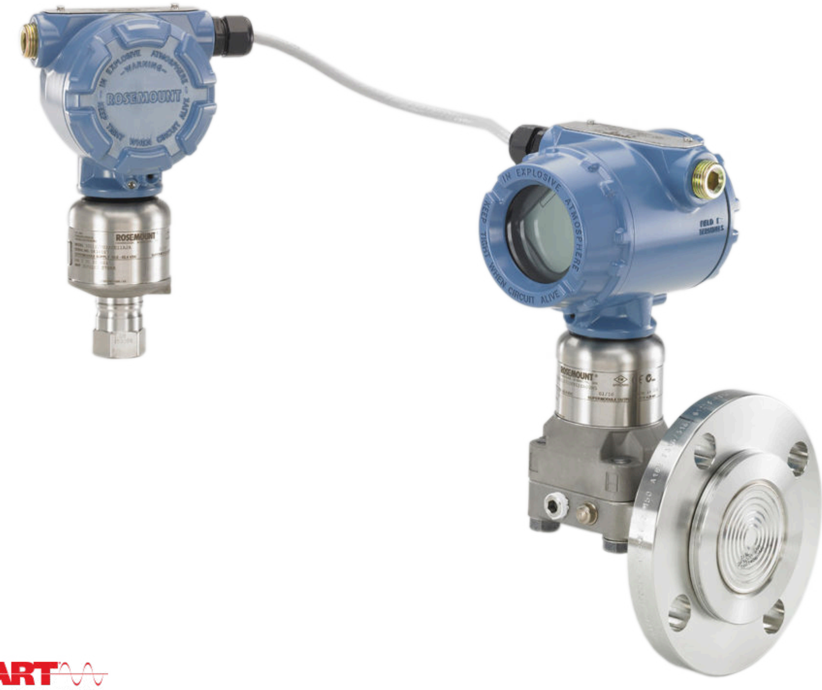
Reference Manual
00809-0100-4804, Rev DB
March 2024

Rosemount™ 3051S Electronic Remote Sensor (ERS)™ System



ROSEMOUNT™

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Safety messages

⚠ WARNING

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

⚠ WARNING

Failure to follow these installation guidelines could result in death or serious injury.

Ensure only qualified personnel perform the installation.

⚠ WARNING

Explosions could result in death or serious injury.

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

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

Both housing covers must be fully engaged to meet Flameproof/explosion-proof requirements.

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

⚠ WARNING

Electrical shock could cause death or serious injury.

If the system is installed in a high-voltage environment and a fault or installation error occurs, high voltage may be present on the sensor leads and terminals.

Use extreme caution when making contact with the leads and terminals.

⚠ 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 Rosemount system is in service.

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

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

⚠ WARNING

Physical access

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

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

NOTICE

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

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

NOTICE

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

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

NOTICE

Static electricity can damage sensitive components.

Observe safe handling precautions for static-sensitive components.

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1 Introduction

1.1 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 Overview

This section contains information on commissioning and tasks that need to be performed on the bench prior to installation.

Instructions for performing configuration functions are given for a communication device and AMS Device Manager version 10.5. For convenience, communication device fast key sequences are labeled *fast keys* for each software function below the appropriate headings.

Example software function

Fast keys	1, 2, 3, etc.

2.2 Setting the loop to Manual

Whenever sending or requesting data that would disrupt the loop or change the output of the transmitter, set the process application loop to **Manual**.

The communication device or AMS Device Manager will prompt to set the loop to **Manual** when necessary. Acknowledging this prompt does not set the loop to **Manual**. The prompt is only a reminder; set the loop to **Manual** as a separate operation.

2.3 Wiring diagrams

Connect a communication device or AMS Device Manager using a wiring configuration as shown in Figure 3-11, Figure 3-12, or Figure 3-13.

The communication device or AMS Device Manager may be connected at **PWR/COMM** on the terminal block of the Rosemount 3051S ERS Primary Transmitter, across the load resistor, or at any termination point in the signal loop.

The communication device or AMS Device Manager will search for a HART®-compatible device and indicate when the connection is made. If the communication device or AMS Device Manager fail to connect, it indicates that no device was found. If this occurs, refer to Troubleshooting.

2.4 Basic setup

Emerson recommends that the following items are verified and configured to ensure the proper functionality of the system.

2.4.1 Device tagging

Fast Keys	2, 1, 1, 1

Tag

An 8-character free-form text field that can be used to uniquely identify the device.

Long tag

A 32-character free-form text field that can be used to uniquely identify the device. **Long tag** is only supported by host systems that are HART® Revision 6 or higher.

Descriptor

A 16-character free-form text field that can be used to further describe the device or application.

Message

A 32-character free-form text field that can be used to save a message or memo about the device or application.

Date

A formatted field (mm/dd/yyyy) available to enter and store a date (such as the day of installation or last calibration).

2.4.2 Units of measure

Fast Keys	2, 1, 1, 2, 1

The **Differential Pressure**, P_{HI} Pressure, and P_{LO} Pressure measurements can be independently configured for any of the units shown in Table 2-1.

The P_{HI} and P_{LO} Module Temperatures can be independently configured for Fahrenheit or Celsius.

Table 2-1: Pressure Units of Measure

inH_2O at 68 °F	bar	Torr
inHg at 0 °C	mbar	Atm
ftH_2O at 68 °F	g/cm^2	MPa
mmH_2O at 68 °F	kg/cm^2	inH_2O at 4 °C
mmHg at 0 °C	Pa	mmH_2O at 4 °C
Psi	kPa	in H_2O at 60 °F

2.4.3 Damping

Fast keys	2, 1, 1, 2, 2

The **Damping** software feature introduces a delay in processing. This increases the response time of the measurement, smoothing variations in output readings caused by rapid input changes. Determine the appropriate **Damping** setting based on the necessary response time, signal stability, and other requirements of your application.

Damping can be set independently for the **Differential Pressure**, P_{HI} Pressure, and P_{LO} Pressure measurements. **Damping** values can be set anywhere from 0 to 60 seconds.

2.4.4 Variable mapping

Fast keys	2, 1, 1, 3

Select which ERS System parameters to assign to each HART® variable.

Primary Variable

The parameter assigned to the HART **Primary Variable** controls the 4–20 mA **Analog Output**. The following system parameters can be assigned to the **Primary Variable**:

- **Differential pressure**
- P_{HI} Pressure
- P_{LO} Pressure
- **Scaled Variable**

2nd, 3rd, and 4th variables

The 2nd, 3rd, and 4th variables can be accessed digitally through a HART host. A HART-to-Analog converter, such as the Rosemount 333 Tri-Loop™, can also be used to convert each of the variables to a separate 4–20 mA analog output signal. These variables can also be accessed wirelessly by using an Emerson Wireless THUM™ Adapter. The following system parameters can be assigned to the 2nd, 3rd, and 4th variables:

- **Differential Pressure**
- P_{HI} Pressure
- P_{LO} Pressure
- P_{HI} Module Temperature
- P_{LO} Module Temperature
- **Scaled Variable**

2.4.5 Analog output

Fast keys	2, 1, 1, 4

Configure the lower and upper range values, which correspond to the 4 and 20 mA analog output range points. The 4 mA point represents the zero percent of span reading, and the 20 mA point represents the 100% of span reading.

The analog output range points can also be set using the zero and span adjustment buttons located on the electronics of the primary transmitter (see Figure 2-1) and a pressure source.

Procedure

1. Using a pressure source with an accuracy three to ten times the desired calibrated accuracy, apply a pressure equivalent to the lower range value to the P_{HI} transmitter.
2. Push and hold the **Zero Adjustment** button for between two and ten seconds.
3. Apply a pressure equivalent to the upper range value to the P_{HI} transmitter.
4. Push and hold the **Span Adjustment** button for at least two seconds but no longer than 10 seconds.

Figure 2-1: Zero and Span buttons

A. ***Zero***
B. ***Span***

2.4.6 Alarm and saturation levels

Fast keys 2, 1, 1, 5

The transmitter automatically and continuously performs self-diagnostic routines. If a self-diagnostic routine detects a failure, the ERS System will drive the output to the configured alarm value that is based on the position of the **failure mode alarm** switch (see Configure process alerts). The ERS System will also drive the output to configured saturation values if the applied pressure goes outside the 4–20 mA range values.

The system has three options for configuring the failure mode alarm and saturation levels:

- Rosemount (Standard)
- NAMUR-Compliant
- Custom

Note
The system will drive the output to alarm level (high or low) if the pressure applied to either sensor is outside of the Lower sensor limit (LSL) or Upper sensor limit (USL).

Table 2-2: Alarm and Saturation Values

Rosemount (Standard)		
Switch Position	**Saturation Level**	**Alarm Level**
Low	3.9 mA	≤ 3.75 mA
High	20.8 mA	≥ 21.75 mA
NAMUR-Compliant		
Switch Position	**Saturation Level**	**Alarm Level**
Low	3.8 mA	≤ 3.6 mA
High	20.5 mA	≥ 22.5 mA
Custom		
Switch Position	**Saturation Level**	**Alarm Level**
Low	3.7 — 3.9 mA	3.54 — 3.8 mA

Table 2-2: Alarm and Saturation Values *(continued)*

High	20.1 — 21.5 mA	20.2 — 23.0 mA

Additional considerations when using custom alarm and saturation values:

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

2.5 Additional configuration

The following items are considered optional and may be configured as needed.

Refer to Figure 2-7 for the full communication device menu tree.

2.5.1 Local display

Fast Keys	2, 1, 3

A local display is available as an orderable option on the primary transmitter. The display will show a 0–100 percent scaled bar graph, the selected measurements from Table 2-3, and any diagnostic or error messages. At least one parameter from Table 2-3 must be selected. If more than one item is selected, the display will scroll through the selected parameters, showing each for three seconds.

Table 2-3: Parameters for Local Display

Differential pressure	P_{HI} module temperature	Output (% of range)
P_{HI} pressure	P_{LO} module temperature	N/A
P_{LO} pressure	Scaled variable	N/A

2.5.2 Burst mode

Fast keys	2, 2, 5, 3

When configured for **Burst** mode, ERS provides faster digital communication from the system to the control system by eliminating the time required for the control system to request information from the system.

When in **Burst** mode, the system will continue to output a 4–20 mA 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 (process variables in engineering units, primary variable in percent of span, and the analog output reading), and does not affect the way other transmitter data is accessed.

Access to information that is not burst can be obtained through the normal poll/response method of HART communication. A communication device, AMS Device Manager, or the control system may request any of the information that is normally available while the system is in **Burst** mode.

Configure Burst mode

To have the system configured to communicate in burst mode:

Procedure

1. Set the **Burst** Mode parameter to **On**.
2. Select a **Burst** Option from Table 2-4 below.
   This parameter determines what information is communicated through **Burst** mode.

Table 2-4: Burst Command Options

HART® command	Burst option	Description
1	**PV**	Primary variable
2	**% range/current**	Percent of range and mA output
3	**Dyn vars/current**	All process variables and mA output
9	**Devices vars w/status**	Burst variables and status information
33	**Device variables**	Burst variables

Note
If using a system with the Rosemount 333 HART Tri-Loop, the **Burst** option must be set to **Dyn vars/current**.

Burst variable slot definition

If either **Device vars w/status** or **Device Variables** is selected as the **Burst** Option, you will need to configure which variables are communicated in **Burst** Mode.

This is accomplished by assigning a variable to a **Burst Slot**. The system has four available **Burst Slots** for burst communication.

2.5.3 Multidrop communication

Fast keys	2, 2, 5, 2

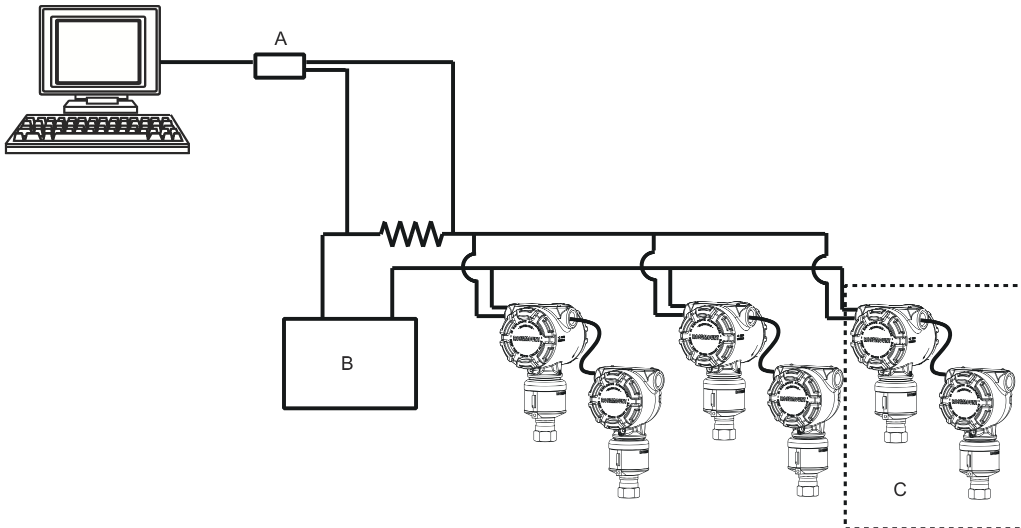
The HART® protocol allows several transmitters to communicate digitally on a single transmission line when wired in a Multidrop network. If using a system in a multidrop network, the connection to the network is made through the primary sensor as shown in Figure 2-2.

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

Note
A transmitter in multidrop mode with **Loop Current Mode** disabled has the analog output fixed at 4 mA.

Communication between the host and the transmitters takes place digitally, and the analog output on each transmitter is deactivated.

Figure 2-2: Typical Multidrop Network



A. HART modem
B. Power supply
C. ERS System

Enable multidrop configuration

To configure a system to be part of a multidrop network:

Procedure

1. Assign a unique address to the system.

   For a HART® Revision 5 system, the valid address range is 1–15. For systems that are HART Revision 6 or above, the valid address range is 1-63. All transmitters are shipped from the factory with the default address of zero (0).

2. Disable **Loop Current Mode**.

   Note
   When a system is configured for multidrop communication, a failure or alarm condition will no longer be indicated through the analog output. Failure signals in multidropped transmitters are communicated digitally through HART messages.

   This will cause the analog output of the system to be fixed at 4 mA.

Disable multidrop configuration

To configure a system with the factory default point-to-point communication:

Procedure

1. Assign the ERS System with an address of zero (0).
2. Enable **Loop Current Mode**.

2.5.4 Scaled Variable

Fast keys	2, 2, 3

Scaled Variable can be used to convert the Differential Pressure (DP) that is calculated by the ERS System into an alternative measurement such as level, mass, or volume. For example, a system that measures 0–500 mbar of DP can be configured to output a level measurement of 0–5 m. The **Scaled Variable** calculation can be shown on the LCD display and can also be assigned to the 4–20 mA output.

Anywhere from two to 20 points can be used to define the mathematical relationship between the measured DP and the calculated **Scaled Variable**.

Configure scaled variable to calculate level

Fast keys	2, 2, 3, 5, 1

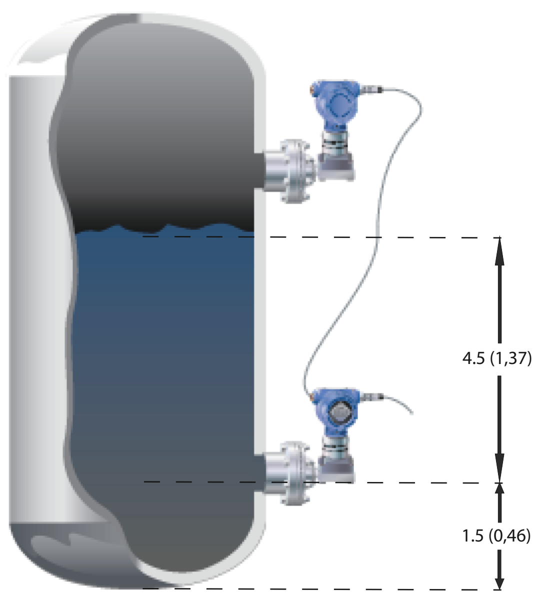
Because level can be linearly derived from differential pressure (DP), only two scaled variable points are required to configure ERS to calculate a Level measurement. To configure a **scaled variable** for a level application:

Procedure

1. Enter in a text string (up to five characters: A–Z, -, %, /, *, and “space”) to define the unit of measure for the scaled output.

   Examples include: METER, FEET, or INCH.
2. Enter the minimum DP (in engineering units) that the system will measure. This value will usually be zero (0).
3. Enter the scaled variable value (in terms of the scaled units defined in Step 1) that corresponds to the minimum DP from Step 2.
4. Enter the maximum DP that the system will measure.
5. Enter the scaled variable value that corresponds to the DP from Step 4.
6. To have the 4–20 mA signal of the system output the scaled variable measurement, map scaled variable to the HART Primary Variable and configure the upper and lower range values.

Figure 2-3: Scaled Variable - Level



a. Specific gravity = 0.94

b. Dimensions are in feet (meters).

Table 2-5: Scaled Variable configuration option

Variable	Unit
Scaled Units	Feet (Meter)
DP_1 (Minimum DP)	0 inH_2O (0 mmH_2O)
$Scaled_1$ (Level at min. DP)	1.5 ft. (0.46 m)
DP_2 (DP at max level)	50.76 inH_2O (1289 mmH_2O)
$Scaled_2$ (max Level)	6.0 ft. (1.83 m)
Primary variable	Scaled variable
LRV (4 mA)	1.5 ft. (0.46 m)
URV (20 mA)	6.0 ft. (1.83 m)

Configuring Scaled Variable to calculate mass or volume

Fast keys 2, 2, 3, 5, 1

To derive a mass or volume calculation from a DP measurement, more than two **Scaled Variable** points may be required depending on the tank shape and geometry. ERS supports three different methods for configuring **Scaled Variable** for mass or volume applications:

Direct Manually configure **Scaled Variable** using anywhere from two to 20 points.

