

Rosemount™ 2140 Level Detector

Vibrating Fork



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Rosemount 2140 Level Detector Vibrating Fork

NOTICE

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

For technical assistance, contacts are listed below:

Customer Central

Technical support, quoting, and order-related questions.

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

Asia Pacific: 65 777 8211

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

North American Response Center

Equipment service needs.

1 800 654 7768 (24 hours — includes Canada)

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

⚠ CAUTION

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

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

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

⚠ WARNING

Replacement equipment or spare parts not approved by Emerson for use as spare parts could reduce the capabilities of the Rosemount 2140 and 2140:SIS Level Detectors (“level detectors”), and may render the instrument dangerous.

- Use spare parts supplied or sold by Emerson.
-

▲ WARNING

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

- The Rosemount 2140 and 2140:SIS Level Detectors (“level detectors”) must be installed, connected, commissioned, operated, and maintained by suitably qualified personnel only, observing any national and local requirements that may apply.
- Use the equipment only as specified in this manual. Failure to do so may impair the protection provided by the equipment.
- The weight of a level detector with a heavy flange and extended fork length may exceed 37 lb. (18 kg). A risk assessment is required before carrying, lifting, and installing the level detector.

Explosions could result in death or serious injury.

- Please review the approvals section of this reference manual for any restrictions associated with an installation.

Electrical shock could cause death or serious injury.

- If the level detector is installed in a high voltage environment and a fault condition or installation error occurs, high voltage may be present on leads and terminals.
- Use extreme caution when making contact with the leads and terminals.
- Make sure that power to the level detector is off while making connections.

External surface may be hot.

- Care must be taken to avoid possible burns. The flange and process seal may be hot at high process temperatures. Allow time to cool before servicing.
-

Section 1 Introduction

1.1 Models covered

The following point level detectors are covered by this manual:

- Rosemount 2140 Level Detector – Vibrating Fork
- Rosemount 2140:SIS Level Detector Vibrating Fork

Note

For detailed information about proof-testing the Rosemount 2140:SIS, refer to the Rosemount 2140:SIS [Functional Safety Manual](#).

1.2 Point level detector overview

The Rosemount 2140 and Rosemount 2140:SIS are point level detectors, and are designed to use the principle of a tuning fork. A piezo-electric crystal oscillates the forks at their natural frequency, and changes to this frequency are continuously monitored by electronics. The frequency of the vibrating fork sensor changes depending on the liquid medium in which it is immersed. The denser the liquid, the lower the frequency.

When the level detector is used as a low level alarm, the liquid medium in the tank or pipe drains down past the fork, causing a change of frequency that is detected by the electronics and it indicates a dry condition.

When the level detector is used as a used as a high level alarm or for overflow detection ([Figure 1-1](#)), the liquid medium rises in the tank or pipe, making contact with the fork which then causes the electronics to indicate a wet condition.

The wet and dry conditions can be transmitted digitally as a HART® signal or as a discrete output using the analog output. See “[Analog output type and operating modes](#)” on [page 23](#) for details.

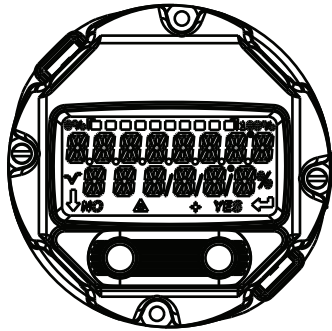
Figure 1-1. Typical Application



Major components of the point level detector are the fork and the electronics housing. The electronics housing contains the output electronics board, optional external configuration buttons, and terminal block.

An optional Local Operator Interface (“LOI”) uses a character display (Figure 1-2) to indicate the live output state, diagnostic messages, and menus. There are two rows of characters, with 8 on the upper row and 6 on the lower row. The LOI also comes with two integral buttons (“internal buttons”) for using the menu system.

Figure 1-2. Local Operator Interface (LOI) Display



1.3 Using this manual

The sections in this manual provide information on installing, operating, and maintaining the Rosemount 2140 and Rosemount 2140:SIS Level Detectors (“level detectors”). The sections are organized as follows:

[Section 2: Configuration](#) provides instruction on basic and advanced configuration tasks when commissioning and operating the level detectors.

[Section 3: Hardware Installation](#) contains mechanical installation instructions.

[Section 4: Electrical Installation](#) contains electrical installation instructions.

[Section 5: Operation and Maintenance](#) provides information on calibrating and testing.

[Section 6: Troubleshooting](#) provides troubleshooting techniques for common operating problems.

[Appendix A: Specifications and Reference Data](#) contains specifications, dimension drawings, and ordering information.

[Appendix B: Product Certifications](#) contains intrinsic safety approval information.

[Appendix C: Field Communicator Menu Tree](#) provides full menu trees to assist with commissioning, operating, and maintenance tasks.


[Appendix D: Local Operator Interface](#) provides detailed LOI menu trees to assist with commissioning, operating, and maintenance tasks.

1.4 Product recycling/disposal

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

Section 2 Configuration

2.1 Safety messages

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

▲ WARNING

Explosions could result in death or serious injury.

Installation of this Rosemount 2140 and Rosemount 2140:SIS Level Detectors (“level detectors”) in an explosive environment must be in accordance with the appropriate local, national, and international standards, codes, and practices.

Please review [Appendix B: Product Certifications](#) for any restrictions associated with a safe installation.

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

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

Process leaks may cause harm or result in death.

Install and tighten process connectors before applying pressure.

Electrical shock can result in death or serious injury.

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

2.2 Overview

This section provides instructions for using a Field Communicator, AMS™ Device Manager, or Local Operator Interface (LOI) to configure the Rosemount 2140 or Rosemount 2140:SIS Level Detectors.

For convenience, Field Communicator fast key sequences are labeled “Fast keys”.

Full Field Communicator menu trees are in [Appendix C: Field Communicator Menu Tree](#).

Local Operator Interface menu trees are in [Appendix D: Local Operator Interface](#).

2.3 Get started with your preferred configuration tool

The Rosemount 2140 Level Detector and Rosemount 2140:SIS Level Detector can easily be configured by using:

- Device Description (DD) based systems
e.g. AMS Device Manager and the 475 Field Communicator
- Local Operator Interface (LOI)

2.3.1 AMS Device Manager

Get the latest Device Description (DD)

The Device Description (DD) is a configuration tool that is developed to assist the user through the configuration tasks. The Rosemount 2140 DD is typically installed together with AMS Device Manager.

To download the latest HART DD, visit the Emerson Process Management Device Install Kit site at Emerson.com/devicefiles

After downloading, add the DD to AMS Device Manager:

1. Close AMS Device Manager.
2. Click the **Start** button, and then select **All Programs > AMS Device Manager > Add Device Type**.
3. Browse to the downloaded DD files and select **OK**.

In the **Add Device Type** application, select the **Help** button for more information on how to complete this operation.

Configure the HART® modem interface

Before connecting to the device using a HART modem, the HART modem interface must be configured in AMS Device Manager:

1. Close AMS Device Manager.
2. Click the Start button, and then select **All Programs > AMS Device Manager > Network Configuration**.
3. Select **Add**.
4. In the drop down list, select **HART modem** and select **Install**.
5. Follow the on-screen instructions.

In the **Network Configuration** application, select the **Help** button for more information on how to complete this operation.

2.3.2 Field Communicator

An overview of the Field Communicator is shown in [Figure 2-1](#). See “[Field Communicator menu trees](#)” on [page 125](#) for the menu tree diagrams.

Figure 2-1. 475 Field Communicator



- | | |
|--------------------|------------------------|
| A. Power key | E. Enter key |
| B. Navigation keys | F. Function key |
| C. Tab key | G. Alphanumeric keypad |
| D. Backlight key | |

Get the latest Device Description (DD)

If the Rosemount 2140 DD is not included in your 475, then use the Easy Upgrade Utility to update the Field Communicator with the latest DD.

For more information on how to update the DD and all the capabilities, see the 475 Field Communicator [User's Manual](#), available at www.fieldcommunicator.com.

2.3.3 Local Operator Interface (LOI)

The LOI requires option code M4 to be ordered.

To activate the LOI, push either configuration button. Configuration buttons are located on the LCD display (after removing the housing cover to access), or underneath the top tag of the point level detector. See [Table 2-1](#) for configuration button functionality and [Figure 2-2](#) for configuration button location.

When using the LOI for configuration, several features require multiple screens for a successful configuration. Data entered will be saved on a screen-by-screen basis; the LOI will indicate this by flashing “SAVED” on the LCD display each time.


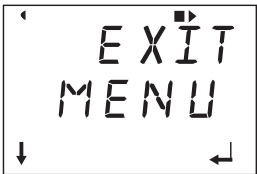
LOI menu trees are available in [Appendix D: Local Operator Interface](#).

Figure 2-2. LOI Configuration Buttons



- A. Internal configuration buttons
- B. External configuration buttons

Table 2-1. LOI Button Operation

Button		
Left	No	↓ (SCROLL)
Right	Yes	↵ (ENTER)

2.4 Switching HART Revision

2.4.1 Switching HART revision with a generic menu

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

1. Locate “Message” field.
 - a. To change to HART Revision 5, enter **HART5** and 27 spaces in the message field.
 - b. To change to HART Revision 7, Enter: **HART7** and 27 spaces in the message field.

2.4.2 Switching HART revision with Field Communicator

Fast keys	2, 2, 5 [or 6], 2, 4
-----------	----------------------

1. From the Home screen, select **2: Configure**.
2. Select **2: Manual Setup > 5: HART** (or **6: HART** if Scaled Variable is available).
3. Select **2: Communication Settings > 4: Change HART Revision**.
4. Change the HART revision.

Note

When messages about the loop appear, take appropriate safe action and select “OK”. See “[Configuration basics](#)” on page 10 for further information.

2.4.3 Switching HART Revision with AMS Device Manager

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

Note

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

Note

When messages about the loop appear, take appropriate safe action and select “Next >”. See “[Configuration basics](#)” on page 10 for further information.

2.4.4 Switching HART revision with Local Operator Interface

1. Press any LOI button to activate the menu.
(See [Table 2-1](#) on page 8 for assistance with using the LOI buttons).
2. Scroll down (↓) and then select **EXTENDED MENU** (↵).
3. Scroll down (↓) and then select **HART REV**(↵).
4. To change HART revision:
 - a. Select **HART REV 5** (↵) or scroll down (↓) and select **HART REV 7**(↵) to switch.
5. Exit the menu system by either waiting one minute for the **EXIT MENU?** prompt, or scrolling down menus to find and select **BACK TO MENU** and **EXIT MENU**.


Note

When messages about the loop appear, take appropriate safe action and select “↵”. See “[Configuration basics](#)” on page 10 for further information.


2.5 Configuration basics

The Rosemount 2140 and 2140:SIS Level Detectors (“level detectors”) can be configured before or after installation. Configuring the point level detector before installation ensures all level detector components are in working order before installation.

2.5.1 Setting the security switch

Verify that the security switch is set in the unlock position () to proceed with configuration. See [Figure 2-6 on page 43](#) for the switch location.

2.5.2 Setting the loop to manual

 When sending or requesting data that would disrupt the loop or change the point level detector output, set the process application loop to manual control. The Field Communicator, AMS Device Manager, or the LOI prompts you to set the loop to manual when necessary. The prompt is only a reminder. Acknowledging this prompt does not set the loop to manual. It is necessary to set the loop to manual control as a separate operation.

2.6 Configure device using Guided Setup

The options available in the Guided Setup wizard include all items required for basic operation. All basic configuration parameters are described in “[Basic setup](#)” on page 14.

2.6.1 Guided setup on the AMS Device Manager

1. Click the **Start** button, and then select **All Programs > AMS Device Manager > AMS Device Manager**.
2. Select **View > Device Connection View**.
3. In the Device Connection View, double-click the **HART** modem icon.
4. Double-click the device icon.
5. From the Home screen, select **Configure > Guided Setup**.
6. Select **Basic Setup** and follow the on-screen instructions.

2.6.2 Guided setup on the Field Communicator

1. Turn on the Field Communicator.
2. From the Main Menu, tap the HART symbol. The Field Communicator now connects to the device.
3. From the Home screen, select **Configure > Guided Setup**.
4. Select **Basic Setup** and follow the on-screen instructions.

2.6.3 Guided setup on the LOI

The Guided Setup wizard is not available on the LOI. Turn to “Basic setup” on page 14 for the LOI instructions to configure basic parameters, and then return here to verify configuration.

2.7 Verify the configuration before installation

It is recommended that various configuration parameters are verified prior to installation into the process. The various parameters are detailed out for each configuration tool.

2.7.1 Verifying configuration (Field Communicator or AMS)

Configuration parameters, listed in Table 2-2, are to be reviewed before the level detector is installed. From the HOME screen of the Field Communicator, enter the fast key sequences listed. Alternatively, turn to the page for detailed instructions.

Table 2-2. Verifying Configuration (Fast Key Sequences)

Parameter	Fast key sequence	
	HART 7	HART 5
Tag	1, 8, 1, 2	1,8, 1, 1
Model	1, 8, 1, 3	1,8, 1, 3
Primary Variable (page 11)	3, 2, 1, 1	3, 2, 1, 1
Sensor Operating Mode (page 14)	2, 2, 1, 1, 1	2, 2, 1, 1, 1
Sensor Output Delay (page 16)	2, 2, 1, 1, 2	2, 2, 1, 1, 2
Media Density (page 17)	2, 2, 1, 1, 3	2, 2, 1, 1, 3
Sensor Fault Delay (page 22)	2, 2, 1, 3, 2	2, 2, 1, 3, 2
Current Output Type ⁽¹⁾ (page 23)	2, 2, 2, 1, 1	2, 2, 2, 1, 1
Custom Off Current ⁽²⁾ (page 23)	2, 2, 2, 1, 3	2, 2, 2, 1, 3
Custom On Current ⁽²⁾ (page 23)	2, 2, 2, 1, 4	2, 2, 2, 1, 4
Upper Range Value ⁽³⁾ (page 26)	2, 2, 2, 2, 2	2, 2, 2, 2, 2
Lower Range Value ⁽³⁾ (page 26)	2, 2, 2, 2, 3	2, 2, 2, 2, 3
High Alarm Level ⁽⁴⁾ (page 33)	2, 2, 2, 5, 3	2, 2, 2, 5, 3
Low Alarm Level ⁽⁴⁾ (page 33)	2, 2, 2, 5, 6	2, 2, 2, 5, 6
High Saturation Level ⁽³⁾⁽⁴⁾ (page 33)	2, 2, 2, 5, 4	2, 2, 2, 5, 4
Low Saturation Level ⁽³⁾⁽⁴⁾ (page 33)	2, 2, 2, 5, 5	2, 2, 2, 5, 5
Alarm Switch Position/Direction (page 46)	2, 2, 2, 5, 2	2, 2, 2, 5, 2

1. Only applicable when the Primary Variable is mapped to the Output State variable.
2. Only applicable when Current Output Type is set to “Custom”.
3. Only applicable when the Primary Variable is mapped to the Sensor Frequency or Scaled Variable variables. See “Dynamic variables configuration” on page 13 and “Analog output range points” on page 26 for details.
4. Alarm level and saturation level indicated depends on the setting of alarm level switch (page 46) and the ordered Alarm Level code (Table A-6 on page 115).

2.7.2 Verifying configuration (LOI)

1. Press any configuration button to activate the LOI.
2. Select **VIEW CONFIG** (↵).
3. Scroll down (↓) to review the following parameters prior to installation:

TAG	
MODEL	– e.g. “2140”.
T Range	– Operating temperature range (page 115)
EFP	– Extended Features Package enabled (Yes/No)
IS PV ⁽¹⁾	– Primary Variable mapping (page 11)
S UNIT ⁽¹⁾	– Secondary Variable units (page 129)
T UNIT ⁽²⁾	– Electronics temperature units (page 30)
OP MODE	– Operating mode (page 14).
DENSITY	– Media density (page 17).
O DLY	– Sensor output delay (page 16).
F DLY	– Fault output delay (page 22).
AOMODE ⁽³⁾	– Analog Output operating mode (page 23)
OFF MA ⁽⁴⁾	– Custom mA output for ‘off’ output state (page 23)
ON MA ⁽⁴⁾	– Custom mA output for ‘on’ output state (page 23)
S-START	– Device test (page 73)/proof test (page 75) at start.
URV ⁽⁵⁾	– Upper range value for analog output (page 26)
LRV ⁽⁵⁾	– Lower range value for analog output (page 26)
DAMPING ⁽¹⁾	– Scaled Variable damping (page 28)
HIALRM ⁽⁶⁾	– High alarm level (page 33)
LOALRM ⁽⁶⁾	– Low alarm level (page 33)
HI SAT ⁽⁵⁾⁽⁶⁾	– High saturation level (page 33)
LO SAT ⁽⁵⁾⁽⁶⁾	– Low saturation level (page 33)
ALARM	– Alarm switch position/direction (page 46)
SECURE	– Security switch position (page 43)

1. Only available when the Extended Features Package (EFP) is enabled.
2. SI units only.
3. Only visible when the Primary Variable (“PV”) is mapped to the Output State variable.
4. Only visible when the Analog Output operating mode is set to custom.
5. Only visible when the Primary Variable (“PV”) is mapped to the Sensor Frequency or Scaled Variable variables.
6. Alarm level and saturation level indicated depends on the setting of hardware alarm level switch ([page 46](#)) and the ordered Alarm Level code ([Table A-6 on page 115](#)).

4. Exit the menu system by either waiting one minute for the **EXIT MENU?** prompt, or scrolling down menus to find and select **BACK TO MENU** and **EXIT MENU**.

2.7.3 Dynamic variables configuration

This section describes how to verify that the four dynamic variables are mapped correctly. If incorrectly mapped, see “HART (re-mapping dynamic variables)” on page 31.

Default mapped dynamic variables

By default, the four mapped dynamic variables are:

- **Primary Variable (“PV”)**
Mapped to: Output State – the level detector output state is off (0.0) or on (1.0).
- **Secondary Variable (“SV”)**
Mapped to: Sensor State – indicates the state of the sensor as dry (0.0) or wet (1.0).
- **Tertiary Variable (“TV”)**
Mapped to: Sensor Frequency – the frequency of the vibrating fork in units of Hz.
- **Quaternary Variable (“QV”)**
Mapped to: Electronics Temperature – the temperature inside the housing in °F/°C.

Verifying dynamic variables (Field Communicator)

Fast keys	3, 2, 2
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To view the Variables menu:

1. From the Home screen, select **3: Service Tools**.
2. Select **2: Variables > 2: Mapped Variables**
3. Select a dynamic variable:
 - a. Select **1: Primary Variable**.
 - b. Select **2: Secondary Variable**.
 - c. Select **3: Tertiary Variable**.
 - d. Select **4: Quaternary Variable**.

Verifying dynamic variables (AMS Device Manager)

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

Verifying dynamic variables (LOI)

The mapping of dynamic variables is not viewable on the LOI.

Optional re-mapping of PV

Versions of the Rosemount 2140 with the Extended Features Package (EFP) can re-map the PV to:

- Sensor Frequency
- Scaled Variable

Optional re-mapping of SV, TV, or QV

The Rosemount 2140 and Rosemount 2140:SIS can re-map the SV, TV, or QV to:

- Output State
- Sensor State
- Sensor Frequency
- Electronics Temperature
- Terminal Voltage

Versions of the Rosemount 2140 with the Extended Features Package (EFP) can also re-map the SV, TV, or QV to:

- Scaled Variable

Note

See “HART (re-mapping dynamic variables)” on page 31 for related information.

2.8

Basic setup

2.8.1

Sensor operation mode

Fast keys	2, 2, 1, 1, 1
-----------	---------------

The level detector has three operation modes:

- Normal (Rosemount 2140 only)
Default mode with no sensor fault detection enabled.
- Enhanced wet
Optional mode where the **Sensor State** device variable is forced to a ‘wet state’ while sensor faults are detected. (Default mode on Rosemount 2140:SIS).
- Enhanced dry
Optional mode where the **Sensor State** device variable is forced to a ‘dry state’ while sensor faults are detected.

Note

Sensor State (page 82) is used to derive the **Output State** (page 13).

To change or view the mode (Field Communicator)

1. From the Home screen, select **2: Configure**.
2. Select **2: Manual Setup > 1: Operation > 1: Application**.
3. Select **1: Sensor Operation Mode**.
4. If changing the mode setting:
 - a. Select a mode: “Normal”, “Enhanced (Fault=Wet)”, or “Enhanced (Fault=Dry)”.

Note

When messages about the loop appear, take appropriate safe action and select “OK”. See “[Configuration basics](#)” on page 10 for further information.

To change or view the mode (AMS Device Manager)

1. Right click on the device and select **Configure**.
2. Select **Manual Setup**, and then select the **Operation** tab.
3. If changing the mode setting:
 - a. Select a mode: “Normal”, “Enhanced (Fault=Wet)”, or “Enhanced (Fault=Dry)” at the **Sensor Operation Mode** field.

Note

When messages about the loop appear, take appropriate safe action and select “Next >”. See “[Configuration basics](#)” on page 10 for further information.

To change or view the mode (LOI)

1. Press any LOI button to activate the menu.
(See [Table 2-1 on page 8](#) for assistance with using the LOI buttons).
2. If changing the mode setting:
 - a. Scroll down (↓) and then select **EXTENDED MENU** (↵).
 - b. Scroll down (↓) and then select **SENSOR** (↵).
 - c. Select **SENSOR OPMODE** (↵).
 - d. Follow on-screen instructions to select a new mode:
NORM (normal), EN WET (enhanced wet), or EN DRY (enhanced dry).
3. If viewing the mode setting:
 - a. Select **VIEW CONFIG** (↵).
 - b. Scroll down (↓) until **OPMODE** and the mode setting appears.
4. Exit the menu system by either waiting one minute for the **EXIT MENU?** prompt, or scrolling down menus to find and select **BACK TO MENU** and **EXIT MENU**.

Note

When messages about the loop appear, take appropriate safe action and select “↵”. See “Configuration basics” on page 10 for further information.

2.8.2 Sensor output delay

Fast keys	2, 2, 1, 1, 2
-----------	---------------

When there is a detected change in process conditions, from wet-to-dry or dry-to-wet, the **Sensor Output Delay** variable can action a delay of up to 3600 seconds before the new state change is indicated. The default delay is one second.

Depending on the application, a suitable delay can prevent constant switching of the output state. If, for example, there are waves in a tank, then there may be splashes causing intermittently detected changes in process conditions. The sensor output delay ensures that the fork is dry or wet for a suitable period before switching.

To change or view the delay setting (Field Communicator)

1. From the Home screen, select **2: Configure**.
2. Select **2: Manual Setup > 1: Operation > 1: Application**.
3. Select **2: Sensor Output Delay**.
4. If changing the delay setting:
 - a. Edit a delay value in the range 0 to 3600 seconds.

Note

When messages about the loop appear, take appropriate safe action and select “OK”. See “Configuration basics” on page 10 for further information.

To change or view the delay setting (AMS Device Manager)

1. Right click on the device and select **Configure**.
2. Select **Manual Setup**, and then the select the **Operation** tab.
3. If changing the delay setting:
 - a. Edit a delay in the range 0 to 3600 seconds at the **Sensor Output Delay** field.

To change or view the delay setting (LOI)

1. Press any LOI button to activate the menu.
(See Table 2-1 on page 8 for assistance with using the LOI buttons).
2. If changing the mode setting:
 - a. Scroll down (↓) and then select **EXTENDED MENU** (↵).
 - b. Scroll down (↓) and then select **SENSOR** (↵).

- c. Scroll down (↓) and then select **OUTPUT DELAY** (↵).
 - d. Follow on-screen instructions and edit a new delay setting in the range 0 to 3600. Entering a delay outside this range results in ERROR being displayed.
3. If viewing the mode setting:
 - a. Select **VIEW CONFIG** (↵).
 - b. Scroll down (↓) until **O DELAY** and the delay setting appears.
 4. Exit the menu system by either waiting one minute for the **EXIT MENU?** prompt, or scrolling down menus to find and select **BACK TO MENU** and **EXIT MENU**.

Note

When messages about the loop appear, take appropriate safe action and select “↵”. See “[Configuration basics](#)” on page 10 for further information.

2.8.3 Media density

Fast keys	2, 2, 1, 1, 3
-----------	---------------

The measured frequency of the fork, when immersed in process medium, can be affected by liquid density variations. As a result, the dry-to-wet and wet-to-dry switching points are different for all types and varieties of process medium ([Figure 2-3 on page 18](#)).

To overcome this, accurate switching points can be calculated by the Rosemount 2140 and Rosemount 2140:SIS after a suitable density band is selected for the process medium.

Media Density options the Rosemount 2140 and Rosemount 2140:SIS are:

- **0.4 – 0.6 SG** (for a 400 to 600 kg/m³ range – e.g. propane)
- **0.5 – 0.9 SG** (for a 500 to 900 kg/m³ range – e.g. alcohol)
- **0.8 – 1.3 SG** (for a 800 to 1300 kg/m³ range – e.g. water) (**default selection**)
- **1.2 – 3.0 SG** (for a 1200 to 3000 kg/m³ range – e.g. acid)

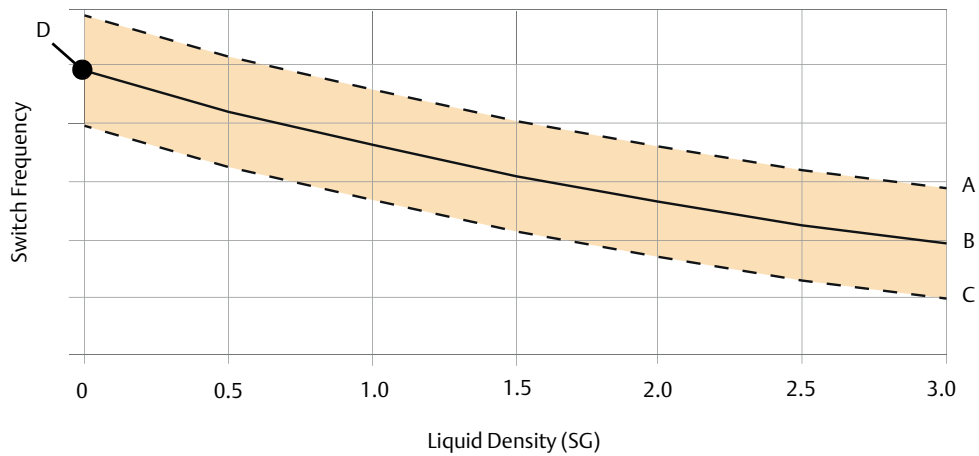
Extra options on the Rosemount 2140 are:

- Low compacted sediment
- Medium compacted sediment
- High compacted sediment
- Extreme compacted sediment

Note

Versions of the Rosemount 2140 and Rosemount 2140:SIS with the Extended Features Package (EFP) can use **Media Learn** ([page 19](#)) to automatically select a density band. For all other versions, keep the default setting for Media Density when the liquid specific gravity is unknown.

Figure 2-3. Example of Calculated Switching Points for a Process Media



- A. Top limit boundary (allowing for variations in fork manufacture).
- B. Nominal switching point frequencies for this process medium.
- C. Bottom limit boundary (allowing for variations in fork manufacture).
- D. Dry fork frequency – see “Dry fork frequency and switching points” on page 85 for details.

To change or view the media density (Field Communicator)

1. From the Home screen, select **2: Configure**.
2. Select **2: Manual Setup > 1: Operation > 1: Application**.
3. Select **3: Media Density**.
4. Select the option that is closest to the process medium density range.

Note

When messages about the loop appear, take appropriate safe action and select “OK”. See “Configuration basics” on page 10 for further information.

To change or view the media density (AMS Device Manager)

1. Right click on the device and select **Configure**.
2. Select **Manual Setup**, and then select the **Operation** tab.
3. Select the **Media Density** option that is closest to the process medium density range.

Note

When messages about the loop appear, take appropriate safe action and select “Next >”. See “Configuration basics” on page 10 for further information.

To change or view the media density (LOI)

1. Press any LOI button to activate the menu.
(See [Table 2-1 on page 8](#) for assistance with using the LOI buttons).
2. Scroll down (↓) and then select **EXTENDED MENU** (↵).
3. Scroll down (↓) and then select **MEDIA** (↵).
4. Select **DENSITY** (↵).
5. Follow on-screen instructions to select an option that is closest to the process medium density range.

Note

When messages about the loop appear, take appropriate safe action and select “↵”. See “[Configuration basics](#)” on [page 10](#) for further information.

2.8.4 Media learn

Fast keys	2, 2, 1, 1, 5
-----------	---------------

Versions of the Rosemount 2140 and Rosemount 2140:SIS with the Extended Features Package (EFP) can use the **Media Learn** function.

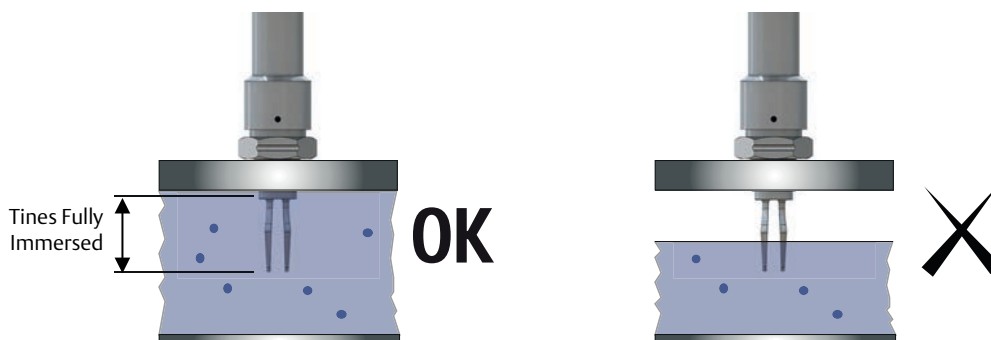
Media Learn makes configuring the **Media Density** variable ([page 17](#)) even easier.

This procedure requires the fork tines to be fully immersed in the process medium for a short period to gather the frequency data, calculate the liquid density, and then auto-select the option for the Media Density variable.

Note

Media Learn may have unexpected results in high temperatures.

Figure 2-4. Fully Immersed Tines for Media Learn



To use Media Learn (Field Communicator)

1. From the Home screen, select **2: Configure**.
2. Select **2: Manual Setup > 1: Operation > 1: Application**.
3. Select **5: Media Learn**.
4. Follow on-screen instructions until the learning procedure is completed.

Note

When messages about the loop appear, take appropriate safe action and select “OK”. See “[Configuration basics](#)” on [page 10](#) for further information.

To use Media Learn (AMS Device Manager)

1. Right click on the device and select **Configure**.
2. Select **Manual Setup**, and then select the **Operation** tab.
3. **Click on the Media Learn** button (in the Application box).
4. Follow on-screen instructions until the learning procedure is completed. (The “Recall Learnt” option restores a previously learnt media density).
5. In the Application box, the **Learnt** box is now marked.

Note

When messages about the loop appear, take appropriate safe action and select “Next >”. See “[Configuration basics](#)” on [page 10](#) for further information.

To use Media Learn (LOI)

1. Press any LOI button to activate the menu. (See [Table 2-1 on page 8](#) for assistance with using the LOI buttons).
2. Scroll down (↓) and select **EXTENDED MENU** (↵).
3. Scroll down (↓) and select **MEDIA** (↵).
4. Scroll down (↓) and select **LEARN** (↵).
5. Follow on-screen instructions until the learning procedure is completed.

Note

When messages about the loop appear, take appropriate safe action and select “↵”. See “[Configuration basics](#)” on [page 10](#) for further information.

2.8.5 Allowable change in dry fork frequency

Fast keys	2, 2, 1, 3, 1
-----------	---------------

When the level detector is re-calibrated in the field, a comparison is made between the new dry fork frequency and original factory-set **Dry Fork Frequency** value. If the difference is greater than the allowable change value, the re-calibration is rejected. Check the fork for damage, corrosion, or coating, and clean the fork if necessary before re-trying.

The default setting is 100 Hz, but can be set to a value in the range 0 to 255 Hz. Setting the value to 0 Hz switches off the allowable change monitoring.

Note

Fast key sequence is 3, 4, 1, 2, 1 for the original factory-set Dry Fork Frequency.

To change or view the allowable change (Field Communicator)

1. From the Home screen, select **2: Configure**.
2. Select **2: Manual Setup > 1: Operation > 3: Sensor**.
3. Select **1: Allowable Change In Dry Fork Frequency**.
4. Follow the on-screen instructions to configure the allowable change.

Note

When messages about the loop appear, take appropriate safe action and select “OK”. See “[Configuration basics](#)” on page 10 for further information.

To change or view the allowable change (AMS Device Manager)

1. Right click on the device and select **Configure**.
2. Select **Manual Setup**, and then select the **Operation** tab.
3. If changing the allowable change setting:
 - a. Edit a frequency in the range 0 to 255 Hz at the **Allowable Change In Dry Fork Frequency** field.

Note

When messages about the loop appear, take appropriate safe action and select “Next >”. See “[Configuration basics](#)” on page 10 for further information.

To change or view the allowable change (LOI)

This configuration parameter is not available on the LOI.

2.8.6 Sensor fault delay

Fast keys	2, 2, 1, 3, 2
-----------	---------------

When the level detector is operating in Enhanced Mode and detects a fork sensor fault, **Sensor State** (page 82) indicates a fault state after a delay.

The default setting is 5 seconds. It can be set to a value in the range 0 to 3600 seconds.

Note

When the Rosemount 2140 is operating in Normal mode, a fork sensor fault is not detected and **Sensor State** continues to indicate a valid state.

To change or view the sensor fault delay (Field Communicator)

1. From the Home screen, select **2: Configure**.
2. Select **2: Manual Setup > 1: Operation > 3: Sensor**.
3. Select **2: Sensor Fault Delay**.
4. Follow the on-screen instructions to configure the delay.

Note

When messages about the loop appear, take appropriate safe action and select “OK”. See “Configuration basics” on page 10 for further information.

