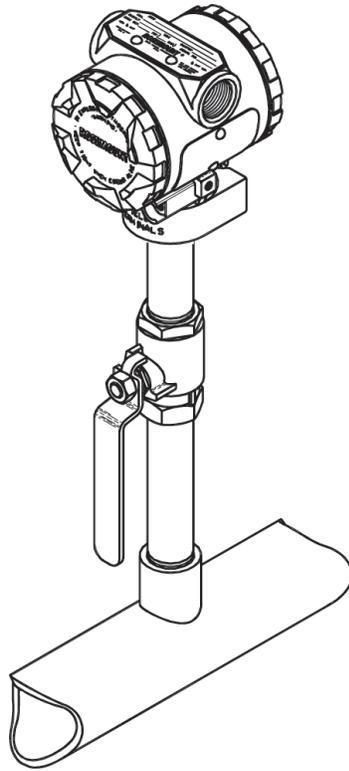
Steam measurement

- Place tap to the side of the line.

- Mount the transmitter below the taps to ensure the impulse piping will stay filled with condensate.

- In steam service above 250 °F (121 °C), fill impulse line with water to prevent steam from contacting the transmitter directly and to ensure accurate measurement start-up.

Figure 3-5: Steam Applications Installation Example
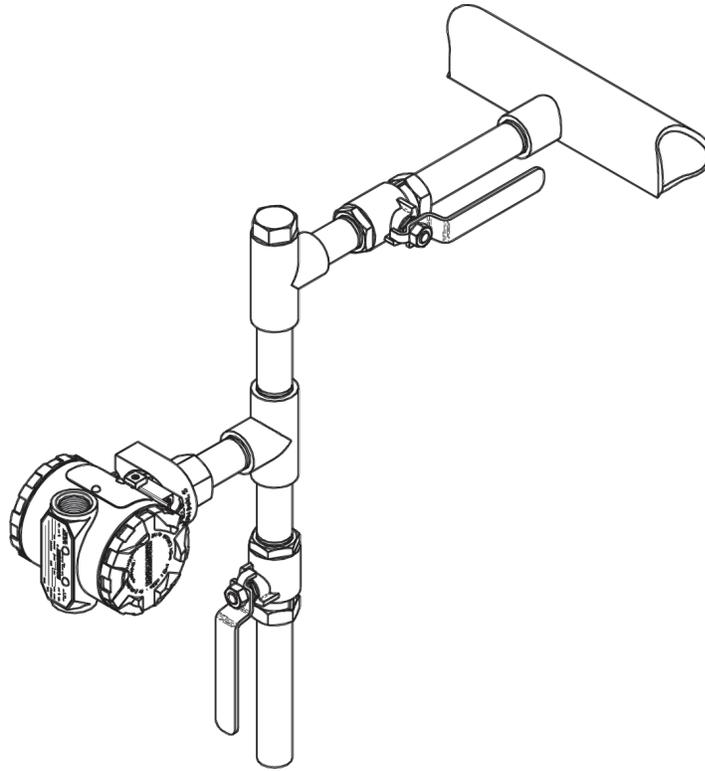
> ⚠ **CAUTION**
>
> For steam or other elevated temperature services, it is important that temperatures at the process connection do not exceed the transmitter's process temperature limits.

Best practices

The piping between the process and the transmitter must accurately transfer the pressure to obtain accurate measurements.

There are six possible sources of error:

1. Pressure transfer

2. Leaks

3. Friction loss (particularly if purging is used)

4. Trapped gas in a liquid line

5. Liquid in a gas line

6. 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   In-line process connection

In-line gage 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 gage transmitter is located in the neck of the transmitter, behind the housing. The vent path is 360 degrees around the transmitter between the housing and sensor (See Figure 3-6).

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

Figure 3-6: In-Line Gage Low Side Pressure Port
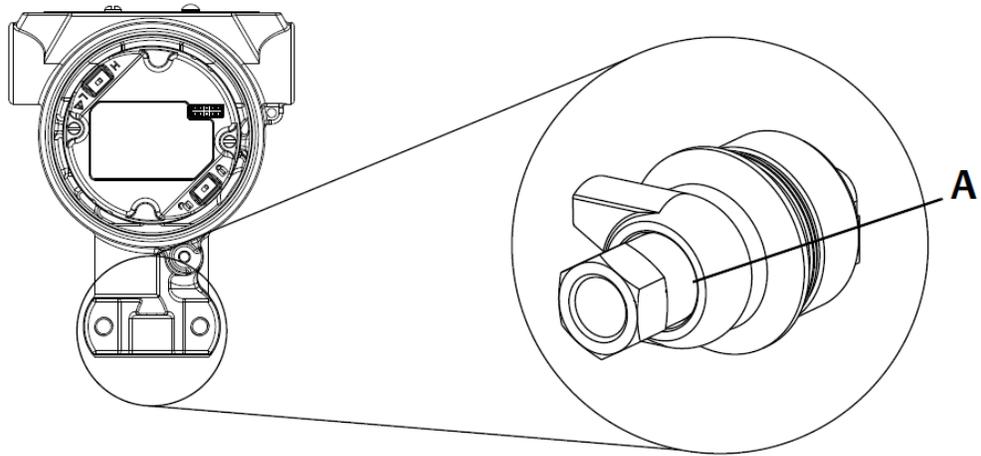
A. Low side pressure port (atmospheric reference)

⚠ CAUTION

Rotation between the sensor module and the process connection can damage the electronics.

Do not apply torque directly to the sensor module.
To avoid damage, apply torque only to the hex-shaped process connection.
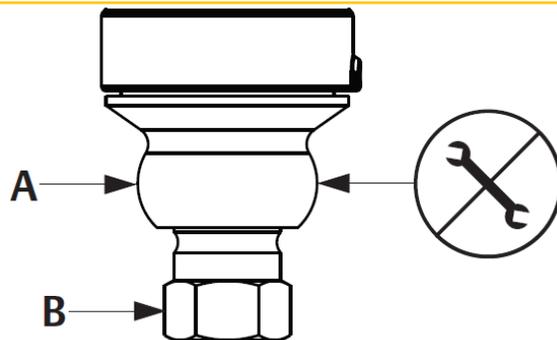
3.5   Rosemount 306 Manifold

The Rosemount 306 Integral Manifold is used with the Rosemount 3051P In-Line Transmitter to provide block-and-bleed valve capabilities of up to 10,000 psi (690 bar).

Figure 3-7: Rosemount 3051P and 306 In-line Manifold
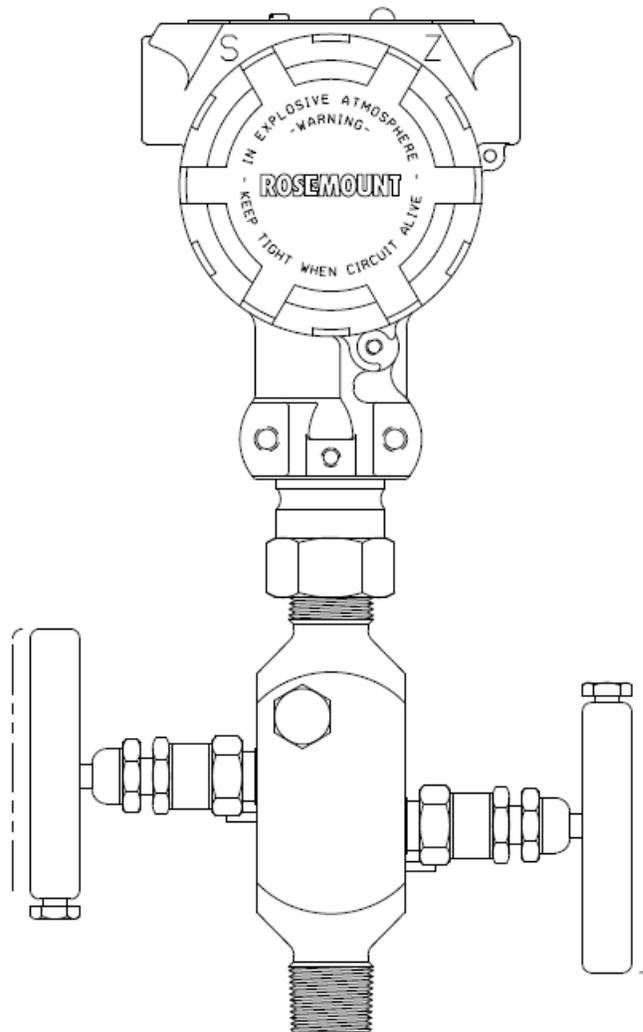
3.5.1   Rosemount 306 Integral Manifold installation procedure

Assemble the Rosemount 306 Manifold to the Rosemount 3051P In-Line Transmitter with a thread sealant.

4 Electrical installation

4.1 Overview

The information in this section covers installation considerations for the Rosemount 3051P.

Emerson ships a Quick Start Guide with every transmitter to describe pipe-fitting, wiring procedures, and basic configuration for initial installation.

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

4.2 Safety messages

Procedures and instructions in this section may require special precautions to ensure the safety of the personnel performing the operations.

⚠ WARNING

Explosions could result in death or serious injury.

Installation of this transmitter in an explosive environment must be in accordance with the appropriate local, national, and international standards, codes, and practices. Review the Product Certifications section of the Rosemount 3051P Product Data Sheet for any restrictions associated with a safe installation.

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

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

⚠ WARNING

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

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.

> **⚠ 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 to traditional flange can damage sensor module.

> **⚠ WARNING**
>
> Improper assembly of manifolds to traditional flange can damage the device.
>
> 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**
>
> **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   Local Operating Interface (LOI)/LCD display

Emerson ships transmitters ordered with the LCD display option (M5) or LOI option (M4) 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: LOI Display Assembly

A. *LCD/LOI display*
B. *Extended cover*
C. *Captive screws*

4.3.1   Rotate LCD/local operator interface (LOI) display

Procedure

1. Secure the loop to manual control and remove power to transmitter.
2. Remove transmitter housing cover.
3. Remove screws form the LCD/LOI display and rotate to desired orientation.
   a) Insert 10-pin connector into the display board for the correct orientation. Carefully align pins for insertion into the output board.
4. Re-insert screws.
5. Reattach transmitter housing cover.

⚠ **WARNING**

Explosions

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

6. Reattach power and return loop to automatic control.

4.4 Configuring transmitter security

The transmitter has four security methods.