Tank formulas **Scaled Variable** will automatically be configured by inputting the **Tank Shape**, **Tank Geometry**, and **Specific Gravity** of the process.

Strapping table **Scaled Variable** will automatically be configured by inputting a traditional ***Level vs. Volume*** strapping table.

Configure Scaled Variable using Direct method

To configure **Scaled Variable** for a mass or volume application:

Procedure

1. Enter in a text string (up to five characters: A–Z, -, %, /, *, and "space") to define the unit of measure for the scaled output.

   Examples include **GALNS**, **POUND**, or **LITER**.

2. Define the number of **Scaled Variable** points that will be configured (valid range = 2 – 20).
3. Enter the first **differential pressure (DP)** value (in engineering units) and the corresponding **Scaled Variable** value.
4. Repeat Step 3 for the number of scaled variable points defined in Step 2.

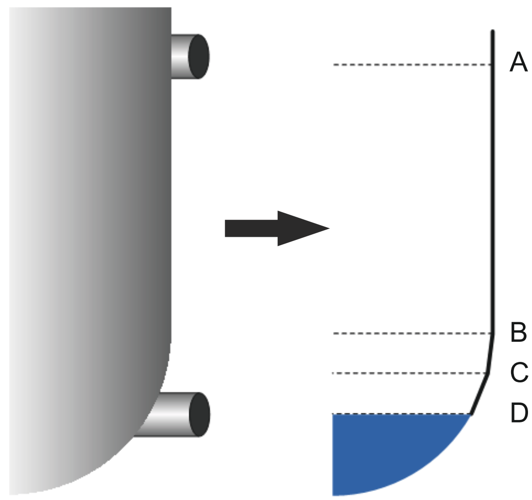
   Note
   The values entered for each successive **DP** and **Scaled Variable** pair must be greater than or equal to the previous pair.

5. The system will not be able to calculate mass or volume if the process is below the P_{HI} pressure tap. If the **Scaled Variable** configuration needs to be adjusted to account for the mounting location of P_{HI} sensor, you can enter in an offset:

- No offset: The **Scaled Variable** configuration defined in Step 3 and Step 4 already accounts for the mounting location of the P_{HI} transmitter.
- **Offset A**: Adjust the **Scaled Variable** configuration by providing the height of the P_{HI} pressure tap (relative to the bottom of the vessel) and the specific gravity of the process.
- **Offset B**: Adjust the **Scaled Variable** configuration by defining how much mass or volume is located below the P_{HI} pressure tap (this will define how much scaled output is present when the system is reading **0 DP**).

6. If an offset was used in Step 5, a new **Scaled Variable** configuration will automatically be created which accounts for the mounting location of the P_{HI} transmitter.

Figure 2-4: Scaled Variable - Direct Method



*A. 50 inH_2O = **300 GALNS***
*B. 20 inH_2O = **50 GALNS***
*C. 15 inH_2O = **30 GALNS***
*D. 0 inH_2O = **15 GALNS***

Table 2-6: Scaled Variable Configuration Options

Variable	Unit
Scaled units	gal (L)
Number of scaled points	4
DP_1 $Scaled_1$	0 inH_2O (0 mmH_2O) 15 gal (57 L)
DP_2 $Scaled_2$	15 inH_2O (381 mmH_2O) 30 gal (114 L)
DP_3 $Scaled_3$	20 inH_2O (508 mmH_2O) 50 gal (189 L)
DP_4 $Scaled_4$	50 inH_2O (1270 mmH_2O) 300 gal (1136 L)
Offset	No offset

Table 2-6: Scaled Variable Configuration Options *(continued)*

Variable	Unit
Primary variable	**Scaled Variable**
Lower range value (LRV) (4 mA)	15 gal (57 L)
Upper range value (URV) (20 mA)	50 gal (189 L)

Configure Scaled Variable using the Tank Formula method

The tank formula method for configuring **Scaled Variable** can be used if the ERS System is installed on one of the types of tanks shown in Figure 2-5.

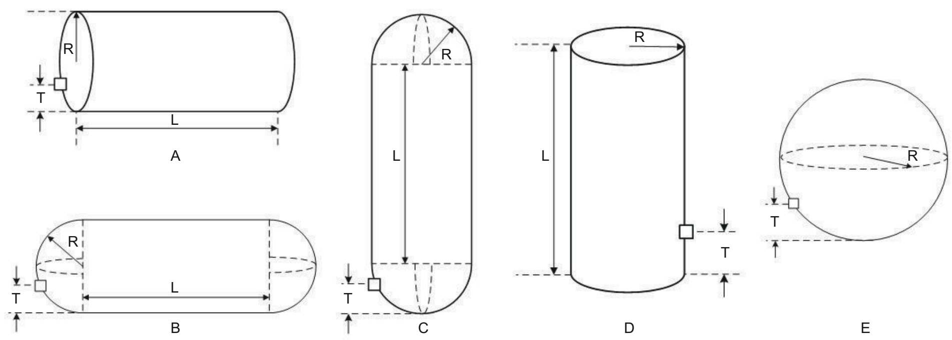
Procedure

1. Enter in a text string (up to five characters: A–Z, -, %, /, *, and "space") to define the unit of measure for the scaled output.

   Examples include **GALNS**, **POUND**, or **LITER**.
2. Select the type of tank for the ERS application (reference Figure 2-5).
3. Define the following information about the tank:
   - **Units of measure** used for tank dimensions
   - **Tank length (L)** (not applicable for spherical tanks) (reference Figure 2-5)
   - **Tank radius (R)** (reference Figure 2-5)
   - Location of P_{HI} pressure tap (T) (reference Figure 2-5)
   - Maximum capacity of vessel (in terms of **unit of measure** defined in Step 1)
   - **Specific gravity of process fluid**

   A **Scaled Variable** configuration will automatically be generated based on the information from Step 3.
4. If necessary, verify and modify the **Scaled Variable** configuration.
5. To have the 4–20 mA signal of the ERS System output the **Scaled Variable** measurement, map **Scaled Variable** to the HART® **primary variable** and configure the **upper** and **lower range values**.

Figure 2-5: Supported Tank Shapes for "Tank Formula" Configuration Method



A. *Horizontal cylinder*
B. *Horizontal bullet*
C. *Vertical bullet*
D. *Vertical cylinder*
E. *Sphere*

Configure Scaled Variable using the Strapping Table method

Scaled Variable can also be configured by inputting a traditional ***Level vs. Volume*** strapping table.

Procedure

1. Select the **unit of measure** for the level data.
2. Enter in a text string (up to five characters: A–Z, -, %, /, *, and "space") to define the unit of measure for the volume data.

   Examples include **GALNS** or **LITER**.
3. Define the **specific gravity** of the process fluid.
4. Define the number of strapping table points that will be inputted.
5. Enter the **first level** value (in engineering units) and the corresponding **volume** value.
6. Repeat Step 5 for the number of strapping table points defined in Step 4.
   A **Scaled Variable** configuration will automatically be generated based on the provided strapping table information.
7. Verify and modify the **Scaled Variable** configuration if necessary.
8. To have the 4–20 mA signal of the system output the **Scaled Variable** measurement, map scaled variable to the HART® **primary variable** and configure the **upper** and **lower range values**.

2.5.5 Module assignments

Fast keys	2, 2, 6

The ERS System calculates differential pressure (DP) by taking the pressure measurement from the P_{HI} transmitter and subtracting the pressure measurement from the P_{LO} transmitter.

Transmitters are shipped from the factory preconfigured so the primary sensor (4–20 loop termination and optional LCD display) is assigned as the P_{HI} device, and the secondary sensor (junction box housing) is assigned as the P_{LO} device. In installations where the primary transmitter is installed on the P_{LO} process connection (such as at the top of a tank), these designations may be switched electronically using a communication device.

Change the P_{HI} and P_{LO} module assignments

Procedure

1. View the neck label on each transmitter and note the serial number and pressure location (P_{HI} vs. P_{LO}) of the transmitter.
2. Using a communication device, view the serial number and the assigned pressure location for either **Module 1** or **Module 2**.
3. If the currently assigned P_{HI}/P_{LO} designations do not reflect the actual installation as recorded from Step 1, change the P_{HI}/P_{LO} assignments using one of the following commands:
   - Set **Module 1** = P_{HI}, **Module 2** = P_{LO}
   - Set **Module 1** = P_{LO}, **Module 2** = P_{HI}

   View the DP measurement from the system and verify the calculation is of positive magnitude. If the DP measurement is of negative magnitude, use the other module assignment command from Step 3.

Figure 2-6: Example of How to Change the P_{HI} and P_{LO} Module Assignments

A. P_{LO} sensor, serial number 11223344
B. DP = P_{HI} - P_{LO}
C. P_{HI} sensor, serial number 44332211

2.5.6 Process alerts

Fast Keys	2, 3

Process alerts allow for the configuration of the system to output a HART® message when a parameter (such as the measured DP) exceeds a user-defined operating window. An alert will be communicated to the HART host (such as a communication device or AMS Device Manager) when polled, and on the LCD display of the system. The alert will reset once the value returns within range.

Process alerts may be configured for the following parameters:

- **Differential pressure**
- P_{HI} **pressure**
- P_{LO} **pressure**
- P_{HI} **module temperature**
- P_{LO} **module temperature**

Configure process alerts

Procedure

1. Select a parameter for which the process alert will be configured.
2. Set the **Alert** Mode to **enable**.
3. Define the **low alert** value.
   If the measured value for the parameter goes below the **low alert** value, an alert message will be generated.
4. Define the **high alert** value.
   If the measured value for the parameter goes above the **high alert** value, an alert message will be generated.

Disable process alerts

Procedure

1. Select a parameter for which the process alert will be disabled.
2. Set the **Alert** mode to **disabled**.

2.6 HART® menu trees

Figure 2-7: *Overview*

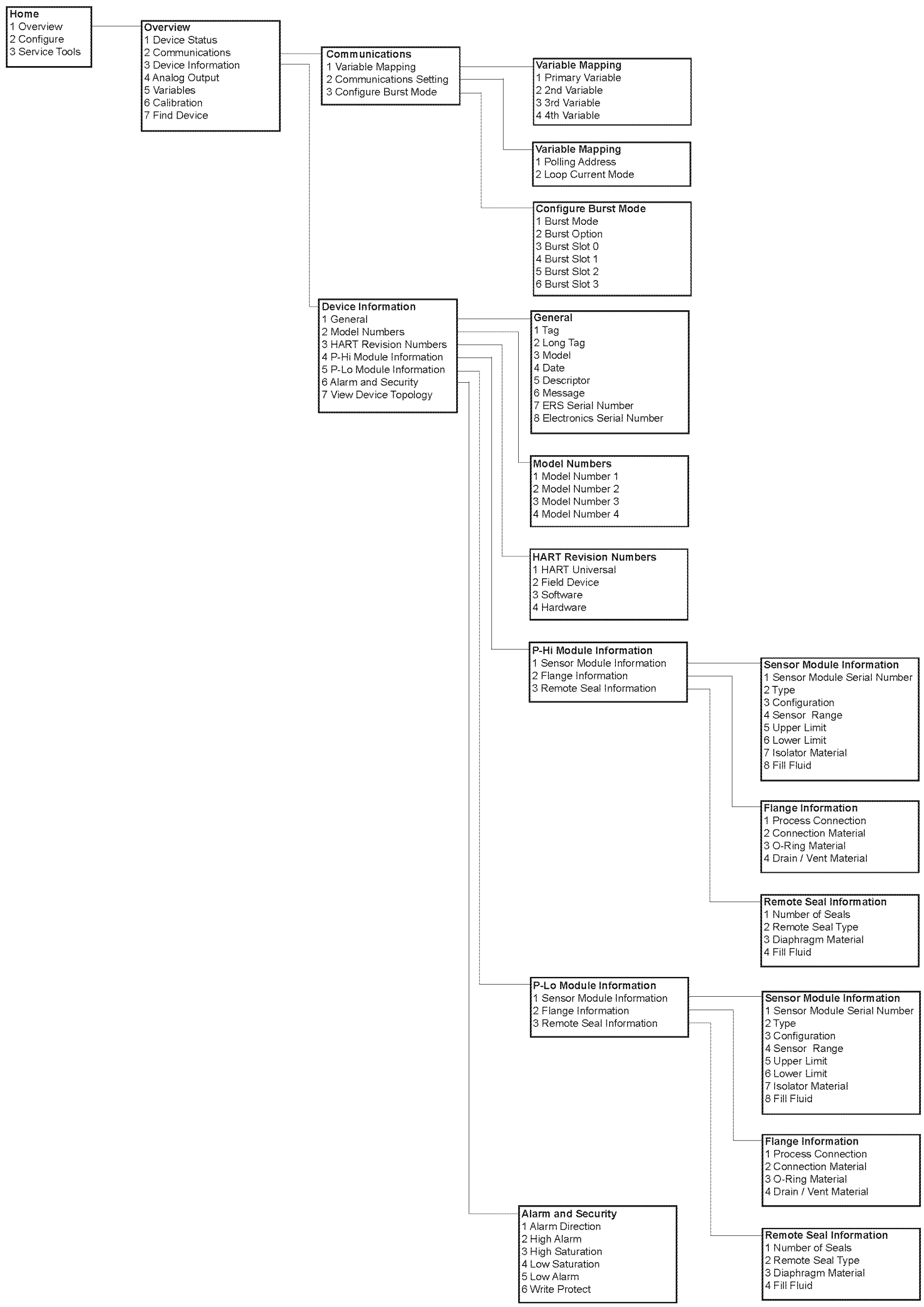


Figure 2-8: *Configure*

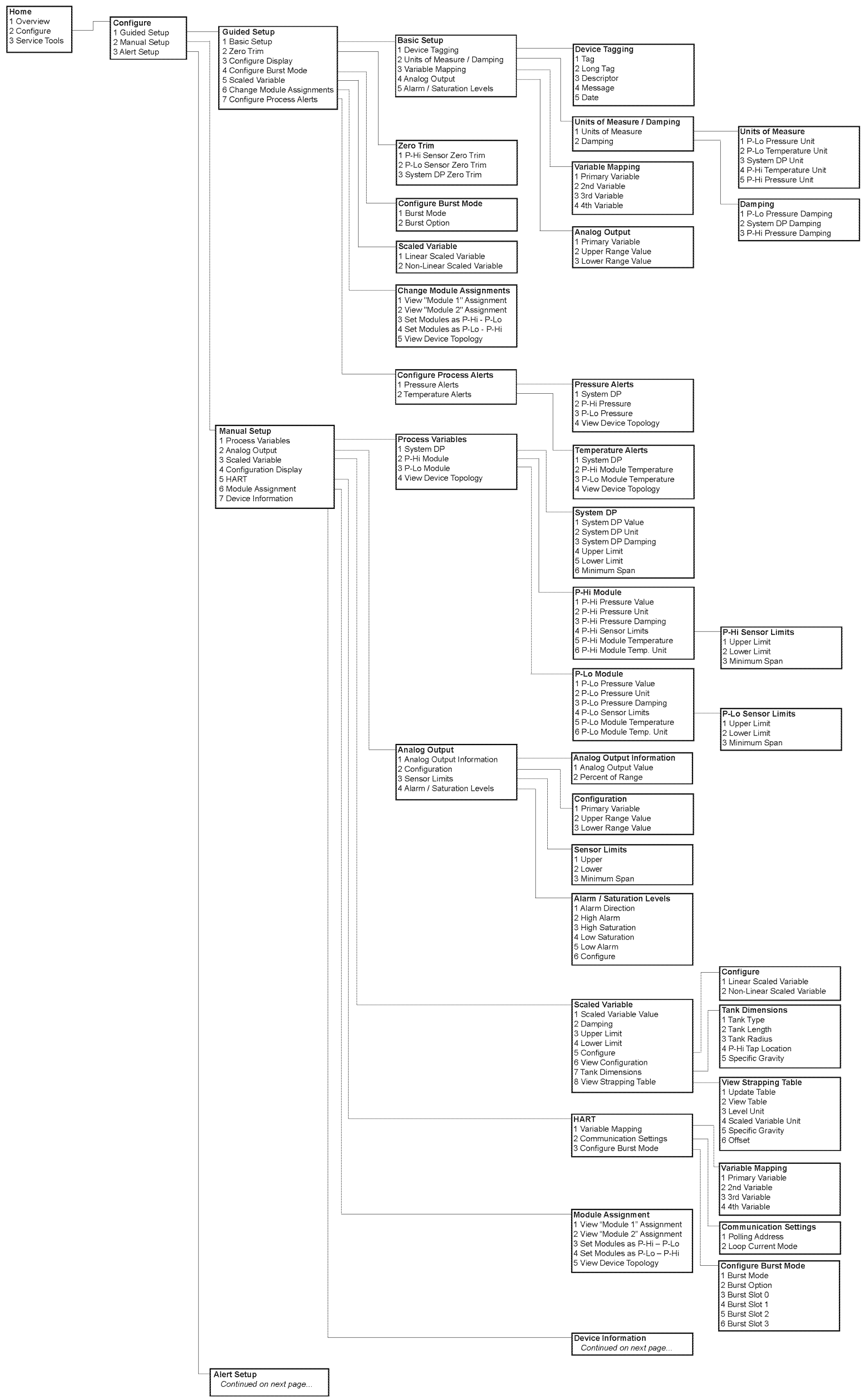
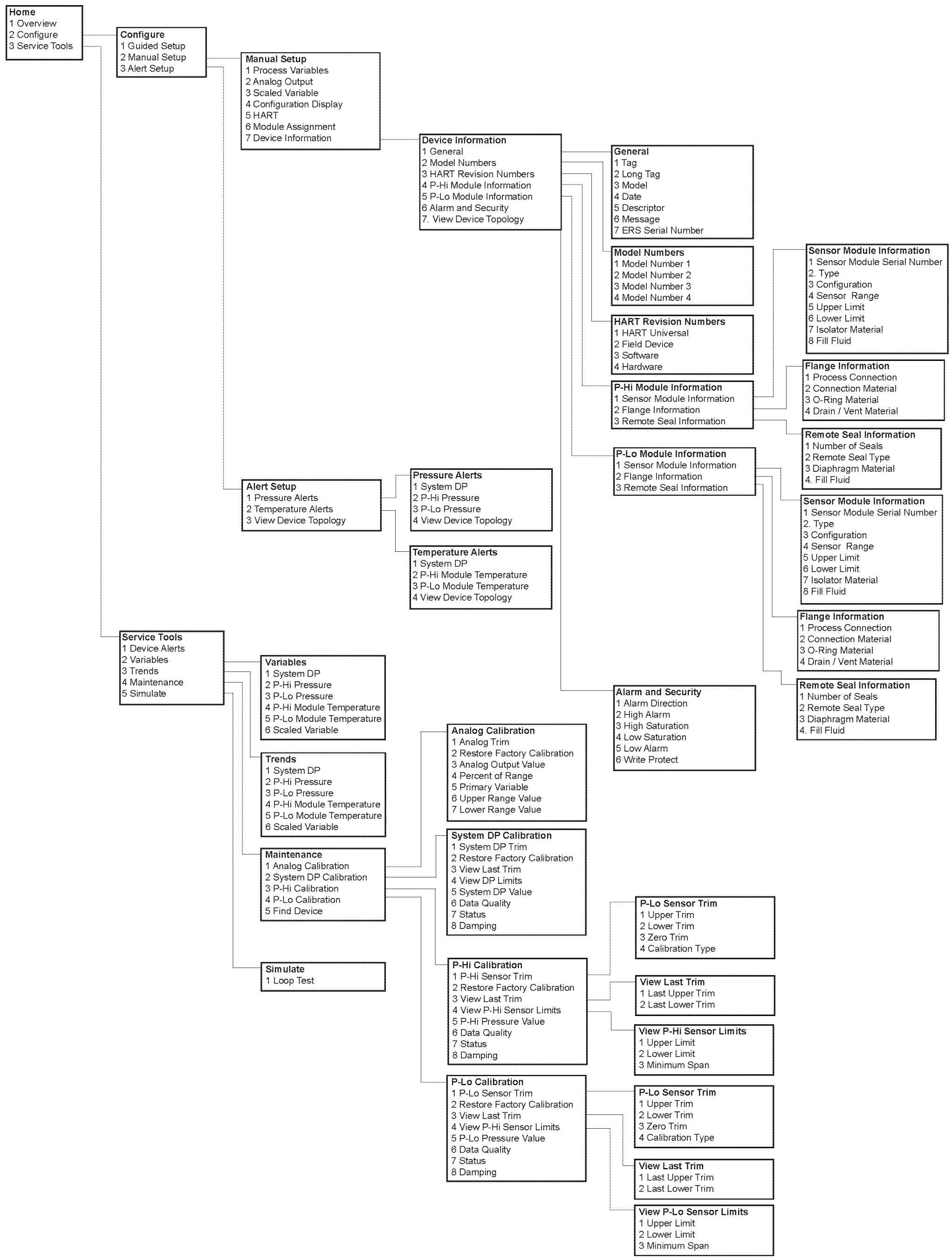