To change or view the sensor fault delay (AMS Device Manager)

1. Right click on the device and select **Configure**.
2. Select **Manual Setup**, and then select the **Operation** tab.
3. If changing the delay setting:
 - a. Edit the number of seconds at the **Sensor Fault Delay** field.

Note

When messages about the loop appear, take appropriate safe action and select “Next >”. See “Configuration basics” on page 10 for further information.

To change or view the sensor fault delay (LOI)


1. Press any LOI button to activate the menu.
(See Table 2-1 on page 8 for assistance with using the LOI buttons).
2. If changing the mode setting:
 - a. Scroll down (↓) and then select **EXTENDED MENU** (↵).
 - b. Scroll down (↓) and then select **SENSOR** (↵).

- c. Scroll down (↓) and then select **FAULT DELAY** (↵).
 - d. Follow on-screen instructions and edit a new delay setting in the range 0 to 3600. Entering a delay outside this range results in ERROR being displayed.
3. If viewing the mode setting:
 - a. Select **VIEW CONFIG** (↵).
 - b. Scroll down (↓) until **F DELAY** and the delay setting appears.
 4. Exit the menu system by either waiting one minute for the **EXIT MENU?** prompt, or scrolling down menus to find and select **BACK TO MENU** and **EXIT MENU**.

Note

When messages about the loop appear, take appropriate safe action and select “↵”. See “Configuration basics” on page 10 for further information.

2.8.7 Analog output type and operating modes

 The analog output is driven by a device variable mapped to the Primary Variable (“PV”). Carefully read displayed warnings that appear before applying changes.

This sub-section is for establishing how the analog output will operate.

Current output type

Fast keys	2, 2, 2, 1, 1
-----------	---------------

Options to select are:

- **4 and 20 mA** – i.e. 4mA = ‘off’ and 20 mA = ‘on’ switched output states.
Continue reading this sub-section for related configuration steps.
- **8 and 16 mA** – i.e. 8 mA = ‘off’ and 16 mA = ‘on’ switched output states.
Continue reading this sub-section for related configuration steps.
- **Custom**– i.e. user-set output currents for ‘off’/‘on’ switched output states.
The output current levels for ‘off’ and ‘on’ output states are user-entered under the **Custom Off Current** and **Custom On Current** variables. Continue reading this sub-section for related configuration steps.
- **LEVELTESTER**– compatibility mode
See [Table 2-3](#) for output current information.

Table 2-3. LEVELTESTER Output Current

Output current	Wet on	Dry on
Wet	18.5±0.5 mA @ 0.5 Hz	6 mA
Dry	9 mA	13.5±0.5 mA @ 0.5 Hz

Current output operating mode

Fast keys	2, 2, 2, 1, 2
-----------	---------------

This selects the fork sensor state associated with the **Output State** device variable indicating 'on'. Options to select are:

- **Dry on**
- **Wet on**

Custom “off” current

Fast keys	2, 2, 2, 1, 3
-----------	---------------

When the **Current Output Type** is set to “Custom”, this parameter is for entering the output current to be applied when:

- The Current Output Operating Mode variable is set to “Dry on” and the fork is immersed in liquid or sand/sediment.
- The Current Output Operating Mode variable is set to “Wet on” and the fork is not immersed in liquid or sand/sediment.

Custom “on” current

Fast keys	2, 2, 2, 1, 4
-----------	---------------

When the **Current Output Type** is set to “Custom”, this parameter is for entering the output current to be applied when:

- The Current Output Operating Mode variable is set to “Wet on” and the fork is immersed in liquid or sand/sediment.
- The Current Output Operating Mode variable is set to “Dry on” and the fork is not immersed in liquid or sand/sediment.

To change current output type and operating mode (Field Communicator)

1. From the Home screen, select **2: Configure**.
2. Select **2: Manual Setup > 2: Analog Output > 1: Mode Setup**.
3. If changing the current output type:
 - a. Select **1: Current Output Type**.
 - b. Make the type selection.
 - c. If the type is set to **Custom**, enter output current levels in the **3: Custom Off Current** and **4: Custom On Current** screens.
4. If changing the current output operating mode:
 - a. Select **2: Current Output Operating Mode**.
 - b. Make the mode selection.

Note

When messages about the loop appear, take appropriate safe action and select “OK”. See “[Configuration basics](#)” on page 10 for further information.

To change the current output type and operating mode (AMS Device Manager)

1. Right click on the device and select **Configure**.
2. Select **Manual Setup**, and then select the **Analog Output** tab.
3. If changing the current output type:
 - a. Select an option for the **Current Output Type field**.
 - b. If the type selected is **Custom**, enter output currents for ‘off’/‘on’ output states at the **Custom Off Current** and **Custom On Current** fields.
4. If changing the current output operating mode:
 - a. Select an option for the **Current Output Operating Mode field**.
5. Click on **Send**.
6. Carefully read the warning and click **Yes** if it is safe to apply the changes.

Note

When messages about the loop appear, take appropriate safe action. See “[Configuration basics](#)” on page 10 for further information.

To change the current output type and operating mode (LOI)

1. Press any LOI button to activate the menu.
(See [Table 2-1](#) on page 8 for assistance with using the LOI buttons).
2. If changing the current output type:
 - a. Scroll down (↓) and then select **EXTENDED MENU** (↵).
 - b. Scroll down (↓) and then select **ANALOG OUTPUT** (↵).
 - c. Scroll down (↓) and then select **OUTPUT TYPE** (↵).
 - d. Follow on-screen instructions and select a current output type (“4 and 20 mA”, “8 and 16 mA”, or “Custom”).
 - e. If the type selected is “Custom”, enter output currents for ‘off’ and ‘on’ output states at the **CUSTOM OFF** and **CUSTOM ON** menus.
3. If changing the current output operating mode:
 - a. Scroll down (↓) and then select **EXTENDED MENU** (↵).
 - b. Scroll down (↓) and then select **ANALOG OUTPUT** (↵).
 - c. Scroll down (↓) and then select **OPERATE MODE** (↵).
 - d. Follow on-screen instructions and select a current output operating mode (“Wet on” or “Dry on”).

Note

When messages about the loop appear, take appropriate safe action and select “↵”. See “[Configuration basics](#)” on page 10 for further information.

2.8.8 Analog output range points

- ⚠ The analog output is driven by a device variable mapped to the Primary Variable (“PV”). Carefully read displayed warnings that appear before applying changes.

This section is for entering the range points for the PV to be output using the analog output.

The **Lower Range Value (LRV)** variable is the PV represented by 4 mA, and the **Upper Range Value (URV)** variable is the PV represented by 20 mA. This PV range can be a sub-set of the sensor limits defined by **Upper PV Limit** and **Lower PV Limit** variables (see [Table 2-4 on page 28](#)).

However, by default, the **Output State** is mapped to the PV. The range points for this are read-only and identical to the associated sensor limits (see “[Sensor limits](#)” on page 28).

If supported, **Sensor Frequency** or **Scaled Variable** can instead be re-mapped to the PV. The range points then automatically change from read-only to editable, allowing range points to be changed, but are subject to the sensor limits (see “[Sensor limits](#)” on page 28).

Optionally, use **Scaled Variable Damping** ([page 28](#)) to smooth out large steps in output current changes when the PV is a scaled variable.

See also “[Site calibration of analog output](#)” on page 70 for other related information.

Entering range points (Field Communicator)

Fast keys	2, 2, 2, 2
-----------	------------

1. From the Home screen, select **2: Configure**.
2. Select **2: Manual Setup > 2: Analog Output > 2: Set Range Points**.
3. Enter the PV value at 20 mA in the **2: Upper Range Value** variable.
4. Enter the PV value at 4 mA in the **3: Lower Range Value** variable.

Note

At the **4: Readings** menu (2, 2, 2, 4), the **1: Analog Output** item indicates the live output current. The **2: Percent of Range** item indicates the percentage of that output current in terms of the complete 4–20 mA range. For example, 8 mA is 25% of range, 12 mA is 50%

Note

When messages about the loop appear, take appropriate safe action and select “OK”. See “[Configuration basics](#)” on page 10 for further information.

Entering range points (AMS Device Manager)

1. Right click on the device and select **Configure**.
2. Select **Manual Setup**, and then select the **Analog Output** tab.
3. Enter the PV at 4 mA in the **Lower Range Value** field.
4. Enter the PV at 20 mA in the **Upper Range Value** field.
5. Click **Send**.
6. Carefully read the warning and click **Yes** if it is safe to apply the changes.

Note

In the **Readings** box, the **Analog Output** device variable indicates the live output current. The **Percent of Range** device variable indicates a percentage of that output current in terms of the complete 4–20 mA range. For example, 8 mA is 25% of range, 12 mA is 50%, etc.

Note

When messages about the loop appear, take appropriate safe action. See “[Configuration basics](#)” on page 10 for further information.

Entering range points (LOI)

1. Press any LOI button to activate the menu.
(See [Table 2-1 on page 8](#) for assistance with using the LOI buttons).
2. If changing the range points:
 - a. Scroll down (↓) and then select **RERANGE** (↵).
 - b. Select **ENTER VALUES** (↵).
 - c. Select **LRV** (↵).
 - d. Follow on-screen instructions and edit a new PV value at 4 mA.
(Attempting to enter an invalid value results in ERROR being displayed).
 - e. Scroll down (↓) and then select **URV** (↵).
 - f. Follow on-screen instructions and edit a new PV value at 20 mA.
(Attempting to enter an invalid value results in ERROR being displayed).
3. If viewing the range points:
 - a. Select **VIEW CONFIG** (↵).
 - b. Scroll down (↓) until **LRV** and the lower range value setting appears.
 - c. Scroll down (↓) until **URV** and the upper range value setting appears.
4. Exit the menu system by either waiting one minute for the **EXIT MENU?** prompt, or scrolling down menus to find and select **BACK TO MENU** and **EXIT MENU**.

Note

When messages about the loop appear, take appropriate safe action and select “↵”. See “[Configuration basics](#)” on page 10 for further information.

Sensor limits

Table 2-4 shows the sensor limits applied when a device variable is mapped to the PV dynamic variable. They are used for scaling gauges in a Host system (e.g. AMS Device Manager) and for validating the range points in the analog output (page 26).


Note

See also “Dynamic variables configuration” on page 13 for related information.

Table 2-4. Sensor Limits for Device Variables

Device Variables	Lower PV Limit	Upper PV Limit
Output State	0.0	1.0
Sensor State	0.0	1.0
Sensor Frequency	250.0 Hz	1800.0 Hz
Electronics Temperature	-40 °C	85 °C
Terminal Voltage	10.5 V	42.4 V
Scaled Variable	Defined by sensor frequency limits and scaling data.	

2.8.9 Scaled Variable damping

 Damping is an optional parameter for changing the response time of the level detector when the PV is mapped to the Scaled Variable. Increasing the damping value can smooth wide variations in the output caused by rapid input changes, but at the cost of decreasing response times.

Damping settings range from 0.0 to 60.0 seconds. An appropriate damping setting is a balance of the necessary response time, signal stability, and other requirements of the loop dynamics within your system.

Carefully read displayed warnings that appear before applying changes.

Note

Versions of the Rosemount 2140 with the Extended Features Package (EFP) can re-map the PV to Scaled Variable.

Damping with a Field Communicator

Fast keys	2, 2, 2, 2, 4
-----------	---------------

1. From the Home screen, select **2: Configure**.
2. Select **2: Manual Setup > 2: Analog Output > 2: Set Range Points**.
3. Select **4: Damping**.
4. Enter the damping setting.

Note

When messages about the loop appear, take appropriate safe action. See “[Configuration basics](#)” on page 10 for further information.

Damping with AMS Device Manager

1. Right click on the device and select **Configure**.
2. Select **Manual Setup**, and then select the **Analog Output** tab.
3. Enter the damping setting, and click **Send**.
4. Carefully read the warning and click **Yes** if it is safe to apply the changes.

Damping with a LOI

1. Press any LOI button to activate the menu.
(See [Table 2-1](#) on page 8 for assistance with using the LOI buttons).
2. If changing the damping setting:
 - a. Scroll down (↓) and then select **EXTENDED MENU** (↵).
 - b. Scroll down (↓) and then select **DAMPING** (↵).
 - c. Follow on-screen instructions and edit a new damping setting in the range 0 to 60. Attempting to enter a value outside this range results in ERROR being displayed.

If viewing the damping setting:

 - a. Select **VIEW CONFIG** (↵).
 - b. Scroll down (↓) until **DAMPING** and the damping setting appears.
3. Exit the menu system by either waiting one minute for the **EXIT MENU?** prompt, or scrolling down menus to find and select **BACK TO MENU** and **EXIT TO MENU**.

2.9 Local Operator Interface (LOI) display

Fast keys	2, 2, 2
-----------	---------

The LOI display configuration allows customization of the displayed information to suit application requirements. The LOI alternates between selected items.

■ Output State (page 13)	■ Electronics Temperature (page 13)
■ Sensor State (page 13)	■ Terminal Voltage (page 13)
■ Sensor Frequency (page 13)	■ Percent of Range (page 26)
■ Scaled Variable ⁽¹⁾ (page 13)	■ Analog Output (page 26)

1. This is selectable only if the Rosemount 2140 has the Extended Features Package enabled.

Note

The LOI can also be configured to display configuration information during the device startup. Select **Review Parameters at Startup** to enable this functionality.

Configuring LOI display (using Field Communicator)

1. From the Home screen, select **2: Configure**.
2. Select **2: Manual Setup > 5: Display**.
3. For items **1** to **8**, select or de-select the parameters to show on the LOI display. Optionally, select **9: Review Parameters at Startup**.

Configuring LOI display (using AMS Device Manager)

1. Right click on the device and select **Configure**.
2. Click **Manual Setup**, and then select the **Display** tab.
3. Select or de-select the parameters to show on the LOI display, and then click **Send**.
4. Optionally, select **Review Parameters at Startup**.

Configuring LOI display (using LOI)

1. Press any LOI button to activate the menu.
(See [Table 2-1 on page 8](#) for assistance with using the LOI buttons).
2. Scroll down (↓) and then select **DISPLAY** (↵).
3. Scroll down (↓), and then for each item:
 - a. Use the select (↵) to change the setting to ON or OFF
 - b. Answer YES (↵) to confirm the change or NO (↓) to abandon the change.
4. Exit the menu system by either waiting one minute for the **EXIT MENU?** prompt, or scrolling down menus to find and select **BACK TO MENU** and **EXIT TO MENU**.

2.9.1 Electronics temperature units

Note

Available on SI units only.

Changing temperature units (Field Communicator)

Fast keys	2, 2, 4, 3
-----------	------------

1. From the Home screen, select **2: Configure**.
2. Select **2: Manual Setup > 4: Device Temperature > 3: Units**.
3. Select the measurement units.

Note

When messages about the loop appear, take appropriate safe action and select "OK". See ["Configuration basics" on page 10](#) for further information.

Changing temperature units (AMS Device Manager)

1. Right click on the device and select **Configure**.
2. Select **Manual Setup**, and then select the **Device Temperature** tab.
3. Select the measurement units at the Setup Unit box, and click **Send**.

Note

When messages about the loop appear, take appropriate safe action.
See “[Configuration basics](#)” on page 10 for further information.

Changing temperature units (LOI)


1. Press any LOI button to activate the menu.
(See [Table 2-1](#) on page 8 for assistance with using the LOI buttons).
2. Scroll down (↓) and then select **UNITS** (↵).
3. Select DEG C or scroll down (↓) and select DEG F (↵).
4. Exit the menu system by either waiting one minute for the **EXIT MENU?** prompt, or scrolling down menus to find and select **BACK TO MENU** and **EXIT MENU**.

Note

When messages about the loop appear, take appropriate safe action and select “↵”.
See “[Configuration basics](#)” on page 10 for further information.

2.10 Detailed setup

2.10.1 HART (re-mapping dynamic variables)

-  The re-mapping of process variables to the primary, secondary, tertiary, and quaternary variables (“PV”, “SV”, “TV”, and “QV” respectively) can be performed here, if supported. See “[Dynamic variables configuration](#)” on page 13 to find out what is supported.

The PV can be re-mapped with a Field Communicator, AMS Device Manager, or a LOI. However, the other three variables (SV, TV, and QV) can only be re-mapped using a Field Communicator or the AMS Device Manager.

Note

The process variable assigned to the PV drives the analog output.
See “[Analog output type and operating modes](#)” on page 23 for further information.

Re-mapping process variables (Field Communicator)

Fast keys	2, 1, 5 (or 6), 1
-----------	-------------------

1. From the Home screen, select **2: Configure**.
2. Select **2: Manual Setup > 5: (or 6:) HART**.
3. Select **1: Variable Mapping**.
4. Assign Primary Variable, Secondary Variable, Tertiary Variable and Quaternary Variable to supported process variables.

Note

When messages about the loop appear, take appropriate safe action and select “OK”. See “[Configuration basics](#)” on page 10 for further information.

Re-mapping process variables (AMS Device Manager)

1. Right click on the device and select **Configure**.
2. Select **Manual Setup**, and then click on the **HART** tab.
3. In the Variable Mapping box, assign Primary Variable, Secondary Variable, Tertiary Variable and Quaternary Variable to supported process variables.
4. Click **Send**.
5. Carefully read the warning and click **Yes** if it is safe to apply the changes.

Note

When messages about the loop appear, take appropriate safe action. See “[Configuration basics](#)” on page 10 for further information.

Re-mapping process variables (LOI)

1. Press any LOI button to activate the menu.
(See [Table 2-1 on page 8](#) for assistance with using the LOI buttons).
2. Scroll down (↓) and then select **EXTENDED MENU** (↵).
3. Scroll down (↓) and then select **ASSIGN PV** (↵).
4. Scroll down (↓) to the desired device variable mapping and then select (↵) it.
5. Exit the menu system by either waiting one minute for the **EXIT MENU?** prompt, or scrolling down menus to find and select **BACK TO MENU** and **EXIT TO MENU**.

Note

When messages about the loop appear, take appropriate safe action and select “↵”. See “[Configuration basics](#)” on page 10 for further information.

2.10.2 Configuring alarm and saturation levels

Note

This function is available only when the Primary Variable ("PV") is mapped to the Sensor Frequency or Scaled Variable device variables.

The Rosemount 2140 continuously performs self-diagnostic routines. When there is a device malfunction that is an alarm condition, the Analog Output current is driven to a configured alarm level (see tables) based on the HI or LO alarm switch position (see "Setting the alarm switch" on page 46) and the ordered Alarm Level code.

In normal operation, the Analog Output current is driven in response to fork frequency changes. If the fork frequency goes outside sensor limits (see Table 2-4 on page 28), or if the output current would be beyond the saturation points (see tables), the current is limited to a saturation level based on the alarm switch position and the ordered Alarm Level code.

Table 2-5. Rosemount Alarm and Saturation Values (Alarm Level code C8)

Level	4–20 mA saturation	4–20 mA alarm
Low (LO position)	3.9 mA	≤ 3.75 mA
High (HI position)	20.8 mA	≥ 21.75 mA

Table 2-6. NAMUR-Compliant Alarm and Saturation Values (Alarm Level codes C4/C5)

Level	4–20 mA saturation	4–20 mA alarm
Low (LO position)	3.8 mA	≤ 3.6 mA
High (HI position)	20.5 mA	≥ 22.5 mA

Table 2-7. Custom Alarm and Saturation Values (Alarm Level code C1)

Level	4–20 mA saturation	4–20 mA alarm
Low (LO position)	3.7 mA to 3.9 mA	3.6 mA to 3.8 mA
High (HI position)	20.1 mA to 22.9 mA	20.2 mA -to 23.0 mA

Failure mode alarm and saturation levels can be custom-configured using a Field Communicator, AMS Device Manager, or the Local Operator Interface (LOI).

The following limitations exist for custom-configurable levels:

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

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

Note

When set to HART multi-drop mode, all saturation and alarm information is sent digitally; saturation and alarm conditions will not affect the analog output. See also "Establishing multi-drop communications (optional)" on page 40.

To change or view alarm and saturation levels (Field Communicator)

Fast keys	2, 2, 2, 5, 7
-----------	---------------

1. From the Home screen, select **2: Configure**.
2. Select **2: Manual Setup > 2: Analog Output > 5: Alarm/Saturation Levels**.
3. Select **7: Config Alarm/Sat Levels**.
4. Follow prompts to configure alarm and saturation levels.
(See [Table 2-5](#), [Table 2-6](#), and [Table 2-7](#) for reference).

Note

When messages about the loop appear, take appropriate safe action and select “OK”.
See “[Configuration basics](#)” on [page 10](#) for further information.

To change or view alarm and saturation levels (AMS Device Manager)

1. Right click on the device, and select **Configure**.
2. Select **Manual Setup**, and then select **Analog Output** tab.
3. Click on the **Configure Alarm and Saturation Levels** button.
4. Follow screen prompts to configure Alarm and Saturation Levels.
(See [Table 2-5](#), [Table 2-6](#), and [Table 2-7](#) for reference).

Note

When messages about the loop appear, take appropriate safe action.
See “[Configuration basics](#)” on [page 10](#) for further information.

To change or view alarm and saturation levels (LOI)

1. Press any LOI button to activate the menu.
(See [Table 2-1](#) on [page 8](#) for assistance with using the LOI buttons).
2. If changing the alarm and saturation levels setting:
 - a. Scroll down (↓) and then select **EXTENDED MENU** (↵).
 - b. Scroll down (↓) and then select **ALRM SAT VALUES** (↵).
 - c. Scroll down (↓) to the desired option (“ROSEMOUNT VALUES”, “NAMUR VALUES” or “CUSTOM VALUES”) and then select (↵) it.
 - d. Follow screen prompts to configure Alarm and Saturation Levels.
(See [Table 2-5](#), [Table 2-6](#), and [Table 2-7](#) for reference).
3. If viewing the alarm and saturation levels:

- a. Select **VIEW CONFIG** (↵).
 - b. Scroll down (↓) until **HI SAT** and the high saturation level setting appears.
 - c. Scroll down (↓) until **LO SAT** and the high saturation level setting appears.
4. Exit the menu system by either waiting one minute for the **EXIT MENU?** prompt, or scrolling down menus to find and select **BACK TO MENU** and **EXIT TO MENU**.

Note

When messages about the loop appear, take appropriate safe action and select “↵”. See “[Configuration basics](#)” on page 10 for further information.

2.10.3 Configuring process alerts

Note

This function is available only a Rosemount 2140 and Rosemount 2140:SIS with the Extended Features Package enabled.

Process alerts allow the level detector to indicate when a pre-set data point is exceeded. Alerts can be set for the following device variables:

- Output State
- Sensor State
- Sensor Frequency
- Scaled Variable (if supported)
- Terminal Voltage
- Electronics Temperature

An active alert is displayed on a Field Communicator, AMS Device Manager status screen or in the error section of an LOI display. When the value returns within range, an alert is reset.

Alerts are configured by:

- Alert Mode – Select “on” to enable the alert, or “off” to disable it.
- High Value Alert – Defines the upper boundary limit for a device variable value.
- Low Value Alert – Defines the lower boundary limit for a device variable value.

Note

The high alert value must be higher than the low alert value. Both alert values must also be within the sensor limits.

Configuring process alerts (Field Communicator)

Fast keys	2, 3
-----------	------

1. From the Home screen, select **2: Configure**.
2. Select **3: Alert Setup**.
3. Select a device variable e.g. **Output State**.
4. Select **1: Configure Alert**.
5. Follow screen prompts to configure the alert.

Configuring process alerts (AMS Device Manager)

1. Right click on the device and select **Configure**.
2. Select **Guided Setup**, and then click the **Process Alerts** button.
3. Follow screen prompts to configure Process Alerts.

Configuring process alerts (LOI)

This function is not configurable on the Local Operator Interface.

2.10.4 Configuring Scaled Variable

Note

The Scaled Variable function is available if the Rosemount 2140 has the Extended Features Package (EFP) enabled.

The Scaled Variable function allows custom units to be displayed on the LOI display and drive the 4-20 mA output.

If custom units are to drive the 4-20 mA analog output, Scaled Variable must be re-mapped as the primary variable. See “[Configuring burst mode \(optional\)](#)” on page 38.

The Scaled Variable configuration defines the following items:

- Scaled Variable units
 - Enter the custom unit description to be displayed.
- Scaled data options
 - Select the transfer function for the application: Linear or discrete.
- Frequency value position 1
 - Enter the lower known value point (with consideration of linear offset).
- Scaled Variable value position 1
 - Enter the custom unit (equivalent to the lower known value point).

- Frequency value position 2
 - Enter the upper known value point.
- Scaled Variable value position 2
 - Enter the custom unit (equivalent to the upper known value point).
- Linear offset
 - The value required to zero out fork frequency effecting the desired fork frequency reading.

Configuring Scaled Variable (Field Communicator)

Fast keys	2, 1, 4
-----------	---------

1. From the Home screen, select **2: Configure**.
2. Select **1: Guided Setup**, and then **3: (or 4:) Scaled Variable**.
3. Follow the screen prompts to configure the Scaled Variable function.

Note

When messages about the loop appear, take appropriate safe action and select “OK”. See “[Configuration basics](#)” on page 10 for further information.

Configuring Scaled Variable (AMS Device Manager)

1. Right click on the device and, select **Configure**.
2. Select the **Scaled Variable** tab and click the **Scaled Variable** button.
3. Follow the prompts to configure the Scaled Variable function.

Note

When messages about the loop appear, take appropriate safe action. See “[Configuration basics](#)” on page 10 for further information.

Configuring Scaled Variable (LOI)

1. Press any LOI button to activate the menu.
(See [Table 2-1 on page 8](#) for assistance with using the LOI buttons).
2. Scroll down (↓) and then select **EXTENDED MENU** (↵).
3. Scroll down (↓) and then select **SCALED VARIAB** (↵).
4. Scroll down (↓) and then select **CONFIG SCALED** (↵).
5. Follow the prompts to configure the Scaled Variable function.

Note

When messages about the loop appear, take appropriate safe action and select “↵”. See “[Configuration basics](#)” on page 10 for further information.

2.11 Configuring burst mode (optional)

Fast keys	2, 2, 5 or 6, 3
-----------	-----------------

Burst mode is compatible with the analog output signal. Due to the way that 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 variables (PV, SV, TV, and QV), and does not affect the way other data is accessed. However, when activated, burst mode can slow down communication of non-dynamic variable data to the host by 50%.

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

Choosing burst mode options in HART 5

Message content options:

- PV only
- Percent of Range
- PV, SV, TV, and QV
- Process Variables
- Device Status

Choosing burst mode options in HART 7

Message content options:

- PV only
- Percent of Range
- PV, SV, TV, and QV
- Process Variables and Status
- Process Variables
- Device Status

Choosing a HART 7 Trigger Mode

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

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

Note

Consult your host system manufacturer for burst mode requirements.

Configuring burst mode (Field Communicator)

1. From the Home screen, select **2: Configure**.
2. Select **2: Manual Setup > (5: or 6:) HART. > 3: Burst Mode Configuration**.
3. Configure **Burst Message 1**.
 - a. Select **Burst Message 1** and choose **Enabled**.
 - b. Select **Message 1 Content** and choose an option e.g. "PV, SV, TV, and QV".
4. Optionally configure **Burst Message 2** and **Burst Message 3**.

Note

When messages about the loop appear, take appropriate safe action.
See "[Configuration basics](#)" on [page 10](#) for further information.

Note

Burst Message 1 will burst at a continuous rate of 0.5 s.
Alternatively, use the guided setup for configuring burst mode (fast keys 2, 1, 5).

Configuring burst mode (AMS Device Manager)

1. Right click on the device and select **Configure**.
2. Select **Manual Setup** and click on the **HART** tab.
3. Configure **Burst Message 1** in the **Burst Mode Configuration** box.
 - a. Select "Enabled" for **Burst Message 1**.
 - b. Select an option e.g. "PV, SV, TV, and QV" for **Message 1 Content**.
4. Optional click on the **Configure Additional Messages** button to configure **Burst Message 2** and **Burst Message 3**.
 - a. Select the message content e.g. "PV Only".
 - b. Select the trigger mode e.g. "Rising", and then the trigger level and update rate.

Note

Burst Message 1 will burst at a continuous rate of 0.5 s.
Alternatively, use the guided setup for configuring burst mode.

2.12 System readiness

- If using HART based control or asset management systems, confirm the HART capability of such systems prior to commissioning and installation. Not all systems are capable of communicating with HART revision 7 devices.
- For instructions on how to change the HART revision of your point level detector, see “Switching HART Revision” on page 8.
- Verify the latest Device Driver (DD/DTM) is loaded on your systems to ensure proper communications.

2.12.1 Confirm correct Device Driver (DD)

1. Download the latest DD from Emerson.com (or www.hartcomm.org).
2. In the **Browse by Member** drop-down menu, select Rosemount business unit of Emerson Process Management.
3. Select Rosemount 2140.

2.13 Establishing multi-drop communications (optional)

Multi-dropping refers to the connection of several devices to a single communications transmission line. Communication between the host device and another device takes place digitally with the analog output of the level detector deactivated.

Multi-drop installation requires consideration of the update rate necessary from each device, the combination of different device types, and the length of the transmission line. Communication with devices can be accomplished with HART modems and a host implementing the HART protocol. Each device is identified by a unique address and responds to the commands defined in the HART protocol.

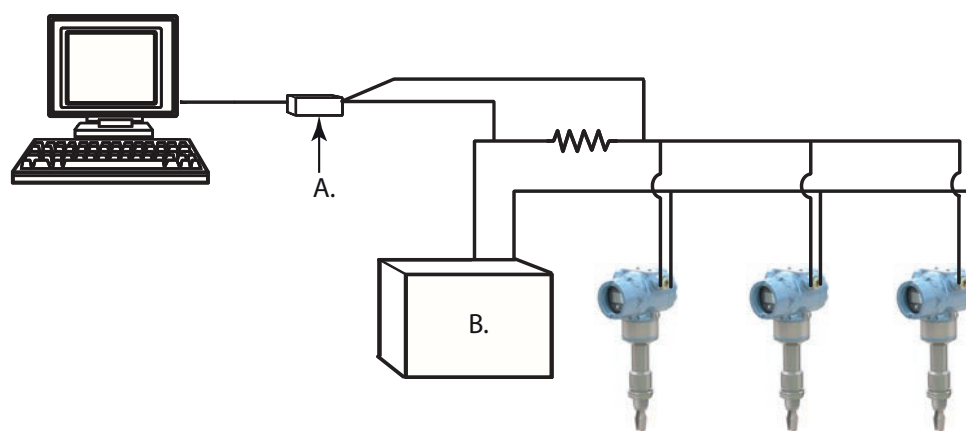
Field Communicators and AMS Device Manager can test, configure, and format a multi-dropped device the same way as a device in a standard point-to-point installation.

Figure 2-5 shows a typical multi-drop network.

Note

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

Figure 2-5. Typical Multi-drop Network



A. HART modem
B. Power supply

The Rosemount 2140 and Rosemount 2140:SIS are set to address zero (0) at the factory, which allows operation in the standard point-to-point manner with a 4–20 mA output signal.

To activate multi-drop communication, the level detector address must be changed to a number from 1 to 15 for HART Revision 5, or 1 to 63 for HART Revision 7. This change deactivates the 4–20 mA analog output, sending it to 4 mA. It also disables the failure mode alarm signal, which is controlled by the upscale/downscale switch position. Failure signals in multi-dropped devices are communicated through HART messages.

2.13.1 Communicating with a multi-dropped level detector

To communicate with a multi-drop level detector, the Field Communicator or AMS Device Manager has to be set up for polling.

Communicating with a multi-dropped device (Field Communicator)

1. Select **Utility** and **Configure HART Application**.
2. Select **Polling Addresses**, and then enter **0 to 63**.

Communicating with a multi-dropped device (AMS Device Manager)

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

2.13.2 Changing a level detector polling address

Fast keys	2, 2, 5 or 6, 2, 2
-----------	--------------------

To activate multi-drop communication, the Rosemount 2140 or Rosemount 2140:SIS poll address must be assigned a unique number from 1 to 15 for HART 5, or 1 to 63 for HART 7. Each device in a multi-dropped loop must have a unique poll address.

Changing the polling address (Field Communicator)

1. From the Home screen, select **2: Configure**.
2. Select **2: Manual Setup > 6: HART > 2: Communication Settings**.
3. Change the polling address.
 - a. In HART 5 mode, enter a polling address in the **1: Polling Address** screen.
 - b. In HART 7 mode, enter a polling address in the **2: Change Polling Address** screen.

Changing the polling address (AMS Device Manager)

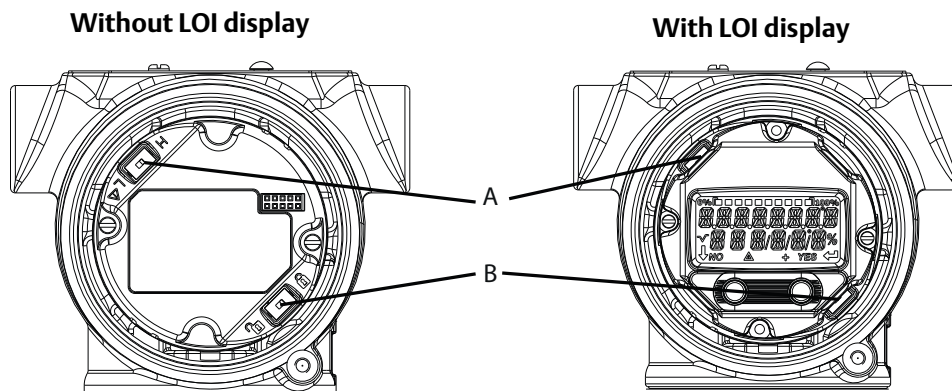
1. Right click on the device and select **Configure**.
2. In HART 5 mode:
 - a. Click on **Manual Setup**, select the **HART** tab.
 - b. In the Communication Settings box, enter a new polling address and click **Send**.
3. In HART 7 mode:
 - a. Click on **Manual Setup**, and then select the **HART** tab.
 - b. Click the **Change Polling Address** button.
4. Carefully read the warning and click **Yes** if it is safe to apply the changes.