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

Figure 4-2: 4–20 mA Electronics Board

Without LCD display meter	With LCD display /LOI display

A. Alarm
B. Security
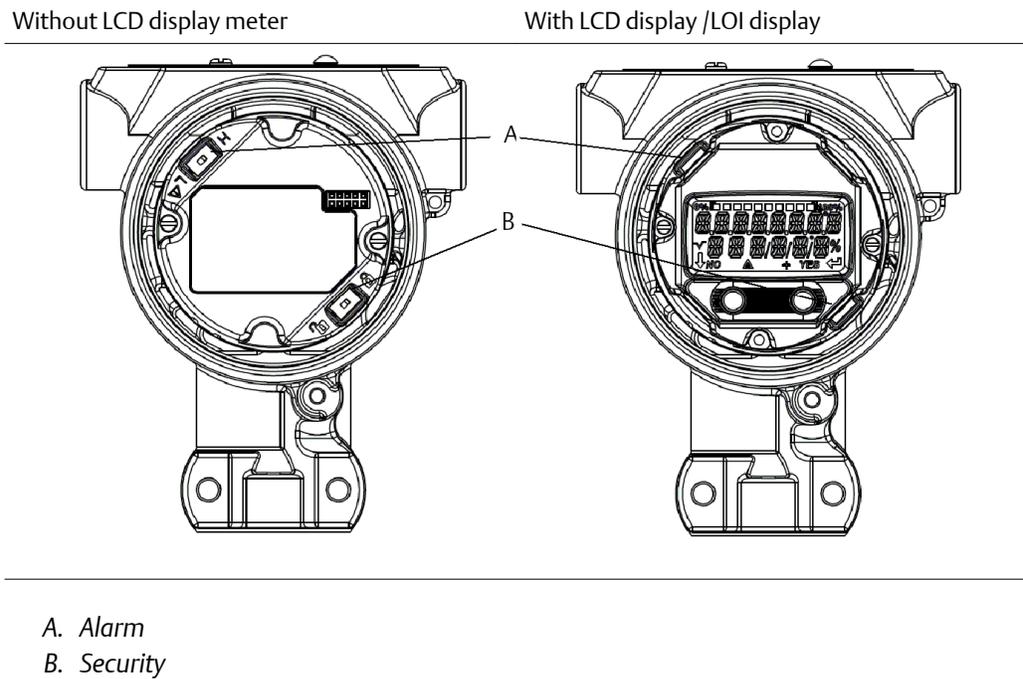
4.4.1 Set security switch

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®, local operator interface (LOI), or local configuration buttons will be rejected by the transmitter, and the transmitter configuration data will not be modified.

See 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 lock (🔒) position.
4. Replace transmitter housing cover.

> **⚠ WARNING**
>
> Cover must be fully engaged to comply with explosion proof requirements.

4.4.2   HART® Lock

The HART Lock prevents changes to the transmitter configuration from all sources; all changes requested via HART, local operator interface (LOI), and local configuration buttons will be rejected.

You can only set the HART Lock via HART communication, and it is only available in HART Revision 7 mode. Enable or disable the HART lock with a Field Communicator or AMS Device Manager.

Configure HART® Lock using Field Communicator

Procedure

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

Device Dashboard Fast Keys	2, 2, 6, 4

Configure HART® Lock using AMS Device Manager

Procedure

1. Right click 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 local operator interface (LOI) and local buttons will be rejected.

You can only lock local external keys via HART® communication.

Configure button lock using the Field Communicator

Procedure

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

Device Dashboard Fast Keys	2, 2, 6, 3

Configure button lock using AMS Device Manager

Procedure

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

2. Under Manual Setup select the **Security** tab.

3. Fron 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   Local operator interface (LOI) password

You can enter and enable an LOI password to prevent review and modification of device configuration via the LOI.

This does not prevent configuration from HART® or external keys (analog zero and span; digital zero trim). The LOI password is a four digit code that is to be set by the user. If the password is lost or forgotten the master password is **9307**.

You can figure and enable or disable the LOI password with HART® communication via a Field Communicator, AMS Device Manager, or the LOI.

Configure local operator interface (LOI) password with Field Communicator

Procedure

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

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

Configure local operator interface (LOI) password with AMS Device Manager

Procedure

1. Right click 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.

Configure local operator interface (LOI) password using LOI

Figure 4-3: LOI Password
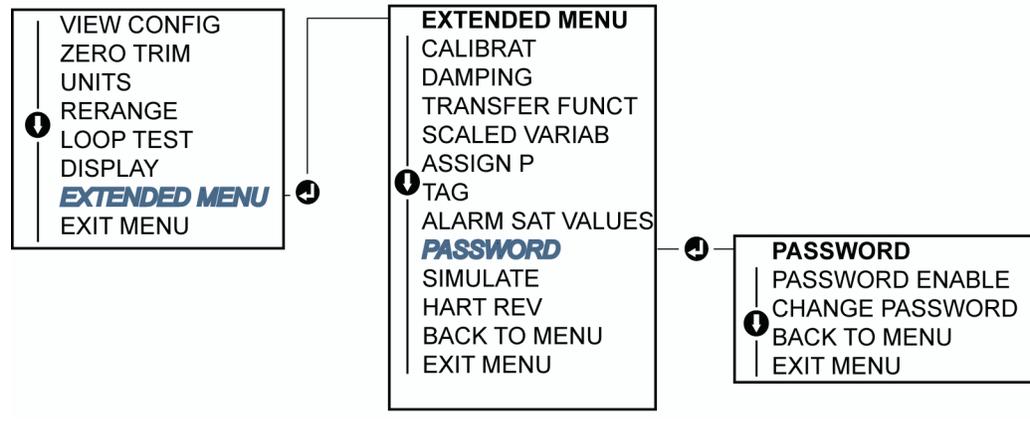
4.5 Set transmitter alarm

On the electronics board is an alarm switch; see Figure 4-2 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.

⚠ **WARNING**

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

4.6 Electrical considerations

⚠ **WARNING**

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

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.

Figure 4-4: Recommended Conduit Installation Diagrams
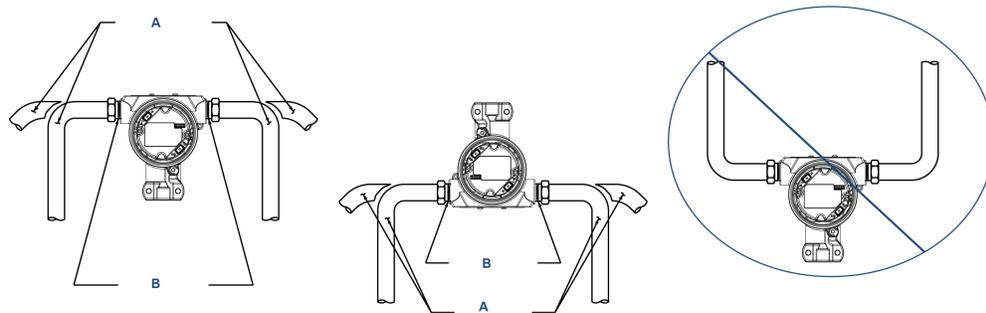
A. *Possible conduit line positions*
B. *Sealing compound*

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

Figure 4-5: Load Limitation
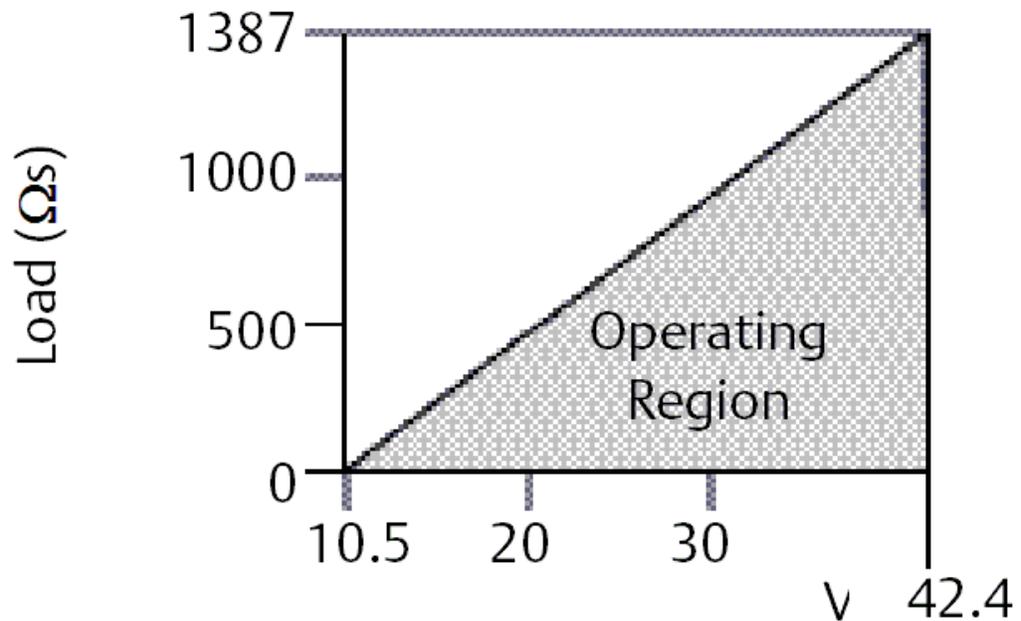
Maximum loop resistance = 43.5 x (Power supply voltage – 10.5)

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

4.6.3 Wiring the transmitter

> **⚠ CAUTION**
>
> Incorrect wiring can damage test circuits.
>
> Do not connect the power signal wiring to the test terminals.

Note
Use shielded twisted pairs to yield best results. To ensure proper communication, use 24 AWG or larger wire and do not exceed 5,000 ft. (1500 m).