Figure 2-9: *Alert Setup*, *Device Information*, and *Service Tools*



3 Installation

3.1 Overview

This section covers installation considerations for the Rosemount 3051S Electronic Remote Sensor (ERS)™ System.

Emerson ships a *Quick Start Guide* with every Rosemount 3051S ERS Transmitter to describe basic installation, wiring, configuration, and start-up procedures. Dimensional drawings for each Rosemount 3051S ERS Transmitter are included in Product Data Sheet.

3.2 Models covered

The Rosemount ERS System is a flexible, 2-wire HART® architecture that calculates differential pressure (DP) electronically, using two pressure sensors. The pressure sensors are linked together with an electrical cable and synchronized to create a single Rosemount ERS System. The sensors used in the Rosemount ERS System can consist of any combination of Rosemount 3051SAM and 3051SAL models. One of the sensors is required to be a “Primary” and the other is required to be a “Secondary.”

The Primary sensor contains the 4–20 mA loop termination and optional LCD display. The Secondary sensor is made up of a pressure sensor module and junction box housing that is connected to the primary sensor, using a standard instrument cable.

Rosemount 3051SAM Scalable™ ERS Measurement Transmitter

- Coplanar™ and In-Line sensor module platforms
- Variety of process connections including NPT, flanges, manifolds, and Rosemount 1199 Remote Diaphragm Seals

Rosemount 3051SAL Scalable ERS Level Transmitter

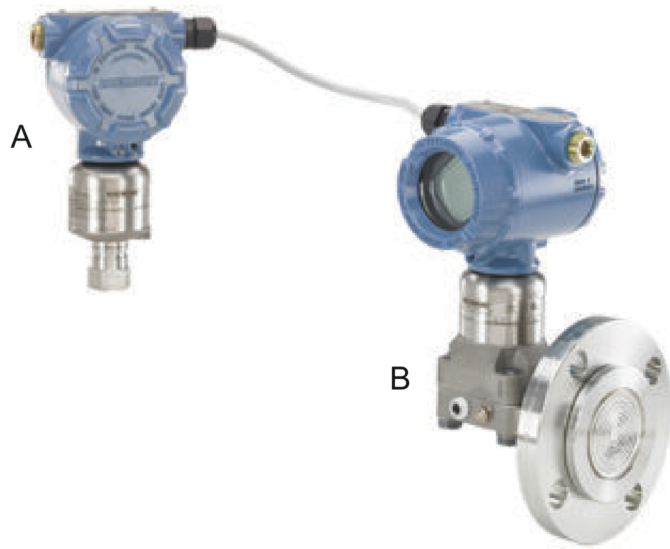
- Integrated transmitter and remote diaphragm seal in a single model number
- Variety of process connections including flanged, threaded, and hygienic remote diaphragm seals

Rosemount 300ERS Housing Kit

- Upgrade and convert an existing Rosemount 3051S Transmitter into a Rosemount 3051S ERS Transmitter.
- Easily order replacement housings and electronics for an existing Rosemount ERS System.

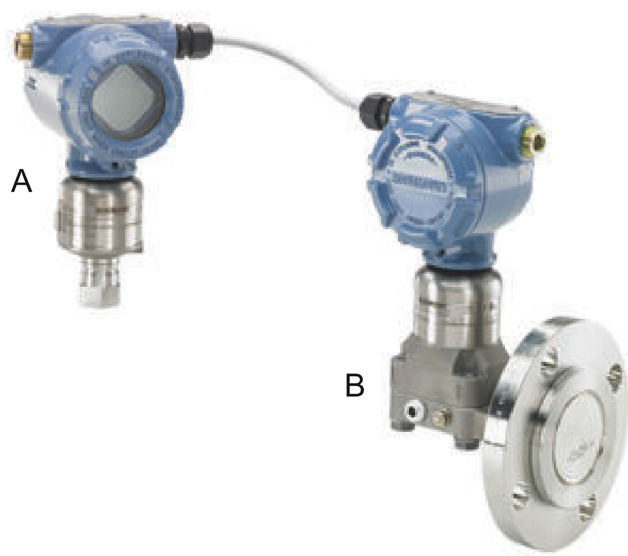
Models and possible configurations

Figure 3-1: Coplanar primary with In-line Secondary



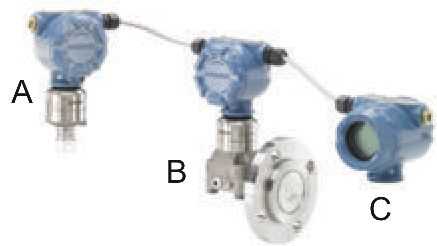
A. Rosemount 3052SAM In-Line (secondary)
B. Rosemount 3051SAL Coplanar with Foundation™ Fieldbus (FF) seal (primary)

Figure 3-2: In-line Primary with Coplanar Secondary



A. 3051SAM In-Line (primary)
B. 3051SAL Coplanar with FF seal (secondary)

Figure 3-3: Coplanar Primary with In-line Secondary and Remote Display



A. *3051SAM In-Line (secondary)*
B. *3051SAL Coplanar with FF seal (primary)*
C. *Remote display*

3.3 Considerations

3.3.1 General

Measurement performance depends upon proper installation of each transmitter and impulse piping.

Mount each Rosemount 3051S ERS Transmitter close to the process and use minimum piping to achieve best performance. Also, consider the need for easy access, personnel safety, practical field calibration, and a suitable environment. Install each sensor to minimize vibration, shock, and temperature fluctuation.

NOTICE

Install the enclosed pipe plugs in any unused conduit openings. For proper straight and tapered thread engagement requirements, see the appropriate approval drawings in Product Data Sheet. For material compatibility considerations, see Material Selection Technical Note.

3.3.2 Mechanical

For dimensional drawing information, refer to Product Data Sheet.

For steam service or for applications with process temperatures greater than the limits of each Rosemount 3051S ERS Transmitter, do not blow down impulse piping through either sensor. Flush lines with the blocking valves and refill lines with water before resuming measurement.

If a Rosemount 3051S ERS Transmitter is mounted on its side, position the flange/manifold to ensure proper venting or draining.

Field terminal side of housing

Mount each Rosemount ERS Sensor so the terminal side is accessible. Clearance of 0.75-in. (19 mm) is required for cover removal.

Electronics side of housing

If an LCD display is installed, provide 0.75-in. (19 mm) of clearance for units without an LCD display. 3 in. (76 mm) of clearance is required for cover removal.

Cover installation

Always ensure a proper seal by installing the housing covers so that metal contacts metal in order to prevent performance degradation due to environmental effects. For replacement cover O-rings, use Rosemount O-rings (part number 03151-9040-0001).

Conduit entry threads

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

Cover jam screw

For housings shipped with a cover jam screw (as shown in Figure 3-4), the screw must be properly installed once the Rosemount ERS System has been wired and powered up.

The cover jam screw is intended to prevent the removal of the housing covers in flameproof environments without the use of tools.

Procedure

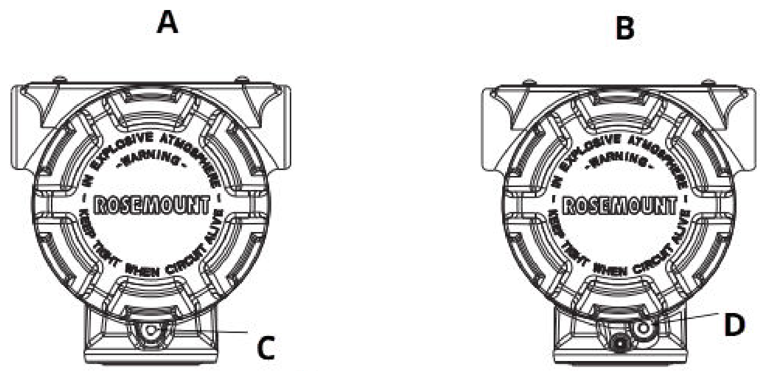
1. Verify the cover jam screw is completely threaded into the housing.
2. Install the housing covers and verify that metal contacts metal in order to meet flameproof/explosion-proof requirements.
3. Using an M4 hex wrench, turn the jam screw counterclockwise until it contacts the housing cover.
4. Turn the jam screw an additional 1/2 turn counterclockwise to secure the cover.

NOTICE

Application of excessive torque may strip the threads.

5. Verify the covers cannot be removed.

Figure 3-4: Cover Jam Screw



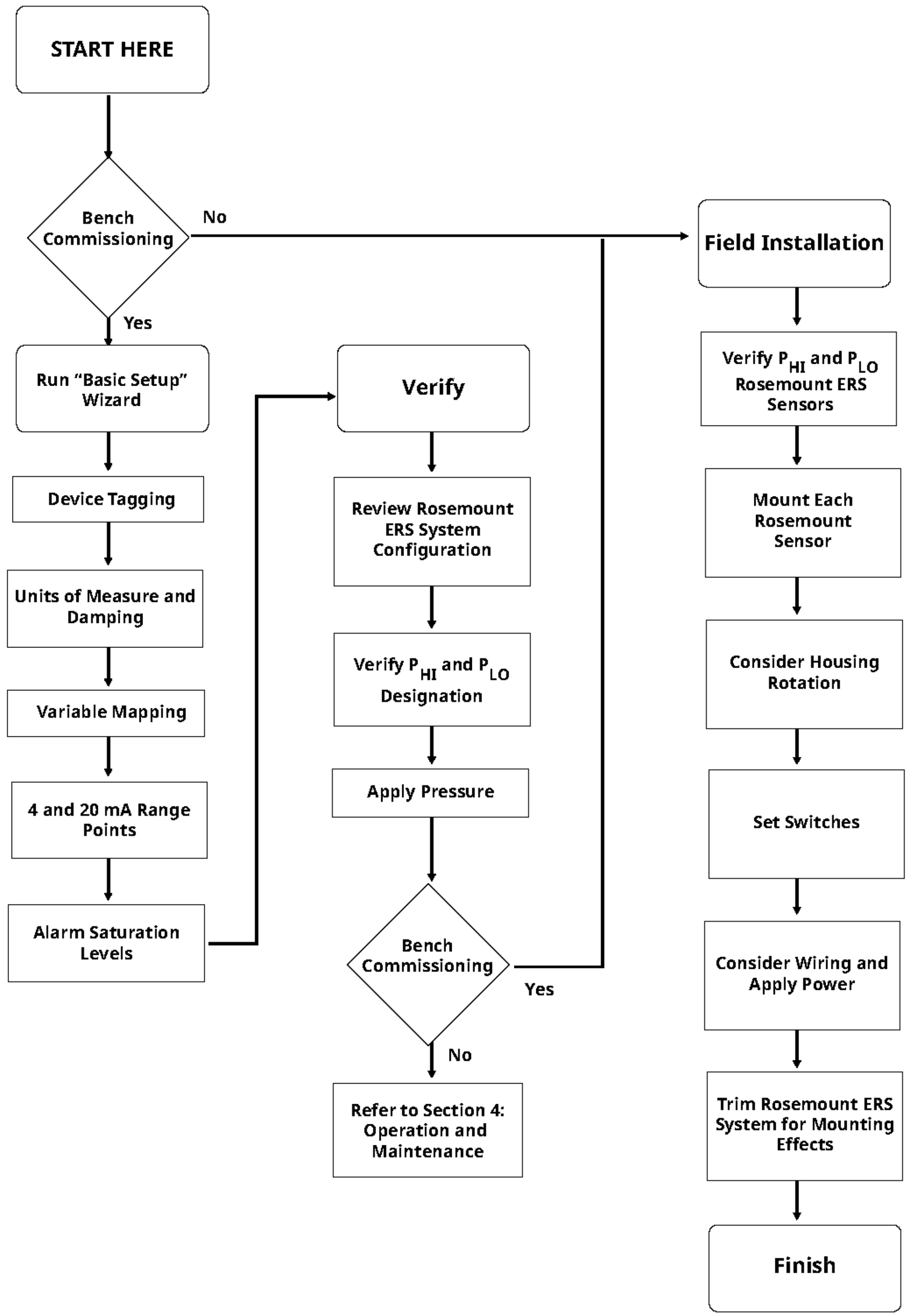
A. *Plantweb™ housing*
B. *Junction box housing*
C. *Two cover jam screws (one per side)*
D. *Cover jam screw*

3.3.3 Environmental considerations

Access requirements and cover installation can help optimize transmitter performance. Mount each transmitter to minimize ambient temperature changes, vibration, mechanical shock, and to avoid external contact with corrosive materials.

Note
The Rosemount ERS System contains additional electrical protection that is inherent to the design. As a result, ERS Systems cannot be used in applications with floating electrical grounds greater than 50 Vdc (such as Cathodic Protection). Consult an Emerson Sales Representative for additional information or considerations on use in similar applications.

Figure 3-5: Installation flowchart



3.4 Installation procedures

3.4.1 Identify Rosemount ERS Sensors

A complete ERS System contains two pressure sensors.

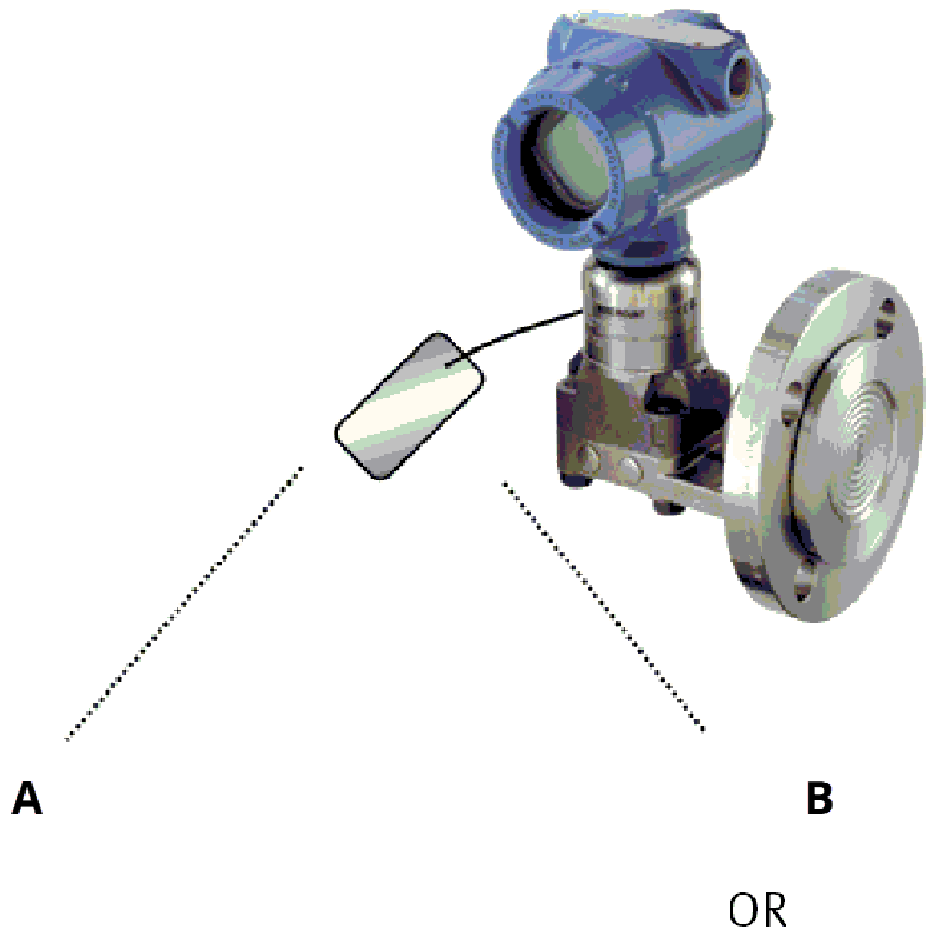
One is mounted on the high-pressure (P_{HI}) process connection, and the other is mounted on the low-pressure (P_{LO}) process connection. An optional remote display and interface may also be included if ordered.

