Rosemount™ 644 Temperature Transmitter with HART® Protocol

For product shipped before September 2012

EMERSON™
Process Management

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Rosemount™ 644 Temperature Transmitter

Rosemount 644 Hardware Revision	30	1	1
Device Revision	7	8	9
HART® Revision	5	5	7

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

The United States has two toll-free assistance numbers and one international number.

Customer Central
1-800-999-9307 (7:00 a.m. to 7:00 p.m. CST)

National Response Center
1-800-654-7768 (24 hours a day)

Equipment service needs
International
1-(952)-906-8888

1.1   Safety messages

Instructions and procedures in this section may require special precautions to ensure the safety of the personnel performing the operations. Information that potentially raises safety issues is indicated by a warning symbol (⚠). 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.**
>
> - Make sure only qualified personnel perform the installation.
>
> **Explosions could result in death or serious injury.**
>
> - Do not remove the connection head cover in explosive atmospheres when the circuit is live.
> - Before connecting HART® in an explosive atmosphere, make sure the instruments in the loop are installed in accordance with intrinsically safe or non-intrinsic field wiring practices.
> - Verify that the operating atmosphere of the transmitter is consistent with the appropriate hazardous locations certifications.
> - All connection head covers must be fully engaged to meet explosion-proof requirements.
> - Do not remove the thermowell while in operation.
>
> Install and tighten thermowells and sensors before applying pressureInstallation of this transmitter in an explosive environment must be in accordance with the appropriate local, national, and international standards, codes, and practices. Review the approvals section of the Rosemount 644 Reference Manual for any restrictions associated with a safe installation.
>
> - In an Explosion-Proof/Flameproof installation, do not remove the transmitter covers when power is applied to the unit.Process leaks could result in death or serious injury.
>
> **Electrical shock could cause death or serious injury.**
>
> - Use extreme caution when making contact with the leads and terminals.

⚠ CAUTION

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

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

For information on Rosemount nuclear-qualified products, contact an Emerson™ Process Management Sales Representative.

Section 1 Introduction

1.1 Manual overview

This manual is designed to assist in the installation, operation, and maintenance of Rosemount™ 644 Head Mount and 644 Rail Mount Transmitters with the HART protocol.

Section 2: Configuration

This section provides instruction on the commissioning and operating of the Rosemount 644 HART Transmitter. The information explains how to configure software functions and many configuration parameters on an Asset Management System, a Field Communicator, and the Local Operator Interface display option.

Section 3: Hardware installation

This section contains mechanical installation instructions for the transmitter.

Section 4: Electrical Installation

This section contains electrical installation instructions and considerations for the transmitter.

Section 5: Operation and maintenance

This section contains common operation and maintenance techniques for the transmitter.

Section 6: Troubleshooting

This section provides troubleshooting techniques for the most common transmitter operating problems.

Section 7: Safety Instrumented Systems (SIS) Certification

This section provides identification, installation, configuration, operation and maintenance, and inspection information for Safety Instrumented Systems as it pertains to the Rosemount 644 Head Mount Temperature Transmitter.

Appendix A: Specifications and Reference Data

This section supplies transmitter specifications and reference data as well as transmitter ordering information.

Appendix B: Product Certifications

This section contains the approved manufacturing locations, Hazardous Location Product Certification information, European Union Directive information, and Installation Drawings.

Appendix C: Field Communicator Menu Trees and Fast Keys

This section contains Field Communicator menu trees and Field Communicator Fast Keys.

Appendix D: Local Operator Interface (LOI)

This section contains instructions for number entry, text entry, as well as the LOI menu tree and LOI extended menu tree.

1.2   Transmitter overview

The Rosemount 644 Head Mount Temperature Transmitter supports the following features:
- HART configuration with Selectable HART revision capability (Revisions 5 or 7)

- Accepts either 1 or 2 inputs from a wide variety of sensor types (2-, 3-, and 4-wire RTD, Thermocouple, mV, and Ohm)

- A compact transmitter size with electronics completely encapsulated in protective silicone and enclosed in a plastic housing, ensuring long-term transmitter reliability

- Optional Safety Certification Option (IEC 61508 SIL 2)

- Optional Enhanced accuracy and stability performance

- Optional LCD display with extended temperature ratings of -40 °C to 85 °C

- Optional advanced LCD display with local operator interface (LOI) with extended temperature ratings of -40 °C to 80 °C

- Two housing materials (Aluminum and SST) and various housing style options that allow for mounting flexibility in a variety of environmental conditions

- Special dual-sensor features include Hot Backup™, Sensor Drift Alert, first good, differential and average temperature measurements, and four simultaneous measurement variable outputs in addition to the analog output signal

- Additional advanced features include: Thermocouple Degradation Diagnostic, which monitors thermocouple health, and process and transmitter Minimum/Maximum Temperature Tracking

The Rosemount 644 Rail Mount Temperature Transmitter supports the following features:
- 4-20 mA/HART protocol (Revision 5)

- Accepts 1 sensor input from a wide variety of sensor types (2-, 3-, and 4-wire RTD, Thermocouple, mV, and Ohm)

- Completely encapsulated electronics to ensure long term transmitter reliability

Refer to the following literature for a full range of compatible connection heads, sensors, and thermowells provided by Emerson™ Process Management.
- Temperature Sensors and Assemblies Product Data Sheet, Volume 1 (document number 00813-0100-2654)

- Temperature Sensors and Assemblies Product Data Sheet, Volume 2 (document number 00813-0200-2654)

1.3   Considerations

1.3.1   General

Electrical temperature sensors such as RTDs and thermocouples produce low-level signals proportional to their sensed temperature. The Rosemount 644 converts the low-level sensor signal to a standard 4–20 mA DC or digital HART signal that is relatively insensitive to lead length and electrical noise. This signal is then transmitted to the control room via two wires.

1.3.2   Commissioning

The transmitter can be commissioned before or after installation. It may be useful to commission it on the bench, before installation, to ensure proper operation and to become familiar with its functionality.

Make sure the instruments in the loop are installed in accordance with intrinsically safe, or non-incendive field wiring practices.

1.3.3   Mechanical

Location

When choosing an installation location and position, take into account the need for access to the transmitter.

Special mounting

Special mounting hardware is available for mounting a Rosemount 644 Head Mount Transmitter to a DIN rail or assembling a new Rosemount 644 Head Mount to an existing threaded sensor connection head (former option code L1).

1.3.4   Electrical

Proper electrical installation is necessary to prevent errors due to sensor lead resistance and electrical noise. For best results, shielded cable should be used in electrically noisy environments.

Make wiring connections through the cable entry in the side of the housing. Be sure to provide adequate clearance for cover removal.

1.3.5   Environmental

The transmitter electronics module is permanently sealed within a plastic enclosure, resisting moisture and corrosive damage. Verify that the operating atmosphere of the transmitter is consistent with the appropriate hazardous locations certifications.

Temperature effects

The transmitter will operate within specifications for ambient temperatures between –40 and 185 °F (–40 and 85 °C). Heat from the process is transferred from the thermowell to the transmitter housing. If the expected process temperature is near or beyond specification limits, consider the use of additional thermowell lagging, an extension nipple, or a remote mounting configuration to isolate the transmitter from the process.

Figure 1-1 provides an example of the relationship between transmitter housing temperature rise and extension length.

Figure 1-1. Rosemount 644 Head Mount Transmitter Connection Head Temperature Rise vs. Extension Length
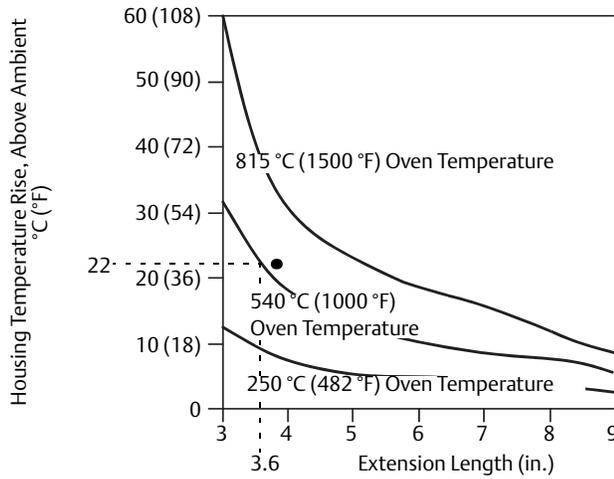
Example

The maximum permissible housing temperature rise (T) can be calculated by subtracting the maximum ambient temperature (A) from the transmitter's ambient temperature specification limit (S). For instance, if A = 40 °C.

$$T = S - A$$
$$T = 85\ °C - 40\ °C$$
$$T = 45\ °C$$

For a process temperature of 540 °C (1004 °F), an extension length of 3.6 inches (91.4 mm) yields a housing temperature rise (R) of 22 °C (72 °F), providing a safety margin of 23 °C (73 °F). A 6.0 inch (152.4 mm) extension length (R = 10 °C (50 °F)) offers a higher safety margin (35 °C (95 °F)) and reduces temperature-effect errors but would probably require extra transmitter support. Gauge the requirements for individual applications along this scale. If a thermowell with lagging is used, the extension length may be reduced by the length of the lagging.

1.4   Return of materials

To expedite the return process in North America, call the Emerson™ Process Management National Response Center toll-free at 800-654-7768. This center, available 24 hours a day, will assist you with any needed information or materials.

⚠ The center will ask for the following information:
- Product model

- Serial numbers

- The last process material to which the product was exposed

The center will provide
- A Return Material Authorization (RMA) number

- Instructions and procedures that are necessary to return goods that were exposed to hazardous substances

For other locations, contact an Emerson Process Management sales representative.

Note
If a hazardous substance is identified, a Material Safety Data Sheet (MSDS), required by law to be available to people exposed to specific hazardous substances, must be included with the returned materials.

1.5   Transmitter security

1.5.1   Available security options

There are three security methods to utilize with the Rosemount 644 Transmitter.
- Software Security Switch (Write Protect)
- HART Lock
- LOI Password

The **Write Protect** feature allows you to protect the transmitter data from accidental or unwarranted configuration changes. To enable the write protect feature, perform the following procedures.

Configuring Write Protect, HART Lock and LOI Password with a Field Communicator

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

Device Dashboard Fast Keys-Write Protect	2, 2, 9, 1
Device Dashboard Fast Keys-HART Lock	2, 2, 9, 2
Device Dashboard Fast Keys- LOI Password	2, 2, 9, 3

Configuring Write Protect, HART Lock and LOI Password with AMS™ Device Manager

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

1.   In the left navigation pane choose **Manual Setup** then chose the **Security tab**.

2.   All three parameters can be configured from this screen.

3.   Click **Apply** when complete.

Section 2   Configuration

2.1   Overview

This section contains information on commissioning and tasks that should be performed on the bench prior to installation. Field Communicator, AMS™ Device Manager, and Local Operator Interface (LOI) instructions are given to perform configuration functions. For convenience, Field Communicator Fast Key sequences are labeled "Fast Keys," and abbreviated LOI menus are provided for each function below. The LOI is only available on the Rosemount 644 Head Mount design and the configuration instructions referencing the interface will not apply to the rail mount form factor.

Full Field Communicator menu trees and Fast Key sequences are available in Appendix C: Field Communicator Menu Trees and Fast Keys. LOI menu trees are available in Appendix D: Local Operator Interface (LOI).

2.2   Safety messages

Instructions and procedures in this section may require special precautions to ensure the safety of the personnel performing the operations. Information that potentially raises safety issues is indicated by a warning symbol (⚠). 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.

- Make sure only qualified personnel perform the installation.

Explosions could result in death or serious injury.

- Do not remove the connection head cover in explosive atmospheres when the circuit is live.
- Before connecting a Field Communicator in an explosive atmosphere, make sure the instruments in the loop are installed in accordance with intrinsically safe or non-incendive field wiring practices.
- Verify the operating atmosphere of the transmitter is consistent with the appropriate hazardous locations certifications.
- All connection head covers must be fully engaged to meet explosion-proof requirements.

Process leaks could result in death or serious injury.

- Do not remove the thermowell while in operation.
- Install and tighten thermowells and sensors before applying pressure.

Electrical shock could cause death or serious injury.

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

2.3   System readiness

Confirm HART® revision capability

- If using HART based control or asset management systems, confirm the HART capability of those systems prior to transmitter installation. Not all systems are capable of communicating with HART Revision 7 protocol. This transmitter can be configured for either HART Revision 5 or 7.
- For instructions on how to change the HART revision of your transmitter, see "Switching HART Revision" on page 82.

2.3.1 Confirm correct device driver

- Verify the latest Device Driver files are loaded on your systems to ensure proper communications.
- Download the latest Device Driver at www.EmersonProcess.com or www.HartComm.org

Table 2-1. Rosemount 644 Device Revisions and Files

Software date	Identify device		Find device driver files		Review instructions	Review functionality
Date	NAMUR software revision	HART software revision	HART universal revision[1]	Device revision [2]	Manual document number	Changes to software[3]
June 2012	1.1.1	01	5	8	00809-0100-4728	See footnote 3 for list of changes
			7	9		

1. NAMUR Software Revision is located on the hardware tag of the device. HART Software Revision can be read using a HART communication tool.
2. Device Driver file names use Device and DD Revision, e.g. 10_01. HART Protocol is designed to enable legacy device driver revisions to continue to communicate with new HART devices. To access new functionality, the new Device Driver must be downloaded. It is recommended to download the new Device Driver files to ensure full functionality.
3. HART Revision 5 and 7 Selectable. Dual Sensor support, Safety Certified, Advanced Diagnostics (if ordered), Enhanced Accuracy and Stability (if ordered).

2.3.2 Surges/transients

The transmitter will withstand electrical transients of the energy level encountered in static discharges or induced switching transients. However, high-energy transients, such as those induced in wiring from nearby lightning strikes, welding, heavy electrical equipment, or switching gears, can damage both the transmitter and the sensor. To protect against high-energy transients, install the transmitter into a suitable connection head with the Rosemount 470 Transient Protector. Refer to the Rosemount 470 Transient Protector Product Data Sheet (document number 00813-0100-4191) for more information.

2.4 Configuration methods

⚠ CAUTION

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

The Rosemount 644 can be configured either before or after installation. Configuring the transmitter on the bench using either a Field Communicator, AMS Device Manager, or Local Operator Interface (LOI) ensures all transmitter components are in working order prior to installation.

The Rosemount 644 Transmitter can be configured either on-line or off-line using a Field Communicator, AMS Device Manager or the optional Local Operator Interface (LOI) (Head mount only). During on-line configuration, the transmitter is connected to a Field communicator. Data is entered in the working register of the communicator and sent directly to the transmitter.

Off-line configuration consists of storing configuration data in a Field Communicator while it is not connected to a transmitter. Data is stored in nonvolatile memory and can be downloaded to the transmitter at a later time.

2.4.1 Configuring on the bench

To configure on the bench, required equipment includes a power supply, a digital multimeter (DMM), and a Field Communicator, AMS Device Manager, or a Local Operator Interface (LOI – Option M4).

Connect the equipment as shown in Figure 2-1. Connect HART Communication leads at any termination point in the signal loop. To ensure successful HART communication, a resistance of at least 250 ohms must be present between the transmitter and the power supply. Connect the Field Communicator leads to the clips behind the power (+,-) terminals on the top of the device. Avoid exposing the transmitter electronics to the plant environment after installation by setting all transmitter jumpers during the commissioning stage on the bench.

Figure 2-1. Powering the Transmitter for Bench Configuration

Rosemount 644 Head Mount   **Rosemount 644 Rail Mount**
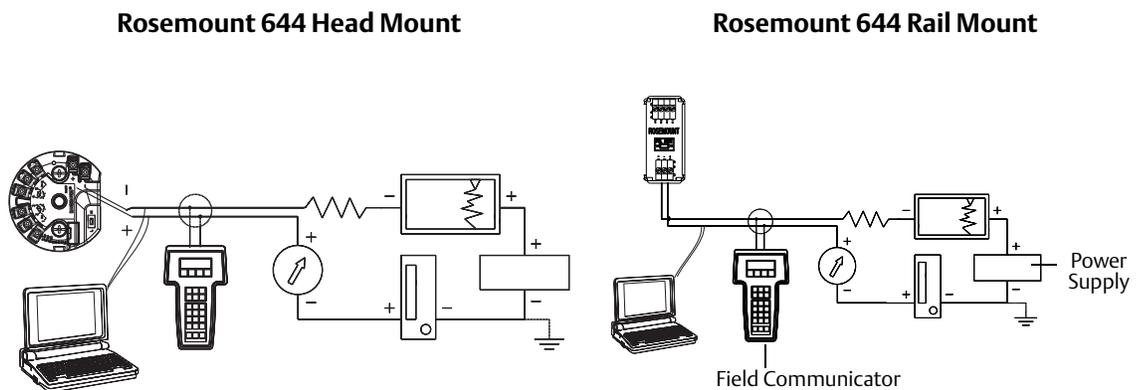
Note: Signal loop may be grounded at any point or left ungrounded.
Note: A Field Communicator may be connected at any termination point in the signal loop. The   signal loop must have between 250 and 1100
         ohms load for communications.
Note: Max torque is 6 in.-lbs (0/7 N-m)

2.4.2 Choosing a configuration tool

Configuring with a Field Communicator

The Field Communicator is a handheld device that exchanges information with the transmitter from the control room, the instrument site, or any wiring termination point in the loop. To facilitate communication, connect the Field Communicator, shown in this manual, in parallel with the transmitter (see Figure 2-1). Use the loop connection ports on the rear panel of the Field Communicator. The connections are non-polarized. Do not make connections to the serial port or the NiCad recharger jack in explosive atmospheres. Before connecting the Field Communicator in an explosive atmosphere make sure the instruments in the loop are installed in accordance with intrinsically safe or non-incendive field wiring practices.

There are two interfaces available with the Field Communicator: Traditional and Dashboard interfaces. All steps using a Field Communicator will be using Dashboard interfaces. Figure 2-2 shows the Device Dashboard interface. As stated in "System readiness" on page 8, it is critical that the latest DD's are loaded into the Field Communicator for optimal transmitter performance.

Visit www.emersonprocess.com to download latest DD library.

Turn on the Field Communicator by pressing the ON/OFF key. The Field Communicator will search for a HART-compatible device and indicate when the connection is made. If the Field Communicator fails to connect, it indicates that no device was found. If this occurs, refer to Section 6: Troubleshooting.

Figure 2-2. Field Communicator Device Dashboard Interface
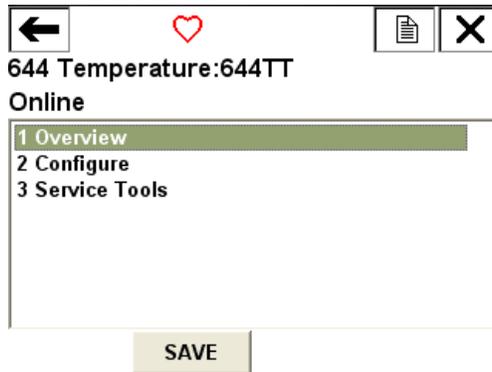
Field Communicator menu trees and Fast Keys are available in Appendix C: Field Communicator Menu Trees and Fast Keys Configuring with AMS Device Manager

With an AMS Device Manager software package, you can commission and configure instruments, monitor status and alerts, troubleshoot from the control room, perform advanced diagnostics, manage calibration, and automatically document activities with a single application.

Full configuration capability with AMS Device Manager requires loading the most current Device Descriptor (DD) for this device. Download the latest DD at www.emersonprocess.com, or www.hart-comm.org.

Note
All steps listed in this product manual using AMS Device Manager assume the use Version 11.5.

Configuring with a Local Operator Interface

The LOI requires option code M4 to be ordered. To activate the LOI push either configuration button. Configuration buttons are located on the LCD display (must remove housing cover to access the interface. See Table 2-2 for configuration button functionality and Figure 2-3 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.

Note
Entering into the LOI menu effectively disables the ability to write to the device by any other host or configuration tool. Make sure this is communicated to necessary personnel before using the LOI for device configuration.

Figure 2-3. LOI Configuration Buttons
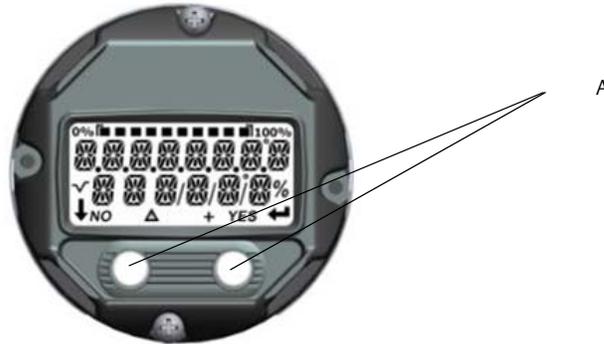
A. Configuration buttons

Table 2-2. LOI Button Operation

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

Local Operator Interface password

A Local Operator Interface Password can be entered and enabled to prevent review and modification of device configuration via the LOI. This does not prevent configuration from HART or through the control system. The LOI password is a 4 digit code that is to be set by the user. If the password is lost or forgotten the master password is "9307". The LOI password can be configured and enabled/disabled by HART communication via a Field Communicator, AMS Device Manager, or the LOI.

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

2.4.3 Setting the loop to manual

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

2.4.4 Failure mode

As part of normal operation, each transmitter continuously monitors its own performance. This automatic diagnostics routine is a timed series of checks repeated continuously. If diagnostics detect an input sensor failure or a failure in the transmitter electronics, the transmitter drives its output to low or high depending on the position of the failure mode switch. If the sensor temperature is outside the range limits, the transmitter saturates its output to 3.9 mA for standard configuration on the low end (3.8 mA if configured for NAMUR-compliant operation) and 20.5 mA on the high end (or NAMUR-compliant). These values are also custom configurable

by the factory or using the Field Communicator. The values to which the transmitter drives its output in failure mode depend on whether it is configured to standard, NAMUR-compliant, or custom operation. See "Hardware and Software Failure Mode" on page 108 for standard and NAMUR-compliant operation parameters.

2.4.5 HART software Lock

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

Configuring HART lock using a Field Communicator

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

Device Dashboard Fast Keys	3, 2, 1

Configuring HART lock using AMS Device Manager

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

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

3. Click **Lock/Unlock** button under *HART Lock (Software)* and follow the screen prompts.

2.5 Verify configuration

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

2.5.1 Using Field Communicator

Configuration parameters listed in Figure 2-4 below are the basic parameters that should be reviewed prior to transmitter installation. A full list of configuration parameters that can be reviewed and configured using a Field Communicator are located in Appendix C: Field Communicator Menu Trees and Fast Keys. A Rosemount 644 Device Descriptor (DD) must be installed on the Field Communicator to verify configuration.

1. Verify device configuration using Fast Key sequences in Figure 2-4.

   a. From the *HOME* screen, enter the Fast Key sequences listed in Figure 2-4.

Figure 2-4. Rosemount 644 Device Dashboard Fast Key Sequences

	Fast Key Sequence	
Function	**HART 5**	**HART 7**
Alarm Values	2, 2, 5, 6	2, 2, 5, 6
Damping Values	2, 2, 1, 5	2, 2, 1, 6
Lower Range Value (LRV)	2, 2, 5, 5, 3	2, 2, 5, 5, 3
Upper Range Value (URV)	2, 2, 5, 5, 2	2, 2, 5, 5, 2
Primary Variable	2, 2, 5, 5, 1	2, 2, 5, 5, 1
Sensor 1 Configuration	2, 1, 1	2, 1, 1
Sensor 2 Configuration[1]	2, 1, 1	2, 1, 1
Tag	2, 2, 7, 1, 1	2, 2, 7, 1, 1
Units	2, 2, 1, 5	2, 2, 1, 4

1. Available only if option code (S) is ordered.

2.5.2   Using AMS Device Manager

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

2.5.3   Using Local Operator Interface

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

- Tag
- Sensor Configuration
- Units
- Alarm and Saturation Levels
- Primary Variable
- Range Values
- Damping

2.5.4   Checking transmitter output

Before performing other transmitter on-line operations, review the Rosemount 644 digital output parameters to ensure the transmitter is operating properly and is configured to the appropriate process variables.

Checking or setting process variables

The **Process Variables** menu displays process variables, including sensor temperature, percent of range, analog output, and terminal temperature. These process variables are continuously updated. The default primary variable is *Sensor 1*. The secondary variable is the transmitter terminal temperature by default.

Using a Field Communicator

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

Device Dashboard Fast Keys	3, 2, 1

Using AMS Device Manager

Right click on the device and select **Service Tools** from the menu. The *Variables* tab displays the following process variables:

- Primary, Second, Third and Fourth variables, as well as the Analog Output

Using Local Operator Interface

To check the process variables from the LOI, the user must first configure the display to show the desired variables (see "Configuring the LCD display" on page 30). Once the desired device variables are chosen, simply EXIT the LOI menu and view the alternating values on the display screen.

```
┌─────────────────────┐           ┌─────────────────────┐        ┌──────────┐
│   VIEW CONFIG       │           │   SENSOR 1          │    ↵   │  ON/OFF  │
│   ZERO TRIM         │           │   SENSOR 2*         │        └──────────┘
│   UNITS             │           │ ↓ ANALOG            │
│   RERANGE           │           │   PV                │
│ ↓ LOOP TEST         │      ↵    │   AVG               │
│   DISPLAY           │           │   1ST GOOD          │
│   EXTENDED MENU     │           │   DIFF              │
│   EXIT MENU         │           │   % RANGE           │
└─────────────────────┘           │   TERM              │
                                  │   MNMAX1*           │
                                  │   MNMAX2*           │
                                  │   MNMAX3*           │
                                  │   MNMAX4*           │
                                  │   BACK TO MENU      │
                                  │   EXIT MENU         │
                                  └─────────────────────┘
```
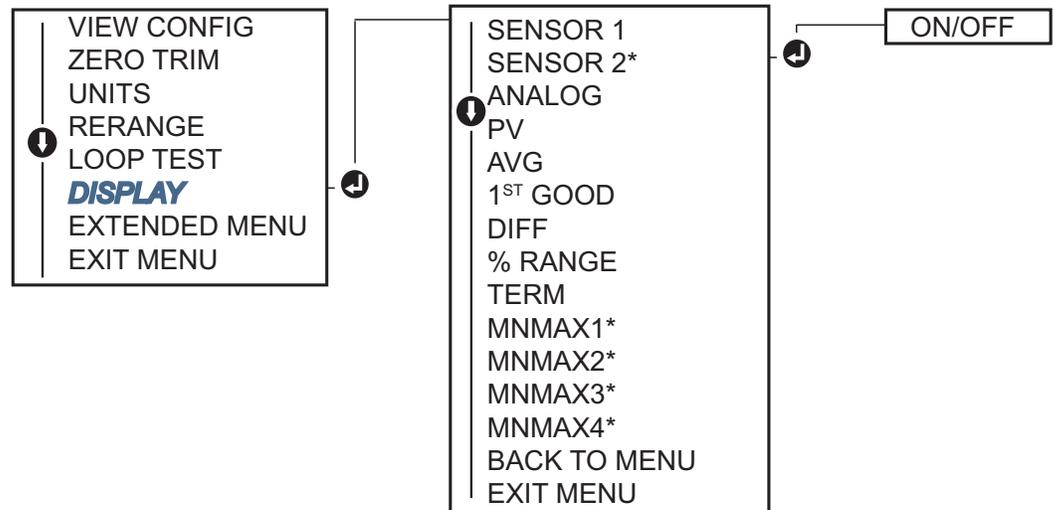
2.6 Basic configuration of the transmitter

The Rosemount 644 must be configured for certain basic variables in order to be operational. In many cases, all of these variables are pre-configured at the factory. Configuration may be required if the transmitter is not configured or if the configuration variables need revision.

2.6.1 Mapping the HART variables

Using a Field Communicator

The *Variable Mapping* menu displays the sequence of the process variables. Select the sequence below to change this configuration. The Rosemount 644 single sensor input configuration screens allow selection of the primary variable (PV) and the secondary variable (SV). When the *Select PV* screen appears, *Snsr 1* must be selected.

The Rosemount 644 dual-sensor option configuration screens allow selection of the primary variable (PV), secondary variable (SV), tertiary variable (TV), and quaternary variable (QV). Variable choices are:

- Sensor 1
- Sensor 2
- Differential Temperature
- Average Temperature
- Terminal Temperature
- Not Used

The 4-20 mA analog signal represents the Primary Variable.

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

Device Dashboard Fast Keys	2, 2, 8, 6

Using AMS Device Manager

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

1. In the left navigation pane choose **Manual Setup** then on the **HART tab**.

2. Map each variable individually or use the **Re-map Variables** method to guide you through the re-mapping process.

3. Click **Apply** when complete.

Using the Local Operator Interface

Follow flow chart to select the desired mapped variables. Use the **SCROLL** and **ENTER** buttons to select each variable. Save by selecting **SAVE** as indicated on the LCD screen when prompted. See Figure 2-5 on page 16 for an example of a mapped variable with the LOI.

Figure 2-5. Mapping Variables with LOI
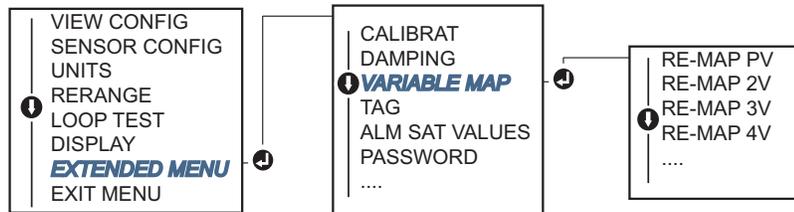
2.6.2   Configuring the sensor(s)

Sensor configuration includes setting the information for:

- Sensor Type
- Connection Type
- Units
- Damping values
- Sensor Serial Number
- RTD 2-Wire Offset

Using a Field Communicator

The Configure Sensors method will guide you through the configuration of all necessary settings associated with configuring a sensor including:

For a full list of Sensor Types available with the Rosemount 644 and their associated levels of accuracy, see Table A-2 on page 110.

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

Device Dashboard Fast Keys	2, 1, 1

Using AMS Device Manager

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

1. In the left navigation pane choose **Manual Setup** and choose the **Sensor 1** or **Sensor 2** tab depending on the need.

2. Individually select the Sensor Type, Connection, Units and other sensor related information as desired from the drop down menus on the screen.

3. Click **Apply** when complete.

Using Local Operator Interface

Reference the below image for guidance on where to find Sensor Configuration in the LOI menu.

Figure 2-6. Configuring Sensors with LOI
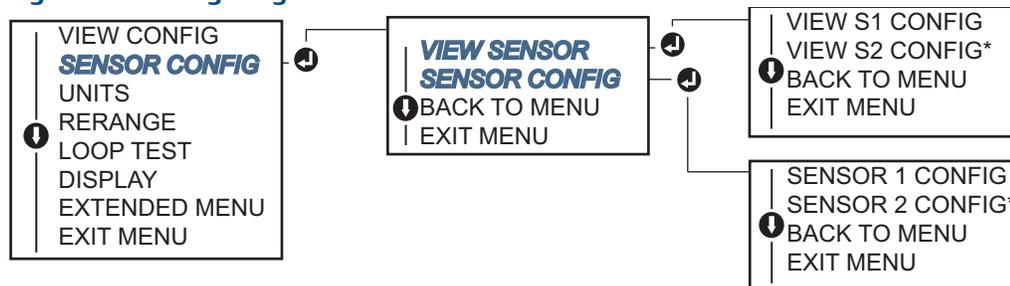
* Available only if option code (S) is ordered.

Contact a Emerson Process Management representative for information on the temperature sensors, thermowells, and accessory mounting hardware that is available through Emerson Process Management.

2-wire RTD offset

The 2-wire Offset feature allows the measured lead wire resistance to be input and corrected for, which results in the transmitter adjusting its temperature measurement for the error caused by this added resistance. Because of a lack of lead wire compensation within the RTD, temperature measurements made with a 2-wire RTD are often inaccurate.

This feature can be configured as a subset of the **Sensor Configuration** process in the Field Communicator, AMS Device Manager, and the Local Operator Interface.

To utilize this feature properly perform the following steps:

1. Measure the lead wire resistance of both RTD leads after installing the 2-Wire RTD and Rosemount 644.

2. Navigate to the 2-Wire RTD Offset parameter:

3. Enter the total measured resistance of the two RTD leads at the *2-Wire Offset* prompt to ensure proper adjustment. The transmitter will adjust its temperature measurement to correct the error caused by lead wire resistance.

Enter 2-wire offset with Field Communicator

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

Device Dashboard Fast Keys	2, 1, 1

Enter 2-wire offset with AMS Device Manager

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

2. In the left navigation pane choose **Manual Setup** and choose the **Sensor 1** or **Sensor 2** tab depending on the need. Find the 2-Wire Offset text field and enter the value.

3. Click **Apply** when complete.

2.6.3   Setting output units

The Units can be configured for a number of different parameters in the Rosemount 644. Individual Units can be configured for:

- Sensor 1
- Sensor 2
- Terminal Temperature
- Differential Temperature
- Average Temperature
- First Good Temperature

Each of the base parameters and calculated outputs from those values can have a Unit of measure associated with it. Set the transmitter output to one of the following engineering units:

- Degrees Celsius
- Degrees Fahrenheit
- Degrees Rankine
- Kelvin
- Ohms
- Millivolts

Using a Field Communicator

From the *HOME* screen, enter the Fast Key sequence	HART 5	HART 7
Device Dashboard Fast Keys	2, 2, 1, 4	2, 2, 1, 5

Using AMS Device Manager

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

2. In the left navigation pane choose **Manual Setup**. The unit fields for various variables are spread over the Manual Setup tabs, click through the tabs and change the desired units.

3. Click **Apply** when complete.

Using Local Operator Interface

Reference the below image for where to find the **Units** configuration in the LOI menu.

Figure 2-7. Configuring Units with LOI
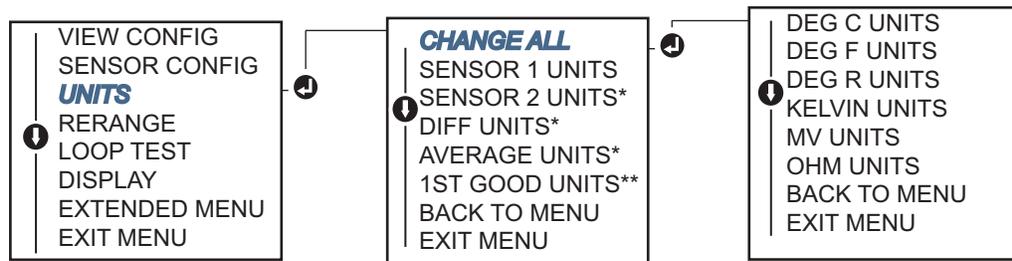
* Available only if option code (S) is ordered.

** Available only if option Codes (S) and (DC) are both ordered.

Note
The list of choices available for *Units* after the primary menu is dependent on sensor configuration settings.

2.7 Configure dual sensor options

Dual-sensor configuration deals with the functions that can be used with a transmitter ordered with Dual Sensor inputs. In the Rosemount 644 these functions include:

- Differential Temperature
- Average Temperature
- Hot Backup™ and Sensor Drift Alert Diagnostics (requires option code DC)
  - First Good Temperature (requires options S and DC)

2.7.1 Differential temperature configuration

The Rosemount 644 ordered and configured for dual-sensors can accept any two inputs then display the differential temperature between them. Use the following procedures to configure the transmitter to measure differential temperature.

Note
This procedure assumes the Differential Temperature is a calculated output of the device but does not re-assign it as the Primary Variable. If it desired for Differential to be the transmitter's primary variable see "Mapping the HART variables" on page 15 to set it to PV.

Using Field Communicator

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

| **Device Dashboard Fast Keys**	2, 2, 3, 1

Using AMS Device Manager

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

1. In the left navigation pane choose **Manual Setup**.

2. On the **Calculated Output Tab** find the **Differential Temperature** group box.

3. Choose Units and Damping settings then click **Apply** when complete.

Using Local Operator Interface

To configure the Differential Temperature on the Local Operator Interface you will have to set the Units and Damping values separately. Reference Figure 2-8 and Figure 2-9 below for where to find these in the menu.