2.14 Configuring level detector security

There are four security methods with the Rosemount 2140 and Rosemount 2140:SIS.

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


Figure 2-6. Alarm and Security Switches





A. Alarm switch
B. Security switch

2.14.1 Setting the security switch

The security switch is used to prevent changes to the configuration data. Figure 2-6 indicates the security switch location.

If the security switch is set to the locked location (), any configuration requests made using HART, LOI, or local configuration buttons are rejected and the configuration data will not be modified.

Enabling the security switch (lock position)

1.  Set process loop to manual and remove power.
2. Remove the housing cover.
3. Use a small screwdriver to slide the security switch to the lock () position.
4. Replace the housing cover.
5. The cover must be fully engaged to comply with explosion-proof requirements.

Viewing the security switch status (Field Communicator)

1. From the Home screen, select **3: Service Tools**.
2. Select **4: Maintenance > 6: Security**.
3. Select **1: Security Switch Status**.

Viewing the security switch status (AMS device Manager)

1. Right click on the device and select **Service Tools**.
2. Select **Maintenance**, and then select the **Security** tab.
3. The **Security Switch Status** is in the Hardware box.

Viewing the security switch status (LOI)

1. Press any configuration button to activate the LOI.
(See [Table 2-1 on page 8](#) for assistance with using the LOI buttons).
2. Select **VIEW CONFIG** (↵).
3. Scroll down (↓) until **SECURE** and the status is displayed.
4. Exit the menu system by either waiting one minute for the **EXIT MENU?** prompt, or scrolling down the menus to find and select **BACK TO MENU** and **EXIT TO MENU**.

2.14.2 HART Lock

Fast keys	2, 2, 6 [or 7], 4
-----------	-------------------

The HART Lock prevents changes to the configuration data from all sources.

The HART Lock can only be set using HART communication, and is only available in HART Revision 7 mode. The HART Lock can be enabled or disabled with a Field Communicator or AMS Device Manager.

Configuring HART Lock (Field Communicator)

1. From the Home screen, select **2: Configure**.
2. Select **2: Manual Setup**. > **6: Security** (or **7: Security** if Scaled Variable is available).
3. Select **4: HART Lock**.
4. Select the **Lock** or **Unlock** option.

Configuring HART Lock (AMS device Manager)

1. Right click on the device and select **Configure**.
2. Select **Manual Setup**, and then select the **Security** tab.
3. Click on the **Lock/Unlock** button in HART Lock (Software) box.
4. Follow the screen prompts to lock or unlock.

2.14.3 Configuration button lock

Fast keys	2, 2, 6 [or 7], 3
-----------	-------------------

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

Configuring the configuration button lock (Field Communicator)

1. From the Home screen, select **2: Configure**.
2. Select **2: Manual Setup > 6: Security** (or **7: Security** if Scaled Variable is available).
3. Select **3: Configuration Buttons**.
4. Select the **Disable** option to lock, or the **Enabled** option to unlock.

Configuring the configuration button lock (AMS device Manager)

1. Right click on the device and select **Configure**.
2. Select **Manual Setup**, and then select the **Security** tab.
3. Within the Configuration Buttons drop-down menu, select **Disabled** to lock the external local buttons or **Enabled** to unlock.
4. Click **Send**.
5. Confirm service reason and click **Yes**.

2.14.4 Local Operator Interface (LOI) password

Fast keys	2, 2, 6 [or 7], 5
-----------	-------------------

A Local Operator Interface password can be entered and enabled to prevent review and modification of device configuration using the LOI.

This password protection does not prevent configuration from HART or external buttons. A LOI password is a 4-digit code that is to be set by the user.

LOI password protection can be configured and enabled/disabled by HART communication using a Field Communicator, AMS Device Manager, or the LOI.

Configuring LOI password (Field Communicator)

1. From the Home screen, select **2: Configure**.
2. Select **2: Manual Setup > 6: Security** (or **7: Security** if Scaled Variable is available).
3. Select **5: LOI Password Protection**.
4. Select the **Enabled** option.
5. Enter a 4-digit number as the password.

Configuring LOI password (AMS Device Manager)


1. Right click on the device and select **Configure**.
2. Select **Manual Setup**, and then select the **Security** tab.
3. Within the Local Operator Interface box, click the **Configure Password** button.
4. Follow the screen prompts:
 - a. Enable the LOI password protection.
 - b. Enter a 4-digit number as the password.

Configuring LOI password (using Local Operator Interface)

1. Press any LOI button to activate the menu.
(See [Table 2-1 on page 8](#) for assistance with using the LOI buttons).
2. Scroll down (↓) and then select **EXTENDED MENU** (↵).
3. Scroll down (↓) and then select **PASSWORD** (↵).
4. Enable the LOI password protection.
5. Enter a 4-digit number as the password.
6. Exit the menu system by either waiting one minute for the **EXIT MENU?** prompt, or scrolling down the menus to find and select **BACK TO MENU** and **EXIT TO MENU**.

2.15 Setting the alarm switch

On the electronics board is an alarm switch (see [Figure 2-6 on page 43](#)). Follow the steps below to configure the alarm switch.

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

Section 3 Hardware Installation

3.1 Safety messages

Procedures and instructions in this section may require special precautions to ensure the safety of the personnel performing the operation. Information that raises potential safety issues is indicated by a warning symbol (⚠). The external hot surface symbol (🔥) is used when a surface is hot and care must be taken to avoid possible burns. If there is a risk of an electrical shock, the (⚡) symbol is used. Refer to the following safety messages before performing an operation preceded by this symbol.

⚠ WARNING

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

- The Rosemount 2140 Level Detector and Rosemount 2140:SIS Level Detector (“level detectors”) must be installed, connected, commissioned, operated, and maintained by suitably qualified personnel only, observing any national and local requirements that may apply.
- Ensure the wiring is suitable for the electrical current and the insulation is suitable for the voltage, temperature, and environment.
- Use the equipment only as specified in this manual. Failure to do so may impair the protection provided by the equipment.
- Any substitution of non-recognized parts may jeopardize safety and is under no circumstances allowed.
- The weight of a level detector with a heavy flange and extended fork length may exceed 37 lb. (18 kg). A risk assessment is required before carrying, lifting, and installing the level detector.

Failure to comply with the following requirements will result in the invalidation of the product safety certification.

- Check for risk of process medium build-up on the level switch forks. Avoid situations where drying and coating products may create an excessive build-up (see [Figure 3-3 on page 51](#)) or implement preventative maintenance programs to ensure the build-up is not enough to impair performance.
- Ensure there is no risk of 'bridging' the level switch forks. Examples of products that create 'bridging' of the forks are dense paper slurries and bitumen.

Explosions could result in death or serious injury.

- Installation of this level detector in a hazardous area environment must be in accordance with the appropriate local, national, and international standards, codes, and practices.
- Please review [Appendix B: Product Certifications](#) for restrictions associated with hazardous area installation.
- Before connecting a Field Communicator in an explosive atmosphere, ensure the instruments in the loop are installed in accordance with intrinsically safe or non-incendive field wiring practices.
- In an explosion-proof/flameproof installation, do not remove the level detector covers when power is applied to the unit.

▲ WARNING

External surface may be hot.

- Care must be taken to avoid possible burns.

Process leaks may cause harm or result in death.

- Install and tighten process connectors before applying pressure.
- Do not attempt to loosen or remove process connectors while a level detector is in service.

Electrical shock can result in death or serious injury.

- If the level detector is installed in a high voltage environment and a fault condition or installation error occurs, high voltage may be present on leads and terminals.
- Use extreme caution when making contact with the leads and terminals.
- Make sure that power to the level detector is off while making connections.

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

- Use only spare parts supplied or sold by Emerson.

3.2 Considerations before installation

Important

Emerson is not in a position to evaluate or guarantee the compatibility of the process fluid or other process parameters with the product, options, configuration or materials of construction selected.

3.2.1 Safety considerations

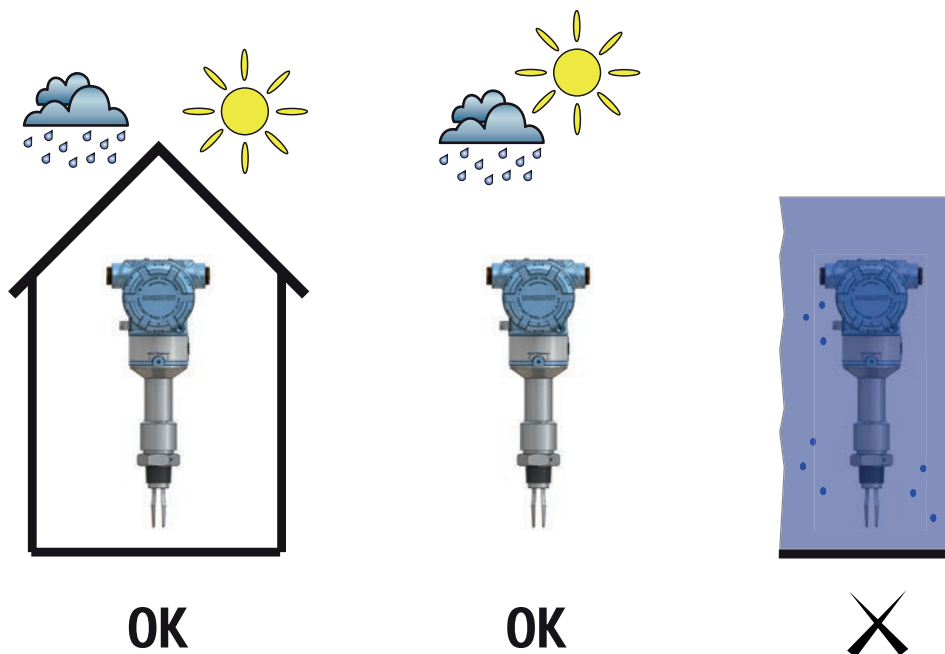
Control drawings for hazardous area installations are in [Appendix B: Product Certifications](#), and there are safety instructions in the Rosemount 2140 [Product Certifications Manual](#) (see Emerson.com/Rosemount for other language versions).

3.2.2 Environmental considerations

The Rosemount 2140 Level Detector and Rosemount 2140:SIS Level Detector are wired point level detectors, and are available as Intrinsically Safe (IS) or explosion-proof/flame-proof versions for hazardous area installations. There are also ordinary location versions for unclassified, safe areas. Approvals are listed in [Appendix B: Product Certifications](#) of this manual.

These level detectors are designed for open or closed tanks, and pipe installation. It is weatherproof and protected against the ingress of dust, but must be protected from flooding. Avoid installing the level detector near heat sources.

Figure 3-1. Environmental Considerations



3.2.3 Application considerations

For most liquids, including coating, aerated liquids and slurries, the function is virtually unaffected by flow, turbulence, bubbles, foam, vibration, solid particles, build-up, or properties of the liquid.

The Rosemount 2140 and 2140:SIS Level Detectors (“level detectors”) are available as Intrinsically Safe (IS) or explosion-proof/flameproof versions for hazardous area installations. There are also ordinary location versions for unclassified, safe areas.

The level detectors can be mounted in an open or closed tank, or a pipe. There is a wide range of threaded, flanged, and hygienic process connection options.

Supported process temperature ranges are dependent on the selected Operating Temperature code in the model number.

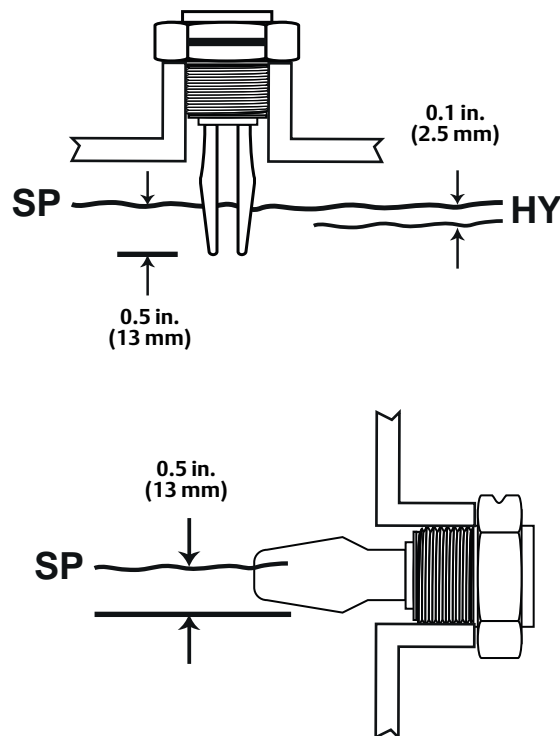
- 2140***M is the mid range option: -40 °F (-40 °C) to 356 °F (180 °C)
- 2140***E is the high range option: -94 °F (-70 °C) to 500 °F (260 °C)

If applicable, see also [Appendix B: Product Certifications](#) for the process temperature range limits required to comply with hazardous area product approvals.

Application limits

- Check for risk of process medium build-up on the level switch forks.
Avoid situations where a drying and coating process medium may create an excessive build-up (see [Figure 3-3 on page 51](#)) or implement preventative maintenance programs to ensure the build-up is not enough to impair performance.
- Ensure there is no risk of ‘bridging’ the level switch forks. Examples of products that can create ‘bridging’ of forks are dense paper slurries and bitumen.
- Problems may occur if product coats and dries causing caking.
- Ensure the process is operating within the instrument operating temperature and pressure ranges (see “[Specifications](#)” on page 103).
- Ensure the liquid viscosity is within the recommended viscosity range (see “[Specifications](#)” on page 103).
- Check that the liquid density is higher than 0.4 SG (400 kg/m³) (see “[Specifications](#)” on page 103).
- Liquid density affects the switch-point e.g. dry-to-wet (see [Figure 3-2 on page 50](#)).
- The Rosemount 2140 and 2140:SIS are normally insensitive to foams (i.e. they do not see the foam). However, on rare occasions, some very dense foams may be seen as liquid; known examples of this are found in ice-cream and orange juice manufacturing.

Figure 3-2. Level Detection Switching Point

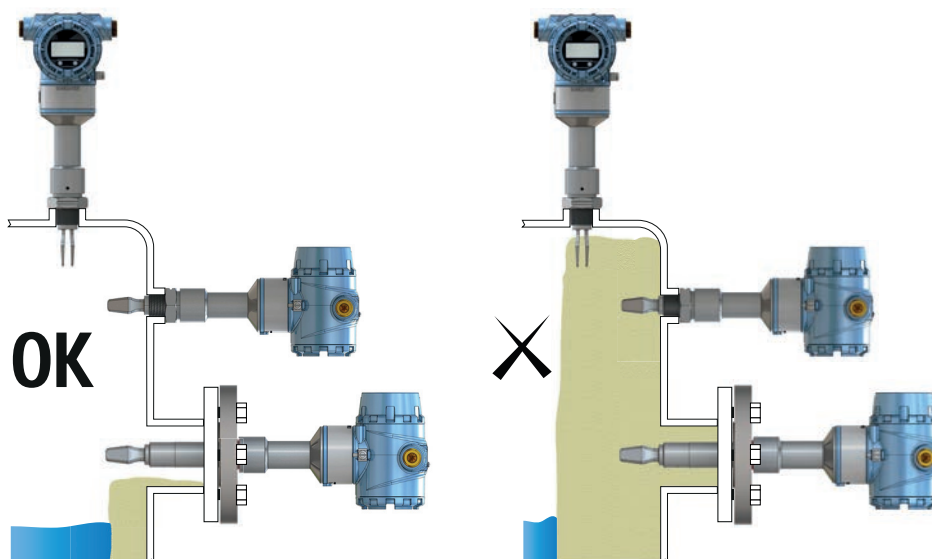


SP: Switching point (H₂O)
HY: Switching point hysteresis

Note

When mounted vertically, a low density process medium has a switching point closer to the process connection. A high density process medium has a switching point closer to fork tip.

Figure 3-3. Avoid Product Build-up



3.2.4 Installation considerations

Measurement accuracy is dependent upon the proper installation of the level detector. Keep in mind the need for easy access, personnel safety, practical field calibration, and a suitable environment for the level detector.

For dimensional drawings, see “[Dimensional drawings](#)” on page 106.

Device identification

To identify the Rosemount 2140 version, see the labels on the housing.

Electronics housing clearances

Mount the level detector in a position to allow easy access to the terminals.

Provide 0.75 in. (19 mm) of clearance for a standard cover to be removed. If an LCD display is installed, provide 3 in. (76.2 mm) of clearance for the extended cover to be removed.

For dimensional drawings, see “[Dimensional drawings](#)” on page 106.

Covers installation

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

Grounding

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

The most effective grounding method for the housing is a direct connection to earth ground with minimal impedance. Housings have an external earth ground point for making this connection.

Adjust display rotation

To rotate the housing (Figure 3-4), perform the following procedure:


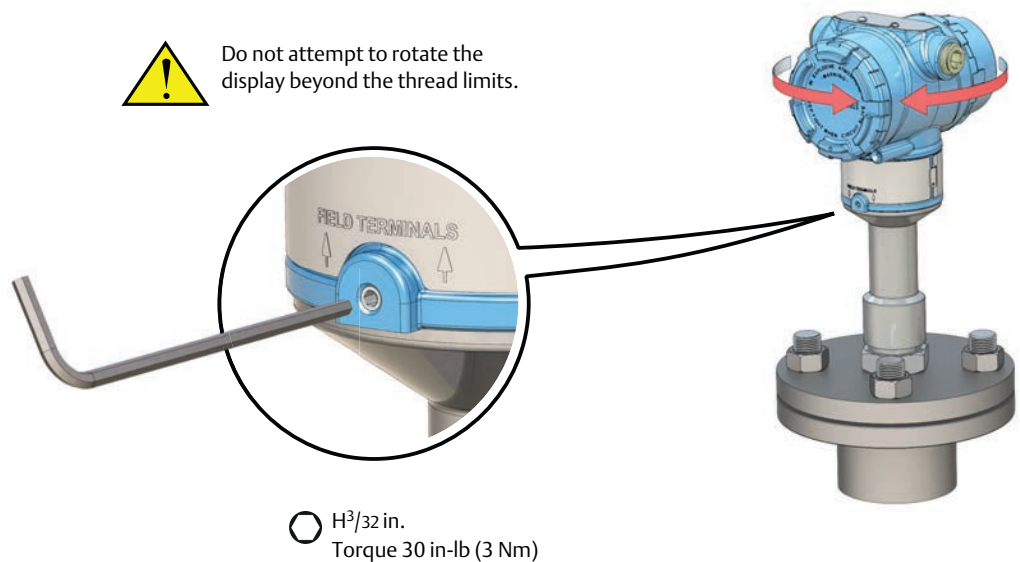
1.  Loosen the set screw until the level detector housing can rotate smoothly.
 - a. Do not unscrew all the way. Rotating the housing, without this screw in place, can damage the internal wiring.
2. First, rotate the housing clockwise to the desired location.
 - a. If the desired location cannot be achieved due to the internal thread limit, rotate the housing counterclockwise
3. Re-tighten the set screw.

Figure 3-4. Housing Rotation

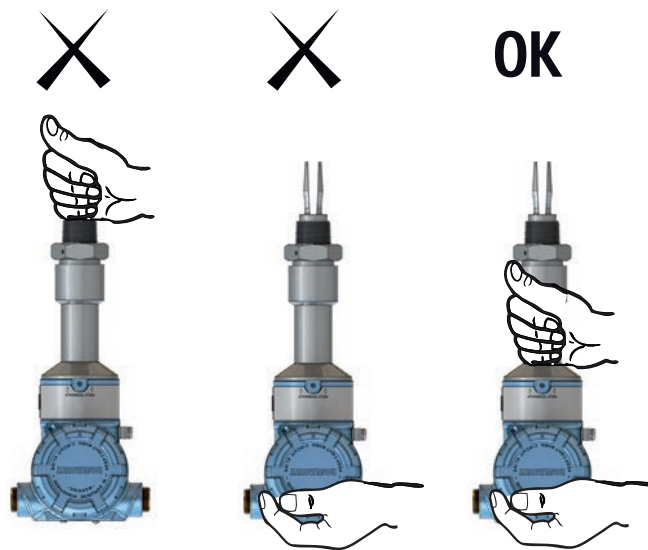


How to handle the Rosemount 2140

The weight of the level detector with a heavy flange and extended fork length may exceed 37 lb. (18 kg). A risk assessment is required before carrying, lifting, and installing the Rosemount 2140.

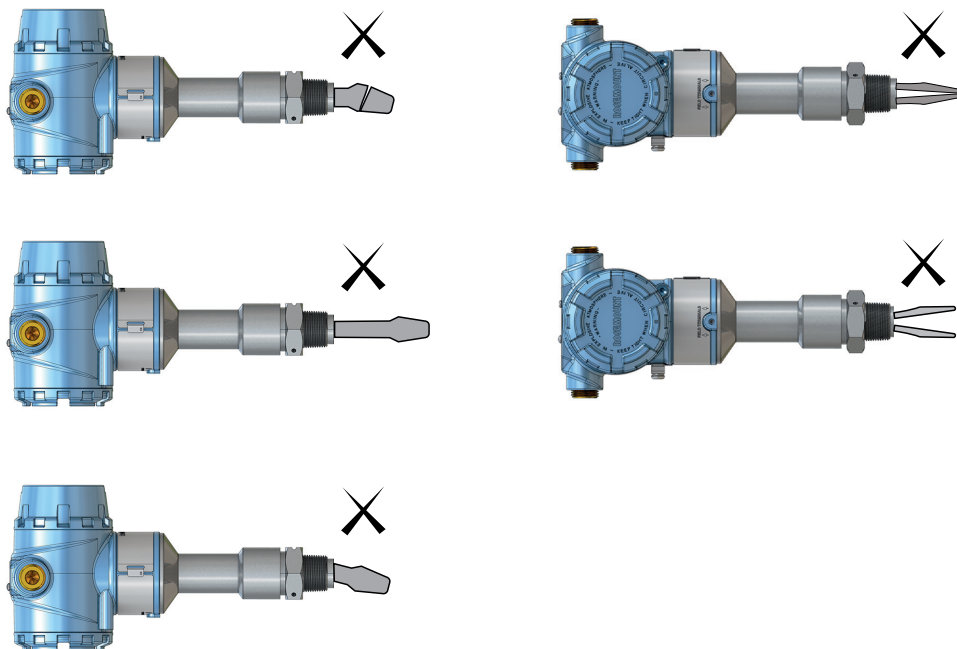
Use both hands to carry the level detector, and do not hold using the forks (Figure 3-5).

Figure 3-5. Handling the Rosemount 2140



Do not change the Rosemount 2140 in any way

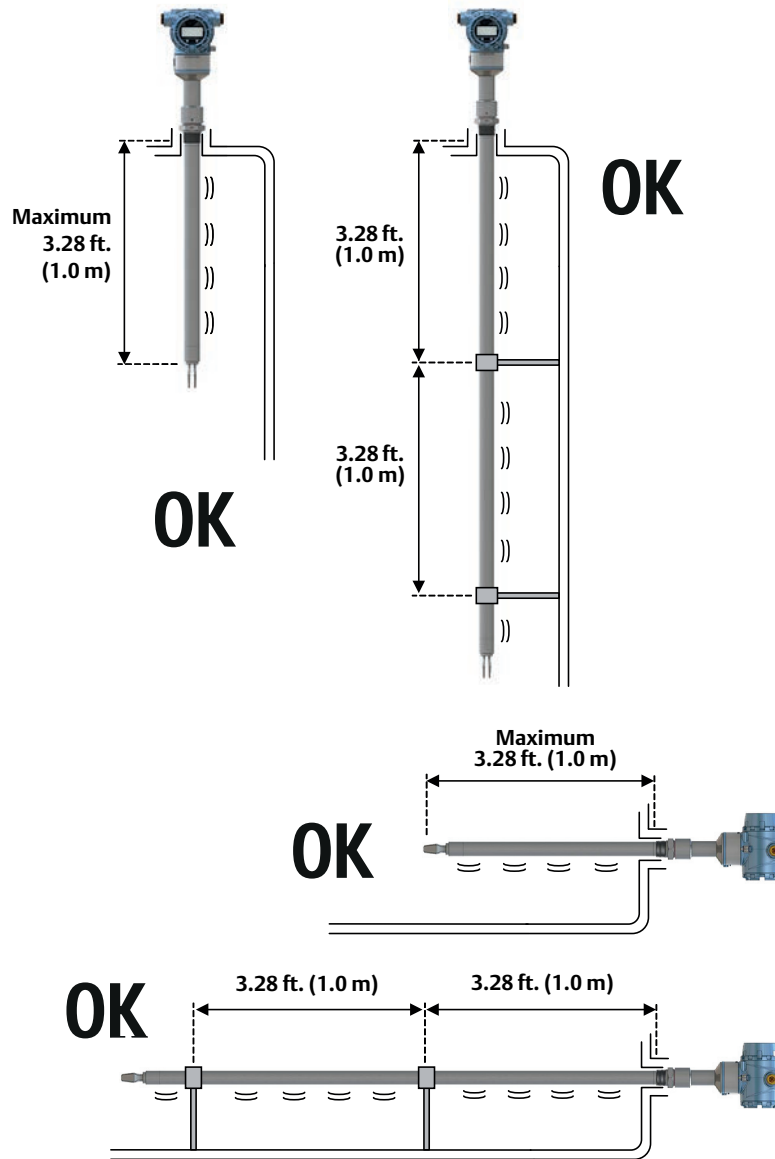
Figure 3-6. Do Not Change the Rosemount 2140



Installation recommendations

- Avoid installing near to liquid entering the tank at the fill point.
- Avoid heavy splashing on the forks.
Increasing the sensor output delay reduces accidental switching caused by splashing (see “[Sensor output delay](#)” on page 16).
- Ensure that the forks do not come into contact with the tank wall, any internal fittings, or obstructions.
- Ensure there is sufficient distance between build-up on the tank wall and the fork (see [Figure 3-3](#) on page 51).
- Ensure the installation does not create tank crevices around the forks where liquid may collect. This can happen with high-viscosity and high-density liquids.
- Extra consideration is needed if the plant vibration is close to the 1400 Hz. operating frequency of the Rosemount 2140.
- Supporting the fork extension tube avoids long fork length vibration (see [Figure 3-7](#) on page 55).

Figure 3-7. Required Supports for Extended Fork



3.2.5 Installation examples

Figure 3-8. High and Low Level Alarms

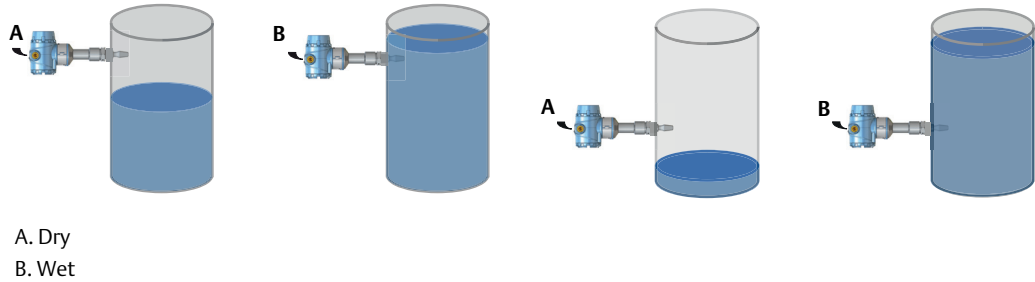


Figure 3-9. Pump Control or Overfill Protection

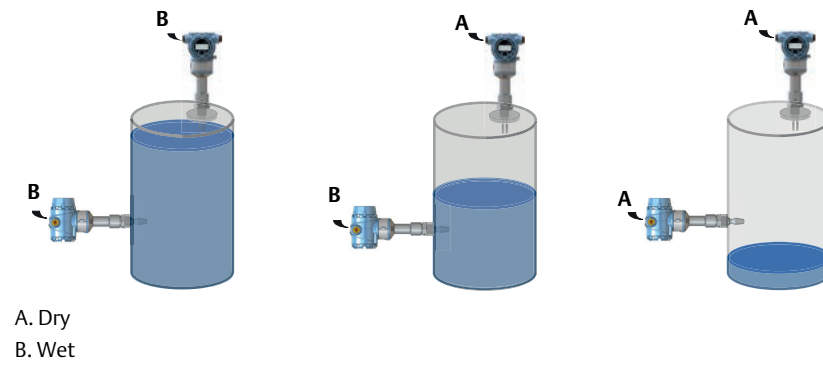
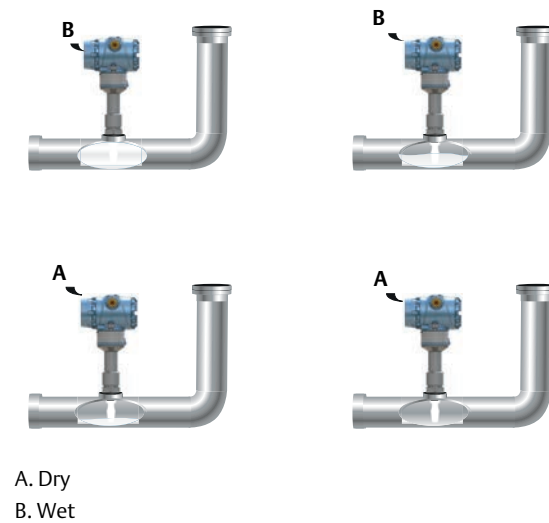


Figure 3-10. Pump or Empty Pipe Protection

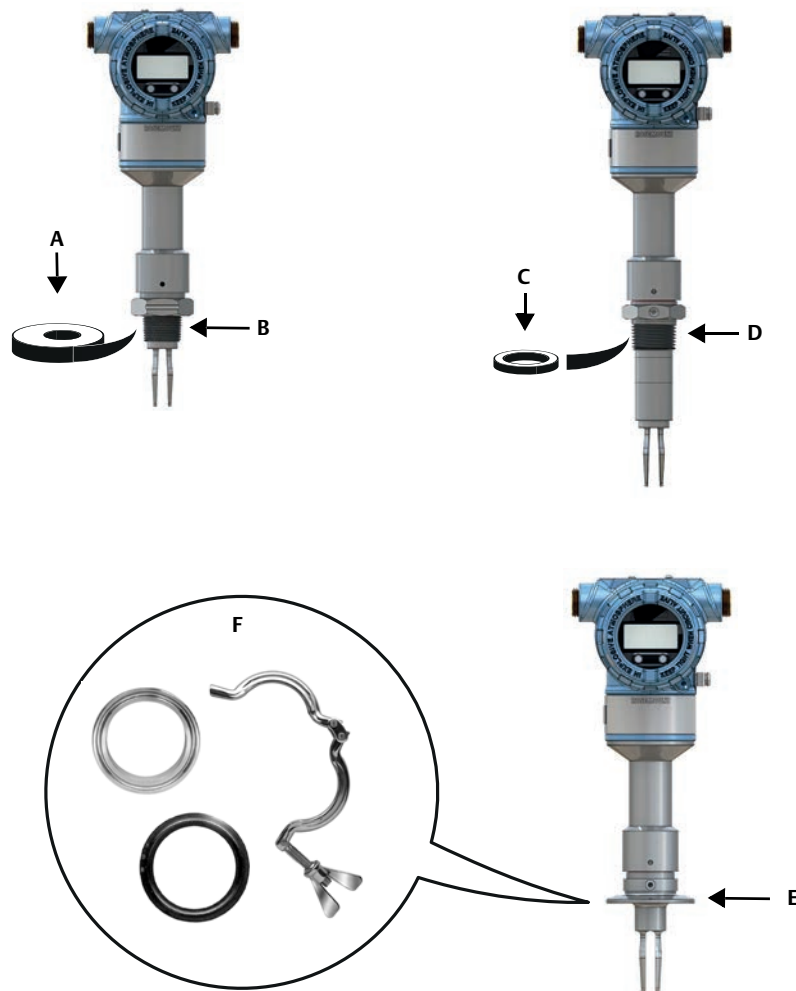


3.3 Installation procedures

For dimensional drawings, see Appendix A: Specifications and Reference Data on page 106.

3.3.1 Process connection seals

Figure 3-11. Process Connection Seals

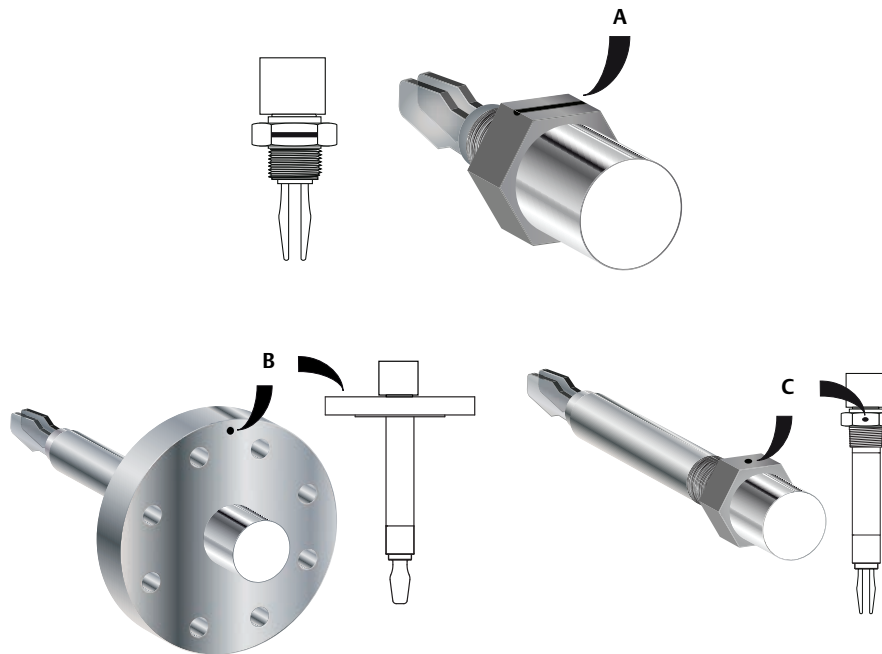


- A. PTFE
- B. NPT or BSPT (R) thread
- C. Gasket
- D. BSPP (G) thread
- E. Tri Clamp
- F. The Tri Clamp seal is supplied as an as accessory kit (see page 119)

3.3.2 Correct fork alignment

Ensure the fork is correctly aligned by using the notches and grooves as indicated in Figure 3-12.