Procedure

1. Look at the wire-on tag on the 3051S ERS Transmitter to identify whether it is configured as the P_{HI} or P_{LO} sensor (see Figure 3-6).
2. Locate the second sensor that will be used in the Rosemount ERS System:
   - For new installations or applications, the second Rosemount ERS Sensor may have been shipped in a separate box.
   - If servicing or replacing part of an existing Rosemount ERS System, the other sensor may already be installed.

Note
Rosemount 3051S ERS Transmitters are shipped from the factory preconfigured such that the primary unit (4–20 loop termination and optional LCD display) is assigned as the P_{HI} sensor and the secondary unit (junction box housing) is assigned as the P_{LO} sensor. In installations where there the primary transmitter is installed on the P_{LO} process connection (such as at the top of a tank), these designations may switched electronically using a communication device (see Local display).

Figure 3-6: ERS P_{HI} and P_{LO} wire-on tags



A. 3051S Electronic Remote Sensor Configured as Pressure High
B. 3051S Electronic Remote Sensor Configured as Pressure Low

3.4.2 Mount each sensor

Mount the P_{HI} and P_{LO} sensors at the correct process connections for the application.

Figure 3-7 shows common ERS installations.

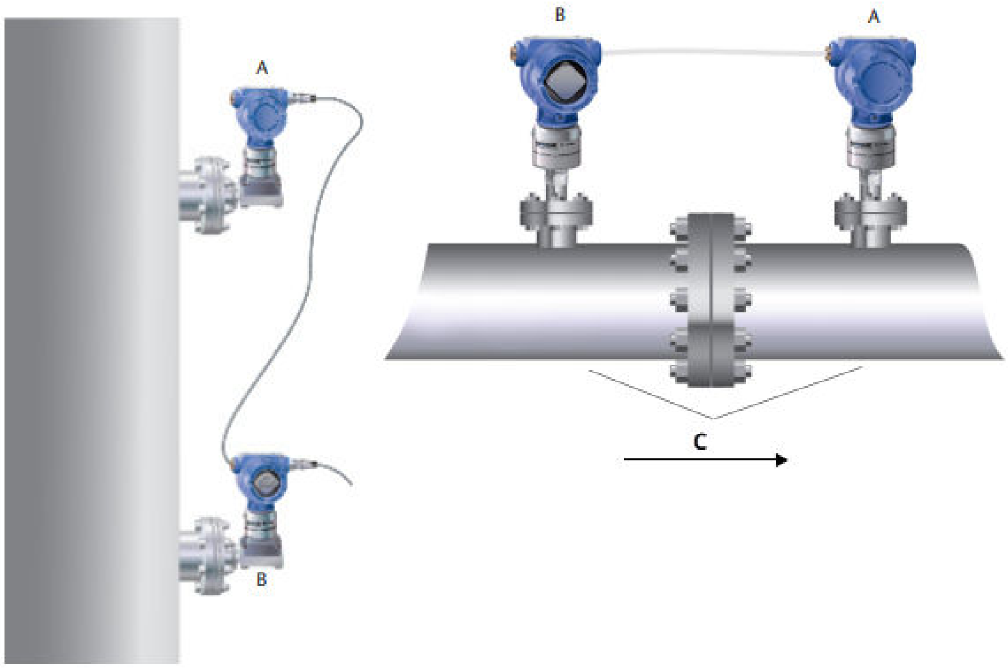
Vertical installation

In a vertical installation such as on a vessel or distillation column, install the P_{HI} sensor at the bottom process connection. Install the P_{LO} sensor at the top process connection.

Horizontal installation

In a horizontal installation, install the P_{HI} sensor at the upstream process connection. Install the P_{LO} sensor downstream.

Figure 3-7: Vertical and horizontal ERS installations



A. P_{LO} sensor
B. P_{HI} sensor
C. Pressure drop

Mounting brackets

Mounting brackets are available to facilitate mounting the transmitter to a 2-in. pipe or to a panel. The B4 stainless steel (SST) bracket option is for use with Coplanar™ and in-line process connections. Figure 3-8 shows dimensions and mounting configuration for the B4 bracket. Other bracket options are listed in Table 3-1.

When installing a Rosemount 3051S ERS Transmitter to one of the optional mounting brackets, torque the bolts to 125 in-lb. (0.9 N-m).

Table 3-1: Mounting brackets

Options	Description	Mounting type	Bracket material	Bolt material
B4	Coplanar flange bracket	2-in. pipe/ panel	SST	SST
B1	Traditional flange bracket	2-in. pipe	Painted carbon steel	Carbon steel
B2	Traditional flange bracket	Pane	Painted carbon steel	Carbon steel
B3	Traditional flange flat bracket	2-in. pipe	Painted carbon steel	Carbon steel
B7	Traditional flange bracket	2-in. pipe	Painted carbon steel	SST
B8	Traditional flange bracket	Pane	Painted carbon steel	SST
B9	Traditional flange flat bracket	2-in. pipe	Painted carbon steel	SST
BA	Traditional flange bracket	2-in. pipe	SST	SST

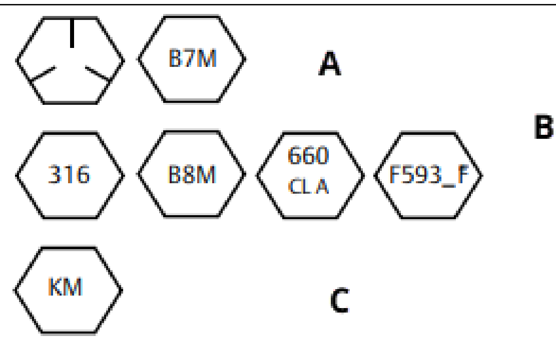
Table 3-1: Mounting brackets *(continued)*

Options	Description	Mounting type	Bracket material	Bolt material
BC	Traditional flange flat bracket	2-in. pipe	SST	SST

Flange bolts

An Rosemount 3051S ERS Transmitter can be shipped with a Coplanar flange or a traditional flange installed with four 1.75-in. flange bolts. Mounting bolts and bolting configurations for the Coplanar and traditional flanges can be found on Table 3-2. Stainless steel bolts supplied by Emerson are coated with a lubricant to ease installation. Carbon steel bolts do not require lubrication. No additional lubricant should be applied when installing either type of bolt.

Bolts supplied by Emerson are identified by their head markings:



A. Carbon steel (CS) head markings
B. Stainless steel (SST) head markings[(1)]
C. Alloy K-500 head marking

Install bolts

Only use bolts supplied with the 3051S ERS Transmitter or sold by Emerson as spare parts.

Procedure

1. Finger-tighten the bolts.
2. Torque the bolts to the initial torque value using a crossing pattern.
   For initial torque values, see Table 3-2.
3. Torque the bolts to the final torque value using the same crossing pattern.
   For final torque values, see Table 3-2.
   Torque values for the flange and manifold adapter bolts are as follows:

Table 3-2: Bolt installation torque values

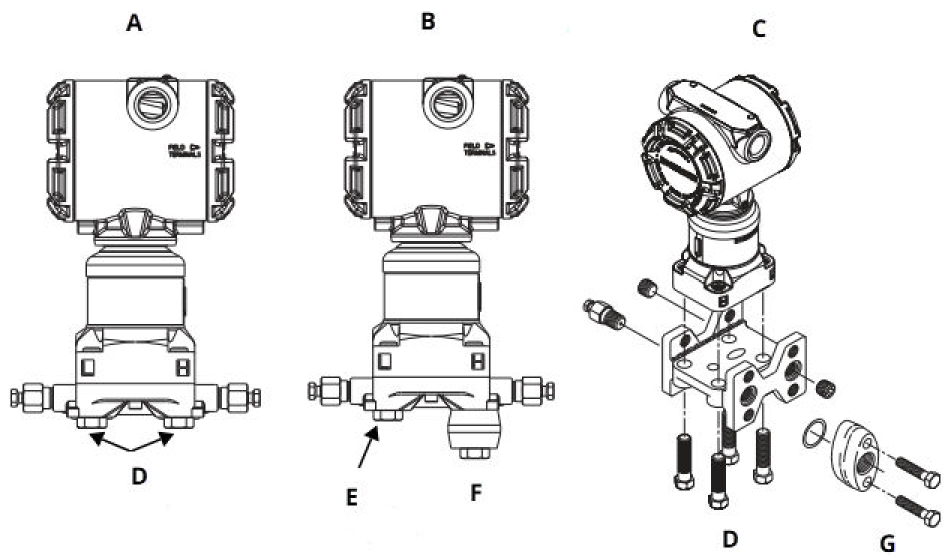
Bolt material	Option code	Initial torque value	Final torque value
Carbon steel (CS)-ASTM-A449	Standard	300 in.-lb (34 N-m)	650 in.-lb (73 N-m)
316 stainless steel (SST)	Option L4	150 in.-lb (17 N-m)	300 in.-lb (34 N-m)

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

Table 3-2: Bolt installation torque values *(continued)*

Bolt material	Option code	Initial torque value	Final torque value
ASTM-A-193-B7M	Option L5	300 in.-lb (34 N-m)	650 in.-lb (73 N-m)
Alloy K-500	Option L6	300 in.-lb (34 N-m)	650 in.-lb (73 N-m)
ASTM-A-453-660	Option L7	150 in.-lb (17 N-m)	300 in.-lb (34 N-m)
ASTM-A-193-B8M	Option L8	150 in.-lb (17 N-m)	300 in.-lb (34 N-m)

Figure 3-8: Common Rosemount 3051S ERS Transmitter/Flange Assemblies



A. Transmitter with Coplanar flange
B. Transmitter with Coplanar flange and flange adapters
C. Transmitter with traditional flange and flange adapters
D. 1.75 in. (44 mm) x 4
E. 1.75 in. (44 mm) x 2
F. 2.88 in. (73 mm) x 2
G. 1.5 in. (38 mm) x 2

3.4.3 Process connections

The process connection size on a 3051S ERS Transmitter flange is 1/4–18-in. NPT.

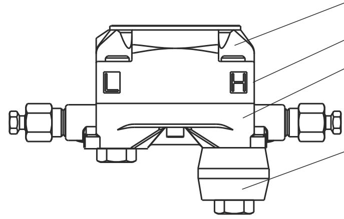
Flange adapters with a 1/4–18 NPT to 1/2–14 NPT connection are available with the D2 option. Use a plant-approved lubricant or sealant when making the process connections. For other level flange type connection options, reference the Rosemount DP Level Transmitters and Diaphragm Seal Systems Reference Manual.

Install and tighten all four flange bolts before applying pressure to avoid leakage. When properly installed, the flange bolts will protrude through the top of the sensor module isolator plate. See Figure 3-9.

NOTICE

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

Figure 3-9: Sensor module isolator plate



A. Bolt
B. Sensor module isolator plate
C. Coplanar™ flange
D. Flange adapters

Procedure

1. Remove the flange bolts.
2. Leaving the flange in place, move the adapters into position with the O-rings installed.
3. Attach the adapters and the Coplanar flange to the transmitter sensor module assembly using the longer of the bolts supplied.
4. Tighten the bolts.

   Refer to Table 3-2 for torque specifications.

   ⚠ WARNING

   Failure to install proper fitting flange adapter O-rings may cause process leaks, which can result in death or serious injury.

   Use only the O-rings included with the flange adapter for the Rosemount 3051S ERS Transmitter.

5. When removing flanges or adapters, visually inspect the PTFE O-rings. Replace them if there are any signs of damage such as nicks or cuts. If replacing O-rings, re-torque the flange bolts after installation to compensate for seating of the PTFE O-ring.

Impulse piping

The piping between the process and each 3051S ERS Transmitter must accurately transfer the pressure to obtain accurate measurements.

There are many possible sources of error:

- Pressure transfer
- Leaks
- Friction loss (particularly if purging is used)
- Trapped gas in a liquid line

- Liquid in a gas line
- Plugged impulse lines

The best location for each 3051S ERS Transmitter depends on the process itself. To determine sensor location and placement of impulse piping:

- Keep impulse piping as short as possible.
- For liquid service, slope the impulse piping at least 1 inch per foot (8 cm per m) upward from the transmitter toward the process connection.
- For gas service, slope the impulse piping at least 1 inch per foot (8 cm per m) downward from the transmitter toward the process connection.
- Avoid high points in liquid lines and low points in gas lines.
- When purging, make the purge connection close to the process tap and purge through equal lengths of the same size pipe. Avoid purging through either Rosemount 3051S ERS Transmitter.
- Keep corrosive or hot (above 250 °F or 121 °C) process material out of direct contact with the sensor module process connection and flanges.
- Prevent sediments from being deposited in the impulse piping.

Note
Take necessary steps to prevent process fluid from freezing with the process flange to avoid damage to each Rosemount 3051S ERS Transmitter.

Note
Verify the zero point on each Rosemount 3051S ERS Transmitter after installation. To reset the zero trim, refer to Calibration overview.

3.4.4 Consider housing orientation

Rotate housing

Rotate housing to improve access to wiring or to better view the LCD display (if ordered).

To rotate the housing:

Procedure

1. Loosen the housing set screw.
2. Turn the housing up to 180° to the left or right of its original (as shipped) position.

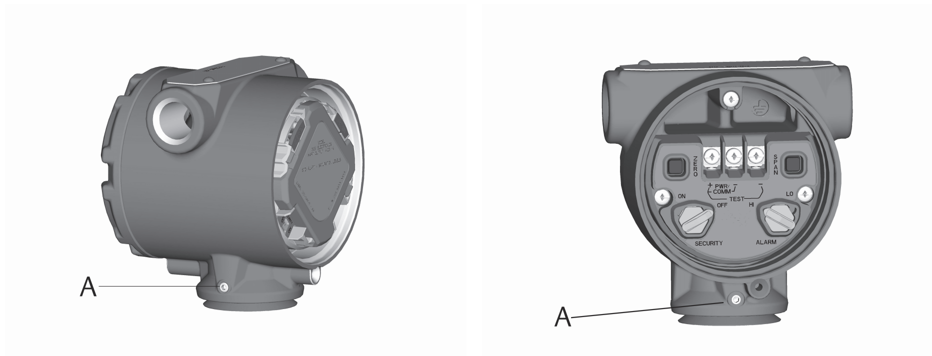
   Note
   Do not rotate the housing more than 180° from its original position without first performing a disassembly procedure (see Disassembly considerations). Over rotation may sever the electrical connection between the sensor module and the electronics feature board.

3. Retighten the housing rotation set screw.

Figure 3-10: Housing rotation

Plantweb™ housing

Junction box housing



A Housing rotation set screw (3/32-in.)

LCD display rotation

In addition to rotating the housing, the optional LCD display on the primary sensor can be rotated in 90° increments by squeezing the two tabs, pulling out the display, rotating, and snapping the display back into place.

Note
If the LCD display pins are inadvertently removed from the electronics feature board, re-insert the pins before snapping the LCD display back into place.

3.4.5 Configure security and alarm

Security switch

Changes to the Rosemount ERS System configuration can be prevented with the **security (write protect)** switch, which is located on the electronics feature board of the Rosemount 3051S ERS Primary Transmitter. See Figure 3-11 for the location of the switch. Position the switch in the **ON** position to prevent accidental or deliberate change to the Rosemount ERS System configuration.

If the **write protect** switch is in the **ON** position, the Rosemount ERS System will not accept any “writes” to its memory. Configuration changes, such as digital trim and reranging, cannot take place when the security switch is set to **ON**.

Alarm direction

The alarm direction of the analog output of the Rosemount ERS System is set by repositioning the alarm switch, which is located on the electronics feature board of the primary transmitter. Position the switch in the **HI** position to have the Rosemount ERS System go to high alarm in a fail condition, or position the switch in the **LO** position to have the system go to low alarm in a fail condition.

Related information

Alarm and saturation levels

Switch configuration procedure

To reposition the hardware switches:

Procedure

1. If the 3051S ERS System is live, set the loop to **Manual** and remove power.

   ⚠ WARNING

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

2. On the 3051S ERS Primary Transmitter, remove the housing cover opposite the field terminal side.
3. Reposition the **alarm** and **security** switches as desired, by using a small screwdriver.
4. Reinstall the housing cover.

   ⚠ WARNING

   Covers must be fully engaged so the metal contacts metal in order to meet flameproof/explosion-proof requirements.

Figure 3-11: Alarm and Security Switches

*A. **Security** switch*
*B. **Alarm** switch*

3.4.6 Connect wiring and power up

Typical Rosemount ERS System

Procedure

1. Remove the housing cover labeled **Field Terminals** on both Rosemount 3051S ERS Transmitters.
2. Using the Rosemount ERS Madison Cable (if ordered) or an equivalent 4-wire shielded assembly per the specifications detailed on 3051S ERS System cable specifications, connect the 1, 2, A, and B terminals between the two sensors per

Figure 3-12. Maintain uniform twist in wires as close as possible to the screw terminals.

3. Connect the Rosemount ERS System to the control loop by wiring the “+” and “–” **PWR/COMM** terminals of the Rosemount 3051S ERS Primary Transmitter to the positive and negative leads, respectively.
4. Plug and seal all unused conduit connections.
5. If applicable, install wiring with a drip loop. Arrange the drip loops so the bottom is lower than the conduit connections and the transmitter housings.
6. Reinstall and tighten the housing covers on both sensors so metal contacts metal to meet explosion-proof requirements.