Figure 2-8. Configuring Differential Units with LOI

```
VIEW CONFIG                CHANGE ALL                 DEG C UNITS
SENSOR CONFIG              SENSOR 1 UNITS             DEG F UNITS
UNITS                      SENSOR 2 UNITS*            DEG R UNITS
RERANGE                    DIFFRNTL UNITS*            KELVIN UNITS
LOOP TEST                  AVERAGE UNITS*             MV UNITS
DISPLAY                    1ST GOOD UNITS**           OHM UNITS
EXTENDED MENU             BACK TO MENU               BACK TO MENU
EXIT MENU                  EXIT MENU                  EXIT MENU
```

* Available only if option code (S) is ordered.

** Available only if option codes (S) and (DC) are both ordered.

Figure 2-9. Configuring Differential Damping with LOI
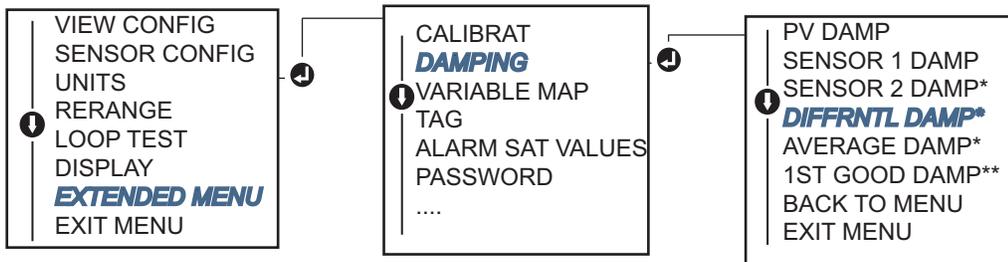
```
VIEW CONFIG                CALIBRAT                   PV DAMP
SENSOR CONFIG             DAMPING                    SENSOR 1 DAMP
UNITS                      VARIABLE MAP               SENSOR 2 DAMP*
RERANGE                    TAG                        DIFFRNTL DAMP*
LOOP TEST                  ALARM SAT VALUES           AVERAGE DAMP*
DISPLAY                    PASSWORD                   1ST GOOD DAMP**
EXTENDED MENU             ....                       BACK TO MENU
EXIT MENU                                             EXIT MENU
```

* Available only if option code (S) is ordered.

** Available only if option codes (S) and (DC) are both ordered.

2.7.2   Average temperature configuration

The Rosemount 644 Transmitter ordered and configured for dual-sensors can output and display the Average temperature of any two inputs. Use the following procedures to configure the transmitter to measure the average temperature:

Note
This procedure assumes the Average Temperature is a calculated output of the device but does not re-assign it as the Primary Variable. If it desired for Differential to be the transmitter's primary variable see "Mapping the HART variables" on page 15 to set it to PV.

Using a Field Communicator

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

Device Dashboard Fast Keys	2, 2, 3, 3

Using AMS Device Manager

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

1. In the left navigation pane choose **Manual Setup**.

2. On the **Calculated Output Tab** find the *Average Temperature* group box.

3. Choose Units and Damping settings then click **Apply** when complete.

Using Local Operator Interface

To configure Average Temperature on the Local Operator Interface you will have to set the Units and Damping values separately. Reference Figure 2-10 and Figure 2-11 below for where to find these in the menu.

Figure 2-10. Configuring Average Units with LOI

* Available only if option code (S) is ordered.

** Available only if option codes (S) and (DC) are both ordered.

Figure 2-11. Configuring Average Damping with LOI
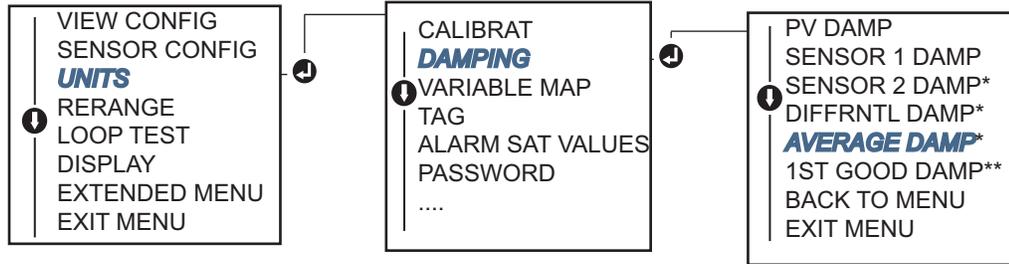
```
┌─────────────────────┐     ┌─────────────────────┐     ┌─────────────────────┐
│  VIEW CONFIG        │     │  CALIBRAT           │     │  PV DAMP            │
│  SENSOR CONFIG      │ ↵   │  DAMPING            │ ↵   │  SENSOR 1 DAMP      │
│  UNITS              │     │ ●VARIABLE MAP       │     │ ●SENSOR 2 DAMP*     │
│ ●RERANGE            │     │  TAG                │     │  DIFFRNTL DAMP*     │
│  LOOP TEST          │     │  ALARM SAT VALUES   │     │  AVERAGE DAMP*      │
│  DISPLAY            │     │  PASSWORD           │     │  1ST GOOD DAMP**    │
│  EXTENDED MENU      │     │  ....               │     │  BACK TO MENU       │
│  EXIT MENU          │     │                     │     │  EXIT MENU          │
└─────────────────────┘     └─────────────────────┘     └─────────────────────┘
```

* Available only if option code (S) is ordered.

** Available only if option codes (S) and (DC) are both ordered

Note

If Sensor 1 and/or Sensor 2 should fail while PV is configured for average temperature and Hot Backup is not enabled, the transmitter will go into alarm. For this reason, it is recommended when PV is Sensor Average, that Hot Backup be enabled when dual-element sensors are used, or when two temperature measurements are taken from the same point in the process. If a sensor failure occurs when Hot Backup is enabled, while PV is Sensor Average, three scenarios could result:

- If Sensor 1 fails, the average will only be reading from Sensor 2, the working sensor
- If Sensor 2 fails, the average will only be reading from Sensor 1, the working sensor
- If both sensors fail simultaneously, the transmitter will go into alarm and the status available (via HART) states that both Sensor 1 and Sensor 2 have failed

In the first two scenarios, the 4-20 mA signal is not disrupted and the status available to the control system (via HART) specifies which sensor has failed.

2.7.3 Hot Backup configuration

The Hot Backup feature configures the transmitter to automatically use Sensor 2 as the primary sensor if Sensor 1 fails. With Hot Backup enabled, the primary variable (PV) must either be First Good or Average. See the "NOTE" directly above for details on using Hot Backup when the PV is set to Average.

Sensors 1 or 2 can be mapped as the secondary variable (SV), tertiary variable (TV), or quaternary variable (QV). In the event of a primary variable (Sensor 1) failure, the transmitter enters Hot Backup mode and Sensor 2 becomes the PV. The 4–20 mA signal is not disrupted, and a status is available to the control system through HART that Sensor 1 has failed. An LCD display, if attached, displays the failed sensor status.

While configured to Hot Backup, if Sensor 2 fails but Sensor 1 is still operating properly, the transmitter continues to report the PV 4–20 mA analog output signal, while a status is available to the control system through HART that Sensor 2 has failed.

Resetting Hot Backup

In Hot Backup mode, if Sensor 1 does fail and Hot Backup is initiated, the transmitter will not revert back to Sensor 1 to control the 4–20 mA analog output until the Hot Backup mode is reset by re-enabling through HART, re-setting it through the LOI or by briefly powering down the transmitter.

Hot Backup configuration with a Field Communicator

The field communicator will walk you through a method to correctly configure the necessary elements of the Hot Backup feature.

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

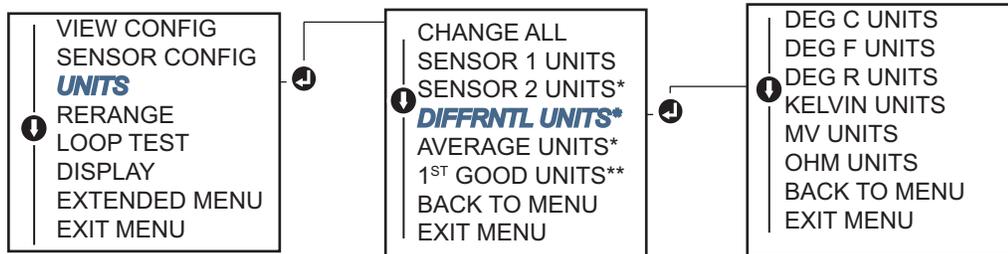| Device Dashboard Fast Keys	2, 1, 5

Hot Backup configuration with AMS Device Manager

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

1. In the left navigation pane choose **Manual Setup**.

2. On the *Diagnostics Tab* find the **Hot Backup** group box.

3. Choose the button "Configure Hot Backup" or "Reset Hot Backup" depending on the desired function and walk through the guided steps.

4. Click **Apply** when complete.

Hot Backup configuration with Local Operator Interface

To configure Hot Backup on the Local Operator Interface, you will have to Enable the Mode and set the PV values. Reference Figure 2-12 below for where to find these in the menu.

Figure 2-12. Configuring Hot Backup with LOI


```
VIEW CONFIG
SENSOR CONFIG
UNITS
RERANGE
LOOP TEST
DISPLAY
EXTENDED MENU
EXIT MENU
```

```
CALIBRAT
DAMPING
VARIABLE MAP
TAG
ALM SAT VALUES
PASSWORD
SIMULATE
HART REV
HOT BACK CONFIG**
DRIFT ALERT**
....
```

```
HOT BACK MODE
HOT BACK PV
HOT BACK RESET
BACK TO MENU
EXIT MENU
```
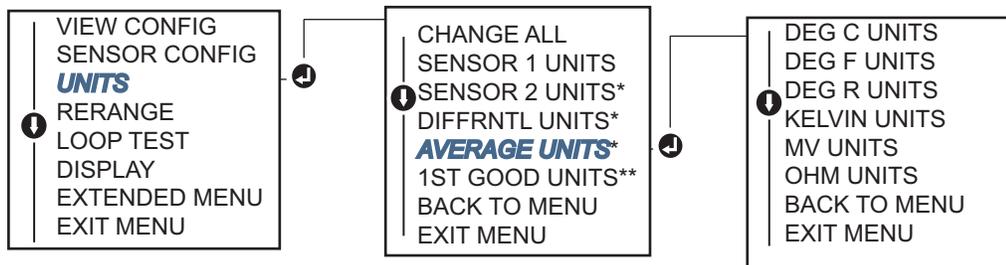
* Available only if option code (S) is ordered.

** Available only if option Codes (S) and (DC) are both ordered.

For information on using Hot Backup in conjunction with the HART Tri-Loop™ see "Using the transmitter with the HART Tri-Loop" on page 40.

2.7.4 Sensor Drift Alert configuration

The Sensor Drift Alert command allows the transmitter to set a warning flag (through HART), or go into analog alarm when the temperature difference between Sensor 1 and Sensor 2 exceeds a user-defined limit.

This feature is useful when measuring the same process temperature with two sensors, ideally when using a dual-element sensor. When Sensor Drift Alert mode is enabled, the user sets the maximum allowable difference, in engineering units, between Sensor 1 and Sensor 2. If this maximum difference is exceeded, a Sensor Drift Alert warning flag will be set.

Though it defaults to WARNING, when configuring the transmitter for Sensor Drift Alert, the user also has the option of specifying that the analog output of the transmitter go into ALARM when sensor drifting is detected.

Note
Using dual sensor configuration in the Rosemount 644, the temperature transmitter supports the configuration and simultaneous use of Hot Backup and Sensor Drift Alert. If one sensor fails, the transmitter switches output to use the remaining good sensor. Should the difference between the two sensor readings exceed the configured threshold, the AO will go to alarm indicating the sensor drift condition. The combination of Sensor Drift Alert and Hot Backup improves sensor diagnostic coverage while maintaining a high level of availability. Refer to the Rosemount 644 FMEDA report for the impact on safety.

Using a Field Communicator

The field communicator will walk you through a method to correctly configure the necessary elements of a Sensor Drift Alert feature.

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

Device Dashboard Fast Keys	2, 1, 6

Using AMS Device Manager

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

2. On the **Diagnostics Tab** find the **Sensor Drift Alert** group box.

3. Choose to **Enable** the **Mode** and fill in the **Units**, **Threshold** and **Damping** values from the drop downs provided or click the "**Configure Sensor Drift Alert**" button and walk through the guided steps.

4. Click **Apply** when complete.

Using Local Operator Interface

To configure Sensor Drift Alert on the Local Operator Interface you will have to Enable the Mode, set the PV, set the Drift Limit and set a value for Drift Alert Damping all separately. Reference Figure 2-13 below for where to find these in the menu.

Figure 2-13. Configuring sensor drift alert with LOI
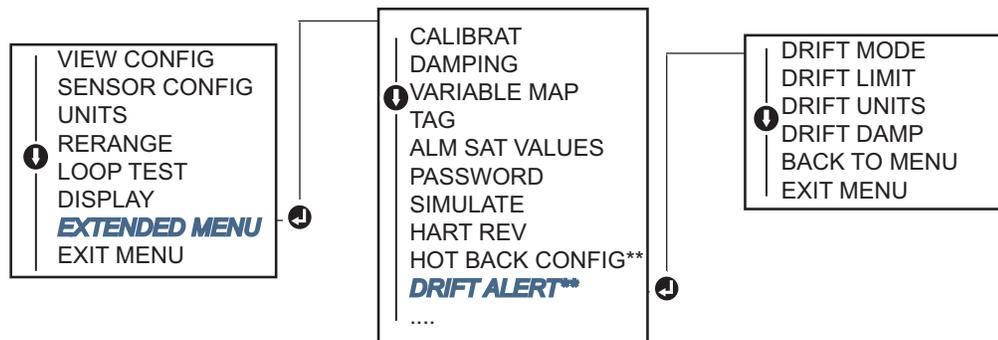

```
VIEW CONFIG          CALIBRAT              DRIFT MODE
SENSOR CONFIG        DAMPING               DRIFT LIMIT
UNITS                VARIABLE MAP          DRIFT UNITS
RERANGE              TAG                   DRIFT DAMP
LOOP TEST            ALM SAT VALUES        BACK TO MENU
DISPLAY              PASSWORD              EXIT MENU
EXTENDED MENU        SIMULATE
EXIT MENU            HART REV
                     HOT BACK CONFIG**
                     DRIFT ALERT**
                     ....
```

* Available only if option code (S) is ordered.

** Available only if option Codes (S) and (DC) are both ordered.

Note
Enabling the Drift Alert Option to WARNING will set a flag (through the HART communications) whenever the maximum acceptable difference between Sensor 1 and Sensor 2 has been exceeded. For the transmitter's analog signal to go into ALARM when Drift Alert is detected, select Alarm during the configuration process.

2.8 Configure device outputs

2.8.1 Rerange the transmitter

Reranging the transmitter sets the measurement range to the limits of the expected readings for a certain application. Setting the measurement range to the limits of expected readings maximizes transmitter performance; the transmitter is most accurate when operated within the expected temperature range for the application.

The range of expected readings is defined by the Lower Range Value (LRV) and Upper Range Value (URV). The transmitter range values can be reset as often as necessary to reflect changing process conditions. For a complete listing of Range & Sensor limits, refer to Table A-2 on page 110.

Note
The rerange functions should not be confused with the trim functions. Although the rerange function matches a sensor input to a 4–20 mA output, as in conventional calibration, it does not affect the transmitter's interpretation of the input.

Select from one of the methods below to rerange the transmitter.

Using a Field Communicator

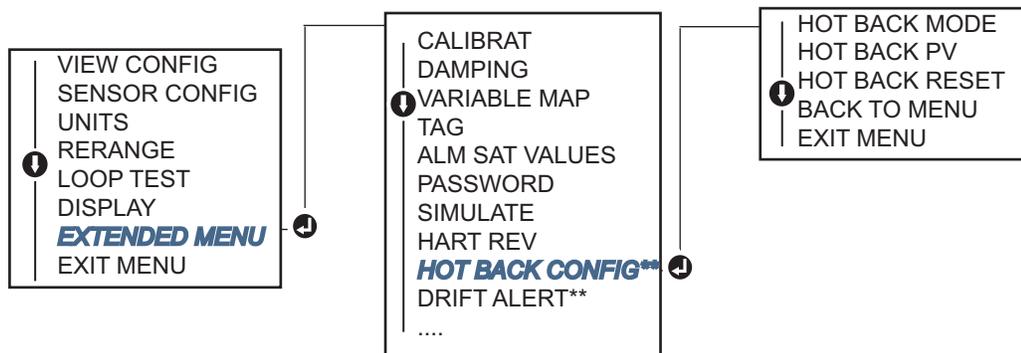| From the *HOME* screen, enter the Fast Key sequence	Lower Range Value	Upper Range Value
Device Dashboard Fast Keys	2, 2, 5, 5, 3	2, 2, 5, 5, 2

Using AMS Device Manager

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

1. In the left navigation pane choose **Manual Setup**.

2. On the **Analog Output Tab** find the Primary Variable Configuration group box.

3. Change the **Upper Range Value** and **Lower Range Value** to their desired settings.

4. Click **Apply** when complete.

Using Local Operator Interface

Reference the image below to find the Range Value configuration path on the LOI.

Figure 2-14. Reranging the transmitter with LOI
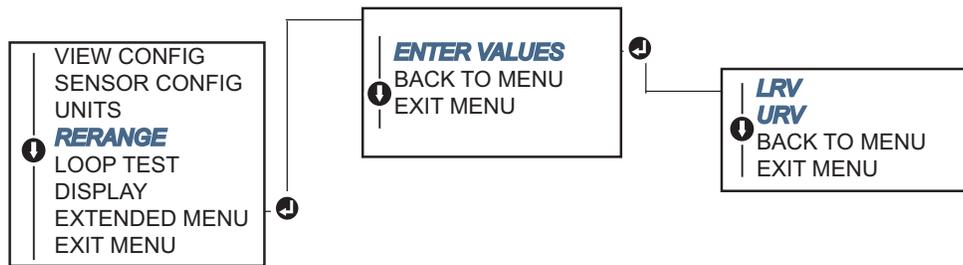
2.8.2 Damping

The damping function changes the response time of the transmitter to smooth variations in output readings caused by rapid changes in input. Determine the appropriate damping setting based on the necessary response time, signal stability, and other requirements of the loop dynamics of the system. The default damping value is 5.0 seconds and can be reset to any value between 1 and 32 seconds.

The value chosen for damping affects the response time of the transmitter. When set to zero (disabled), the damping function is off and the transmitter output reacts to changes in input as quickly as the intermittent sensor algorithm allows. Increasing the damping value increases transmitter response time.

With damping enabled, if the temperature change is within 0.2% of the sensor limits, the transmitter measures the change in input every 500 milliseconds (for a single sensor device) and outputs values according to the following relationship:

$$\text{Damped Value} = (N - P) \times \left(\frac{2T - U}{2T + U}\right) + P$$

P = previous damped value

N = new sensor value

T = damping time constant

U = update rate

At the value to which the damping time constant is set, the transmitter output is at 63% of the input change and it continues to approach the input according to the damping equation above.

For example, as illustrated in Figure 2-15, if the temperature undergoes a step change—within 0.2% of the sensor limits—from 100 degrees to 110 degrees, and the damping is set to 5.0 seconds, the transmitter calculates and reports a new reading every 500 milliseconds using the damping equation. At 5.0 seconds, the transmitter outputs 106.3 degrees, or 63% of the input change, and the output continues to approach the input curve according to the equation above.

For information regarding the damping function when the input change is greater than 0.2% of the sensor limits, refer to "Intermittent sensor detection" on page 33.

Figure 2-15. Change in Input vs. Change in Output with Damping Set to 5 Seconds
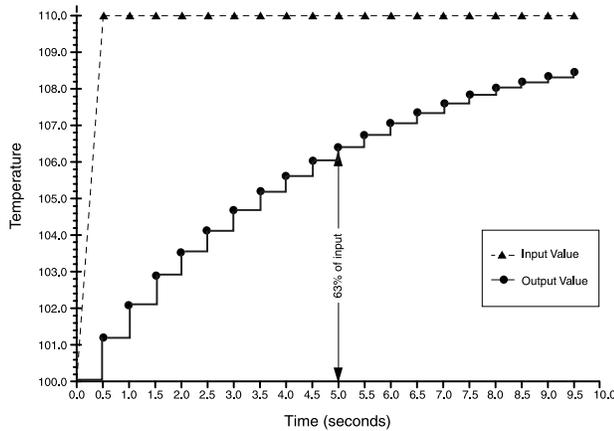
Damping can be applied to a number of parameters in the Rosemount 644 Transmitter. Variables that can be damped are:

■ Primary Variable (PV)

■ Sensor 1

■ Sensor 2

■ Differential Temperature

■ Average Temperature

■ 1st Good Temperature

Note
The instructions below only refer to the damping of the Primary Variable (PV).

Using a Field Communicator

| From the *HOME* screen, enter the Fast Key sequence	HART 5	HART 7
Device Dashboard Fast Keys	2, 2, 1, 5	2, 2, 1, 6

Using AMS Device Manager

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

1. In the left navigation pane choose **Manual Setup**.

2. On the **Sensor 1** Tab find the Setup group box.

3. Change the **Damping Value** to the desired setting.

4. Click **Apply** when complete.

Using Local Operator Interface

Reference the figure below to find the Damping configuration path on the LOI.

```
VIEW CONFIG              CALIBRAT                PV DAMP
SENSOR CONFIG            DAMPING                 SENSOR 1 DAMP
UNITS                    VARIABLE MAP            SENSOR 2 DAMP*
RERANGE                  TAG                     DIFFRNTL DAMP*
LOOP TEST                ALM SAT VALUES          AVERAGE DAMP*
DISPLAY                  PASSWORD                1ST GOOD DAMP**
EXTENDED MENU            ....                    BACK TO MENU
EXIT MENU                                        EXIT MENU
```

2.8.3 Configure alarm and saturation levels

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

The Rosemount 644 Transmitter automatically and continuously performs self-diagnostic routines. If the self-diagnostic routines detect a failure, the transmitter drives the output to configured alarm value based on the position of the alarm switch. The alarm and saturation settings allow the alarm settings (Hi or Low) and saturation values to be viewed and changed.

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

- The low alarm value must be less than the Low Saturation level.
- The high alarm value 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.

See Table 2-3, Table 2-4, and Table 2-5 below for the common Alarm and Saturation levels.

Table 2-3. Rosemount Alarm and Saturation Values

Level	4–20 mA saturation	4–20 mA alarm
Low	3.9 mA	≤ 3.75 mA
High	20.5 mA	≥ 21.75 mA

Table 2-4. NAMUR-Compliant Alarm and Saturation Values

Level	4–20 mA saturation	4–20 mA alarm
Low	3.8 mA	≤ 3.6 mA
High	20.5 mA	≥22.5 mA

Table 2-5. Custom Alarm and Saturation Values

Level	4–20 mA saturation	4–20 mA alarm
Low	3.7 mA - 3.9 mA	3.6 mA - 3.8 mA
High	20.1 mA - 22.9 mA	20.2 mA - 23.0 mA

Note
Transmitters set to HART multidrop mode send all saturation and alarm information digitally; saturation and alarm conditions will not affect the analog output.

Using with a Field Communicator

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

Device Dashboard Fast Keys	2, 2, 5, 6

Using with AMS Device Manager

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

1. In the left navigation pane choose **Manual Setup**.

2. On the **Analog Output** Tab find the Alarm and Saturation Levels group box.

3. Enter the High Alarm, High Saturation, Low Saturation and Low Alarm levels to the desired vales.

4. Click **Apply** when complete.

Usingh the Local Operator Interface

Reference the figure below to find the Alarm and Saturation value configuration path on the LOI.

Figure 2-16. Configuring Alarm and Saturation Values with LOI
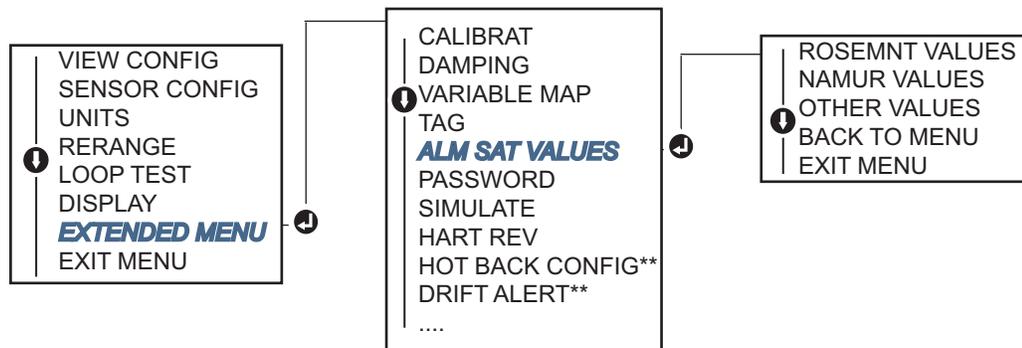
* Available only if option code (S) is ordered.

** Available only if option Codes (S) and (DC) are both ordered.

2.8.4   Configuring the LCD display

The LCD display configuration command allows customization of the LCD display to suit application requirements. The LCD display will alternate between the selected items with each item displaying for a 3- second interval.

- Sensor 1
- Sensor 2
- Analog Output
- Primary Variable
- Average Temperature
- First Good Temperature
- Differential Temperature

- Percent of Range
- Terminal Temperature
- Min and Max 1
- Min and Max 2
- Min and Max 3
- Min and Max 4

Reference Figure 2-17 to view the differences between the LCD display and Local Operator Interface display options available with the Rosemount 644.

Figure 2-17. LCD Display and Local Operator Interface Display
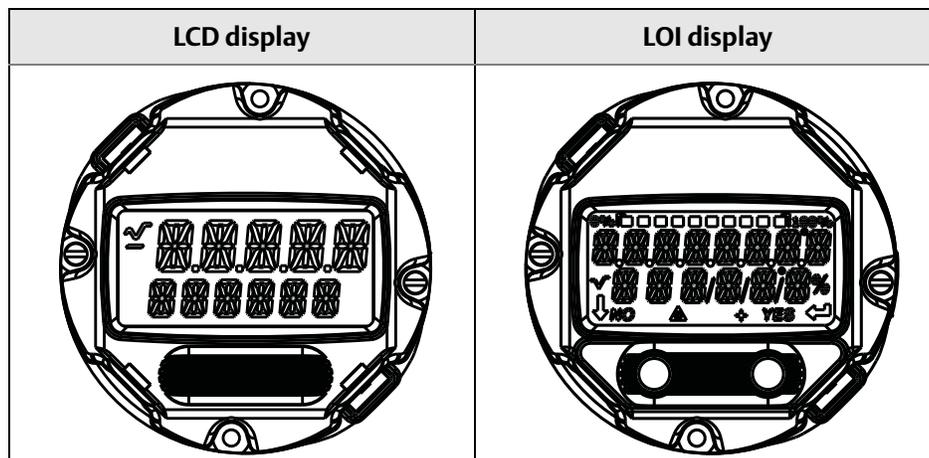
LCD display	LOI display

Using a Field Communicator

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

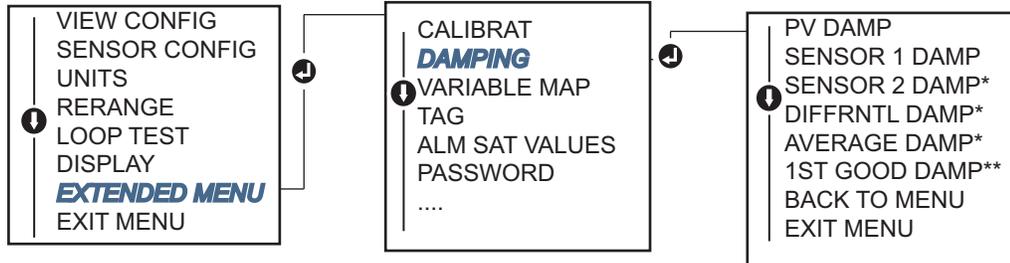| **Device Dashboard Fast Keys**	2, 1, 4

Using AMS Device Manager

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

2. In the left navigation pane choose **Manual Setup**.

3. On the **Display** Tab there will be a group box with all available variables that can be displayed.

4. Check and un-check the desired display variables, with a checked box indicating that the variable will be displayed.

5. Click **Apply** when complete.

Using Local Operator Interface

Reference the figure below to find the Alarm and Saturation value configuration path on the LOI.

Figure 2-18. Configuring Alarm and Saturation Values with LOI

```
                                    SENSOR 1
                                    SENSOR 2*
    VIEW CONFIG                    ⬇ANALOG
    SENSOR CONFIG                   PV
    UNITS                           AVG*
    RERANGE                         1ST GOOD*
  ⬇ LOOP TEST                       DIFF*
    DISPLAY              ↵          % RANGE
    EXTENDED MENU                   TERM
    EXIT MENU                       MNMAX1*
                                    MNMAX2*
                                    MNMAX3*
                                    MNMAX4*
                                    BACK TO MENU
                                    EXIT MENU
```

* Available only if option code (S) is ordered.

2.9   Inputting device information

Access the transmitter information variables online using the Field Communicator or other suitable communications device. The following is a list of transmitter information variables, including device identifiers, factory-set configuration variables, and other information.

2.9.1   Tag, Date, Descriptor and Message

The *Tag*, *Date*, *Descriptor* and *Message* are parameters that provide transmitter identification in large installations. See below for a description and a process to enter these pieces of configurable device information.

The **Tag** variable is the easiest way to identify and distinguish between different transmitters in multi-transmitter environments. It is used to label transmitters electronically according to the requirements of the application. The defined Tag is automatically displayed when a HART-based communicator establishes contact with the transmitter at power-up. The Tag is up to 8 characters and the Long Tag (a parameter introduced with the HART 6 and 7 protocol) was extended to 32 characters long. Neither parameter has any impact on the primary variable readings of the transmitter, it is only for information.

The **Date** is a user-defined variable that provides a place to save the date of the last revision of configuration information. It has no impact on the operation of the transmitter or the HART-based communicator.

The **Descriptor** variable provides a longer user-defined electronic label to assist with more specific transmitter identification than is available with tag. The descriptor may be up to 16 characters long and has no impact on the operation of the transmitter or the HART-based communicator.

The **Message** variable provides the most specific user-defined means for identifying individual transmitters in multi-transmitter environments. It allows for 32 characters of information and is stored with the other configuration data. The message variable has no impact on the operation of the transmitter or the HART-based communicator.

Using a Field Communicator

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

Device Dashboard Fast Keys	1, 8

Using AMS Device Manager

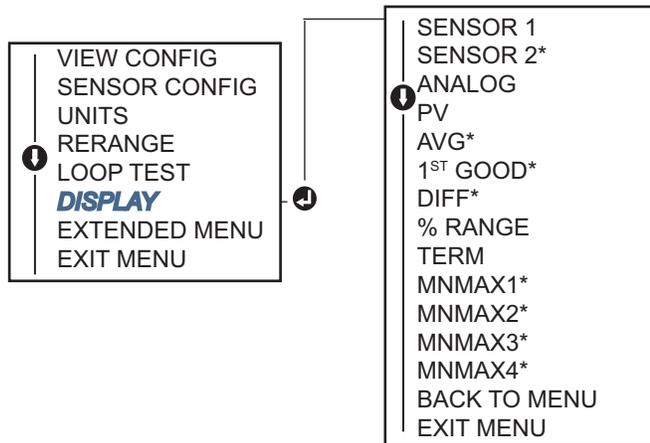1. Right click on the device and select **Configure**.

2. In the left navigation pane choose **Manual Setup**.

3. On the **Device** Tab there will be a group box called Identification, in the box find the fields **Tag**, **Date**, **Descriptor** and **Message**, and enter the desired characters.

4. Click **Apply** when complete.

Using Local Operator Interface

Reference the figure below to find the Tag configuration path in the LOI.

Figure 2-19. Configuring the Tag with LOI

```
┌─────────────────────┐        ┌─────────────────────┐
│   VIEW CONFIG       │        │   CALIBRAT          │
│   SENSOR CONFIG     │        │   DAMPING           │
│   UNITS             │      ↕ │   VARIABLE MAP      │
│ ↕ RERANGE           │        │   TAG               │
│   LOOP TEST         │        │   ALM SAT VALUES    │
│   DISPLAY           │        │   PASSWORD          │
│   EXTENDED MENU   ↵ │        │   ....              │
│   EXIT MENU         │        └─────────────────────┘
└─────────────────────┘
```

2.10   Configure measurement filtering

2.10.1   50/60 Hz filter

The 50/60 Hz Filter (also known as Line Voltage Filter or AC Power Filter) function sets the transmitter electronic filter to reject the frequency of the AC power supply in the plant. The 60 Hz or 50 Hz mode can be chosen. The factory default for this setting is 60 Hz.

Note
In high noise environments, normal mode is recommended.

Configuring 50/60 Hz filter with a Field Communicator

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

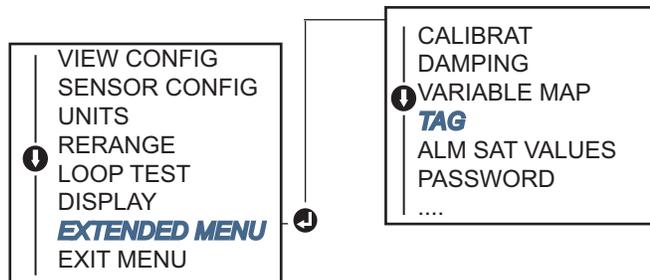| **Device Dashboard Fast Keys**	2, 2, 7, 4, 1

Configuring 50/60 Hz filter with AMS Device Manager

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

1. In the left navigation pane choose **Manual Setup**.

2. On the **Device** Tab there will be a group box called **Noise Rejection**, in the box **AC Power Filter** choose from the drop down menu.

3. Click **Apply** when complete.

2.10.2   Resetting the device

Processor Reset function resets the electronics without actually powering down the unit. It does not return the transmitter to the original factory configuration.

Using a Field Communicator

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

Device Dashboard Fast Keys	3, 4, 6, 1

Using AMS Device Manager

Right click on the device and select **Service Tools**.

1. In the left navigation pane choose **Maintenance**.

2. On the **Reset/Restore** Tab click the **Processor Reset** button.

3. Click **Apply** when complete.

2.10.3   Intermittent sensor detection

The **Intermittent Sensor Detection** feature (also known as the Transient Filter) is designed to guard against erratic process temperature readings caused by intermittent open sensor conditions. An intermittent sensor condition is an open sensor condition that lasts less than one update. By default, the transmitter is shipped with the Intermittent Sensor Detection feature switched **ON** and the threshold value set at 0.2% of sensor limits. The Intermittent Sensor Detect feature can be switched **ON** or **OFF** and the threshold value can be changed to any value between 0 and 100% of the sensor limits with a Field Communicator.

When the Intermittent Sensor Detection feature is switched **ON**, the transmitter can eliminate the output pulse caused by intermittent open sensor conditions. Process temperature changes (T) within the threshold value will be tracked normally by the transmitter's output. A (T) greater than the threshold value will activate the intermittent sensor algorithm. True open sensor conditions will cause the transmitter to go into alarm.

The threshold value of the Rosemount 644 should be set at a level that allows the normal range of process temperature fluctuations; too high and the algorithm will not be able to filter out intermittent conditions; too low and the algorithm will be activated unnecessarily. The default threshold value is 0.2% of the sensor limits.

When the Intermittent Sensor Detection feature is switched **OFF**, the transmitter tracks all process temperature changes, even from an intermittent sensor. (The transmitter in effect behaves as though the threshold value had been set at 100%.) The output delay due to the intermittent sensor algorithm will be eliminated.

Using a Field Communicator

The following steps indicate how to turn the Intermittent Sensor Detect or Transient Filter) feature **ON** or **OFF**. When the transmitter is connected to a Field Communicator, use the Fast Key sequence and choose **ON** (normal setting) or **OFF**.

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

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

The threshold value can be changed from the default value of 0.2%. Turning the Intermittent Sensor Detect feature **OFF** or leaving it **ON** and increasing the threshold value above the default does not affect the time needed for the transmitter to output the correct alarm signal after detecting a true open sensor condition. However, the transmitter may briefly output a false temperature reading for up to one update in either direction up to the threshold value (100% of sensor limits if Intermittent Sensor Detect is **OFF**). Unless a rapid response rate is necessary, the suggested setting is **ON** with 0.2% threshold.

Using AMS Device Manager

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

2. In the left navigation pane choose **Manual Setup**.

3. On the **Device** Tab there will be a group box called Noise Rejection, in the box **Transient Filter Threshold**, enter the desired percent.