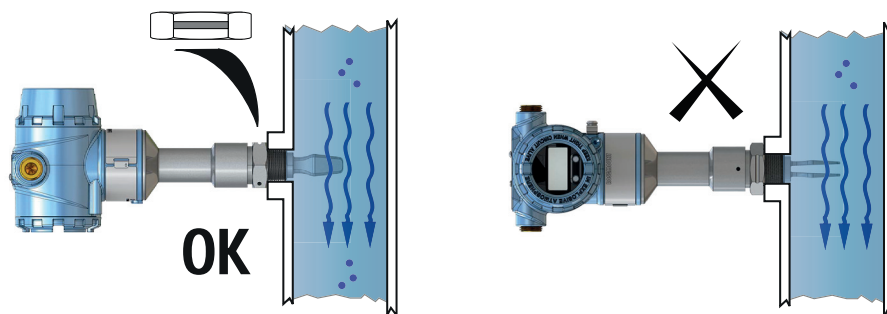
Figure 3-12. Correct Fork Alignment



- A. Alignment groove on standard length Rosemount 2140
- B. Alignment notch on flanged Rosemount 2140
- C. Alignment notch on extended length Rosemount 2140

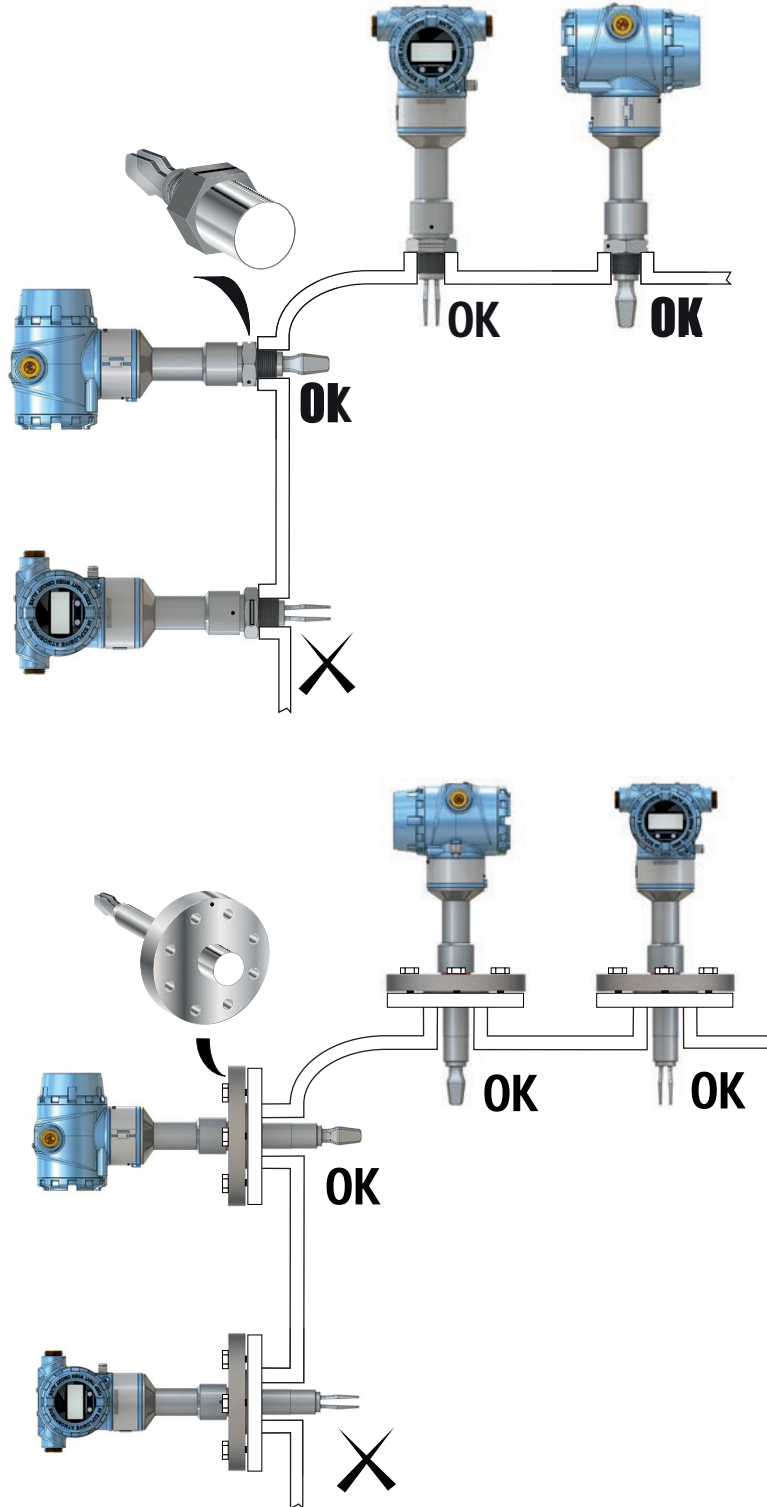
Pipe installation

Figure 3-13. Pipe Installation



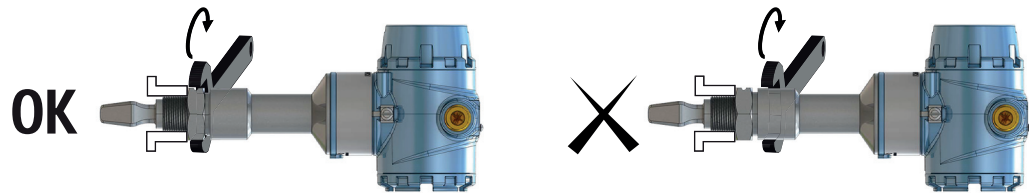
Tank installation

Figure 3-14. Tank Installation



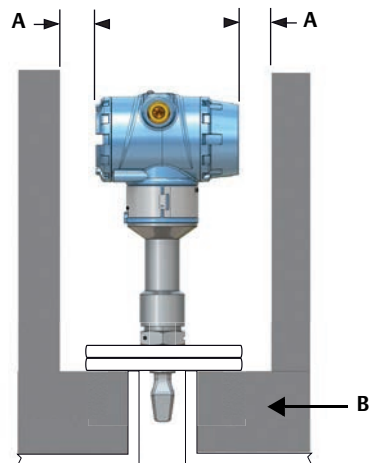
3.3.3 Tightening the threaded Rosemount 2140

Figure 3-15. Tightening the Threaded Rosemount 2140



3.3.4 Insulation


Figure 3-16. Insulation



- A. 3.9 in. (100 mm) clearance all around
- B. ROCKWOOL®

Section 4 Electrical Installation

4.1 Safety messages

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

WARNING

Explosions could result in death or serious injury.

- Installation of Rosemount 2140 and 2140:SIS Level Detectors (“level detectors”) in an explosive environment must be in accordance with the appropriate local, national, and international standards, codes, and practices.
- Please review [Appendix B: Product Certifications](#) for any restrictions associated with a safe installation.
- Before connecting a Field Communicator in an explosive atmosphere, ensure the instruments in the loop are installed in accordance with intrinsically safe or non-incendive field wiring practices.
- In an explosion-proof/flameproof installation, do not remove the level detector covers when power is applied to the unit.
- Covers are not to be removed in extreme environmental conditions. The internals must be kept free from moisture and conductive dust.

Process leaks may cause harm or result in death.

- Install and tighten process connectors before applying pressure.

Electrical shock can result in death or serious injury.

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

CAUTION

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

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

For explosion-proof and ordinary locations installations in accordance with the National Electrical Code, ANSI/NFPA 70 or the Canadian Electrical Code, C22.1., the Rosemount 2140 is to be supplied by a Class 2 or Limited Energy Source.

4.2 Cable selection

Wiring should be adequately rated and not be susceptible to mechanical damage. Electrical conduit is commonly used to protect wiring. The wiring to this device must maintain creepage(1) and clearance distances. Therefore, the conductors stripping length should be no greater than 6 mm and be free from stray strands.

Use shielded twisted pairs to get the best results. To ensure proper communications, use 24 AWG, to a maximum of 14 AWG, and do not exceed 5000 ft. (1500 m). Cable length is limited by the selection of monitoring resistance and wire gauge.

All power to the level detector is supplied over the signal wiring. Signal wiring does not need to be shielded, but use twisted pairs for best results. Do not run unshielded signal wiring in conduit or open trays with power wiring, or near heavy electrical equipment. For high EMI/RFI environments, shielded twisted pair cable should be used.

4.3 Cable gland/conduit

For explosion-proof/flameproof installations, only use cable glands/conduit entry devices certified as explosion-proof/flameproof. For ordinary location installations, use suitably rated cable glands to maintain the IP rating.

Un-used conduit entries must be sealed with a suitably rated blanking plug. See “Conduit entries” on page 103 for all other details.

4.4 Power supply

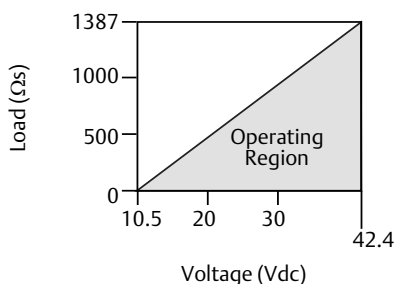
Terminals in the housing provide connections for signal wiring.

Rosemount 2140 and Rosemount 2140:SIS Level Detectors (“level detectors”) operate with the following power supplies:

- 10.5 to 42.4 Vdc (10.5 to 30 Vdc in Intrinsically Safe installations).

For HART communication, a minimum loop resistance of 250Ω is required. Maximum loop resistance is determined by the voltage level of the external power supply (Figure 4-1).

Figure 4-1. Load Limitation



$$\text{Maximum Loop Resistance} = 43.5 * (\text{External Power Supply Voltage} - 10.5)$$

4.5 Hazardous areas

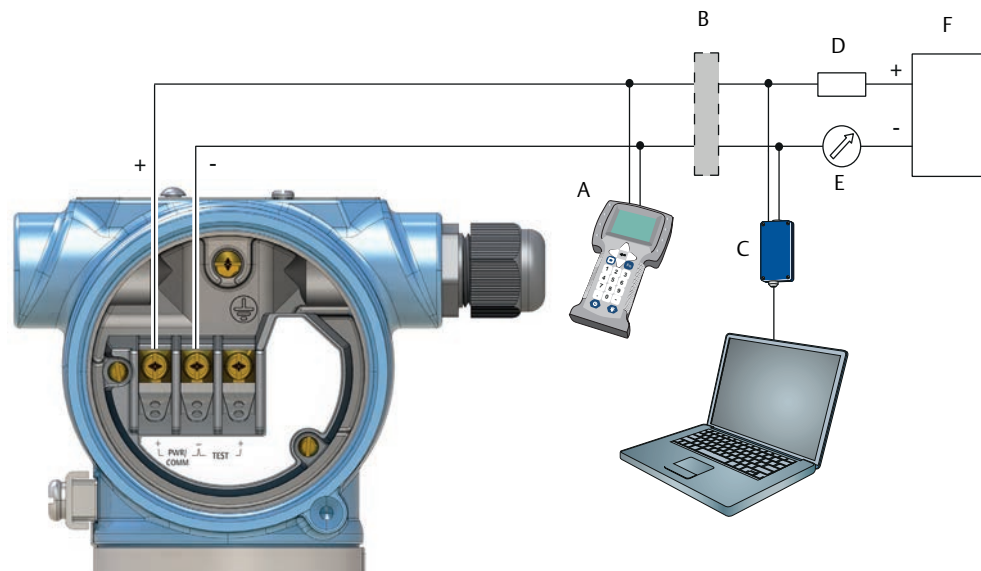
When the level detector is installed in hazardous areas, local regulations and specifications in applicable certificates must be observed.

4.6 Wiring diagram

⚠ CAUTION

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

Figure 4-2. 4-20 mA/HART® Communication



- A. Field Communicator (IS approved for intrinsically safe installations)
- B. Approved IS barrier (for intrinsically safe installations only)
- C. HART modem
- D. Load resistance ($\geq 250\Omega$)
- E. Current meter
- F. Power supply

4.7 Grounding

Always ground the housing in accordance with national and local electrical codes. Failure to do so may impair the protection provided by the equipment.

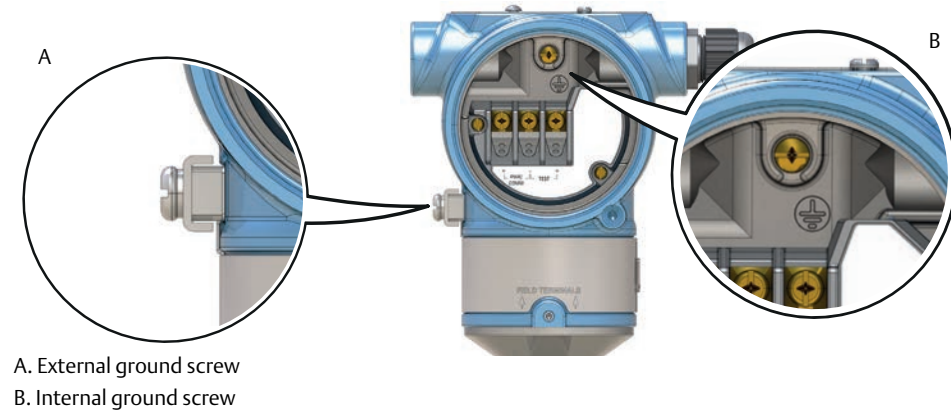
4.7.1 Level switch grounding

The most effective grounding method is a direct connection to earth ground with minimal impedance ($< 1\Omega$). [Figure 4-3 on page 64](#) shows the two grounding screw connections provided on the level detector.

Note

Grounding the level detector using a threaded conduit connection may not provide a sufficient ground.

Figure 4-3. Ground Screws

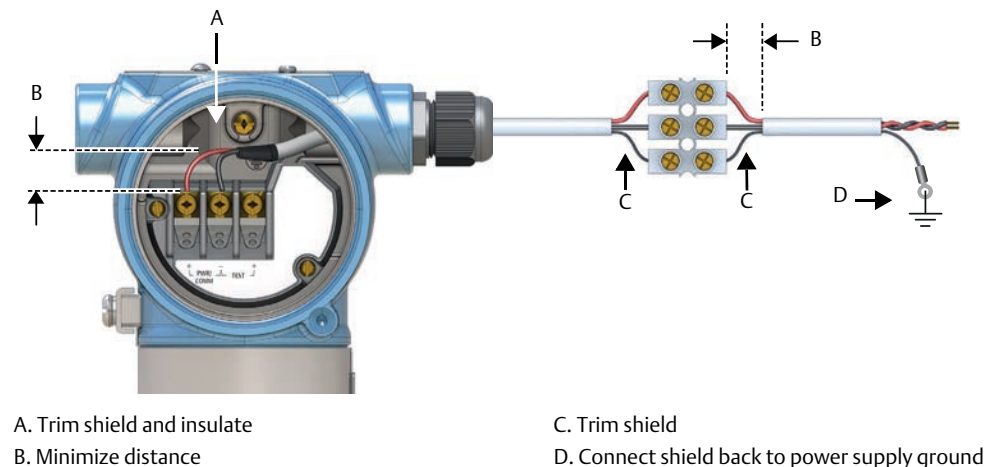


4.7.2 Signal cable shield grounding

Make sure the instrument cable shield is:

- trimmed close and insulated from touching the level detector housing.
- continuously connected throughout the segment.
- connected to a good earth ground at the power supply end.

Figure 4-4. Cable Shield



4.7.3 Transient protection terminal block grounding

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

A transient protection terminal block can be ordered as an installed option (code T1). The lightning bolt symbol in identifies the transient protection terminal block.

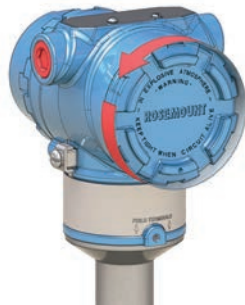
Note

The transient protection terminal block does not provide transient protection unless the housing is properly grounded.

4.8 Wiring and power-up

- ⚠ 1. Verify the power supply is disconnected.
- ⚠ 2. Remove the field terminals cover.

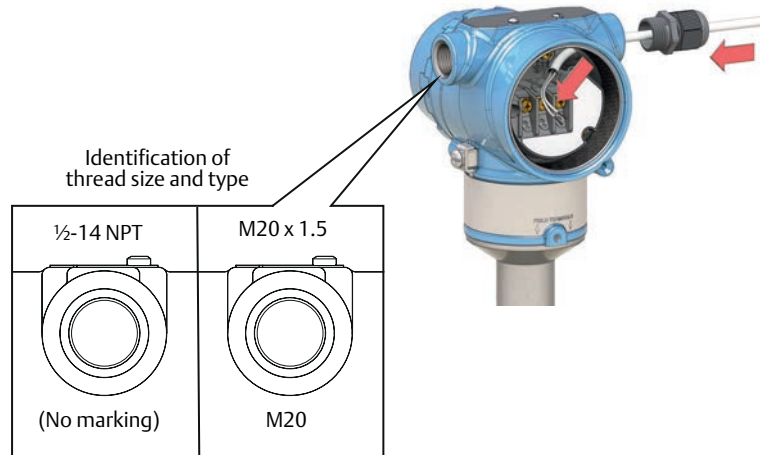
In an explosion-proof/flameproof installation, do not remove the level detector covers when power is applied to the unit. Covers are also not to be removed in extreme environmental conditions.



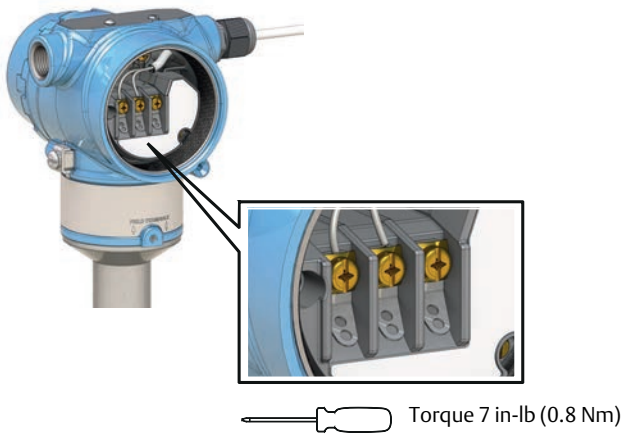
3. Remove the plastic plugs



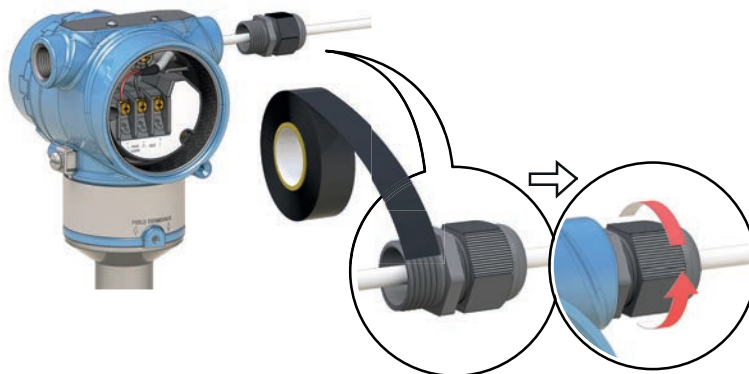
4. Pull the cable through the cable gland/conduit.



5. Connect the cable wires (see also [Figure 4-2 on page 63](#)).



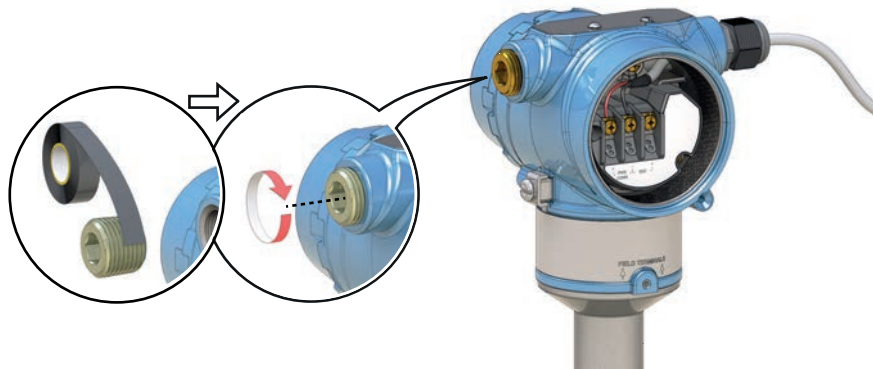
6. Ensure proper grounding (see [“Grounding” on page 63](#)).
7. Tighten the cable gland.
Apply PTFE tape or other sealant to the threads.



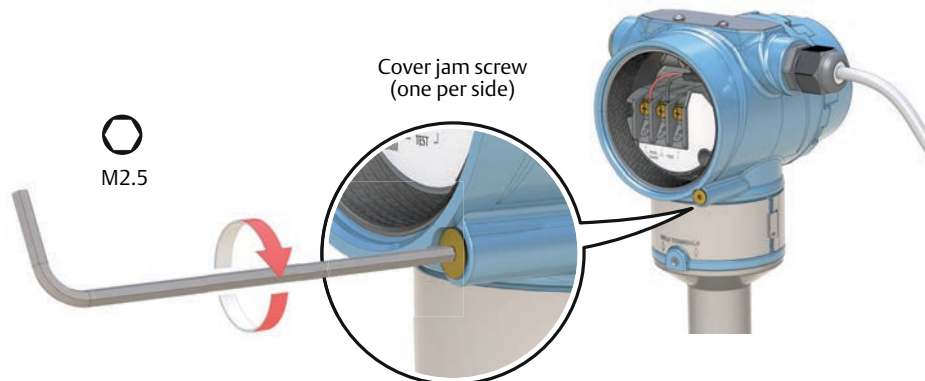
8. Arrange the wiring with a drip loop.



9. Plug and seal the unused conduit connection to avoid moisture and dust accumulation inside the housing.
Apply PTFE tape or other sealant to the thread.



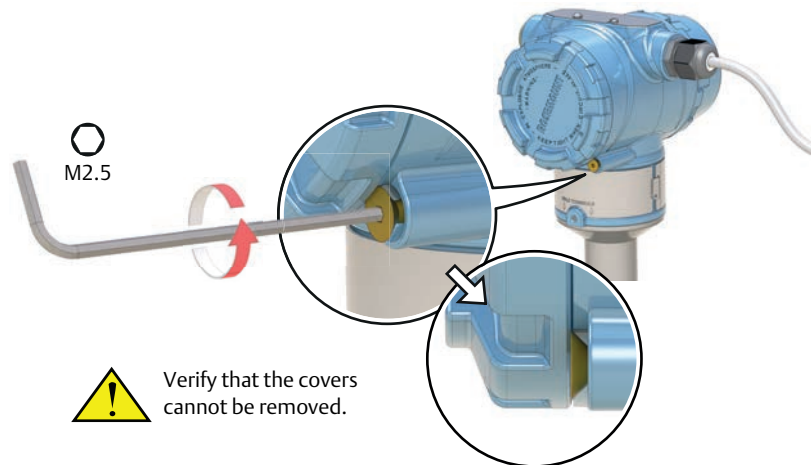
10. Re-fit the field terminals housing cover.
a. Verify the cover jam screws are completely threaded into the housing.



- b. Attach and tighten the covers. Make sure the covers are fully engaged.



- 11. Required for explosion-proof/flameproof installations only:
The cover must be fully engaged to comply with explosion-proof requirements.
 - a. Turn the cover jam screw counterclockwise until it contacts the cover.
 - b. Turn the jam screw an extra $\frac{1}{2}$ turn counterclockwise to secure the cover.




- 12. Connect the power supply.

Section 5 Operation and Maintenance

5.1 Overview

This section contains information on calibrating and testing the Rosemount 2140 and Rosemount 2140:SIS. Field Communicator, AMS, and Local Operator Interface (LOI) instructions are given to perform configuration functions.

5.2 Safety messages

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

WARNING

Explosions could result in death or serious injury.

Installation of this Rosemount 2140 and 2140:SIS Level Detector (“level detectors”) in an explosive environment must be in accordance with the appropriate local, national, and international standards, codes, and practices.

Please review [Appendix B: Product Certifications](#) for any restrictions associated with a safe installation.

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

Process leaks may cause harm or result in death.

- Install and tighten process connectors before applying pressure.

Electrical shock can result in death or serious injury.

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

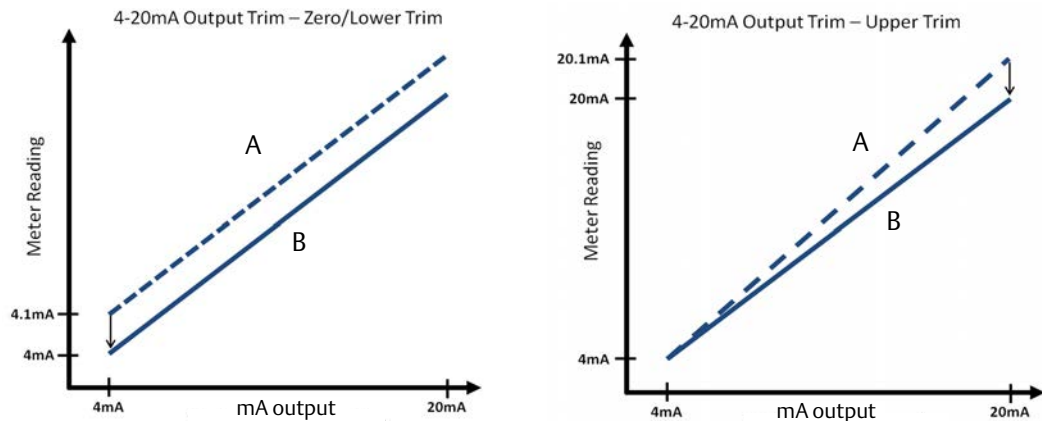
5.3 Analog output calibration

The analog output can be calibrated to match the user's measurement system. The Analog Output Trim (4-20mA Output Trim) will calibrate the loop at the 4 mA and 20 mA points.

5.3.1 Trimming the analog output

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

Figure 5-1. Analog Output Trim Example




A. Before trim
B. After Trim

Note

If a resistor is added to the loop, ensure that the power supply is sufficient to power the level detector to a 20 mA output with additional loop resistance. Refer to [“Power supply” on page 62](#).

5.3.2 Site calibration of analog output

Fast Keys	3, 4, 4, 2
-----------	------------

 This command starts the on-site calibration of the analog output. It should only be performed by authorized persons.

Note

A reference meter (ammeter) is a required for measuring the actual output current at 4 mA and 20 mA. See [“Wiring diagram” on page 63](#) for the analog output connections.

To start the on-site calibration (Field Communicator)

1. From the Home screen, select **3: Service Tools**.
2. Select **4: Maintenance > 4: Calibrate Analog**.
3. Select **2: Calibrate**.
4. Follow on-screen instructions to perform the calibration of 4 mA and 20 mA.

Note

In the Calibrate Analog menu, the **4: Analog Output** option indicates the live output current output and the **5: Percent Range** option indicates the percentage of that output current in terms of the complete 4–20 mA range. For example, 8 mA is 25% of range, 12 mA is 50%, etc.

Note

When messages about the loop appear, take appropriate safe action and select “OK”. See [“Configuration basics” on page 10](#) for further information.

To start the on-site calibration (AMS Device Manager)

1. Right click on the device and select **Service Tools**.
2. Select **Maintenance**, and then select the **Calibrate Analog** tab.
3. Click on the **Calibrate** button in the **Analog** box.
4. Follow on-screen instructions to perform the calibration of 4 mA and 20 mA.

Note

The **Analog Output** device variable indicates the live output current output, and the **Percent of Range** device variable indicates the percentage of that output current in terms of the complete 4–20 mA range. For example, 8 mA is 25% of range, 12 mA is 50%, etc.

Note

When messages about the loop appear, take appropriate safe action. See [“Configuration basics” on page 10](#) for further information.

To start the on-site calibration (using LOI)

1. Press any LOI button to activate the menu.
(See [Table 2-1 on page 8](#) for assistance with using the LOI buttons).
2. Scroll down (↓) and then select **EXTENDED MENU** (↵).
3. Select **CALIBRATE** (↵).
4. Scroll down (↓) and then select **ANALOG TRIM** (↵).
5. Follow on-screen instructions to perform the calibration of 4 mA and 20 mA.
6. Exit the menu system by either waiting one minute for the **EXIT MENU?** prompt, or scrolling down the menus to find and select **BACK TO MENU** and **EXIT TO MENU**.


Note

When messages about the loop appear, take appropriate safe action and select “↵”. See [“Configuration basics” on page 10](#) for further information.

5.3.3

Restoring factory calibration of the analog output

Fast Keys	3, 4, 4, 3
-----------	------------

-  The Recall Factory Trim—Analog Output command allows the restoration of the as-shipped factory settings of the analog output trim. This command can be useful for recovering from an inadvertent trim, incorrect Plant Standard or faulty meter. It is accessible after a site calibration has been performed, but should only be performed by authorized persons.

To restore the factory calibration (Field Communicator)

1. From the Home screen, select **3: Service Tools**.
2. Select **4: Maintenance > 4: Calibrate Analog**.
3. Select **3: Restore Factory Calibration**.
4. Follow on-screen instructions to restore the calibration.

Note

A **Restore Site Calibration** command becomes available afterwards.

Note

When messages about the loop appear, take appropriate safe action and select “OK”. See [“Configuration basics” on page 10](#) for further information.

To restore the factory calibration (AMS Device Manager)

1. Right click on the device and select **Service Tools**.
2. Select **Maintenance**, and then select the **Calibrate Analog** tab.
3. Click on the **Restore Factory Calibration** in the **Analog** box.
4. Follow on-screen instructions to restore the calibration.

Note

A **Restore Site Calibration** command becomes available afterwards.

Note

When messages about the loop appear, take appropriate safe action. See “[Configuration basics](#)” on page 10 for further information.

To restore the factory calibration (LOI)

1. Press any LOI button to activate the menu.
(See [Table 2-1 on page 8](#) for assistance with using the LOI buttons).
2. Scroll down (↓) and then select **EXTENDED MENU** (↵).
3. Select **CALIBRATE** (↵).
4. Scroll down (↓) and then select **PARAMETR RECALL** (↵).
5. Scroll down (↓) and then select **ANALOG RECALL** (↵).
6. Follow on-screen instructions to restore the calibration.
7. Exit the menu system by either waiting one minute for the **EXIT MENU?** prompt, or scrolling down the menus to find and select **BACK TO MENU** and **EXIT TO MENU**.

Note

When messages about the loop appear, take appropriate safe action and select “↵”. See “[Configuration basics](#)” on page 10 for further information.

5.4 Performing tests and simulations

5.4.1 Device tests (partial proof test)

The Rosemount 2140 Level Detector (“level detector”) has device-testing functionality. Checks include:

- Critical RAM
- Program ROM
- Configuration storage non-volatile memory
- Device supply voltage

The level detector can be configured to exercise the analog output to produce the currents representing the lower and upper range values (page 26) and alarm current (page 33).

If the level detector has the Extended Features Package (EFP) and the Scaled Variable or Sensor Frequency is assigned to the PV, the analogue output is also exercised from the low saturation level to the high saturation level (page 33).

By default, the device-testing sequence is not started at every power-up. It can be started by an operator through the LOI menu system i.e. **TEST > DEVICE TEST** or, when no LOI is not fitted, by using an optional single external push-button fitted to the top of the level detector (underneath the movable nameplate).

There are optional settings to configure:

- Duration of the whole testing sequence (each phase takes an equal division of that total time).
- Enable/disable device-testing at start-up.

To change device-test parameters (Field Communicator)

1. From the Home screen, select **2: Configure**.
2. Select **2: Manual Setup > 1: Operation > 2: Device Test**.
3. Choose the device-test parameter to change:
 - a. Select **1: Duration** for setting how long the device-test lasts.
 - b. Select **2: Start-up Device-Test** for setting if device-testing at start-up is enabled/disabled.

Note

When messages about the loop appear, take appropriate safe action and select “OK”. See “[Configuration basics](#)” on page 10 for further information.

To change device-test parameters (AMS Device Manager)

1. Right click on the device and select **Configure**.
2. Select **Manual Setup**, and then select the **Operation** tab.
3. Edit the **Duration** field if changing the setting for how long the device-test lasts.
4. Select enabled or disabled at the **Start-up Device Test** field.

Note

When messages about the loop appear, take appropriate safe action. See “[Configuration basics](#)” on page 10 for further information.

To change device-test parameters (LOI)

1. Press any LOI button to activate the menu.
(See [Table 2-1 on page 8](#) for assistance with using the LOI buttons).
2. Scroll down (↓) and then select **EXTENDED MENU** (↵).
3. Scroll down (↓) and then select **DEVICE TEST** (↵).
4. Choose the device-test parameter to change:
 - c. Select **DURATION** for setting how long the test lasts.
 - d. Select **START-UP** for setting if device-testing at start-up is enabled/disabled.
5. Exit the menu system by either waiting one minute for the **EXIT MENU?** prompt, or scrolling down the menus to find and select **BACK TO MENU** and **EXIT TO MENU**.

Note

When messages about the loop appear, take appropriate safe action and select “↵”.
See [“Configuration basics” on page 10](#) for further information.

5.4.2 Proof tests

The Rosemount 2140:SIS must be tested at regular intervals to detect any failures not automatically detected by the device self-test at start-up and the continuous fork sensor diagnostics when operating in Enhanced mode ([page 14](#)).