3051S ERS System with optional remote display and interface

Procedure

1. Remove the housing cover labeled **Field Terminals** on both ERS Sensors and the remote housing.
2. Using the Rosemount ERS Madison Cable (if ordered) or an equivalent 4-wire shielded assembly per the specifications detailed on 3051S ERS System cable specifications, connect the 1, 2, A, and B terminals between the two sensors and remote housing in a “tree” (Figure 3-13) or daisy-chain (Figure 3-14) configuration. Maintain uniform twist in wires as close as possible to the screw terminals.
3. Connect the Rosemount ERS System to the control loop by wiring the “+” and “–” **PWR/COMM** terminals of the remote housing to the positive and negative leads, respectively.
4. Plug and seal all unused conduit connections.
5. If applicable, install wiring with a drip loop. Arrange the drip loops so the bottom is lower than the conduit connections and the transmitter housings.
6. Reinstall and tighten all housing covers so metal contacts metal to meet explosion-proof requirements.

NOTICE

Intrinsically safe (IS) barriers with inductive loads greater than 1 mH must not be used with the Rosemount ERS System and may cause the device to not function properly.

3051S ERS System cable specifications

- Cable type: Recommend gray Madison 04ZZXLF015 cable, blue Madison `04ZZXLF021` cable, and Southwire HLX-SPOS two pairs armor cable. Other comparable cable may be used as long as it has independent dual twisted shielded pair wires with an outer shield. The power wires (pin terminals 1 and 2) must be 22 AWG minimum and the communication wires (pin terminals A and B) must be 24 AWG minimum.
- Maximum cable length: The total length of cable used to connect the ERS primary transmitter, secondary transmitter, and remote display (if ordered) should not exceed maximum lengths below.
  - Madison (gray cable): up to 500 ft. (152.4 m) for non-intrinsically safe (IS) applications and 225 ft. (68.58 m) for IS applications; consult Emerson for applications requiring beyond 500 ft. (152.4 m).
  - Madison (blue cable): up to 225 ft. (68.58 m) for IS applications
  - Armored cable: up to 125 ft. (38.1 m)

- For SIS maximum lengths, see Rosemount ERS Systems safety certified identification
- Cable capacitance: The capacitance between the communication lines as wired must be less than 5000 pF total. This allows up to 50 pF per ft. (164 pF/m) for a 100-ft. cable.
- Gray and blue cable outside diameter: 0.270-in. (6.86 mm) Armor cable outside diameter: 0.76-in. (19.3 mm)
- For armored cable, cable glands are included with the packaging

4–20 mA loop wiring specifications

Emerson recommends using twisted pair wiring.

To ensure proper communication, use 24 to 14 AWG wire and do not exceed 5,000 ft. (1,500 m).

Note
There are four connections plus shield, which require correct configuration for operation. There is no mechanism that can result in re-sequencing of messages from the physical connections.

Surges/transients

NOTICE

The 3051S ERS System will withstand electrical transients of the energy level usually encountered in static discharges or induced switching transients. However, high-energy transients, such as those induced in wiring from nearby lightning strikes, can damage the system.

Optional transient protection terminal block

The transient protection terminal block can be ordered as an installed (option code T1) or as a spare part to retrofit an existing Rosemount ERS System in the field. A lightning bolt symbol on a terminal block identifies it as having transient protection.

Note
The transient terminal block is only available as an option on the primary Rosemount 3051S ERS Transmitter. When ordered and installed, a primary Rosemount 3051S ERS Transmitter with the transient terminal block will protect the entire Rosemount ERS Assembly including the secondary Rosemount 3051S ERS Transmitter.

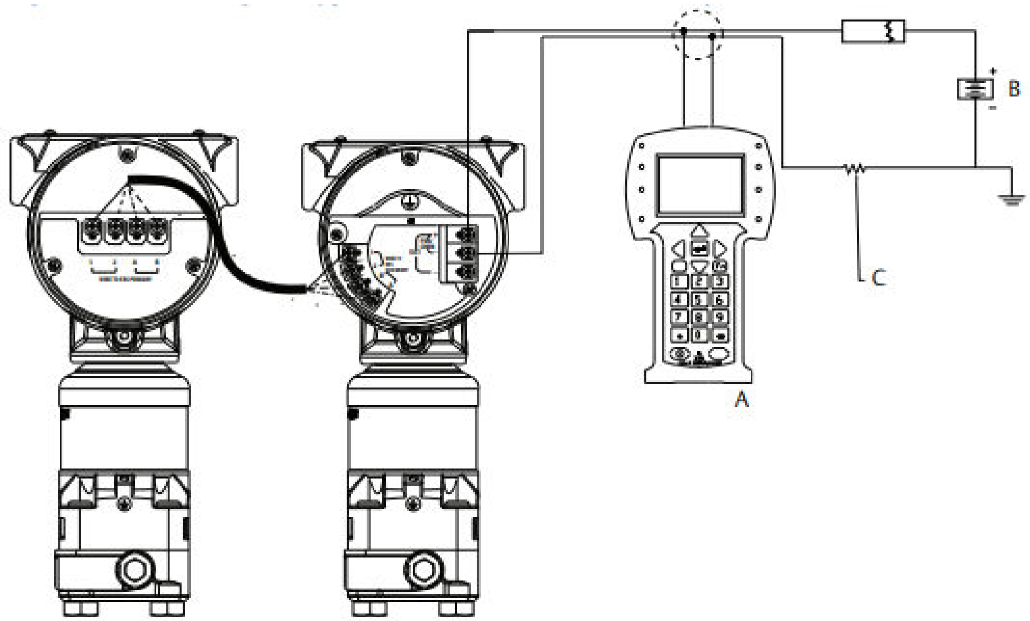
Power supply requirements

The DC power supply will provide power with less than two percent ripple. The total loop resistance is the sum of the resistance from the signal leads and the load resistance of the controller, indicator, and related pieces.

Note that the resistance of intrinsically safe barriers, if used, must be included.

Note
A minimum loop resistance of 250 ohms is required to communicate with a communication device. If a single power supply is used to power more than one ERS System, the power supply used and circuitry common to the transmitters should not have more than 20 ohms of impedance at 1200 Hz.

Figure 3-12: Wiring for typical 3051S ERS System

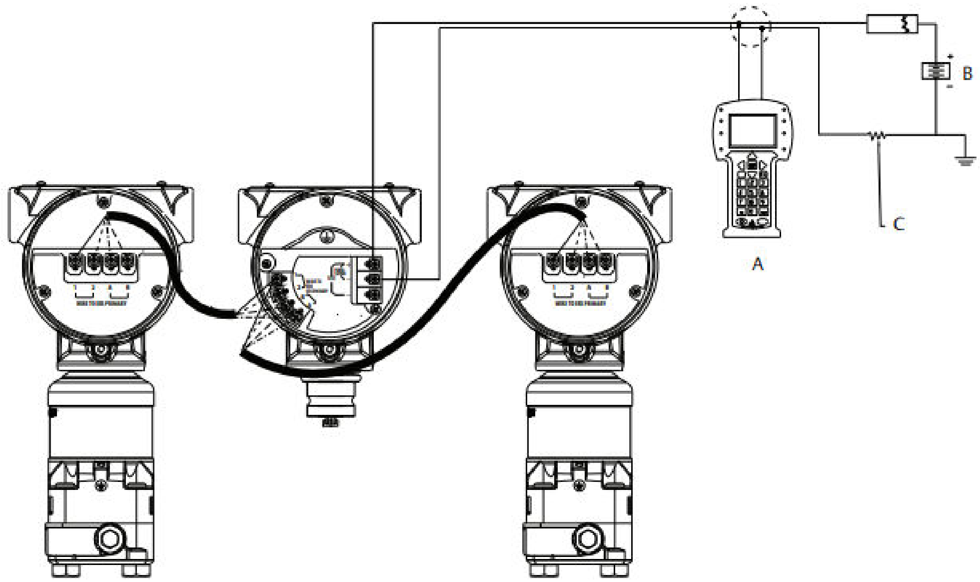


A. communication device
B. Power supply
C. 250 Ω resistor needed for HART® communications

Table 3-3: Wiring legend

Wire color	Terminal connection
Red	1
Black	2
White	A
Blue	B

Figure 3-13: Wiring for Rosemount 3051S ERS System with Remote Display in "Tree" Configuration

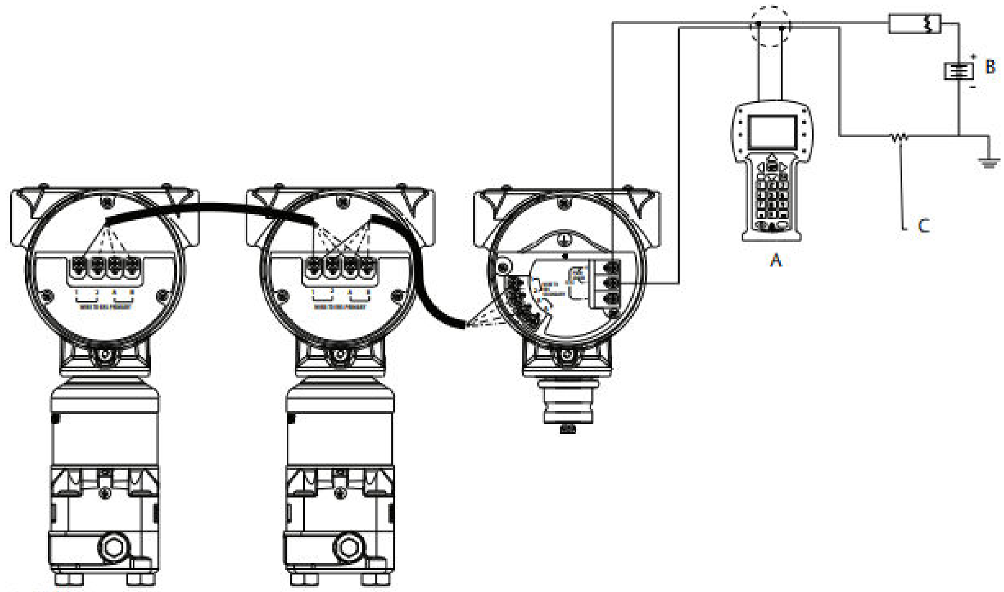


A. *communication device*
B. *Power supply*
C. *250 Ω resistor needed for HART communications*

Table 3-4: Wiring legend

Wire color	Terminal connection
Red	1
Black	2
White	A
Blue	B

Figure 3-14: Wiring for Rosemount 3051S ERS System with Remote Display in “Daisy-Chain” Configuration



A. communication device
B. Power supply
C. 250 Ω resistor needed for HART communications

Table 3-5: Wiring legend

Wire color	Terminal connection
Red	1
Black	2
White	A
Blue	B

3.4.7 Grounding

Loop wiring grounding

⚠ WARNING

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

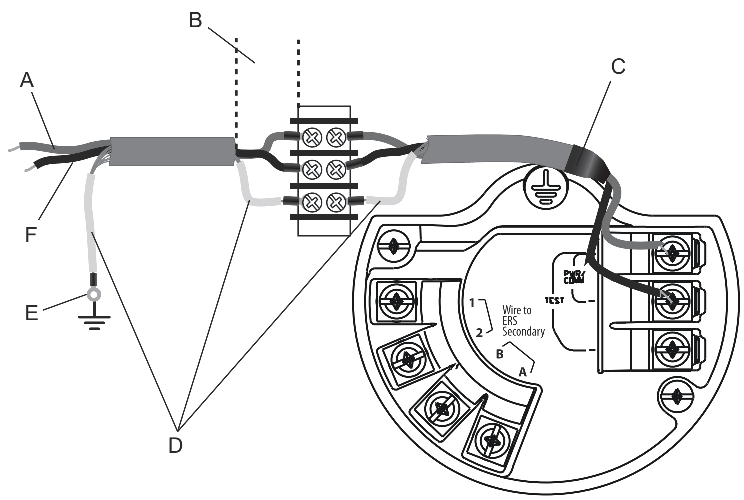
Ground the shield of the signal wiring at any one point on the signal loop. See Figure 3-15. The negative terminal of the power supply is a recommended grounding point.

NOTICE

If a lightning strike occurs, the ground wire may carry excessive current.

Grounding the transmitter case using the threaded conduit connection may not provide a sufficient ground. The transient protection terminal block (option code T1) will not provide transient protection unless the transmitter case is properly grounded. Do not run transient protection ground wire with signal wiring.

Figure 3-15: Loop Wire Grounding (Rosemount 3051S ERS Primary Transmitter)

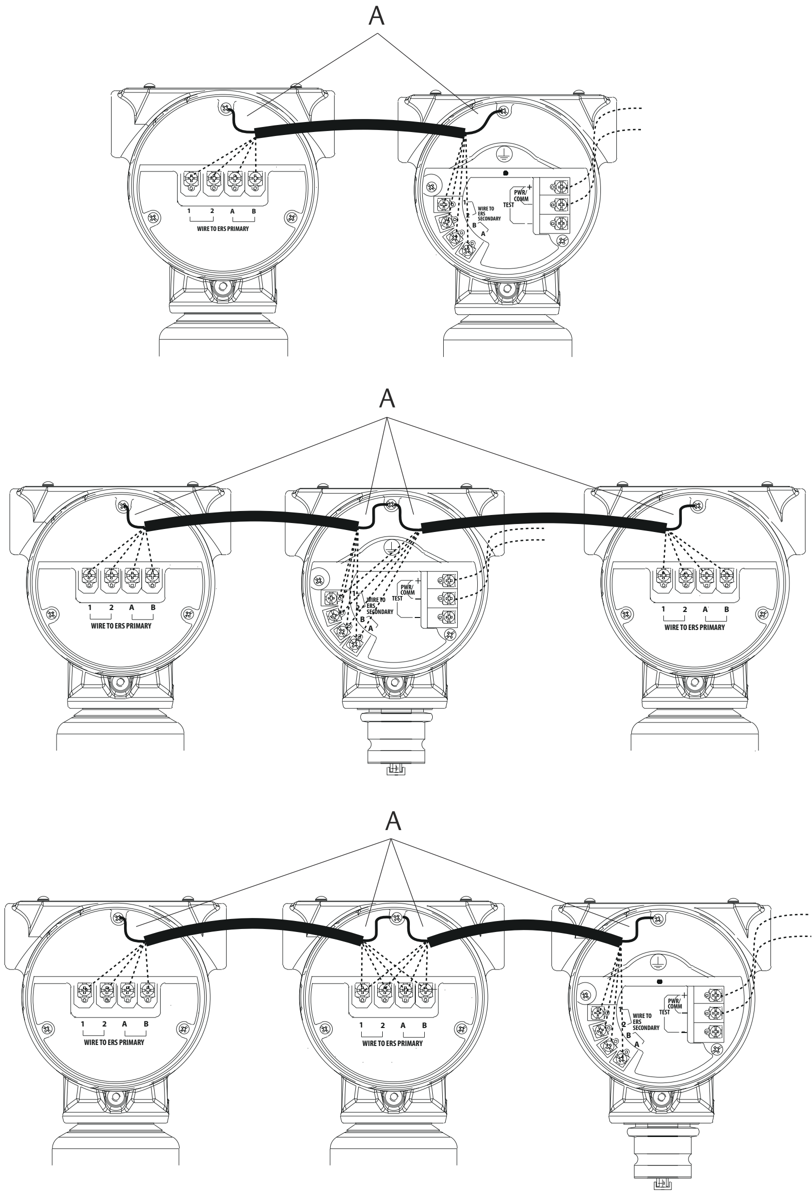


A. Positive
B. Minimize distance
C. Trim shield and insulate
D. Insulate shield
E. Connect shield back to the power supply negative terminal
F. Negative

Shield grounding

Connect the shield from the Madison Cable assembly to each housing case for the applicable wiring configuration as shown in Figure 3-16.

Figure 3-16: Shield Grounding



A. Cable shield

Transmitter case

⚠ WARNING

Always ground the transmitter case in accordance with national and local electrical codes. The most effective transmitter case grounding method is a direct connection to earth ground with minimal impedance (< 1 ohm).

Methods for grounding the transmitter case include:

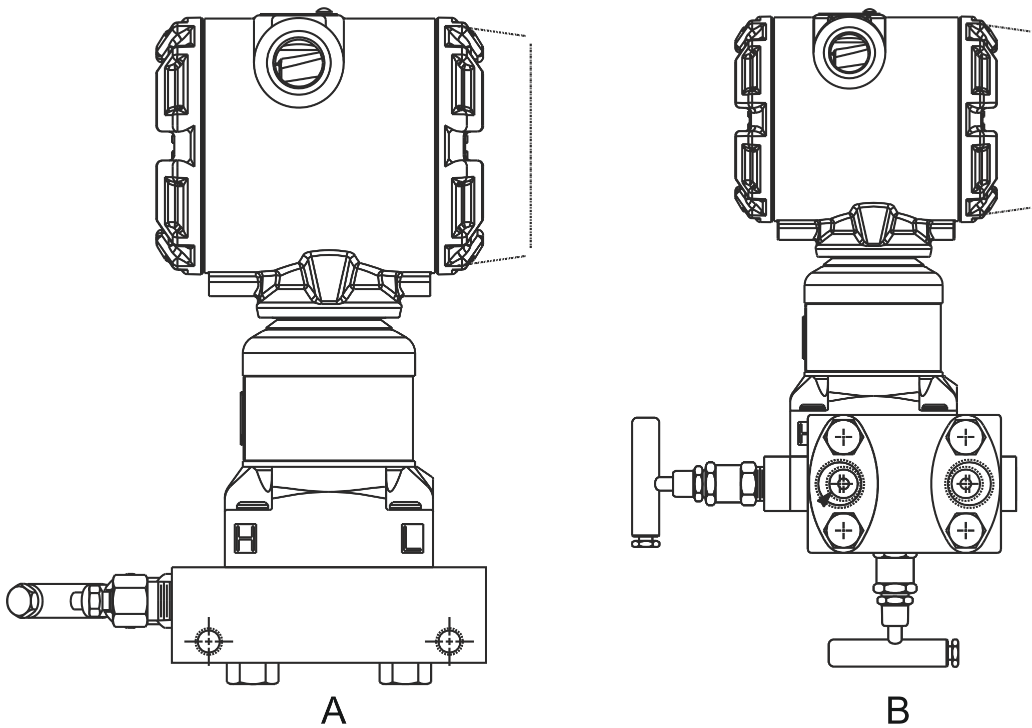
- Internal ground connection: The Internal Ground Connection screw is inside the terminal side of the electronics housing. The screw is identified by a ground symbol (⏚), and is standard on all Rosemount 3051S ERS Transmitters.
- External ground connection: The External Ground Connection is on the outside of the SuperModule™ housing. The connection is identified by a ground symbol (⏚).