4. Click **Apply** when complete.

2.10.4   Open Sensor Holdoff

The **Open Sensor Holdoff** option, at the normal setting, enables the Rosemount 644 to be more robust under heavy EMI conditions. This is accomplished by the software having the transmitter perform additional verification of the open sensor status prior to activating the transmitter alarm. If the additional verification shows that the open sensor condition is not valid, the transmitter will not go into alarm.

For users of the Rosemount 644 that desire a more vigorous open sensor detection, the Open Sensor Holdoff option can be changed to a fast setting where the transmitter will report an open sensor condition without additional verification of whether or not the open condition is valid.

Using a Field Communicator

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

Device Dashboard Fast Keys	2, 2, 7, 3

Using AMS Device Manager

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

2. In the left navigation pane choose **Manual Setup**.

3. On the **Device** Tab there will be a group box called Open Sensor Hold Off. Change the Mode to either **Normal** or **Fast**.

4. Click **Apply** when complete.

2.11 Diagnostics and service

2.11.1 Performing a loop test

The Analog **Loop Test** verifies the output of the transmitter, the integrity of the loop, and the operations of any recorders or similar devices installed in the loop. To initiate a loop test, follow the steps below.

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

Using a Field Communicator

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

Device Dashboard Fast Keys	3, 5, 1

Using AMS Device Manager

1. Right click on the device and select **Service Tools**.

2. In the left navigation pane choose **Simulate**.

3. On the **Simulate** Tab find the **Perform Loop Test** button in the **Analog Output Verification** group box.

4. Follow the guided instructions and click **Apply** when complete.

Using Local Operator Interface

Reference the figure below to find the path to the Loop Test in the LOI menu.

Figure 2-20. Configuring the Tag with LOI
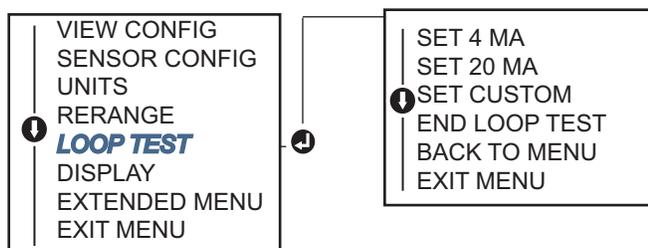
2.11.2 Simulate digital signal (Digital Loop Test)

The **Simulate Digital Signal** function adds to the analog loop test by confirming the HART output values are outputting correctly. Digital Loop Test is only available in HART Revision 7 mode.

Using a Field Communicator

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

Device Dashboard Fast Keys	3, 5, 2

Using AMS Device Manager

1. Right click on the device and select **Service Tools**.

2. In the left navigation window select **Simulate.**

3. In the group box labeled **Device Variables** choose the variable to simulate.

- Sensor 1 Temperature
- Sensor 2 Temperature (only available with option S)

4. Follow the screen prompts to simulate selected digital value.

Using Local Operator Interface

Reference the figure below to find the path to the Simulate Digital Signal in the LOI menu.

Figure 2-21. Simulating the Digital Signal with LOI
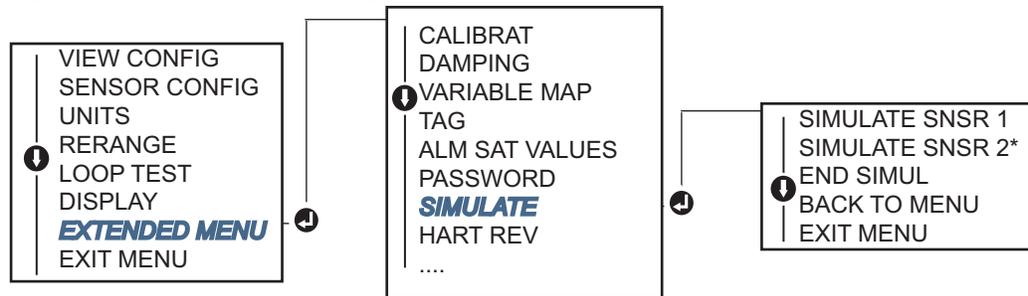
* Available only if option code (S) is ordered.

2.11.3   Thermocouple Degradation Diagnostic

Thermocouple Degradation Diagnostic acts as a gauge of the general health of the thermocouple and is indicative of any major changes in the status of the thermocouple or the thermocouple loop. The transmitter monitors the resistance of the thermocouple loop to detect drift conditions or wiring condition changes. The transmitter uses a baseline and threshold Trigger value and reports the suspected status of the thermocouple based off the difference between these values. This feature is not intended to be a precise measurement of thermocouple status, but is a general indicator of thermocouple and thermocouple loop health.

Thermocouple diagnostic must be Enabled as well as connected and configured to read a thermocouple type sensor. Once the diagnostic has been activated, a Baseline Resistance value is calculated. Then a Trigger threshold must be selected, which can be two, three, or four times the Baseline resistance, or the default of 5000 ohms. If the thermocouple loop resistance reaches the Trigger Level, a maintenance alert is generated.

⚠ CAUTION

The Thermocouple Degradation Diagnostic monitors the health of the entire thermocouple loop, including wiring, terminations, junctions, and the sensor itself. Therefore, it is imperative that the diagnostic baseline resistance be measured with the sensor fully installed and wired in the process, and not on the bench.

Note
The thermocouple resistance algorithm does not calculate resistance values while the active calibrator mode is enabled.

Configure T/C Diagnostic with a Field Communicator

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

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

Configure T/C Diagnostic with AMS Device Manager

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

2. In the left navigation window select **Manual Setup.**

3. On the Diagnostics tab, there is a group box labeled **Sensor and Process Diagnostics**; choose the button for **Configure Thermocouple Diagnostic**.

4. Follow the screen prompts to Enable and set the values for the diagnostic.

Glossary of AMS Device Manager terms

Resistance: This is the existing resistance reading of the thermocouple loop.

Resistance Threshold Exceeded: The check box indicates if the sensor resistance has passed the Trigger Level.

Trigger Level: Threshold resistance value for the thermocouple loop. The Trigger Level may be set for 2, 3, or 4 x baseline or the default of 5000 Ohms. If the resistance of the thermocouple loop surpasses the Trigger Level, a maintenance alert will be generated.

Baseline Resistance: The resistance of the thermocouple loop obtained after installation, or after resetting the baseline value. The Trigger Level may be calculated from the baseline Value.

Reset Baseline Resistance: Launches a method to recalculate the baseline value (which may take several seconds).

TC Diagnostic Mode Sensor 1or 2: This field will read either *Enabled* or *Disabled* indicating when the Thermocouple Degradation Diagnostic is on or off for that sensor.

Configure T/C Diagnostic with the Local Operator Interface

Reference the figure below to find the path to the Thermocouple Diagnostic in the LOI menu.

Figure 2-22. Configuring T/C Diagnostic with LOI
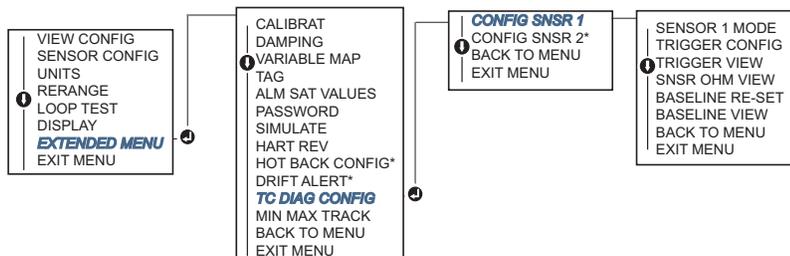
* Available only if option code (S) is ordered.

2.11.4   Min/Max Tracking diagnostic

Minimum and Maximum Temperature Tracking (Min/Max Tracking) when enabled records minimum and maximum temperatures with date and time stamps on Rosemount 644 HART Head mount Temperature Transmitters. This feature records values for Sensor 1, Sensor 2, Differential, Average, First Good and Terminal temperatures. Min/Max Tracking only records temperature maxima and minima obtained since the last reset, and is not a logging function.

To track maximum and minimum temperatures, Min/Max Tracking must be enabled using a Field Communicator, AMS Device Manager, Local Operator Interface, or other communicator. While enabled, this feature allows for a reset of information at any time, and all variables can be reset simultaneously. Additionally, each of the individual parameter's minimum and maximum values may be reset individually. Once a particular field has been reset, the previous values are overwritten.

Using a Field Communicator

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

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

Using AMS Device Manager

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

2. In the left navigation window select **Manual Setup.**

3. On the Diagnostics tab, there is a group box labeled **Sensor and Process Diagnostics**; choose the button for **Configure Min/Max Tracking**.

4. Follow the screen prompts to Enable and configure the settings for the diagnostic.

Using Local Operator Interface

Reference the figure below to find the path to the Thermocouple Diagnostic in the LOI menu.

Figure 2-23. Configuring Min/Max Tracking with LOI
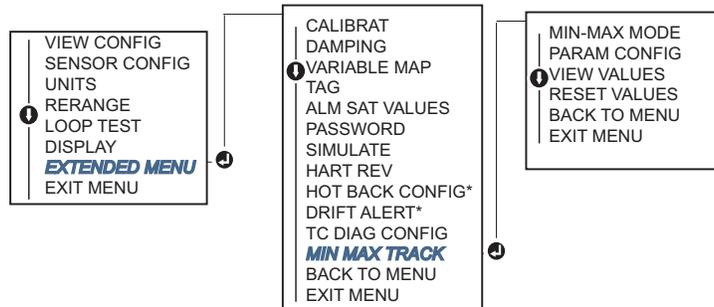
* Available only if option code (S) is ordered.

2.12 Establishing multidrop communication

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

Many Rosemount transmitters can be multidropped. With the HART communications protocol, up to 15 transmitters can be connected on a single twisted pair of wires or over leased phone lines.

A Field Communicator can test, configure, and format a multidropped Rosemount 644 Transmitter in the same way as in a standard point-to-point installation. The application of a multidrop installation requires consideration of the update rate necessary from each transmitter, the combination of transmitter models, and the length of the transmission line. Each transmitter is identified by a unique address (1–15) and responds to the commands defined in the HART protocol. A HART-based communicator can test, configure, and format a multidropped Rosemount 644 Transmitter the same as in a standard point-to-point installation.

Note
Multidrop is not suitable for safety-certified applications and installations.

Figure 2-24. Typical Multidropped Network
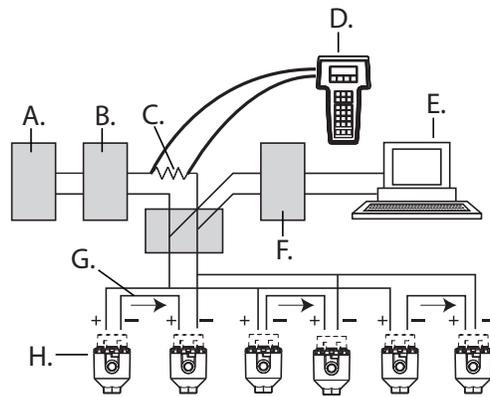
A. Power supply
B. Power supply impedance
C. 250 Ω
D. Handheld terminal
E. Computer or DCS
F. HART Interface
G. 4-20 mA
H. Rosemount 644 HART Transmitter

Note
Rosemount 644 Transmitters are set to address 0 at the factory, allowing them to operate in the standard point-to-point manner with a 4–20 mA output signal. To activate multidrop communication, the transmitter address must be changed to a number between 1 and 15. This change deactivates the 4–20 mA analog output, sending it to 4 mA. The failure mode current also is disabled.

2.12.1 Changing a transmitter address

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

Using a Field Communicator

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

Device Dashboard Fast Keys	1, 2, 1

Using AMS Device Manager

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

2. In *HART Revision 5* mode:

   a. In the *HART* tab, enter poll address into the **Polling Address** box, click **Apply**.

3. In *HART Revision 7* mode:

   a. In the *HART* tab, click the **Change Polling Address** button.

2.13 Using the transmitter with the HART Tri-Loop

To prepare the Rosemount 644 Transmitter with dual-sensor option for use with a Rosemount 333 HART Tri-Loop, the transmitter must be configured to Burst Mode and the process variable output order must be set. In Burst Mode, the transmitter provides digital information for the four process variables to the HART Tri-Loop. The HART Tri-Loop divides the signal into separate 4–20 mA loops for up to three of the following choices:

- Primary Variable (PV)
- Secondary Variable (SV)
- Tertiary Variable (QV)
- Quaternary Variable (QV)

When using the Rosemount 644 Transmitter with dual-sensor option in conjunction with the HART Tri-Loop, consider the configuration of the differential, average, first good temperatures, Sensor Drift Alert, and Hot Backup features (if applicable).

Note
The procedures are to be used when the sensors and transmitters are connected, powered, and functioning properly. Also, a Field Communicator must be connected and communicating to the transmitter control loop. For communicator usage instructions, see "Configuring with a Field Communicator" on page 10.

2.13.1   Set the transmitter to Burst Mode

To set the transmitter to burst mode, follow the steps below with the Fast Key sequence:

Using a Field Communicator

| From the *HOME* screen, enter the Fast Key sequence	HART 5	HART 7
Device Dashboard Fast Keys	2, 2, 8, 4	2, 2, 8, 5

Using AMS Device Manager

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

2. In the left navigation window select **Manual Setup.**

3. On the **HART** tab find the Burst Mode Configuration group box and fill in the necessary content.

4. Click **Apply** when complete.

2.13.2   Set process variable output order

To set the process variable output order, follow the steps in one of the methods outlined in "Mapping the HART variables" on page 15 .

> **Note**
> Take careful note of the process variable output order. The HART Tri-Loop must be configured to read the variables in the same order.

Special considerations

To initiate operation between a Rosemount 644 Transmitter with dual-sensor option and the HART Tri-Loop, consider the configuration of both the differential, average and first good temperatures, Sensor Drift Alert, and Hot Backup features (if applicable).

Differential temperature measurement

To enable the differential temperature measurement feature of a dual-sensor Rosemount 644 operating in conjunction with the HART Tri-Loop, adjust the range end points of the corresponding channel on the HART Tri-Loop to include zero. For example, if the secondary variable is to report the differential temperature, configure the transmitter accordingly (see "Mapping the HART variables" on page 15) and adjust the corresponding channel of the HART Tri-Loop so one range end point is negative and the other is positive.

Hot Backup

To enable the Hot Backup feature of a Rosemount 644 Transmitter with dual-sensor option operating in conjunction with the HART Tri-Loop, ensure that the output units of the sensors are the same as the units of the HART Tri-Loop. Use any combination of RTDs or thermocouples as long as the units of both match the units of the HART Tri-Loop.

Using the Tri-Loop to detect sensor drift alert

The dual-sensor Rosemount 644 Transmitter sets a failure flag (through HART) whenever a sensor failure occurs. If an analog warning is required, the HART Tri-Loop can be configured to produce an analog signal that can be interpreted by the control system as a sensor failure.

Use these steps to set up the HART Tri-Loop to transmit sensor failure alerts.

1. Configure the dual-sensor Rosemount 644 variable map as shown.

Variable	Mapping
PV	Sensor 1 or Sensor Average
SV	Sensor 2
TV	Differential Temperature
QV	As Desired

2. Configure Channel 1 of the HART Tri-Loop as TV (differential temperature). If either sensor should fail, the differential temperature output will be +9999 or –9999 (high or low saturation), depending on the position of the Failure Mode Switch (see "Alarm Switch (HART)" on page 15).

3. Select temperature units for Channel 1 that match the differential temperature units of the transmitter.

4. Specify a range for the TV such as –100 to 100 °C. If the range is large, then a sensor drift of a few degrees will represent only a small percent of range. If Sensor 1 or Sensor 2 fails, the TV will be +9999 (high saturation) or –9999 (low saturation). In this example, zero is the midpoint of the TV range. If a ΔT of zero is set as the lower range limit (4 mA), then the output could saturate low if the reading from Sensor 2 exceeds the reading from Sensor 1. By placing a zero in the middle of the range, the output will normally stay near 12 mA, and the problem will be avoided.

5. Configure the DCS so that TV < –100 °C or TV > 100 °C indicates a sensor failure and, for example, TV ≤ –3 °C or TV ≥ 3 °C indicates a drift alert. See Figure 2-25.

Figure 2-25. Tracking Sensor Drift and Sensor Failure with Differential Temperature
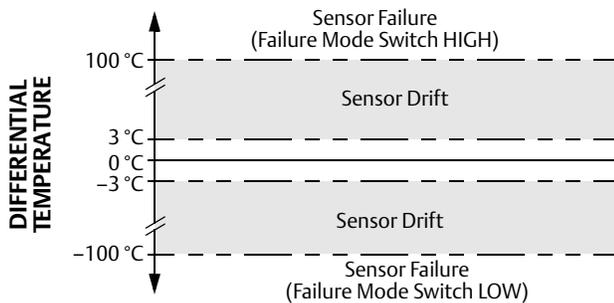
Section 3   Hardware Installation

Note
Each transmitter is marked with a tag indicating the approvals. Install the transmitter according to all applicable installation codes, and approval and installation drawings (see Appendix Appendix B Product Certifications). Verify the operating atmosphere of the transmitter is consistent with the hazardous location certifications. Once a device labeled with multiple approval types is installed, it should not be reinstalled using any of the other labeled approval types. To ensure this, the approval label should be permanently marked to distinguish the approval type(s) used.

3.1   Overview

The information in this section covers installation considerations for the Rosemount™ 644 Temperature Transmitter with HART® protocol. A Quick Start Guide (document number 00825-0200-4728) is shipped with every transmitter to describe recommended mounting and wiring procedures for initial installation. Dimensional drawings for Rosemount 644 mounting configurations are included in Appendix A: Specifications and Reference Data.

3.2   Safety messages

Instructions and procedures in this section may require special precautions to ensure the safety of the personnel performing the operations. Information that potentially raises safety issues is indicated by a warning symbol (⚠). 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.

- Make sure only qualified personnel perform the installation.

Explosions could result in death or serious injury.

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

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

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

- All connection head covers must be fully engaged to meet explosion-proof requirements.

Process leaks could result in death or serious injury.

- Do not remove the thermowell while in operation.

- Install and tighten thermowells and sensors before applying pressure.

Electrical shock could cause death or serious injury.

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

3.3   Considerations

3.3.1   Installation considerations

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

3.3.2   Environmental considerations

Best practice is to mount the transmitter in an environment that has minimal ambient temperature change. The transmitter electronics temperature operating limits are –40 to 185 °F (–40 to 85 °C). Refer to Appendix A: Specifications and Reference Data for sensing element operating limits. Mount the transmitter so it is not susceptible to vibration and mechanical shock and does not have external contact with corrosive materials.

3.4 Installation procedures

Figure 3-1. Installation Flowchart
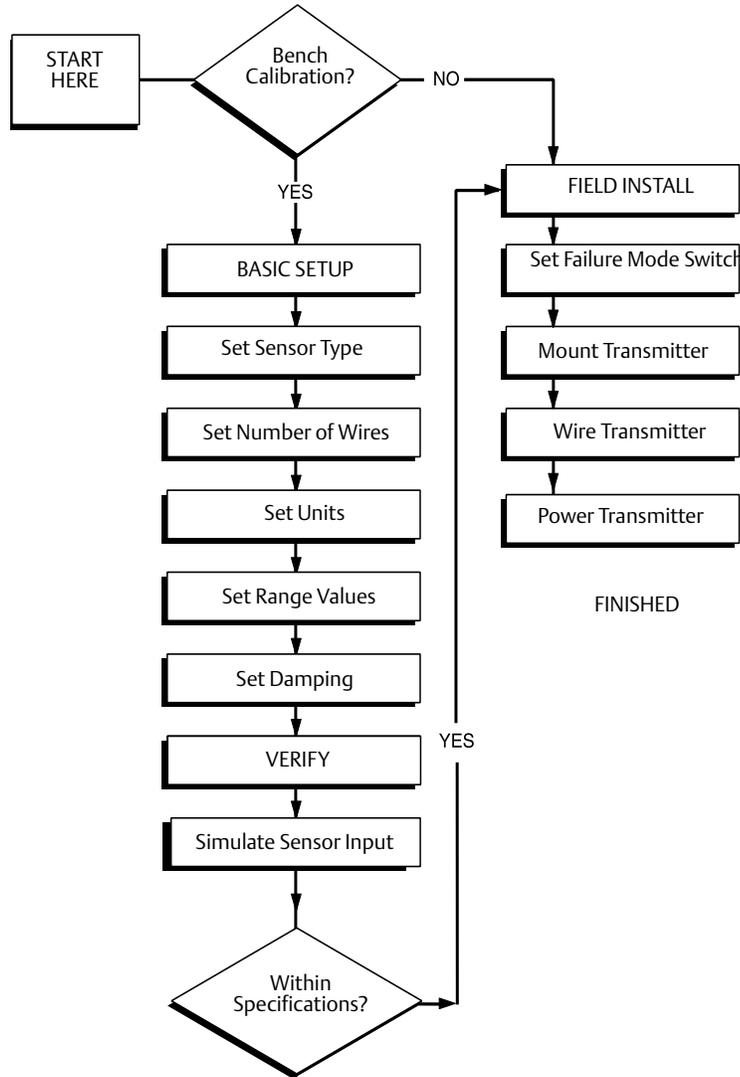
3.4.1 Set the alarm switch

Make sure the alarm switch is set to the desired position before putting the device into operation to ensure correct function in the instance of a failure.

Without an LCD display

1. Set the loop to manual (if applicable) and disconnect the power.

2. Remove the housing cover.

3. Set the physical hardware alarm switch to the desired position. **H** indicates High, **L** indicates Low. Then reattach the housing cover. See Figure 3-2 below for alarm switch location.

4. Apply power and set the loop to automatic control.

Figure 3-2. Failure Switch Location
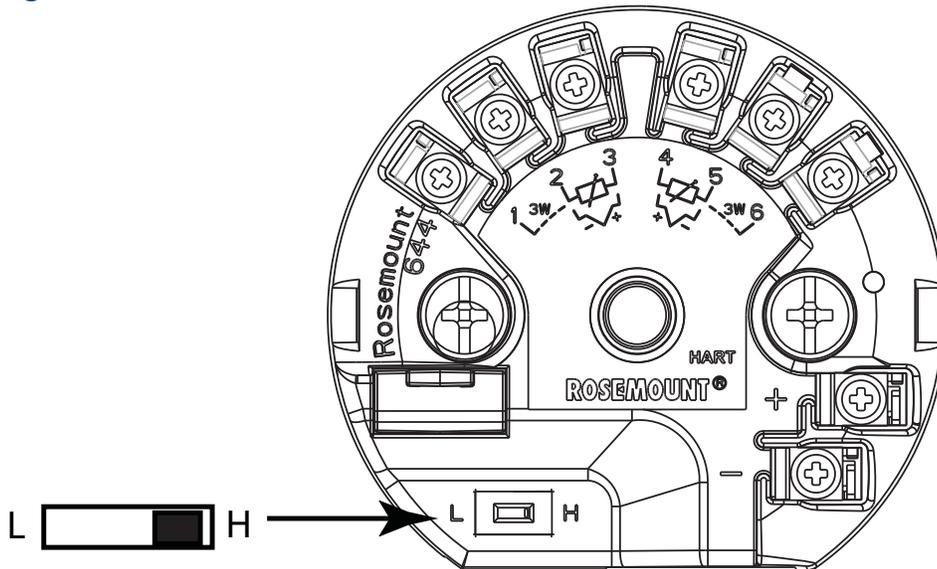
Note
If using an LCD display or Local Operator Interface, first remove the display by detaching it from the top of the Rosemount 644 device, set the switch to the desired position and reattach the display. See Figure 3-3. for proper display orientation.

Figure 3-3. Display Connection
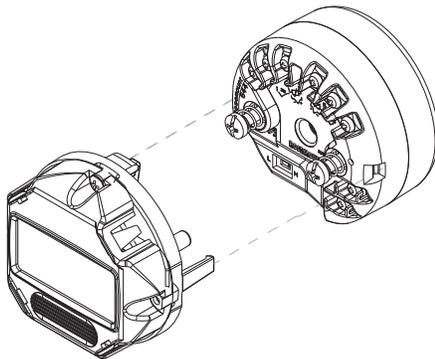
3.4.2   Mount the transmitter

Mount the transmitter at a high point in the conduit run to prevent moisture from draining into the transmitter housing.

The Rosemount 644 head mount installs:

- In a connection head or universal head mounted directly on a sensor assembly
- Apart from a sensor assembly using a universal head
- To a DIN rail using an optional mounting clip

The Rosemount 644 rail mount attaches directly to a wall or to a DIN rail.

Mounting a Rosemount 644 to a DIN Rail

To attach a head mount transmitter to a DIN rail, assemble the appropriate rail mounting kit (part number 00644-5301-0010) to the transmitter as shown in Figure 3-4. Follow the procedure under "Rail mount transmitter and sensor".

Figure 3-4. Assembling Rail Clip Hardware to a Rosemount 644
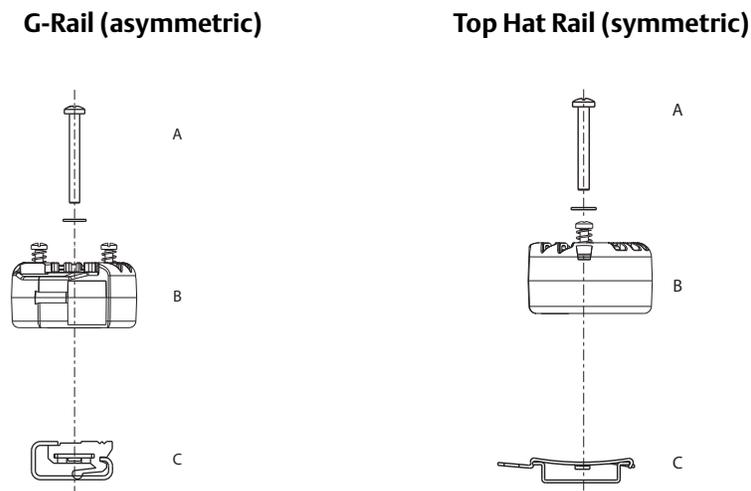
G-Rail (asymmetric)   **Top Hat Rail (symmetric)**

Note: Kit (part number 00644-5301-0010) includes mounting hardware and both types of rail kits.

A. Mounting hardware
B. Transmitter
C. Rail clip

3.4.3   Install the device

Typical connection head installation–head mount transmitter with DIN plate style sensor

1. Attach the thermowell to the pipe or process container wall. Install and tighten the thermowell before applying process pressure.

2. Verify the transmitter failure mode switch position.

3. Assemble the transmitter to the sensor[1]. Push the transmitter mounting screws through the sensor mounting plate.

4. Wire the sensor to the transmitter (see "Wiring and powering the transmitter" on page 53).

5. Insert the transmitter-sensor assembly into the connection head. Thread the transmitter mounting screw into the connection head mounting holes. Assemble the extension to the connection head by tightening the threaded connections of the extension to the housing. Insert the assembly into the thermowell and tighten the threaded connections.

6. If using a cable gland for power wiring, properly attach the cable gland to a housing conduit entry.

7. Insert the shielded cable leads into the connection head through the conduit entry.

1,   *If using a threaded type sensor with a connection head, Reference steps in "Wiring and powering the transmitter" on page 53.*

⚠ 8. Connect the shielded power cable leads to the transmitter power terminals. Avoid contact with sensor leads and sensor connections. Connect and tighten the cable gland.

⚠ 9. Install and tighten the connection head cover. Enclosure covers must be fully engaged to meet explosion-proof requirements.
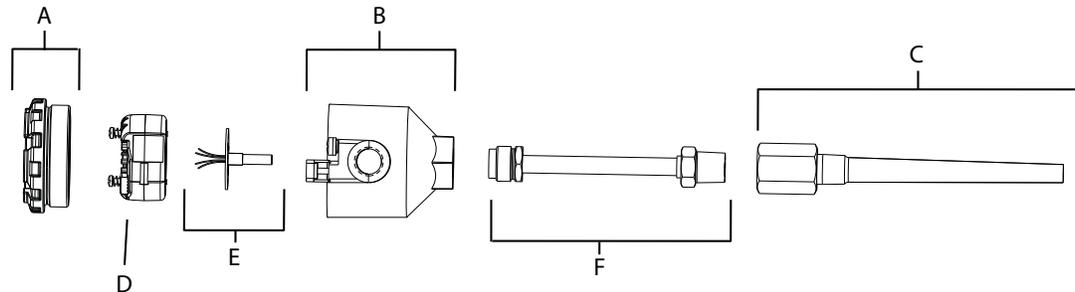
A. Connection head cover
B. Connection head
C. Thermowell
D. Rosemount 644 Transmitter
E. Integral mount sensor with flying leads
F. Extension

Typical Universal Head Installation–head mount transmitter with threaded sensor

⚠ 1. Attach the thermowell to the pipe or process container wall. Install and tighten thermowells before applying process pressure.

2. Attach necessary extension nipples and adapters to the thermowell. Seal the nipple and adapter threads with silicone tape.

3. Screw the sensor into the thermowell. Install drain seals if required for severe environments or to satisfy code requirements.

4. Verify the transmitter failure mode switch is in the desired position.

5. Pull the sensor wiring leads through the universal head and transmitter. Mount the transmitter in the universal head by threading the transmitter mounting screws into the universal head mounting holes.

6. Seal adapter threads with thread sealant.

7. Pull the field wiring leads through the conduit into the universal head. Wire the sensor and power leads to the transmitter (see "Wiring and powering the transmitter" on page 64). Avoid contact with other terminals.

⚠ 8. Install and tighten the universal head cover. Enclosure covers must be fully engaged to meet explosion-proof requirements.
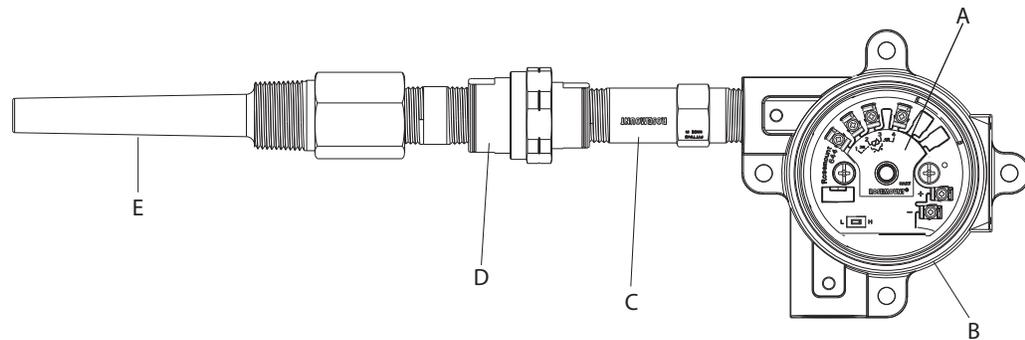
A. Rosemount 644 Transmitter   D. Extension
B. Universal junction box   E. Threaded thermowell
C. Threaded style sensor

Rail mount transmitter and sensor

⚠ 1. Attach the transmitter to a suitable rail or panel.

2. Attach the thermowell to the pipe or process container wall. Install and tighten the thermowell, according to plant standards, before applying pressure.

3. Attach the sensor to the connection head and mount the entire assembly to the thermowell.

4. Attach and connect sufficient lengths of sensor lead wire from the connection head to the sensor terminal block.

⚠ 5. Tighten the connection head cover. Enclosure covers must be fully engaged to meet explosion-proof requirements.

6. Run sensor lead wires from the sensor assembly to the transmitter.

7. Verify the transmitter failure mode switch.

⚠ 8. Attach the sensor wires to the transmitter.
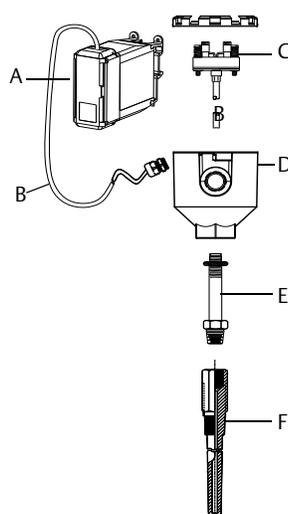
A. Rail mount transmitter
B. Sensor leads with cable Glands
C. Integral mount sensor with terminal block
D. Connection head
E. Standard extension
F. Threaded thermowell

Rail mount transmitter with threaded sensor

⚠ 1. Attach the transmitter to a suitable rail or panel.

2. Attach the thermowell to the pipe or process container wall. Install and tighten the thermowell before applying pressure.

3. Attach necessary extension nipples and adapters. Seal the nipple and adapter threads with thread sealant.

4. Screw the sensor into the thermowell. Install drain seals if required for severe environments or to satisfy code requirements.

5. Screw the connection head to the sensor.

6. Attach the sensor lead wires to the connection head terminals.

7. Attach additional sensor lead wires from the connection head to the transmitter.

⚠ 8. Attach and tighten the connection head cover. Enclosure covers must be fully engaged to meet explosion-proof requirements.

9. Set the transmitter failure mode switch.

⚠ 10. Attach the sensor wires to the transmitter.
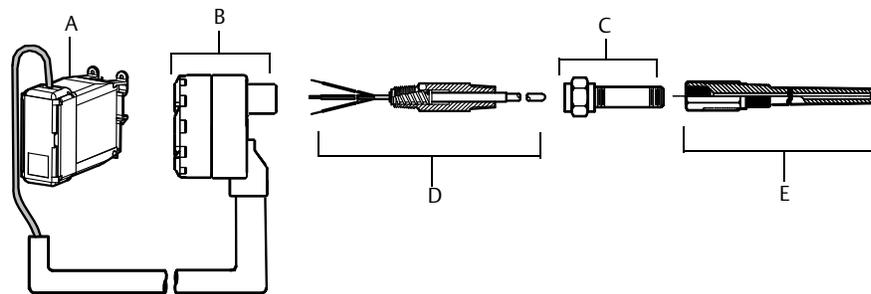
A. Rail mount transmitter D. Threaded style sensor
B. Threaded sensor connection head E. Threaded thermowell
C. Standard extension

3.4.4 Multichannel installations

In a HART installation, several transmitters can be connected to a single master power supply, as shown in Figure 3-5. In this case, the system may be grounded only at the negative power supply terminal. In multichannel installations where several transmitters depend on one power supply and the loss of all transmitters would cause operational problems, consider an uninterrupted power supply or a back-up battery. The diodes shown in Figure 3-5 prevent unwanted charging or discharging of the back-up battery.

Figure 3-5. Multichannel Installations

Between 250 Ω and 1100 Ω if no load resistor.
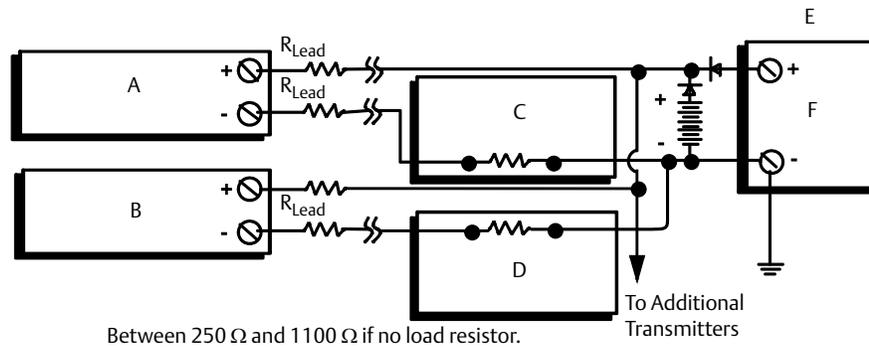
A. Transmitter number 1	D. Readout or controller number 2
B. Transmitter number 2	E. Backup battery
C. Readout or controller number 1	F. dc power supply

3.4.5 LCD display Installation

The LCD display provides local indication of the transmitter output and abbreviated diagnostic messages governing transmitter operation. Transmitters ordered with the LCD display are shipped with the meter installed. After-market installation of the meter can be performed. After-market installation requires the meter kit (part number 00644-7630-0011), which includes:

- LCD display assembly (includes LCD display, meter spacer, and 2 screws)
- Meter cover with O-ring in place

Figure 3-6. Installing the LCD Display
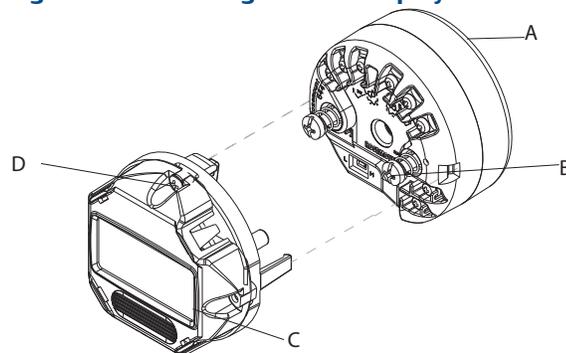
A. Rosemount 644 Transmitter
B. Mounting screws and springs
C. LCD display
D. LCD display rotation screws

Use the following procedure to install the meter.