Figure 4-6: 4–20 mA HART®
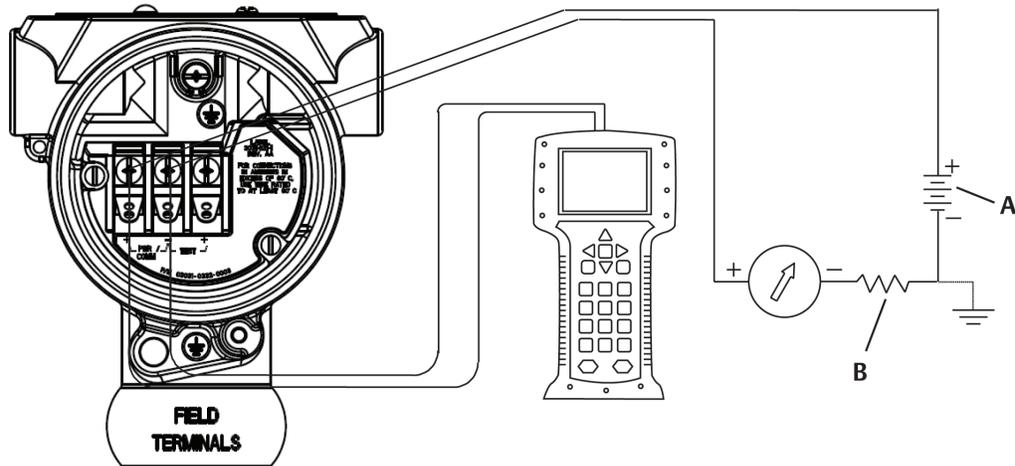
A. DC power supply
B. $R_L \geq 250$ (necessary for HART communication only)

Perform the following procedure to make wiring connections:

Procedure

1. Remove the housing cover on terminal compartment side.

⚠ **WARNING**

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

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–**).

⚠ **CAUTION**

Power could damage the test diode.

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

3. Ensure full contact with terminal block screw and washer. When using a direct wiring method, wrap wire clockwise to ensure it is in place when tightening the terminal block screw.

⚠ **CAUTION**

The connection may be susceptible fo loosening over time or under vibration.

Emerson does not recommend using a pin or ferrule wire.

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

4.6.4   Grounding the transmitter

Ground signal cable shield

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

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, trim the cable shield and shield drain wire close and insulate them from transmitter housing.
4. Reattach the field terminals housing cover.

   ⚠ **WARNING**

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

5. At terminations outside the transmitter housing, ensure that the cable shield drain wire is continuously connected.
   a) Prior to the termination point, insulate any exposed shield drain wire as shown in Figure 4-7 (B).

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

Figure 4-7: Wiring Pair and Ground
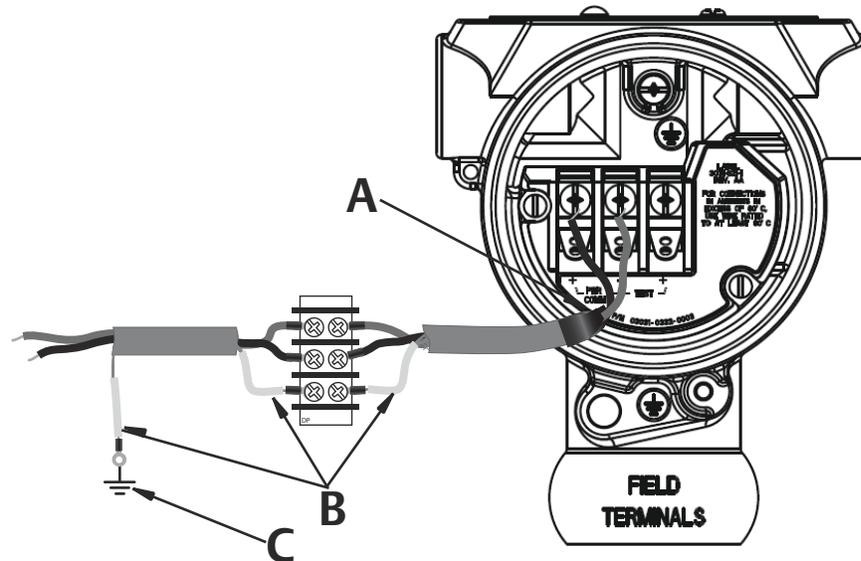
A. Insulate shield and shield drain wire.
B. Insulate exposed shield drain wire.
C. Terminate cable shield drain wire to earth ground.

Transmitter case grounding

The most effective transmitter case grounding method is a direct connection to earth ground with minimal impedance.

⚠ WARNING

Always ground the transmitter case in accordance with national and local electrical codes.

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 3051P Transmitters. Refer to Figure 4-8.

Figure 4-8: Internal Ground Connection
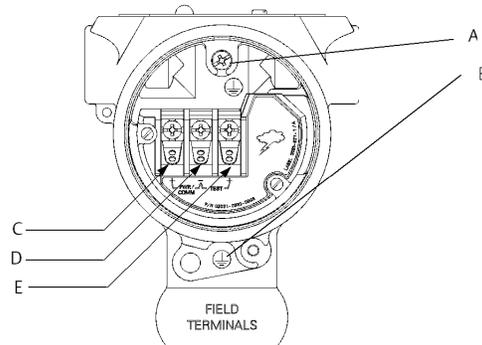
A. Internal ground location
B. External ground location
C. Positive
D. Negative
E. Test

- External ground connection: The external ground connection is located on the exterior of the transmitter housing. Refer to Figure 4-8. This connection is only available with option T1.

> ⚠ **WARNING**
>
> 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.

You can order the transient protection terminal block as an installed option (option code T1) or as a spare part to retrofit existing Rosemount 3051P Transmitters in the field. See the Rosemount 3051P Product Data Sheet for part numbers. The lightning bolt symbol shown in Figure 4-9 identifies the transient protection terminal block.

Figure 4-9: Transient Protection Terminal Block
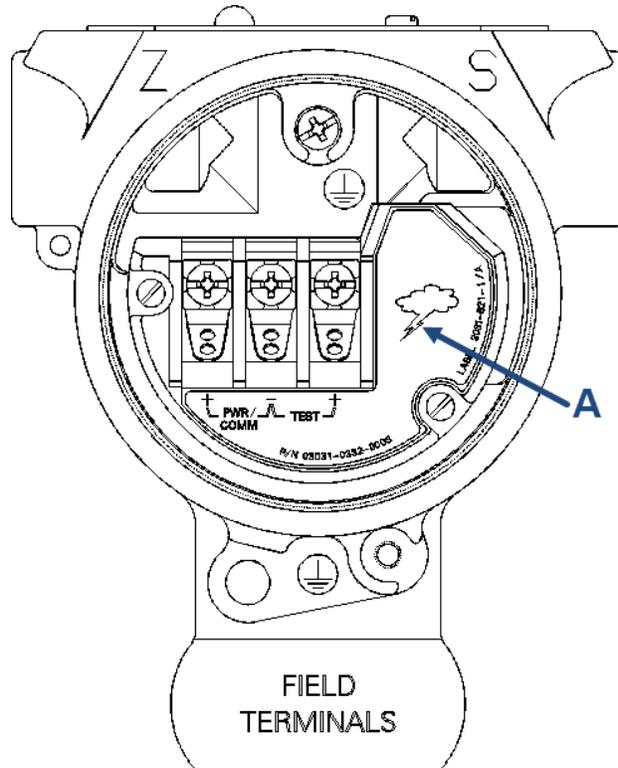
A. Lightning bolt location

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 4-8.

5 Operation and maintenance

5.1 Overview

This section contains information on calibrating Rosemount 3051P Pressure Transmitters.

This section gives instructions on using the Field Communicator, AMS Device Manager and Local Operator Interface (LOI) to calibrate the transmitter.

5.2 Safety messages

Procedures and instructions in this section may require special precautions to ensure the safety of the personnel performing the operations.

> ⚠ **WARNING**

Explosions could result in death or serious injury.

> Installation of this transmitter in an explosive environment must be in accordance with the appropriate local, national, and international standards, codes, and practices. Review the Product Certifications section of the Rosemount 3051P Product Data Sheet for any restrictions associated with a safe installation.
>
> Before connecting a handheld communicator in an explosive atmosphere, ensure that the instruments in the loop are installed in accordance with intrinsically safe or non-incendive field wiring practices.
>
> In an explosion-proof/flameproof installation, do not remove the transmitter covers when power is applied to the unit.

> ⚠ **WARNING**

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**

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.

> **⚠ 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 to traditional flange can damage sensor module.

> **⚠ WARNING**
>
> Improper assembly of manifolds to traditional flange can damage the device.
>
> 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**
>
> **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**
>
> **Emerson calibrates absolute pressure transmitters at the factory.**
>
> Trimming adjusts the position of the factory calibration curve. If you trim the transmitter improperly or with inaccurate equipment, you may degrade the transmitter's performance.

5.3.1   Calibrate in the field

Procedure

1. Perform sensor zero/lower trim: Compensate for mounting pressure effects

   Refer to Rosemount 306 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 Calibrate on the bench

Procedure

1. Perform optional 4–20 mA output trim.
2. Perform a sensor trim.
   a) Zero/lower trim using line pressure effect correction.

      Reference Hardware installation for manifold drain/vent valve operation instructions.

   b) Perform an optional full scale trim, which sets the span of the device and requires accurate calibration equipment.

   c) Set/check basic configuration parameters.

5.4 Calibration overview

Emerson fully calibrates the Rosemount 3051P at the factory to ensure accuracy. You can also calibrate the transmitter in the field to meet plant requirements or industry standards. Complete calibration of the transmitter can be split into two halves: sensor calibration and analog output calibration.

With sensor calibration, you can 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. Emerson recommends making this correction. 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, you can calibrate the analog output to match the user measurement system. The analog output trim (4–20 mA) will calibrate the loop at the 4 m and 20 mA points.

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

Calibrate the sensor

- Performing a sensor trim
- Perform a digital zero trim (option DZ)

Calibrate the 4–20 mA output

- Performing digital-to-analog trim (4–20mA output trim)
- Performing digital-to-analog trim (4–20mA output trim) using other scale

5.4.1 Determine 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.

Trimming the pressure signal outlines 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. To set the transmitter back to factory settings, see Recall factory trim—sensor trim. 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 Performing 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 (4–20mA output trim).

Trim 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 you can order with the transmitter and use to perform trim operations: Digital zero trim and LOI.

Procedure

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.

- Analog zero and span (D4): Used to rerange the transmitter with an applied pressure.

- Digital zero trim (DZ): Used for performing a sensor zero trim. See Determine calibration frequency for trim instructions.