For full information about proof testing the Rosemount 2140:SIS, refer to the [Functional Safety Manual](#).

5.4.3 Verifying alarm level (optional)


If the electronics board, sensor module, or LOI display is repaired or replaced, verify the alarm current level before returning the level detector to service. This is useful in testing the reaction of the control system to a level detector in an alarm state. Thus ensuring the control system recognizes the alarm when activated.

To verify alarm values, run an analog loop test with the simulate alarm option selected ([page 76](#)). Ensure that the alarm switch is in the required high or low position ([page 46](#)).

Note

Before returning to service, verify the security switch is set to the correct position.
Refer to [“Setting the security switch” on page 43](#).

5.4.4 Analog loop test (optional)

 This test verifies the analog output of the level detector, the integrity of the loop, and the operations of any recorders or similar devices installed in the loop.

It is recommended that the 4-20 mA points, in addition to alarm levels, are verified when installing, repairing, or replacing a level detector.

The host system may provide a current measurement for the 4-20 mA HART output. If not, connect a reference meter (ammeter) to the level detector by either connecting the meter to the test terminals on the terminal block, or shunting level detector power through the meter at some point in the loop.

Fast Keys	3, 5, 1
-----------	---------

This loop test simulation temporarily overrides the analog output with a fixed level of current. Options are:

- 4 mA
- 20 mA
- Simulate alarm
- Other (custom mA)

Note

Simulations are canceled by exiting a screen. They also be cleared by a power re-cycle or device reset. See [“Configuring alarm and saturation levels” on page 33](#) to review output current levels for alarms.

To start the loop test (Field Communicator)

1. From the Home screen, select **3: Service Tools**.
2. Select **5: Simulate > 1: Loop Test**.
3. Select from the loop test options (e.g. 4 mA) to start the simulation.

Note

When messages about the loop appear, take appropriate safe action and select “OK”. See [“Configuration basics” on page 10](#) for further information.

To start the loop test (AMS Device Manager)

1. Right click on the device and select **Service Tools**.
2. Select **Simulate**.
3. Click on **Loop Test**.
4. Follow on-screen instructions to select a loop test and start the simulation.

Note

When messages about the loop appear, take appropriate safe action. See “Configuration basics” on page 10 for further information.

To start the output state simulation (LOI)

1. Press any LOI button to activate the menu.
(See Table 2-1 on page 8 for assistance with using the LOI buttons).
2. Scroll down (↓) and then select **TEST** (↵).
3. Scroll down (↓) and then select **LOOP TEST** (↵).
4. Select a loop test option:
 - a. Select **SET 4MA** (i.e. 4 mA)
 - b. Select **SET 20MA** (i.e. 20 mA)
 - c. Select **SET CUSTOM**.
5. Follow on-screen instructions to start and end the simulation.

5.4.5 Simulate device variables

Fast Keys	3, 5
-----------	------

Simulate device variables is only available in HART Revision 7 mode (“HART 7”).

In HART 7, it is possible to temporarily set a device variable to a user-defined fixed value for testing purposes. After the simulated variable method is exited, the device variable is automatically returned to a live value.

Simulate Output State

Fast Keys	3, 5, 2
-----------	---------

The **Output State** device variable can be temporarily overridden to be “off” or “on”.

Simulate Sensor State

Fast Keys	3, 5, 3
-----------	---------

The **Sensor State** device variable can be temporarily overridden to be “dry” or “wet”.

Simulate Sensor Frequency

Fast Keys	3, 5, 4
-----------	---------

The **Sensor Frequency** device variable can be temporarily overridden with an entered frequency in the range 0 to 3000 Hz.

Simulate Scaled Variable (if supported)

Fast Keys	3, 5, 5
-----------	---------

The **Scaled Variable** device variable can be temporarily overridden with an entered value.

Simulate Electronics Temperature

Fast Keys	3, 5, 6 [or 5]
-----------	----------------

The **Electronics Temperature** device variable can be temporarily overridden with an entered temperature value.

Simulate Terminal Voltage

Fast Keys	3, 5, 7 [or 6]
-----------	----------------

The **Terminal Voltage** device variable can be temporarily overridden with an entered voltage value.

To start a device variable simulation (Field Communicator)

1. From the Home screen, select **3: Service Tools**.
2. Select **5: Simulate**, and then select a device variable option:
 - a. **Output State**.
 - b. **Sensor State**.
 - c. **Sensor Frequency**.
 - d. **Scaled Variable**.
 - e. **Electronics Temperature**.
 - f. **Terminal Voltage**.
3. Follow on-screen instructions to start the simulation.

Note

When messages about the loop appear, take appropriate safe action. See [“Configuration basics” on page 10](#) for further information.

To start a device variable simulation (AMS Device Manager)

1. Right click on the device and select **Service Tools**.
2. Select **Simulate**, and then select a device variable:
 - a. **Output State**.
 - b. **Sensor State**.
 - c. **Sensor Frequency**.
 - d. **Scaled Variable**.
 - e. **Electronics Temperature**.

- f. **Terminal Voltage.**
3. Follow on-screen instructions to start the simulation.

To start a device variable simulation (LOI)

1. Press any LOI button to activate the menu.
(See [Table 2-1 on page 8](#) for assistance with using the LOI buttons).
2. Scroll down (↓) and then select **ENTENDED MENU** (↵).
3. Scroll down (↓) and then select **SIMULATE** (↵).
4. Scroll down (↓) and select (↵) a device variable option:
 - a. **Output State.**
 - b. **Sensor State.**
 - c. **Sensor Frequency.**
 - d. **Scaled Variable.**
 - e. **Electronics Temperature.**
 - f. **Terminal Voltage.**
5. Follow on-screen instructions to start and end the simulation.

Note

When messages about the loop appear, take appropriate safe action and select “↵”.
See [“Configuration basics” on page 10](#) for further information.

5.5 Diagnostics and service

Diagnostics and service functions listed below are primarily for use after field installation.
For troubleshooting common problems, see also [Section 5: Operation and Maintenance](#).

5.5.1 Restart device

The function is used to **reset the electronics** without re-cycling the power.

Note

When messages about the loop appear, take appropriate safe action.
See [“Configuration basics” on page 10](#) for further information.

To perform a device restart (Field Communicator)

1. From the Home screen, select **3: Service Tools**.
2. Select **4: Maintenance**, and then **(6, 7 or 8:) Reset/Restore**.
3. Select **1: Restart Device**, and follow on-screen instructions to perform the restart.

To perform a device restart (AMS Device Manager)

1. Right click on the device and select **Service Tools**.
2. Select **Maintenance**, and then click on the **Reset/Restore** tab.
3. Click on **Restart Device**, and follow on-screen instructions to perform the restart.

To perform a device restart (LOI)

This function is not available on the Local Operator Interface.

5.5.2 Load user defaults

The function **resets variables to their ex-factory settings** (see [Table](#) on page 80).

Note

When messages about the loop appear, take appropriate safe action. See “[Configuration basics](#)” on page 10 for further information.

To load user defaults (using Field Communicator)

1. From the Home screen, select **3: Service Tools**.
2. Select **4: Maintenance**, and then (**6, 7, or 8:**) **Reset/Restore**.
3. Select **2: Load User Defaults**.
4. Follow on-screen instructions to load user defaults.

To load user defaults (AMS Device Manager)

1. Right click on the device and select **Service Tools**.
2. Select **Maintenance**, and then click on the **Reset/Restore** tab.
3. Click on **Load User Defaults**.
4. Follow on-screen instructions to load user defaults.

To load user defaults (LOI)

This function is not available on the Local Operator Interface.

5.5.3 Sensor frequency

Fast Keys	3, 4, 1, 1, 1
-----------	---------------

The vibrating fork frequency is indicated in the **Sensor Frequency** device variable after sensor compensation has been applied.

Sensor Frequency is mapped to the HART dynamic variable SV (Secondary Variable). It is indicated on the LOI (see “Local Operator Interface (LOI) display” on page 29).

To view the fork frequency (Field Communicator)

1. From the Home screen, select **3: Service Tools**.
2. Select **4: Maintenance > 1: Diagnostics > 1: Sensor**.
3. Select **1: Sensor Frequency**.

Note

Fast Key sequence 3, 2, 3, 3 also indicates the compensated fork frequency. The uncompensated fork frequency, i.e. before sensor compensation is applied, is available at fast key sequence 3, 4, 1, 1, 3.

To view the fork frequency (AMS Device Manager)

1. Right click on the device and select **Service Tools**.
2. Select **Maintenance**, and then select the **Diagnostics** tab.
3. **Sensor Frequency** is displayed in the Sensor box.

To view the fork frequency (LOI)

See “Local Operator Interface (LOI) display” on page 29.

5.5.4 Sensor compensation

Fast Keys	3, 4, 3, 3, 3
-----------	---------------

The frequency of the vibrating fork sensor may be affected by a process temperature being different to the calibrated temperature. Entering a known process temperature can compensate accordingly and provide an improved frequency switching point (page 85).

To change the compensation (Field Communicator)

1. From the Home screen, select **3: Service Tools**.
2. Select **4: Maintenance > 3: Calibrate Sensor > 3: Sensor Compensation**.
3. Select **3: Process Temperature**.
4. Enter the known process temperature.

To change the compensation (AMS Device Manager)

1. Right click on the device and select **Service Tools**.
2. Select **Maintenance**, and then select the **Calibrate Sensor** tab.
3. **Process Temperature** is displayed in the Sensor Calibration box.
4. Enter the known process temperature, and select **Send**.

To change the compensation (LOI)

This function is not available on the Local Operator Interface.

5.5.5 Sensor state

Fast Keys	3, 4, 1, 1, 4
-----------	---------------

Sensor State indicates the present state of the vibrating fork sensor.

As the vibrating fork sensor becomes immersed in a process liquid, the vibration frequency decreases and the sensor state changes to a '**wet state**' at a switching point.

When a process liquid falls away from the fork, the vibration frequency increases and the sensor state changes to a '**dry state**' at a switching point.

If the fork sensor becomes damaged or develops a fault, the vibrating frequency moves outside normal operating limits and the sensor state changes to 'too dry', 'too wet', or 'zero'. (See "[Dry fork frequency and switching points](#)" on page 85 for band limits).

To view the sensor state (Field Communicator)

1. From the Home screen, select **3: Service Tools**.
2. Select **4: Maintenance > 1: Diagnostics > 1: Sensor**.
3. Select **4: Sensor State**.

To view the sensor state (AMS Device Manager)

1. Right click on the device and select **Overview**.
2. **Sensor State** is indicated in the Primary Process Variables box.

To view the sensor state (LOI)

See "[Local Operator Interface \(LOI\) display](#)" on page 29 for how to configure the LOI to display this device variable.

5.5.6 Sensor status

Fast Keys	3, 4, 1, 1, 5
-----------	---------------

Sensor Status indicates if the point level device is operating in a valid or fault state.

The sensor status is dependent on the **Sensor State** diagnostic (page 82) and the **Sensor Operation Mode** configuration (page 14).

Note

If the operation mode is set to “Normal”, **Sensor State** cannot indicate “Too Dry”, “Too Wet”, or “Zero”, and the **Sensor Status** always indicates a valid state.

To view the sensor status (Field Communicator)

1. From the Home screen, select **3: Service Tools**.
2. Select **4: Maintenance > 1: Diagnostics > 1: Sensor**.
3. Select **5: Sensor Status**.

To view the sensor status (AMS Device Manager)

1. Right click on the device and select **Overview**.
2. **Sensor Status** is indicated in the Status box.

Table 5-1. Sensor Status Logic (Normal Mode)

Sensor Status	Sensor State ⁽¹⁾	Current Output Operating Mode	PV (Output State)
Valid	Dry	Wet on	Off (0.0)
Valid	Dry	Dry on	On (1.0)
Valid	Wet	Wet on	On (1.0)
Valid	Wet	Dry on	Off (0.0)

1. **Sensor Fault Delay** (page 22) does not delay the update of **Sensor State** when the operation mode is normal.

Table 5-2. Sensor Status Logic (Enhanced Mode, Fault = Wet)

Sensor Status	Sensor State ⁽¹⁾	Current Output Operating Mode	PV (Output State)
Valid	Dry	Wet on	Off (0.0) ⁽²⁾
Valid	Dry	Dry on	On (1.0) ⁽²⁾
Fault	Too Dry	Wet on	On (1.0) ⁽³⁾
Valid	Wet	Wet on	On (1.0) ⁽²⁾
Valid	Wet	Dry on	Off (0.0) ⁽²⁾
Fault	Too Wet	Dry on	On (1.0) ⁽³⁾
Fault	Zero	Wet on	On (1.0) ⁽³⁾

1. **Sensor Fault Delay** (page 22) delays the update of **Sensor State** when the operation mode is enhanced.
2. PV is not changed.
3. PV is automatically changed to on (1.0).

Table 5-3. Sensor Status Logic (Enhanced Mode, Fault = Dry)

Sensor Status	Sensor State ⁽¹⁾	Current Output Operating Mode	PV (Output State)
Valid	Dry	Wet on	Off (0.0) ⁽²⁾
Valid	Dry	Dry on	On (1.0) ⁽²⁾
Fault	Too Dry	Wet on	Off (0.0) ⁽³⁾
Valid	Wet	Wet on	On (1.0) ⁽²⁾
Valid	Wet	Dry on	Off (0.0) ⁽²⁾
Fault	Too Wet	Wet on	Off (0.0) ⁽³⁾
Fault	Zero	Wet on	Off (0.0) ⁽³⁾

1. **Sensor Fault Delay** (page 22) delays the update of **Sensor State** when the operation mode is enhanced.
2. PV is not changed.
3. PV is automatically changed to off (0.0).

5.5.7 Dry fork frequency and switching points

Fast Keys	3, 4, 1, 3
-----------	------------

The **Dry Fork Frequency** and switching points for **Sensor Status** transitions, can be viewed as values on a Field Communicator or graphically on the AMS Device Manager.

- **Dry Fork Frequency (DFF)**

This is the fork frequency recorded when the point level device is calibrated in dry conditions i.e. air. The frequency is typically 1260 to 1500 Hz.

The default dry fork frequency is established at the point of manufacture. However, it can be re-established by using the dry fork calibration procedure ([page 87](#)) when the level detector is installed in a working environment.

The dry fork frequency is also used by the Media Density ([page 17](#)) and Media Learn functions ([page 19](#)).
- **Dry to Too Dry**

Upper boundary for frequencies considered to be outside of the normal dry range. The “too dry” fault is indicated for the enhanced operating mode only.
- **Dry to Indeterminate**

Lower boundary for frequencies considered to be outside of the normal dry range.
- **Wet to Indeterminate**

Upper boundary for frequencies considered to be outside of the normal wet range.
- **Wet to Too Wet**

Lower boundary for frequencies considered to be outside of the normal wet range. The “too wet” fault is indicated for the enhanced operating mode only.
- **Zero**

The cut-off boundary, below which the sensor frequency is considered to be 0 Hz. The “zero” fault is indicated for the enhanced operating mode only.

Note

In normal mode, a 0 Hz sensor frequency represents a wet condition (not a fault).
When operating in enhanced mode, a 0 Hz sensor frequency represents a fault condition.

To view the switch points (Field Communicator)

1. From the Home screen, select **3: Service Tools**.
2. Select **4: Maintenance > 1: Diagnostics > 3: Switch Points**.
3. Select items **1:** to **5:** to see individual switching points.

To view the switch points (AMS Device Manager)

1. Right click on the device and select **Overview**.
2. **Sensor Frequency** is the default mapped dynamic variable TV in the Tertiary box.
3. The colored bands on the gauge are based on the switching points.

To view the switch points (LOI)

These device variables are not available to view on the Local Operator Interface.

5.5.8 Counters and timers

Fast Keys	3, 4, 2, 1 or 2
-----------	-----------------

The following counters are available:

- **Sensor Wet Count**
The count increments each time the Sensor State changes from dry to wet. This counter can be reset by entering a new value using **Reset/Presets Wet Count**.
- **Calibration Count**
The Rosemount 2140 and Rosemount 2140:SIS are calibrated under reference conditions at the factory. In special circumstances, it may be re-calibrated in the field and this increments the count.
- **Fault Count**
The count increments each time there is a fault (see “Sensor status” on page 83). This counter can be reset to zero using **Reset Fault Count**.

The following timers are available when in HART 7 mode:

- **Time Since Output Change**
The time elapsed since the Output State last changed.
- **Total Time Dry**
A totalized time for how long the Sensor State has been indicating ‘dry’. This timer can be reset to zero.
- **Total Time Wet**
A totalized time for how long the Sensor State has been indicating ‘wet’. This timer can be reset to zero.

Note

Units for the times are days, hours, minutes, and seconds.
Seconds are not shown for long times.

To view the counters/timers menu (Field Communicator)

1. From the Home screen, select **3: Service Tools**.
2. For HART 5:
 - a. Select **4: Maintenance > 2: Times**
 - b. Select **1: Counters**.
3. For HART 7:
 - a. Select **4: Maintenance > 2: Counts/Times**
 - b. Select **1: Counters** or **2: Timers**.

4. Select individual items to see the counters and timers.

To view the counters/timers menu (AMS Device Manager)

1. Right click on the device and select **Service Tools**.
2. Select **Maintenance**, and then select the **Counts/Times** tab.


To view the counters or timers menu (LOI)

These device variables are not available to view on the Local Operator Interface.

5.6 Dry fork calibration

5.6.1 Site calibration of dry fork sensor

Fast Keys	3, 4, 3, 1, 3
-----------	---------------

-  This command starts the on-site calibration of the fork sensor in **dry process conditions**. It should only be performed by authorized persons.

A comparison is made between the live fork sensor frequency measured in dry process conditions and original factory-set **Dry Fork Frequency** value (page 85).

If the difference is greater than **Allowable Change In Dry Fork Frequency** (page 21), the re-calibration is rejected. Check the fork for damage, corrosion, or coating, and clean the fork if necessary before re-trying.

When the calibration is successful, **Dry Fork Frequency** is set to the new dry frequency. See also “[Dry fork frequency and switching points](#)” on page 85 for related information.

Note

The **Dry Fork Frequency** variable is available at various locations in the menu system. For convenience when calibrating, it is provided on the Field Communicator within the **Sensor Calibration** menu, along with the live fork sensor frequency.

To start the on-site calibration (Field Communicator)

1. From the Home screen, select **3: Service Tools**.
2. Select **4: Maintenance > 3: Calibrate Sensor > 1: Sensor Calibration**.
3. Select **3: Calibrate Dry Fork**.
4. Follow on-screen instructions to perform the calibration.

Note

When messages about the loop appear, take appropriate safe action and select “OK”. See “[Configuration basics](#)” on page 10 for further information.

To start the on-site calibration (AMS Device Manager)

1. Right click on the device and select **Service Tools**.
2. Select **Maintenance**, and then select the **Calibrate Sensor** tab.
3. **Click on the Calibrate Dry Fork** button in the Sensor Calibration box.
4. Follow on-screen instructions to perform the calibration.

Note


When messages about the loop appear, take appropriate safe action. See “[Configuration basics](#)” on page 10 for further information.

To start the on-site calibration (LOI)

1. Press any LOI button to activate the menu.
(See [Table 2-1 on page 8](#) for assistance with using the LOI buttons).
2. Scroll down (↓) and then select **EXTENDED MENU** (↵).
3. Select **CALIBRATE** (↵).
4. Select **SENSOR CAL** (↵).
5. Follow on-screen instructions to perform the calibration.
6. Exit the menu system by either waiting one minute for the **EXIT MENU?** prompt, or scrolling down menus to find and select **BACK TO MENU** and **EXIT TO MENU**.

5.6.2 Restoring factory calibration of dry fork sensor

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

-  This command restores the factory calibration of the fork sensor in dry process conditions. It is accessible after a site calibration has been performed, but should only be performed by authorized persons.

To restore the factory calibration (Field Communicator)

1. From the Home screen, select **3: Service Tools**.
2. Select **4: Maintenance > 3: Calibrate Sensor > 2: Reset Sensor Calibration**.
3. Select **1: Restore Factory Calibration**.
4. Follow on-screen instructions to restore the calibration.

Note

When messages about the loop appear, take appropriate safe action and select “OK”. See “[Configuration basics](#)” on page 10 for further information.

Note

A **Restore Site Calibration** command becomes available afterwards. For a Field Communicator, use fast key sequence 3, 4, 3, 2, 2.

To restore the factory calibration (AMS Device Manager)

1. Right click on the device and select **Service Tools**.
2. Select **Maintenance**, and then select the **Calibrate Sensor** tab.
3. **Click on the Restore Factory Calibration** button.
4. Follow on-screen instructions to restore the calibration.

Note

When messages about the loop appear, take appropriate safe action. See “[Configuration basics](#)” on [page 10](#) for further information.

Note

A **Restore Site Calibration** command becomes available afterwards. For the AMS Device Manager, use the Restore Site Calibration button on the **Calibrate Sensor** tab.

To restore the factory calibration (LOI)

1. Press any LOI button to activate the menu.
(See [Table 2-1 on page 8](#) for assistance with using the LOI buttons).
2. Scroll down (↓) and then select **EXTENDED MENU** (↵).
3. Select **CALIBRATE** (↵).
4. Scroll down (↓) and then select **PARAMETR RECALL**.
5. Select **DRY RECALL** (↵).
6. Follow on-screen instructions to restore the calibration.

Note

When messages about the loop appear, take appropriate safe action and select “↵”. See “[Configuration basics](#)” on [page 10](#) for further information.

Note

A **Restore Site Calibration** command becomes available afterwards.

5.6.3 Sensor calibration status and calibration count

Fast Keys	3, 4, 3, 1, 4 or 5
-----------	--------------------

Sensor Calibration Status indicates:

- Factory Calibrated – No further calibration is normally required.
- Site Calibrated – Calibration successfully performed on-site.
- Un-calibrated – Calibration is required. Contact the factory.

The Rosemount 2140 and Rosemount 2140:SIS are supplied with an ex-factory calibration, but can optionally be calibrated on-site using the **Calibrate Dry Fork** command (page 87).

Calibration Count stores the number of times a site calibration has been performed.

To view sensor calibration status and calibration count (Field Communicator)

1. From the Home screen, select **3: Service Tools**.
2. Select **4: Maintenance > 3: Calibrate Sensor > 1: Sensor Calibration**.
3. Select **4: Sensor Calibration Status** or select **5: Calibration Count**.

To view sensor calibration status and calibration count (AMS Device Manager)

1. Right click on the device and select **Service Tools**.
2. Select **Maintenance**, and then select the **Calibrate Sensor** tab.
3. The **Sensor Calibration Status** and **Calibration Count** variables are in the **Sensor Calibration** box.

To view sensor calibration status and calibration count (LOI)

This data is not available on the Local Operator Interface.

5.6.4 Configuring Power Advisory Diagnostic Introduction

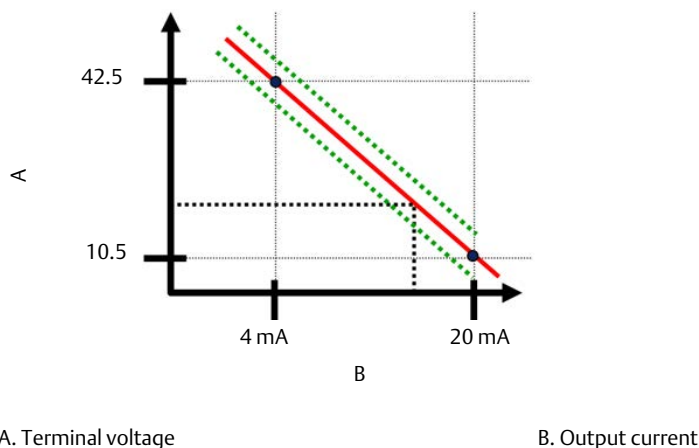
The optional Power Advisory diagnostic provides a means to detect issues that may jeopardize the integrity of the electrical loop. Some examples are: water entering the wiring compartment and making contact with the terminals, an unstable power supply nearing end of life, or heavy corrosion on the terminals.

This technology is based on the premise that, after a Rosemount 2140 or 2140:SIS (“level detector”) is installed and powered up, the electrical loop has a baseline characteristic that reflects the proper installation. If the level detector terminal voltage deviates from the

baseline and outside the user configured threshold, the level detector can generate a HART alert or analog alarm.

To make use of this diagnostic, the user must first create a baseline characteristic for the electrical loop after the level detector has been installed. The loop is automatically characterized with the push of a button. This creates a linear relationship for expected terminal voltage values along the operating region from 4 – 20 mA (see Figure 5-2).

Figure 5-2. Baseline Operating Region



Overview

The Rosemount 2140 and 2140:SIS Level Detectors (“level detectors”), with Extended Features Packages, are shipped with the **Power Advisory** function switched off and without any loop characterization performed. After the level detector is installed and powered-up, the loop characterization must be performed for Power Advisory to function.

When the user initiates a loop characterization, the level detector checks to see if the loop has sufficient power for proper operation. Next, the output is driven to 4 and 20 mA points to establish a baseline and determine the maximum allowable terminal voltage deviation. After this is complete, the user enters a sensitivity threshold called “Terminal Voltage Deviation Limit”. A check is made to make sure this threshold value is valid.

With the loop characterized and Terminal Voltage Deviation Limit is set, the Power Advisory function actively monitors the electrical loop for deviations from the baseline. Now, the level detector generates an alert or alarm whenever the terminal voltage changes (relative to the expected baseline value) and exceeds the Terminal Voltage Deviation Limit.

Note

⚠ Power Advisory monitors and detects changes in the terminal voltage from expected values to detect common failures. It is not possible to predict and detect all types of electrical failures on the 4-20 mA analog output. Therefore, Emerson cannot absolutely warrant or guarantee that Power Advisory will accurately detect failures under all circumstances.

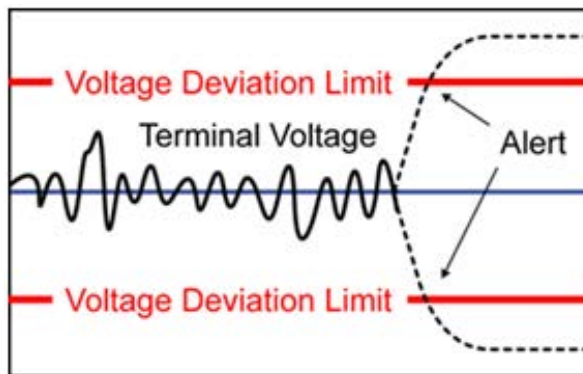
Terminal voltage

This field shows the current terminal voltage value in volts. The terminal voltage is a dynamic value and is directly related to the mA output value.

Terminal voltage deviation limit +/-

The Terminal Voltage Deviation Limit should be set large enough such that expected voltage changes do not cause false failures.

Figure 5-3. Voltage Deviation Limit



⚠ WARNING

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

Resistance

This value is the calculated resistance of the electrical loop (in Ω) measured during the loop characterization procedure. Changes in the resistance may occur due to changes in the physical condition of the loop installation. Baseline and previous baselines can be compared to see how much resistance has changed over time.

Power supply

This value is the calculated power supply voltage of the electrical loop (in volts) measured during the loop characterization procedure. Changes in this value may occur due to degraded performance of the power supply. Baseline and previous baselines can be compared to see how much the power supply has changed over time.

Characterize loop

Loop characterization must be initiated when the level detector is first installed or when electrical loop characteristics have been intentionally altered. Examples include a modified power supply level or loop resistance of the system, changing the terminal block on the level detector, or adding a Smart Wireless THUM to the level detector.

Note

Power Advisory is not recommended for a level detector operating in multi-drop mode.

Power Advisory action

When the voltage deviation exceeds the set limit, four possible actions can be configured and can be set to “Latched” or “Unlatched”.

When the alert or alarm is unlatched, the alert or alarm will disappear if voltage deviation returns to a normal level. A latched alarm or alert will not disappear when the voltage deviation returns to normal levels. This requires the user to acknowledge and clear the alert or alarm.

The four Power Advisory diagnostic actions are:

- None
- Alert latched
- Alarm unlatched
- Alert unlatched

Note

When messages about the loop appear, take appropriate safe action. See “[Configuration basics](#)” on page 10 for further information.

Configuring Power Advisory (Field Communicator)

Fast Keys	2, 1, 5 or 6
-----------	--------------

1. From the Home screen, select **2: Configure**.
2. Select **1: Guided Setup**.
3. Select (**5:** or **6:**) **Power Advisory**.
4. Follow on-screen instructions to configure the Power Advisory function.

Configuring Power Advisory (AMS Device Manager)

1. Right click on the device and select **Configure**.
2. Select **Guided Setup**.
3. Click the **Power Advisory** button.
4. Follow on-screen instructions to configure the Power Advisory function.

Configuring Power Advisory (LOI)

This function is not available on the Local Operator Interface.

5.7 Frequency profiling functions

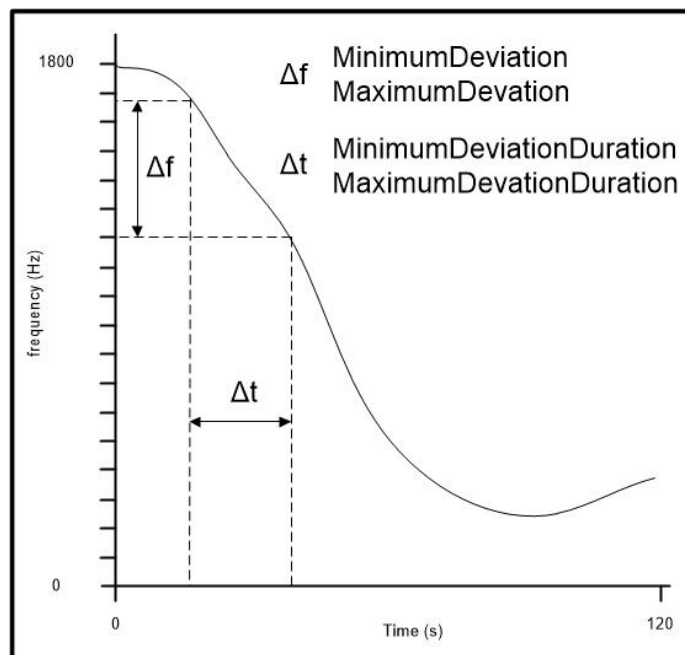
Fast Keys	2, 2, 8
-----------	---------

There are two frequency profiling functions supported on a level detector with the Extended Features Package (EFP) enabled:

- Minimum deviation
- Maximum deviation

Both functions monitor the sensor frequency change for a defined time duration. An alert is generated whenever the maximum frequency variation is smaller or larger than the pre-set thresholds (minimum deviation duration or maximum deviation duration as applicable).

Figure 5-4. Frequency Profile Definition



Minimum Deviation - The smallest change in Sensor Frequency that must occur during the Minimum Deviation Duration in order to prevent an alert from being generated.

Minimum Deviation Duration - the period of time in which the Sensor Frequency must change by more than the Minimum Deviation in order to prevent an alert from being generated.

Maximum Deviation - The change in Sensor Frequency occurring during the Maximum Deviation Duration that will cause an alert to be generated.

Maximum Deviation Duration - the period of time during which a change in the Sensor Frequency greater than the Maximum Deviation will cause an alert to be generated.

Parameter defaults and limits

Minimum Deviation: 0.0 - 1000.0 (default: 0.1 Hz)

Minimum Deviation Duration: 0.2 - 120.0 (default: 120.0 s)

Maximum Deviation: 0.0 - 1000.0 (default: 115.0 Hz)

Maximum Deviation Duration: 0.2 - 120.0 (default: 0.4 s)

Typical application for minimum deviation

The minimum frequency deviation is designed to use this kind of applications such as:

1. The circuit is working properly with a faulty sensor, in which the circuit might generate a very stable frequency output within the minimum deviation in the minimum deviation duration.
2. The circuit might be locked in a self-resonant frequency unexpectedly where the frequency output might be very stable as well.

Typical application for the maximum deviation.

The maximum frequency deviation is designed to use this kind of applications such as

1. The sensor or its wires might be half broken or in intermittent working condition in which the output of frequency of sensor might be jumping up and down.
2. The alter will be generated if the fluid level has raised or felled rapidly during the defined duration, i.e. the large ripples on fluid surface or a possible leakage in tank.

5.8 Upgrading to Extended Features Package (EFP)

Fast Keys	1, 8, 5
-----------	---------

Rosemount 2140 and Rosemount 2140:SIS Level Detector software can be upgraded to make the Extended Features Package (EFP) functions available.

EFP functions include:

- Media Learn
- Remote Proof-test (Rosemount 2140:SIS only)
- Scaled Variable (Rosemount 2140 only)
- Smart Diagnostic Suite

Note

The method for upgrading requires you to enter two start codes (available from Emerson) using the Field Communicator or AMS Device Manager. The LOI does not have the upgrade function.

To upgrade to Extended Features Package (Field Communicator)

1. From the Home screen, select **1: Overview**.
2. Select **8: Device Information > 5: Device Upgrade**
3. If proceeding with upgrade:
 - a. Select **5: Upgrade**.
 - b. Follow on-screen instructions to enter the two start codes.
4. If checking the upgrade success or current model:
 - a. Select **1: Model** or select **2: Upgrade Options**.

To upgrade to Extended Features Package (AMS Device Manager)

1. Right click on the device and select **Overview**.
2. Click on the **Device Information** button.
3. Click on the **Upgrade Device** tab.
4. If a tick is indicated against a ready to upgrade option:
 - a. Click on the Upgrade button.
 - b. Follow on-screen instructions to enter the two start codes.
5. Verify the upgrade success by viewing the **Upgrade Device** tab again.

Section 6 Troubleshooting

6.1 Overview

Table 6-1 provides summarized maintenance and troubleshooting suggestions for the most common operating problems. If you suspect malfunction despite the absence of any diagnostic messages on the Field Communicator display, consider using [Section 5: Operation and Maintenance](#) to identify any potential problem.

6.2 Safety messages

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

⚠ WARNING

Explosions could result in death or serious injury.