3.5 Rosemount manifolds

The Rosemount 305 Integral Manifold assembles directly to a 3051S ERS Transmitter, eliminating the need for the flange.

The 305 is available in two designs: Coplanar™ (bottom process connections) and traditional (side process connections).

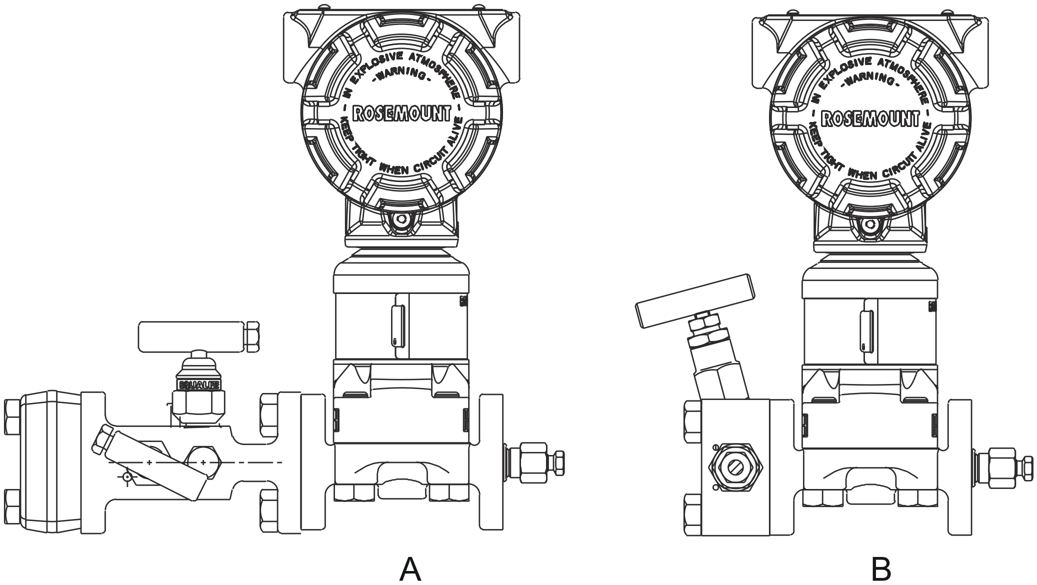
Figure 3-17: Rosemount 305 Integral Manifolds



A. Coplanar
B. Traditional

The Rosemount 304 Conventional Manifold assembles directly to an instrument flange for easy servicing and retrofitting. The Rosemount 304 is available in two basic styles: traditional (flange × flange and flange × pipe) and wafer.

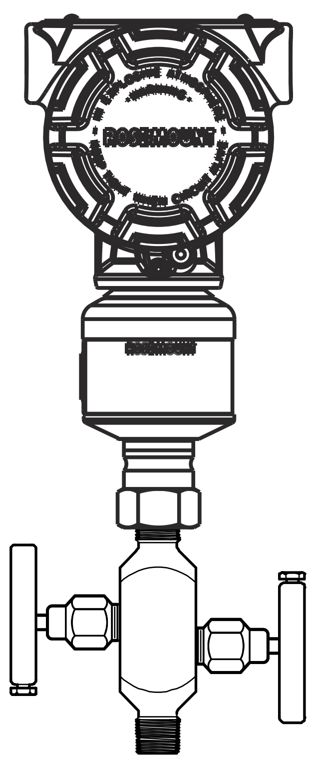
Figure 3-18: Rosemount 304 Conventional Manifolds



A. *Traditional*
B. *Wafer*

The Rosemount 306 Manifold assembles directly to an in-line style transmitter and is available with male or female 1/2-in. NPT process connections.

Figure 3-19: Rosemount 306 In-Line Manifold



3.5.1 305 Manifold installation procedure

Procedure

1. Inspect the PTFE sensor module O-rings.

   If the O-rings are undamaged, reusing them is recommended. If the O-rings are damaged (if they have nicks or cuts, for example), replace them with new O-rings.

   NOTICE

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

2. Install the integral manifold on the sensor module process connection. Use the four manifold bolts for alignment. Finger-tighten the bolts, then tighten the bolts incrementally in a cross pattern to final torque value.

   See Flange bolts for complete bolt installation information and torque values.

   When fully tightened, the bolts should extend through the top of the SuperModule™ housing.
3. If the PTFE sensor module O-rings have been replaced, re-tighten the flange bolts after installation to compensate for seating of the O-rings.
4. If applicable, install flange adapters on the process end of the manifold using the 1.75-in. flange bolts supplied with the Rosemount 3051S ERS Transmitter.

3.5.2 Install Rosemount 304 Manifold

To install a 304 Conventional Manifold to a 3051S ERS Transmitter:

Procedure

1. Align the Rosemount 304 Manifold with the sensor flange. Use the four manifold bolts for alignment.
2. Finger tighten the bolts, then tighten the bolts incrementally in a cross pattern to final torque value.

   See Flange bolts for complete bolt installation information and torque values.

   When fully tightened, the bolts must extend through the top of the sensor module assembly bolt hole but must not contact the transmitter housing.
3. If applicable, install flange adapters on the process end of the manifold using the 1.75-in. flange bolts supplied with the Rosemount 3051S ERS Transmitter.

3.5.3 Rosemount 306 Manifold installation procedure

To install a Rosemount 306 In-Line Manifold to a Rosemount 3051S ERS Transmitter:

Procedure

1. Place the Rosemount 3051S ERS Transmitter into a holding fixture.
2. Apply appropriate thread paste or tape to the threaded instrument end of the manifold.
3. Count the total threads on the manifold before starting assembly.
4. Start turning the manifold by hand into the process connection on the transmitter.

NOTICE

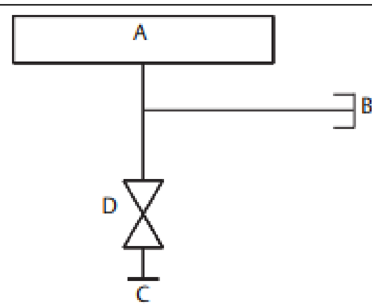
Ensure the thread tape does not strip.

5. Wrench-tighten the manifold into the process connection.
   The minimum torque value is 425 in.-lbs.
6. Count how many threads are still showing.
   The minimum thread engagement is three revolutions.
7. Subtract the number of threads showing (after tightening) from the total threads to calculate the revolutions engaged. Further tighten until a minimum of three rotations is achieved.
8. For block and bleed manifold, verify the bleed screw is installed and tightened. For two-valve manifold, verify the vent plug is installed and tightened.
9. Leak-check assembly to maximum pressure range of transmitter.

3.5.4 Manifold valve configurations

Block-and-bleed manifold

The block-and-bleed configuration is available on the 306 Manifold for use with in-line gauge and absolute pressure transmitters. A single block valve provides instrument isolation, and a plug provides draining/vent capabilities.

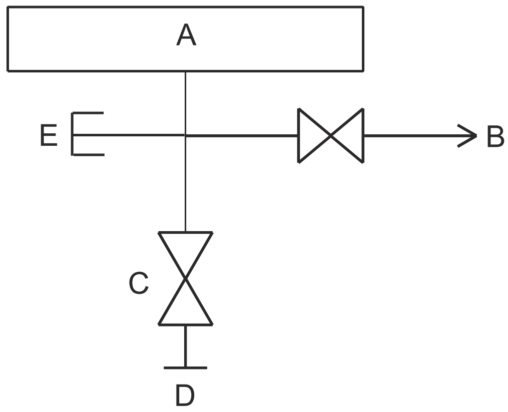


A. Transmitter
B. Bleed screw
C. Process
D. Isolate

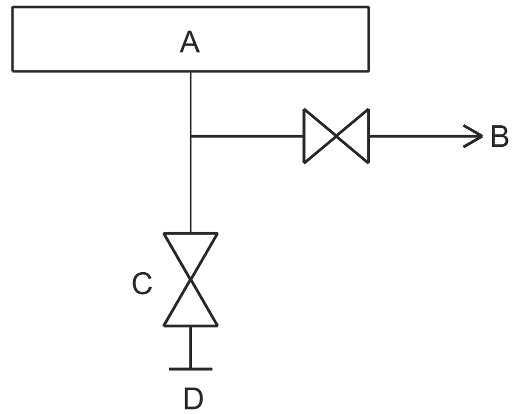
Two-valve manifold

The two-valve configuration is available on the Rosemount 304, 305, and 306 Manifolds for use with gauge and absolute pressure transmitters. A block valve provides instrument isolation, and a drain/vent valve allows for venting, draining, or calibration.

Rosemount 305 and 305 Valve Configuration



Rosemount 304 2-Valve Configuration



A. Transmitter
B. Test/vent
C. Process
D. Isolate
E. Test (plugged)

4 Operation and maintenance

4.1 Overview

This section contains information on commissioning and operating a 3051S Electronic Remote Sensor (ERS) System.

Instructions for performing operation and maintenance functions are given for a communication device. For convenience, communication device Fast Key sequences are labeled “Fast Keys” for each software function below the appropriate headings.

Example software function

Fast Keys	1, 2, 3, etc.

4.2 Calibration

4.2.1 Calibration overview

Calibrating a Rosemount ERS System involves the following tasks:

Procedure

1. Configure process variables.

   See Basic setup for additional details on configuring the following:

   - **Units of measure**
   - **Damping**
   - **Variable mapping**
   - **4** and **20 mA range points**
   - **Alarm** and **saturation** levels

2. Calibrate the P_{HI} and P_{LO} pressure sensors.

   Calibrate each pressure sensor by performing a zero/lower and an upper sensor trim.

3. Zero trim the **differential pressure**.

   Perform a zero-trim on the **Differential Pressure (DP)** reading to establish a zero-based measurement.

4. Calibrate the **4–20 mA output**.

   Adjust the **analog output** to match the control loop.

4.2.2 P_{HI} and P_{LO} sensor calibration

P_{HI} Sensor	3, 4, 3, 1
P_{LO} Sensor	3, 4, 4, 1

Each pressure sensor in the Rosemount 3051S ERS System can be individually calibrated. The calibration trim functions for both pressure sensors can be accessed by connecting to the entire ERS System with a communication device or AMS Device Manager as shown in Figure 3-12, Figure 3-13, and Figure 3-14. It is recommended to zero trim P_{HI} and P_{LO} at initial installation to remove any mounting position effects. While not mandatory, full calibration (upper and zero trims) can eliminate any stability error.

Zero trim

A **zero trim** is a single-point offset adjustment.

It is useful for compensating for mounting position effects and is most effective when performed after the transmitter is installed in its final mounting position.

Note
The pressure reading from the sensor must be within three percent of the true zero (atmospheric pressure) in order to calibrate with the **zero trim** function.

A **zero trim** cannot be performed on an absolute-style pressure sensor. To correct for mounting position effects on an absolute sensor, perform a **lower sensor trim**. The **lower sensor trim** function provides an offset correction similar to the **zero trim**, but it does not require a zero-based input.

To perform a **zero trim**:

Procedure

1. Vent the P_{HI}/P_{LO} sensor to atmosphere.
2. Wait for the P_{HI}/P_{LO} pressure measurement to stabilize.
3. Using AMS Device Manager or a communication device, perform the **zero trim** function on the P_{HI}/P_{LO} sensor.

Upper and lower sensor trims

Sensor trim is a two-point sensor calibration where lower and upper end-point pressures are applied and all readings are linearized between the two points.

Always perform a **lower sensor trim** first to establish the correct offset. The **upper sensor trim** provides a slope correction to the sensor characterization curve based on the **lower sensor trim** value.

Note
Use a pressure reference source that is at least three times more accurate than the actual transmitter sensor and allow the input pressure to stabilize for a minimum of 10 seconds prior to entering any values.

To perform a two-point **sensor trim** on the P_{HI} or P_{LO} sensor:

Procedure

1. Launch the **Lower Sensor Trim** function using AMS Device Manager or a communication device.
2. Physically apply the desired low pressure value to the P_{HI}/P_{LO} sensor using a reference pressure device such as a high-accuracy dead-weight tester.
3. Wait for the P_{HI}/P_{LO} pressure measurement to stabilize.
4. When prompted by AMS Device Manager or the communication device, define the amount of pressure that was applied to the P_{HI}/P_{LO} sensor.
5. Launch the **Upper Sensor Trim** function using AMS Device Manager or a communication device.

6. Physically apply the desired high-pressure value to the P_{HI}/P_{LO} sensor using a reference pressure device, such as a high-accuracy dead-weight tester.
7. Wait for the P_{HI}/P_{LO} pressure measurement to stabilize.
8. When prompted by AMS Device Manager or the communication device, define the amount of pressure that was applied to the P_{HI}/P_{LO} sensor.

4.2.3 DP calibration

Fast keys	3, 4, 2, 1

The **DP calibration** function can be used to adjust the calculated DP measurement of the system. For example, a **DP zero trim** can be performed if the calculated DP of the system has a small offset when the expected output should be **0 DP**.

Note

Because the DP calculation is dependent on the P_{HI} and P_{LO} pressure measurements, all **DP calibration** functions must be performed after completing the calibration functions on the individual P_{HI} and P_{LO} sensors.

Zero trim for PHI and PLO eliminates the DP offset. Performing a **zero DP trim** will establish a new DP zero point (and eliminate any residual **DP zero trims**). A **zero DP trim** should be performed after installing and calibrating the individual pressure sensors and before subjecting the ERS System to the actual process conditions in order to establish a zero-based DP measurement.

Differential pressure (DP) zero trim

The **DP zero trim** function establishes a true zero-based DP calculation by taking the current measurement output and forcing that value as the new zero-reference.

A **DP zero trim** should only be performed when the expected output of the ERS System is **0 DP**. For non-zero based trims, a **DP Lower Trim** should be performed instead.

The **DP zero trim** function requires both pressure sensors to be wired and connected.

To perform a **DP zero trim**:

Procedure

1. Ensure that the individual P_{HI} and P_{LO} pressure sensors have been calibrated as detailed on P_{HI} and P_{LO} sensor calibration and are wired together as shown in Figure 3-12, Figure 3-13, or Figure 3-14.
2. Launch the **DP Zero Trim** function using AMS Device Manager or a communication device.
3. Apply **0 DP** to the system and wait for the DP measurement to stabilize.
4. Using AMS Device Manager or a communication device, perform the **zero trim** function on the system.

Upper and lower DP trims

The DP calculation can be trimmed using a two-point calibration where lower and upper end-point pressures are applied, and all readings are linearized between the two points.

Unlike the **DP zero trim** function, the **upper** and **lower DP trims** can be performed when the ERS System is pressurized under actual process conditions.

Always perform a **lower DP trim** first to establish the correct offset. The **upper DP trim** provides a slope correction.

To perform a two-point **DP trim**:

Procedure

1. Launch the **Lower DP Trim** function using AMS Device Manager or a communication device.
2. Physically apply the desired low DP value to the entire ERS System.

   This may require the use of two separate reference pressure devices.
3. Wait for the DP value to stabilize.
4. When prompted by AMS Device Manager or the communication device, define the amount of DP that was applied to the system.
5. Launch the **Upper DP Trim** function using AMS Device Manager or a communication device.
6. Physically apply the desired high DP value to the entire ERS System.

   This may require the use of two separate reference pressure devices.
7. Wait for the DP value to stabilize.
8. When prompted by AMS Device Manager or the communication device, define the amount of DP that was applied to the system.

4.2.4 Analog output trim

Fast Keys	3, 4, 1, 1

The **analog output trim** command allows for the adjustment of the 4–20 mA output of the system to match a plant or control system standard. This command only impacts the digital-to-analog conversion that drives the analog output and does not affect the actual DP calculation.

To perform an **analog output trim**:

Procedure

1. Launch the **Analog Trim** function using AMS Device Manager or a communication device.
2. Connect a reference milliamp meter to the **4–20 mA output** of the primary sensor. Connect the positive lead to the positive terminal and the negative lead to the test terminal.
   The **Analog Trim** function will then force the **analog output** of the ERS System to 4 mA.
3. Enter the mA reading from the reference meter when prompted.
   The **mA output** of the system will be adjusted based on the value entered in Step 3.
4. Select an option:
   - If the reference meter still does not read "4 mA," select **NO**, and repeat Step 3.
   - If the reference meter reads "4 mA," select **YES** and continue to Step 5.
5. Repeat Step 3 and Step 4 for the **20 mA output**.

4.2.5 Recall factory trim

Analog output	3, 4, 1, 2
Differential pressure (DP)	3, 4, 2, 2

P_{HI} **sensor**	3, 4, 3, 2
P_{LO} **sensor**	3, 4, 4, 2

The **recall factory trim** command allows the restoration of the as-shipped factory settings of the **analog output**, **DP**, and the P_{HI} and P_{LO} **sensor** calibrations. This command can be useful for recovering from an inadvertent trim or an inaccurate pressure source.

4.3 Functional tests

Fast Keys	3, 5, 5

The **loop test** command verifies the output of the ERS System, the integrity of the 4–20 mA loop, and the operations of any recorders or similar devices installed in the loop.