Monitor all configuration changes either on the 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

B
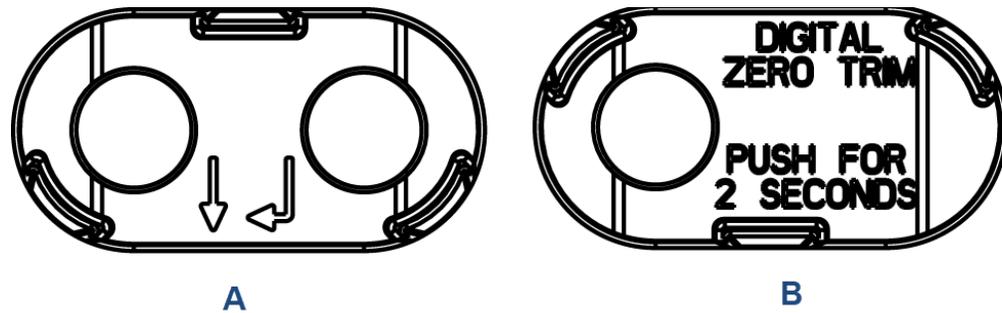
A. Analog zero and span (D4)- green retainer
B. Digital zero trim (DZ)- blue retainer

5.4.2   Determine 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.

   Example

Required Performance:	0.50 percent of span

2. Determine the operating conditions.

   Example

Transmitter	Rosemount 3051P, Range 1 [URL = 30 psi (2.1 bar)]
Calibrated span	30 psi (2.1 bar)
Ambient temperature change	±50 °F (28 °C)

3. Calculate the total probable error (TPE).

   Example

   $$\text{TPE}\quad \sqrt{(ReferenceAccuracy)^2 + (TemperatureEffect)^2 + (StaticPressureEffect)^2} = 0.303 \text{ percent of span}$$

   Where:

Reference accuracy	± 0.040 percent of span
Ambient temperature effect	±(0.05 percent URL + 0.25 percent of span) per 50 °F (28 °C) = ±0.3 percent of span
Static pressure effect	0 percent (does not apply to in-line products)

4. Calculate the stability per month.

    Example

    Stability $\text{Stability} = \pm\left[\frac{(0.200 \times \text{URL})}{\text{Span}}\right]\%\text{ of span for 10 years} = \pm0.0017\%\text{ of URL for 1 month}$

5. Calculate the calibration frequency.

    Example

    Calibration frequency $\text{Cal. Freq.} = \frac{(\text{Req. Performance} - \text{TPE})}{\text{Stability per Month}} = \frac{(0.5\% - 0.303\%)}{0.0017\%} = 118 \text{ months}$

5.5   Trimming the pressure signal

5.5.1   Sensor trim overview

A sensor trim corrects the pressure offset and pressure range to match a pressure standard. The upper sensor trim corrects the pressure range, and the lower sensor trim (zero trim) corrects the pressure offset. An accurate pressure standard is required for full calibration. You can perform a zero trim if the process is vented.

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, do not use it in place of a sensor trim over the full sensor range.

Note
Do not perform a zero trim on Rosemount 3051P 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 and all output is linearized between them; this trim requires an accurate pressure source. Always adjust the low trim value first to establish the correct offset. Adjustment of the high trim value provides a slope correction to the characterization curve based on the low trim value. The trim values help optimize performance over a specific measurement range.

Figure 5-2: Sensor Trim Example
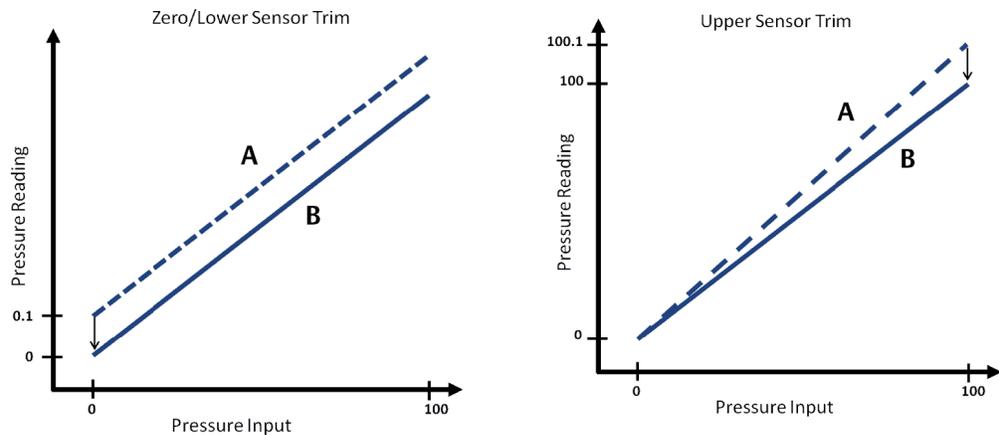
A. *Before trim*
B. *After trim*

5.5.2 Performing a sensor trim

When performing a sensor trim, you can trim both the upper and lower limits. If doing both upper and lower trims, perform the lower trim before 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.

Perform 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:

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. To do this, see Reranging 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.

Perform a sensor trim with AMS Device Manager

Procedure

1. Right click the device and, under the *Method* drop down menu, move the cursor over **Calibrate**.

2. Under *Sensor Trim*, select **Lower Sensor Trim**.

3. Follow the screen prompts to perform a sensor trim using AMS Device Manager.

4. If desired, repeat Step 1.

5. Under *Sensor Trim*, select **Upper Sensor Trim**.

Perform a sensor trim using local operator interface (LOI)

Procedure

See Figure 5-3 to perform an upper and lower sensor trim.

Figure 5-3: Sensor Trim with LOI
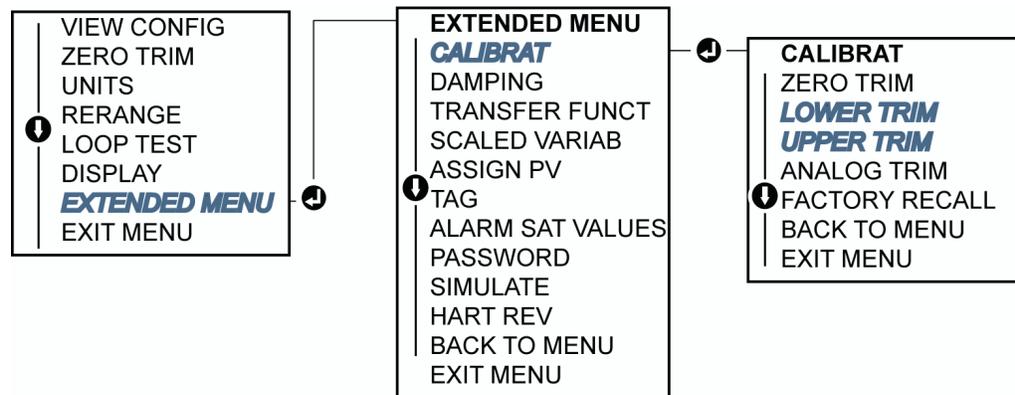
Perform a digital zero trim (option DZ)

A digital zero trim (option DZ) provides the same function as a zero/lower sensor trim, but you can complete it in hazardous areas at any given time by 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, you can use external configuration buttons located underneath the top tag of the transmitter to perform a digital zero trim. 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.

5.5.3 Recall factory trim—sensor trim

The recall factory trim-sensor trim command allows the restoration of the as-shipped factory settings of the sensor trim. You can use this command to recover from an inadvertent zero trim of an absolute pressure unit or inaccurate pressure source.

Recall factory trim with a Field Communicator

Procedure

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

Recall factory trim with AMS Device Manager

Procedure

1. Right click on the device and, under the **Method** dropdown 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.

Recall factory trim with local operator interface (LOI)

Procedure

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

Figure 5-4: Recall Factory Trim with LOI
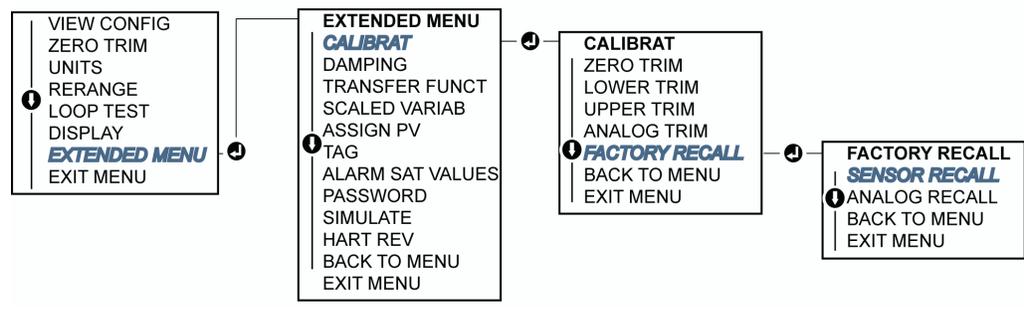
5.6 Trimming the analog output

The Analog Output Trim commands allow you to adjust the transmitter's current output at the 4 and 20 mA points to match the plant standards.

Perform this trim after the digital to analog conversion, so only the 4–20 mA analog signal will be affected. Figure 5-5 graphically shows the two ways the characterization curve is affected when an analog output trim is performed.

Figure 5-5: Analog Output Trim Example
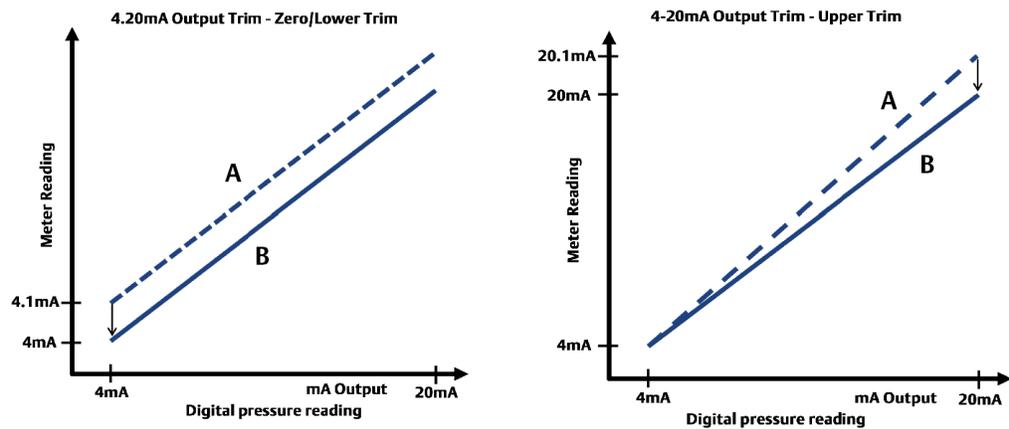
A. Before trim
B. After trim

5.6.1 Performing digital-to-analog trim (4–20mA output trim)

Note
If adding a resistor to the loop, ensure that the power supply is sufficient to power the transmitter to a 20 mA output with additional loop resistance. Refer to Power supply.