1. If the transmitter is installed in a loop, secure the loop and disconnect the power. If the transmitter is installed in an enclosure, remove the cover from the enclosure.

2. Decide meter orientation (the meter can be rotated in 90° increments). To change meter orientation, remove the screws located above and below the display screen. Lift the meter off the meter spacer. Rotate the display top and re-insert it in the location that will result in the desired viewing orientation.

3. Reattach the meter to the meter spacer using the screws. If the meter was rotated 90 degrees from its original position it will be necessary to remove the screws from their original holes and re-insert them in the adjacent screws holes.

4. Line up the connector with the pin socket and push the meter into the transmitter until it snaps into place.

5. Attach the meter cover. The cover must be fully engaged to meet explosion-proof requirements.

6. Use a Field Communicator, AMS software tool to configure the meter to the desired display. Refer to "LCD Meter Options (644H Only)" for information on configuring the LCD display.

Note
Observe the following LCD display temperature limits:
Operating: –4 to 185 °F (–20 to 85 °C)
Storage: –50 to 185 °F (–45 to 85 °C)

Section 4 Electrical Installation

4.1 Overview

The information in this section covers installation considerations for the Rosemount 644 Transmitter. A Quick Start Guide is shipped with every transmitter to describe mounting, wiring, and basic configuration procedures for initial installation.

4.2 Safety messages

Instructions and procedures in this section may require special precautions to ensure the safety of the personnel performing the operations. Information that potentially raises 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 transmitter in an explosive environment must be in accordance with the appropriate local, national, and international standards, codes, and practices. Review the approvals section of the Rosemount 644 Reference Manual for any restrictions associated with a safe installation.

- In an Explosion-Proof/Flameproof installation, do not remove the transmitter 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.

4.3 Wiring and powering the transmitter

All power to the transmitter is supplied over the signal wiring. Use ordinary copper wire of sufficient size to ensure that the voltage across the transmitter power terminals does not drop below 12.0 Vdc.

If the sensor is installed in a high-voltage environment and a fault condition or installation error occurs, the sensor leads and transmitter terminals could carry lethal voltages. Use extreme caution when making contact with the leads and terminals.

Note
Do not apply high voltage (e.g. ac line voltage) to the transmitter terminals. Abnormally high voltage can damage the unit (sensor and transmitter power terminals are rated to 42.4 Vdc. A constant 42.4 volts across the sensor terminals may damage the unit).

For multichannel HART installations, see above. The transmitters will accept inputs from a variety of RTD and thermocouple types. Refer to Figure 2-6 on page 17 when making sensor connections.

The sensor Wiring Diagram is located on the device's top label below the terminal screws. See Figure 4-1 and Figure 4-2 for where to find and how to correctly wire all sensor types to the Rosemount 644 Transmitter.

Figure 4-1. Wiring Diagram Location

Rosemount 644H – single input

A. Sensor terminals
B. Single input wiring diagram
C. Power terminals

Rosemount 644S – dual inputs

A. Sensor terminals
B. Dual input wiring diagram
C. Power terminals
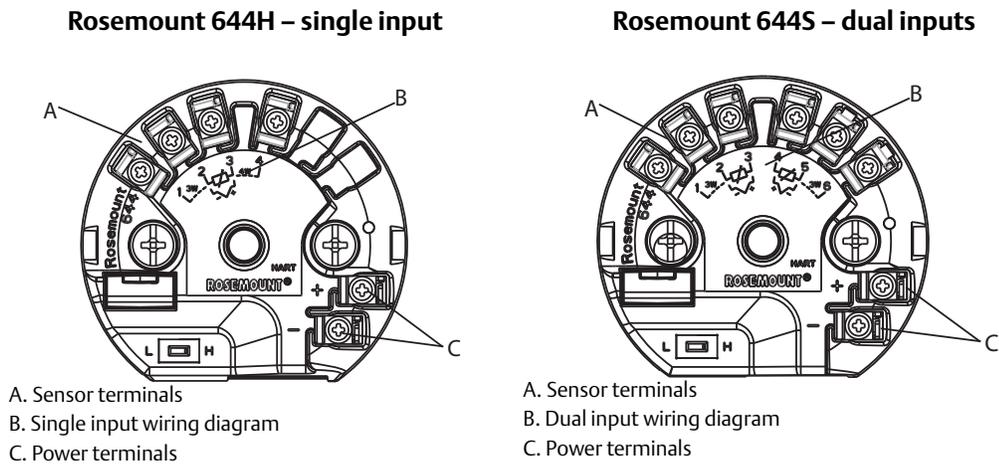
4.3.1   Sensor connections

The Rosemount 644 is compatible with a number of RTD and thermocouple sensor types. Figure 4-2 shows the correct input connections to the sensor terminals on the transmitter. To ensure a proper sensor connection, anchor the sensor lead wires into the appropriate captive terminals and tighten the screws.

Figure 4-2. Sensor Wiring
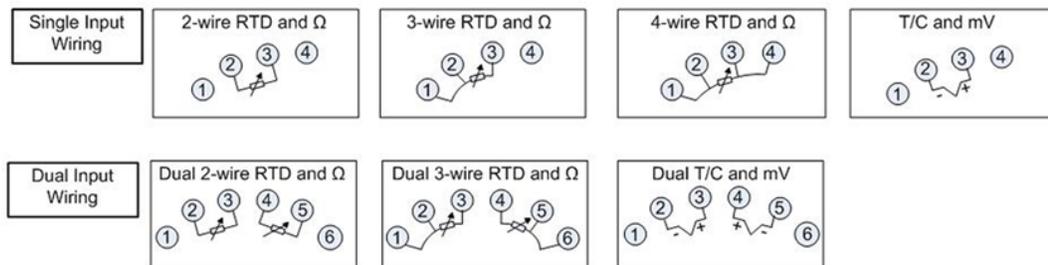
*The transmitter must be configured for at least a 3-wire RTD in order to recognize an RTD with a compensation loop.

** Emerson™ Process Management provides a 4-wire sensors for all single element RTDs. Use these RTDs in 3-wire configurations by leaving the unneeded leads disconnected and insulated with electrical tape.

Thermocouple or millivolt inputs

The thermocouple can be connected directly to the transmitter. Use appropriate thermocouple extension wire if mounting the transmitter remotely from the sensor. Make millivolt inputs connections with copper wire. Use shielding for long runs of wire.

RTD or ohm inputs

The transmitters will accept a variety of RTD configurations, including 2-, 3- or 4-wire. If the transmitter is mounted remotely from a 3- or 4-wire RTD, it will operate within specifications, without recalibration, for lead wire resistances of up to 60 ohms per lead (equivalent to 6,000 feet of 20 AWG wire). In this case, the leads between the RTD and transmitter should be shielded. If using only two leads, both RTD leads are in series with the sensor element, so significant errors can occur if the lead lengths exceed three feet of 20 AWG wire (approximately 0.05 °C/ft). For longer runs, attach a third or fourth lead as described above.

Sensor lead wire resistance effect– RTD input

When using a 4-wire RTD, the effect of lead resistance is eliminated and has no impact on accuracy. However, a 3-wire sensor will not fully cancel lead resistance error because it cannot compensate for imbalances in resistance between the lead wires. Using the same type of wire on all three lead wires will make a 3-wire RTD installation as accurate as possible. A 2-wire sensor will produce the largest error because it directly adds the lead wire resistance to the sensor resistance. For 2- and 3-wire RTDs, an additional lead wire resistance error is induced with ambient temperature variations. The table and the examples shown below help quantify these errors.

Note
For HART transmitters, the use of two grounded thermocouples with a dual option Rosemount 3144P Transmitter is not recommended. For applications in which the use of two thermocouples is desired, connect either two ungrounded thermocouples, one grounded and one ungrounded thermocouple, or one dual element thermocouple.

4.3.2 Power the transmitter

1. An external power supply is required to operate the transmitter.

2. Remove the housing cover (if applicable).

3. Connect the positive power lead to the "+" terminal. Connect the negative power lead to the "–" terminal.

4. Tighten the terminal screws. When tightening the sensor and power wires, the max torque is 6.5 in.-lbs (0.73 N-m).

5. Reattach and tighten the cover (if applicable).

6. Apply power (12 – 42 Vdc).

Rosemount 644 (DIN A Head Mount)

HART device shown with captivated screw terminals

Dimensions are in millimeters (inches).
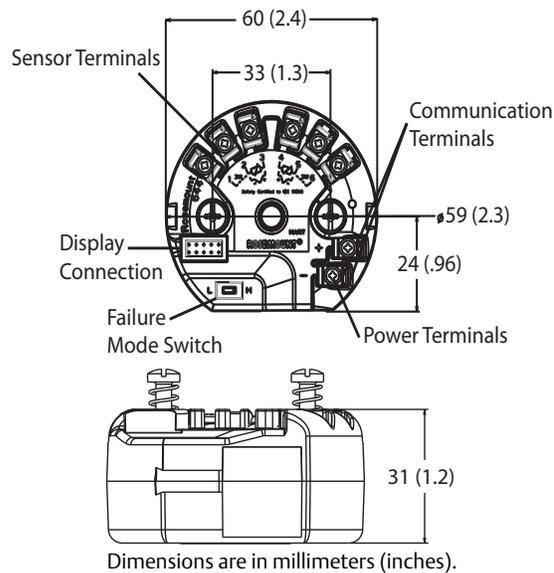
Rosemount 644 Rail Mount
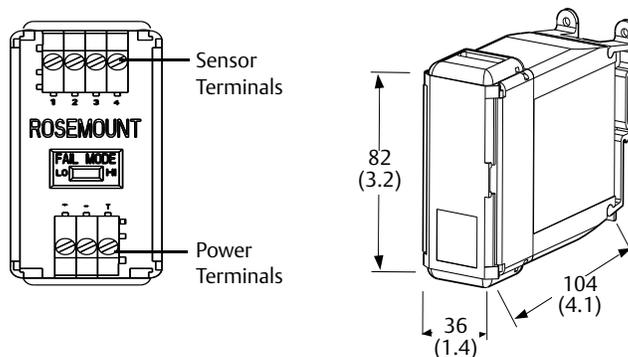
Powering the transmitter for bench configuration

Rosemount 644 Head mount
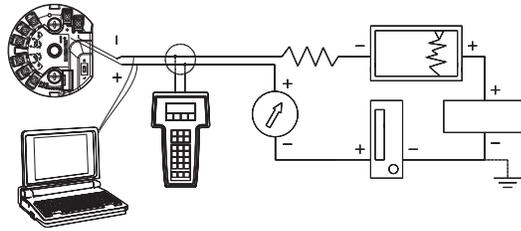
Rosemount 644 Rail mount
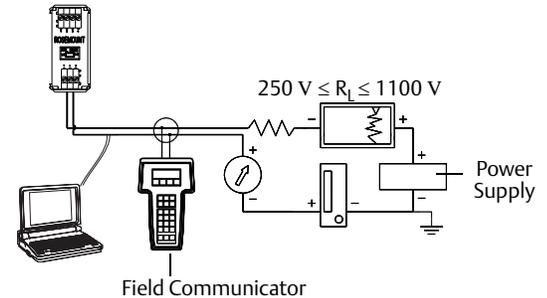
Signal loop may be grounded at any point or left ungrounded.

A Field Communicator may be connected at any termination point in the signal loop. The signal loop must have between 250 and 1100 ohms load for communications.

Max torque is 6 in.-lbs (0/7 N-m).

Load limitation

The power required across the transmitter power terminals is 12 to 42.4 Vdc (the power terminals are rated to 42.4 Vdc). To prevent damaging the transmitter, do not allow terminal voltage to drop below 12.0 Vdc when changing the configuration parameters.

4.3.3 Ground the transmitter

Sensor shielding

The currents in the leads induced by electromagnetic interference can be reduced by shielding. Shielding carries the current to ground and away from the leads and electronics. If the ends of the shields are adequately grounded, only a small amount of current will actually enter the transmitter. If the ends of the shield are left ungrounded, voltage is created between the shield and the transmitter housing and also between the shield and earth at the element end. The transmitter may not be able to compensate for this voltage, causing it to lose communication and/or go into alarm. Instead of the shield carrying the currents away from the transmitter, the currents will now flow through the sensor leads into the transmitter circuitry where it will interfere with the circuit operation.

Shielding recommendations

The following are recommended practices from API Standard 552 (Transmission Standard) section 20.7, and from field and laboratory testing. If more than one recommendation is given for a sensor type, start with the first technique shown or the technique that is recommended for the facility by its installation drawings. If the technique does not eliminate the transmitter alarms, try another technique. If all of the techniques do not eliminate or prevent the transmitter alarms because of high EMI, contact an Emerson Process Management representative.

To ensure proper grounding, it is important that the instrument cable shield be:

- Trimmed close and insulated from touching the transmitter housing
- Connected to the next shield if cable is routed through a junction box
- Connected to a good earth ground at the power supply end

Ungrounded thermocouple, mV, and RTD/ohm inputs

Each process installation has different requirements for grounding. Use the grounding options recommended by the facility for the specific sensor type, or begin with grounding Option 1: (the most common).

Option 1

1. Connect sensor wiring shield to the transmitter housing.

2. Ensure the sensor shield is electrically isolated from surrounding fixtures that may be grounded.

3. Ground signal wiring shield at the power supply end.
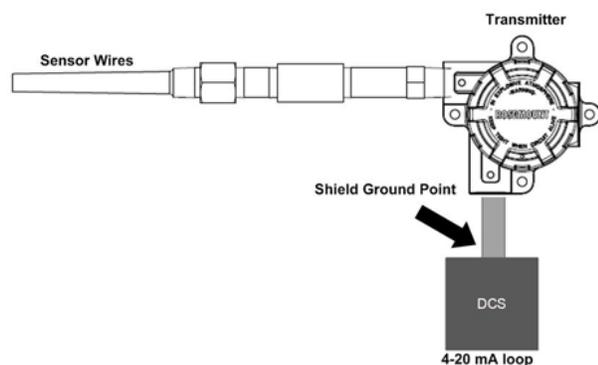
Option 2

1. Connect signal wiring shield to the sensor wiring shield.

2. Ensure the two shields are tied together and electrically isolated from the transmitter housing.

3. Ground shield at the power supply end only.

4. Ensure the sensor shield is electrically isolated from the surrounding grounded fixtures.
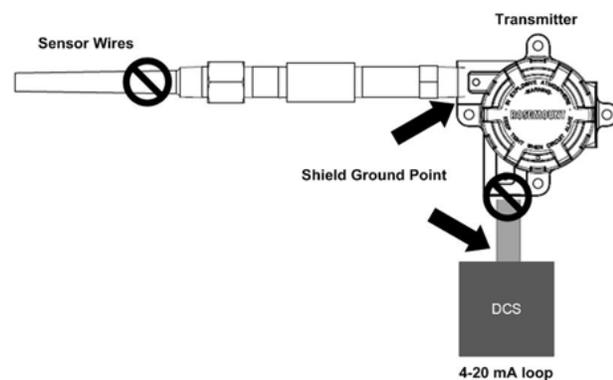
5. Connect shields together, electrically isolated from the transmitter.

Option 3

1. Ground sensor wiring shield at the sensor, if possible.

2. Ensure that the sensor wiring and signal wiring shields are electrically isolated from the transmitter housing.

3. Do not connect the signal wiring shield to the sensor wiring shield.

4. Ground signal wiring shield at the power supply end.
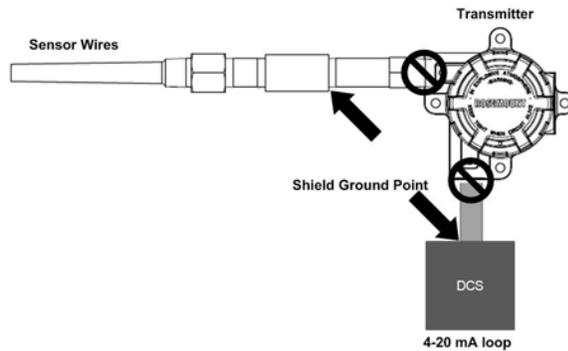
Grounded thermocouple inputs

Option 1

1. Ground sensor wiring shield at the sensor.

2. Ensure the sensor wiring and signal wiring shields are electrically isolated from the transmitter housing.

3. Do not connect the signal wiring shield to the sensor wiring shield.

4. Ground signal wiring shield at the power supply end.
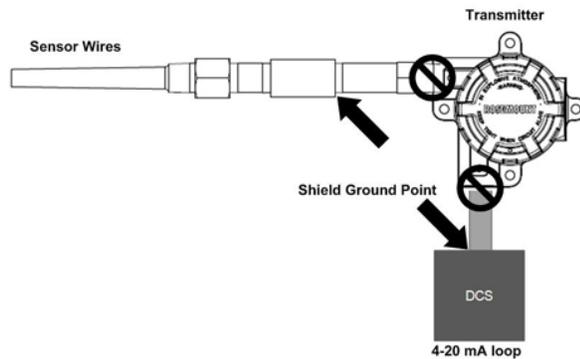
4.3.4 Wiring with a Rosemount 333 HART Tri-Loop™ (HART / 4–20 mA only)

Use the dual-sensor option Rosemount 644 Transmitter that is operating with two sensors in conjunction with a Rosemount 333 HART Tri-Loop HART-to-Analog Signal Converter to acquire an independent 4–20 mA analog output signal for each sensor input. The Rosemount 644 Transmitter can be configured to output four of the six following digital process variables:

- Sensor 1
- Sensor 2
- Differential temperature
- Average temperature
- First good temperature
- Transmitter terminal temperature

The HART Tri-Loop reads the digital signal and outputs any or all of these variables into as many as three separate 4–20 mA analog channels. Refer to Figure 2-6 on page 17 for basic installation information. Refer to the Rosemount 333 HART Tri-Loop HART-to-Analog Signal Converter Reference Manual (document number 00809-0100-4754) for complete installation information.

Power supply

An external power supply is required to operate the Rosemount 644 and is not included. The input voltage range of the transmitter is 12 to 42.4 Vdc. This is the power required across the transmitter power terminals. The power terminals are rated to 42.4 Vdc. With 250 ohms of resistance in the loop, the transmitter requires a minimum of 18.1 Vdc for communication.

The power supplied to the transmitter is determined by the total loop resistance and should not drop below the lift-off voltage. The lift-off voltage is the minimum supply voltage required for any given total loop resistance. If the power drops below the lift-off voltage while the transmitter is being configured, the transmitter may output incorrect information.

The dc power supply should provide power with less than 2% ripple. The total resistance load is the sum of the resistance of the signal leads and the load resistance of any controller, indicator, or related piece of equipment in the loop. Note that the resistance of intrinsic safety barriers, if used, must be included.

Note
Permanent damage to the transmitter could result if the voltage drops below 12.0 Vdc at the power terminals, when changing transmitter configuration parameters.

Figure 4-3. Load Limits

Maximum Load = 40.8 X (Supply Voltage - 12.0)
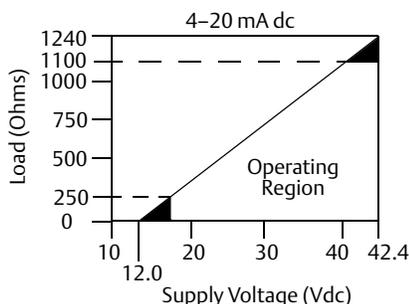
Section 5 Operation and Maintenance

5.1 Overview

This section contains information on calibrating Rosemount™ 644 Temperature Transmitter. Field Communicator, AMS™ Device Manager, and Local Operator Interface (LOI) instructions are given to perform all functions.

5.2 Safety messages

Instructions and procedures in this section may require special precautions to ensure the safety of the personnel performing the operations. Information that potentially raises safety issues is indicated by a warning symbol (⚠). 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.

- Make sure only qualified personnel perform the installation.

Explosions could result in death or serious injury.

- Do not remove the connection head cover in explosive atmospheres when the circuit is live.
- Before connecting a Field Communicator in an explosive atmosphere, make sure the instruments in the loop are installed in accordance with intrinsically safe or non-incendive field wiring practices.
- Verify the operating atmosphere of the transmitter is consistent with the appropriate hazardous locations certifications.
- All connection head covers must be fully engaged to meet explosion-proof requirements.

Process leaks could result in death or serious injury.

- Do not remove the thermowell while in operation.
- Install and tighten thermowells and sensors before applying pressure.

Electrical shock could cause death or serious injury.

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

5.3   Calibration overview

Calibrating the transmitter increases the measurement precision by allowing corrections to be made to the factory-stored characterization curve by digitally altering the transmitter's interpretation of the sensor input.

To understand calibration, it is necessary to understand that smart transmitters operate differently from analog transmitters. An important difference is that smart transmitters are factory-characterized, meaning that they are shipped with a standard sensor curve stored in the transmitter firmware. In operation, the transmitter uses this information to produce a process variable output, in engineering units, dependent on the sensor input.

Calibration of the Rosemount 644 may include the following procedures:

- **Sensor Input Trim**: digitally alter the transmitter's interpretation of the input signal
- **Transmitter Sensor Matching**: generates a special custom curve to match that specific sensor curve, as derived from the Callendar-Van Dusen constants
- **Output Trim**: calibrates the transmitter to a 4–20 mA reference scale
- **Scaled Output Trim**: calibrates the transmitter to a user-selectable reference scale.

5.3.1   Trimming

The trim functions should not be confused with the rerange functions. Although the rerange command matches a sensor input to a 4–20 mA output—as in conventional calibration—it does not affect the transmitter's interpretation of the input.

One or more of the trim functions may be used when calibrating. The trim functions are as follows:

- Sensor Input Trim
- Transmitter-Sensor Matching
- Output Trim
- Output Scaled Trim

5.4   Sensor input trim

The *Sensor Trim* command allows for alteration of the transmitter's interpretation of the input signal. The sensor trim command trims, in engineering (°F, °C, °R, K) or raw (ohms, mV) units, the combined sensor and transmitter system to a site standard using a known temperature source. Sensor trim is suitable for validation procedures or for applications that require profiling the sensor and transmitter together.

Perform a sensor trim if the transmitter's digital value for the primary variable does not match the plant's standard calibration equipment. The sensor trim function calibrates the sensor to the transmitter in temperature units or raw units. Unless the site-standard input source is NIST-traceable, the trim functions will not maintain the NIST-traceability of your system.

Figure 5-1. Trim

Application: Linear Offset
Solution: Single-Point Trim

Method:
1. Connect sensor to transmitter. Place sensor in bath between range points.
2. Enter known bath temperature using the Field Communicator.
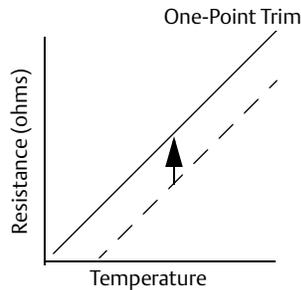
Application: Linear Offset and Slope Correction
Solution: Two-Point Trim
Method:
1. Connect sensor to transmitter. Place sensor in bath at low range point.
2. Enter known bath temperature using the Field Communicator.
3. Repeat at high range point.

One-Point Trim

Resistance (ohms)

Temperature

Two-Point Trim

Resistance (ohms)

Temperature
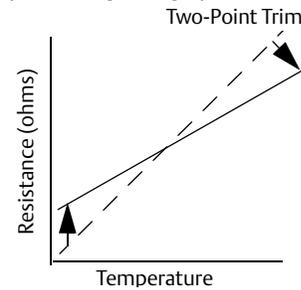
Transmitter System Curve
Site-Standard Curve

Using Field Communicator

Use the following procedures to perform a sensor trim on the Rosemount 644:

1. Connect the calibration device or sensor to the transmitter. (If using an active calibrator, see "Active calibrator and EMF compensation" on page 65)

2. Connect the communicator to the transmitter loop.

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

Device Dashboard Fast Keys	3, 4, 4, 1

The communicator will ask "Are you using an active calibrator?"

   a. Select "**No**" if a sensor is connected to the transmitter

   b. Select "**Yes**" if using a calibration device. By selecting yes, the transmitter will switch into active calibration mode (see "Active Calibrator and EMF Compensation"). This is critical if the calibrator requires constant sensor current for calibration. If using a calibration device that can accept pulsed current, select "No."

Using AMS Device Manager

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

2. On the main *Overview* tab, click on the **Calibrate Sensor(s)** button near the bottom of the window.

3. Follow the screen prompts that will guide you through the sensor trimming process.

Using the Local Operator Interface

Reference the below image for guidance on where to find *Sensor Calibration* in the LOI menu.

Figure 5-2. Trimming the Sensor with the LOI
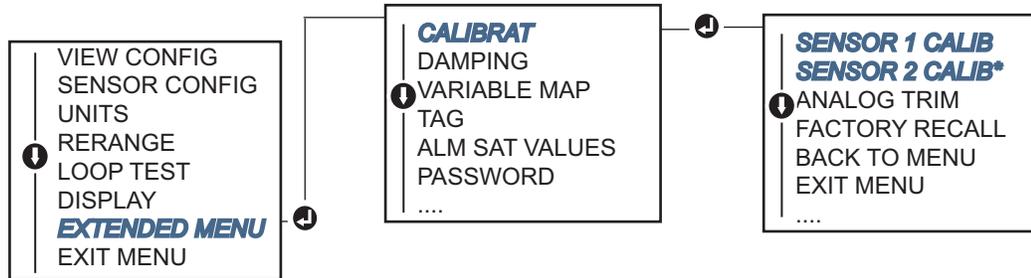
5.4.1 Recall Factory Trim—Sensor trim

The Recall Factory Trim—Sensor Trim feature 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.

Using Field Communicator

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

Device Dashboard Fast Keys	3, 4, 4, 2

Using AMS Device Manager

1. Right click on the device and select **Service Tools**.

2. On the Sensor Calibration tab, click on the **Restore Factory Calibration**.

3. Follow the screen prompts that will guide you through the restoring of the calibration settings.

Using the Local Operator Interface

Reference the below image for where to find Recall Sensor Trim in the LOI menu.

Figure 5-3. Recalling the Sensor Trim with the LOI
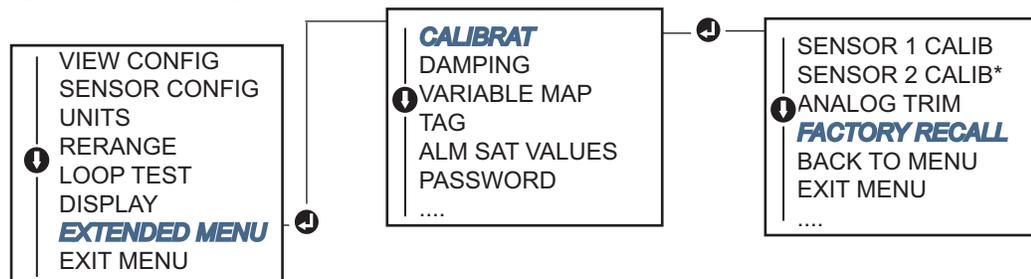
5.4.2   Active calibrator and EMF compensation

The transmitter operates with a pulsating sensor current to allow EMF compensation and detection of open sensor conditions. Because some calibration equipment requires a steady sensor current to function properly, the *Active Calibrator Mode* feature should be used when an active calibrator is connected. Enabling this mode temporarily sets the transmitter to provide steady sensor current unless two sensor inputs are configured.

Disable this mode before putting the transmitter back into the process to set the transmitter back to pulsating current. *Active Calibrator Mode* is volatile and will automatically be disabled when a master reset is performed (through HART) or when the power is cycled.

EMF compensation allows the transmitter to provide sensor measurements that are unaffected by unwanted voltages, typically due to thermal EMFs in the equipment connected to the transmitter, or by some types of calibration equipment. If this equipment also requires steady sensor current, the transmitter must be set to *Active Calibrator Mode*. However, the steady current does not allow the transmitter to perform EMF compensation and as a result, a difference in readings between the active calibrator and actual sensor may exist.

If a reading difference is experienced and is greater than the plant's accuracy specification allows, perform a sensor trim with *Active Calibrator Mode* disabled. In this case, an active calibrator capable of tolerating pulsating sensor current must be used or the actual sensors must be connected to the transmitter. When the Field Communicator, AMS Device Manager or the LOI asks if an active calibrator is being used when the sensor trim routine is entered, select **No** to leave the *Active Calibrator Mode* disabled.

5.5   Trim the analog output

5.5.1   Analog output trim or Scaled Analog Output Trim

Perform an Output Trim or a Scaled Output Trim if the digital value for the primary variable matches the plant's standards but the transmitter's analog output does not match the reading on the output device. The output trim function calibrates the transmitter to a 4–20 mA reference scale; the scaled output trim function calibrates to a user-selectable reference scale. To determine the need for an output trim or a scaled output trim, perform a loop test ("Performing a loop test" on page 39).

Figure 5-4. Measurement Dynamics of a Smart Temperature transmitter
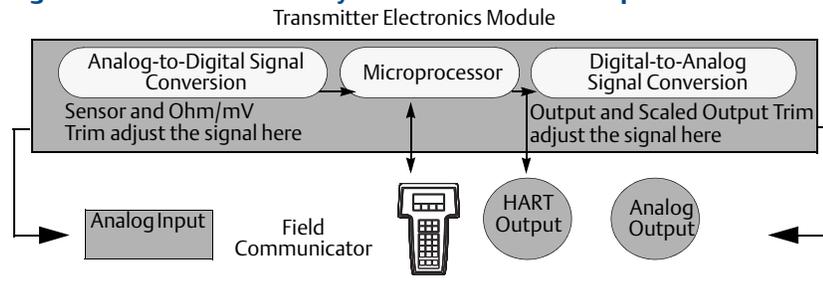
5.5.2   Analog output trim

The Analog Output Trim allows the transmitter's conversion of the input signal to a 4–20 mA output to be altered (Figure 5-4). Adjust the analog output signal at regular intervals to maintain measurement precision. To perform a digital-to-analog trim, perform the following procedure with Traditional Fast Key sequence:

Using Field Communicator

1. Connect an accurate reference meter to the transmitter at the **CONNECT REFERENCE METER** prompt by shunting the power to the transmitter through the reference meter at some point in the loop.

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

Device Dashboard Fast Keys	3, 4, 5, 1

Using AMS Device Manager

1. Right click on the device and select **Service Tools**.

2. In the left navigation pane click on **Maintenance**.

3. Find the **Analog Calibration** tab and click on the **Analog Trim** button.

4. Follow the screen prompts that will guide you through the Analog Trimming process.

Using the Local Operator Interface

Reference the below image for guidance on where to find Analog Trim in the LOI menu.

Figure 5-5. Trimming the Analog Output with the LOI
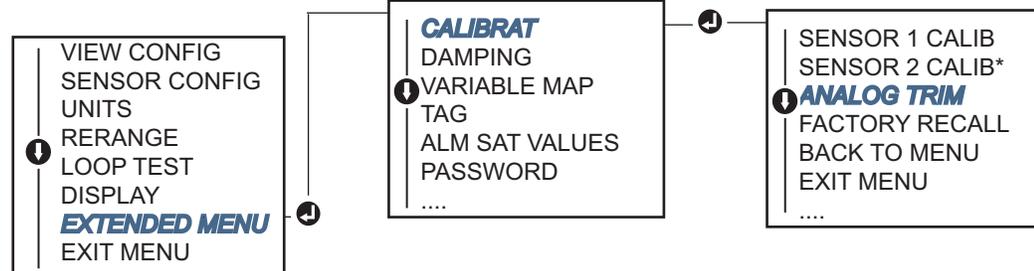
5.5.3   Scaled output trim

The Scaled Output Trim matches the 4 and 20mA points to a user-selectable reference scale other than 4 and 20 mA (2–10 volts, for example). To perform a scaled D/A trim, connect an accurate reference meter to the transmitter and trim the output signal to scale as outlined in the "Trim the analog output" procedure.

Using Field Communicator

1. Connect an accurate reference meter to the transmitter at the **CONNECT REFERENCE METER** prompt by shunting the power to the transmitter through the reference meter at some point in the loop.

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

Device Dashboard Fast Keys	3, 4, 5, 2

Using AMS Device Manager

1. Right click on the device and select **Service Tools.**

2. In the left navigation pane click on **Maintenance**.

3. Find the **Analog Calibration** tab and click on the **Scaled Trim** button.

4. Follow the screen prompts that will guide you through the analog trimming process.

5.6   Transmitter-Sensor Matching

Use Transmitter-Sensor Matching to enhance the temperature measurement accuracy of the system and if you have a sensor with Callendar-Van Dusen constants. When ordered from Emerson Process Management, sensors with Callendar-Van Dusen constants are NIST-traceable.

The Rosemount 644 accepts Callendar-Van Dusen constants from a calibrated RTD schedule and generates a special custom curve to match that specific sensor Resistance vs. Temperature performance. Figure 5-6.

Figure 5-6. Standard vs. Actual Sensor Curve
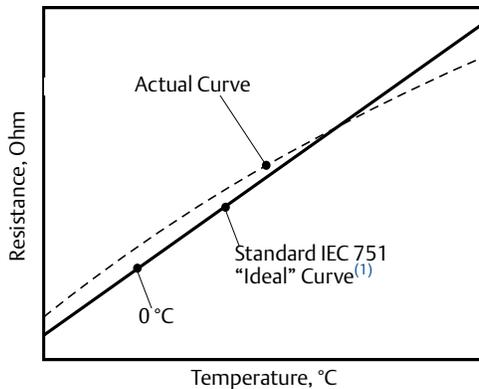
1. The Actual Curve is identified from the Callendar-Van Dusen equation.

Matching the specific sensor curve with the transmitter significantly enhances the temperature measurement accuracy. See the comparison below in Table 5-1.

Table 5-1. Standard RTD vs. RTD with Matched CVD Constants with Standard Transmitter Accuracy

System accuracy comparison at 150 °C using a PT 100 (α=0.00385) RTD with a span of 0 to 200 °C			
Standard RTD		Matched RTD	
Rosemount 644H	±0.15 °C	Rosemount 644H	±0.15 °C
Standard RTD	±1.05 °C	Matched RTD	±0.18 °C
Total System[1]	±1.06 °C	Total System[1]	±0.23 °C

1. Calculated using root-summed-squared (RSS) statistical method

$$TotalSystemAccuracy = \sqrt{(TransmitterAccuracy)^2 + (SensorAccuracy)^2}$$

Table 5-2. Standard RTD vs. RTD with Matched CVD Constants with Enhanced Transmitter Accuracy Option P8

System accuracy comparison at 150 °C using a PT 100 (α=0.00385) RTD with a span of 0 to 200 °C			
Standard RTD		Matched RTD	
Rosemount 644	±0.10 °C	Rosemount 644	±0.10 °C
Standard RTD	±1.05 °C	Matched RTD	±0.18 °C
Total System[1]	±1.05 °C	Total System[1]	±0.21 °C

   1. Calculated using root-summed-squared (RSS) statistical method

$$TotalSystemAccuracy = \sqrt{(TransmitterAccuracy)^2 + (SensorAccuracy)^2}$$

Callendar-Van Dusen equation

The following input variables, included with specially-ordered Rosemount temperature sensors, are required:

$$R_t = R_o + R_o a\,[t - d(0.01t\text{-}1)(0.01t) - b(0.01t - 1)(0.01t)^3]$$

R0 = Resistance at Ice Point
Alpha = Sensor Specific Constant
Beta = Sensor Specific Constant
Delta = Sensor Specific Constant

To input Callendar-Van Dusen constants, perform one the following procedures:

Entering CVD constants using Field Communicator

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

Device Dashboard Fast Keys	2, 2, 1, 9

Entering CVD constants using AMS Device Manager

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

2. In the left navigation pane choose **Manual Setup** and choose the **Sensor 1** or **Sensor 2** tab depending on the need.

3. Find the *Transmitter Sensor Matching (CVD)* group box and enter in the required CVD constants. Or click the **Set CVD Coefficients** button to be guided through steps. You may also click the **Show CVD Coefficients** button to see the current coefficients loaded into the device.

4. Click **Apply** when complete.

Note
When the transmitter-senor matching is disabled, the transmitter reverts to either user or factory trim, whichever was used previously. Make certain the transmitter engineering units default correctly before placing the transmitter into service.