Installation of this Rosemount 2140 and 2140:SIS Level Detector (“level detector”) in an explosive environment must be in accordance with the appropriate local, national, and international standards, codes, and practices.

Please review [Appendix B: Product Certifications](#) for any restrictions associated with a safe installation.

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

Process leaks may cause harm or result in death.

- Install and tighten process connectors before applying pressure.

Electrical shock can result in death or serious injury.

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

External surface may be hot.

- Care must be taken to avoid possible burns. The flange and process seal may be hot at high process temperatures. Allow time to cool before servicing.
-

6.3 Troubleshooting for 4-20 mA Output

Table 6-1. Rosemount 2140 Troubleshooting for 4-20 mA Output

Symptom	Corrective actions
Level detector milliamp reading is zero	Verify terminal voltage is 10.5 to 42.4 Vdc at signal terminals
	Check power wires for reversed polarity
	Check that power wires are connected to signal terminals
	Check for open diode across test terminal
Level detector not communicating with Field Communicator	Verify terminal voltage is 10.5 to 42.4 Vdc
	Check loop resistance, 250Ω minimum (PS voltage -level detector voltage/loop current)
	Check that power wires are connected to signal terminals and not test terminals
	Verify clean DC Power to level detector (Max AC noise 0.2 volts peak to peak)
	Verify the output is between 4 and 20 mA or saturation levels
	Have Field Communicator poll for all addresses
Level detector milliamp reading is low or high	Verify 4 and 20 mA range points
	Verify output is not in alarm condition
	Perform analog trim
	Check that power wires are connected to the correct signal terminals (positive to positive, negative to negative) and not the test terminal
Milliamp reading is erratic	Verify power source to level detector has adequate voltage and current
	Check for external electrical interference
	Verify level detector is properly grounded
	Verify shield for twisted pair is only grounded at one end

6.4 Diagnostic messages

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

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

Listed in the below sections are detailed tables of the possible messages that will appear on either: LOI display, Field Communicator, or an AMS system.

6.4.1 Diagnostic message: failed - fix now

Table 6-2. Status: Failed – Fix Now

Alert name	LOI screen	Problem	Recommended action
Electronics Board Failure	FAIL BOARD	A failure has been detected in the electronics circuit board	1.Contact your local Emerson representative for advice.
Critical Electronics Data Error	MEMORY ERROR	A user written parameter does not match the expected value	1.Confirm and correct all parameters listed in Device Information. 2.Perform a Device Reset. 3.Replace electronics board.
Sensor Failure	FAIL SENSOR	A failure has been detected in the fork sensor	1.Contact Customer Services.

6.4.2 Diagnostic message: maintenance - fix soon

Table 6-3. Status: Maintenance – Fix Soon

Alert name	LOI screen	Problem	Recommended action
Electronics Temperature Beyond Limits	TEMP OUT LIMITS	The temperature of the electronics has exceeded its safe operating range.	1.Confirm electronics temperature is within limits of –40 to 175 °F (–40 to 80 °C) with or without the LOI display. 2.Contact your local Emerson representative for advice.
Power Advisory Diagnostic	POWER ADVISE	The level detector has detected a deviation of the terminal voltage outside of configured limits. This may indicate degraded electrical or loop integrity	1.Check the dc power supply to ensure power is correct, stable, and has minimal ripple. 2.Check loop wiring for degradation or improper grounding. 3.Remove the wiring compartment cover (considering hazardous location requirements) to check for presence of water or corrosion. If conditions have resumed to normal, clicking on Reset Alert will clear the alert.
Electronics Board Parameter Error	MEMORY WARN (also in advisory)	A device parameter does not match the expected value. The error does not affect level detector operation or analog output.	1.Contact your local Emerson representative for advice.
Configuration Buttons Operator Error	STUCK BUTTON	Device is not responding to button presses.	1.Check configuration buttons are not stuck. 2.Contact your local Emerson representative for advice.

6.4.3 Diagnostic message: advisory

Table 6-4. Status: Advisory

Alert name	LOI screen	Problem	Recommended action
Non-Critical User Data Warning	MEMORY WARN	A user written parameter does not match expected value	<ol style="list-style-type: none"> 1. Confirm and correct all parameters listed in Device Information. 2. Perform a Device Reset. 3. Replace Electronics Board.
Scaled Variable Alert	SCALED ALERT	The Scaled Variable alert diagnostic has gone beyond the configured trip points.	<ol style="list-style-type: none"> 1. Verify that the Scaled Variable is at an expected value. 2. Verify the Scaled Variable is beyond the trip points. 3. Modify the trip points or turn off alert.
Sensor Frequency Alert	FREQ ALERT	The Sensor Frequency alert diagnostic has detected that the frequency has gone beyond the configured trip points.	<ol style="list-style-type: none"> 1. Verify that the sensor frequency is at an expected value. 2. Verify the sensor frequency is beyond the trip points. 3. Modify the trip points or turn off alert.
Temperature Alert	TEMP ALERT	The Temperature alert diagnostic has detected that the electronics temperature has gone beyond the configured trip points.	<ol style="list-style-type: none"> 1. Verify that the process and environmental temperature is at an expected value. 2. Verify the temperature is beyond the trip points. 3. Modify the trip points or turn off alert.
LOI Display Update Failure	[If display is not updating]	The LOI display is not receiving updates from the fork sensor.	<ol style="list-style-type: none"> 1. Check the connection between the LOI and the circuit board. 2. Contact your local Emerson representative for advice.
Configuration Changed	[none]	A recent change has been made the device by a secondary HART master such as a handheld device.	<ol style="list-style-type: none"> 1. Verify that the configuration change of the device was intended and expected. 2. Clear this alert by selecting Clear Configuration Changed Status. 3. Connect a HART master such as AMS or similar which will automatically clear it.
Analog Output Fixed	ANALOG FIXED	The analog output is fixed and does not represent the process measurement. This may be caused by other conditions in the device, or because the device has been set to loop test or multidrop mode	<ol style="list-style-type: none"> 1. Take action on any other notifications from the device. 2. If the device is in loop test, and should no longer be, disable or momentarily remove power. 3. If the device is in multidrop mode and should not be, re-enable loop current by setting the polling address to 0.
Simulation Active	[none]	The device is in simulation mode and may not be reporting actual information	<ol style="list-style-type: none"> 1. Verify that simulation is no longer required. 2. Disable simulation mode in service tools. 3. Perform a Device Reset.
Analog Output Saturated	ANALOG SAT	The analog output is saturated either high or low due to the PV either above or below the range values	<ol style="list-style-type: none"> 1. Check the PV applied to ensure it is between the 4-20mA points.

6.5 Service support

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

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

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

▲ WARNING

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

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

Appendix A Specifications and Reference Data

Specifications	page 103
Dimensional drawings	page 106
Ordering information	page 115

A.1 Specifications

A.1.1 General

Products

Rosemount 2140 and Rosemount 2140:SIS Level Detectors.

Measuring technology

Vibrating fork.

Applications

Most liquids including coating liquids, aerated liquids, and slurries.

A.1.2 Physical specifications

Material selection

Emerson provides a variety of Rosemount product with various product options and configurations including materials of construction that can be expected to perform well in a wide range of applications. The Rosemount product information presented is intended as a guide for the purchaser to make an appropriate selection for the application. It is the purchaser's sole responsibility to make a careful analysis of all process parameters (such as all chemical components, temperature, pressure, flow rate, abrasives, contaminants, etc.), when specifying product, materials, options and components for the particular application.

Emerson is not in a position to evaluate or guarantee the compatibility of the process fluid or other process parameters with the product, options, configuration or materials of construction selected.

Electronics housing

Materials

Aluminum Alloy ASTM B85 A360.0 or
Stainless steel (316C)

Rotation

Rotatable housing to allow more convenient cable position.

Display

Optional two-line LCD display with Local Operator Interface (LOI) by selecting option code M4. There are two internal and two external configuration buttons. Includes extended cover with glass window.

Device-test button

The Rosemount 2140 can have an single external button for device testing by selecting the DP option code. (This is not selectable if the LCD with LOI option is selected).

Proof-test button

The Rosemount 2140:SIS comes supplied with an external button for local proof-testing. This can be upgraded to the LCD with LOI by selecting the M4 option code.

Conduit entries

Two M20 X 1.5 or ½-in ANPT conduit entries for cabling.

Rosemount 2140 ships with dust caps installed in the conduit entries. One blanking plug is supplied in a plastic bag, ready to be installed. No cables or cable glands are supplied.

Ingress protection

IP66/67 to EN60529, NEMA® 4X (when supplied blanking plug and suitably-rated cable glands are used).

Process wetted connections

Threaded, Tri Clamp, and flanged process connections. See [Table A-6 on page 115](#) for a full list.

Materials

316/316L Stainless Steel (1.4401/1.4404 dual certified). Mechanically polished option to better than 0.1 µm for Tri Clamp connections.

Alloy C (UNS N10002) and Alloy C-276 (UNS N10276) – available for flanged and selected threaded process connections (¾- and 1-in. BSPT (R), and ¾- and 1-in. NPT).

ECTFE co-polymer coated 316/316L Stainless Steel (1.4401/1.4404 dual certified) – only available for a flanged Rosemount 2140 but excludes 1-in./DN25/25A flanges.

Gasket material for 3/4- and 1-in. BSPP (G) process connection is non-asbestos BS7531 Grade X carbon fiber with rubber binder. Gaskets are not supplied with flanged process connections.

Extended fork lengths

The maximum extended length is 157.5 in. (4000 mm) except for ECTFE copolymer coating and polished process connection options which have a maximum length of 59.1 in. (1500 mm) and 39.4 in. (1000 mm) respectively.

Table A-1 has a summary of the minimum extended lengths. See “[Dimensional drawings](#)” on page 106 for other dimensions.

Table A-1. Minimum Extended Lengths

Process connection	Minimum extended length
3/4-in. threaded	3.8 in. (95 mm)
1-in. threaded	3.7 in. (94 mm)
Flanged	3.5 in. (89 mm)
Tri Clamp	4.1 in. (105 mm)

A.1.3 Performance specifications

Hysteresis (water)

Approximately 0.1 in. (2.5 mm).

Switching point (water)

Approximately 0.5 in. (13 mm) from tip of fork (if vertical installation) or from edge of fork (if horizontal installation).

Switching points vary with different liquid densities. The Rosemount 2140, with Extended Features Package added, allows pre-selection of a liquid type, and has a built-in learning function to make it even easier.

Switching delay

Switching delay is programmable from 0 to 3600 seconds. Default delay is 1 second.

Liquid density ranges

Low (400 to 600 kg/m³), medium (500 to 900 kg/m³), standard (800 to 1300 kg/m³), and high (1200 to 3000 kg/m³)

Liquid viscosity ranges

Up to 1000 cP (centiPoise) in Enhanced mode.

Up to 10000 cP (centiPoise) in Normal mode.

A.1.4 Electrical specifications

Power supply

10.5 to 42.4 Vdc (with no load).

Output

Software selectable analog output type:

- 8/16 mA HART switched output state,
- Custom mA HART switched output state,
- 4–20 mA HART, or
- LEVELTESTER switched output state.

Digital process variable is superimposed on 4–20 mA signal, available to any host that conforms to HART protocol.

Selectable digital HART revisions, HART5 (default) or HART7. The revision can be switched using any HART-based configuration tool or the optional local operator interface.

Grounding

The Rosemount 2140 and Rosemount 2140: SIS must always be grounded through the provided external ground connection.

Terminal connections (wire diameter)

Minimum 24 AWG and maximum 14 AWG (0.2 to 2.5 mm²)

A.1.5 Environmental specifications

Ambient temperature limits

–40 to 175 °F (–40 to 80 °C) with or without the LOI display.

See also [Appendix B: Product Certifications](#) for the reduced ambient temperature limits required by approvals.

Minimum and maximum operating temperatures

See [Figure A-1](#) for operating temperatures.

Check [Appendix B: Product Certifications](#) for the operating temperature ranges covered by the approvals.

Maximum operating pressures

The final rating depends on the selected process connection.

- Threaded connection: See [Figure A-2](#) for operating pressures.
- Tri Clamp connection: 435 psig (30 bar g).
- Flanged connection: See [Figure A-2](#) or [Table A-2](#) (whichever gives the lowest pressure).

Figure A-1. Operating Temperatures

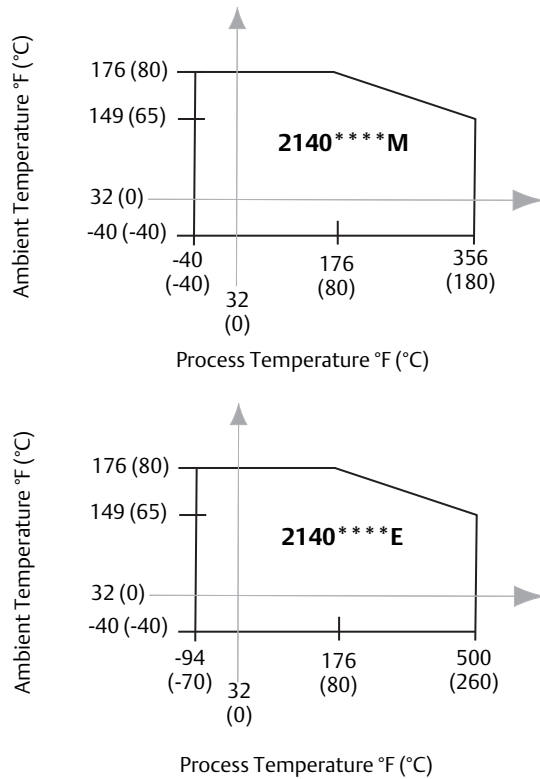


Figure A-2. Operating Pressures

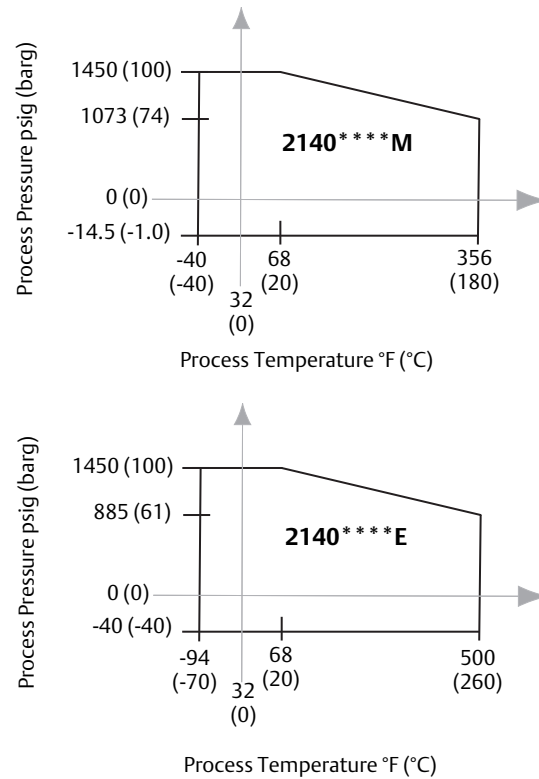


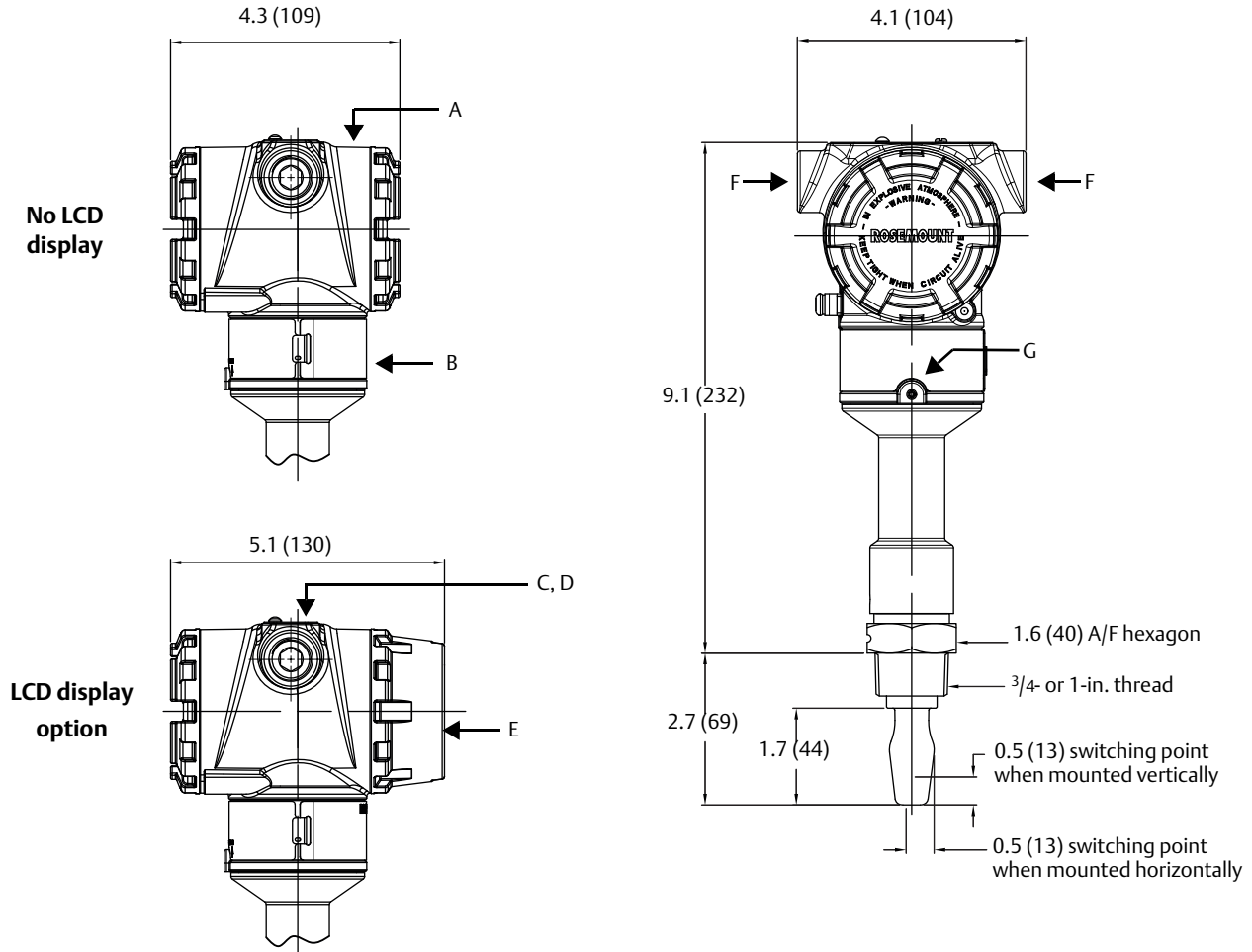
Table A-2. Maximum Flange Pressure Rating

Standard	Class/Rating	SST flanges
ASME B16.5	Class 150	275 psig ⁽¹⁾
ASME B16.5	Class 300	720 psig ⁽¹⁾
ASME B16.5	Class 600	1440 psig ⁽¹⁾
EN1092-1	PN 10/16	16 barg ⁽²⁾
EN1092-1	PN 25/40	40 barg ⁽²⁾
EN1092-1	PN 63	63 barg ⁽²⁾
EN1092-1	PN 100	100 barg ⁽²⁾
JIS B2220	10K	14 barg ⁽³⁾
JIS B2220	20K	34 barg ⁽³⁾
Mobrey A flange	Not applicable	33 bar
Mobrey G flange	Not applicable	21 bar

1. At 100 °F (38 °C), the rating decreases with an increasing process temperature.
2. At 122 °F (50 °C), the rating decreases with an increasing process temperature.
3. At 248 °F (120 °C), the rating decreases with an increasing process temperature.

A.2 Dimensional drawings

Figure A-3. $\frac{3}{4}$ - and 1-in. Threaded Process Connection (Mid Temperature Range, Standard Length Fork)

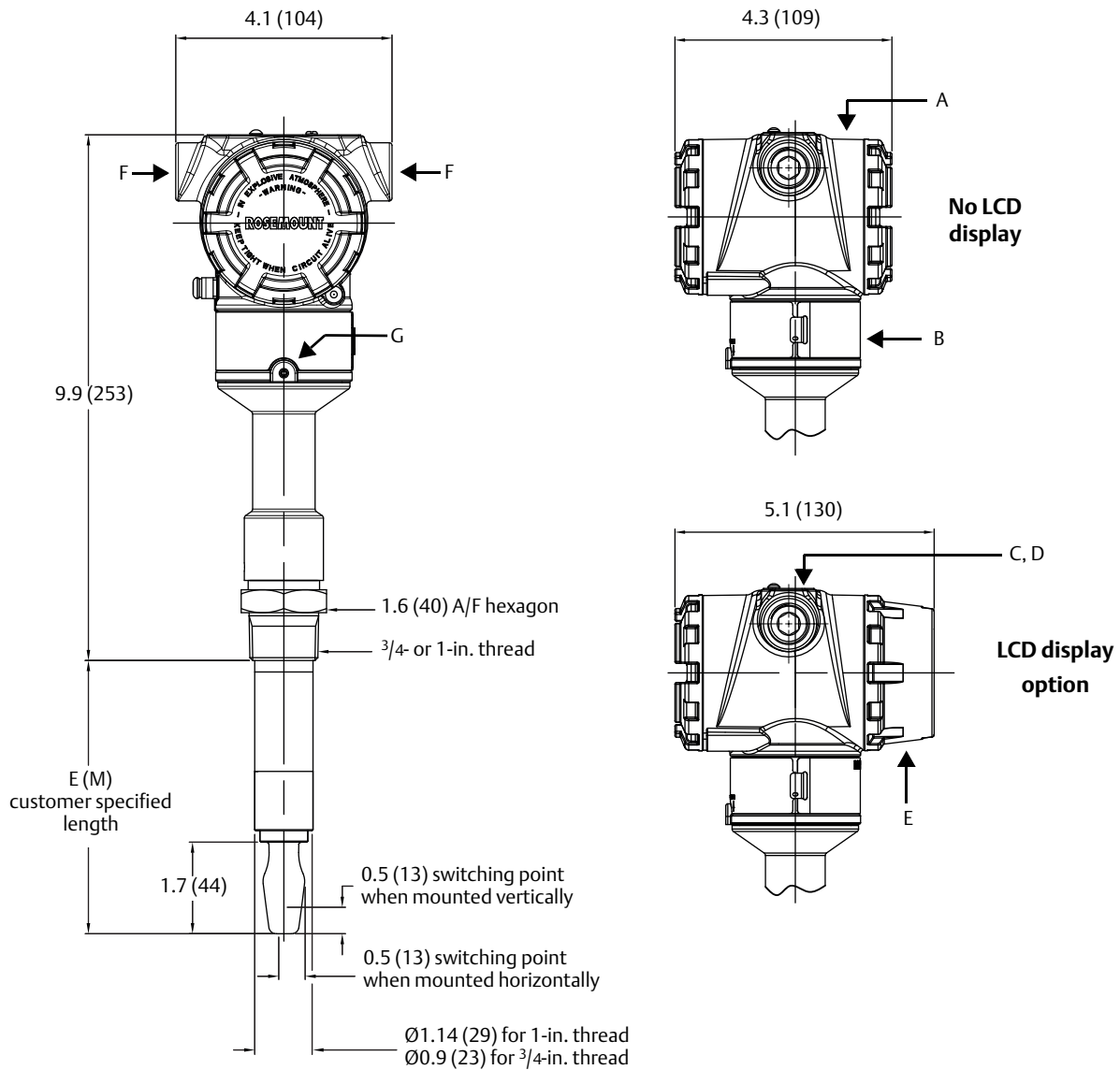


- A. Aluminum or stainless steel housing
- B. Certification plate
- C. Cover plate (with logo, product name, and conduit entry size)
- D. External button(s) under movable plate
- E. LCD display cover

- F. Conduit/cable entry M20 x 1.5 or $\frac{1}{2}$ -in. ANPT
- G. Housing rotation set screw. Do not unscrew all the way. Rotating the housing, without this screw in place, can damage the internal wiring

Dimensions are in inches (mm).

Figure A-4. 3/4- and 1-in. Threaded Process Connection (Mid Temperature Range, Extended Length Fork)

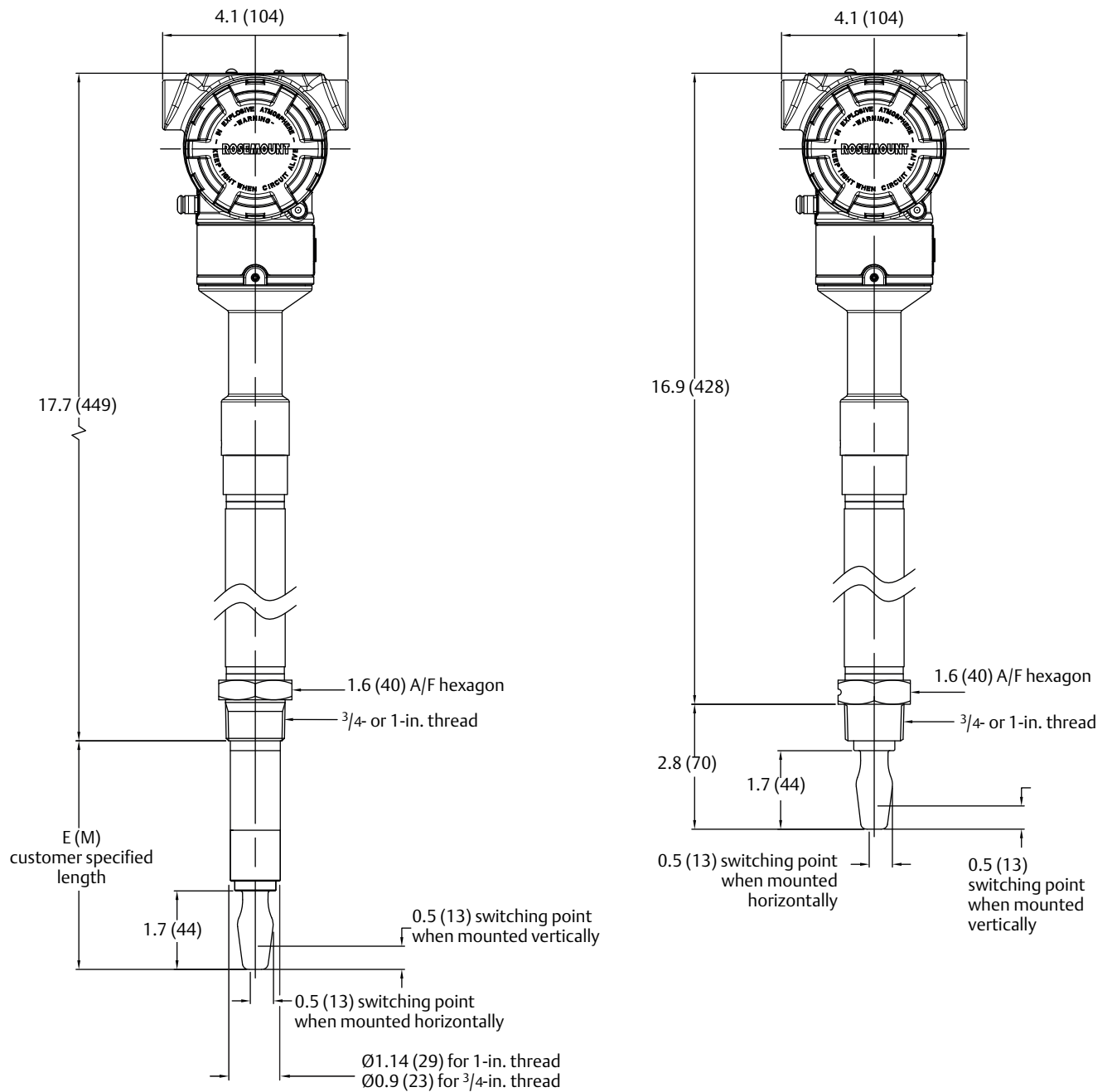


- A. Aluminum or stainless steel housing
 - B. Certification plate
 - C. Cover plate (with logo, product name, and conduit entry size)
 - D. External button(s) under movable plate
 - E. LCD display cover
 - F. Conduit/cable entry M20 x 1.5 or 1/2-in. ANPT
 - G. Housing rotation set screw. Do not unscrew all the way. Rotating the housing, without this screw in place, can damage the internal wiring
- Dimensions are in inches (mm).

Table A-3. Fork Length for 3/4- and 1-in. Threaded Rosemount 2140

Process connection	Standard length fork length code A	Minimum length fork length code E (M)	Maximum length fork length code E (M)
3/4-in. thread	1.7 in. (44 mm)	3.75 in. (95 mm)	157.5 in. (4000 mm)
1-in. thread	1.7 in. (44 mm)	3.74 in. (94 mm)	157.5 in. (4000 mm)

Figure A-5. 3/4- and 1-in. Threaded Process Connection (High Temperature Range, All Fork Lengths)

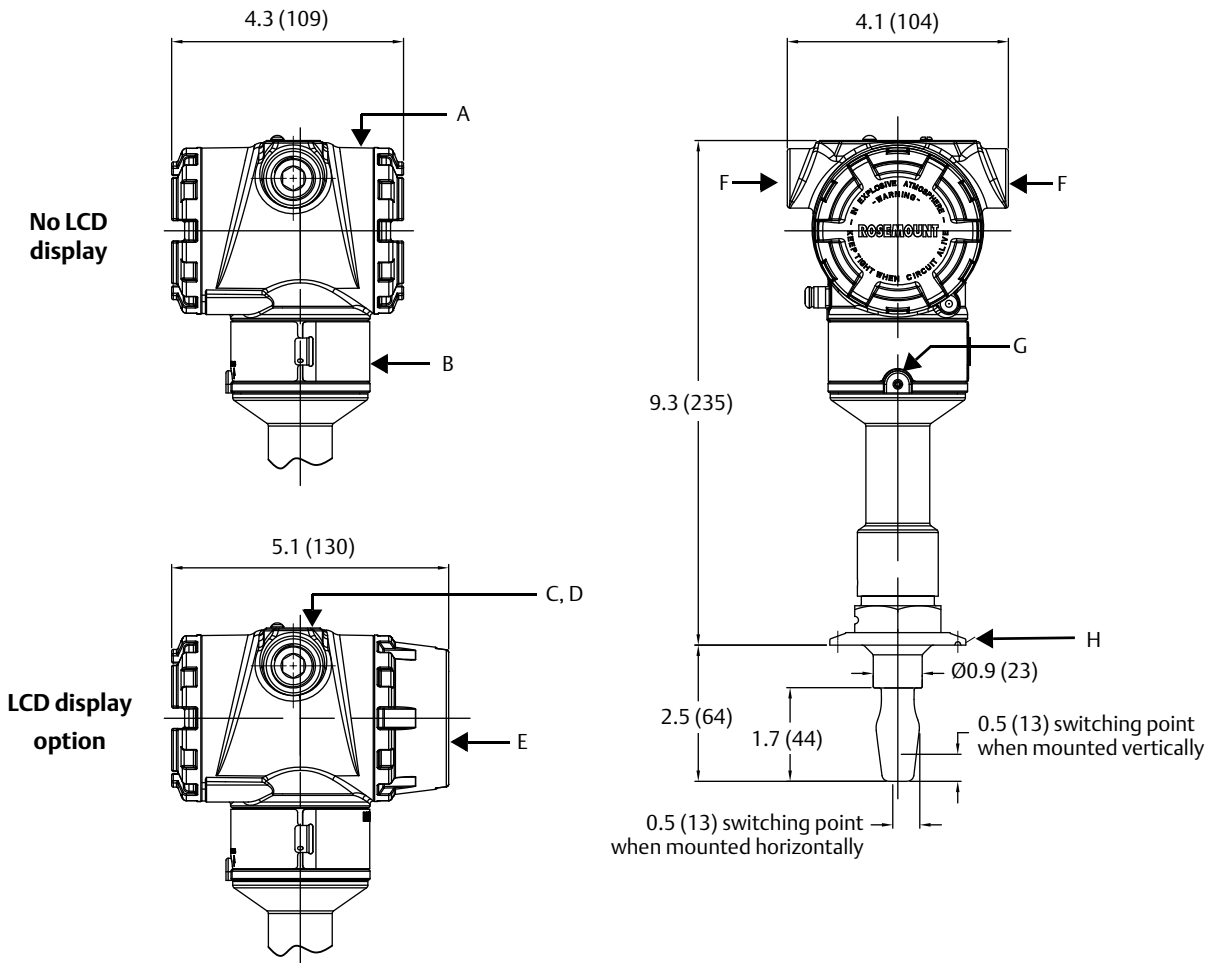


A. Thermal tube

Dimensions are in inches (mm).

For dimensions and features not shown here, see [Figure A-3 on page 106](#).