Perform a 4–20 mA output trim with a Field Communicator

Procedure

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

#### Perform a 4–20 mA output trim with AMS Device Manager

Procedure

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

2. Select **Digital to Analog Trim**.

3. Follow the screen prompts to perform a 4–20 mA output trim.

Perform a 4–20 mA output trim using local operator interface (LOI)

Figure 5-6: 4–20mA Output Trim using LOI
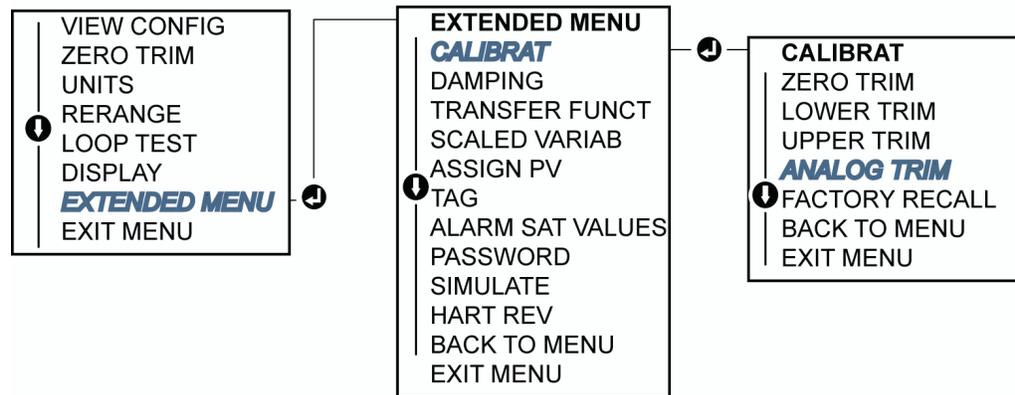
5.6.2 Performing digital-to-analog trim (4–20mA output trim) using other scale

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 (e.g., 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.

Perform a 4–20 mA output trim using other scale with a Field Communicator

Procedure

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

Perform a 4–20 mA output trim using other scale with AMS Device Manager

Procedure

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

2. Select **Scaled Digital to Analog Trim**.

3. Follow screen prompts to perform a 4–20mA output trim.

5.6.3 Recalling factory trim—analog output

The Recall Factory Trim—Analog Output command allows the restoration of the as-shipped factory settings of the analog output trim.

This command can be useful for recovering from an inadvertent trim, incorrect plant standard or faulty meter.

Recall factory trim - analog output with a Field Communicator

Procedure

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

### Recall factory trim - analog output with AMS Device Manager

Procedure

1. Right click the device and, under the **Method** drop down menu, move the 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.

Recall factory trim - analog output with local operator interface (LOI)

Procedure

Reference Figure 5-7 for LOI instructions.

Figure 5-7: Recall Factory Trim – Analog Output with LOI
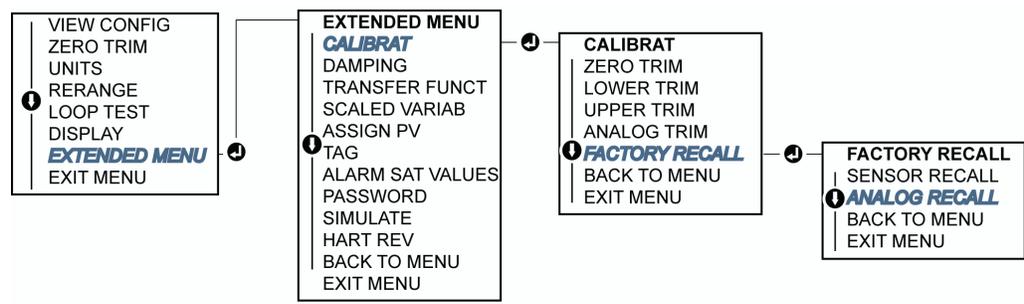
5.7 Switching HART® revision

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

5.7.1 Switch 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. To change to HART Revision 5, enter **HART5** in the Message field.

2. To change to HART Revision 7, enter **HART7** in the Message field.

5.7.2 Switch HART® revision with Field Communicator

Procedure

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

	HART5	HART7
Device Dashboard Fast Keys	2, 2, 5, 2, 4	2, 2, 5, 2, 3

5.7.3 Switch 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.

5.7.4 Switch HART® revision with local operator interface (LOI)

Procedure

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

Figure 5-8: Change HART Revision with LOI

VIEW CONFIG
ZERO TRIM
UNITS
RERANGE
LOOP TEST
DISPLAY
EXTENDED MENU
EXIT MENU

EXTENDED MENU
CALIBRAT
DAMPING
TRANSFER FUNCT
SCALED VARIAB
ASSIGN PV
TAG
ALARM SAT VALUES
PASSWORD
SIMULATE
HART REV
BACK TO MENU
EXIT MENU
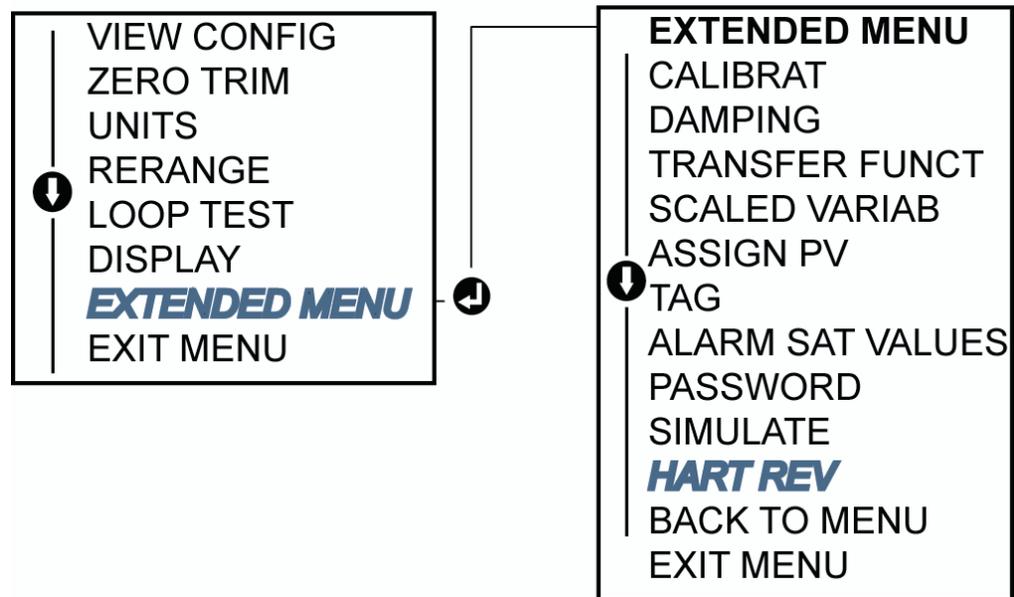
6 Troubleshooting

6.1 Overview

This section provides summarized maintenance and troubleshooting suggestions for the most common operating problems.

If you suspect malfunction despite the absence of any diagnostic messages on the Field Communicator display, consider using 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 operations.

⚠ **WARNING**

Explosions could result in death or serious injury.

> Installation of this transmitter in an explosive environment must be in accordance with the appropriate local, national, and international standards, codes, and practices. Review the Product Certifications section of the Rosemount 3051P Product Data Sheet for any restrictions associated with a safe installation.

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

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

⚠ **WARNING**

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**

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.

> ⚠ **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 to traditional flange can damage sensor module.

> ⚠ **WARNING**

Improper assembly of manifolds to traditional flange can damage the device.

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**

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 Troubleshooting for 4-20 mA output

6.3.1 Transmitter milliamp reading is zero

Recommended actions

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

6.3.2 Transmitter not communicating with Field Communicator

Recommended actions

1. Verify terminal voltage is 10.5 to 42.2 Vdc.
2. Check loop resistance, 250 Ω minimum (PS voltage - transmitter voltage/loop current).

3. Check that power wires are connected to signal terminals and not test terminals.

4. Verify clean DC power to transmitter (maximum AC noise 0.2 volts peak to peak).

5. Verify the output is between 4 and 20 mA or saturation levels.

6. Have Field Communicator poll for all addresses.

6.3.3 Transmitter milliamp reading is low or high

Recommended actions

1. Verify applied pressure.

2. Verify 4 and 20 mA range points.

3. Verify output is not in alarm condition.

4. Perform analog trim.

5. Check that power wires are connected to the correct signal terminals (positive to positive, negative to negative) and not the test terminal.

6.3.4 Transmitter will not respond to changes in applied pressure

Recommended actions

1. Check impulse piping or manifold for blockage.

2. Verify applied pressure is between 4 and 20 mA points.

3. Verify the output is not in alarm condition.

4. Verify transmitter is not in loop test mode.

5. Verify transmitter is not in multidrop mode.

6. Check test equipment.

6.3.5 Digital pressure variable reading is low or high

Recommended actions

1. Check impulse piping for blockage or low fill in wet leg.

2. Verify transmitter is calibrated properly.

3. Check test equipment (verify accuracy).

4. Verify pressure calculations for application.

6.3.6 Digital pressure variable reading is erratic

Recommended actions

1. Check application for faulty equipment in pressure line.

2. Verify transmitter is not reacting directly to equipment turning on/off.

3. Verify damping is set properly for application.

6.3.7 Milliamp reading is erratic

Recommended actions

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

6.4 Diagnostic messages

The following are possible messages that will appear on either the LCD/LOI display, a Field Communicator, or an AMS Device Manager system.

- Good

- Failed – fix now

- Maintenance – fix soon

- Advisory

6.4.1 Status: Failed - Fix Now

No pressure updates

LCD display screen	NO P UPDATE
Local operator interface (LOI) screen	NO PRESS UPDATE

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

Recommended actions

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

Electronics board failure

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

A failure has been detected in the electronics circuit board.

Recommended action

Replace the pressure transmitter.

Critical sensor data error

LCD display screen	MEMRY ERROR
Local operator interface (LOI) screen	MEMORY ERROR

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

Recommended actions

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

Critical electronics data error

LCD display screen	MEMRY ERROR
Local operator interface (LOI) screen	MEMORY ERROR

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

Recommended actions

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

Sensor failure

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

A failure has been detected in the pressure sensor.

Recommended action

Replace pressure transmitter.

Incompatible electronics and sensor

| **LCD display screen** | XMTR MSMTCH |

| **Local operator interface (LOI) screen** | XMTR MSMTCH |

The pressure sensor is incompatible with the attached electronics.