5.7 Switching HART Revision

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

5.7.1 Using the 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 in any HART compliant configuration tool.

1. Locate *Message* field.
   a. To change to HART Revision 5, Enter: **HART5** in the message field.
   b. To change to HART Revision 7, Enter: **HART7** in the message field.

5.7.2 Using Field Communicator

Follow steps within the Field Communicator to complete the HART revision change.

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

Device Dashboard Fast Keys	2, 2, 8, 3

5.7.3 Using AMS Device Manager

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

2. In the left navigation pane choose **Manual Setup** and click on the **HART** tab.

3. Click on the **Change HART Revision** button and follow the prompts.

Note
HART Revision 7 is only compatible with AMS Device Manager 10.5, and greater. AMS Device Manager version 10.5 requires a software patch to be compatible.

5.7.4 Using Local Operator Interface

Reference the below image for where to find HART Rev in the LOI menu.

Figure 5-7. Trimming the Analog Output with the LOI
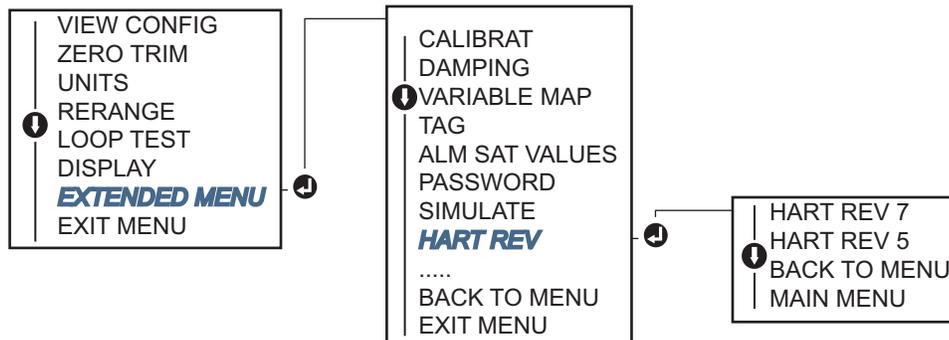
Section 6   Troubleshooting

6.1   Overview

Table 6.3 on page 72 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, follow the procedures described in Table 6.3 on page 72 to verify that transmitter hardware and process connections are in good working order. Under each of four major symptoms, specific suggestions are offered for solving problems. Always deal with the most likely and easiest-to-check conditions first.

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 ($\triangle$). 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 transmitter in an explosive environment must be in accordance with the appropriate local, national, and international standards, codes, and practices. Review the approvals section of the Rosemount™ 644 Reference Manual 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 transmitter 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.

6.3 Troubleshooting the 4-20 mA/HART output

Symptom or issue	Potential source	Corrective action
Transmitter Does Not Communicate with Field Communicator	Loop Wiring	• Check the revision level of the transmitter device descriptors (DDs) stored in your communicator. The communicator should report Dev v4, DD v1 (improved), or reference "Field Communicator" on page 3-2 for previous versions. Contact Emerson™ Process Management Customer Central for assistance. • Check for a minimum of 250 ohms resistance between the power supply and Field Communicator connection. • Check for adequate voltage to the transmitter. If a Field Communicator is connected and 250 ohms resistance is properly in the loop, then the transmitter requires a minimum of 12.0 V at the terminals to operate (over entire 3.5 to 23.0 mA operating range), and 12.5 V minimum to communicate digitally. • Check for intermittent shorts, open circuits, and multiple grounds.
High Output	Sensor Input Failure or Connection	• Connect a Field Communicator and enter the transmitter test mode to check for a sensor failure. • Check for a sensor open or short circuit. • Check the process variable to see if it is out of range.
	Loop Wiring	• Check for dirty or defective terminals, interconnecting pins, or receptacles
	Power Supply	• Check the output voltage of the power supply at the transmitter terminals. It should be 12.0 to 42.4 Vdc (over entire 3.75 to 23 mA operating range).
	Electronics	• Connect a Field Communicator and enter the transmitter status mode to isolate module failure. • Connect a Field Communicator and check the sensor limits to ensure calibration adjustments are within the sensor range.
Erratic Output	Loop Wiring	• Check for adequate voltage to the transmitter. It should be 12.0 to 42.4 Vdc at the transmitter terminals (over entire 3.75 to 23 mA operating range). • Check for intermittent shorts, open circuits, and multiple grounds. • Connect a Field Communicator and enter the Loop test mode to generate signals of 4 mA, 20 mA, and user-selected values.
	Electronics	• Connect a Field Communicator and enter the transmitter test mode to isolate module failure.
Low or No Output	Sensor Element	• Connect a Field Communicator and enter the Transmitter test mode to isolate a sensor failure. • Check the process variable to see if it is out of range.
	Loop Wiring	• Check for adequate voltage to the transmitter. It should be 12.0 to 42.4 Vdc (over entire 3.75 to 23 mA operating range). • Check for shorts and multiple grounds. • Check for proper polarity at the signal terminal. • Check the loop impedance. • Connect a Field Communicator and enter the Loop test mode. • Check wire insulation to detect possible shorts to ground.
	Electronics	• Connect a Field Communicator and check the sensor limits to ensure calibration adjustments are within the sensor range.

6.4 Diagnostic messages

Listed in the below sections are detailed tables of the possible messages that will appear on either the LOI/LCD display, a Field Communicator, or an AMS system. Use the tables below to diagnose particular status messages (i.e. Failed, Maintenance, Advisory).

6.4.1 Diagnostic messages: Failed–Fix now

Alert name	LCD display screen	LOI screen	Problem	Recommended action
Electronics Failure	ALARM DEVICE . . . ALARM FAIL	ALARM DEVICE . . . ALARM FAIL	Essential electronics in the device have failed. For example, the transmitter may have experienced an electronics failure while attempting to store information. If diagnostics indicate an electronics failure.	1. Restart the transmitter. 2. If condition persists, replace the transmitter. Contact the nearest Emerson Process Management Field Service Center if necessary.
Sensor Open[1]	ALARM SNSR 1 . . ALARM FAIL	ALARM SNSR 1 . . ALARM FAIL	This message indicates that the transmitter has detected an open sensor condition. The sensor may be disconnected, connected improperly, or malfunctioning.	1. Verify the sensor connection and wiring. Refer to the wiring diagrams found on the transmitter label to ensure proper wiring. 2. Verify the integrity of the sensor and sensor lead wires. If the sensor is faulty, repair or replace the sensor.
Sensor Short[1]	ALARM SNSR 1 . . ALARM FAIL	ALARM SNSR 1 . . ALARM FAIL	This message indicates that the transmitter has detected a shorted sensor condition. The sensor may be disconnected, connected improperly, or malfunctioning.	1. Verify the process temperature is within the specified sensor's range. Use the Sensor Information button to compare with the process temperature. 2. Verify the sensor is properly wired and connected to the terminals. 3. Verify the integrity of the sensor and sensor lead wires. If the sensor is faulty, repair or replace the sensor.
Terminal Temperature Failure	ALARM TERM . . ALARM FAIL	ALARM TERM . . ALARM FAIL	The Terminal Temperature is outside the internal RTD's specified operating range.	1. Verify the ambient temperature is within the device specified operating range using the Terminal Temperature Information Button.
Invalid Configuration	CONFG SNSR 1 . . WARN ERROR	CONFG SNSR 1 . . WARN ERROR	The Sensor Configuration (type and/or connection) does not match the sensor output and is invalid.	1. Verify sensor type and number of wires matched the Sensor Configuration of the device. 2. Reset the device. 3. If error persists, download the transmitter configuration. 4. If error still present, replace the transmitter.
Field Device Malfunction	ALARM DEVICE . . . ALARM FAIL	ALARM DEVICE . . . ALARM FAIL	The device has malfunctioned or needs immediate attention.	1. Perform a processor reset. 2. View other alerts to see if the transmitter indicates a specific problem. 3. If the condition persists, replace the device.

1. Sensor 1 is used here as an example. If Dual Sensors are ordered, this alert can apply to either sensor.

6.4.2 Diagnostic messages: Warning

Alert name	LCD display screen	LOI screen	Problem	Recommended action
Hot Backup™ Active	HOT BU SNSR 1 . . . HOT BU FAIL	HOT BU SNSR 1 . . . HOT BU FAIL	Sensor 1 has failed (open or shorted) and Sensor 2 is now the primary process variable output.	1. Replace Sensor 1 at you earliest convenience. 2. Reset Hot Backup feature in the device software.
Sensor Drift Alert Active[1]	WARN DRIFT . . . WARN ALERT	WARN DRIFT . . . WARN ALERT	The difference between Sensor 1 and 2 has gone beyond the user-configured Drift Alert Threshold.	1. Verify sensor connections are valid on the transmitter. 2. If necessary, check calibration of each sensor. 3. Verify process conditions match sensor outputs. 4. If calibration fails, one of the sensors has failed. Replace it at your earliest convenience.
Sensor Degraded[1]	WARN SNSR 1 . . . DEGRA SNSR 1	WARN SNSR 1 . . . DEGRA SNSR 1	The resistance of the thermocouple loop has exceeded the configured threshold. This could be caused by excess EMF.	1. Check terminal connections on the Rosemount 644 terminal screws for corrosion. 2. Check the thermocouple loop for any signs of corrosion in terminal blocks, wire thinning, wire breaks, or faulty connections. 3. Verify the integrity of the sensor itself. Harsh process conditions may cause long-term sensor failures.
Calibration Error	[none]	[none]	The value entered for the user trim point was not acceptable.	1. Re-trim the device, make sure the user entered calibration points are close to the applied calibration temperature.
Sensor Out of Operating Limits[1]	SAT SNSR 1 . . . XX.XXX °C	SAT SNSR 1 . . . XX.XXX °C	Sensor # readings are outside the sensor's specified range.	1. Verify the process temperature is within the specified sensor's range. Use the Sensor Information button to compare with the process temperature. 2. Verify the sensor is properly wired and connected to the terminals. 3. Verify the integrity of the sensor and sensor lead wires. If the sensor is faulty, repair or replace the sensor.
Terminal Temperature Out of Operating Limits	SAT TERM . . . DEGRA WARN	SAT TERM . . . DEGRA WARN	The Terminal Temperature is outside the on-board RTD specified operating range	1. Verify the ambient temperature is within the device specified operating range using the Terminal Temperature Information Button.

1. Sensor 1 is used here as an example. If Dual Sensors are ordered, this alert can apply to either sensor.

6.4.3　　　Other LCD display messages

Alert name	LCD display screen	LOI screen	Problem	Recommended action
LCD is not displaying correctly or at all	Rosemount 644 HART 7	Rosemount 644 HART 7	The display may not be functioning or it may be stuck on Home screen	If the meter does not appear to function, make sure the transmitter is configured for the meter option you desire. The meter will not function if the LCD display option is set to *Not Used*.
Analog Output Fixed	WARN LOOP . . . WARN FIXED	WARN LOOP . . . WARN FIXED	The analog output is set to a fixed value and is not currently tracking the HART Primary Variable.	1. Verify it was intended for the transmitter to be operating in "Fixed Current Mode." 2. Disable "Fixed Current Mode" in Service Tools to have the analog output operate normally.
Simulation Active	[none]	[none]	The device is in simulation mode and may not be reporting actual information.	1. Verify simulation is no longer required. 2. Disable simulation mode in service tools. 3. Perform a device reset.

Section 7 Safety Instrumented Systems (SIS) Certification

7.1 Safety Instrumented Systems (SIS) certification

The Rosemount™ 644 Temperature Transmitter is a 2-wire, 4-20 mA smart device. For safety instrumented systems usage it is assumed that the 4-20 mA output is used as the primary safety variable. The transmitter can be equipped with or without the display. The Rosemount 644 Temperature Transmitter is classified as a Type B device according to IEC61508, having a hardware fault tolerance of 0.

The Rosemount 644 HART® Head Mount Transmitter is certified to IEC 61508 for single transmitter use in Safety Instrumented Systems up to SIL 2 and redundant transmitter use in Safety Instrumented Systems up to SIL 3.

7.2 Rosemount 644 safety certified identification

All Rosemount 644 HART Head Mount Transmitters must be identified as safety certified before installing into SIS systems.

To identify a safety certified Rosemount 644, make sure the device satisfies number 1 below and at least one of the options in 2, 3, or 4.

1. Verify the transmitter was ordered with Output Option code "A". This signifies that it is a 4-20mA/HART device.
    a. For Example: MODEL 644HA...........

2. See a yellow tag affixed to the top of the transmitter face, a yellow tag affixed to the outside of the enclosure if preassembled, or the option code QT in the transmitter model string.

3. Check the NAMUR Software Revision located on the adhesive transmitter tag.
   "SW _._._".
   If the device label software revision is 1.1.1 or higher, the device is safety certified.

NAMUR Software Revision Number	
SW[1]	1.1.x
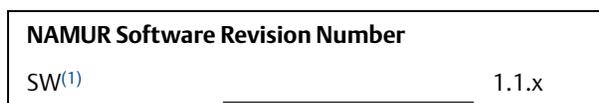
1. NAMUR Software Revision: Located on the adhesive device tag.

4. Identify a certified Rosemount 644 by its Device Revision (found using any HART-compliant communicator).
   For the Rosemount 644, certified device revisions are as follows:
   – Device Revision 8.x (HART 5)
   – Device Revision 9.x (HART 7)

7.3　Installation

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

The loop should be designed so the terminal voltage does not drop below 12 Vdc when the transmitter output is 24.5 mA.

Environmental limits are available in the Rosemount 644 Product Data Sheet (document number 00813-0100-4728).

7.4　Commissioning

The Rosemount 644 Safety Certified Transmitter can be commissioned by a person with average knowledge of Rosemount temperature transmitters and the configuration device being used. Refer to "System readiness" on page 9 to confirm your system's HART Revision capability and to confirm the installation of the correct device drivers (separate drivers required for HART 5 and HART 7).

To commission the Rosemount 644 Safety Certified Transmitter using a 375/475 Field Communicator, use the Table C-1 on page 155.

For more information on the Field Communicator visit http://www2.emersonprocess.com/en-US/brands/fieldcommunicator/Pages/fieldcommunicators.aspx.

7.5　Configuration

Use any HART capable configuration tool or the optional Local Operator Interface to communicate with and verify the initial configuration or any configuration changes made to the Rosemount 644 prior to operating in *Safety Mode*. All configuration methods outlined in Section 3 are the same for the safety certified Rosemount 644 temperature transmitter with any differences noted.

Software Lock must be used in order to prevent unwanted changes to the transmitter configuration.

Note
Transmitter output is not safety-rated during the following: Configuration changes, Multidrop operation, Simulation, Active Calibrator mode, and loop tests. Alternative means should be used to ensure process safety during transmitter configuration and maintenance activities.

7.5.1　Damping

User-adjustable damping affects the transmitter's ability to respond to changes in the applied process. The *damping value + response time* should not exceed the loop requirements.

If using a thermowell assembly, make sure to also take into account the added response time due to thermowell material.

7.6 Alarm and saturation levels

The Rosemount 644 features software driven alarm diagnostics. The independent circuit is designed to provide backup alarm output if the microprocessor software fails. The transmitter will go to a high or low output current for internally detected failures. The connected PLC must monitor the transmitter current for the high and low output current values beyond the normal range. The alarm directions (HI/LO) are user-selectable using the failure mode hardware switch found on the top face of the device. If failure occurs, the position of the switch determines the direction in which the output is driven (HI or LO). The switch feeds into the digital-to-analog (D/A) converter, which drives the proper alarm output even if the microprocessor fails. The values at which the transmitter drives its output in failure mode depends on whether it is configured to Standard, Custom, or NAMUR-compliant (NAMUR recommendation NE 43, June 1997) operation. Figure 7-1 on page 79 shows the alarm ranges available for the device to be configured to. The DCS, or safety logic solver, should be configured to match transmitter configuration.

Setting the alarm values is a two-step process:

1. With a Field Communicator, select the alarm and saturation levels using the following Fast Key sequence 1, 3, 4, 2.

2. Position the alarm switch to the required HI or LO position.

Figure 7-1. Alarm Levels

Rosemount alarm level

3.75 mA[1] 3.9 mA low saturation 4 mA Normal Operation 20 mA 20.8 mA high saturation 21.75[2]

NAMUR alarm level

3.6 mA[1] 3.8 mA low saturation 4 mA Normal Operation 20 mA 20.5 mA high saturation 22.5[2]

Custom alarm level[3][4]

3.6 - 3.8 mA[1] 3.7 - 3.9 mA low saturation 4 mA Normal Operation 20 mA 20.1 - 22.9 mA high saturation 20.2 - 23.0[2]
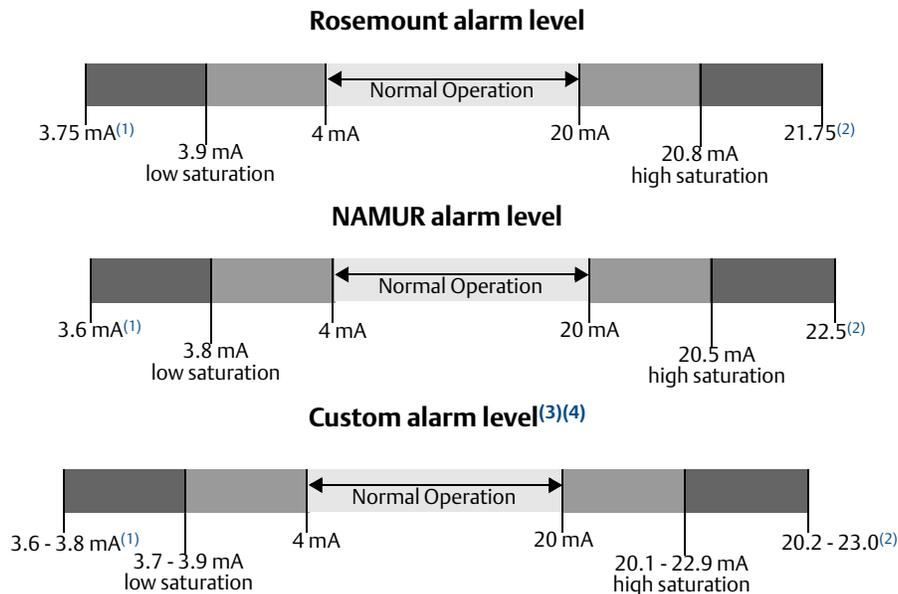
1. Transmitter Failure, hardware or software alarm in LO position.
2. Transmitter Failure, hardware or software alarm in HI position.
3. High alarm must be at least 0.1 mA higher than the high saturation value.
4. Low alarm must be at least 0.1 mA lower than the low saturation value.

7.7 Rosemount 644 SIS operation and maintenance

7.7.1 Proof test

The following proof tests are recommended. In the event that an error is found in the safety functionality, proof test results and corrective actions taken must be documented at www.EmersonProcess.com/Rosemount/Safety. Use Table C-1 on page 155 to perform looptest, review device variables, and view status.

The required proof test intervals depends upon the transmitter configuration and the temperature sensor(s) in use. Guidance is available in Table 7-1 on page 81. Refer to the Rosemount 644 FMEDA report for further information.

7.7.2 Abbreviated proof test

Conducting the abbreviated proof test detects approximately 63 percent of transmitter DU failures, and approximately 90 percent of temperature sensor(s) DU failures, not detected by the Rosemount 644 safety-certified automatic diagnostics, for a typical overall assembly coverage of 67 percent.

1. Bypass the safety PLC or take other appropriate action to avoid a false trip.

2. Using *Loop Test*, enter the milliampere value representing a high alarm state.

3. Check the reference meter to verify the mA output corresponds to the entered value. This tests for compliance voltage problems such as a low loop power supply voltage or increased wiring resistance. This also tests for other possible failures.

4. Using *Loop Test*, enter the milliampere value representing a low alarm state. This tests for possible dormant current related failures.

5. Check the reference meter to verify the mA output corresponds to the entered value.

6. Use a Field Communicator to view detailed device status to ensure no alarms or warnings are present in the transmitter.

7. Check that sensor value(s) are reasonable in comparison to a basic process control system (BPCS) value.

8. Restore the loop to full operation. Remove the bypass from the safety PLC or otherwise restore normal operation.

9. Document the test results per the plant's requirements.

7.7.3 Extended proof test

Conducting the extended proof test, which includes the abbreviated proof test, detects approximately 96 percent of transmitter DU failures and approximately 99 percent of temperature sensor(s) DU failures, not detected by the Rosemount 644 safety-certified automatic diagnostics, for a typical overall assembly coverage of 96 percent.

1. Bypass the safety PLC or take other appropriate action to avoid a false trip.

2. Execute the abbreviated proof test.

3. Perform a minimum two point sensor verification check. If two sensors are used, repeat for each sensor. If calibration is required for the installation, it may be done in conjunction with this verification.

4. Verify the housing temperature value is reasonable.

5. Restore the loop to full operation. Remove the bypass from the safety PLC or otherwise restore normal operation.

6. Document the test results per the plant's requirements.

Table 7-1. Proof Test Intervals

Sensors	Abbreviated proof test	Extended proof test
4-wire RTD	10 years	10 years
Thermocouple	1 year	10 years
	2 years	2 years
Dual Thermocouple	10 years	10 years
Dual 3-wire RTD	10 years	10 years
Thermocouple and 3-wire RTD	10 years	10 years

Proof test intervals are based on sensor failure rates from the "*Electrical and Mechanical Component Reliability Handbook, Second Edition", exida, 2008*. A low stress environment is assumed, with 30 percent of SIL 2 PFDavg limit budgeted for the transmitter and sensor element. See the FMEDA report for additional details or references.

Visual inspection

Not required

Special tools

Not required

Product repair

The Rosemount 644 is repairable by replacement only.

All failures detected by the transmitter diagnostics or by the proof-test must be reported. Feedback can be submitted electronically at www.EmersonProcess.com/Rosemount/Safety/Safety-Cert-Temp.htm (**Contact Us** button).

7.8   Specifications

The Rosemount 644 must be operated in accordance to the functional and performance specifications provided in the Rosemount 3051 Product Data Sheet (document number 00813-0100-4728).

7.8.1   Failure rate data

The FMEDA report includes failure rates and common cause Beta factor estimates.

The report is available at www.EmersonProcess.com/Rosemount/Safety-Products.

7.8.2   Failure values

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

7.8.3   Product life

50 years - based on worst case component wear-out mechanisms - not based on wear-out of process sensors.

Report any safety related product information at: http://rosemount.d1asia.ph/rosemount/safety/ReportAFailure_newweb.asp

Appendix A   Specifications and Reference Data

A.1 Specifications

A.1.1 Functional

Inputs

User-selectable; sensor terminals rated to 42.4 Vdc. See "Accuracy" on page 86 for sensor options.

Output

Single 2-wire device with 4-20 mA/HART® (Revision 5 or 7 Selectable), linear with temperature or input.

Isolation

Input/output isolation tested to 620 Vrms (876.8 Vpp) at 50/60 Hz

Local display

The optional five-digit integral LCD display includes a floating or fixed decimal point. It can also display engineering units (°F, °C, °R, K, Ω, and millivolts), mA, and percent of span. The display can be configured to alternate between selected display options. Display settings are preconfigured at the factory according to the standard transmitter configuration. They can be reconfigured in the field using HART communications.

The device also supports the use of a two-line, 8- and 6-digit (respectively) Local Operator Interface display supporting the same functionality as the basic display with the added capability to perform a number of configuration tasks on the Rosemount 644.

Humidity limits

0–95% relative humidity

Update time

≤ 0.5 seconds per sensor

≤ 1 sec - Head mount HART ordered with Dual Sensors)

Accuracy (default configuration) PT 100

HART protocol (0-100 °C): ±0.18 °C

±0.1 °C (when ordered with option P8)

A.1.2 Physical

Electrical connections

Model	Power and sensor terminals
Rosemount™ 644H	Compression screws permanently fixed to terminal block
Rosemount 644R	Compression screw permanently fixed to front panel

Field Communicator connections

Communication terminals	
Rosemount 644H	Clips permanently fixed to terminal block
Rosemount 644R	Clips permanently fixed to front panel

Materials of construction

Electronics housing and terminal block	
Rosemount 644H	GE polyphenylene oxide glass reinforced
Rosemount 644R	Polycarbonate
Enclosure (Options J5, J6, R1, and R2)	
Housing	Low-copper aluminum
Paint	Polyurethane
Cover O-ring	Buna-N

Materials of constructions (stainless steel housing for Biotechnology, Pharmaceutical Industries, and Sanitary Applications)

Housing and Standard Meter Cover

- 316 SST

Cover O-Ring

- Buna-N

Mounting

The Rosemount 644R attaches directly to a wall or a DIN rail. The Rosemount 644H installs in a connection head or universal head mounted directly on a sensor assembly, apart from a sensor assembly using a universal head, or to a DIN rail using an optional mounting clip.

Weight

Code	Options	Weight
644	HART, Head Mount Transmitter	96 g (3.39 oz)
644R	HART, Rail Mount Transmitter	174 g (6.14 oz)
M5	LCD Display	38 g (1.34 oz)
J5, J6	Universal Head, Standard Cover	577 g (20.35 oz)
J5, J6	Universal Head, Meter Cover	667 g (23.53 oz)
J7, J8	SST Universal Head, Std. Cover	1620 g (57.14 oz)
J7, J8	SST Universal Head, Meter Cover	1730 g (61.02 oz)
R1, R2	Aluminum Connection Head, Std. Cover	523 g (18.45 oz)
R1, R2	Aluminum Connection Head, Meter Cover	618 g (21.79 oz)
R3, R4	Cast SST Connection Head, Std Cover	1615 g (56.97 oz)
R3, R4	Cast SST Connection Head, Meter Cover	1747 g (61.62 oz)

Weight (stainless steel housing for Biotechnology, Pharmaceutical Industries, and Sanitary Applications)

Code	Standard cover	Meter cover
S1	840 g (27 oz)	995 g (32 oz)
S2	840 g (27 oz)	995 g (32 oz)
S3	840 g (27 oz)	995 g (32 oz)
S4	840 g (27 oz)	995 g (32 oz)

Enclosure ratings (Rosemount 644H)

All available enclosures are Type 4X, IP66, and IP68.

Sanitary housing surface

Surface finish is polished to 32 RMA. Laser etched product marking on housing and standard covers.

A.1.3 Performance

EMC (ElectroMagnetic Compatibility)

NAMUR NE 21 Standard

The Rosemount 644 meets the requirements for the NAMUR NE 21 rating.

Susceptibility	Parameter	Influence
		HART
ESD	• 6 kV contact discharge • 8 kV air discharge	None
Radiated	• 80 MHz to 2.7 GHz at 10 V/m	< 1.0%
Burst	• 1 kV for I.O.	None
Surge	• 1 kV line–ground	None
Conducted	• 10 kHz to 80 MHz at 10 V	< 1.0%

CE Electromagnetic compatibility compliance testing

The Rosemount 644 is compliant with Directive 2004/108/EC. Meets the criteria under IEC 61326:2006.

Power supply effect

Less than ±0.005% of span per volt

Stability

RTDs and thermocouples have a stability of ±0.15% of output reading or 0.15 °C (whichever is greater) for 24 months.

When ordered with the P8 option code:

- RTDs: ±0.25% of reading or 0.25 °C, whichever is greater, for 5 years
- Thermocouples: ±0.5% of reading or 0.5 °C, whichever is greater, for 5 years

Self calibration

The analog-to-digital measurement circuitry automatically self-calibrates for each temperature update by comparing the dynamic measurement to extremely stable and accurate internal reference elements.

Vibration effect

The Rosemount 644 HART is tested to the following specifications with no effect on performance per IEC 60770-1, 2010:

Frequency	Vibration
10 to 60 Hz	0.35 mm displacement
60 to 1000 Hz	5 g (50 m/s²) peak acceleration

Sensor connections

**Rosemount 644 Sensor Connection Diagram:
Rosemount 644 Head mount**
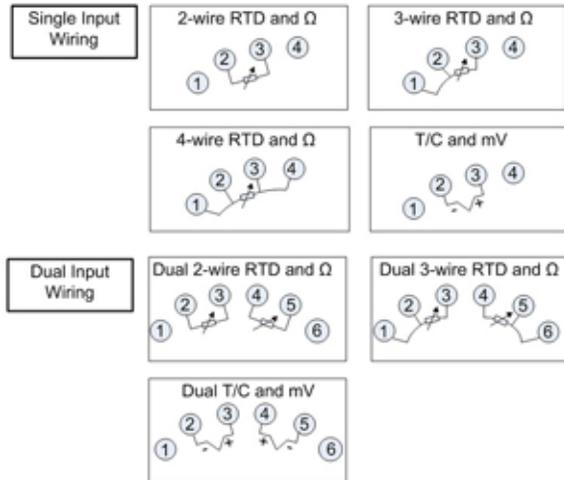
**Rosemount 644 Sensor Connection Diagram:
Rosemount 644 Rail mount**
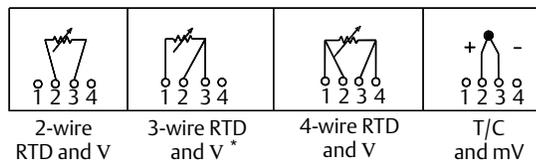
* Emerson™ Process Management provides 4-wire sensors for all single
   element RTDs. You can use these RTDs in 3-wire configurations by leaving
   the unneeded leads disconnected and insulated with electrical tape.

A.1.4 Conformance to specifications

A Rosemount product not only meets its published specifications, but most likely exceeds them. Advanced manufacturing techniques and the use of Statistical Process Control provide specification conformance to at least ± 3σ s[1]. Our commitment to continual improvement ensures that product design, reliability, and performance will improve annually.

For example, the Reference Accuracy distribution for the Rosemount 644 is shown in Figure A-1. Our specification limits are ± 0.15 °C, but, as the shaded area shows, approximately 68 percent of the units perform three times better than the limits. Therefore, it is very likely that you will receive a device that performs much better than our published specifications.

1.   Sigma (σ) is a statistical symbol to designate the standard deviation from
      the mean value of a normal distribution.

Conversely, a vendor who "grades" product without using process control, or who is not committed to ± 3σ performance, will ship a higher percentage of units that are barely within advertised specification limits.

Figure A-1. Typical Accuracy
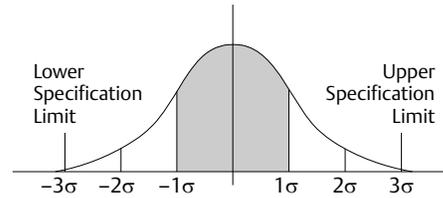
Accuracy distribution shown is for the Rosemount 644, Pt 100 RTD sensor, Range 0 to 100 °C

A.2 4–20 mA / HART specifications

A.2.1 Communication requirements

Transmitter power terminals are rated to 42.4 Vdc. A Field Communicator requires a loop resistance between 250 – 1100 ohms. The Rosemount 644 HART device does not communicate when power is below 12 Vdc at the transmitter terminals.

A.2.2 Power supply

An external power supply is required for HART devices. The transmitter operates on 12.0 to 42.4 Vdc transmitter terminal voltage with load resistance between 250 and 660 ohms. A minimum of 17.75 Vdc power supply is required with a load of 250 ohms. Transmitter power terminals are rated to 42.4 Vdc.

Maximum Load = 40.8 x (Supply Voltage – 12.0)
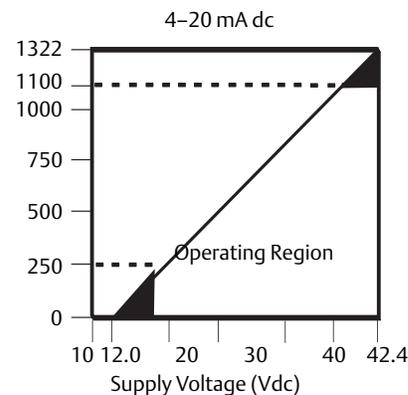
A.2.3 Temperature limits

	Operating limit	Storage limit
With LCD Display	−4 to 185 °F −20 to 85 °C	−50 to 185 °F −45 to 85 °C
Without LCD Display	−40 to 185 °F −40 to 85 °C	−58 to 248 °F −50 to 120 °C

A.2.4 Hardware and software failure mode

The Rosemount 644 features software driven alarm diagnostics. The independent circuit is designed to provide backup alarm output if the microprocessor software fails. The alarm directions (HIGH/LO) are user-selectable using the failure mode switch. If failure occurs, the position of the switch determines the direction in which the output is driven (HI or LO). The switch feeds into the digital-to-analog (D/A) converter, which drives the proper alarm output even if the microprocessor fails. The values at which the transmitter drives its output in failure mode depends on whether it is configured to standard, custom, or NAMUR-compliant (NAMUR recommendation NE 43, June 1997) operation. Table A-1 shows the alarm ranges available for the device to be configured to.

Table A-1. Available Alarm Range[1]

	Standard	NAMUR- NE 43 Compliant
Linear Output:	$3.9 \leq I^{[2]} \leq 20.5$	$3.8 \leq I \leq 20.5$
Fail High:	$21 \leq I \leq 23$	$21 \leq I \leq 23$
Fail Low:	$3.5 \leq I \leq 3.75$	$3.5 \leq I \leq 3.6$

1. Measured in milliamperes.
2. I = Process Variable (current output).

A.2.5 Custom alarm and saturation level

Custom factory configuration of alarm and saturation level is available with option code C1 for valid values. These values can also be configured in the field using a Field Communicator.

A.2.6 Turn-on time

Performance within specifications in less than 5.0 seconds after power is applied, when damping value is set to 0 seconds.

A.2.7 Transient protection

The Rosemount 470 prevents damage from transients induced by lightning, welding, or heavy electrical equipment. For more information, refer to the Rosemount 470 Product Data Sheet (document number 00813-0100-4191).

A.2.8 Accuracy

Table A-2. Rosemount 644 Input Options and Accuracy

Sensor options	Sensor reference	Input ranges		Recommended Min. Span[1]		Digital accuracy[2]		D/A accuracy[3]
2-, 3-, 4-wire RTDs		°C	°F	°C	°F	°C	°F	
Pt 100 (α = 0.00385)	IEC 751	−200 to 850	−328 to 1562	10	18	± 0.15	± 0.27	±0.03% of span
Pt 200 (α = 0.00385)	IEC 751	−200 to 850	−328 to 1562	10	18	± 0.15	± 0.27	±0.03% of span
Pt 500 (α = 0.00385)	IEC 751	−200 to 850	−328 to 1562	10	18	± 0.19	± 0.34	±0.03% of span
Pt 1000 (α = 0.00385)	IEC 751	−200 to 300	−328 to 572	10	18	± 0.19	± 0.34	±0.03% of span
Pt 100 (α = 0.003916)	JIS 1604	−200 to 645	−328 to 1193	10	18	± 0.15	± 0.27	±0.03% of span
Pt 200 (α = 0.003916)	JIS 1604	−200 to 645	−328 to 1193	10	18	± 0.27	± 0.49	±0.03% of span
Ni 120	Edison Curve No. 7	−70 to 300	−94 to 572	10	18	± 0.15	± 0.27	±0.03% of span
Cu 10	Edison Copper Winding No. 15	−50 to 250	−58 to 482	10	18	±1.40	± 2.52	±0.03% of span
Pt 50 (α = 0.00391)	GOST 6651-94	−200 to 550	−328 to 1022	10	18	± 0.30	± 0.54	±0.03% of span
Pt 100 (α = 0.00391)	GOST 6651-94	−200 to 550	−328 to 1022	10	18	± 0.15	± 0.27	±0.03% of span
Cu 50 (α = 0.00426)	GOST 6651-94	−50 to 200	−58 to 392	10	18	±1.34	± 2.41	±0.03% of span
Cu 50 (α = 0.00428)	GOST 6651-94	−185 to 200	−301 to 392	10	18	±1.34	± 2.41	±0.03% of span
Cu 100 (α = 0.00426)	GOST 6651-94	−50 to 200	−58 to 392	10	18	±0.67	± 1.20	±0.03% of span
Cu 100 (α = 0.00428)	GOST 6651-94	−185 to 200	−301 to 392	10	18	±0.67	± 1.20	±0.03% of span
Thermocouples[4]								
Type B[5]	NIST Monograph 175, IEC 584	100 to 1820	212 to 3308	25	45	± 0.77	± 1.39	±0.03% of span
Type E	NIST Monograph 175, IEC 584	−50 to 1000	−58 to 1832	25	45	± 0.20	± 0.36	±0.03% of span

Table A-2. Rosemount 644 Input Options and Accuracy

Sensor options	Sensor reference	Input ranges		Recommended Min. Span[1]		Digital accuracy[2]		D/A accuracy[3]
Type J	NIST Monograph 175, IEC 584	−180 to 760	−292 to 1400	25	45	± 0.35	± 0.63	±0.03% of span
Type K[6]	NIST Monograph 175, IEC 584	−180 to 1372	−292 to 2501	25	45	± 0.50	± 0.90	±0.03% of span
Type N	NIST Monograph 175, IEC 584	−200 to 1300	−328 to 2372	25	45	± 0.50	± 0.90	±0.03% of span
Type R	NIST Monograph 175, IEC 584	0 to 1768	32 to 3214	25	45	± 0.75	± 1.35	±0.03% of span
Type S	NIST Monograph 175, IEC 584	0 to 1768	32 to 3214	25	45	± 0.70	± 1.26	±0.03% of span
Type T	NIST Monograph 175, IEC 584	−200 to 400	−328 to 752	25	45	± 0.35	± 0.63	±0.03% of span
DIN Type L	DIN 43710	−200 to 900	−328 to 1652	25	45	± 0.35	± 0.63	±0.03% of span
DIN Type U	DIN 43710	−200 to 900	−328 to 1112	25	45	± 0.35	± 0.63	±0.03% of span
Type W5Re/W26Re	ASTM E 988-96	0 to 2000	32 to 3632	25	45	± 0.70	± 1.26	±0.03% of span
GOST Type L	GOST R 8.585-2001	−200 to 800	−328 to 1472	25	45	± 1.00	± 1.26	±0.03% of span
Other input types								
Millivolt Input		−10 to 100 mV				±0.015 mV		±0.03% of span
2-, 3-, 4-wire Ohm Input		0 to 2000 ohms				±0.45 ohm		±0.03% of span

1. No minimum or maximum span restrictions within the input ranges. Recommended minimum span will hold noise within accuracy specification with damping at zero seconds.
2. The published digital accuracy applies over the entire sensor input range. Digital output can be accessed by HART or FOUNDATION™ Fieldbus Communications or Rosemount control system.
3. Total analog accuracy is the sum of digital and D/A accuracies. This is not applicable for FOUNDATION Fieldbus.
4. Total digital accuracy for thermocouple measurement: sum of digital accuracy +0.5 °C. (cold junction accuracy).
5. Digital accuracy for NIST Type B T/C is ±3.0 °C (±5.4 °F) from 100 to 300 °C (212 to 572 °F).
6. Digital accuracy for NIST Type K T/C is ±0.70 °C (±1.26 °F) from −180 to −90 °C (−292 to −130 °F).