To perform a **loop test**:

Procedure

1. Connect a reference meter to the Rosemount ERS System by either connecting the meter to the test terminals on the terminal block of the ERS primary sensor or shunting power through the meter at some point in the loop.
2. Launch the **loop test** function using AMS Device Manager or a communication device.
3. When prompted, select a mA value to have the ERS System output on the 4–20 mA loop.
4. Check the reference meter installed in the test loop to verify and compare the reading to the expected mA output of the ERS System.
   - If the values match, the ERS System and the loop are configured and functioning properly.
   - If the values do not match, the reference meter may be attached to the wrong loop, there may be a fault in the wiring, the ERS System may require an **analog output trim**, or the reference meter may be malfunctioning.

4.3.1 Find device

Fast Keys	1, 7

The **find device** function causes the system to flash a unique pattern of characters (Figure 4-1) on the LCD display, making the system easily identifiable in person. The **Find Device** function requires a digital display to be installed on the primary transmitter.

Figure 4-1: Find Device Pattern

0 - 0 - 0 - 0

Procedure

Launch the **find device** function using AMS Device Manager or a communication device.

The system will continue to display the pattern shown in Figure 4-1 until the **Find Device** function is stopped.

Note
It may take up to 60 seconds for the display to return to normal operation after completion of the **Find Device** function.

4.4 Field upgrades and replacements

4.4.1 Disassembly considerations

⚠ WARNING

During disassembly, do not remove any instrument covers in explosive atmospheres when the circuit is live, as this may result in serious injury or death.

Be aware of the following:

- Follow all plant safety rules and procedures.
- Before removing the transmitter from service, isolate and vent the process from the transmitter.
- Disconnect optional process temperature sensor leads and cable.
- Remove all other electrical leads and conduit.
- Detach the process flange by removing the four flange bolts and two alignment screws that secure it.
- Do not scratch, puncture, or depress the isolating diaphragms.
- Clean isolating diaphragms with a soft rag and a mild cleaning solution, then rinse with clear water.
- Whenever the process flange or flange adapters are removed, visually inspect the PTFE O-rings. Emerson recommends reusing O-rings if possible. If the O-rings show any signs of damage, such as nicks or cuts, they must be replaced.

4.4.2 Labeling

Field device labels

The label on the SuperModule™ reflects the replacement model code for reordering a complete ERS Transmitter, including both the SuperModule assembly and the electronics housing. You can use the Rosemount 300 ERS model code stamped on the electronics housing nameplate to reorder an electronics housing assembly.

4.4.3 Removing the terminal block

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

Rosemount 3051S ERS primary (Plantweb™ housing)

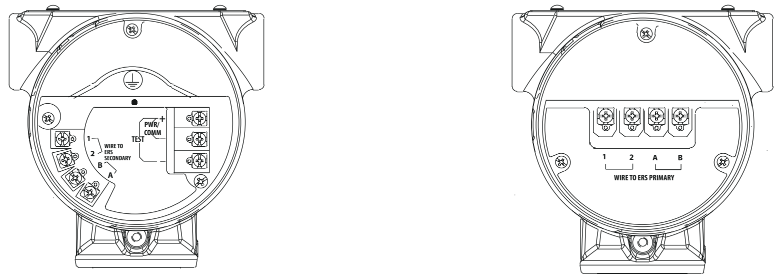
Loosen the two small screws located at the 10 o'clock and 4 o'clock positions, and pull the entire terminal block out.

3051S ERS secondary (junction box)

Loosen the two small screws located at the 8 o'clock and 4 o'clock positions and pull the entire terminal block out. This procedure will expose the SuperModule connector (see Figure 4-3). Grasp the SuperModule connector and pull upwards.

Figure 4-2: Terminal Blocks

Rosemount 3051S ERS Primary | Rosemount 3051S ERS Secondary



4.4.4 Remove the electronics

To remove the electronics feature board from a primary transmitter:

Procedure

1. Remove the housing cover opposite the field terminal side.
2. Remove the LCD display (if applicable) by holding in the two clips and pulling outward.

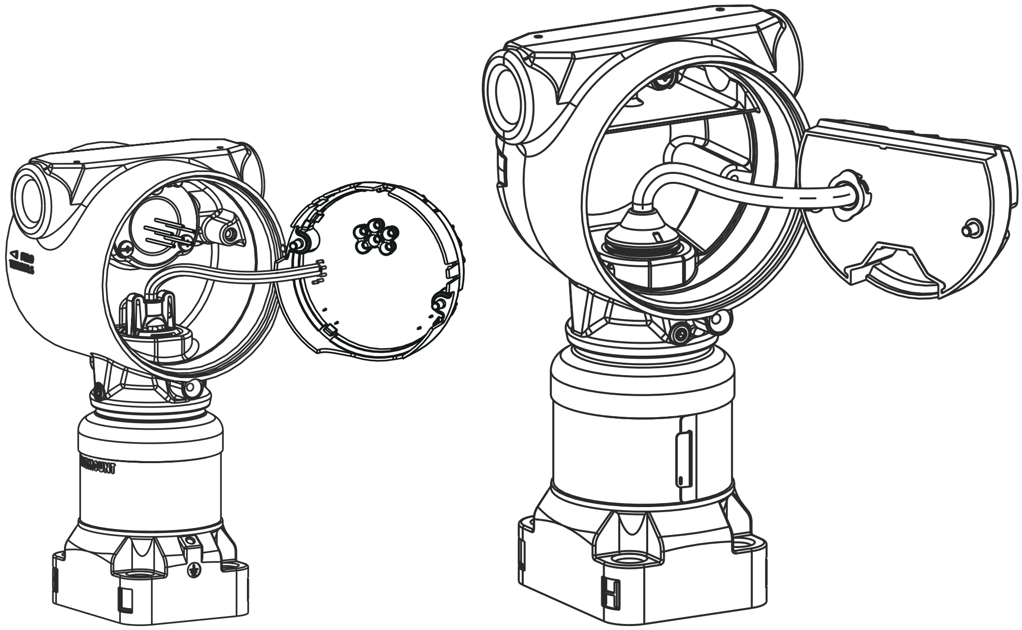
   This will provide better access to the two screws located on the electronics feature board.
3. Loosen the two small screws located on the assembly in the 8 o’clock and 2 o’clock positions.
4. Pull out the assembly to expose the SuperModule™ connector (see Figure 4-3).
5. Grasp the SuperModule connector and pull upwards (avoid pulling wires).

   Housing rotation may be required to access locking tabs.

Figure 4-3: SuperModule electrical connector

3051S ERS Primary

Rosemount 3051S ERS Secondary



4.4.5 Remove the SuperModule™ from the housing

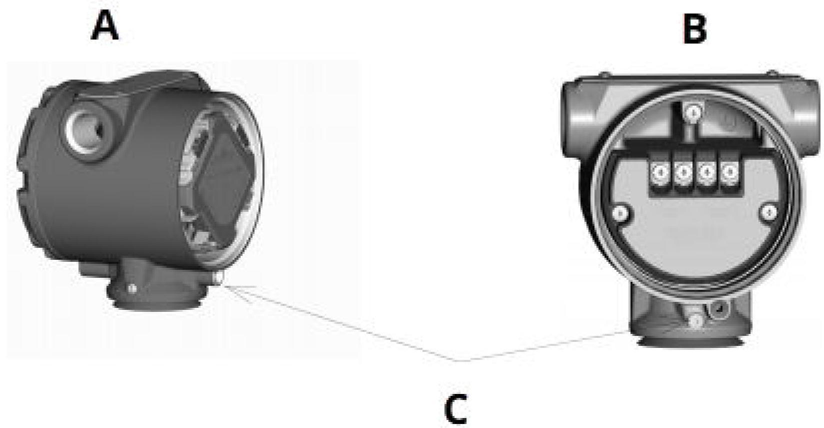
NOTICE

To prevent damage to the SuperModule cable, remove the feature board or terminal block assembly with the connector before separating the SuperModule from the housing assembly.

Procedure

1. Loosen the housing rotation set screw by one full turn with a 3/32-in. hex wrench.
2. Unscrew the housing from the SuperModule.

Figure 4-4: Location of housing rotation set screw



A. *Plantweb™ housing*
B. *Junction box housing*
C. *Housing rotation set screw (3/32-in.)*

4.4.6 Attach the SuperModule™ to the housing

Procedure

1. Install the V-Seal at the bottom of the housing.
2. Apply a light coat of low temperature silicon grease to the SuperModule threads and O-ring.
3. Thread the housing completely onto the SuperModule.

⚠ WARNING

To comply with explosion-proof requirements, the housing must be no more than one full turn from flush with the SuperModule.

4. Tighten the housing rotation set screw using 3/32-in. hex wrench.

4.4.7 Install electronics assembly

Procedure

1. Apply a light coat of low temperature silicon grease to the SuperModule™ connector.
2. Insert the SuperModule connector into the top of the SuperModule.
3. Gently slide the assembly into the housing, making sure the pins from the Plantweb™ housing properly engage the receptacles on the assembly.
4. Tighten the captive mounting screws.
5. Attach the Plantweb housing cover and tighten so that metal contacts metal to meet explosion-proof requirements.

4.4.8 Installing the terminal block

Rosemount 3051S ERS primary (Plantweb™ housing)

Procedure

1. Gently slide the terminal block into the housing.

   Make sure the pins from the Plantweb housing properly engage the receptacles on the terminal block.
2. Tighten the captive screws on the terminal block.
3. Attach the Plantweb housing cover and tighten so that metal contacts metal to meet explosion-proof requirements.

Install terminal block in 3051S ERS secondary (junction box)

Procedure

1. Apply a light coat of low temperature silicon grease to the SuperModule™ connector.
2. Insert the SuperModule connector into the top of the SuperModule.
3. Push the terminal block into the housing and hold for screw position alignment.
4. Tighten the captive mounting screws.
5. Attach the junction box housing cover and tighten so that metal contacts metal to meet explosion-proof requirements.

4.4.9 Reassemble the process flange

Note
If the installation uses a manifold, see Rosemount manifolds.

Procedure

1. Inspect the SuperModule™ PTFE O-rings.

   If the O-rings are undamaged, Emerson recommends reusing them. If the O-rings are damaged (if they have nicks or cuts, for example), replace them with new O-rings.

   NOTICE

   If replacing the O-rings, be careful not to scratch or deface the O-ring grooves or the surface of the isolating diaphragm when removing the damaged O-rings.
2. Install the process flange on the SuperModule. To hold the process flange in place, install the two alignment screws to finger tight (screws are not pressure retaining).

   NOTICE

   Do not over-tighten; this will affect module-to-flange alignment.
3. Install the appropriate flange bolts.
   a) If the installation requires a 1/4–18 NPT connection(s), use four 1.75-in. flange bolts. Go to 3.d.

b) If the installation requires a 1/2–14 NPT connection(s), use two 2.88-in. process flange/adapter bolts and two 1.75-in. bolts. Go to Step 3.c.

c) Hold the flange adapters and adapter O-rings in place. Go to Step 3.e.

d) Finger-tighten the bolts.

e) Tighten the bolts to the initial torque value using a crossed pattern.

See Table 4-1 for appropriate torque values.

f) Tighten the bolts to the final torque value using a crossed pattern.

See Table 4-1 for appropriate torque values.

When fully tightened, the bolts will extend through the top of the module housing.

g) If the installation uses a conventional manifold, then install flange adapters on the process end of the manifold using the 1.75-in. flange bolts supplied with the sensor.

Table 4-1: Bolt Installation Torque Values

Bolt material	Initial torque value	Final torque value
Carbon steel (CS)-ASTM-A445 Standard	300 in-lb. (34 N-m)	650 in-lb. (73 N-m)
316 stainless steel (SST) - Option L4	150 in-lb. (17 N-m)	300 in-lb. (34 N-m)
ASTM-A-193-B7M - Option L5	300 in-lb. (34 N-m)	650 in-lb. (73 N-m)
Alloy K-500 - Option L6	300 in-lb. (34 N-m)	650 in-lb. (73 N-m)
ASTM-A-453-660 - Option L7	150 in-lb. (17 N-m)	300 in-lb. (34 N-m)
ASTM-A-193-B8M - Option L8	150 in-lb. (34 N-m)	300 in-lb. (34 N-m)

4. If replacing the PTFE SuperModule O-rings, re-torque the flange bolts after installation to compensate for cold flow.
5. Install the drain/vent valve.

    a) Apply sealing tape to the threads on the seat. Starting at the base of the valve with the threaded end pointing toward the installer, apply two clockwise turns of sealing tape.

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

    c) Tighten the drain/vent valve to 250 in-lb. (28.25 N-m).

5 Troubleshooting

5.1 Overview

This section contains information for troubleshooting the Rosemount™ 3051S Electronic Remote Sensor (ERS)™ System. Diagnostic messages are communicated via the LCD display or a HART® host.

5.2 HART® host diagnostics

The ERS System provides numerous diagnostic alerts via a HART host, including a communication device and AMS™ Device Manager.

If a malfunction is suspected despite the absence of any diagnostic messages on a communication device or host, follow the procedures described here to verify that ERS System and process connections are in good working order.

5.3 LCD display diagnostics

The optional LCD display on the ERS System can show abbreviated operation, error, and warning messages for troubleshooting.

Messages appear according to their priority; normal operating messages appear last. To determine the cause of a message, use a HART® host to further interrogate the ERS System. A description of each LCD diagnostic message follows.

Error messages

An error indicator message appears on the LCD display to warn of serious problems affecting the operation of the ERS System. The error message is displayed until the error condition is corrected; **ERROR** appears at the bottom of the display.

Warning messages

Warning messages appear on the LCD display to alert the user of user-repairable problems with the ERS System, or current operations. Warning messages appear alternately with other information until the warning condition is corrected or the ERS System completes the operation that triggered the warning message.

5.3.1 CURR SAT

LCD display message

CURR SAT

Host diagnostic message

mA Output Saturated

Potential cause

The **primary variable** has exceeded the range points defined for the 4-20 mA **analog output signal**. The **analog output** is fixed at the **high** or **low saturation point** and is not representative of the current process conditions.

Recommended action

Verify the process conditions and modify the **Analog Range** values if necessary.

5.3.2 DIFFERENTIAL PRESSURE (DP) ALERT

LCD display message

DP ALERT

Host diagnostic message

System DP Alert

Potential cause

The ERS System is measuring a differential pressure value that exceeds the configured **upper** or **lower alert** value.

Recommended actions

1. Verify the measured DP is beyond the trip limits.
2. If necessary, modify the trip limits or disable the diagnostic.

5.3.3 FAIL BOARD ERROR

LCD display message

FAIL BOARD ERROR

Host diagnostic message

Electronics Error

Potential cause

The electronics feature board in the ERS primary unit has malfunctioned.

Recommended action

Replace the electronics feature board.

5.3.4 FAIL P_{HI} ERROR

LCD display message

FAIL P_{HI} **ERROR**

Host diagnostic message

P_{HI} **Module Failure**

Potential cause

The P_{HI} sensor module has failed.

Recommended actions

1. Verify the P_{HI} **Module Temperature** is within the operating limits of the sensor.
2. Replace the P_{HI} sensor module if necessary.

5.3.5 FAIL P_{LO} ERROR

LCD display message

FAIL P_{LO} **ERROR**

Host diagnostic message

P_{LO} **Module Failure**

Potential cause

The P_{LO} sensor module has failed.

Recommended actions

1. Verify the P_{LO} **Module Temperature** is within the operating limits of the sensor.
2. If necessary, replace the P_{LO} sensor module.

5.3.6 FAIL T_{HI} ERROR

LCD display message

FAIL T_{HI} **ERROR**

Host diagnostic message

P_{HI} **Module Failure**

Potential cause

The P_{HI} sensor module has failed.

Recommended actions

1. Verify the P_{HI} **Module Temperature** is within the operating limits of the sensor.
2. Replace the P_{HI} sensor module if necessary.

5.3.7 FAIL T_{LO} ERROR

LCD display message

FAIL T_{LO} **ERROR**

Host diagnostic message

P_{LO} **Module Failure**

Potential cause

The P_{LO} sensor module has failed.

Recommended actions

1. Verify the P_{LO} **Module Temperature** is within the operating limits of the sensor.
2. Replace the P_{LO} sensor module if necessary.

5.3.8 P_{HI} ALERT

LCD display message

P_{HI} **ALERT**

Host diagnostic message

P_{HI} **Pressure Alert**

Potential cause

The P_{HI} sensor module has detected a pressure value that exceeds the **upper** or **lower alert** value.

Recommended actions

1. Verify the P_{HI} **Pressure** is beyond the trip limits.
2. If necessary, modify the trip limits or disable the diagnostics.

5.3.9 P_{HI} LIMIT

LCD display message

P_{HI} **LIMIT**

Host diagnostic message

P_{HI} **Pressure Out of Limits**

Potential cause

The P_{HI} **Pressure** reading has exceeded the sensor's maximum measurement range.

Recommended action

Check the process for potential overpressure conditions.

5.3.10 P_{LO} ALERT

LCD display message

P_{LO} **ALERT**

Host diagnostic message

P_{LO} Pressure Alert

Potential cause

The P_{LO} sensor module has detected a pressure value that exceeds the configured **upper** or **lower alert** value.

Recommended actions

1. Verify the measured P_{LO} **Pressure** is beyond the trip limits.
2. If necessary, modify the trip limits or disable the diagnostic.

5.3.11 P_{LO} COMM ERROR

LCD diagnostic message

P_{LO} **COMM ERROR**

Host diagnostic message

P_{LO} **Module Communication Error**

Potential cause

Communication between the P_{LO} sensor module and the electronics feature board has been lost.

Recommended actions

1. Verify the wiring between the P_{LO} module and the electronics feature board and cycle power to the entire ERS System.
2. Replace the P_{LO} module and/or electronics feature board if necessary.

5.3.12 P_{LO} LIMIT

LCD display message

P_{LO} **LIMIT**

Host diagnostic message

P_{LO} **Pressure Out of Limits**

Potential cause

The P_{LO} **Pressure** reading has exceeded the sensor's maximum measurement range.

