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Reference Manual
00809-0200-4728, Rev RA
April 2015

Rosemount 644 Temperature Transmitter

with HART® Protocol



ROSEMOUNT®

EMERSON™
Process Management

Rosemount 644 Temperature Transmitter

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

⚠ CAUTION

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

⚠ 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 a Emerson Process Management Sales Representative.

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Section 1 Introduction

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.

1.1.1 Warnings

⚠ 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-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.

1.2 Overview

1.2.1 Manual

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

Section 2: Configuration provides instruction the commissioning and operating 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 contains mechanical installation instructions for the transmitter.

Section 4: Electrical Installation contains electrical installation instructions and considerations for the transmitter.

Section 5: Operation and Maintenance contains common operation and maintenance techniques for the transmitter.

Section 6: Troubleshooting provides troubleshooting techniques for the most common transmitter operating problems.

Section 7: Safety Instrumented Systems (SIS) Certification provides identification, installation, configuration, operation and maintenance, and inspection information for Safety Instrumented Systems as it pertains to the Rosemount 644 Head Mount and Field 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 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 contains Field Communicator menu trees and Field Communicator Fast Keys.

Appendix D: Local Operator Interface (LOI) contains instructions for number entry, text entry, as well as the LOI menu tree and LOI extended menu tree.

1.2.2 Transmitter overview

The Rosemount 644 Head Mount and Field Mount Temperature Transmitters support 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)
- The 644 Head Mount Transmitter is available in two housing materials (Aluminum and SST) and various housing options that allow for mounting flexibility in a variety of environmental conditions. The 644 Field Mount is available in an aluminum housing.
- 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:

- 4-20mA/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, Metric (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 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 644 Head Mount Transmitter to a DIN rail or assembling a new 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

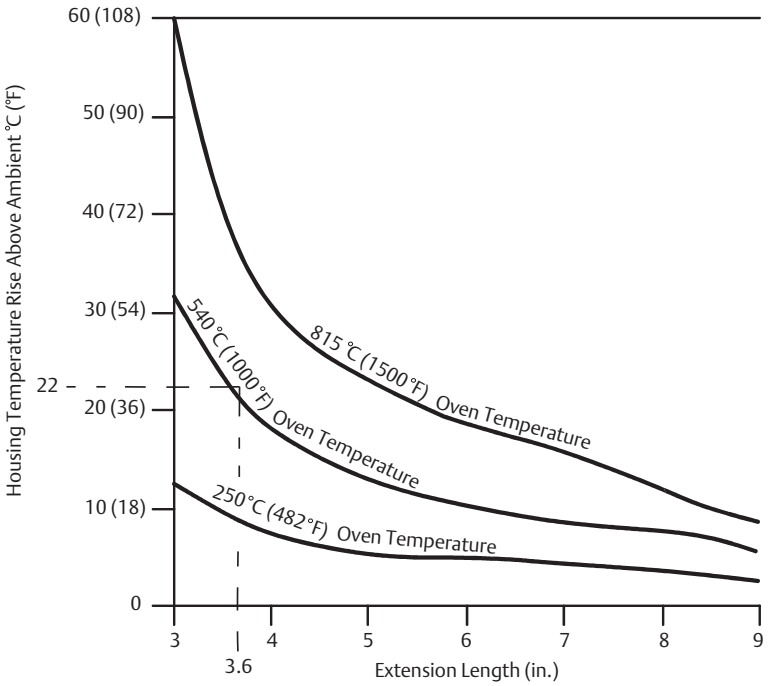
The transmitter electronics module is permanently sealed within a plastic enclosure, resisting moisture and corrosive damage. Verify that the operating atmosphere of the transmitter is consistent with the appropriate hazardous locations certifications.

Temperature effects

The transmitter will operate within specifications for ambient temperatures between –40 and 185 °F (–40 °C 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. 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

1. Right click on the device and select the **Configure** menu.
2. In the left navigation pane select **Manual Setup** then select the **Security** tab.
   - All three parameters can be configured from this screen.
3. Select **Apply** when complete.

Section 2 Configuration

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Configuration methods . . . . . page 9
Verify configuration . . . . . page 13
Basic configuration of the transmitter . . . . . page 16
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Configure device outputs . . . . . page 25
Inputting device information . . . . . page 32
Configure measurement filtering . . . . . page 34
Diagnostics and service . . . . . page 36
Establishing multi drop communication . . . . . page 41
Using the transmitter with the HART Tri-Loop . . . . . page 42

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 644 Head mount and Field mount designs, 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. Local Operator Interface 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.

2.2.1 Warnings

⚠ 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 "System readiness" on page 8.

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 integral transient protector, option T1. Refer to the 644 Product Data Sheet 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 LOI ensures all transmitter components are in working order prior to installation.