Recommended action

Replace the pressure transmitter.

6.4.2   Status: Maintenance - Fix Soon

No temperature updates

| **LCD display screen** | NO T UPDATE |

| **Local operator interface (LOI) screen** | NO TEMP UPDATE |

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

Recommended actions

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

Pressure out of limits

| **LCD display screen** | NO T UPDATE |

| **Local operator interface (LOI) screen** | PRES OUT LIMITS |

The pressure is either above or below the sensor limits.

Recommended actions

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

Sensor temperature beyond limits

| **LOI display screen** | TEMP LIMITS |

**Local operator
interface (LOI)
screen**   TEMP OUT LIMITS

The sensor temperature has exceeded its safe operating range.

Recommended actions

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

Electronics temperature beyond limits

**LCD display
screen**   TEMP LIMITS

**Local operator
interface (LOI)
screen**   TEMP OUT LIMITS

The temperature of the electronics has exceeded its safe operating range.

Recommended actions

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

Electronics board parameter error

**LCD display
screen**   MEMRY WARN (also in advisory)

**Local operator
interface (LOI)
screen**   MEMORY WARN (also in advisory)

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

Recommended action

Replace the pressure transmitter.

Configuration buttons operator error

**LCD display
screen**   STUCK BUTTON

**Local operator
interface (LOI)
screen**   STUCK BUTTON

Device is not responding to button presses.

Recommended actions

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

6.4.3 Status: Advisory

Non-critical user data warning

| **LCD display screen** | MEMRY WARN |

| **Local operator interface (LOI) screen** | MEMORY WARN |

A user-written parameter does not match expected value.

Recommended actions

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

Sensor parameter warning

| **LCD display screen** | MEMRY WARN |

| **Local operator interface (LOI) screen** | MEMORY WARN |

A user-written parameter does not match expected value.

Recommended actions

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

LCD display update failure

| **LCD display screen** | (Not updating) |

| **Local operator interface (LOI) screen** | (Not updating) |

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

Recommended actions

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

Configuration changed

LCD display screen   (None)

Local operator interface (LOI) screen   (None)

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

Recommended actions

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

Analog output fixed

LCD display screen   ANLOG FIXED

Local operator interface (LOI) screen   ANALOG FIXED

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

This may be caused by other conditions in the device or because the device has been set to loop test or multidrop mode.

Recommended actions

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

Simulation active

LCD display screen   (None)

Local operator interface (LOI) screen   (None)

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

Recommended actions

1. Verify that simulation is no longer required.
2. Disable simulation mode in service tools.
3. Perform a Device Reset.

Analog output saturated

LCD display screen   ANLOG SAT

Local operator interface (LOI) screen   ANALOG SAT

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

Recommended actions

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

6.5   Disassembly procedures

⚠ **WARNING**

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

6.5.1   Remove from service

⚠ **WARNING**

Follow all plant safety rules and procedures.

Procedure

1. Power down transmitter.
2. Isolate and vent the process from the transmitter before removing the transmitter from service.
3. Remove all electrical leads and disconnect conduit.

4. Remove the transmitter from the process connection.

   a) The transmitter is attached to the process by a single hex nut process connection. Loosen the hex nut to separate the transmitter from the process.

   ⚠ **CAUTION**

   Do not wrench on neck of transmitter. See warning in In-line process connection.

5. Do not scratch, puncture, or depress the isolating diaphragms.

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

6.5.2 Remove terminal block

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

Procedure

1. Remove the housing cover from the field terminal side.

2. Loosen the two small screws located on the assembly in the 9 and 5 o'clock positions relative to the top of the transmitter.

3. Pull the entire terminal block out to remove it.

6.5.3 Remove the local operator interface (LOI) or LCD display

Rosemount 3051P transmitters with M4 or M5 option codes have an LOI or LCD display. The transmitter LOI/LCD display is located in the compartment opposite the terminal side. To remove and/or replace the LOI/LCD display, perform the following procedures:

Procedure

1. Remove the housing cover opposite the field terminal side.

2. Loosen the two captive screws that are visible.

   See Figure 4-2 for screw locations. The two screws anchor the LOI/LCD display to the electronics board and the electronics board to the housing. See Safety messages.

3. After the loosening the screws, pull the LOI/LCD display off of the electronics board and out of the housing.

   ⚠ **CAUTION**

   Make sure to pull directly backwards to avoid bending or damaging the connection pins on the electronics board.

> ⚠ **CAUTION**
>
> Do not attempt to pull out the electronics board from the housing, as this could permanently damage the transmitter.

6.6   Reassembly procedures

6.6.1   Install the local operator interface (LOI) or LCD display

Procedure

1. While aligning the captive screws with the respective holes on the electronics board, connect the LCD/LOI display to the electronics board by pressing down firmly.
2. Make sure the connecting pins on the back of the LCD fully connect to the front of the electronics board.
3. Fully tighten down the captive screws.
4. Replace the housing cover.

> ⚠ **WARNING**
>
> Ensure the transmitter is fully engaged to meet Explosion-Proof requirement.

6.7   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.

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

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

7　Safety instrumented systems requirements

7.1　Safety instrumented systems (SIS) certification

The safety-critical output of the Rosemount 3051P is provided through a two-wire, 4 - 20 mA signal representing pressure. The Rosemount 3051P 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

7.2　Safety certified identification

All Rosemount 3051P Transmitters must be identified as safety certified before installing into SIS systems.

To identify a safety certified Rosemount 3051P:

Procedure

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

   Example

   Namur Software Revision Number

SW	1.0.x - 1.4.x

   Note
   Namur Software Revision: Located on the metal device tag.

2. Verify that option code **QT** is included in the transmitter model code.

7.3　Installation in safety instrumented systems (SIS) applications

Only qualified personnel should install the transmitter in SIS applications. No special installation is required in addition to the standard installation practices outlined in this document.

⚠ WARNING

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 Rosemount 3051P Product Data Sheet.

Design the loop so that the terminal voltage does not drop below 10.5 Vdc when the transmitter output is set to 23 mA. For more information see the Rosemount 3051P Product Data Sheet.

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

7.4 Configuring in safety instrumented systems (SIS) applications

Use any HART® capable configuration tool to communicate with and verify configuration of the Rosemount 3051P.

Note
Transmitter output is not safety-rated during the following: configuration changes, multidrop, and loop test. Use alternative means to ensure process safety during transmitter configuration and maintenance activities.

7.4.1 Damping

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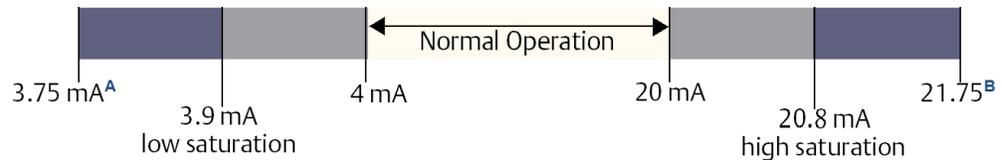
Reference Damping to change damping value.

7.4.2 Alarm and saturation levels

Configure DCS or safety logic solver 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

3.75 mA[A]
3.9 mA
low saturation
4 mA
Normal Operation
20 mA
20.8 mA
high saturation
21.75[B]

Namur alarm level

3.6 mA[A]
3.8 mA
low saturation
4 mA
Normal Operation
20 mA
20.5 mA
high saturation
22.5[B]

Custom alarm level

3.4 - 3.8 mA[A]
3.5 - 3.9 mA
low saturation
4 mA
Normal Operation
20 mA
20.1 - 22.9 mA
high saturation
20.2 - 23.0[B]
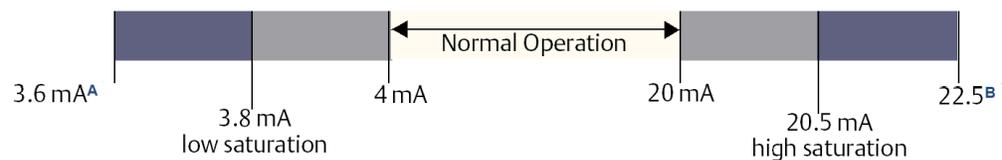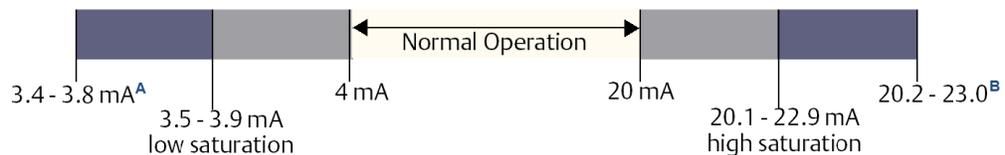
    A. *Transmitter failure, hardware or software alarm in LO position.*
    B. *Transmitter failure, hardware or software alarm in HI position.*

7.5 Safety instrumented systems (SIS) operation and maintenance

7.5.1 Proof tests

Emerson recommends the following proof tests. Ensure that only qualified personnel perform proof tests.

Use Fast Keys to perform a loop test, analog output trim, or sensor trim. Place the security switch in the (🔓) position during proof test execution and reposition it in the (🔒) position after execution.

7.5.2   Partial proof test

The partial 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.

See the FMEDA Report.

Prerequisites

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.

    Note
    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.

    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.

    Note
    This tests for possible quiescent current related failures.

5. Inspect the device for any leaks, visible damage, or contamination.
6. Remove the bypass and otherwise restore the normal operation.
7. Place the **Security** switch in the (🔒) position.

7.5.3   Comprehensive proof test

The comprehensive proof test consists of performing the same steps as the partial 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.

Prerequisites

Required tools: Field Communicator and pressure calibration equipment.

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.

Note

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.

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.

Note

This tests for possible quiescent current related failures.

5. Inspect the device for any leaks, visible damage or contamination.

6. Perform a two-point calibration of the sensor (see Trimming the pressure signal) over the full working range and verify the current output at each point.

7. Remove the bypass and otherwise restore the normal operation.

8. Place the **Security** switch in the (🔒) position.

Note

• The user determines the proof test requirements for impulse piping.

• Automatic diagnostics are defined for the corrected % DU: The tests performed internally by the device during runtime without requiring enabling or programming by the user.

7.6 Inspection

7.6.1 Visual inspection

Not required.

7.6.2 Special tools

Not required.

7.6.3 Product repair

The transmitter is repairable with limited replacement options.