Figure A-6. Tri Clamp Process Connection (Mid Temperature Range, Standard Length Fork)

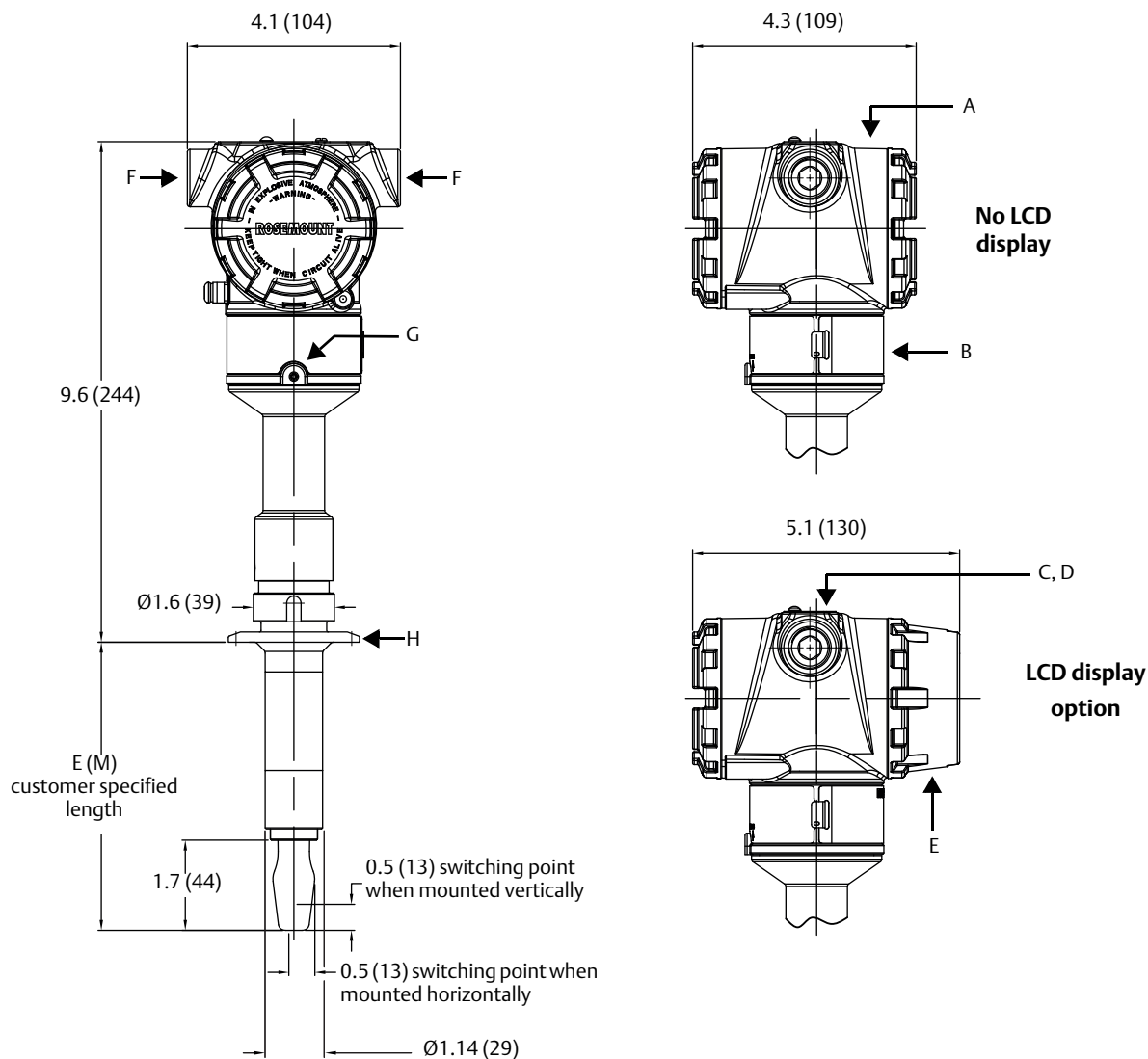


- A. Aluminum or stainless steel housing
- B. Certification plate
- C. Cover plate (with logo, product name, and conduit entry size)
- D. External button(s) under movable plate
- E. LCD display cover
- F. Conduit/cable entry M20 x 1.5 or 1/2-in. ANPT

- G. Housing rotation set screw. Do not unscrew all the way. Rotating the housing, without this screw in place, can damage the internal wiring
- H. 1 1/2- or 2 1/2-in. Tri Clamp

Dimensions are in inches (mm)

Figure A-7. Tri Clamp Process Connection (Mid Temperature Range, Extended Length Fork)



- A. Aluminum or stainless steel housing
- B. Certification plate
- C. Cover plate (with logo, product name, and conduit entry size)
- D. External button(s) under movable plate
- E. LCD display cover
- F. Conduit/cable entry M20 x 1.5 or 1/2-in. ANPT
- G. Housing rotation set screw. Do not unscrew all the way. Rotating the housing, without this screw in place, can damage the internal wiring
- H. 1 1/2- or 2 1/2-in. Tri Clamp

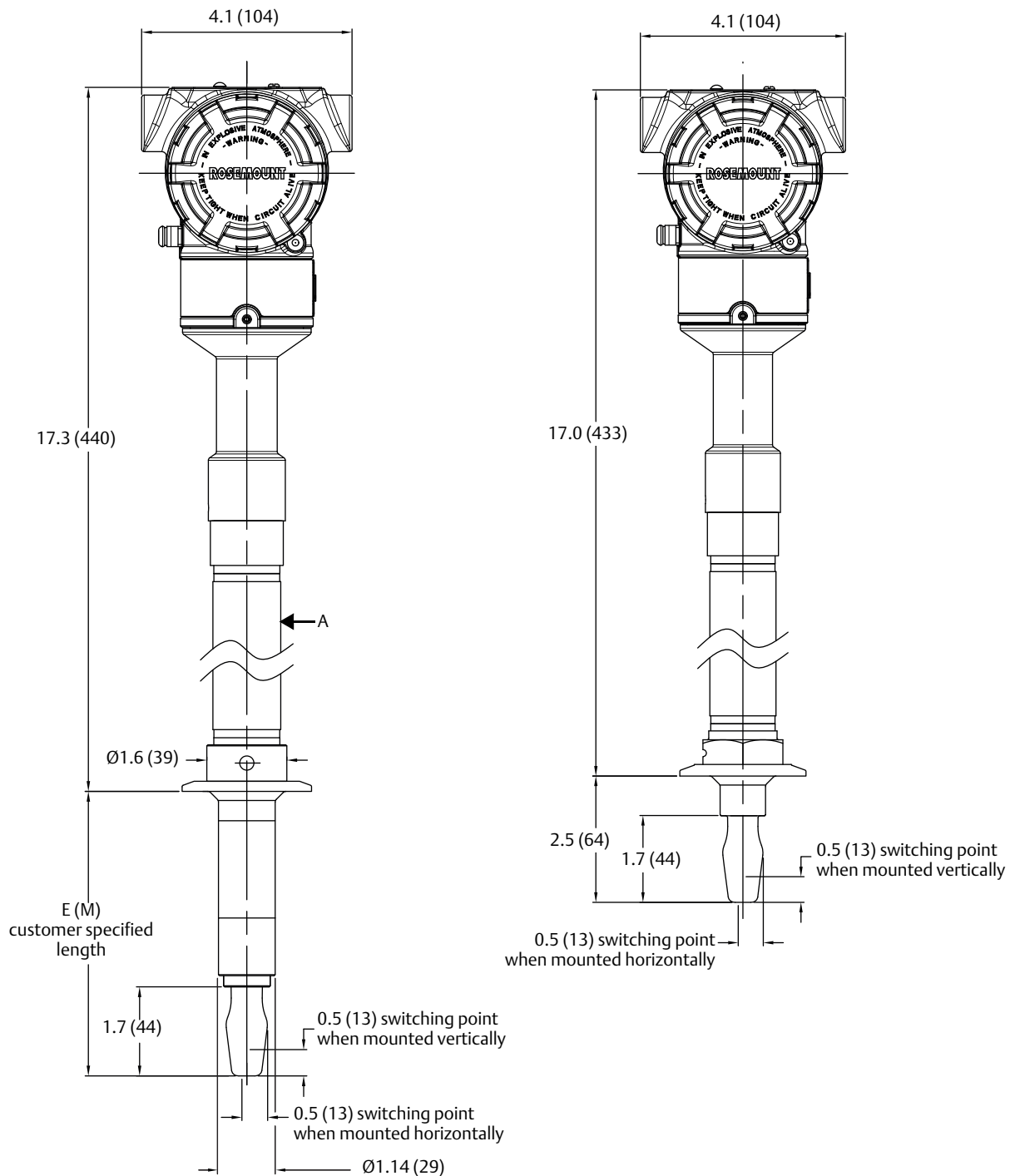
Dimensions are in inches (mm).

Table A-4. Fork Length for Hygienic Rosemount 2140

Process connection	Standard length fork length code A	Minimum length fork length code E (M)	Maximum length fork length code E (M)
Tri Clamp	1.7 in. (44 mm)	4.13 in. (105 mm)	157.5 in. (4000 mm)
O-ring seal (1-in. BSPP) ⁽¹⁾	1.7 in. (44 mm)	4.13 in. (105 mm)	38.4 in. (1000 mm)

1. For these dimension drawings, refer to the Rosemount 2140 Type 1 drawings at Emerson.com/Rosemount.

Figure A-8. Tri Clamp Process Connection (High Temperature Range, All Fork Lengths)

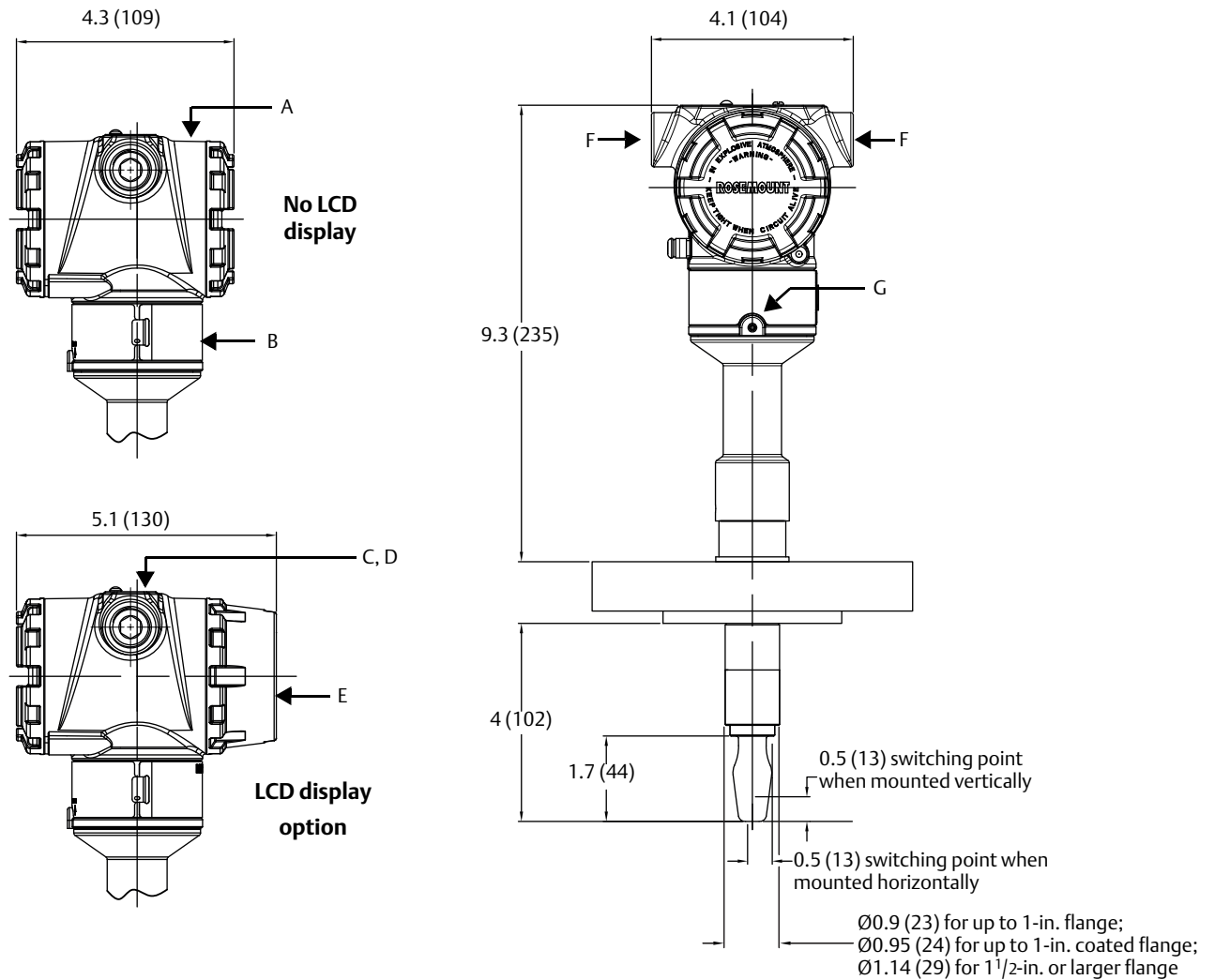


A. Thermal tube

Dimensions are in inches (mm).

For dimensions and features not shown here, see [Figure A-6 on page 109](#).

Figure A-9. Flanged Process Connection (Mid Temperature Range, Standard Length Fork)

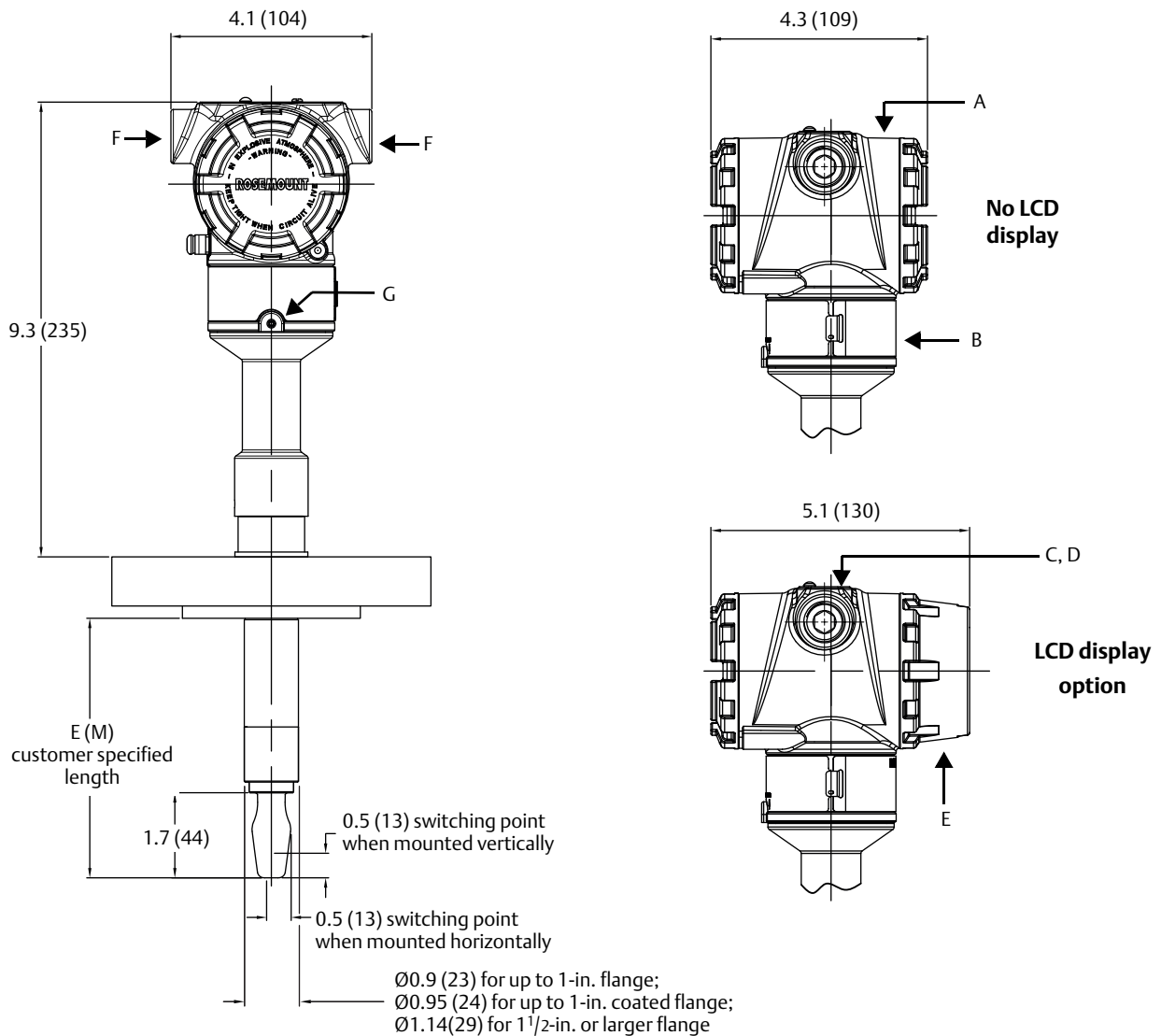


- A. Aluminum or stainless steel housing
- B. Certification plate
- C. Cover plate (with logo, product name, and conduit entry size)
- D. External button(s) under movable plate
- E. LCD display cover

- F. Conduit/cable entry M20 x 1.5 or 1/2-in. ANPT
- G. Housing rotation set screw. Do not unscrew all the way. Rotating the housing, without this screw in place, can damage the internal wiring

Dimensions are in inches (mm).

Figure A-10. Flanged Process Connection (Mid Temperature Range, Extended Length Fork)

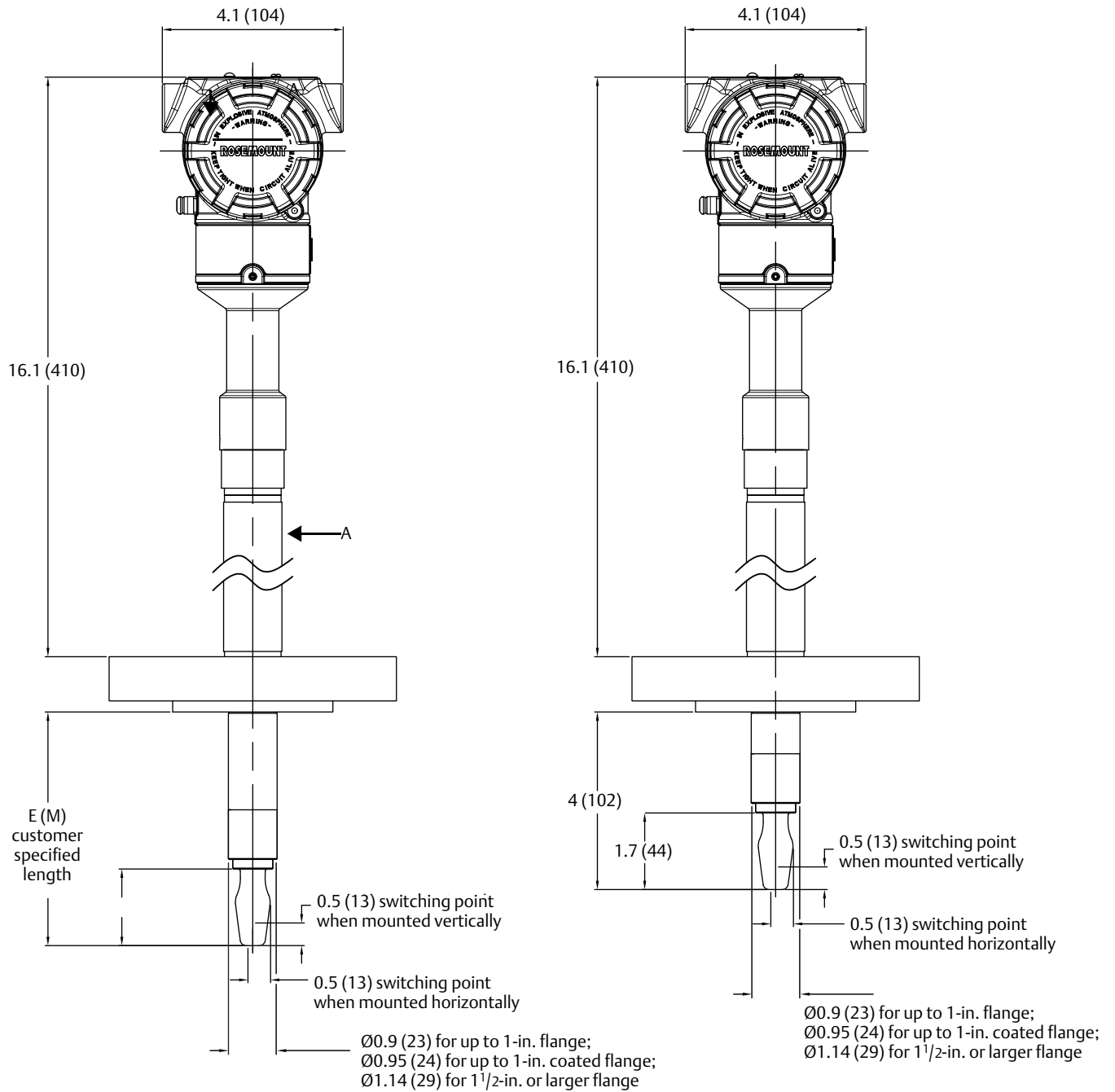


- A. Aluminum or stainless steel housing
 - B. Certification plate
 - C. Cover plate (with logo, product name, and conduit entry size)
 - D. External button(s) under movable plate
 - E. LCD display cover
 - F. Conduit/cable entry M20 x 1.5 or 1/2-in. ANPT
 - G. Housing rotation set screw. Do not unscrew all the way. Rotating the housing, without this screw in place, can damage the internal wiring
- Dimensions are in inches (mm).

Table A-5. Fork Length for Flanged Rosemount 2140

Process connection material	Standard length fork length code H	Minimum length fork length code E (M)	Maximum length fork length code E (M)
Stainless steel	4 in. (102 mm)	3.5 in. (89 mm)	157.5 in. (4000 mm)
ECTFE co-polymer coated	4 in. (102 mm)	3.5 in. (89 mm)	59.1 in. (1500 mm)
Alloy C, alloy C-276, solid	4 in. (102 mm)	3.5 in. (89 mm)	157.5 in. (4000 mm)

Figure A-11. Flanged Process Connection (High Temperature Range, All Fork Lengths)



A. Thermal tube
Dimensions are in inches (mm).
For dimensions and features not shown here, see [Figure A-9 on page 112](#).

A.3 Ordering information

Specification and selection of product materials, options, or components must be made by the purchaser of the equipment. See [page 103](#) for more information on material selection.

Table A-6. Rosemount 2140 and Rosemount 2140:SIS Ordering Information

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

Model	Product description	
2140	Vibrating Fork Liquid Level Detector	
Profile		
A	Standard monitoring and control application	★
F	Functional Safety / SIS applications	★
Output		
H	4–20 mA with HART communication	★
Housing material		
A	Aluminum Alloy ASTM B85 A360.0	★
S	Stainless Steel, 316C	★
Conduit entry / cable threads		
1	1/2-in. ANPT	★
2	M20	★
Operating temperature		
M	Mid-Range: -40 °F (-40 °C)... 356 °F (180 °C)	★
E	High: -94 °F (-70 °C)... 500 °F (260 °C)	★
Materials of construction: process connection / fork		
S	316/316L Stainless Steel (1.4401/1.4404)	★
F ⁽¹⁾	ECTFE copolymer, coated 316/316L SST (1.4401/1.4404)	
H	Alloy C (UNS N10002), Alloy C-276 (UNS N10276), Solid	
Process connection size		
9	3/4-in. / 19 mm	★
1	1-in. / 25 mm (DN25) / 25A	★
2	2-in. / 50 mm (DN50) / 50A	★
5	1 1/2-in. / 40 mm (DN40) / 40A	★
3	3-in. / 80 mm (DN80) / 80A	★
4	4-in. / 100 mm (DN100) / 100A	★
7	2 1/2-in. / 65 mm (DN65) / 65A	★
M	For use with Mobrey flange	★

Process connection rating			
AA	ASME B16.5 Class 150 flange		★
AB	ASME B16.5 Class 300 flange		★
AC	ASME B16.5 Class 600 flange		★
DA	EN1092-1 PN 10/16 flange		★
DB	EN1092-1 PN 25/40 flange		★
DC	EN1092-1 PN 63 flange		★
DD	EN1092-1 PN 100 flange		★
JA	JIS B2220, 10K flange		★
JB	JIS B2220, 20K flange		★
MA	Mobrey A flange		★
MG	Mobrey G flange		★
NN	For use with non-flange process connection type		★
Process connection type			
R	Raised Face (RF) flange		★
M	Mobrey flange		★
B	BSPT (R) thread		★
G	BSPP (G) thread		★
N	NPT thread		★
P	BSPP (G), O-ring		★
C	Tri Clamp		★
Fork length		Available connection	
A	Standard length 1.7 in. (44 mm)	All except flanged options	★
H ⁽²⁾	Standard length flange 4.0 in. (102 mm)	All flanged options	★
E ⁽³⁾	Extended, customer specified length in tenths of inches	All except 1-in. BSPP O-ring (1P)	★
M ⁽³⁾	Extended, customer specified length in millimeters	All except 1-in. BSPP O-ring (1P)	★
M0150	Extended length 150 mm	All except 1-in. BSPP O-ring (1P)	★
M0300	Extended length 300 mm	All except 1-in. BSPP O-ring (1P)	★
M0500	Extended length 500 mm	All except 1-in. BSPP O-ring (1P)	★
E0060	Extended length 6 in.	All except 1-in. BSPP O-ring (1P)	★
E0090	Extended length 9 in.	All except 1-in. BSPP O-ring (1P)	★
E0120	Extended length 12 in.	All except 1-in. BSPP O-ring (1P)	★
E0240	Extended length 24 in.	All except 1-in. BSPP O-ring (1P)	★
Specific extended fork length			
0000	Factory default length (only if Fork Length A or H is selected). Maximum length 157.5 in. (4000 mm)		★
XXXX ⁽³⁾	Specific customer specified length in tenths of inches, or millimeters (XXX.X inches or XXXX) if code M or E is selected		★

Surface finish		Available connections	
1	Standard surface finish	All	★
2	Mechanically polished (Ra < 0.1 μm)	Tri Clamp connection Only	★
Product certifications			
NA	No hazardous locations certifications		★
ND	ATEX, Dust Zone 20		★
NK	IECEX, Dust Zone 20		★
G5 ⁽⁴⁾	American Ordinary Locations (unclassified, safe area)		
G6 ⁽⁵⁾	Canadian Ordinary Locations (unclassified, safe area)		
E1	ATEX Flameproof		★
E5 ⁽⁴⁾	American Explosion-proof		
E6 ⁽⁵⁾	Canadian Explosion-proof		
E7	IECEX Flameproof and Dust		★
E8	ATEX Flameproof and Dust		★
I1	ATEX Intrinsically Safe and Dust, Zone 0, 20		★
I5	American Intrinsic Safety and Non-incendive		
I6	Canadian Intrinsic Safety and Non-incendive		
I7	IECEX Intrinsic Safety, Zone 0		★
I8	ATEX Intrinsic Safety, Zone 1		★
Typical model numbers: 2140 A H A 1 M S 1 N N B A 0000 1 NA			

Options (include with the selected model number)

Calibration data certification		
Q4	Certificate of functional test	★
Material traceability certification ⁽²⁾⁽⁶⁾		
Q8	Material traceability certification per EN 10204 3.1	★
Material certification ⁽²⁾⁽⁶⁾		
Q15	NACE® MR0175 / ISO 15156	★
Q25	NACE MR0103	★
Product features ⁽⁷⁾		
EF0	Ready for upgrade to a Rosemount 2140 with enhanced features	★
EF1	Ready for upgrade to a Rosemount 2140:SIS with enhanced features	★
EF2	Rosemount 2140:SIS safety certified to IEC 61508 with remote proof testing, plus enhanced features enabled	★
EF3	Rosemount 2140 with enhanced features already enabled	★

Terminal block		
T1	Transient protection terminal block	★
Display		
M4	LCD display with Local Operator Interface	★
Additional configuration buttons⁽⁸⁾		
DP	Device test (single button)	★
Special procedures⁽⁹⁾		
P1	Hydrostatic testing with certificate	★
Alarm levels		
C4	Analog output levels compliant with NAMUR recommendation NE43, high alarm	★
C5	Analog output levels compliant with NAMUR recommendation NE43, low alarm	★
C1	Custom alarm and saturation signal levels (requires Configuration Data Sheet)	★
C8	Low alarm (standard Rosemount alarm and saturation levels)	★
HART revision configuration		
HR7	Device configured for HART 7 communication protocol	★
Safety certification⁽¹⁰⁾		
QS	Prior-use certificate of FMEDA data	★
QT ⁽¹¹⁾	Safety certificate to IEC61508	★
Example of options included with the model number: 2140 A H A 1 M S 1 N N B A 0000 1 N A Q4 Q8		

- ECTFE copolymer coating is only available for a flanged Rosemount 2140 but excludes 1-in./DN25/25A flanges. Flanges are dual certified 316 and 316L Stainless Steel (1.4401 and 1.4404).
- Not available for mechanically polished process-wetted parts.
- Minimum length available for 3/4-in. threaded connection is 3.8 in. (95 mm); for 1-in. threaded, it is 3.7 in. (94 mm); for flanged, it is 3.5 in. (89 mm); and for Tri Clamp, it is 4.1 in. (105 mm). Maximum length is 157.5 in. (4000 mm), except for ECTFE copolymer coating and hand-polished process where the maximum length is 59.1 in. (1500 mm) and 39.4 in. (1000 mm) respectively. Examples: Code E1181 is 118.1 inches. Code M3000 is 3000 millimeters.
- See "Ordinary locations certifications" on page 123. E5 includes G5 requirements. G5 is for unclassified, safe area locations only.
- See "Ordinary locations certifications" on page 123. E6 includes G6 requirements. G6 is for unclassified, safe area locations only.
- Only available for process-wetted parts.
- The Extended Features Package includes Scaled Variables, Smart Diagnostics Suite, and Media Learn.
- Option DP only available for a Rosemount 2140 with Profile code A selected. This is not selectable if the Display code M4 is selected.
- Option limited to units with extended lengths up to 59.1-in. (1500 mm). Option is not available for ECTFE coating.
- Available only for a Rosemount 2140:SIS (i.e. Profile code F selected).
- The Rosemount 2140:SIS has been independently certified to IEC 61508 as required by IEC 61511. Certification was conducted by Exida. If documentation is required, add "QT" to the end of the model number.

A.3.1 Rosemount 2140 Spares and Accessories

Specification and selection of product materials, options, or components must be made by the purchaser of the equipment. See page 103 for more information on Material Selection.

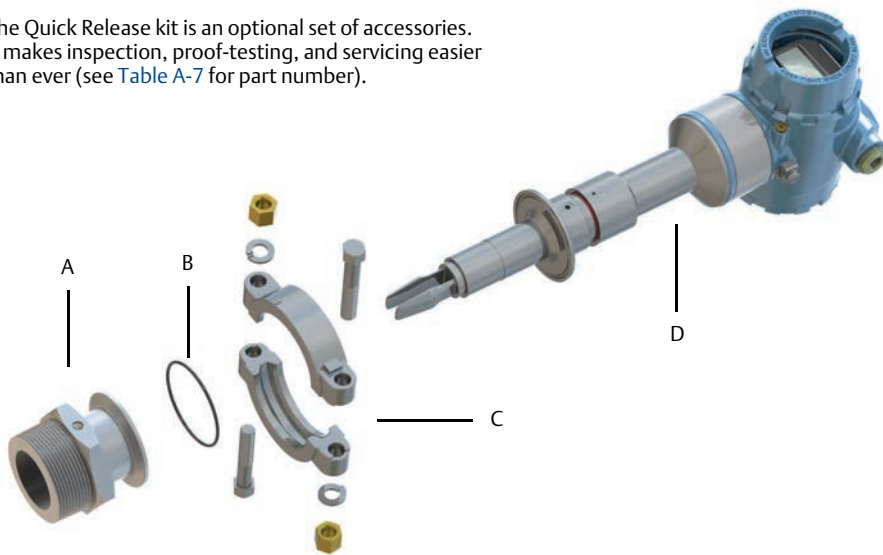
Table A-7. Rosemount 2140 Spares and Accessories

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

Part number	Description	
02100-1000-0001	Seal for 1-in. BSPP (G1A). Material: Non-asbestos BS7531 grade X carbon fiber with rubber binder	★
02100-1040-0001	Seal for 3/4-in. BSPP (G3/4A). Material: Non-asbestos BS7531 grade X carbon fiber with rubber binder	★
02100-1010-0001	1-in. BSPP to 1 1/2-in. (38mm) Tri Clamp. Material: 316 SS fitting. FPM/FKM 'O' ring	★
02100-1020-0001	2-in. (51 mm) Tri Clamp kit (vessel fitting, clamp ring, and seal). Material: 316 SST NBR Nitrile	★
02100-1060-0001	Quick Release kit (contains 2-in. Tri Clamp, seal, and quick release device for 2-in. NPT process connection)	★

Figure A-12. Quick Release Kit

The Quick Release kit is an optional set of accessories. It makes inspection, proof-testing, and servicing easier than ever (see Table A-7 for part number).



A. Quick release device for 2-in. NPT process connection
B. Seal

C. 2-in. Tri Clamp
D. Level detector with 2-in. Tri Clamp process connection

Appendix B Product Certifications

Overview	page 121
European directive information	page 121
Ordinary locations certifications	page 121
Hazardous locations certifications	page 121

B.1 Overview

This appendix contains information on European directives and hazardous locations certifications.

B.2 European directive information

A copy of the EU Declaration of Conformity can be found at the end of the Rosemount 2140 [Product Certifications Manual](#) and at Emerson.com/Rosemount.

B.3 Ordinary locations certifications

G5 USA ordinary location certification

Certificate: 16 CSA 70098390

Standards: UL 61010-1 (3rd Edition)

The level detector has been examined and tested to determine that the design meets basic electrical, mechanical, and fire protection requirements by CSA, a nationally recognized testing laboratory (NRTL) as accredited by the Federal Occupational Safety and Health Administration (OSHA). Type 4X.

G6 Canada ordinary location certification

Certificate: 16 CSA 70098390

Standards:
CAN/CSA C22.2 No 61010-1-12, and
ANSI/ISA-12.27.01:2003

The level detector has been examined and tested to determine that the design meets basic electrical, mechanical, and fire protection requirements by CSA, a nationally recognized testing laboratory as accredited by the Standards Council of Canada (SCC). Type 4X. Single Seal.

Special conditions for use (G5 and G6)

1. To be supplied from a Class 2 or Limited Energy Source in accordance with CAN/CSA C22.2 No. 61010-1-12.

B.4 Hazardous locations certifications

B.4.1 North America and Canada

Note

For full product approvals information, refer to the Rosemount 2140 [Product Certifications Manual](#).