The 644 transmitter can be configured either on-line or off-line using a Field Communicator, AMS Device Manager or the optional LOI (Head mount and field mount). 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

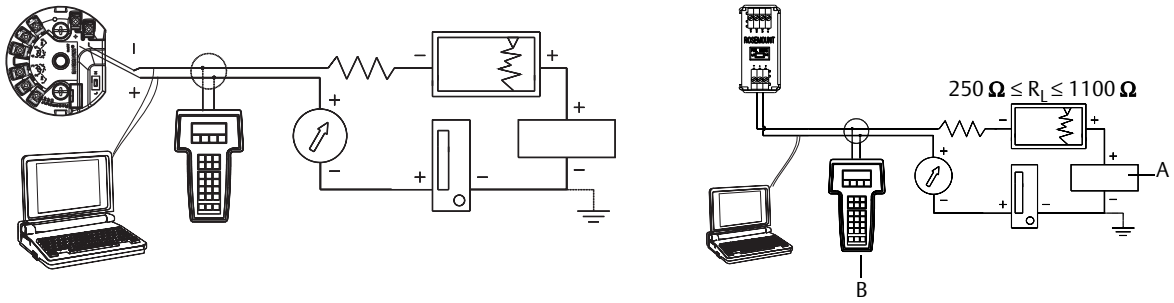
To configure on the bench, required equipment includes a power supply, a digital multimeter (DMM), and a Field Communicator, AMS Device Manager, or a LOI – Option M4.

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

644 Head Mount and Field Mount

644 Rail Mount



A. Power Supply
B. Field Communicator

Note

- 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)

2.4.2 Choosing a configuration tool

Configuring with a Field Communicator

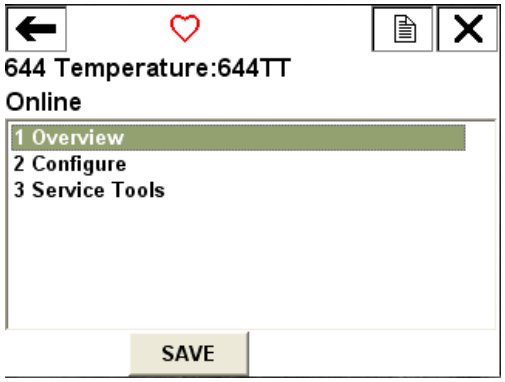
The Field Communicator is a hand-held device that exchanges information with the transmitter from the control room, the instrument site, or any wiring termination point in the loop. To facilitate communication, connect the Field Communicator, shown in this manual, in parallel with the transmitter (see 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 Ni-Cad 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.hartcomm.org.

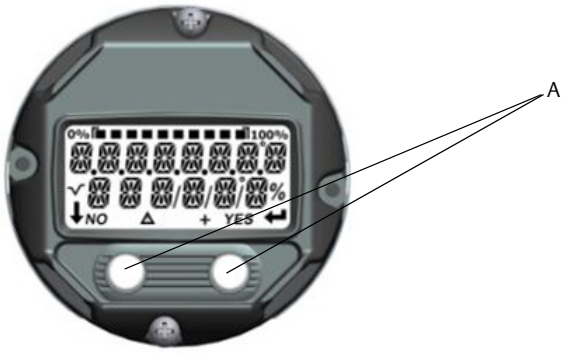
Note
All steps listed in this product manual using AMS Device Manager assume the use Version 11.5.

Configuring with an LOI

The LOI requires option code M4 to be ordered. To activate the LOI push either configuration button. Configuration buttons are located on the LCD Display (must remove housing cover to access 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.

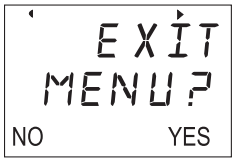
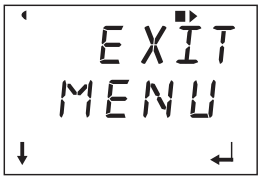
Note
Entering into the LOI menu effectively disables the ability to write to the device by any other host or configuration tool. Make sure this is communicated to necessary personnel before using the LOI for device configuration.

Figure 2-3. LOI Configuration Buttons



A. Configuration Buttons

Table 2-2. LOI Button Operation

Button		
Left	No	SCROLL
Right	Yes	ENTER

LOI password

An LOI password can be entered and enabled to prevent review and modification of device configuration via the LOI. This does not prevent configuration from HART or 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.

LOI menu trees are available in Appendix A: Specifications and Reference Data.

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 97 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. Select the **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 Verify and review configuration with Field Communicator

Configuration parameters listed in Table 2-3 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 Table 2-3.
   a. From the *HOME* screen, enter the Fast Key sequences listed in Table 2-3.

Table 2-3. 644 Device Dashboard Fast Key Sequences

Function	Fast Key sequence	
	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) or (D) is ordered.

2.5.2 Verify and review configuration with AMS Device Manager

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

2.5.3 Verify and review configuration with LOI

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

- Tag
- 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 644 digital output parameters to ensure that 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.