Report all failures detected by the transmitter diagnostics or by the proof test. Submit feedback electronically at Emerson.com/Rosemount/Report-A-Failure

Only qualified personnel should repair the product and replace parts.

7.6.4 Safety instrumented systems (SIS) reference

Operate the transmitter in accordance to the functional and performance specifications provided in the Rosemount 3051P Product Data Sheet.

7.6.5 Failure rate data

The FMEDA Report includes failure rates.

7.6.6 Failure values

Safety Deviation (defines what is dangerous in an FMEDA): ±2.0% of analog output span Transmitter response time: provided in Dynamic performance. Self-diagnostics Test Interval: At least once every 60 minutes.

7.6.7 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 and installation drawings

To view current Rosemount 3051P product certifications and installation drawings, follow these steps:

1. Go to Emerson.com/Rosemount-3051P.

2. Scroll as needed to the green menu bar and click **Documents and Drawings**.

3. Click **Certificates & Approvals**.

A.2 Ordering information, specifications, and dimensional drawings

To view current Rosemount 3051P ordering information, specifications, and dimensional drawings, follow these steps:

1. Go to Emerson.com/Rosemount-3051P.

2. Scroll as needed to the green menu bar and click **Documents and Drawings**.

3. Click **Data Sheets & Bulletins**.

4. Select the appropriate Product Data Sheet.

B   Field Communicator menu trees and Fast Keys

B.1   Menu trees

Figure B-1: Overview
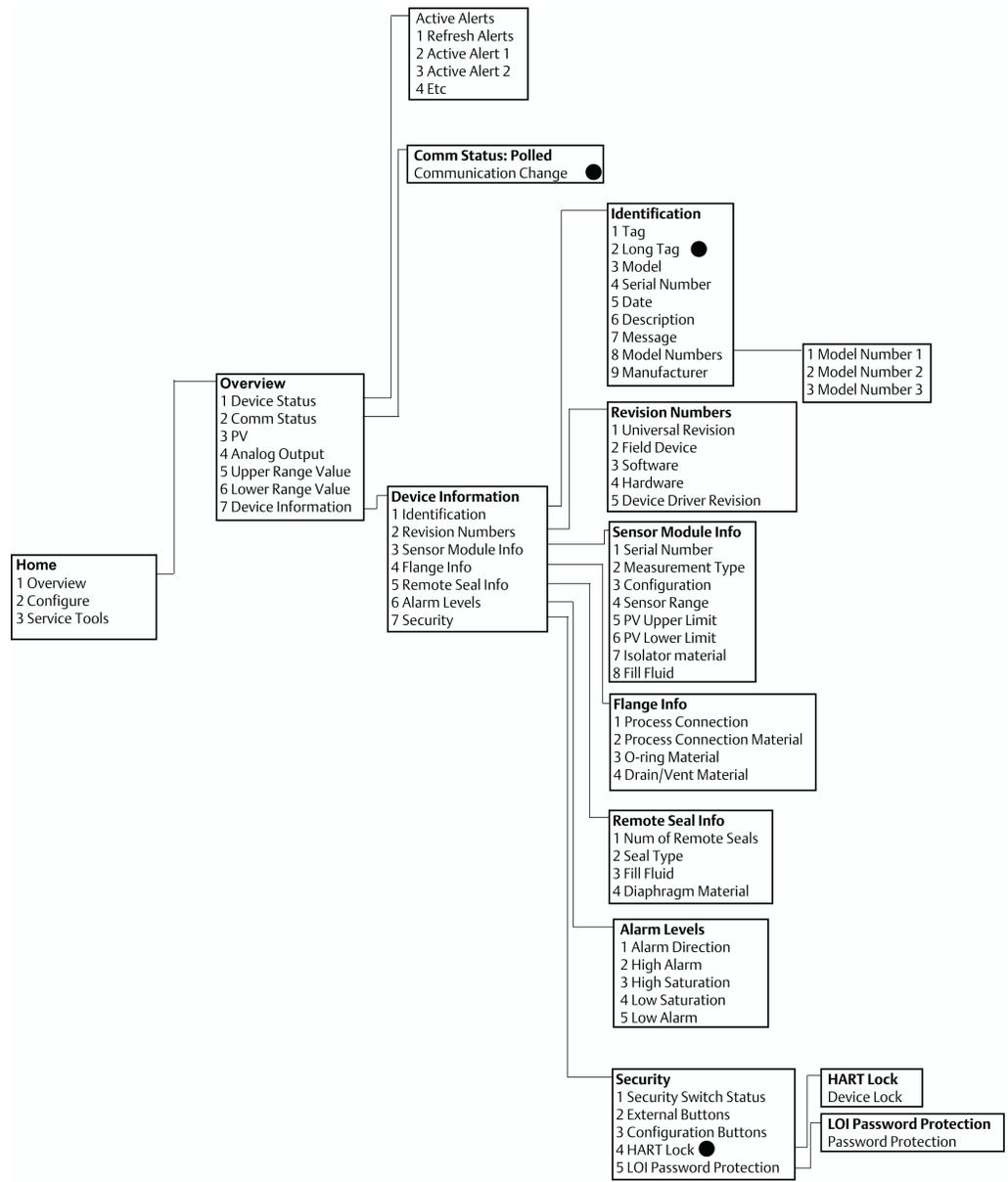
Note

Selections with black circle are only available in HART® Revision 7 mode. Selection will not appear in the HART Revision 5 device descriptor (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 the 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

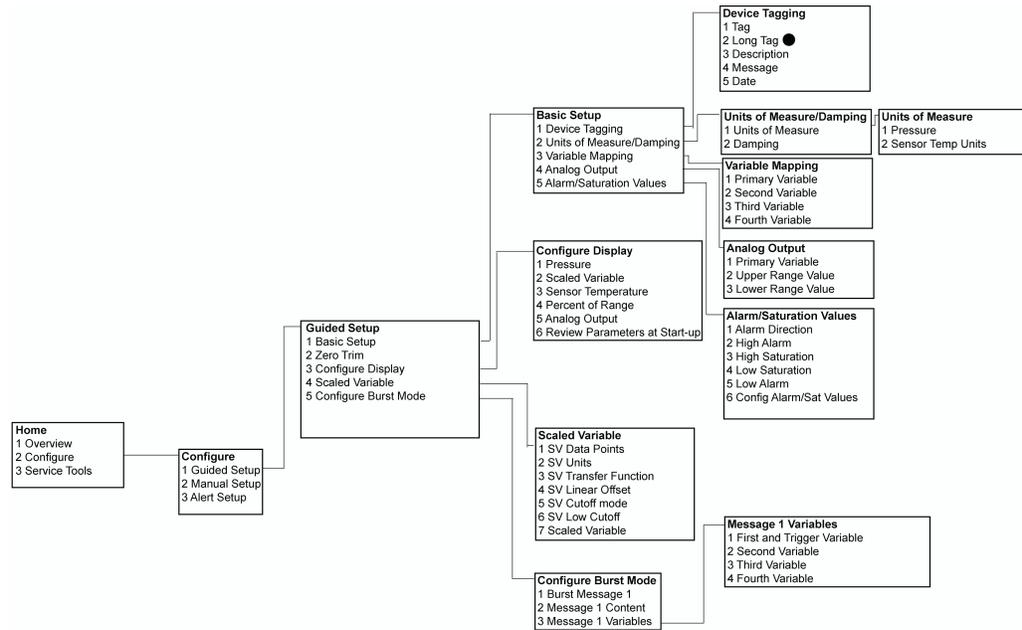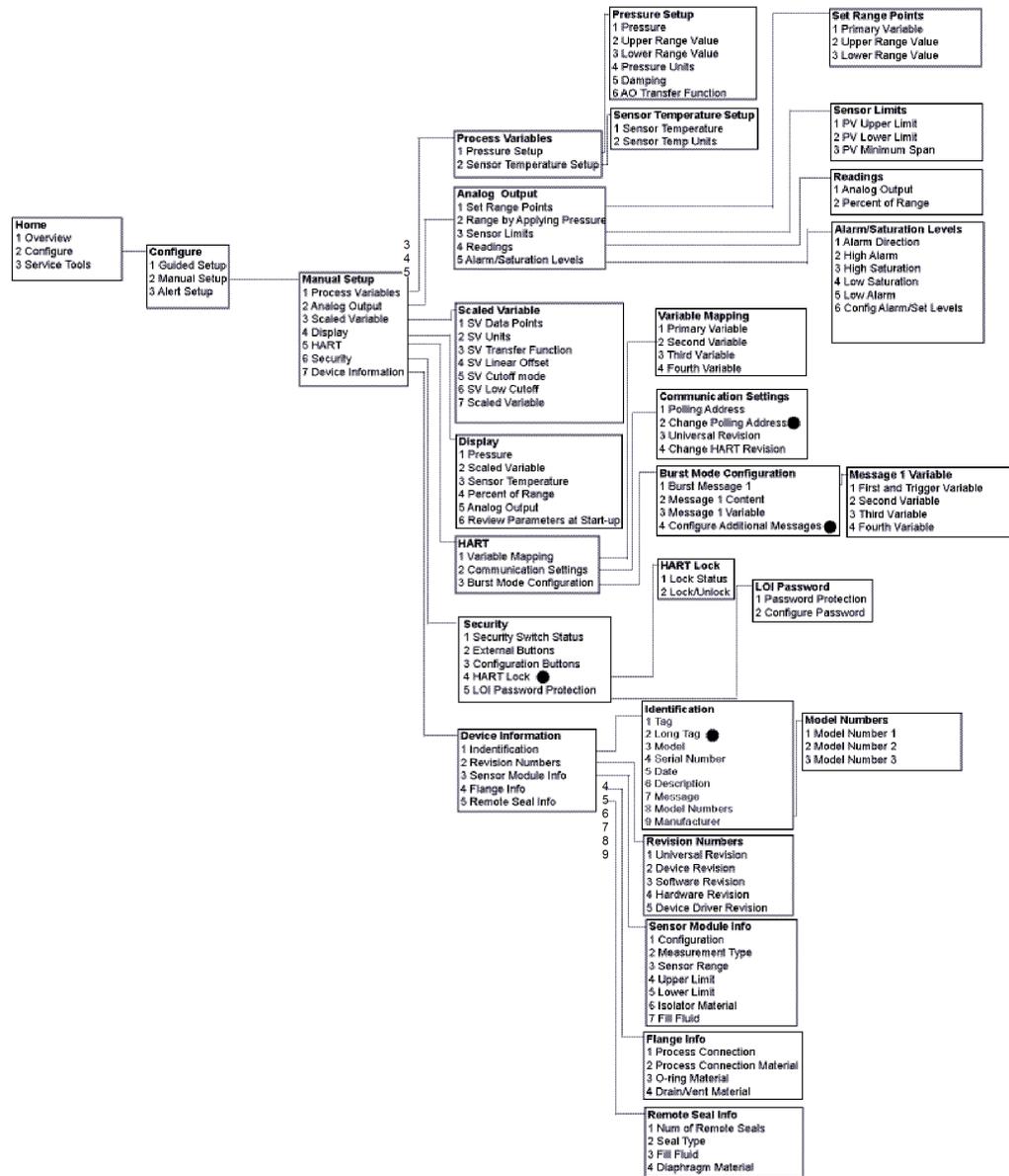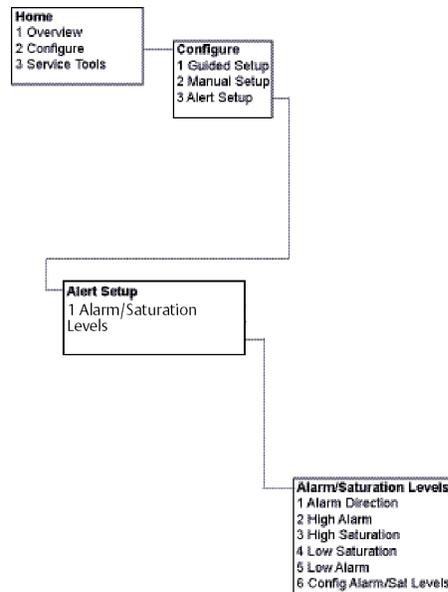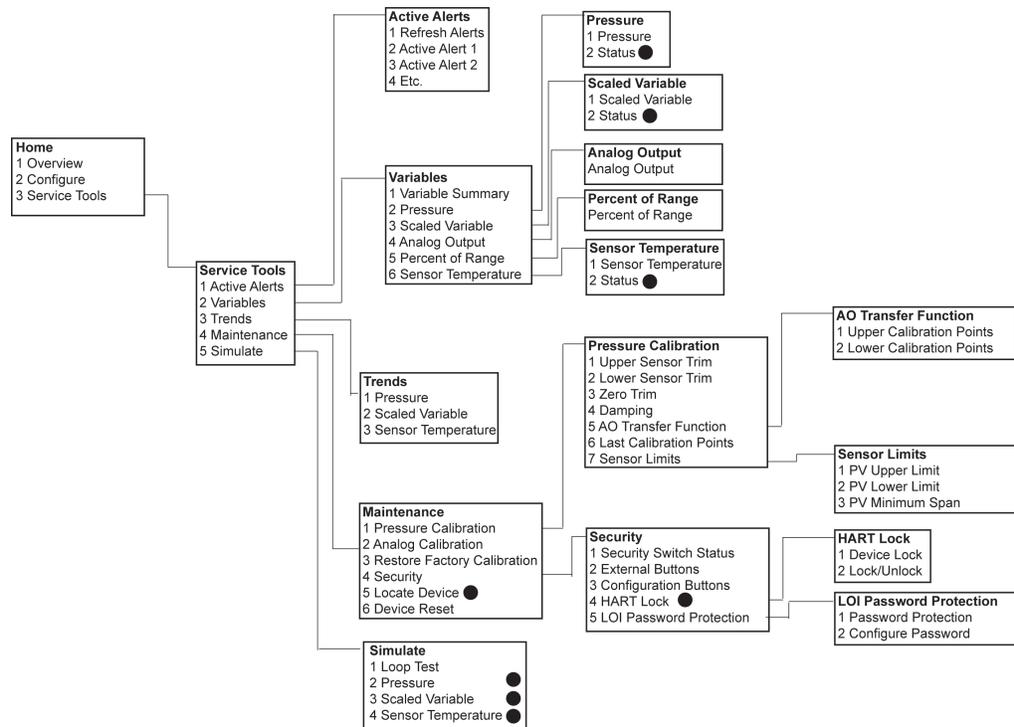**Figure B-5: Service Tools**