E5 USA Explosion-proof (XP)

Certificate: CSA 16CA70098990X

Standards:
FM Class 3600 - 2011,
FM Class 3615 - 2015, and
UL 61010-1 (3rd Edition)

Markings:
Class I Groups B, C and D, T5, Type 4X
Class I, Zone 1, AEx db IIC T6...T2 Gb

E6 Canada Explosion-proof

Certificate: CSA 16CA70098990X

Standards:
ANSI/ISA 12.27.01:2003,
CSA Std. C22.2 No. 30 -M1986,
CSA Std. C22.2 No.60079-0-15,
CSA Std. C22.2. No.60079-1-16,
CSA Std. C22.2 No. 61010-1-12, and
CSA Std. C22.2 No.94-M91

Markings:
Class I Groups B, C and D, T5, Type 4X
Ex db IIC T6...T2 Gb

Special conditions for use (X) (E5 and E6)

1. The user is to ensure the probe assembly is installed in such a way to prevent any damage due to impact or ignition source due to friction.
2. The enclosure may be given a non-standard paint finish which may constitute a potential electrostatic ignition risk. Care should be taken to protect it from external conditions conducive to the build-up of electrostatic charge on such surfaces. The enclosure must not be rubbed or cleaned with a dry cloth.
3. Flameproof joints are not intended for repair.
4. To be supplied from a Class 2 or Limited Energy Source in accordance with CAN/CSA C22.2 No. 61010-1-12.

- I5** USA Intrinsic Safety (IS) and Non-Incendive (NI)
Certificate: CSA 16CA70098990X
Standards:
FM Class 3600 - 2011,
FM Class 3610 - 2015, and
FM Class 3611 - 2004
Markings:
Class I Groups A, B, C and D, T5...T2, Type 4X
Class I, Zone 0, AEx ia IIC T5...T2 Ga
Class I, Division 2, Groups A, B, C, and D
when connected using installation drawing 71097/1387
- I6** Canada Intrinsic Safety and Non-Incendive
Certificate: CSA 16CA70098990X
Standards:
ANSI/ISA 12.27.01:2003,
CSA Std. C22.2 No. 157 -92,
CSA Std. C22.2 No.60079-0-15,
CSA Std. C22.2. No.60079-11-14, and
CSA Std. C22.2 No.213-M1987
Markings:
Class I Groups A, B, C and D, T5...T2, Type 4X
Ex ia IIC T5...T2 Ga
Class I, Division 2, Groups A, B, C, and D
when connected using installation drawing 71097/1387

Special conditions for use (X) (I5 and I6)

1. The equipment, when fitted with the transient suppression terminal block, is not capable of withstanding the 500 volt insulation test. This must be taken into account when installing the equipment.
2. The enclosure may be made of aluminum alloy and given a protective polyurethane paint finish. However, care should be taken to protect it from impact or abrasion if located in Zone 0.
3. The enclosure may be given a non-standard paint finish which may constitute a potential electrostatic ignition risk. Care should be taken to protect it from external conditions conducive to the build-up of electrostatic charge on such surfaces. The enclosure must not be rubbed or cleaned with a dry cloth.

B.4.2 Europe

Note

For full product approvals information, refer to the Rosemount 2140 [Product Certifications Manual](#).

- E1** ATEX Flameproof
Certificate: Dekra 16ATEX0082X
Standards:
EN60079-0:2012+A11:2013,
EN60079-1:2014, and
EN60079-26:2015
Markings:
Ⓔ II 1/2 G, Ex db IIC T6...T2 Ga/Gb
- ND** ATEX Dust
Certificate: Baseefa 16ATEX0137X
Standards:
EN60079-0:2012+A11:2013 and EN60079-31:2014
Markings:
Ⓔ II 1 D Ex ta IIIC (T92°C...T272°C) (T₅₀₀100°C...T₅₀₀280°C) Da
- E8** Combines **E1** and **ND**
- I1** ATEX Intrinsically Safe and Dust (Zone 0, 20)
Certificates:
Baseefa 16ATEX0136X and Baseefa 16ATEX0137X
Standards:
EN60079-0:2012+A11:2013,
EN60079-11:2012,
EN60079-26:2015, and
EN60079-31:2014
Markings:
Ⓔ II 1 G, Ex ia IIC T5...T2 Ga
Ⓔ II 1 D Ex ta IIIC (T92...T272°C) (T₅₀₀100°C...T₅₀₀280°C) Da
(**I1** includes the **ND** approval)
- I8** ATEX Intrinsically Safe (Zone 1)
Certificate: Baseefa 16ATEX0136X
Standards:
EN60079-0:2012+A11:2013,
EN60079-11:2012, and
EN60079-26:2015
Markings:
Ⓔ II 1/2 G, Ex ia IIC T5...T2 Ga/Gb

Special conditions for use (X) (E1 and E8)

1. The user is to ensure the probe assembly is installed in such a way to prevent any damage due to impact or ignition source due to friction.
2. Non-standard paint options may cause risk from electrostatic discharge. Avoid installations that could cause electrostatic build-up of painted surfaces, and only clean the painted surfaces with a damp cloth. If paint is ordered through a special option code, contact the manufacturer for more information.
3. Flameproof joints are not intended for repair.

Special conditions for use (X) (I1 and I8)

1. The equipment, when fitted with the transient suppression terminal block, is not capable of withstanding the 500 volt insulation test. This must be taken into account when installing the equipment.
2. The enclosure may be made of aluminum alloy and given a protective polyurethane paint finish. However, care should be taken to protect it from impact or abrasion if located in Zone 0.
3. The enclosure may be given a non-standard paint finish which may constitute a potential electrostatic ignition risk. Care should be taken to protect it from external conditions conducive to the build-up of electrostatic charge on such surfaces. The enclosure must not be rubbed or cleaned with a dry cloth.
4. The enclosure may be given a non-standard paint finish which may constitute a potential electrostatic ignition risk. Care should be taken to protect it from external conditions conducive to the build-up of electrostatic charge on such surfaces. The enclosure must not be rubbed or cleaned with a dry cloth.

Special conditions for use (X) (ND, E8, and I1)

1. Cable entries must maintain the ingress protection rating of the enclosure to at least IP66.
2. Unused cable entries must be filled with suitable blanking plugs which maintain the ingress protection of the enclosure to at least IP66.
3. Cable entries and blanking plugs must be suitable for the ambient temperature of the equipment and be capable of withstanding a 7J impact test.

B.4.3 International**Note**

For full product approvals information, refer to the Rosemount 2140 [Product Certifications Manual](#).

- E7** IECEx Flameproof and Dust
 Certificates: IECEx DEK 16.0040X and IECEx BAS 16.0106X
 Standards:
 IEC60079-0:2011,
 IEC60079-1:2014,
 IEC60079-26:2014, and
 IEC60079-31:2013
 Markings:
 Ex db IIC T6...T2 Ga/Gb
 Ex ta IIIC (T92°C...T272°C) (T₅₀₀100°C...T₅₀₀280°C) Da
 (E7 also includes the NK approval)
- I7** IECEx Intrinsically Safe
 Certificate: IECEx BAS 16.0105X
 Markings:
 Ex ia IIC T5...T2 Ga
 Standards:
 IEC60079-0:2011 and IEC60079-11:2011
- NK** IECEx Dust
 Certificate: IECEx BAS 16.0106X
 Standards:
 IEC60079-0:2011 and IEC60079-31:2013
 Markings:
 Ex ta IIIC (T92°C...T272°C) (T₅₀₀100°C...T₅₀₀280°C) Da

Special conditions for use (X) (E7)

1. The user is to ensure the probe assembly is installed in such a way to prevent any damage due to impact or ignition source due to friction.
2. Non-standard paint options may cause risk from electrostatic discharge. Avoid installations that could cause electrostatic build-up of painted surfaces, and only clean the painted surfaces with a damp cloth. If paint is ordered through a special option code, contact the manufacturer for more information.
3. Flameproof joints are not intended for repair.

Special conditions for use (X) (I7)

1. The equipment, when fitted with the transient suppression terminal block, is not capable of withstanding the 500 volt insulation test. This must be taken into account when installing the equipment.
2. The enclosure may be made of aluminum alloy and given a protective polyurethane paint finish. However, care should be taken to protect it from impact or abrasion if located in Zone 0.
3. The enclosure may be given a non-standard paint finish which may constitute a potential electrostatic ignition risk. Care should be taken to protect it from external conditions conducive to the build-up of electrostatic charge on such surfaces. The enclosure must not be rubbed or cleaned with a dry cloth.

Special conditions for use (X) (NK, E8)

1. Cable entries must maintain the ingress protection rating of the enclosure to at least IP66.
2. Unused cable entries must be filled with suitable blanking plugs which maintain the ingress protection of the enclosure to at least IP66.
3. Cable entries and blanking plugs must be suitable for the ambient temperature of the equipment and be capable of withstanding a 7J impact test.
4. The enclosure may be given a non-standard paint finish which may constitute a potential electrostatic ignition risk. Care should be taken to protect it from external conditions conducive to the build-up of electrostatic charge on such surfaces. The enclosure must not be rubbed or cleaned with a dry cloth.

Appendix C Field Communicator Menu Tree

C.1 Field Communicator menu trees

Figure C-1. Rosemount 2140 Field Communicator Menu Tree (Overview)

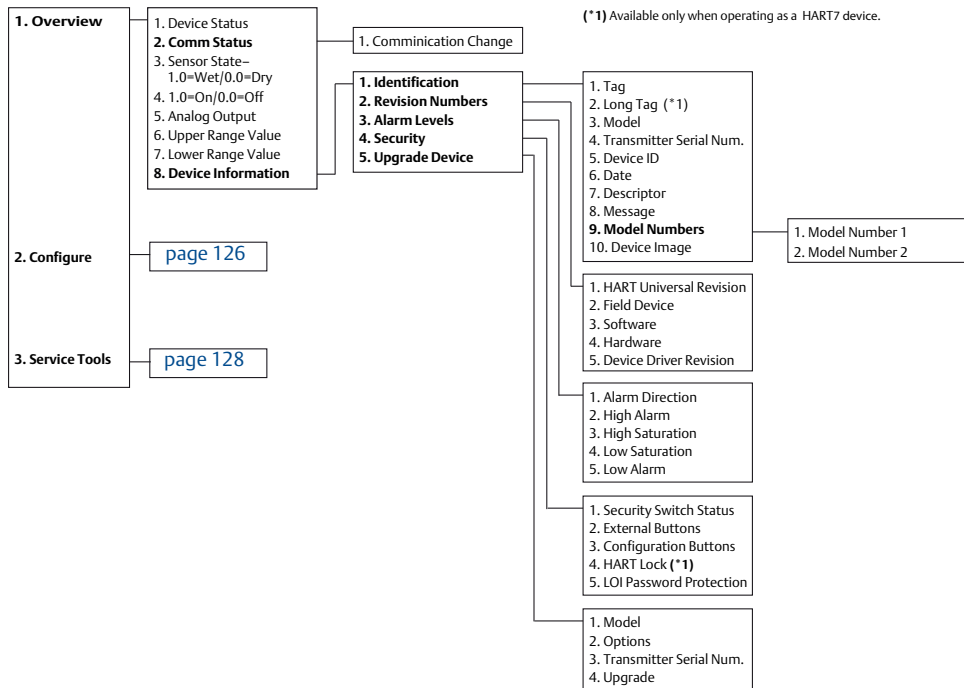


Figure C-2. Rosemount 2140 Field Communicator Menu Tree (Configure Part One)

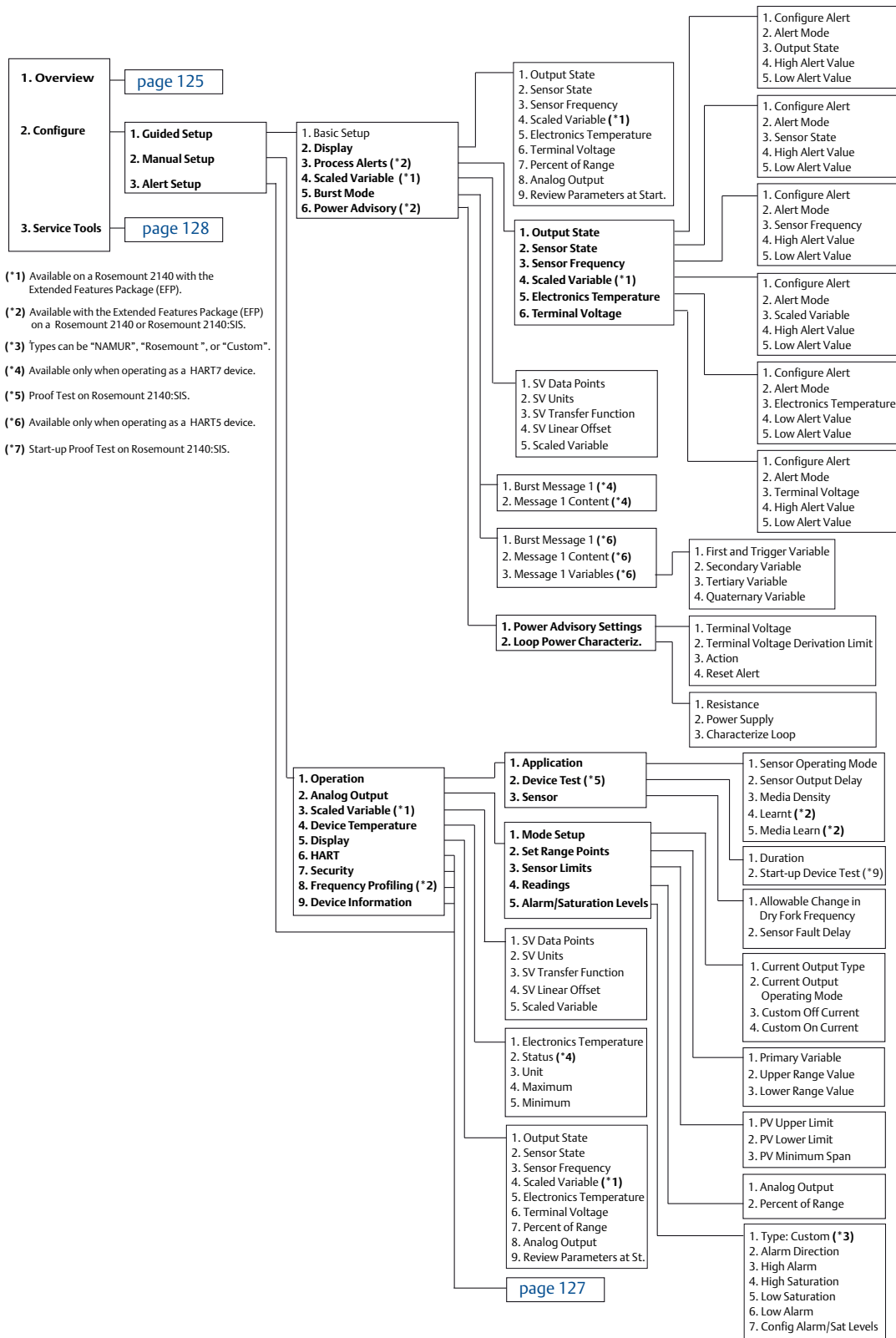
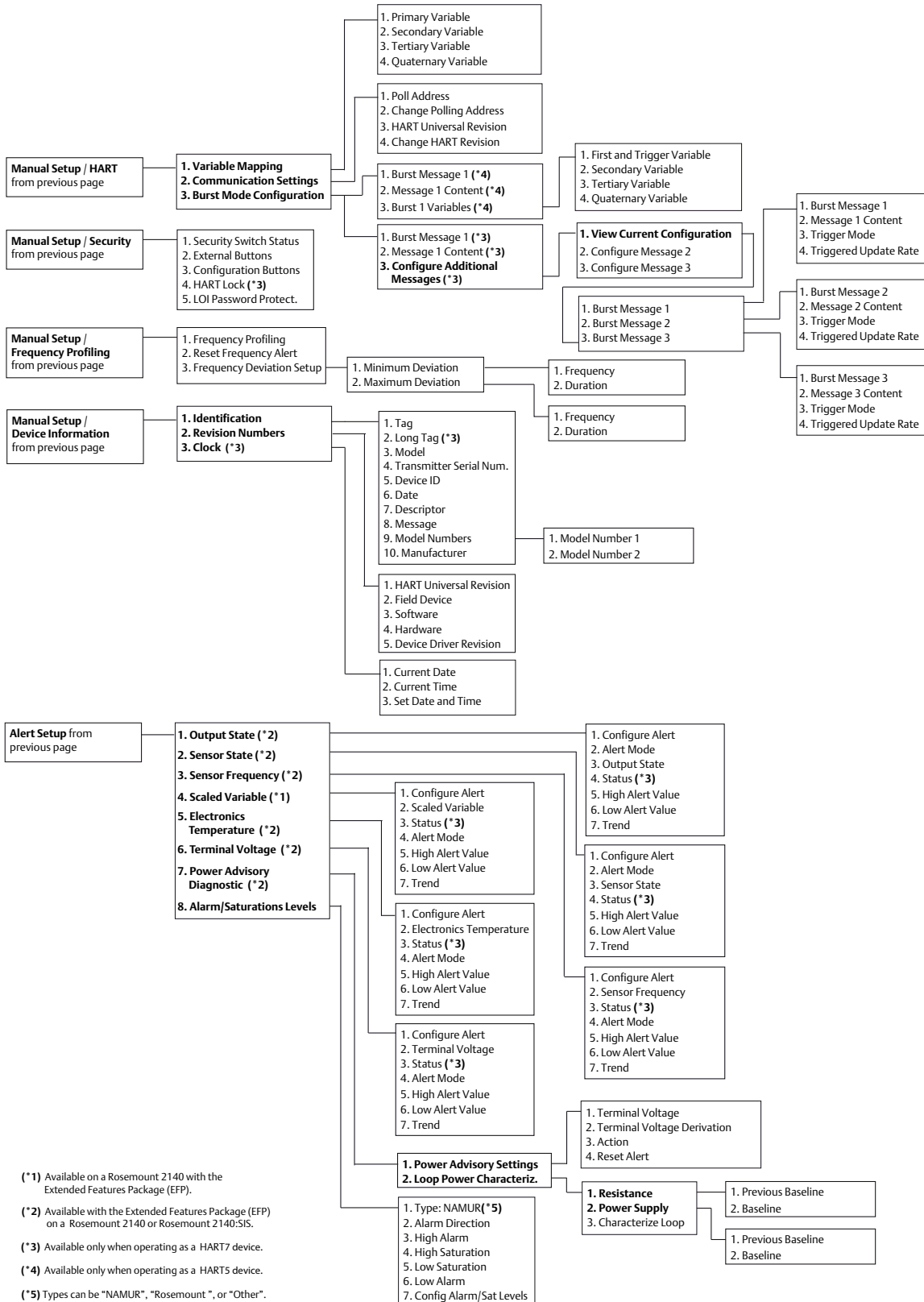


Figure C-3. Rosemount 2140 Field Communicator Menu Tree (Configure Part Two)



(*1) Available on a Rosemount 2140 with the Extended Features Package (EFP).

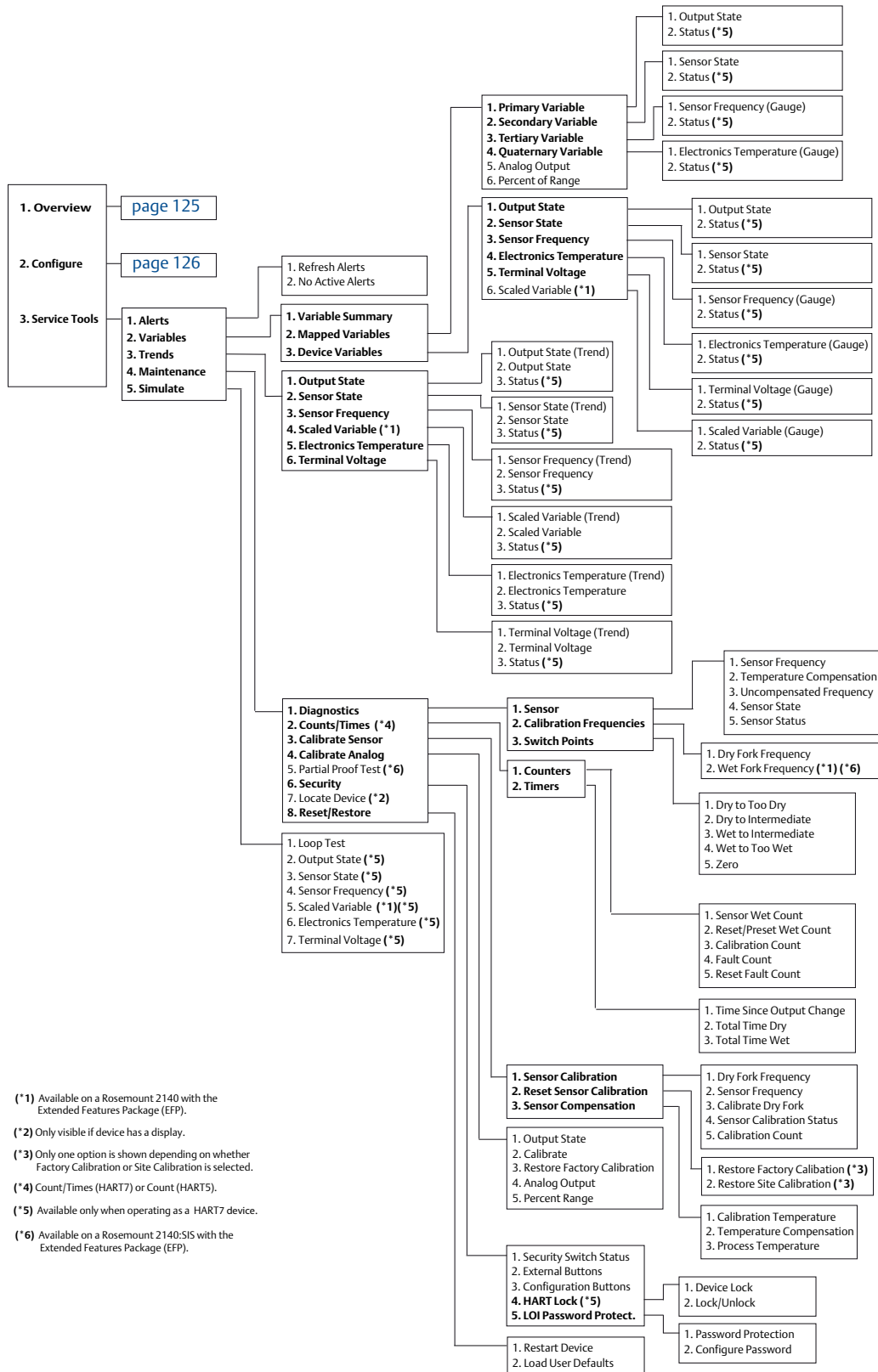
(*2) Available with the Extended Features Package (EFP) on a Rosemount 2140 or Rosemount 2140:5S.

(*3) Available only when operating as a HART7 device.

(*4) Available only when operating as a HART5 device.

(*5) Types can be "NAMUR", "Rosemount", or "Other".

Figure C-4. Rosemount 2140 Field Communicator Menu Tree (Service Tools)

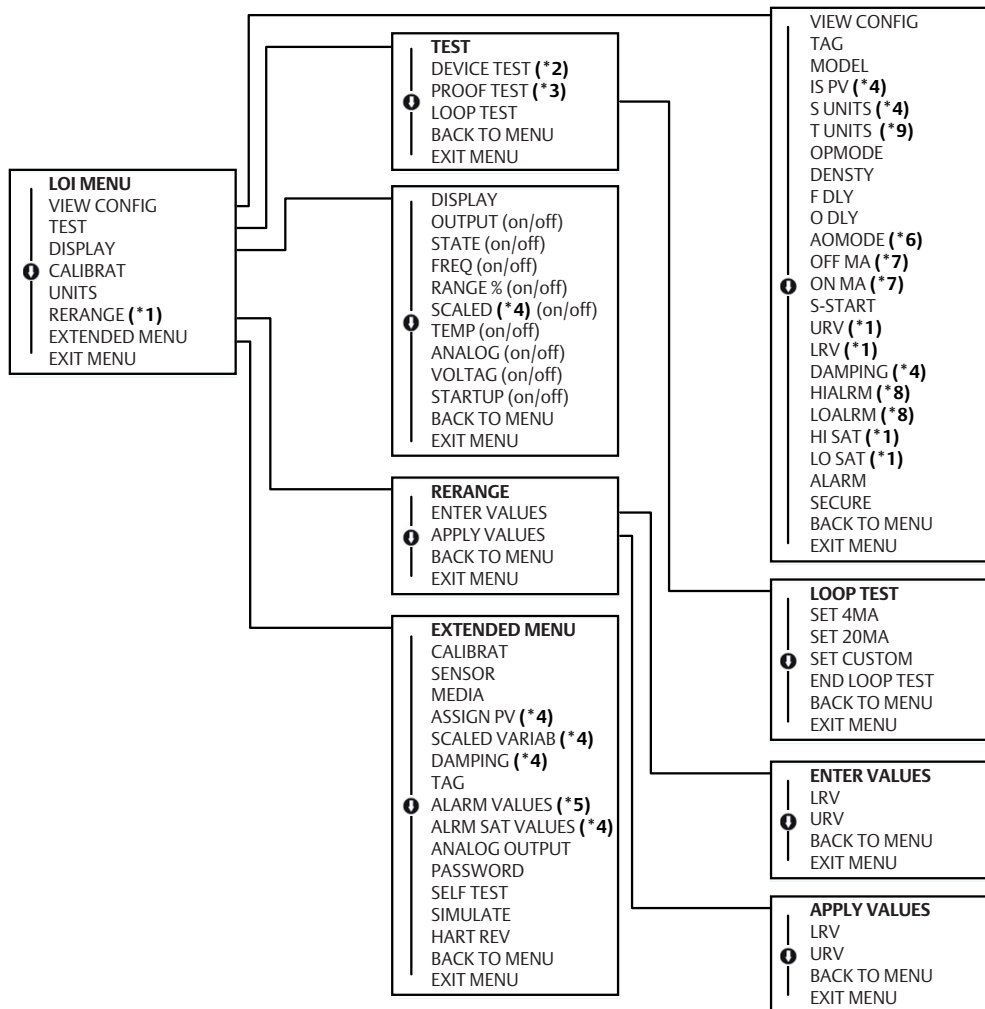


(*1) Available on a Rosemount 2140 with the Extended Features Package (EFP).
 (*2) Only visible if device has a display.
 (*3) Only one option is shown depending on whether Factory Calibration or Site Calibration is selected.
 (*4) Count/Times (HART7) or Count (HART5).
 (*5) Available only when operating as a HART7 device.
 (*6) Available on a Rosemount 2140:SiS with the Extended Features Package (EFP).

Appendix D Local Operator Interface

D.1 LOI menu trees

Figure D-1. LOI Menu Tree (Main)



(*1) Available only when the Primary Variable ("PV") is mapped to the **Sensor Frequency** or **Scaled Variable** device variables.

(*2) Not available for Rosemount 2140: SIS.

(*3) Available for Rosemount 2140: SIS.

(*4) Available for Rosemount 2140 with extended features package.

(*5) Not available for Rosemount 2140 with extended features package.

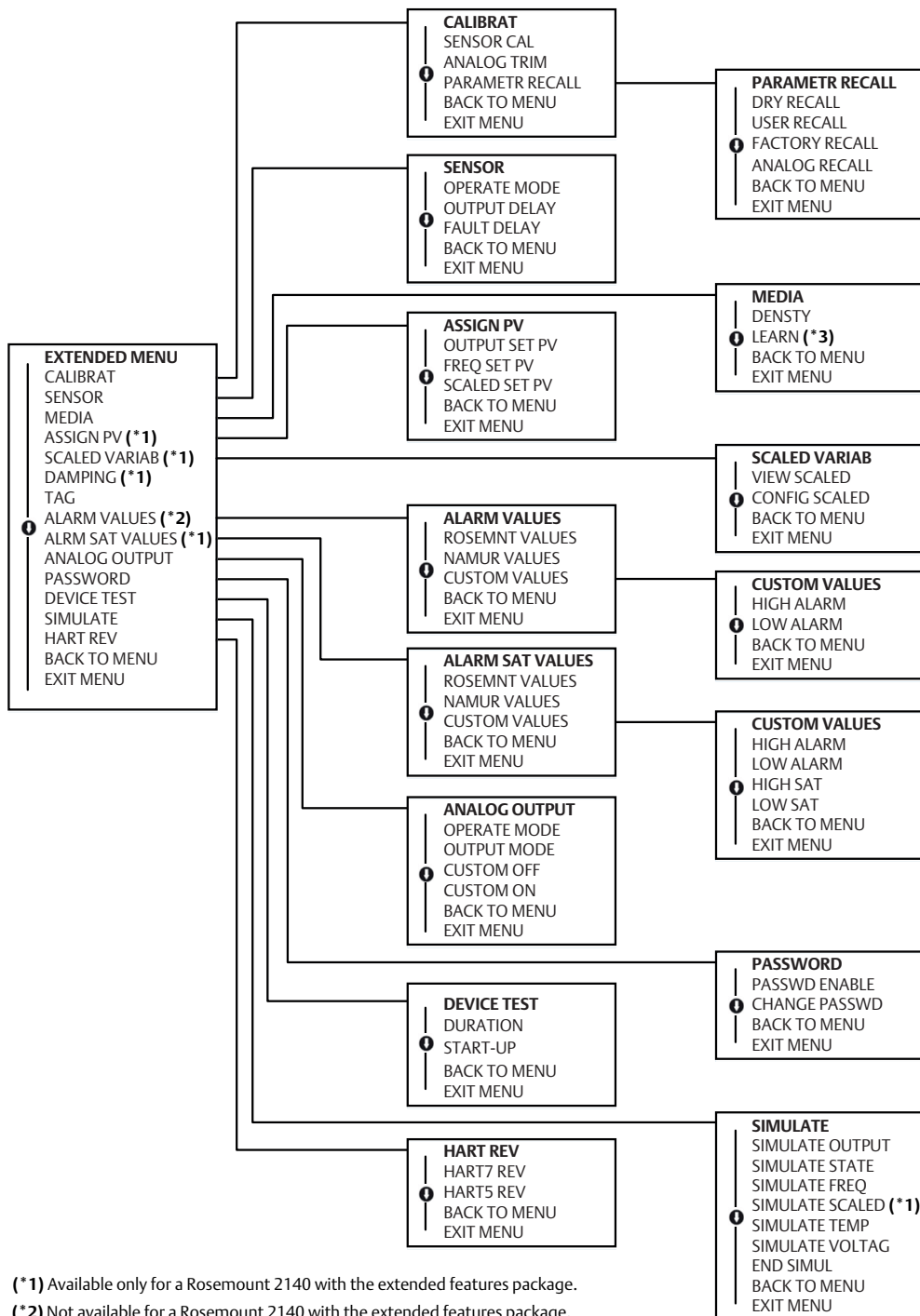
(*6) Displayed only when the PV is mapped to the **Output State** device variable.

(*7) Displayed only when the **Current Output Operating Mode** device variable is set to Custom and the PV is mapped to the **Output State** device variable.

(*8) Alarm level shown depends on setting of the hardware alarm level switch.

(*9) Available on SI units only.

Figure D-2. LOI Menu Tree (Extended Menu)



(*1) Available only for a Rosemount 2140 with the extended features package.
 (*2) Not available for a Rosemount 2140 with the extended features package.
 (*3) Available only with the extended features package.

D.2 Number entry

Floating-point numbers can be entered with the LOI. All eight number locations on the top line can be used for number entry. Refer to [Table 2-1 on page 8](#) for LOI button operation. [Table D-1](#) is an example for changing a value of “-0000022” to “000011.2”.

Table D-1. Changing Value Example

Step	Instruction	Current position (indicated by underline)
1	When the number entry begins, the left-most position is the selected position. In this example, the negative symbol, “-”, will be flashing on the screen.	<u>-</u> 0000022
2	Press the scroll button until the “0” is blinking on the screen in the selected position.	0 <u>0</u> 0000022
3	Press the enter button to select the “0” as an entry. The second digit from the left will be blinking.	00 <u>0</u> 000022
4	Press the enter button to select “0” for second digit. The third digit from the left will be blinking.	000 <u>0</u> 00022
5	Press the enter button to select “0” for the third digit. The fourth digit from the left will now be blinking.	0000 <u>0</u> 0022
6	Press the enter button to select “0” for the fourth digit. The fifth digit from the left will now be blinking.	00000 <u>0</u> 22
7	Press scroll to navigate through the numbers until the “1” is on the screen.	00001 <u>0</u> 22
8	Press the enter button to select the “1” for the fifth digit. The sixth digit from the left will now be blinking.	00001 <u>0</u> 22
9	Press scroll to navigate through the numbers until the “1”, is on the screen.	00001 <u>1</u> 22
10	Press the enter button to select the “1” for the sixth digit. The seventh digit from the left will now be blinking.	000011 <u>2</u> 2
11	Press scroll to navigate through the numbers until the decimal, “.”, is on the screen.	000011. <u>2</u>
12	Press the enter button to select the decimal, “.”, for the seventh digit. After pressing enter, all digits to the right of the decimal will now be zero. The eighth digit from the left will now be blinking.	000011. <u>0</u>
13	Press the scroll button to navigate through the numbers until the “2”, is on the screen.	000011. <u>2</u>
14	Press the enter button to select the “2” for the eighth digit. The number entry will be complete and a “SAVE” screen will be shown.	000011.2

Note

It is possible to move backwards in the number by scrolling to the left arrow symbol and pressing enter. The negative symbol is only allowed in the left most position. Numbers can be entered in scientific notation by placing an “E” in the 7th position.

D.3 Text entry

Text can be entered using the LOI. Depending on the edited item, up to eight locations on the top line can be used for text entry.

Text entry follows the same rules as the number entry rules in “[Number entry](#)” on page 131, except the following characters are available in all locations: A to Z, 0 to 9, -, /, and space.

Note

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

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