Checking process variables with a Field Communicator

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

Device Dashboard Fast Keys	3, 2, 1

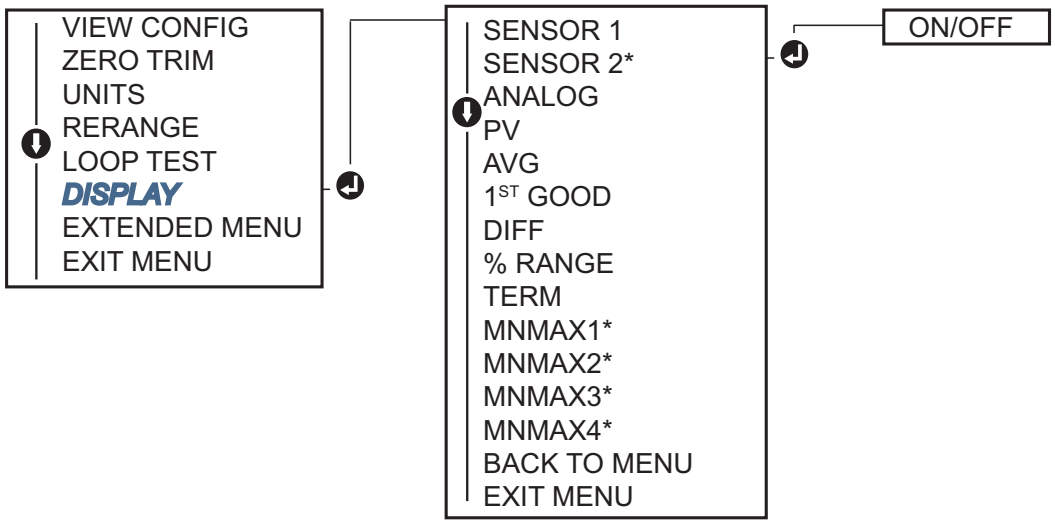
Checking process variables with AMS Device Manager

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.

Checking process variables with LOI

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 31). Once the desired device variables are chosen, simply EXIT the LOI menu and view the alternating values on the display screen.



2.6 Basic configuration of the transmitter

The 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

Mapping the HART variables with a Field Communicator

The “Variable Mapping” menu displays the sequence of the process variables. Select the sequence below to change this configuration. The 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 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, and 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

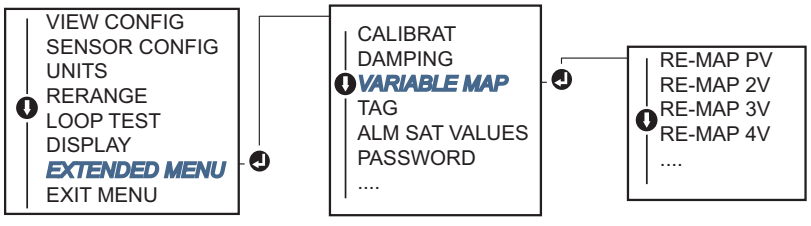
Mapping the HART variables with AMS Device Manager

1. Right click on the device and select the **Configure** menu.
2. In the left navigation pane choose **Manual Setup** then on the **HART tab**.
3. Map each variable individually or use the **Re-map Variables** method to guide you through the re-mapping process.
4. Select **Apply** when complete.

Mapping the HART Variables with LOI

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 2-4 on page 16 for an example of a mapped variable with the LOI.

Figure 2-4. 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

Configuring the sensor(s) with 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 644 and their associated levels of accuracy, see Table A-2 on page 98.

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

Device Dashboard Fast Keys	2, 1, 1

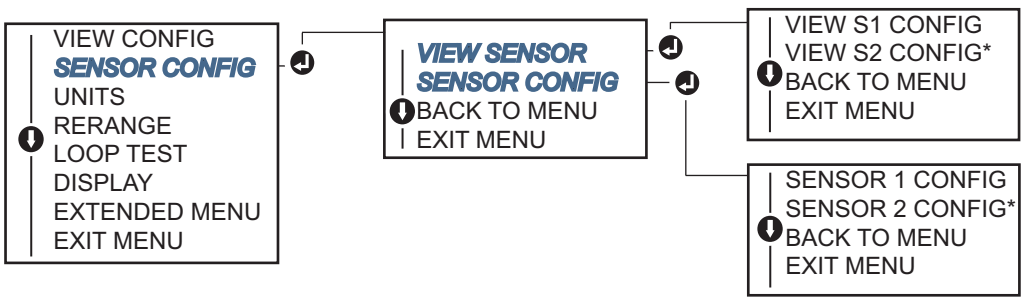
Configuring sensor(s) with AMS Device Manager

1. Right click on the device and select **Configure**.
2. In the left navigation pane select **Manual Setup** and select the **Sensor 1** or **Sensor 2** tab depending on the need.
3. Individually select the Sensor Type, Connection, Units and other sensor related information as desired from the drop down menus on the screen.
4. Select **Apply** when complete.

Configuring the sensor(s) with LOI

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

Figure 2-5. Configuring Sensors with LOI



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

Contact an 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 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 select **Manual Setup** and select the **Sensor 1** or **Sensor 2** tab depending on the need. Find the 2-Wire Offset text field and enter the value.
3. Select **Apply** when complete.