Note

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

B.2 Fast Keys

- A (✓) indicates the basic configuration parameters. At minimum, verify these parameters 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 (HART 7), Device Descriptor (DD) Revision 1 Fast Key Sequence

	Function	Fast Key sequence	
		HART 7	HART 5
✓	Alarm and saturation levels	2, 2, 2, 5	2, 2, 2, 5
✓	Damping	2, 2, 1, 1, 5	2, 2, 1, 1, 5
✓	Primary variable	2, 2, 5, 1, 1	2, 2, 5, 1, 1
✓	Range values	2, 2, 2, 1	2, 2, 2, 1
✓	Tag	2, 2, 7, 1, 1	2, 2, 7, 1, 1
✓	Transfer function	2, 2, 1, 1, 6	2, 2, 1, 1, 6
✓	Pressure units	2, 2, 1, 1, 4	2, 2, 1, 1, 4
	Date	2, 2, 7, 1, 5	2, 2, 7, 1, 4
	Descriptor	2, 2, 7, 1, 6	2, 2, 7, 1, 5
	Digital to analog trip (4–20 mA 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
	Local operator interface (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 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)

C.1   Local operator interface (LOI) menu tree

VIEW CONFIG
TAG
PV
PRESS UNITS
TEMP UNITS
URV
LRV
TRANSFER FUNCTION
DAMPING
HIALARM
LOALARM
HISAT
LOSAT
ALARM
SECURITY
BACK TO MENU
EXIT MENU

UNITS
PRESSURE UNITS
TEMP UNITS
BACK TO MENU
EXIT MENU

LOI MENU
VIEW CONFIG
ZERO TRIM
UNITS
RERANGE
LOOP TEST
DISPLAY
EXTENDED MENU
EXIT MENU

RERANGE
ENTER VALUES
APPLY VALUES
BACK TO MENU
EXIT MENU

ENTER VALUES
LRV
URV
BACK TO MENU
EXIT MENU

LOOP TEST
SET 4MA
SET 20MA
SET CUSTOM
END LOOP TEST
BACK TO MENU
EXIT MENU

APPLY VALUES
LRV
URV
BACK TO MENU
EXIT MENU

DISPLAY
PRESS (on/off)
SCALED (on/off)
TEMP (on/off)
RANGE % (on/off)
STARTUP (on/off)
BACK TO MENU
EXIT MENU

EXTENDED MENU
CALIBRAT
DAMPING
TRANSFER FUNCT
SCALED VARIAB
ASSIGN PV
TAG
ALARM SAT VALUES
PASSWORD
SIMULATE
HART REV
BACK TO MENU
EXIT MENU

C.2   Local operator interface (LOI) menu tree - extended menu

CALIBRAT
ZERO TRIM
LOWER TRIM
UPPER TRIM
ANALOG TRIM
FACTORY RECALL
BACK TO MENU
EXIT MENU

FACTORY RECALL
SENSOR RECALL
ANALOG RECALL
BACK TO MENU
EXIT MENU

EXTENDED MENU
CALIBRAT
DAMPING
TRANSFER FUNCT
SCALED VARIAB
ASSIGN PV
TAG
ALARM SAT VALUES
PASSWORD
SIMULATE
HART REV
BACK TO MENU
EXIT MENU

TRANSFER FUNCT
LINEAR TRANSFER FUNCTION
SQR ROOT TRANSFER FUNCTION
BACK TO MENU
EXIT MENU

SCALED VARIAB
VIEW SCALED
CONFIG SCALED
BACK TO MENU
EXIT MENU

ASSIGN PV
PRESSURE SET PV
SCALED SET PV
BACK TO MENU
EXIT MENU

ALARM SAT VALUES
ROSEMOUNT VALUES
NAMUR VALUES
OTHER VALUES
BACK TO MENU
EXIT MENU

OTHER VALUES
HIGH ALARM
LOW ALARM
HIGH SATURATION
LOW SATURATION
BACK TO MENU
EXIT MENU

PASSWORD
ENABLE PASSWORD
CHANGE PASSWORD
BACK TO MENU
EXIT MENU

SIMULATE
SIMULATE PRESS
SIMULATE TEMP
SIMULATE SCALED
END SIMUL
BACK TO MENU
EXIT MENU

HART REV
HART7 REV
HART5 REV
BACK TO MENU
EXIT MENU

C.3   Entering numbers

You can enter floating-point numbers with the local operator interface (LOI).

You can use all eight number locations on the top line for number entry. Refer to Table 2-2 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 leftmost position is the selected position. In this example, the negative symbol, "-", will be flashing on the screen.	<u>-</u>0000022
2	Press the scroll button until the **0** is blinking on the screen in the selected position.	<u>0</u>0000022
3	Press **Enter** to select the **0** as an entry. The second digit from the left will be blinking.	0<u>0</u>000022
4	Press the **Enter** button to select **0** for the second digit. The third digit from the left will be blinking.	00<u>0</u>00022
5	Press **Enter** to select **0** for the third digit. The fourth digit from the left will now be blinking.	000<u>0</u>0022
6	Press **Enter** to select **0** for the fourth digit. The fifth digit from the left will now be blinking.	0000<u>0</u>022
7	Press **Scroll** to navigate through the numbers until the **1** is on the screen.	0000<u>1</u>022
8	Press **Enter** to select **1** for the fifth digit. The sixth digit from the left will now be blinking.	00001<u>0</u>22
9	Press **Scroll** to navigate through the numbers until **1** is on the screen.	00001<u>1</u>22
10	Press **Enter** to select **1** for the sixth digit. The seventh digit from the left will now be blinking.	000011<u>2</u>2
11	Press **Scroll** to navigate through the numbers until the decimal, ".", is on the screen.	000011<u>.</u>2
12	Press **Enter** 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.<u>0</u>
13	Press **Scroll** to navigate through the numbers until **2** is on the screen.	000011.<u>2</u>
14	Press **Enter** to select **2** for the eighth digit. The number entry will be complete, and a *SAVE* screen is shown.	000011.2

Usage notes:

- To move backwards in the number, scroll to the left arrow symbol and press **Enter**.

- The negative symbol is only allowed in the leftmost position.

- To enter numbers in scientific notation, place an **E** in the 7th position.

C.4　Entering text

You can enter text with the local operator interface (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 Entering numbers, except the following characters are available in all locations: **A-Z**, **0-9**, **-**, **/**, space.

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

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