Accuracy example

When using a Pt 100 (α = 0.00385) sensor input with a 0 to 100 °C span:

- Digital accuracy = ±0.15 °C

- D/A accuracy = ±0.03% of 100 °C or ±0.03 °C

- Total accuracy = ±0.18 °C.

A.3 Dimensional drawings

Figure A-2. Rosemount 644 (DIN A Head Mount)

HART device shown with captivated screw terminals
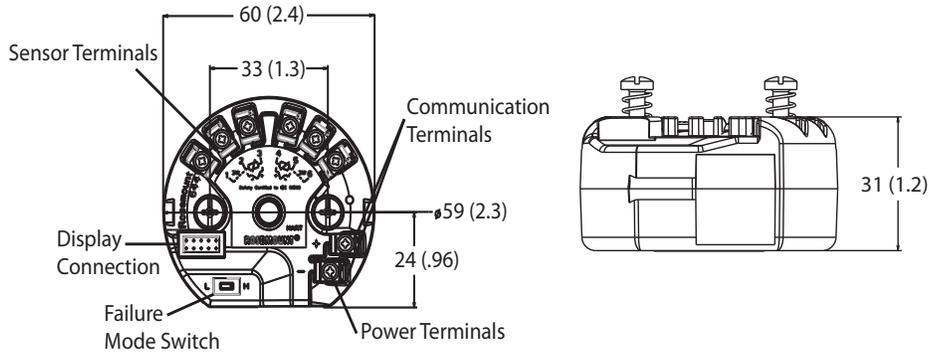
Dimensions are in millimeters (inches)

Figure A-3. Rosemount 644 with LCD Display
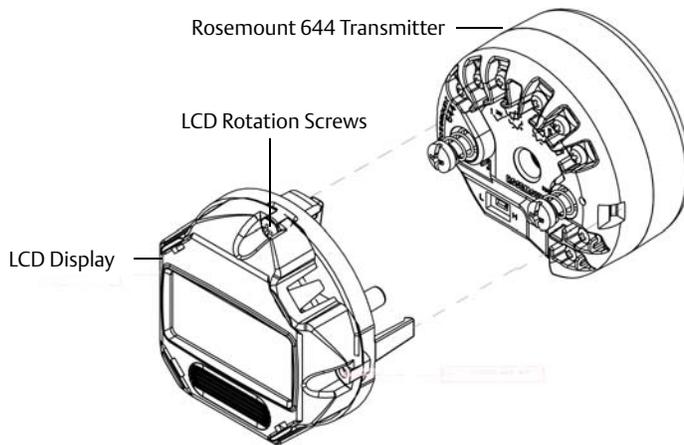
Figure A-4. Rosemount 644 Rail Mount
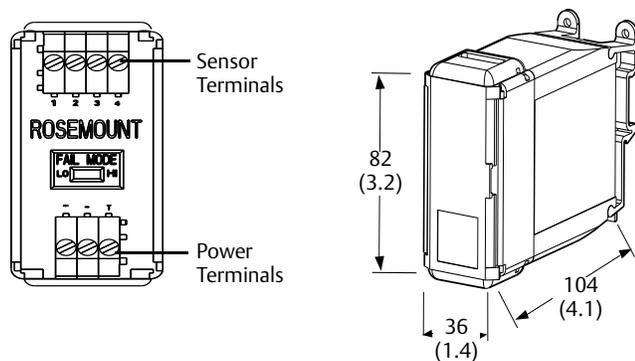
Figure A-5. Mounting Kits for Rosemount 644 Head Mount

Rosemount 644R rail and wall clips

Rosemount 644H rail clips

G-Rail (asymmetric)   **Top hat rail (symmetric)**

G-Rail Grooves

Top Hat Rail Grooves

Screw Holes for Mounting to a Wall

Mounting Hardware

Transmitter

Rail Clip

Mounting Hardware

Transmitter

Rail Clip

Note: Kit (part number 00644-5301-0010) includes mounting hardware and both types of rail kits.

(part number 03044-4103-0001)

A.3.1 LCD display cover

■ 316L SST

■ Glass

Figure A-6. Threaded-Sensor Universal Head (Option code J5, J6, J7 or J8)

112 (4.41)

96 (3.76)

Label

LCD Display

95 (3.74)

Meter Cover

103 (4.03) with LCD Display

75 (2.93)

Standard Cover

316 SST "U" Bolt Mounting, 2-inch Pipe
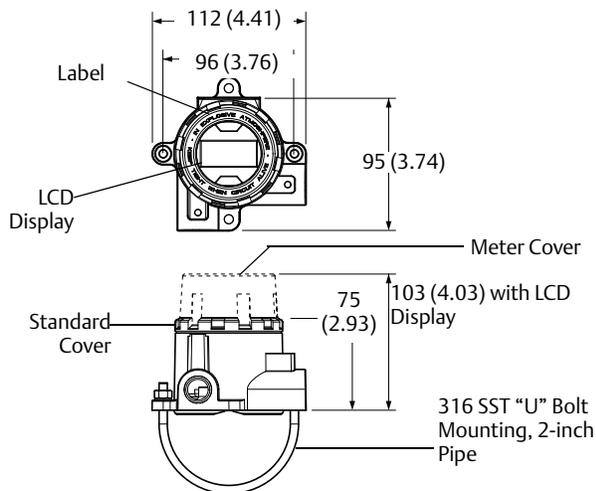
Note: A "U" Bolt is shipped with each universal head unless assembly option XA is ordered.

Figure A-7. DIN Style Sensor Connection Head (Option code R1, R2, R3 or R4)

104 (4.09)

78 (3.07)

128 (5.04) with LCD Display

100 (3.93)
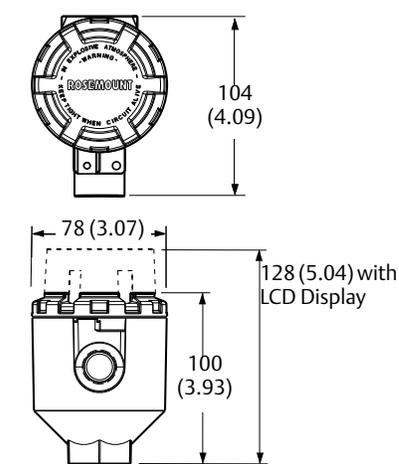
Dimensions are in millimeters (inches).

A.3.2 Stainless steel housing for biotechnology, pharmaceutical industries, and sanitary applications

Figure A-8. Sanitary Housing (Option Codes S1, S2, S3, S4)

Standard cover

Standard Cover
O-Ring
Housing
76.2 (3.0)
33 (1.3)
79.8 (3.14)
27.9 (1.1)
25.4 (1.0)
24.4 (0.96)
44.5 (1.75)
70.0 (2.76)

LCD display cover

LCD Display Cover
O-Ring
Housing
47 (1.85)
61 (2.4)
33 (1.3)
76.2 (3.0)
27.9 (1.1)
74.4 (2.93)
25.4 (1.0)
44.5 (1.75)
70.0 (2.76)
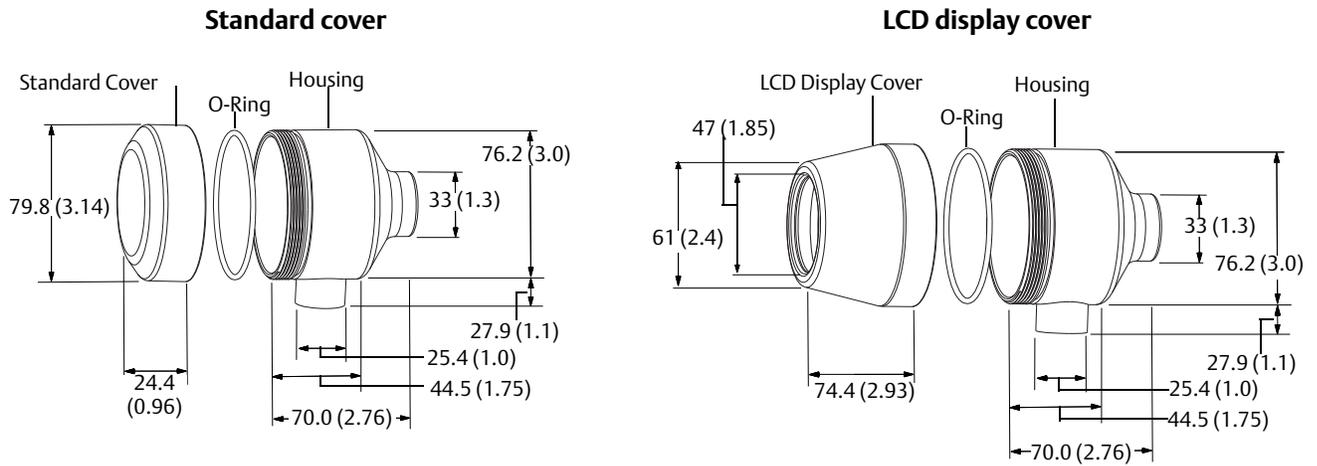
Dimensions are in millimeters (inches).

A.4 Ordering information

The Rosemount 644 is a versatile temperature transmitter that delivers field reliability and advanced accuracy and stability to meet demanding process needs.

Transmitter features include:

- HART/4-20 mA with Selectable Revision 5 and 7 selectable (Option Code A), FOUNDATION Fieldbus (Option Code F) or PROFIBUS® PA (Option Code W)
- DIN A or Rail Mount mounting styles
- Dual Sensor Input (Option Code S)
- SIS SIL 2 Safety Certification (Option Code QT)
- LCD display suite
  - Local Operator Interface (Option Code M4)
  - LCD Display (Option Code M5)
- Advanced Diagnostics (Option Codes DC and DA1)
- Enhanced Transmitter Accuracy and Stability (Option Code P8)
- Transmitter-Sensor Matching (Option Code C2)

Table A-3. Rosemount 644 Temperature Transmitter Ordering Information

★ The Standard offering represents the most common models and options. These options should be selected for best delivery. The Expanded offering is manufactured after receipt of order and is subject to additional delivery lead time.

		● = Available – = Not Available			
Model	**Product description**				
644	Temperature Transmitter				
Transmitter type					
H	DIN A Head Mount - Single Sensor Input				★
R	Rail Mount - Single Sensor Input				★
S	DIN A Head Mount - Dual Sensor Input (HART only)				★
Output		**Head**		**Rail**	
A	4–20 mA with digital signal based on HART protocol	●		●	★
F	FOUNDATION Fieldbus digital signal (includes 2 AI function blocks and Backup Link Active Scheduler)	●		–	★
W	PROFIBUS PA digital signal	●		–	★
Product certifications					
Hazardous Locations Certificates (consult factory for availability)		A	F	W	A
NA	No approval	●	●	●	●	★
E5	FM Explosion-proof; Dust Ignition-proof	●	●	●	–	★
I5	FM Intrinsically Safe; Non-incendive	●	●	●	●	★
K5	FM Explosion-proof; Intrinsically Safe; Non-incendive; Dust Ignition-proof	●	●	●	–	★

Table A-3. Rosemount 644 Temperature Transmitter Ordering Information

★ **The Standard offering represents the most common models and options. These options should be selected for best delivery.**
The Expanded offering is manufactured after receipt of order and is subject to additional delivery lead time.

		● = Available − = Not Available				
NK	IECEx Dust	●	−	−	−	★
KC	FM and CSA Intrinsically Safe and Non-incendive	−	−	−	●	★
KB	FM and CSA: Explosion-proof; Intrinsically Safe; Non-incendive; Dust Ignition-proof	●	−	−	−	★
KD	FM, CSA and ATEX Explosion-proof, Intrinsically Safe	●	●	●		★
I6	CSA Intrinsically Safe	●	●	●	●	★
K6[1]	CSA Explosion-proof; Intrinsically Safe; Non-incendive; Dust Ignition-proof	●	●	●	−	★
I3	China Intrinsic Safety	●	−	−	−	★
E3	China Flameproof	●	●	●	−	★
N3	Chine Type n	●	−	−	−	★
E1	ATEX Flameproof	●	●	●	−	★
N1	ATEX Type n	●	●	●	−	★
NC[2]	ATEX Type n Component	●	●	●	●	★
K1	ATEX Flameproof; Intrinsic Safety; Type n; Dust	●	●	●		★
ND	ATEX Dust Ignition–Proof	●	●	●	−	★
KA	CSA and ATEX: Explosion-proof; Intrinsically Safe; Non-incendive	●	−	−	−	★
I1[2]	ATEX Intrinsic Safety	●	●	●	●	★
E7	IECEx Flameproof	●	●	●	−	★
I7[2]	IECEx Intrinsic Safety	●	●	●	●	★
N7	IECEx Type n	●	●	●	−	★
NG[2]	IECEx Type n Component	●	●	●	●	★
K7	IECEx Flameproof; Intrinsic Safety; Type n; Dust	●	−	−	−	★
I2	INMETRO Intrinsic Safety	●	−	−	−	
I4	TIIS Intrinsic Safety					★
E2	INMETRO Flameproof	●	●	●	−	★

Options

PlantWeb™ control functionality						
A01	FOUNDATION Fieldbus Advanced Control Function Block Suite	−	●	−	−	★
PlantWeb standard diagnostic functionality						
DC	Diagnostics: Hot Backup and Sensor Drift Alert	●	−	−	−	★
PlantWeb advanced diagnostic functionality						
DA1	HART Sensor and Process Diagnostic Suite: Thermocouple Diagnostic and Min/Max Tracking	●	−	−	−	★

Table A-3. Rosemount 644 Temperature Transmitter Ordering Information

★ The Standard offering represents the most common models and options. These options should be selected for best delivery.
The Expanded offering is manufactured after receipt of order and is subject to additional delivery lead time.

		● = Available – = Not Available				
Enclosure options						
J5[3][4]	Universal Head (junction box), aluminum alloy with 50.8 mm (2-in.) SST pipe bracket (M20 entries)	●	●	●	–	★
J6[3]	Universal Head (junction box), aluminum alloy with 50.8 mm (2-in.) SST pipe bracket ($^1/_2$–14 NPT entries)	●	●	●	–	★
R1	Rosemount Connection Head, Aluminum alloy (M20 x 1.5 conduit and entries)	●	●	●	–	★
R2	Rosemount Connection Head, Aluminum alloy ($^1/_2$–14 NPT entries)	●	●	●	–	★
R3	Rosemount Connection Head, cast SST (M20 x 1.5 conduit and entries)	●	●	●	–	★
R4	Rosemount Connection Head, cast SST ($^1/_2$–14 NPT entries)	●	●	●	–	★
J7[3][4]	Universal Head (junction box), cast SST with 50.8 mm (2-in.) SST pipe bracket (M20 entries)	●	●	●	–	
J8[3]	Universal Head (junction box), cast SST with 50.8 mm (2-in.) SST pipe bracket ($^1/_2$–14 NPT entries)	●	●	●	–	
S1	Connection Head, Polished Stainless Steel ($^1/_2$–14 NPT entries)	●	●	●	–	
S2	Connection Head, Polished Stainless Steel ($^1/_2$–14 NPSM entries)	●	●	●	–	
S3	Connection Head, Polished Stainless Steel (M20 x 1.5 conduit and entries)	●	●	●	–	
S4	Connection Head, Polished Stainless Steel (M20 x 1.5 conduit entries, M24 x 1.5 head entry)	●	●	●	–	
Display and interface options						
M4	LCD Display with Local Operator Interface	●	–	–	–	★
M5	LCD Display	●	●	●	–	★
Software configuration						
C1	Custom Configuration of Date, Descriptor and Message (Requires CDS with order)	●	●	●	●	★
Enhanced performance						
P8	Enhanced Transmitter Accuracy and Stability	●	–	–	–	★
Alarm level configuration						
A1	NAMUR alarm and saturation levels, high alarm	●	–	–	●	★
CN	NAMUR alarm and saturation levels, low alarm	●	–	–	●	★
C8	Low Alarm (Standard Rosemount Alarm and Saturation Values)	●	–	–	●	★
Line filter						
F5	50 Hz Line Voltage Filter	●	●	●	●	★
F6	60 Hz Line Voltage Filter	●	●	●	●	★
Sensor trim						
C2	Transmitter-Sensor Matching - Trim to Specific Rosemount RTD Calibration Schedule (CVD constants)	●	●	●	●	★

Table A-3. Rosemount 644 Temperature Transmitter Ordering Information

★ The Standard offering represents the most common models and options. These options should be selected for best delivery.
The Expanded offering is manufactured after receipt of order and is subject to additional delivery lead time.

		● = Available − = Not Available				
5-point calibration option						
C4	5-point calibration. *Use option code Q4 to generate a calibration certificate*	●	●	●	●	★
Calibration certificate						
Q4	Calibration certificate. *3-Point calibration with certificate*	●	●	●	●	★
QP	Calibration Certification & Tamper Evident Seal	●	●	●	–	★
Quality certification for safety						
QT	Safety Certified to IEC 61508 with certificate of FMEDA data (HART only)	●	–	–	–	★
External ground						
G1	External ground lug assembly	●	●	●	–	★
Cable gland option						
G2[5]	Cable gland (7.5 mm - 11.99 mm)	●	●	●	–	★
G7	Cable gland, M20 x 1.5, Ex e, Blue Polyamide (5 mm - 9 mm)	●	●	●	–	★
Cover chain option						
G3	Cover chain	●	●	●	–	★
Conduit electrical connector						
GE[6]	M12, 4-pin, Male Connector (eurofast®)	●	●	●	–	★
GM[6]	A size Mini, 4-pin, Male Connector (minifast®)	●	●	●	–	★
External label						
EL	External label for ATEX Intrinsic Safety	●	●	●	–	★
HART revision configuration						
HR7[7]	Configured for HART Revision 7	●	–	–	–	★
Assemble to options						
XA	Sensor Specified Separately and Assembled to Transmitter	●	●	●	–	★
Typical rail mount model number: 644 R A I5 **Typical head mount model number: 644 S A I5 DC DA1 M5 J5**						

1. Requires housing option R2, R4, J6 or J8.

2. Approval not valid if ordered with a housing.

3. Suitable for remote mount configuration.

4. When ordered with XA, 1/2-in. NPT enclosure will come equipped with an M20 adapter with the sensor installed as process ready.

5. Requires housing option J6.

6. Available with Intrinsically Safe approvals only. For FM Intrinsically Safe or non-incendive approval (option code I5), install in accordance with Rosemount drawing 03151-1009 to maintain NEMA® 4X rating.

7. Configures the HART output to HART Revision 7. The device can be field configured to HART Revision 5 if needed.

Note
For additional options (e.g. "K" codes), contact your local Emerson Process Management representative.

Table A-4. Transmitter Accessories

Part description	Part number
Aluminum alloy Universal Head, standard cover—M20 entries	00644-4420-0002
Aluminum alloy Universal Head, meter cover—M20 entries	00644-4420-0102
Aluminum alloy Universal Head, standard cover—$^1/_2$-14 NPT entries	00644-4420-0001
Aluminum alloy Universal Head, meter cover—$^1/_2$-14 NPT entries	00644-4420-0101
LCD Display (includes meter and meter spacer assembly)	00644-4430-0002
LCD Display kit (includes meter and meter spacer assembly, and meter cover)	00644-4430-0001
Ground screw assembly kit	00644-4431-0001
Kit, Hardware for mounting a Rosemount 644H to a DIN rail (includes clips for symmetrical and asymmetrical rails)	00644-5301-0010
Kit, Hardware for retrofitting a Rosemount 644H in an existing threaded sensor connection head (former option code L1)	00644-5321-0010
Kit, 316 U-Bolt for Universal Housing	00644-4423-0001
Universal clip for rail or wall mount	03044-4103-0001
24 inches of symmetric (top hat) rail	03044-4200-0001
24 inches of asymmetric (G) Rail	03044-4201-0001
Ground clamp for symmetric or asymmetric rail	03044-4202-0001
End clamp for symmetric or asymmetric rail	03044-4203-0001
Snap rings kit (used for assembly to a DIN sensor – quantity 12)	00644-4432-0001
SST Universal Head, standard cover—M20 entries	00644-4433-0002
SST Universal Head, meter cover—M20 entries	00644-4433-0102
SST Universal Head, standard cover—$^1/_2$-14 NPT entries	00644-4433-0001
SST Universal Head, meter cover—$^1/_2$-14 NPT entries	00644-4433-0101
Polished SST Connection Head, standard cover—$^1/_2$-14 NPT entries	00079-0312-0011
Polished SST Connection Head, meter cover—$1^1/_2$-14 NPT entries	00079-0312-0111
Polished SST Connection Head, standard cover—$^1/_2$-14 NPSM entries	00079-0312-0022
Polished SST Connection Head, meter cover—$^1/_2$-14 NPSM entries	00079-0312-0122
Polished SST Connection Head, standard cover—M20 x 1.5 entries	00079-0312-0033
Polished SST Connection Head, meter cover—M20 x 1.5 entries	00079-0312-0133
Polished SST Connection Head, standard cover—M20 x 1.5 / M24 x 1.5 entries	00079-0312-0034
Polished SST Connection Head, meter cover—M20 x 1.5 / M24 x 1.5 entries	00079-0312-0134

A.5 Configuration

A.5.1 Transmitter configuration

The transmitter is available with standard configuration settings for HART. The configuration settings may be changed in the field with DeltaV™, with AMS Device Manager, or with any field communicator.

A.5.2 Standard HART Configuration

Unless specified, the transmitter will be shipped as follows:

Sensor Type	RTD, Pt 100 (α=0.00385, 4-wire)
4 mA Value	0 °C
20 mA Value	100 °C
Output	Linear with temperature
Saturation Levels	3.9 / 20.5 mA
Damping	5 seconds
Line Voltage Filter	50 Hz
Alarm	High (21.75 mA)
LCD (when installed)	Engineering Units and mA
Tag	See Custom configuration
HART Revision	5

A.5.3 Tagging

Hardware tag

- 13 characters total
- Tags are located on adhesive labels permanently affixed to the transmitter

Software tag

HART Revision 5

A HART Revision 5 transmitter can store up to eight characters for the HART software tag and defaults to the first eight characters of the hardware tag.

HART Revision 7

A HART Revision 7 transmitter can store the same eight character tag as the Revision 5 but has a additional and separate Long software tag that can be configured for up to 32 characters.

A.5.4 Considerations

Special mounting considerations

See Figure A-5 on page 89 for the special hardware that is available to:

- Mount a Rosemount 644H to a DIN rail. (see Table A-4 on page 95)
- Retrofit a new Rosemount 644H to replace an existing Rosemount 644H Transmitter in an existing threaded sensor connection head. (see Table A-4 on page 95)

External ground screw assembly

The external ground screw assembly can be ordered by specifying code G1 when an enclosure is specified. However, some approvals include the ground screw assembly in the transmitter shipment, hence it is not necessary to order code G1. The table below identifies which approval options include the external ground screw assembly and which do not.

Approval type	External ground screw assembly included?
E5, I1, I2, I5, I6, I7, K5, K6, NA, KB, I3, NG	No–Order option code G1
E1, E2, E3, E4, E7, K7, N1, N7, ND, K1, K2, KA, NK	Yes

Custom configuration

Custom configurations are to be specified when ordering. This configuration must be the same for all sensors. The following table lists the necessary requirements to specify a custom configuration.

	Option code	Requirements/specification
HART	**C1**: Factory Configuration Data (CDS required) Also needs option code: **...DC** **...DC** **...M4 or M5**	**Date**: day/month/year **Descriptor**: 8 alphanumeric characters **Message**: 32 alphanumeric character **Custom Alarm and saturation levels**: Choose custom High and Low Alarm and Saturation levels **Diagnostics Configuration:** **Hot Backup** – Mode, PV **Sensor Drift Alert** - Mode, Limit, Units **Display Configuration:** Choose up to 10 variables to display on the LCD display
	C2:Transmitter – Sensor Matching	The transmitters are designed to accept Callendar-Van Dusen constants from a calibrated RTD. Using these constants, the transmitter generates a custom curve to match the sensor-specific curve. Specify a Series 65, 65, or 78 RTD sensor on the order with a special characterization curve (V or X8Q4 option). These constants will be programmed into the transmitter with this option.
	Q4: Three-Point Calibration with Certificate	Calibration certificate. Three-Point calibration at 0, 50 and 100% with certificate.
	C4: Five-Point Calibration	Will include five-point calibration at 0, 25, 50, 75, and 100% analog and digital output points. Use with Calibration Certificate Q4
	HR7: HART Revision configuration	Your Rosemount 644 device is HART revision selectable. Order the HR7 code to configure your device to operate in HART Revision 7 mode. Your device is also configurable in the field. Refer to the Rosemount 644 Quick Start Guide or Reference Manual for more instructions.

A.6 Specifications and Reference Data for Rosemount 644 HART Head Mount

(Manufacturing date of May 2012 or before)

A.6.1 Functional specifications

Inputs

User-selectable; sensor terminals rated to 42.4 Vdc. See "Accuracy" on page 86 for sensor options.

Output

Single 2-wire device with either 4-20 mA/HART, linear with temperature or input. Device supports both protocol revisions HART 5 and 7.

Isolation

Input/output isolation tested to 600 Vrms.

Local display

The optional five-digit integral LCD Display includes a floating or fixed decimal point. It can also display engineering units (°F, °C, °R, K, W, and mV), mA, and percent of span. The display can be configured to alternate between selected display options. Display settings are preconfigured at the factory according to the standard transmitter configuration. They can be reconfigured in the field using a compliant Field Communicator.

Humidity limits

0–95% relative humidity

Update time

≤ 0.5 seconds

Accuracy (default configuration) PT 100

HART (0-100 °C): ±0.18 °C

A.6.2 Physical specifications

Electrical connections

Model	Power and sensor terminals
Rosemount 644H	Compression screws permanently fixed to terminal block

Field Communicator connections

Communication terminals	
Rosemount 644H	Clips permanently fixed to terminal block

Materials of construction

Electronics housing and terminal block	
Rosemount 644H	GE polyphenylene oxide glass reinforced
Enclosure (Options J5, J6)	
Housing	Low-copper aluminum
Paint	Polyurethane
Cover O-ring	Buna-N

Materials of construction (stainless steel housing for biotechnology, pharmaceutical industries, and sanitary applications)

Housing and Standard Meter Cover

- 316 SST

Cover O-Ring

- Buna-N

Mounting

The Rosemount 644H installs in a connection head or universal head mounted directly on a sensor assembly, apart from a sensor assembly using a universal head, or to a DIN rail using an optional mounting clip.

Special mounting considerations

See Figure A-5 on page 89 for the special hardware that is available to:

- Mount a Rosemount 644H to a DIN rail. (see Figure A-4 on page 88)

- Retrofit a new Rosemount 644H to replace an existing Rosemount 644H Transmitter in an existing threaded sensor connection head.(see Table A-4 on page 95)

Weight

Code	Options	Weight
644H	HART, Head Mount Transmitter	95 g (3.39 oz)
644H	FOUNDATION Fieldbus, Head Mount Transmitter	92 g (3.25 oz)
644H	PROFIBUS PA Head Mount Transmitter	92 g (3.25 oz)
644R	HART, Rail Mount Transmitter	174 g (6.14 oz)
M5	LCD Display	35 g (1.34 oz)
J5, J6	Universal Head, Standard Cover	577 g (20.35 oz)
J5, J6	Universal Head, Meter Cover	667 g (23.53 oz)
J7, J8	SST Universal Head, Std. Cover	1620 g (57.14 oz)
J7, J8	SST Universal Head, Meter Cover	1730 g (61.02 oz)

Weight (stainless steel housing for Biotechnology, Pharmaceutical Industries, and Sanitary Applications)

Code	Standard cover	Meter cover
S1	840 g (27 oz)	995 g (32 oz)
S2	840 g (27 oz)	995 g (32 oz)
S3	840 g (27 oz)	995 g (32 oz)
S4	840 g (27 oz)	995 g (32 oz)

Enclosure ratings (Rosemount 644H)

All available enclosures are Type 4X, IP66, and IP68.

Sanitary housing surface

Surface finish is polished to 32 RMA. Laser etched product marking on housing and standard covers.

A.6.3 Performance specifications

EMC (ElectroMagnetic Compatibility)
NAMUR NE 21 Standard

The Rosemount 644H HART meets the requirements for NAMUR NE 21 Rating.

Susceptibility	Parameter	Influence
		HART
ESD	• 6 kV contact discharge • 8 kV air discharge	None
Radiated	• 80 – 1000 MHz at 10 V/m AM	< 1.0%
Burst	• 1 kV for I.O.	None
Surge	• 0.5 kV line–line • 1 kV line–ground (I.O. tool)	None
Conducted	• 100 kHz to 80 MHz at 10 V	< 1.0%

CE electromagnetic compatibility compliance testing

The Rosemount 644 is compliant with Directive 2004/108/EC. Meets the criteria under IEC 61326:2006

Power supply effect

Less than ±0.005% of span per volt

Stability

RTDs and thermocouples have a stability of ±0.15% of output reading or 0.15 °C (whichever is greater) for 24 months

Self calibration

The analog-to-digital measurement circuitry automatically self-calibrates for each temperature update by comparing the dynamic measurement to extremely stable and accurate internal reference elements.

Vibration effect

The Rosemount 644 is tested to the following specifications with no effect on performance per IEC 60770-1, 1999:

Frequency	Vibration
10 to 60 Hz	0.21 mm displacement
60 to 2000 Hz	3 g peak acceleration

Sensor connections

Rosemount 644₂₄₄EH Sensor connections diagram
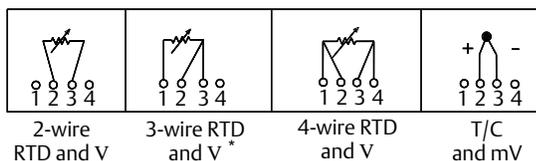
| 2-wire RTD and V | 3-wire RTD and V * | 4-wire RTD and V | T/C and mV |

* Emerson Process Management provides 4-wire sensors for all single element RTDs. You can use these RTDs in 3-wire configurations by leaving the unneeded leads disconnected and insulated with electrical tape.

Tagging

   Hardware

- 13 characters total
- Tags are adhesive labels affixed to the side of the transmitter
- Permanently attached to transmitter
- Character height is $1/16$-in (1.6 mm)

   Software

- The transmitter can store up to eight characters for the HART protocol
- Order software tag with C1 option code

A.6.4 4–20 mA / HART Specifications

Power supply

External power supply required. Transmitters operate on 12.0 to 42.4 Vdc transmitter terminal voltage (with 250 ohm load, 18.1 Vdc power supply voltage is required). Transmitter power terminals rated to 42.4 Vdc.

Load limitations

Maximum load = 40.8 X (supply voltage - 12.0)[1]
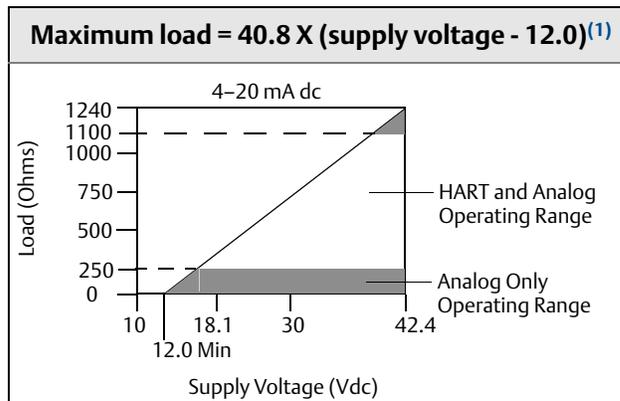
1. Without transient protection (optional).

Note
HART Communication requires a loop resistance between 250 and 1100 ohms. Do not communicate with the transmitter when power is below 12 Vdc at the transmitter terminals.

Temperature limits

	Operating limit	Storage limit
With LCD display[1]	−40 to 185 °F −40 to 85 °C	−50 to 185 °F −45 to 85 °C
Without LCD display	−40 to 185 °F −40 to 85 °C	−60 to 248 °F −50 to 120 °C

1. LCD display may not be readable and display updates will be slower at temperatures below -4 °F (-20 °C).

Hardware and software failure mode

The Rosemount 644 features software driven alarm diagnostics and an independent circuit which is designed to provide backup alarm output if the microprocessor software fails. The alarm direction (HI/LO) is user-selectable using the failure mode switch. If failure occurs, the position of the switch determines the direction in which the output is driven (HI or LO). The switch feeds into the digital-to-analog (D/A) converter, which drives the proper alarm output even if the microprocessor fails. The values at which the transmitter software drives its output in failure mode depends on whether it is configured to standard, custom, or NAMUR-compliant (NAMUR recommendation NE 43, June 1997) operation. Table A-1 on page 86 shows the configuration alarm ranges.

	Standard	**NAMUR- NE 43 compliant**
Linear Output:	$3.9 \leq I^{(1)} \leq 20.5$	$3.8 \leq I \leq 20.5$
Fail High:	$21.75 \leq I \leq 23$	$21.5 \leq I \leq 23$
Fail Low:	$3.5 \leq I \leq 3.75$	$3.5 \leq I \leq 3.6$

1.   I = Process Variable (current output).

Custom alarm and saturation level

Custom factory configuration of alarm and saturation level is available with option code C1 for valid values. These values can also be configured in the field using a Field Communicator.

Turn-on time

Performance within specifications in less than 5.0 seconds after power is applied, when damping value is set to 0 seconds.

Transient protection

The Rosemount 470 prevents damage from transients induced by lightning, welding, or heavy electrical equipment. For more information, refer to the Rosemount 470 Product Data Sheet (document number 00813-0100-4191).

Configuration

For standard and custom configuration information, see .

Appendix B   Product Certifications

B.1 Approved manufacturing locations

Emerson Process Management Rosemount Division. – Chanhassen, MN

Emerson Process Management Asia Pacific Limited – Singapore

Emerson Process Management GmbH & Co. - Karlstein, Germany

Emerson Process Management (India) Private Ltd. – Mumbai, India

Emerson Process Management Brazil - Sorocaba, Brazil

Emerson Process Management, Dubai - Emerson FZE

Beijing Rosemount Far East Instrument Co., Limited. - Beijing, China

B.2 European Union Directive Information

The EC declaration of conformity for all applicable European directives for this product can be found at www.EmersonProcess.com.