2.6.3 Setting output units

The Units can be configured for a number of different parameters in the 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

Setting output units with 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

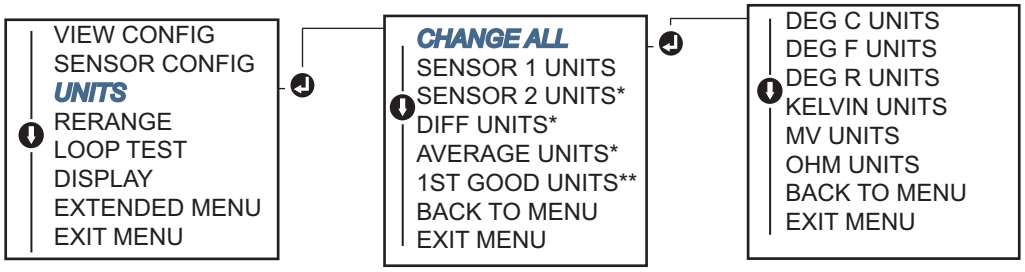
Setting output units with AMS Device Manager

1. Right click on the device and select **Configure.**
2. In the left navigation pane select **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. Select **Apply** when complete.

Setting output units with LOI

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

Figure 2-6. Configuring Units with LOI



** Available only if option code (S) or (D) is ordered.*
*** Available only if option codes (S) and (DC) are both ordered, or if option codes (D) and (DC) are both ordered.*

Note
The list of choices available for Units after the primary menu is dependent on your 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, or options D and DC)

2.7.1 Differential temperature configuration

The 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 Section 2.6.1 Mapping the HART Variables to set it to PV.

Differential temperature configuration with Field Communicator

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

Device Dashboard Fast Keys	2, 2, 3, 1

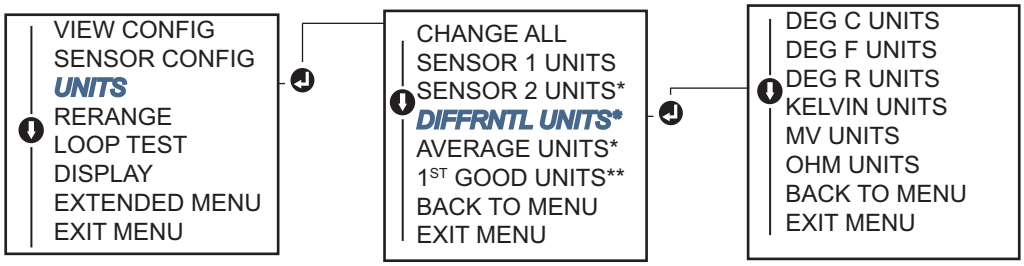
Differential temperature configuration with AMS Device Manager

1. Right click on the device and select **Configure**.
2. In the left navigation pane choose **Manual Setup**.
3. On the **Calculated Output Tab** find the **Differential Temperature** group box.
4. Select Units and Damping settings then select **Apply** when complete.

Differential Temperature configuration with LOI

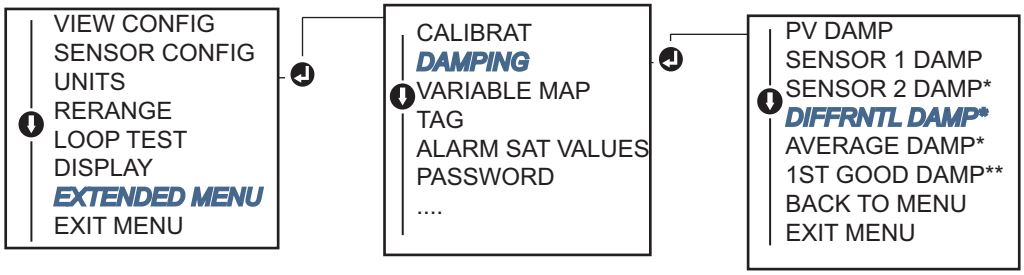
To configure the Differential Temperature on the LOI, the Units and Damping values must be set separately. Reference Figure 2-7 and Figure 2-8 below for where to find these in the menu.

Figure 2-7. Configuring Differential Units with LOI



** Available only if option code (S) or (D) is ordered.*
*** Available only if option codes (S) and (DC) are both ordered, or if option codes (D) and (DC) are both ordered.*

Figure 2-8. Configuring Differential Damping with LOI



** Available only if option code (S) or (D) is ordered.*
*** Available only if option codes (S) and (DC) are both ordered, or if option codes (D) and (DC) are both ordered.*

2.7.2 Average temperature configuration

The 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 is desired for Average to be the transmitter's primary variable see "Mapping the HART variables" on page 16 to set it to PV.

Average temperature configuration with a Field Communicator

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

Device Dashboard Fast Keys	2, 2, 3, 3

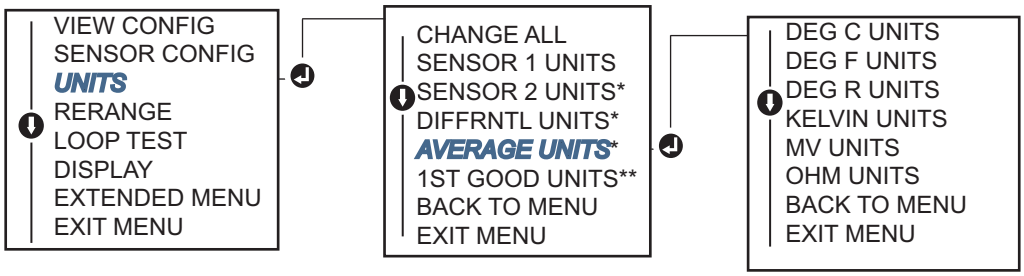
Average temperature configuration with AMS Device Manager

1. Right click on the device and select **Configure**.
2. In the left navigation pane select **Manual Setup**.
3. On the **Calculated Output Tab** find the *Average Temperature* group box.
4. Select Units and Damping settings then select **Apply** when complete.