Recommended action

Check the process for potential overpressure conditions.

5.3.13 LOOP TEST

LCD display message

LOOP TEST

Host diagnostic message

mA Output Fixed

Potential cause

The analog output of the ERS System is in **fixed current** mode and is not representative of the HART® **Primary Variable (PV)**.

Recommended action

Using a communication device or AMS Device Manager, disable **Loop Current** mode.

5.3.14 SNSR COMM ERROR

LCD display message

SNSR COMM ERROR

Host diagnostic message

Sensor Module Missing

Potential cause

A sensor module is missing or not detected.

Recommended action

Verify that both sensors are properly connected and wired.

5.3.15 No P_{HI} Module Configuration Present

LCD display message

SNSR CONFIG ERROR

Host diagnostic message

No P_{HI} Module Configuration Present

Potential cause

Neither of the modules in the ERS System are configured as the P_{HI} sensor.

Recommended actions

1. Verify that both sensors are connected and properly wired.
2. Change the pressure designation of one of the two modules to P_{HI} using a communication device or AMS Device Manager.

5.3.16 No P_{LO} Module Configuration Present

LCD display message

SNSR CONFIG ERROR

Host diagnostic message

No P_{LO} Module Configuration Present

Potential cause

Neither of the modules in the ERS System are configured as the P_{LO} sensor.

Recommended actions

1. Verify that both sensors are connected and properly wired.
2. Using a communication device or AMS Device Manager, change the pressure designation of one of the two modules to P_{LO}

5.3.17 Unknown Sensor Module Configuration

LCD display message

SNSR CONFIG ERROR

Host diagnostic message

Unknown Sensor Module Configuration

Potential cause

The configuration of one or both sensor modules is unknown.

Recommended actions

1. Verify that both sensors are connected and properly wired.
2. Using a communication device or AMS Device Manager, assign one of the modules as the P_{HI} sensor and the other module as the P_{LO} sensor.

5.3.18 SNSR INCOMP ERROR

LCD display message

SNSR INCOMP ERROR

Host diagnostic message

Sensor Module Incompatibility

Potential cause

The ERS System contains two sensor modules that will not work together. The ERS System cannot contain one gauge and one absolute pressure sensor.

Recommended action

Replace one of the two modules so that both sensors are either gauge or absolute.

5.3.19 Stuck Span Button

LCD display message

STUCK KEY

Host diagnostic message

Stuck Span Button

Potential cause

The **Span** button on the electronics feature board is stuck.

Recommended actions

1. Locate the ERS primary unit.
2. Remove the front housing cover (considering hazardous location requirements).
3. Gently pry the **Span** button.

5.3.20 Stuck Zero Button

LCD display message

STUCK KEY

Host diagnostic message

Stuck Zero Button

Potential cause

The **Zero** button on the electronics feature board is stuck.

Recommended actions

1. Locate the ERS primary unit.
2. Remove the front housing cover (considering hazardous location requirements).
3. Gently pry the **Zero** button.

5.3.21 T_{HI} ALERT

LCD display message

T_{HI} **ALERT**

Host diagnostic message

P_{HI} **Temperature Alert**

Potential cause

The P_{HI} sensor module has detected a temperature value that exceeds the configured **upper** or **lower alert** value.

Recommended actions

1. Verify the measured P_{HI} temperature is beyond the trip limits.
2. If necessary, modify the trip limits or disable the sensor.

5.3.22 T_{HI} LIMIT

LCD display message

T_{HI} **LIMIT**

Host diagnostic message

P_{HI} **Module Temp. Out of Limits**

Potential cause

The internal temperature sensor on the P_{HI} pressure module has exceeded the safe operating range.

Recommended action

Verify the ambient conditions do not exceed the temperature limits of the pressure module (-40 to +185 °F [-40 to +85 °C]).

5.3.23 T_{LO} ALERT

LCD display message

T_{LO} **ALERT**

Host diagnostic message

P_{LO} **Temperature Alert**

Potential cause

The P_{LO} sensor module has detected a temperature value that exceeds the configured **upper** or **lower alert** value.

Recommended actions

1. Verify the measured P_{LO} temperature is beyond the trip limits.
2. If necessary, modify the trip limits or disable the diagnostic.

5.3.24 T_{LO} LIMIT

LCD display message

T_{LO} **LIMIT**

Host diagnostic message

P_{LO} **Module Temp. Out of Limits**

Potential cause

The internal temperature on the P_{LO} pressure module has exceeded the safe operating range.

Recommended action

Verify the ambient conditions do not exceed the temperature limits of the pressure module (-40 to +185 °F [-40 to +85 °C]).

5.3.25 XMTR INFO

LCD display message

XMTR INFO

Host diagnostic message

Non-Volatile Memory Warning

Potential cause

ERS System information data is incomplete. ERS System operation will not be affected.

Recommended action

Replace the electronics feature board at the next maintenance shutdown.

5.3.26 XMTR INFO ERROR

LCD display message

XMTR INFO ERROR

Host diagnostic message

Non-Volatile Memory Error

Potential cause

Non-volatile data of the device is corrupt.

Recommended action

Replace the electronics feature board.

5.3.27 LCD display is blank

LCD display message

(LCD display is blank.)

Host diagnostic message

LCD Update Error

Potential cause

The electronics circuit board on the ERS primary unit has lost communication with the LCD display.

Recommended actions

1. Examine the LCD connector and reinstall and re-power the LCD display.
2. If the problem persists, first replace the LCD display and then replace the feature board electronics if necessary.

5.3.28 NO UPDATE

LCD display message

NO UPDATE

Host diagnostic message

LCD Update Error

Potential cause

The LCD display on the ERS primary unit is not updating.

Recommended action

Make sure the correct LCD display has been installed.

Related information

Ordering information, specifications, and drawings

5.4 ERS System troubleshooting

5.4.1 mA output of the ERS system is zero

Recommended actions

1. Verify power is applied to "+" and "−" **PWR/COMM** terminals on the ERS primary unit.
2. Check power wires for reversed polarity.
3. Verify terminal voltage is 16 to 42.4 Vdc.
4. Check for open diode across test terminals on the ERS primary unit.

5.4.2 ERS System is not communicating with a communication device or AMS Device Manager

Recommended actions

1. Verify the output is between 4 and 20 mA or saturation levels.
2. Verify clean DC power to transmitter.

   The maximum AC noise is 0.2 volts peak to peak.
3. Check that the loop resistance is 250 - 1321 Ω.

   Loop resistance = (power supply voltage - transmitter voltage)/loop current

4. Check if ERS system is at an alternate HART® address.

5.4.3 mA output of ERS System is low or high

Recommended actions

1. Verify applied process conditions.
2. Verify the desired process variable is mapped to the HART® primary variable (PV).
3. Verify 4 and 20 mA range points.
4. Verify **output** is not in **alarm** or **saturation** condition.
5. Perform an analog output trim or sensor trim.

5.4.4 ERS System is not responding to changes in measured process variables

Recommended actions

1. Check to ensure isolation valves are not closed.
2. Check test equipment.
3. Check impulse piping or manifold for blockage.
4. Verify **primary variable** measurement is between the 4 and 20 mA set points.
5. Verify **output** is not in **alarm** or **saturation** condition.
6. Verify ERS System is not in **Loop Test**, **Multidrop**, **Test Calculation**, or **Fixed Variable** mode.

5.4.5 **Digital Variable** output is too low or high

Recommended actions

1. Check test equipment (verify accuracy).
2. Check impulse piping for blockage or low fill in wet leg.
3. Verify **sensor trim** on each pressure sensor.
4. Verify measured variables are within all sensor limits.

5.4.6 **Digital Variable** output is erratic

Recommended actions

1. Verify power source to ERS System has adequate voltage and current.
2. Check for external electrical interference.
3. Verify ERS System is properly grounded.
4. Verify shield for twisted pairs only grounded at both ends.

5.4.7 ERS System output is normal, but the LCD display is off and diagnostics indicate an LCD display problem

Recommended actions

1. Verify LCD display is installed correctly.

2. Replace LCD display.

5.4.8 Differential Pressure (DP) calculation is negative

Recommended action

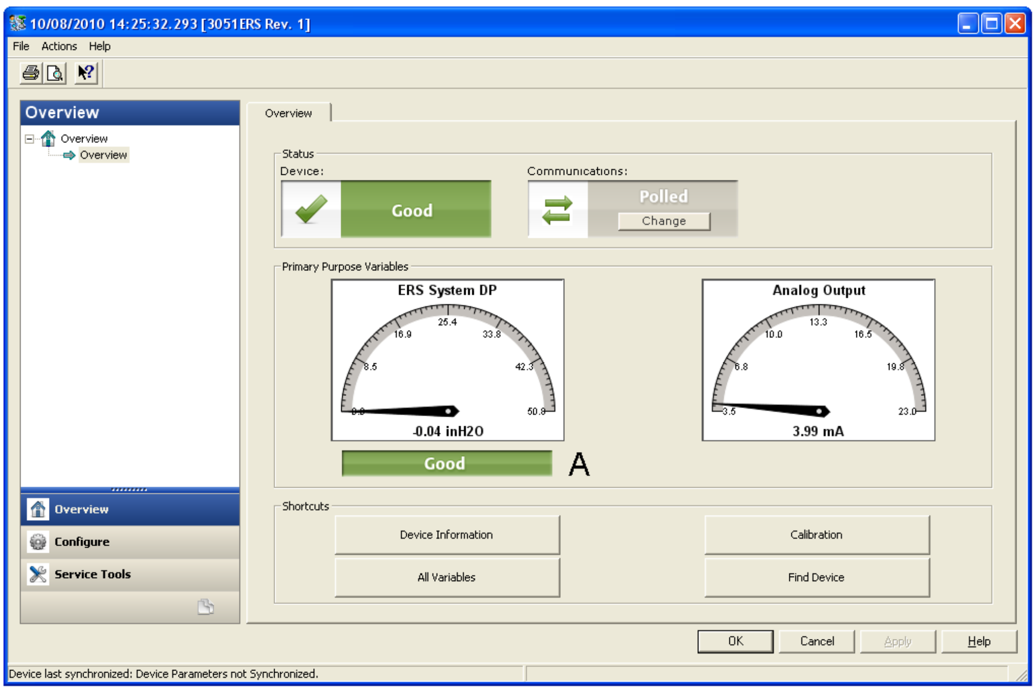
If the **Analog Output (AO)** is saturated low, verify that **DP Variable** is a possible value. If the **DP Variable** is negative, P_{HI} and P_{LO} may be reversed.

5.5 Measurement quality status

The ERS System is compliant with the HART® Revision 6 Standard.

One of the most noticeable enhancements available with the HART Revision 6 standard is that each variable has a measurement quality status. These statuses can be viewed in AMS Device Manager, with a communication device, or with any HART Revision 6 compatible host system.

Figure 5-1: Measurement Quality Status



A. *Quality Status on Differential Pressure (DP) measurement status*

Possible measurement quality statuses

- **Good**: Displayed during normal device operation.
- **Poor**: Indicates the accuracy of the measured variable has been compromised. For example, the P_{HI} **Module Temperature** has failed and is no longer compensating the P_{HI} **Pressure** measurement.
- **Bad**: Indicates the variable has failed. For example, the P_{HI} **Pressure** sensor has failed.

6 Safety Instrumented Systems (SIS) requirements

6.1 Safety Instrumented Systems (SIS) Certification

The 3051S Electronic Remote Sensor (ERS) System is a two wire, 4–20 mA architecture that calculates differential pressure electronically using two pressure sensors that are linked together with a digital cable.

The transmitter system uses standard, well-proven sensor boards in combination with a microprocessor board that performs diagnostics. It is programmed to send its output to a specified failure state, either high or low, when an internal failure is detected. It is assumed that the 4–20 mA output is used as a primary safety variable. No other output variants are covered by this report.

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

6.1.1 Rosemount ERS Systems safety certified identification

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

To identify a safety certified Rosemount ERS System, verify the following information:

- Model string should contain 3051SAM, 3051SAL_P, or 3051SAL_S
- Software revision should be 57 or higher
- Model string should contain option code QT
- Maximum ERS cable length for SIS certification is 200 ft. (60.96 m). Cable must also meet the specifications from 3051S ERS System cable specifications.

6.1.2 Installation in SIS applications

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

Environmental and operational limits are available in Reference Data.

The loop should be designed so the terminal voltage does not drop below 16 Vdc when the transmitter output is set to 23 mA. Refer to Reference Data to verify limitation.

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

6.1.3 Configuring in Safety Instrumented Systems (SIS) applications

Use any HART®-capable configuration tool to communicate with and verify configuration of the ERS System.

⚠ WARNING

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.

Damping

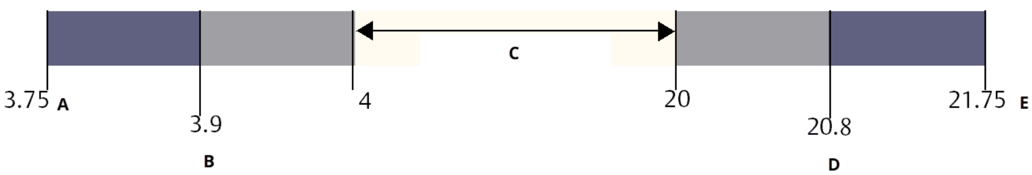
User-selected **damping** will affect the transmitter's ability to respond to changes in the applied process. The **damping** value + response time must not exceed the loop requirements.

Reference Damping to change **damping** value.

Alarm and saturation levels

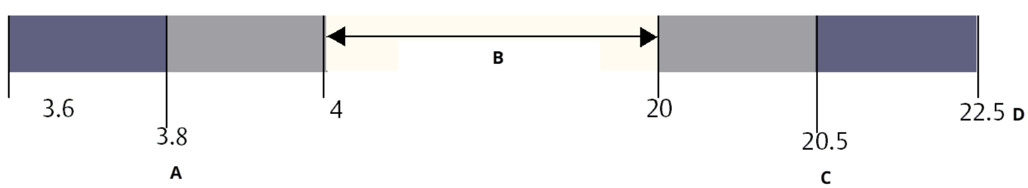
Configure distributed control system (DCS) or safety logic solver to match transmitter configuration. Figure 6-1, Figure 6-2, and Figure 6-3 identify the three alarm levels available and their operation values in mA.

Figure 6-1: Rosemount alarm levels



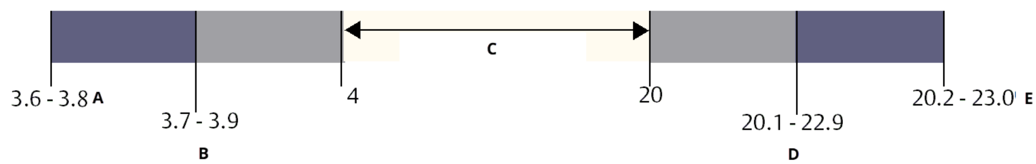
*A. Transmitter **Failure**, hardware or software alarm in **LO** position*
B. Low saturation
C. Normal operation
D. High saturation
*E. Transmitter **Failure**, hardware or software alarm in **HI** position*

Figure 6-2: Namur alarm levels



A. Low saturation
B. Normal operation
C. High saturation
D. Transmitter Failure, hardware or software alarm in HI position

Figure 6-3: Custom alarm levels



A. *Transmitter **Failure**, hardware or software alarm in **LO** position*
B. *Low saturation*
C. *Normal operation*
D. *High saturation*
E. *Transmitter **Failure**, hardware or software alarm in **HI** position*

Related information

Damping

6.1.4 3051S Safety Integrated Systems (SIS) operation and maintenance

Proof test

Emerson recommends the following proof tests:

⚠ WARNING

Ensure that qualified personnel perform all proof test procedures.

Use Fast Keys referenced in Calibration to perform a **Loop Test**, **Analog Output Trim**, or **Sensor Trim**. Security switch should be in the (unlocked) position during proof test execution and repositioned in the (locked) position after execution.

Comprehensive proof test

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

Prerequisites

Required tools: communication device 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(2).
4. Send a HART command to the transmitter to go to the low alarm current output and verify that the analog current reaches that value(3).

(2) *This tests for compliance voltage problems such as a low power supply voltage or increased wiring resistance. This also tests for other possible failures.*
(3) *This tests for possible quiescent current related failures.*

5. Perform complete system calibration (**zero** and **upper trims** for P_{HI} and P_{LO}, **zero trim** for DP)
6. Remove the bypass and otherwise restore normal operation.
7. Place the **Security** switch in the (🔒) position.

Note

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

6.1.5 Inspection

Visual inspection

Not required

Special tools

Not required

Product repair

The 3051S ERS is repairable by major component replacement.

All failures detected by the transmitter diagnostics or by the proof-test must be reported.

⚠ WARNING

Ensure qualified personnel perform all product repair and part replacement.

Rosemount 3051S ERS SIS reference

The Rosemount 3051S ERS must be operated in accordance to the functional and performance specifications provided in Reference Data.

Failure rate data

The FMEDA report includes failure rates.

Failure values

- Safety deviation (% of analog span shift that defines a dangerous failure): Two percent
- System response time: See Ordering information, specifications, and drawings
- Self-diagnostics test interval: At least once every 60 minutes

Product life

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

A Reference data

A.1 Product Certifications

To view current 3051S ERS™ Product Certifications:

1. Go to Emerson.com/Rosemount3051S.
2. Click **Documents & Drawings**.
3. Click **Manuals & Guides**.
4. Select the appropriate Quick Start Guide.

A.2 Ordering information, specifications, and drawings

To view current 3051S ERS ordering information, specifications, and drawings:

1. Go to Emerson.com/Rosemount3051S.
2. Click **Documents & Drawings**.
3. For installation drawings, click **Drawings & Schematics** and select the appropriate document.
4. For ordering information, specifications, and dimensional drawings, click **Data Sheets & Bulletins** and select the appropriate Product Data Sheet.

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For more information: **Emerson.com/global**

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