B.2.1 Ordinary Location Certification from FM Approvals

As standard, the transmitter has been examined and tested to determine that the design meets basic electrical, mechanical, and fire protection requirements by FM Approvals, a nationally recognized testing laboratory (NRTL) as accredited by the Federal Occupational Safety and Health Administration (OSHA).

B.2.2 Hazardous Locations Certifications

North American Certifications

FM Approvals

I5 Intrinsically Safe and Non-Incendive

Certificate: 3044581

Standards: FM Class 3600 – 1998, FM Class 3610 – 2010, FM Class 3611 – 2004,
FM Class 3810 – 2005, ANSI/NEMA® 250 - 2003

Markings: (without enclosure):
INT. SAFE CL I, GP ABCD, T4
IS CL I Zone 0, AEX ia IIC; T4 Ga
NI CL I, DIV.2, GP ABCD
INSTALL PER DRAWINGS 00644-2071

Markings: (with enclosure):
IS CL I,II,III, GP ABCDEFG T4
IS CL I Zone 0, AEX ia IIC; T4
NI CL I, DIV.2, GP ABCD
INSTALL PER DRAWINGS 00644-2071
ENCLOSURE TYPE 4X

Special Conditions for Safe Use (X):

1. The surface resistivity of the non-metallic enclosure materials is greater than one gigaohm. Care must be taken to avoid electrostatic charge build-up. Do not rub or cleaned with solvents or a dry cloth.

2. The Model 644 optional enclosures may contain aluminum and are considered a potential risk of ignition by impact or friction. Care must be taken into account during installation and use to prevent impact and friction.

E5 Explosion-Proof and Dust Ignition Proof

Certificate: 3006278

Standards: FM Class 3600 – 1998, FM Class 3615 – 2006, FM Class 3810 – 2005, ANSI/NEMA 250 - 2003

Markings:EXPLOSIONPROOF FOR CL. I, DIV. 1, GP BCD
DUST-IGNITIONPROOF FOR CL. II & III, DIV. 1, GP EFG
NON-INCENDIVE FOR CL. I, DIV 2, GP ABCD
WHEN INSTALLED PER ROSEMOUNT DRAWING 00644-1049
CONDUIT SEAL NOT REQUIRED;
ENCLOSURE TYPE 4X

CSA International

I6 Intrinsically Safe

Certificate: 1091070

Standards: CSA Std. C22.2 No. 142 – M1987, CSA Std. C22.2 No. 157 – 92, ANSI/ISA 12.27.02-2003

Markings: (without enclosure):
Ex ia
CLASS I (GRPS A, B, C, D) CLASS I, ZONE 0, IIC
SUITABLE FOR CLASS I DIV 2, GROUPS A, B, C, D
INSTALL PER DRAWING 00644-2072.

Markings: (with enclosure):
Ex ia
CLASS I, GRPS A,B,C,D, T4/T6, CLASS I, ZONE 0, IIC
WHEN INSTALL PER DRAWING 00644-1064 or
0644-2072
SUITABLE CLASS I DIV 2, WITH NON-INCENDIVE
OUTPUT WHEN INSTALL PER DRAWING
00644-2072
ENCLOSURE TYPE 4X

K6 Explosion-Proof, Dust Ignition Proof, Intrinsically Safe and
Suitable for Class I Division 2

Certificate: 1091070

Standards: CSA Std. C22.2 No. 142 – M1987, CSA Std. C22.2
No. 30 – M1986, CSA Std. C22.2 No. 213 –
M1987, ANSI/ISA 12.27.02-2003

Markings: CL I, DIV. 1, GRPS. B,C,D;
DUST-IGNITION PROOF, CL II, GRPS E,F, CL. III;
SUITABLE FOR CL I, DIV. 2, GROUPS A,B,C,D
INSTALL PER DRAWING 00644-1059
ENCLOSURE TYPE 4X; CONDUIT SEAL NOT
REQUIRED,

Ex ia
INTRINSICALLY SAFE, CLASS I, GROUPS A, B, C, D,
T4/T5/T6CLASS I, ZONE 0, IIC. INSTALL PER
DRAWING 00644-1064 or 00644-2072.
SUITABLE FOR CLASS I DIV 2, GROUPS A, B, C, D
INSTALL PER DRAWING 00644-2072.

European Certifications

I1 ATEX Intrinsic Safety

Certificate: Baseefa 12ATEX0101X

Standards: IEC 60079-0: 2011, EN60079-11: 2007
Markings: ⟨Ex⟩ II 1 G, Ex ia IIC T6...T4 Ga;
See Certificate (Table)
CE 1180

Special Conditions for Safe Use (X):

1. The apparatus must be installed in an enclosure which
affords a degree of protection of at least IP20.

2. Non-metallic enclosures must have a surface resistance of
less than 1Gohm.
Light alloy or zirconium enclosures must be protected from
impact and friction when installed.

Table B-1. Input Parameters

Loop	
U_i = 30 V	
I_i = 150 mA	Ta < 60°
= 170 mA	Ta < 70°
= 190 mA	Ta < 80°
P_i = 0.67 W	T6 (-60 °C ≤ Ta ≤ 40 °C), T5 (-60 °C ≤ Ta ≤ 50 °C)
= 0.8 W	T5 (-60 °C ≤ Ta ≤ 40 °C), T4 (-60 °C ≤ Ta ≤ 80 °C)

Table B-1. Input Parameters

C_i = 3.3 nF	
L_i = 0	
Sensor	
U_O = 13.6 V	
I_O = 80 mA	
P_O = 80 mW	
C_i = 0.44 nF	C_O = 0.816 µF Group IIC
	C_O = 5.196 µF Group IIB
	C_O = 18.596 µF Group IIA
L_i = 0	L_O = 5.79 mH Group IIC
	L_O = 23.4 mH Group IIB
	L_O = 48.06 mH Group IIA

N1 ATEX Type n (with enclosure)

Certification: BAS 00ATEX3145

Standards: EN 60079-0: 2006, EN60079-15: 2005
Markings: ⟨Ex⟩ II 3 G, Ex nA IIC T5 Gc (-40 °C ≤ Ta ≤
70 °C)

Specific Condition for Safe Use (X):

1. The apparatus is not capable of withstanding the 500 V
insulation test required by Clause 6.8.1 of EN
60079-15:2005. This must be taken into account when
installing the apparatus.

NC ATEX Type n (without enclosure)

Certificate: Baseefa12ATEX0102U

Standards: IEC 60079-0: 2011, EN60079-15: 2005
Markings: ⟨Ex⟩ II 3 G, Ex nA IIC T6...T5 Gc
V_{max} = 45 volts max

Temperature limitations – T6 (-60 °C ≤ Ta ≤ 40 °C),
T5 (-60 °C ≤ Ta ≤ 85 °C)

Specific Condition for Safe Use (X):

1. The component must be installed in a suitably certified
enclosure such that it is afforded a degree of protection of at
least IP54 in accordance with IEC 60529, IEC 60079-0 & EN
60079-15.

E1 ATEX Flameproof

Certification: KEMA 99ATEX8715X

Standards: EN60079-0: 2006, EN60079-1: 2007

Markings: ⟨Ex⟩ II 2 G, Ex d IIC T6 Gb (-50°C ≤ Ta ≤ 65°C)
CE 1180

Specific Condition for Safe Use (X):

1. For information on the dimensions of the flameproof joints
the manufacture shall be contacted.

ND   ATEX Dust

Certification: KEMA 99ATEX8715X

Standards: EN 61241-0:2006, EN 61241-1:2004
Markings: ⟨Ex⟩ II 1 D, Ex tD A20 IP66 T95°C
CE 1180

Special Conditions for Safe Use (X): None

IECEx Certifications

I7   IECEX Intrinsic Safety

Certificate: IECEx BAS 12.0069X

Standards: IEC 60079-0: 2011, IEC 60079-11: 2007

Markings: Ex ia IIC T6...T4 Ga
See Certificate (Table)

Special Conditions for Safe Use (X):

1. The apparatus must be installed in an enclosure which affords a degree of protection of at least IP20

2. Non-metallic enclosures must have a surface resistance of less than 1Gohm

3. Light alloy or zirconium enclosures must be protected from impact and friction when installed

N7   IECEX Type n (with enclosure)

Certification: IECEx BAS 07.0055

Standards: IEC 60079-0: 2004, EN60079-15: 2005

Markings: Ex nL IIC T5 Gc (-40 °C ≤ Ta ≤ 70 °C)

NG   IECEX Type n (without enclosure)

Certificate: IECEx BAS 12.0070U

Standards: IEC 60079-0: 2011, IEC 60079-15: 2010
Markings: Ex nA IIC T6...T5 Gc
Vmax = 45 volts max

Temperature limitations – T6 (-60 °C ≤ Ta ≤ 40 °C), T5 (-60 °C ≤ Ta ≤ 85 °C)

Specific Condition for Safe Use (X):

1. The component must be installed in a suitable certified enclosure such that it is afforded a degree of protection of at least IP54 in accordance with IEC 60529, IEC 600790, and IEC 60079-15.

E7   IECEx Flameproof

Certification: IECEx KEM 09.0015X

Standards: IEC 60079-0: 2004, IEC 60079-1: 2007

Markings: Ex d IIC T6 Gb (-40 °C ≤ Ta ≤ 65 °C)

Specific Condition for Safe Use (X):

1. For information on the dimensions of the flameproof joints the manufacture shall be contacted.

NK   IECEX Dust

Certification: IECEx KEM 09.0015X

Standards: IEC 61241-0:2004, IEC 61241-1:2004

Markings: Ex tD A20 IP66 T95°C

Special Conditions for Safe Use (X): None

Combinations of certifications

Stainless steel certification tag is provided when optional approval is specified. Once a device labeled with multiple approval types is installed, it should not be reinstalled using any other approval types. Permanently mark the approval label to distinguish it from unused approval types.

K1   Combination of E1, I1, N1, and ND

K5   Combination of E5 and I5

K6   Combination of E6 and I6

K7   Combination of E7, I7, NK, and N7

KA   Combination of E1, I1, E6, and I6

KB   Combination of E5, I5, I6, and E6

KC   Combination of E5, E1, I5, and I1

KD   Combination of E5, I5, E6, I6, E1, and I1

B.2.3 Other certifications

Shipboard

SBS   American Bureau of Shipping (ABS)

Certificate: 00-HS145383/1-PDA

Standards: ABS Rules:2008 Steel Vessels Rules 1-1-4/7.7, 4-8-3/1.7

Intended Service: Measurement of Pressure, Flow and Level for Liquid, Gas and Vapor Applications on ABS Classed Vessels, Marine and Offshore Installations

B.3 Rosemount 644 with FOUNDATION Fieldbus and Profibus PA

B.3.1 European Union Directive Information

The EC declaration of conformity for all applicable European directives for this product can be found at www.EmersonProcess.com.

B.3.2 Hazardous Locations Certificates

North American Certifications

Factory Mutual (FM) Approvals

I5   FM Intrinsically Safe

Intrinsically Safe FISCO for use in Class I, II, III, Division 1,

Groups A, B, C, D, E, F, and G; when installed per control drawing 00644-2075.
Temperature Code: T4A (T_{amb} = – 50 °C to 60 °C).
Nonincendive for use in Class I, Division 2, Groups A, B, C, and D.
Temperature Code: T5 (T_{amb} = – 50 °C to 85 °C);
T6 (T_{amb} = – 50 °C to 70 °C) when installed per Rosemount control drawing 00644-2075

E5 FM Explosion Proof

Explosion Proof for Class I, Division 1, Groups B, C, and D.

Nonincendive for use in Class 1, Division 2, Groups A, B, C, and D.

Temperature Code: T5 (T_{amb} = – 50 °C to 85 °C)
When installed per Rosemount control drawing 00644-1049

Dust Ignition Proof for Class II/III, Division 1, Groups E, F, G.
Temperature Code: T5 (T_a = – 50 °C to 85°C)

When installed per Rosemount drawing 00644-1049.
(J5, J6, and J8 options only.)

Canadian Standards Association (CSA) Approvals

I6 CSA Intrinsically Safe

Intrinsically Safe and FISCO for Class I, Division 1, groups A, B, C, and D when connected per Rosemount drawing 00644-2076.

Temperature code: T4 (T_{amb} = – 50 °C to 60 °C);

Suitable for Class I, Division 2, groups A, B, C, and D (must be installed in a suitable enclosure)

K6 CSA Intrinsically Safe, Explosion-proof

Includes Intrinsically Safe "I6" and Explosion-Proof for Class I, Division 1, groups B, C, and D.
Dust-Ignition Proof for Class II, Division 1, Groups E, F, and G. Dust-Ignition Proof for Class III, Division 1 Seal not required.
CSA Enclosure Type 4X

Temperature Code: T4 (T_{amb} = – 50 °C to 60 °C);
T5 (T_{amb} = – 50 °C to 85°C)

Note
K6 is only available with 644H option code J6.

B.3.3 European Certifications

E1 ATEX Flame-Proof

Certificate: KEMA99ATEX8715X

ATEX Marking: ⟨Ex⟩ II 2 G
CE 1180
Ex d IIC T6 (–50 °C ≤ T_{amb} ≤ 65 °C)
U_i = 32 Vdc

Special Conditions for Safe Use (X):

1. For information on the dimensions of the flameproof joints the manufacturer shall be contacted.

I1 ATEX Intrinsic Safety

Certificate: Baseefa03ATEX0499X

ATEX Marking: ⟨Ex⟩ II 1 G
CE 1180
Ex ia IIC T4 (-50 °C ≤ T_{amb} ≤ 60 °C)

Table B-2. Entity Parameters

I.S. Loop/power terminals
U_i = 30 V
I_i = 300 mA
P_i = 1.3 W
C_i = 2.1 nF
L_i = 0
FISCO loop/power terminals
U_i = 17.5 V
I_i = 380 mA
P_i = 5.32 W
C_i = 2.1 nF
L_i = 0
Sensor terminals
U_o = 13.9 V
I_o = 23 mA
P_o = 79 mW
C_i = 7.7 nF
L_i = 0

Specific Condition for Safe Use (X):

1. The apparatus must be installed in an enclosure which affords it a degree of protection of at least IP20.

2. Non-metallic enclosures must have a surface resistance of less than $1 G\Omega$, light alloy or zirconium enclosures must be protected from impact and friction when installed.

N1 ATEX Type n

Certificate: BAS00ATEX3145

ATEX Marking: ⟨Ex⟩ II 3 G
Ex nL IIC T5 (-40 °C ≤ T_{amb} ≤ 70 °C)
Max Input Voltage: U_i = 42.4 Vdc

NC ATEX Type n Component

Certificate: BAS99ATEX3084U

ATEX Marking: ⟨Ex⟩ II 3 G
Ex nL IIC T5 (-40 °C ≤ T_{amb} ≤ 70 °C)
Max Input Voltage: U_i = 42.4 Vdc

Note
The equipment must be installed in an enclosure meeting the requirements of IP54 and the requirements of the impact tests described in EN60079-15.

ND ATEX Dust Ignition-Proof

Certificate: KEMA99ATEX8715X

ATEX Marking: ⟨Ex⟩ II 1 D
Ex tD A20 T95°C (-50 °C ≤ T_{amb} ≤ 85 °C)
CE 1180
IP66

Specific Condition for Safe Use (X):

1. For information on the dimensions of the flameproof joints the manufacturer shall be contacted.

B.3.4 IECEx Certifications

E7 IECEx Flameproof and Dust

Certificate: IECEx KEM 09.0015X

Ex d IIC T6 (Flameproof) -40 °C < T_{amb} < 65 °C
Ex tD A20 IP 66 T 95 °C (Dust)
Vmax = 42.4 V

Specific Condition for Safe Use (X):

1. For information on the dimensions of the flameproof joints the manufacturer shall be contacted.

Table B-3. Electrical Data

Transmitter	Sensor
V_{max} = 32 Vdc	U_{max} = 5 Vdc
I_{max} = 24.0 mA	I_{max} = 2.0 mA

I7 IECEx Intrinsic Safety

Certificate: IECEx BAS 07.0053X

Ex ia IIC T4/T5/T6

Table B-4. Temperature Classification

$P_{i\,(W)}$	Temperature class	T_{amb}
1.3	T4	-50 °C to 60 °C
5.32 (FISCO Group IIC)	T4	-60 °C to 60 °C

Special Conditions for Safe Use (X):

1. The apparatus must be installed in an enclosure which affords it a degree of protection of at least IP20.

2. Non-metallic enclosures must have a surface resistance of less than 1 GΩ; light alloy or zirconium enclosures must be protected from impact and friction when installed.

Table B-5. Entity Parameters

Transmitter (I.S.)	Transmitter (FISCO)	Sensor
U_i = 30 Vdc	U_i = 17.5 Vdc	U_o = 13.9 Vdc
I_i = 300 mA	I_i = 380 mA	I_o = 23 mA
P_i = 1.3 W	P_i = 5.32 W	P_o = 79 mW
C_i = 2.1 nF	C_i = 2.1 nF	C_i = 7.7 nF
L_i = 0 mH	L_i = 0 mH	L_i = 0 mH

N7 IECEx Type n

Certificate: IECEx BAS 07.0055

Ex nA nL IIC T5 (-40 °C ≤ T_{amb} ≤ 70 °C)

Table B-6. Electrical Data

Transmitter	Sensor	
	RTD	Thermocouple
U_i = 32 V	U_i = 5 V	U_i = 0

NG IECEx Type n Component

Certificate: IECEx BAS 07.0054U

Ex nA nL IIC T5 (-40 °C ≤ T_{amb} ≤ 75 °C)

Input Parameter: Ui = 32 Vdc

Schedule of Limitations:

The component must be housed in a suitably certified enclosure that provides a degree of protection of at least IP54.

B.3.5 Japanese Certifications

Japanese Industrial Standard (JIS) Approvals

I4 JIS Intrinsic Safety

E4 JIS Explosion Proof

Table B-7. Certificate and Description

Certificate	Description	Approval group	Temp code
C15744	Rosemount 644H with meter and no sensor	Ex d II C	T6
C15745	Rosemount 644H without meter and no sensor	Ex d II C	T6
C15749	Rosemount 644H without meter and with RTD	Ex d II B	T4
C15750	Rosemount 644H without meter and with thermocouple	Ex d II B	T4
C15751	Rosemount 644H with meter and thermocouple	Ex d II B	T4
C15752	Rosemount 644H with meter and RTD	Ex d II B	T4
C15910	Rosemount 644H without meter and with thermocouple	Ex d II B + H2	T4
C15911	Rosemount 644H with meter and thermocouple	Ex d II B + H2	T4
C15912	Rosemount 644H without meter and with RTD	Ex d II B + H2	T4
C15913	Rosemount 644H with meter and RTD	Ex d II B + H2	T4

B.3.6 Combination Approvals

K5 Combination of I5 and E5

B.3.7 Russian GOST Certifications

PPC BA-13006:

0 Ex ia IIC T4/T5/T6

B.3.8 Kazakhstan GOST

Pattern approval Certificate for Measuring Instruments

See Certificate

B.3.9 Ukraine GOST

Pattern Approval for Measuring Instruments

See Certificate

Figure B-1. CSA Intrinsic Safety Installation Drawing 00644-1064, Rev. AB

Figure B-2. CSA Explosion-Proof Installation Drawing 00644-1059, Rev. AH
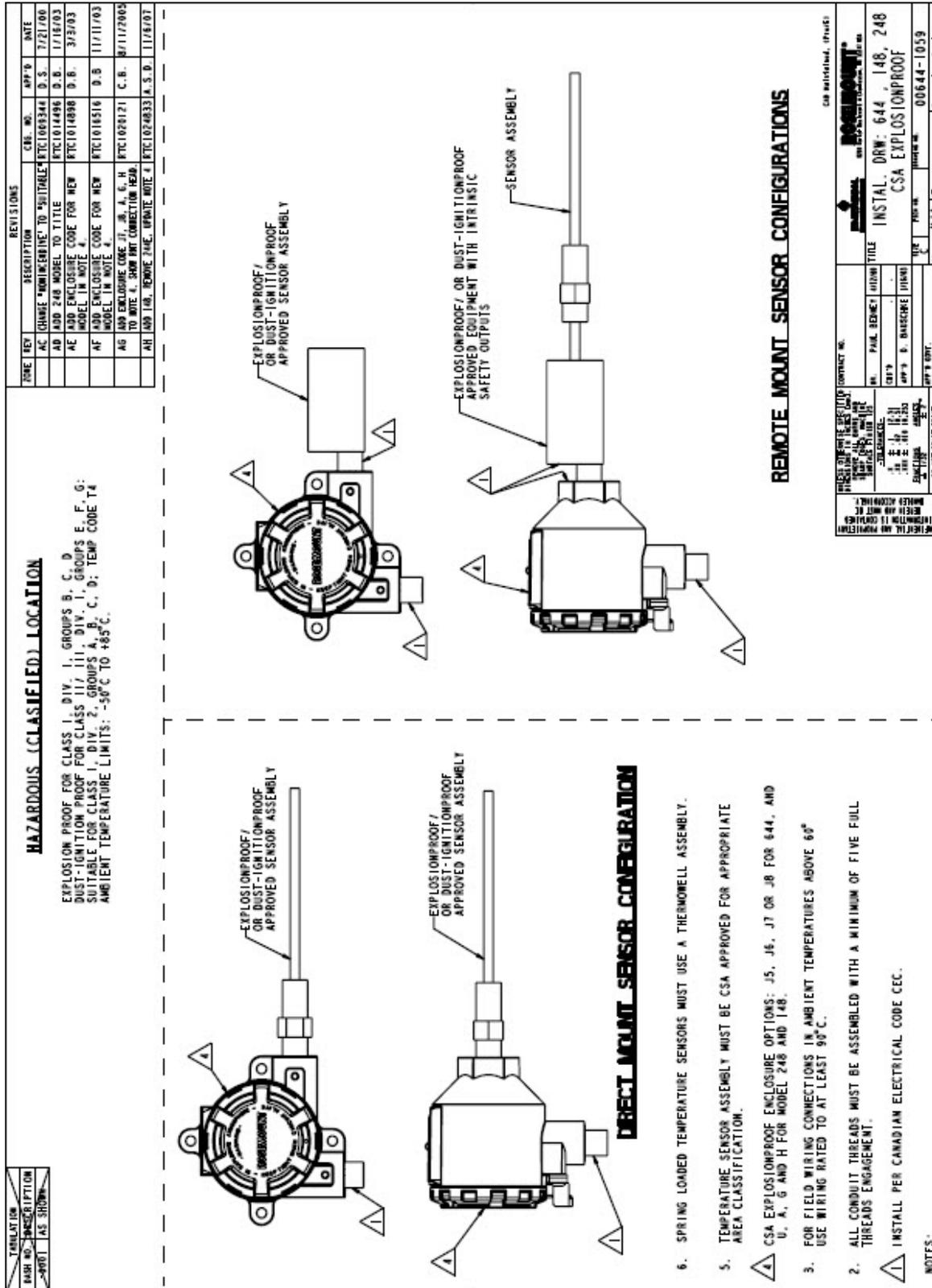
Figure B-3. FM Intrinsic Safety Installation Drawing 00644-0009, Rev. AE Sheet 1 of 2
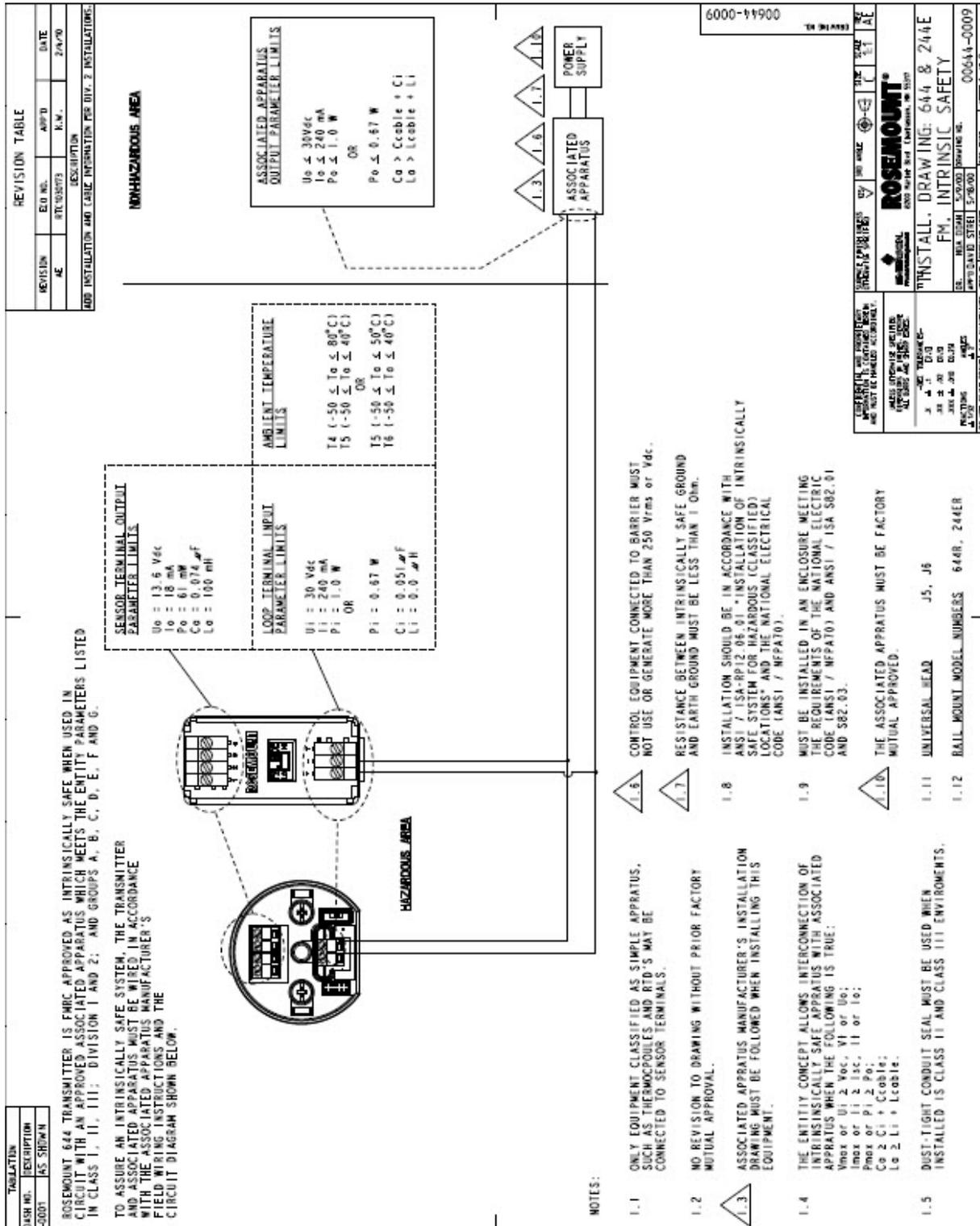
Sheet 2 of 2
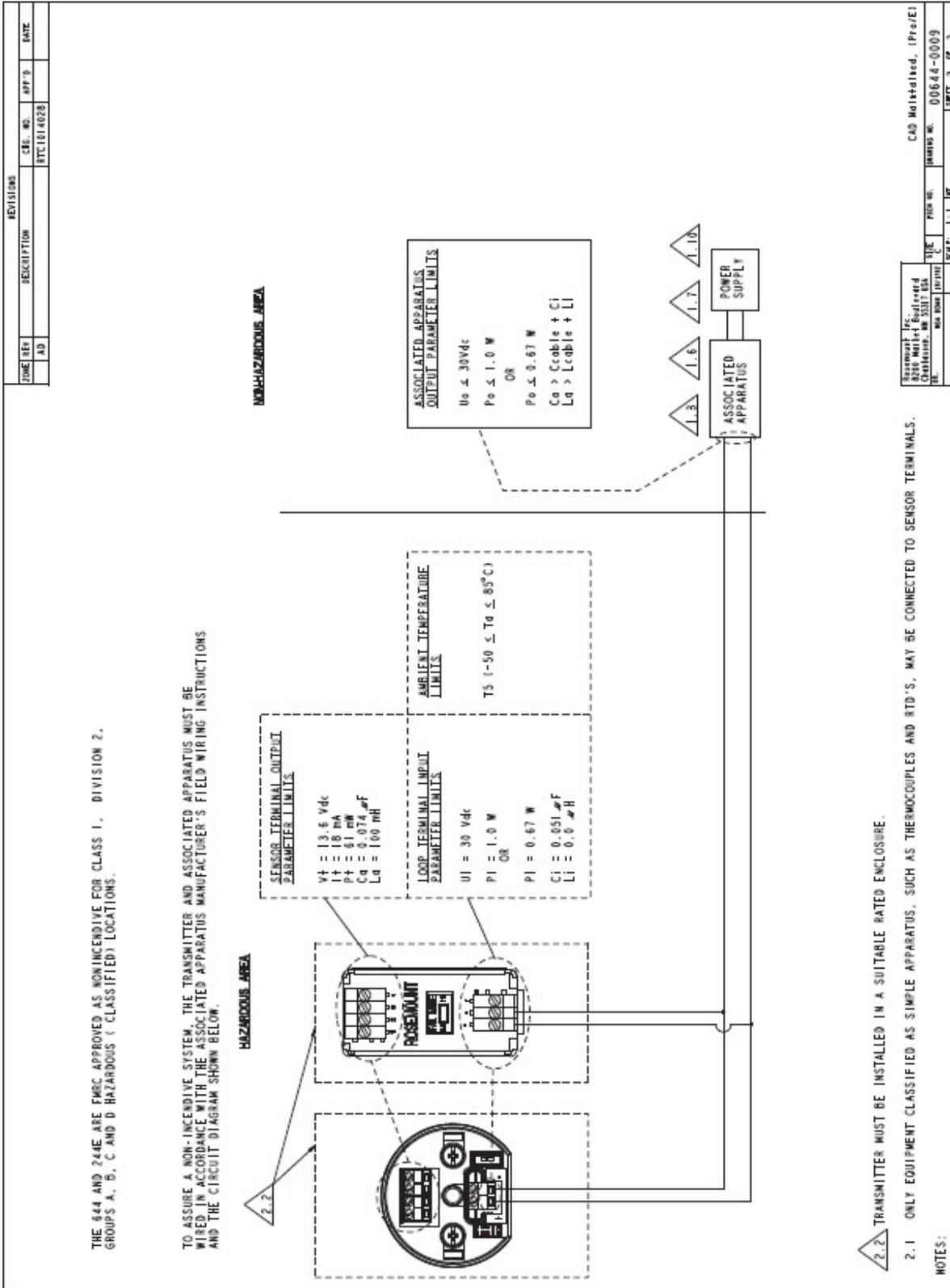
Figure B-4. FM Explosion-Proof Installation Drawing 00644-1049, Rev. AE
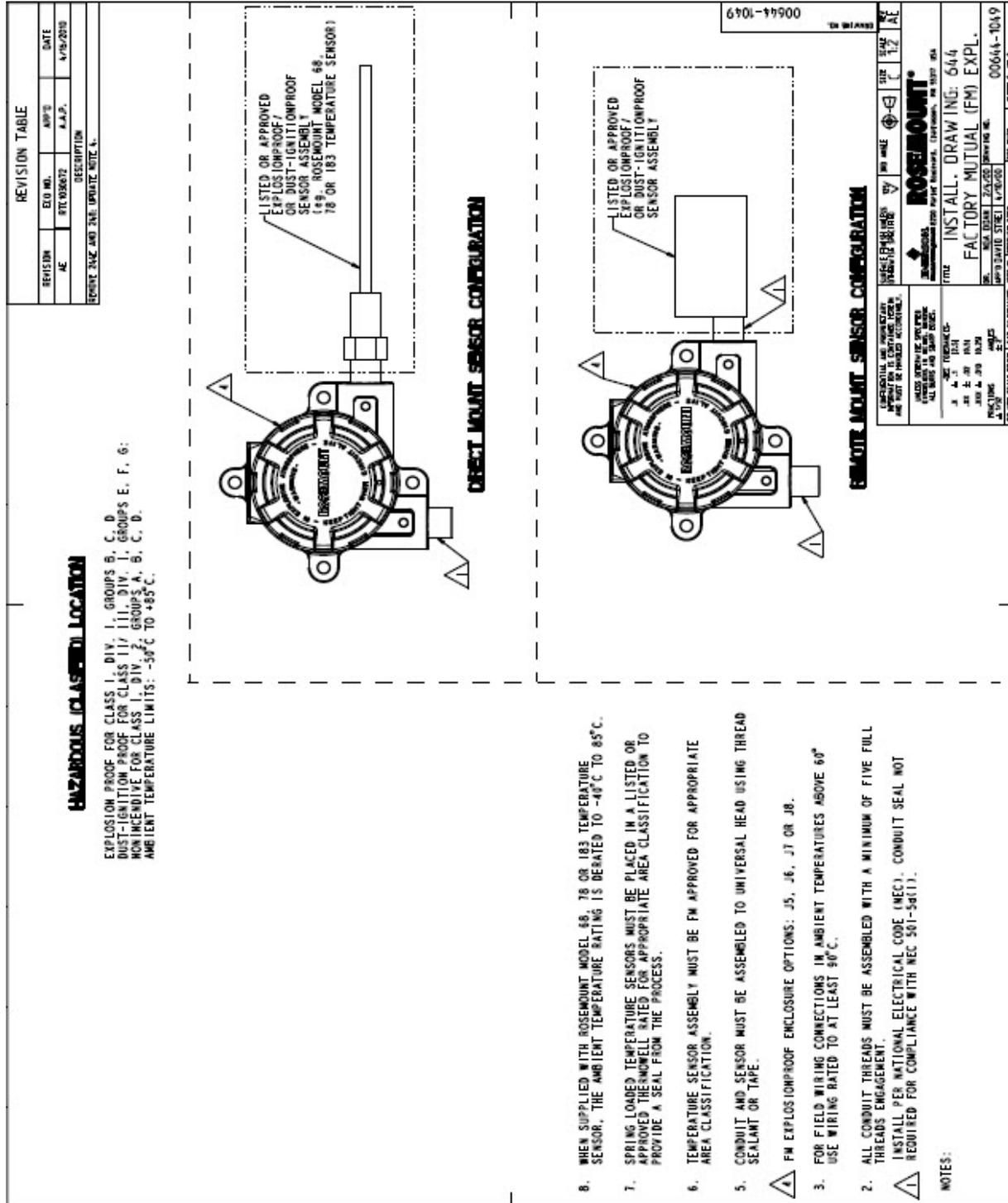
Appendix C   Field Communicator Menu Trees and Fast Keys

C.1   Field Communicator menu trees

Figure C-1. HART Revision 5 Field Communicator Menu Tree - Overview

Active Alerts
1 Good (only if No Alerts)
2 Failed
3 Advisory
4 Maintenance (Fix Soon)

Good (only if No Alerts)
1 No Active Alerts

Failed
1 Invalid Configuration
2 Electronics Failure
3 Calibration Error
4 Sensor Drift Alert Active
5 Sensor 1 Open
6 Sensor 2 Open
7 Sensor 1 Shorted
8 Sensor 2 Shorted
9 Terminal Temp Failure

Advisory
1 Calibration Error

Maintenance
1 Hot Backup Active
2 Sensor Drift Alert Active
3 Sensor 1 Degraded
4 Sensor 2 Degraded
5 Excess EMF
6 Sensor 1 Out of Operating Range
7 Sensor 2 Out of Operating Range
8 Terminal Temp Out of Range
9 Analog Output Saturated
10 Analog Output Fixed

Home
1 Overview
2 Configure
3 Service Tools

Overview
1 Device Status
2 Primary Variable
3 Sensor 1 Temp
4 Sensor 2 Temp
5 Analog Output Value
6 Upper Range Value
7 Lower Range Value
8 Device Information

Device Information
1 Identification
2 Revisions
3 Alarm Type and Security
4 Options Ordered

Identification
1 Tag
2 Model
3 Electronics S/N
4 Final Assembly Num
5 Date
6 Description
7 Message
8 Device Image

Revisions
1 HART Universal Rev
2 Field Device
3 Hardware
4 Software
5 DD Revision

Alarm Type and Security
1 Alarm Direction
2 High Saturation
3 Low Saturation
4 High Alarm
5 Low Alarm
6 Software Write Protect
7 Password Protection*