Average temperature configuration with LOI

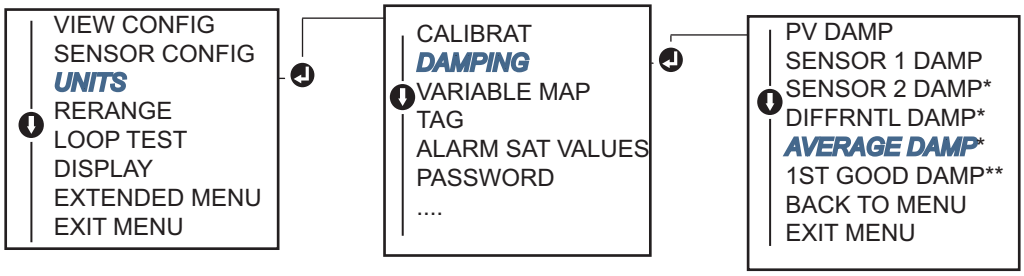
To configure average temperature on the LOI, the Units and Damping values must be set separately. Reference Figure 2-9 and Figure 2-10 below for where to find these in the menu.

Figure 2-9. Configuring Average Units with LOI



** Available only if option code (S) or (D) is ordered.*
*** Available only if option codes (S) and (DC) are both ordered, or if option codes (D) and (DC) are both ordered.*

Figure 2-10. Configuring Average Damping with LOI



** Available only if option code (S) or (D) is ordered.*
*** Available only if option codes (S) and (DC) are both ordered, or if option codes (D) 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

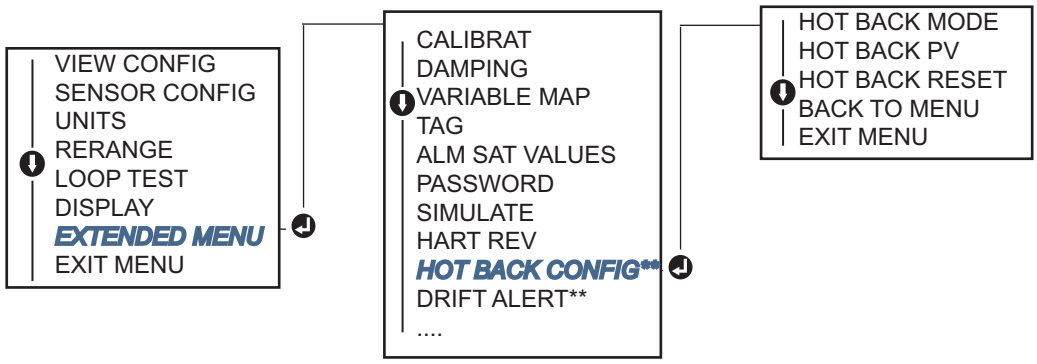
Hot Backup configuration with AMS Device Manager

1. Right click on the device and select **Configure**.
2. In the left navigation pane select **Manual Setup**.
3. On the *Diagnostics Tab* find the **Hot Backup** group box.
4. Choose the button **Configure Hot Backup** or **Reset Hot Backup** depending on the desired function and walk through the guided steps.
5. Select **Apply** when complete.

Hot Backup configuration with LOI

To configure Hot Backup on the LOI, enable the mode and set the PV values. Reference Figure 2-11 below for where to find these in the menu.

Figure 2-11. Configuring Hot Backup with LOI



** Available only if option code (S) or (D) is ordered.*
*** Available only if option codes (S) and (DC) are both ordered, or if option codes (D) 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 42.

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 the analog output of the transmitter go into ALARM when sensor drifting is detected.

Note
Using dual sensor configuration in the 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 644 FMEDA report for the impact on safety.

Sensor drift alert configuration with 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

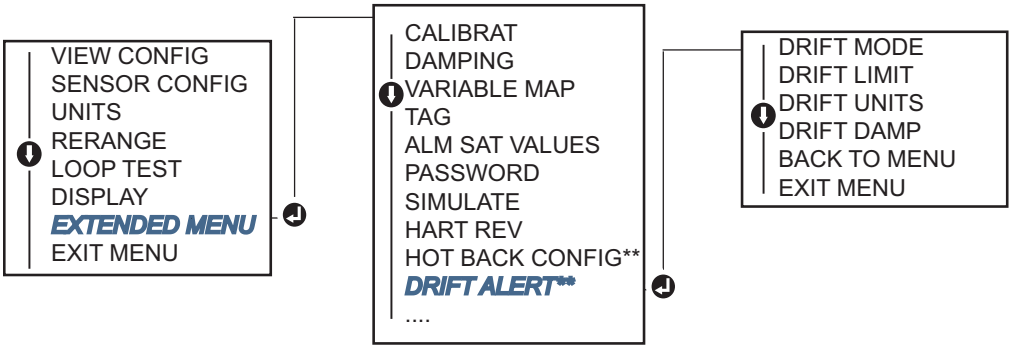
Sensor drift alert configuration with AMS Device Manager

1. Right click on the device and select **Configure**.
2. On the **Diagnostics Tab** find the **Sensor Drift Alert** group box.
3. Select to **Enable** the **Mode** and fill in the **Units**, **Threshold** and **Damping** values from the drop downs provided or select the **Configure Sensor Drift Alert** button and walk through the guided steps.
4. Select **Apply** when complete.

Sensor drift alert configuration with LOI

To configure sensor drift alert on the LOI, enable the mode, then set the PV, drift limit, and value for drift alert damping all separately. Reference Figure 2-12 below for where to find these in the menu.

Figure 2-12. Configuring Sensor Drift Alert with LOI



** Available only if option code (S) or (D) is ordered.*
*** Available only if option codes (S) and (DC) are both ordered, or if option codes (D) 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 Re-range the transmitter

⚠ Re-ranging 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 98.

Note
The re-range functions should not be confused with the trim functions. Although the re-range 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 re-range the transmitter.

Re-range the transmitter with 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

Re-range the transmitter with AMS Device Manager

1. Right click on the device and select **Configure"**
2. In the left navigation pane select **Manual Setup**.
3. On the **Analog Output Tab** find the Primary Variable Configuration group box.
4. Change the **Upper Range Value** and **Lower Range Value** to their desired settings.
5. Select **Apply** when complete.

Re-range the transmitter with LOI

Reference the image below to find the range value configuration path on the LOI.

Figure 2-13. Re-ranging 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

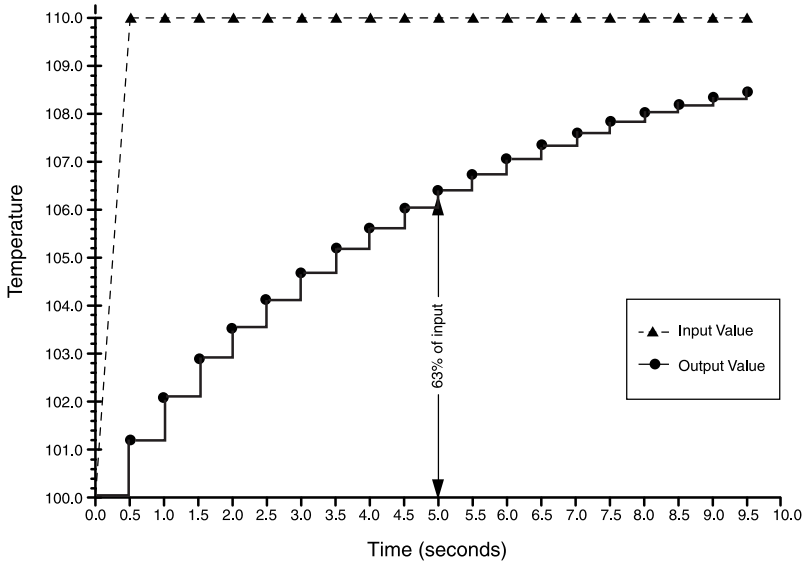
U = update rate

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 2-14, 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 35.

Figure 2-14. Change in Input vs. Change in Output with Damping Set to 5 Seconds



Damping can be applied to a number of parameters in the 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).

Damping the transmitter with a Field Communicator

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

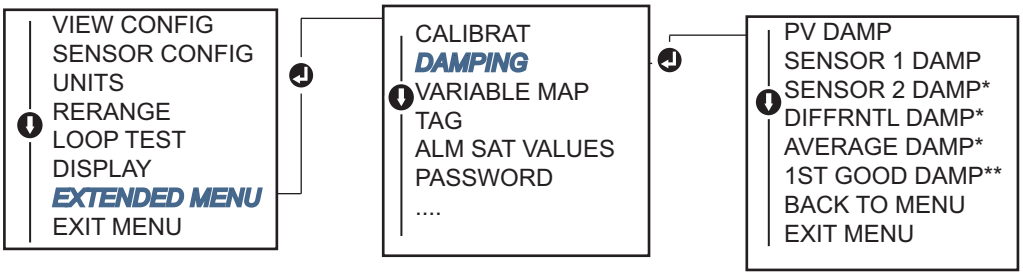
	HART 5	HART 7
Device Dashboard Fast Keys	2, 2, 1, 5	2, 2, 1, 6

Damping the transmitter with AMS Device Manager

1. Right click on the device and select **Configure**.
2. In the left navigation pane select **Manual Setup**.
3. On the **Sensor 1** Tab find the Setup group box.
4. Change the **Damping Value** to the desired setting.
5. Select **Apply** when complete.

Damping the transmitter with LOI

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



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 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 2-4, Table 2-5, and Table 2-6 below for the common Alarm and Saturation levels.