Options Ordered
1 Dual Sensor Option
2 Hot BU and Sensor Drift
3 O-ring Material
4 T/C Diag & Min/Max

Figure C-2. HART Revision 5 Field Communicator Menu Tree - Configure

Home
1 Overview
2 Configure
3 Service Tools

Configure
1 Guided Setup
2 Manual Setup

Guided Setup
1 Configure Sensors
2 Calibrate Sensors
3 Configure Device
4 Configure Display
5 Config Hot Backup*
6 Config Drift Alert*
7 Diagnostics Suite*

Manual Setup
1 Sensor 1
2 Sensor 2
3 Calculated Output
4 Diagnostics
5 Analog Output
6 Display
7 Device
8 HART
9 Security

Sensor 1
1 Sensor 1 Temp
2 Sensor 1 Type
3 Sensor 1 Connection
4 Engineering Units
5 Damping
6 Serial Number
7 Sensor Limits
8 Sensor Matching-CVD
9 2-Wire Offset

Sensor 2
1 Sensor 2 Temp
2 Sensor 2 Type
3 Sensor 2 Connection
4 Engineering Units
5 Damping
6 Serial Number
7 Sensor Limits
8 Sensor Matching-CVD
9 2-Wire Offset

Calculated Output
1 Differential Temperature*
2 First Good Temperature*
3 Average Temperature*

Diagnostics
1 Hot Backup
2 Sensor Drift Alert
3 Sensor and Process Diagnostics

Analog Output
1 Analog Output Value
2 Percent of Range
3 Primary Variable
4 Param
5 PV Configuration
6 Alarm/Sat Levels

PV Configuration
1 Primary Variable
2 Upper Range Value
3 Lower Range Value
4 Minimum Span

Alarm/Sat Levels
1 Alarm Direction
2 High Alarm
3 High Saturation
4 Low Saturation
5 Low Alarm
6 Config Alarm/Sat Levels

Display
1 Variables Displayed
2 Decimal Places
3 Bar Graph*

Device
1 Device Information
2 Terminal Temp Units
3 Open Sensor Hold Off
4 Noise Rejection

Device Information
1 Tag
2 Date
3 Description
4 Message
5 Final Assembly Num

Noise Rejection
1 AC Power Filter
2 Transient Filter

HART
1 Polling Address
2 HART Universal Rev
3 Change HART Rev
4 Burst Mode Config
5 Variable Mapping

Burst Mode Config
1 Burst Message 1
2 Message 1 Content
3 1st and Trigger Value
4 Second Variable
5 Third Variable
6 Fourth Variable

Security
1 Software Write Protect
2 Local Operator Interface*

Variable Mapping
1 Primary Variable
2 Second Variable
3 Third Variable
4 Fourth Variable
5 Re-Map Variables

Figure C-3. HART Revision 5 Field Communicator Menu Tree – Service Tools

Good (only if No Alerts)
1 No Active Alerts

Failed
1 Invalid Configuration
2 Electronics Failure
3 Calibration Error
4 Sensor Drift Alert Active
5 Sensor 1 Open
6 Sensor 2 Open
7 Sensor 1 Shorted
8 Sensor 2 Shorted
9 Terminal Temp Failure

Advisory
1 Calibration Error

Maintenance
1 Hot Backup Active
2 Sensor Drift Alert Active
3 Sensor 1 Degraded
4 Sensor 2 Degraded
5 Excess EMF
6 Sensor 1 Out of Operating Range
7 Sensor 2 Out of Operating Range
8 Terminal Temp Out of Range
9 Analog Output Saturated
10 Analog Output Fixed

Active Alerts
1 Good (only if No Alerts)
2 Failed
3 Advisory
4 Maintenance (Fix Soon)

Home
1 Overview
2 Configure
3 Service Tools

Variables
1 Variable Summary
2 Primary Variable
3 Second Variable
4 Third Variable
5 Fourth Variable
6 Analog Output

Primary Variable
1 Primary Variable
2 Parameter

Second Variable
1 Second Variable
2 Parameter

Third Variable
1 Third Variable
2 Parameter

Fourth Variable
1 Fourth Variable
2 Parameter

Service Tools
1 Alerts
2 Variables
3 Trends
4 Maintenance
5 Simulate

Analog Output
1 Analog Output Value
2 AO Gauge

Trends
1 Sensor 1
2 Sensor 2
3 Differential
4 Average
5 Terminal Temperature
6 First Good

Thermocouple Diag Sensor X
1 Resistance
2 Sensor X Status
3 Threshold Exceeded
4 TC Diag Config

Maintenance
1 Thermocouple Diag Snsr 1
2 Thermocouple Diag Snsr 2
3 Min/Max Tracking
4 Sensor Calibration
5 Analog Calibration

Min/ Max Tracking
1 Min/Max Mode
2 Reset All Min/Max Values
3 Parameter 1
4 Parameter 2
5 Parameter 3
6 Parameter 4

Simulate
1 Perform Loop Test
2 Device Variables

Sensor Calibration
1 Calibrate Sensors
2 Restore Facotry Cal
3 Sensor 1 Lower Cal
4 Sensor 1 Upper Cal
5 Sensor 2 Lower Cal
6 Sensor 2 Upper Cal
7 Active Calibrator

Analog Calibration
1 Analog Trim
2 Scaled Trim

Figure C-4. HART Revision 7 Field Communicator Menu Tree – Overview

Active Alerts
1 Good (only if No Alerts)
2 Failed
3 Advisory
4 Maintenance (Fix Soon)

Good (only if No Alerts)
1 No Active Alerts

Failed
1 Invalid Configuration
2 Electronics Failure
3 Calibration Error
4 Sensor Drift Alert Active
5 Sensor 1 Open
6 Sensor 2 Open
7 Sensor 1 Shorted
8 Sensor 2 Shorted
9 Terminal Temp Failure

Advisory
1 Calibration Error

Maintenance
1 Hot Backup Active
2 Sensor Drift Alert Active
3 Sensor 1 Degraded
4 Sensor 2 Degraded
5 Excess EMF
6 Sensor 1 Out of Operating Range
7 Sensor 2 Out of Operating Range
8 Terminal Temp Out of Range
9 Analog Output Saturated
10 Analog Output Fixed

Home
1 Overview
2 Configure
3 Service Tools

Overview
1 Device Status
2 Comm Status
3 Primary Variable
4 Sensor Values/Status
5 Analog Output Value
6 Upper Range Value
7 Lower Range Value
8 Device Information

Device Information
1 Identification
2 Revisions
3 Alarm Type and Security
4 Options Ordered

Identification
1 Tag
2 Long Tag
3 Model
4 Electronics S/N
5 Final Assembly Num
6 Date
7 Description
8 Message
9 Device Image

Revisions
1 HART Universal Rev
2 Field Device
3 Hardware
4 Software
5 DD Revision

Alarm Type and Security
1 Alarm Direction
2 High Saturation
3 Low Saturation
4 High Alarm
5 Low Alarm
6 Software Write Protect
7 Lock Status
8 Password Protection

Options Ordered
1 Dual Sensor Option
2 Hot BU and Sensor Drift
3 T/C Diag & Min/Max

Figure C-5. HART Revision 7 Field Communicator Menu Tree - Configure

Home
1 Overview
2 Configure
3 Service Tools

Configure
1 Guided Setup
2 Manual Setup

Guided Setup
1 Configure Sensors
2 Calibrate Sensors
3 Configure Device
4 Configure Display
5 Config Hot Backup
6 Config Drift Alert
7 Diagnostics Suite

Manual Setup
1 Sensor 1
2 Sensor 2
3 Calculated Output
4 Diagnostics
5 Analog Output
6 Display
7 Device
8 HART
9 Security

Sensor 1
1 Sensor 1 Temp
2 Sensor 1 Status*
3 Sensor 1 Type
4 Sensor 1 Connection
5 Engineering Units
6 Damping
7 Serial Number
8 Sensor Limits
9 Sensor Matching-CVD
10 2-Wire Offset

Sensor 2
1 Sensor 2 Temp
2 Sensor 2 Status*
3 Sensor 2 Type
4 Sensor 2 Connection
5 Engineering Units
6 Damping
7 Serial Number
8 Sensor Limits
9 Sensor Matching-CVD
10 2-Wire Offset

Calculated Output
1 Differential Temperature*
2 First Good Temperature*
3 Average Temperature*

Diagnostics
1 Hot Backup
2 Sensor Drift Alert
3 Sensor and Process Diagnostics

Analog Output
1 Analog Output Value
2 Percent of Range
3 Primary Variable
4 Param
5 PV Configuration
6 Alarm/Sat Levels

PV Configuration
1 Primary Variable
2 Upper Range Value
3 Lower Range Value
4 Minimum Span

Alarm/Sat Levels
1 Alarm Direction
2 High Alarm
3 High Saturation
4 Low Saturation
5 Low Alarm
6 Config Alarm/Sat Levels

Display
1 Variables Displayed
2 Decimal Places
3 Bar Graph*

Device
1 Device Information
2 Terminal Temp Units
3 Open Sensor Hold Off
4 Noise Rejection

Device Information
1 Tag
2 Long Tag
3 Date
4 Description
5 Message
6 Final Assembly Num

Noise Rejection
1 AC Power Filter
2 Transient Filter

HART
1 Polling Address
2 Change Polling Address
3 HART Universal Rev
4 Change HART Rev
5 Burst Mode Config
6 Variable Mapping

Burst Mode Config
1 Burst Message 1
2 Message 1 Content
3 1st and Trigger Value
4 Second Variable
5 Third Variable
6 Fourth Variable
7 Config Adt'l Messages

Security
1 Software Write Protect
2 HART Lock
3 Local Operator Interface*

Variable Mapping
1 Primary Variable
2 Second Variable
3 Third Variable
4 Fourth Variable
5 Re-Map Variables

Figure C-6. HART Revision 7 Field Communicator Menu Tree – Service Tools

Good (only if No Alerts)
1 No Active Alerts

Failed
1 Invalid Configuration
2 Electronics Failure
3 Calibration Error
4 Sensor Drift Alert Active
5 Sensor 1 Open
6 Sensor 2 Open
7 Sensor 1 Shorted
8 Sensor 2 Shorted
9 Terminal Temp Failure

Active Alerts
1 Good (only if No Alerts)
2 Failed
3 Advisory
4 Maintenance (Fix Soon)

Advisory
1 Calibration Error

Maintenance
1 Hot Backup Active
2 Sensor Drift Alert Active
3 Sensor 1 Degraded
4 Sensor 2 Degraded
5 Excess EMF
6 Sensor 1 Out of Operating Range
7 Sensor 2 Out of Operating Range
8 Terminal Temp Out of Range
9 Analog Output Saturated
10 Analog Output Fixed

Home
1 Overview
2 Configure
3 Service Tools

Variables
1 Variable Summary
2 Primary Variable
3 Second Variable
4 Third Variable
5 Fourth Variable
6 Analog Output

Primary Variable
1 Primary Variable
2 Parameter
3 Status

Second Variable
1 Second Variable
2 Parameter
3 Status

Service Tools
1 Alerts
2 Variables
3 Trends
4 Maintenance
5 Simulate

Third Variable
1 Third Variable
2 Parameter
3 Status

Fourth Variable
1 Fourth Variable
2 Parameter
3 Status

Trends
1 Sensor 1
2 Sensor 2
3 Differential
4 Average
5 Terminal Temperature
6 First Good

Analog Output
1 Analog Output Value
2 AO Gauge

Thermocouple Diag Sensor X
1 Resistance
2 Sensor X Status
3 Threshold Exceeded
4 TC Diag Config

Maintenance
1 Thermocouple Diag Snsr 1
2 Thermocouple Diag Snsr 2
3 Min/Max Tracking
4 Sensor Calibration
5 Analog Calibration

Min/ Max Tracking
1 Min/Max Mode
2 Reset All Min/Max Values
3 Parameter 1
4 Parameter 2
5 Parameter 3
6 Parameter 4

Simulate
1 Perform Loop Test
2 Device Variables

Sensor Calibration
1 Calibrate Sensors
2 Restore Facotry Cal
3 Sensor 1 Lower Cal
4 Sensor 1 Upper Cal
5 Sensor 2 Lower Cal
6 Sensor 2 Upper Cal
7 Active Calibrator

Analog Calibration
1 Analog Trim
2 Scaled Trim

C.2 Field Communicator Fast Keys

Table C-1. Device Revision 8 and 9 (HART 5 and 7) Field Communicator Device Dashboard Fast Key Sequences

Function	HART 5	HART 7
Alarm Values	2, 2, 5, 6	2, 2, 5, 6
Analog Calibration	3, 4, 5	3, 4, 5
Analog Output	2, 2, 5, 1	2, 2, 5, 1
Average Temperature Setup	2, 2, 3, 3	2, 2, 3, 3
Burst Mode	2, 2, 8, 4	2, 2, 8, 4
Comm Status		1, 2
Configure additional messages		2, 2, 8, 4, 7
Configure Hot Backup	2, 2, 4, 1, 3	2, 2, 4, 1, 3
D/A Trim	3, 4, 4, 1	3, 4, 4, 1
Damping Values	2, 2, 1, 5	2, 2, 1, 6
Date	2, 2, 7, 1, 2	2, 2, 7, 1, 3
Display Setup	2, 1, 4	2, 1, 4
Descriptor	2, 2, 7, 1, 4	2, 2, 7, 1, 5
Device Information	1, 8, 1	1, 8, 1
Differential Temperature Setup	2, 2, 3, 1	2, 2, 3, 1
Drift Alert	2, 2, 4, 2	2, 2, 4, 2
Filter 50/60 Hz	2, 2, 7, 4, 1	2, 2, 7, 4, 1
First Good Temperature Setup	2, 2, 3, 2	2, 2, 3, 2
Hardware Revision	1, 8, 2, 3	1, 8, 2, 3
HART Lock		2, 2, 9, 2
Intermittent Sensor Detect	2, 2,7,4,2	2, 2,7,4,2
Loop Test	3, 5, 1	3, 5, 1
Locate Device		3, 4, 6, 2
Lock Status		1, 8, 3, 8
LRV (Lower Range Value)	2, 2, 5, 5, 3	2, 2, 5, 5, 3
LSL (Lower Sensor Limit)	2, 2, 1, 7, 2	2, 2, 1, 8, 2
Message	2, 2, 7, 1, 3	2, 2, 7, 1, 4
Open Sensor Holdoff	2, 2, 7, 3	2, 2, 7, 3
Percent Range	2, 2, 5, 2	2, 2, 5, 2
Sensor 1 Configuration	2, 1, 1	2, 1, 1
Sensor 2 Configuration	2, 1, 1	2, 1, 1
Sensor 1 Serial Number	2, 2, 1, 6	2, 2, 1, 7
Sensor 2 Serial Number	2, 2, 2, 7	2, 2, 2, 8
Sensor 1 Type	2, 2, 1, 2	2, 2, 1, 3
Sensor 2 Type	2, 2, 2, 2	2, 2, 2, 3
Sensor 1 Unit	2, 2, 1, 4	2, 2, 1, 5
Sensor 2 Unit	2, 2, 2, 4	2, 2, 2, 5
Sensor 1 Status		2, 2, 1, 2
Sensor 2 Status		2, 2, 2, 2
Simulate Digital Signal		3, 5, 2

Table C-1. Device Revision 8 and 9 (HART 5 and 7) Field Communicator Device Dashboard Fast Key Sequences

Function	HART 5	HART 7
Software Revision	1, 8, 2, 4	1, 8, 2, 4
Tag	2, 2, 7, 1, 1	2, 2, 7, 1, 1
Long Tag		2, 2, 7, 1, 2
Terminal Temperature	2, 2, 7, 1	2, 2, 8, 1
URV (Upper Range Value)	2, 2, 5, 5, 2	2, 2, 5, 5, 2
USL (Upper Sensor Limit)	2, 2, 1, 7, 2	2, 2, 1, 8, 2
Variable Mapping	2, 2, 8, 5	2, 2, 8, 5
2-wire Offset Sensor 1	2, 2, 1, 9	2, 2, 1, 10
2-wire Offset Sensor 2	2, 2, 2, 9	2, 2, 2, 10

Table C-2. Device Revision 7 Field Communicator Traditional Fast Key Sequences

Function	Fast Keys	Function	Fast Key
Active Calibrator	1, 2, 2, 1, 3	Num Req Preams	1, 3, 3, 3, 2
Alarm/Saturation	1, 3, 3, 2	Open Sensor Holdoff	1, 3, 5, 3
AO Alarm Type	1, 3, 3, 2, 1	Percent Range	1, 1, 5
Burst Mode	1, 3, 3, 3, 3	Poll Address	1, 3, 3, 3, 1
Burst Option	1, 3, 3, 3, 4	Process Temperature	1, 1
Calibration	1, 2, 2	Process Variables	1, 1
Callendar-Van Dusen	1, 3, 2, 1	PV Damping	1, 3, 3, 1, 3
Configuration	1, 3	PV Unit	1, 3, 3, 1, 4
D/A Trim	1, 2, 2, 2	Range Values	1, 3, 3, 1
Damping Values	1, 1, 10	Review	1, 4
Date	1, 3, 4, 2	Scaled D/A Trim	1, 2, 2, 3
Descriptor	1, 3, 4, 3	Sensor Connection	1, 3, 2, 1, 1
Device Info	1, 3, 4	Sensor 1 Setup	1, 3, 2, 1, 2
Device Output Configuration	1, 3, 3	Sensor Serial Number	1, 3, 2, 1, 4
Diagnostics and Service	1, 2	Sensor 1 Trim	1, 2, 2, 1
Filter 50/60 Hz	1, 3, 5, 1	Sensor 1 Trim-Factory	1, 2, 2, 1, 2
Hardware Rev	1, 4, 1	Sensor Type	1, 3, 2, 1, 1
Hart Output	1, 3, 3, 3	Software Revision	1, 4, 1
Intermittent Detect	1, 3, 5, 4	Status	1, 2, 1, 4
LCD Display Options	1, 3, 3, 4	Tag	1, 3, 4, 1
Loop Test	1, 2, 1, 1	Terminal Temperature	1, 3, 2, 2
LRV (Lower Range Value)	1, 1, 6	Test Device	1, 2, 1
LSL (Lower Sensor Limit)	1, 1, 8	URV (Upper Range Value)	1, 1, 7
Measurement Filtering	1, 3, 5	USL (Upper Sensor Limit)	1, 1, 9
Message	1, 3, 4, 4	Variable Mapping	1, 3, 1
Meter Configuring	1, 3, 3, 4, 1	Variable Re-Map	1, 3, 1, 5
Meter Decimal Point	1, 3, 3, 4, 2	Write Protect	1, 2, 3
		2-Wire Offset	1, 3, 2, 1, 2, 1

Appendix D Local Operator Interface (LOI)

D.1 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 2-2 on page 13 for LOI button operation. Below is a floating-point number entry example for changing a value of "-0000022" to "000011.2"

Table D-1. LOI Number Entry

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

Usage notes:

- It is possible to move backwards in the number by scrolling to the left and pressing enter. The left arrow appears as such in the LOI: **ˌ**
- The negative symbol is only allowed in the left most position.
- The *Over score* character " ¯ " is used in the LOI to enter a blank space for Tag entry.

D.2   Text entry

Text can be entered with the LOI. Depending on the edited item, up to eight locations on the top line can be used for text entry. Text entry follows the same rules as the number entry rules in "Number entry" on page 121, except the following characters are available in all locations: A-Z, 0-9, -, /, space.

D.2.1   Scrolling

When it is desired to move more quickly through the list of menu choices or alpha numeric characters without individual button presses, a faster scrolling technique is available. Scrolling functionality allows the user to walk through any menu in forward or reverse order, enter text or digits easily and quickly.
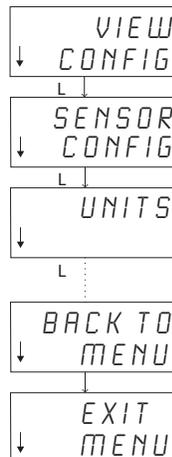
Menu scrolling

Hold down the left button after it brings you to the next menu item. Each of the proceeding menus will be shown one after another while the button is pressed down. For an example, see Figure D-1 below.
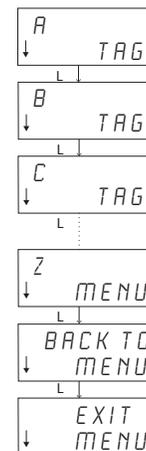
Text or digit entry scrolling

Quickly navigate through number and text menu lists by holding down the left button the same as in Menu.

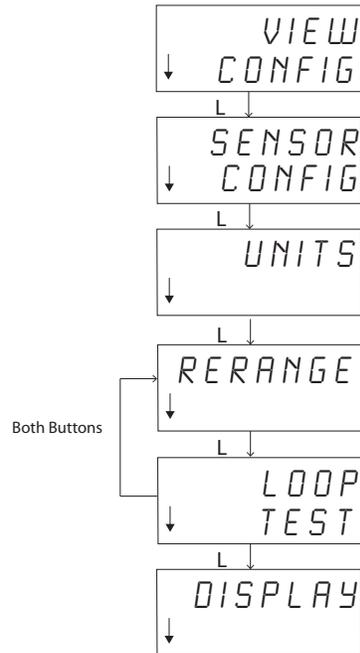**Figure D-1. Menu Scrolling/Text and Digit Scrolling**

Scrolling backwards

Moving backwards during digit or text entry was described above in Digit Entry "Usage Notes". During regular menu navigation it is possible to go back to the previous screen by pressing both buttons at the same time.

Figure D-2. Scrolling Backwards

D.3   Timeout

The LOI in standard operation will Time Out and return to the home screen after 15 minutes of inactivity. To re-enter into the LOI menu, press either button.

D.4   Saving and canceling

The Save and Cancel functionality implemented at the end of a series of steps allows the user to save the change or exit the function without saving any of the changes. The way these functions are shown should always look as follows:
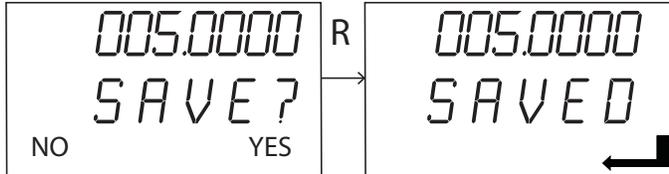
D.4.1   Saving

Whether you're choosing a setting from a list of choices or entering digits or text the first screen shall show "SAVE?" to ask the user if they want to save the information just entered. You can select the cancel function (choose **NO**) or the save function (choose **YES**). After the save function is selected, "SAVED" shall appear on the screen.
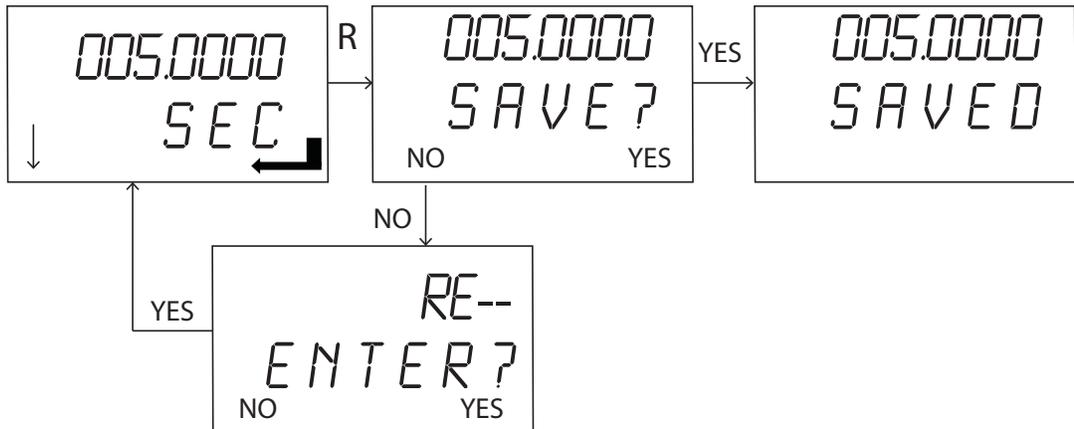
Saving a setting

```
 DEG C   R    DEG C
 SAVE?        SAVED
NO     YES          ⏎
```

Saving text or values
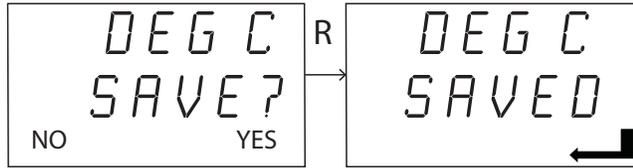
```
 005.0000  R   005.0000
  SAVE?          SAVED
NO      YES           ⏎
```
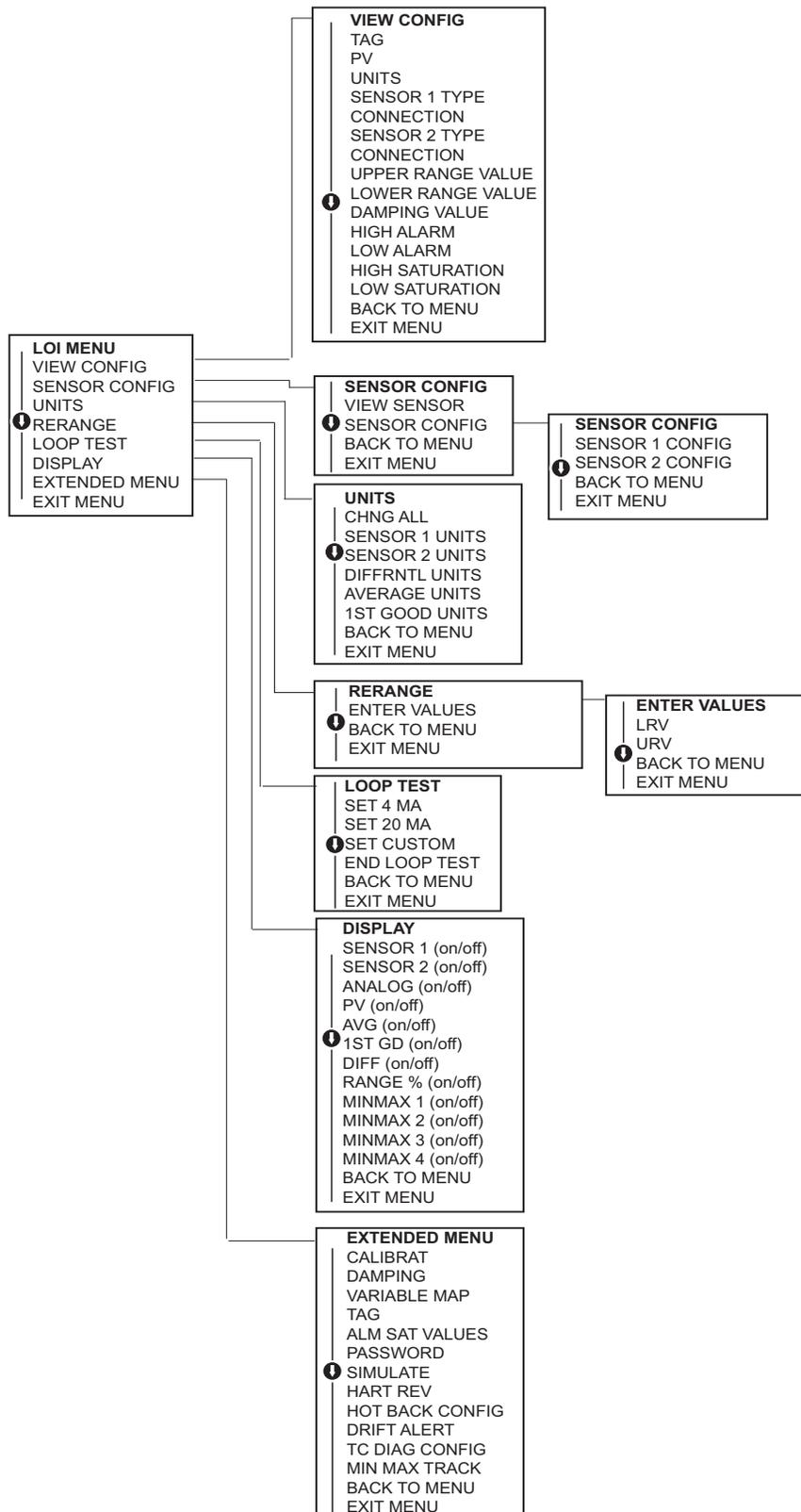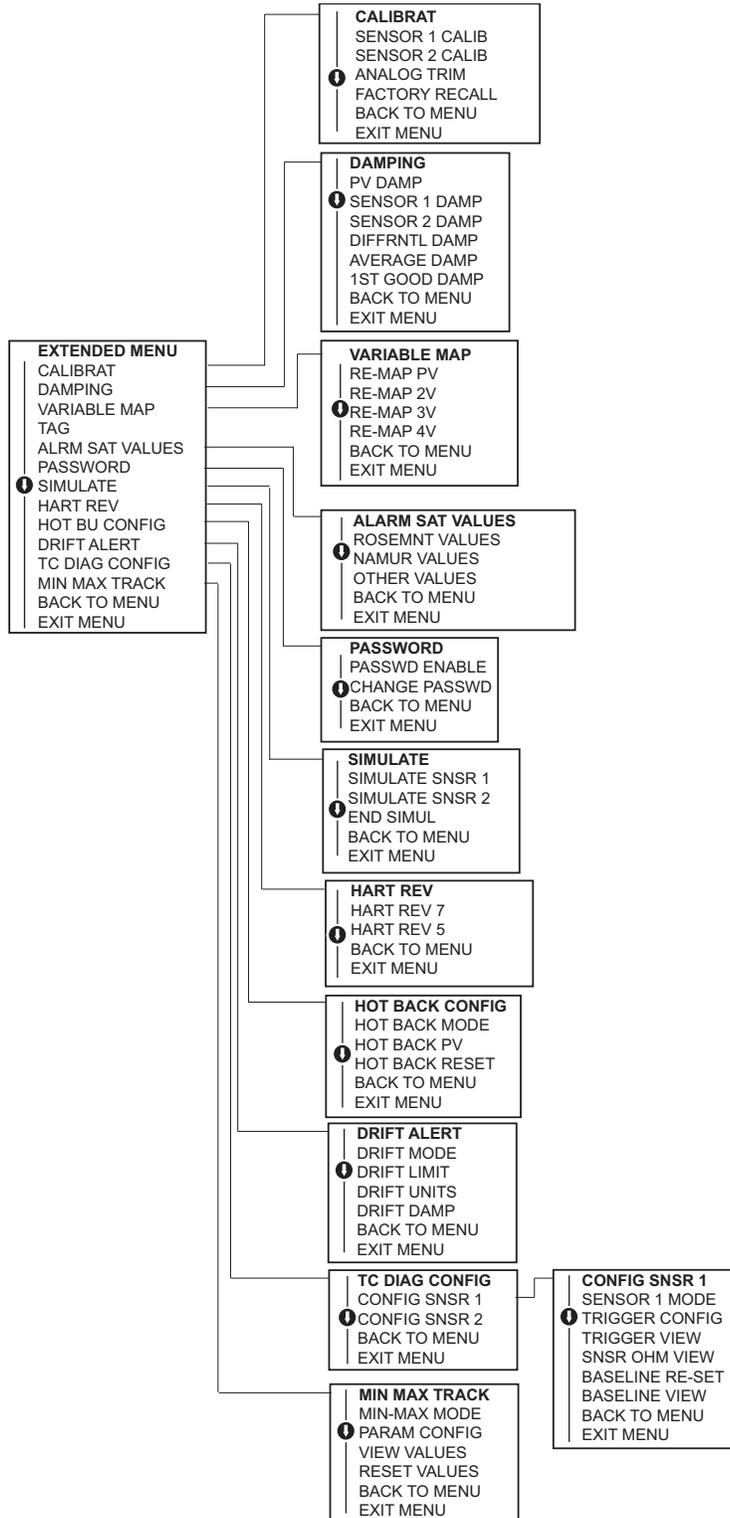
D.4.2   Canceling

When a value or text string is being entered into the transmitter via the LOI and the function is canceled, the LOI menu can offer the user a means to re-enter the value without losing the information entered. Examples of a value being entered are the Tag, Damping, and Calibration values. If you do not want to Re-Enter the value and desire to continue canceling, select the **NO** option when prompted.

```
 005.0000  R   005.0000   YES   005.0000
   SEC          SAVE?            SAVED
↓        ⏎    NO      YES

                    NO

              RE--
            ENTER?
     YES    NO      YES
```

D.5 LOI menu tree

VIEW CONFIG
TAG
PV
UNITS
SENSOR 1 TYPE
CONNECTION
SENSOR 2 TYPE
CONNECTION
UPPER RANGE VALUE
LOWER RANGE VALUE
DAMPING VALUE
HIGH ALARM
LOW ALARM
HIGH SATURATION
LOW SATURATION
BACK TO MENU
EXIT MENU

LOI MENU
VIEW CONFIG
SENSOR CONFIG
UNITS
RERANGE
LOOP TEST
DISPLAY
EXTENDED MENU
EXIT MENU

SENSOR CONFIG
VIEW SENSOR
SENSOR CONFIG
BACK TO MENU
EXIT MENU

SENSOR CONFIG
SENSOR 1 CONFIG
SENSOR 2 CONFIG
BACK TO MENU
EXIT MENU

UNITS
CHNG ALL
SENSOR 1 UNITS
SENSOR 2 UNITS
DIFFRNTL UNITS
AVERAGE UNITS
1ST GOOD UNITS
BACK TO MENU
EXIT MENU

RERANGE
ENTER VALUES
BACK TO MENU
EXIT MENU

ENTER VALUES
LRV
URV
BACK TO MENU
EXIT MENU

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

DISPLAY
SENSOR 1 (on/off)
SENSOR 2 (on/off)
ANALOG (on/off)
PV (on/off)
AVG (on/off)
1ST GD (on/off)
DIFF (on/off)
RANGE % (on/off)
MINMAX 1 (on/off)
MINMAX 2 (on/off)
MINMAX 3 (on/off)
MINMAX 4 (on/off)
BACK TO MENU
EXIT MENU

EXTENDED MENU
CALIBRAT
DAMPING
VARIABLE MAP
TAG
ALM SAT VALUES
PASSWORD
SIMULATE
HART REV
HOT BACK CONFIG
DRIFT ALERT
TC DIAG CONFIG
MIN MAX TRACK
BACK TO MENU
EXIT MENU

D.6 LOI menu tree – extended menu

CALIBRAT
SENSOR 1 CALIB
SENSOR 2 CALIB
ANALOG TRIM
FACTORY RECALL
BACK TO MENU
EXIT MENU

DAMPING
PV DAMP
SENSOR 1 DAMP
SENSOR 2 DAMP
DIFFRNTL DAMP
AVERAGE DAMP
1ST GOOD DAMP
BACK TO MENU
EXIT MENU

EXTENDED MENU
CALIBRAT
DAMPING
VARIABLE MAP
TAG
ALRM SAT VALUES
PASSWORD
SIMULATE
HART REV
HOT BU CONFIG
DRIFT ALERT
TC DIAG CONFIG
MIN MAX TRACK
BACK TO MENU
EXIT MENU

VARIABLE MAP
RE-MAP PV
RE-MAP 2V
RE-MAP 3V
RE-MAP 4V
BACK TO MENU
EXIT MENU

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

PASSWORD
PASSWD ENABLE
CHANGE PASSWD
BACK TO MENU
EXIT MENU

SIMULATE
SIMULATE SNSR 1
SIMULATE SNSR 2
END SIMUL
BACK TO MENU
EXIT MENU

HART REV
HART REV 7
HART REV 5
BACK TO MENU
EXIT MENU

HOT BACK CONFIG
HOT BACK MODE
HOT BACK PV
HOT BACK RESET
BACK TO MENU
EXIT MENU

DRIFT ALERT
DRIFT MODE
DRIFT LIMIT
DRIFT UNITS
DRIFT DAMP
BACK TO MENU
EXIT MENU

TC DIAG CONFIG
CONFIG SNSR 1
CONFIG SNSR 2
BACK TO MENU
EXIT MENU

CONFIG SNSR 1
SENSOR 1 MODE
TRIGGER CONFIG
TRIGGER VIEW
SNSR OHM VIEW
BASELINE RE-SET
BASELINE VIEW
BACK TO MENU
EXIT MENU

MIN MAX TRACK
MIN-MAX MODE
PARAM CONFIG
VIEW VALUES
RESET VALUES
BACK TO MENU
EXIT MENU

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