Table 2-4. 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 2-5. 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 2-6. 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 multi-drop mode send all saturation and alarm information digitally; saturation and alarm conditions will not affect the analog output.

Configuring alarm and saturation levels with a Field Communicator

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

Device Dashboard Fast Keys	2, 2, 5, 6

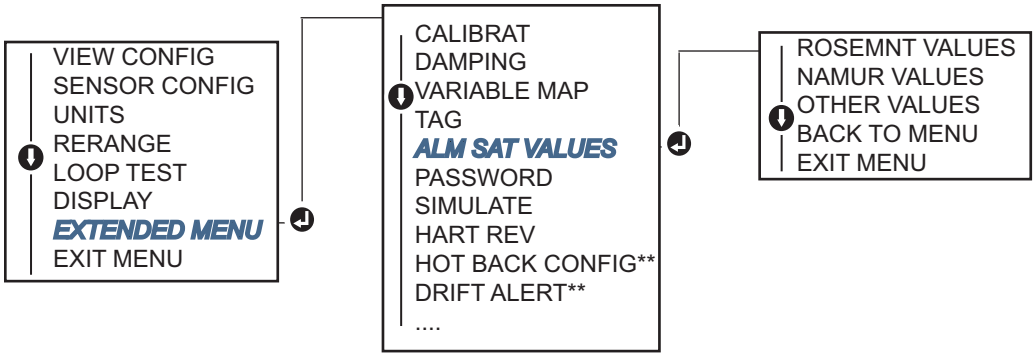
Configuring alarm and saturation levels with AMS Device Manager

1. Right click on the device and select **Configure**.
2. In the left navigation pane select **Manual Setup**.
3. On the **Analog Output** Tab find the Alarm and Saturation Levels group box.
4. Enter the High Alarm, High Saturation, Low Saturation and Low Alarm levels to the desired vales.
5. Select **Apply** when complete.

Configuring alarm and saturation levels with LOI

Reference the figure below to find the alarm and saturation value configuration path on the LOI.

Figure 2-15. Configuring Alarm and Saturation Values with LOI



** Available only if option code (S) or (D) is ordered.*
*** Available only if option codes (S) and (DC) are both ordered, or if option codes (D) and (DC) are both ordered.*

2.8.4 Configuring the LCD display

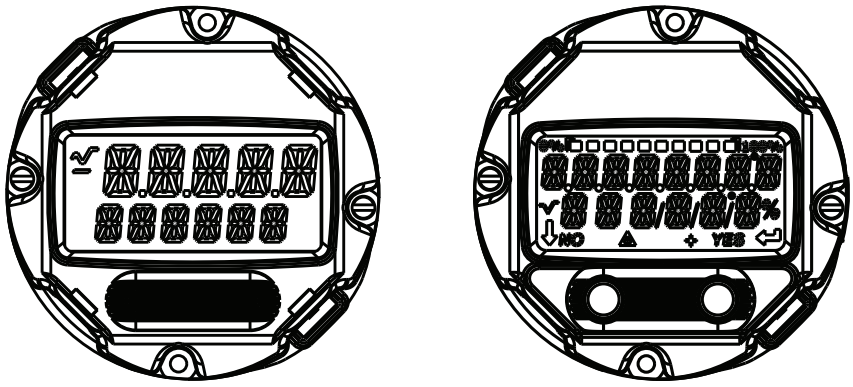
The LCD display configuration command allows customization of the LCD display to suit application requirements. The LCD display will alternate between the selected items with each item displaying for a 3 second interval.

- 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 2-16 to view the differences between the LCD display and LOI display options available with the 644.

Figure 2-16. LCD Display and Local Operator Interface Display

LCD display **LOI display**



Configuring LCD display with a Field Communicator

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

Device Dashboard Fast Keys	2, 1, 4

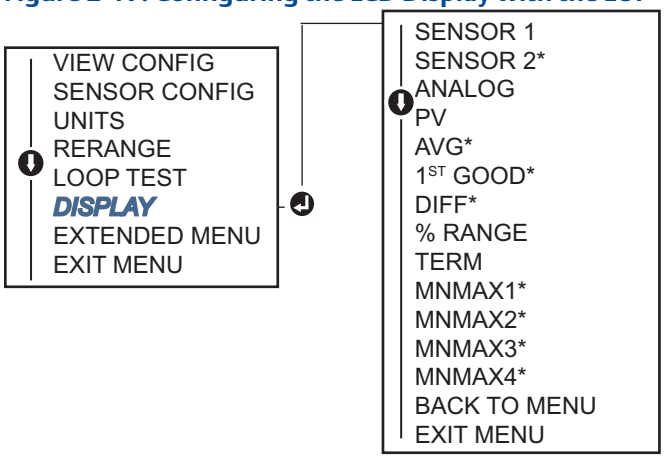
Configuring LCD display with AMS Device Manager

1. Right click on the device and select **Configure**.
2. In the left navigation pane select **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. Select **"Apply"** when complete.

Configuring LCD display with LOI

Reference the figure below to find the LCD display value configuration path on the LOI.

Figure 2-17. Configuring the LCD Display with the LOI



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

2.9 Inputting device information

Access the transmitter information variables on-line 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.

Configuring device information with a Field Communicator

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

Device Dashboard Fast Keys	1, 8

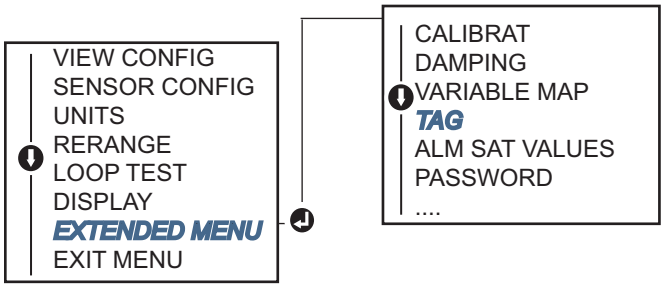
Configuring device information with AMS Device Manager

1. Right click on the device and select **Configure**.
2. In the left navigation pane select **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. Select **Apply** when complete.

Configuring tag with LOI

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

Figure 2-18. Configuring the Tag with LOI



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 50 Hz.

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

1. Right click on the device and select **Configure**.
2. In the left navigation pane select **Manual Setup**.
3. On the **Device** Tab there will be a group box called **Noise Rejection**, in the box **AC Power Filter** select from the drop down menu.
4. Select **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.

Performing a processor reset with a Field Communicator

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

Device Dashboard Fast Keys	3, 4, 6, 1

Performing a processor reset AMS Device Manager

1. Right click on the device and select **Service Tools**.
2. In the left navigation pane select **Maintenance**.
3. On the **Reset/Restore** Tab select the **Processor Reset** button.
4. Select **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 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.

Configure intermittent sensor detection with 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.

Configure intermittent sensor detection with AMS Device Manager

1. Right click on the device and select **Configure**.
2. In the left navigation pane select **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. Select **Apply** when complete.

2.10.4 Open Sensor Hold Off

The Open Sensor Hold Off option, at the normal setting, enables the 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 644 that desire a more vigorous open sensor detection, the Open Sensor Hold Off 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.

Note
In high noise environments, normal mode is recommended.

Configure open sensor hold off with a Field Communicator

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

Device Dashboard Fast Keys	2, 2, 7, 3

Configure open sensor hold off with AMS Device Manager

1. Right click on the device and select **Configure**.
2. In the left navigation pane select **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. Select **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.

Performing a loop test with a Field Communicator

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

Device Dashboard Fast Keys	3, 5, 1

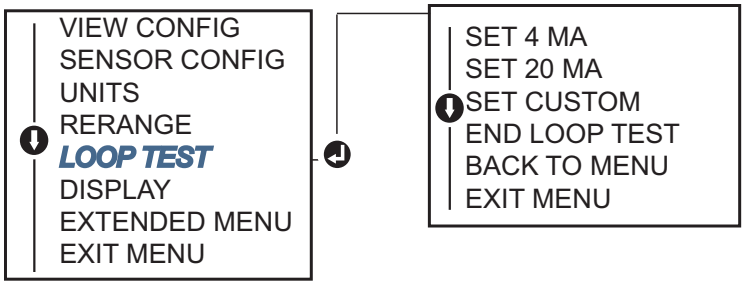
Performing a loop test with AMS Device Manager

1. Right click on the device and select **Service Tools**.
2. In the left navigation pane select **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 select **Apply** when complete.

Performing a loop test with LOI

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

Figure 2-19. Performing a Loop Test with the 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.

Simulate digital signal with a Field Communicator

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

Device Dashboard Fast Keys	3, 5, 2

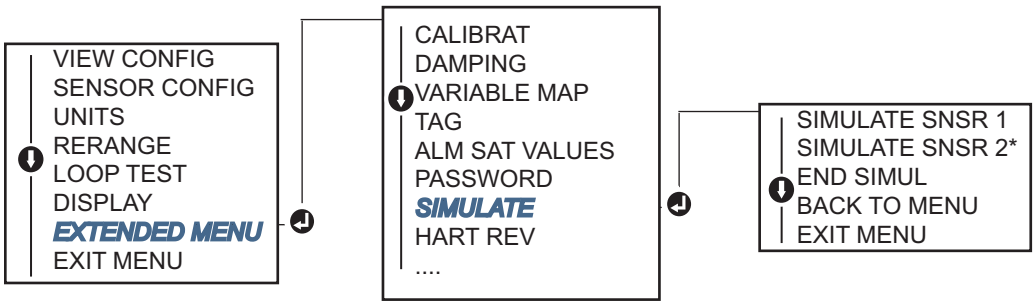
Simulate digital signal with AMS Device Manager

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** select the variable to simulate.
   a. Sensor 1 Temperature
   b. Sensor 2 Temperature (only available with option S or D)
4. Follow the screen prompts to simulate selected digital value.

Simulate digital signal with LOI

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

Figure 2-20. Simulating the Digital Signal with LOI



** Available only if option code (S) or (D) 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**; select the button for **Configure Thermocouple Diagnostic**.
4. Follow the screen prompts to Enable and set the values for the diagnostic.

AMS 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.

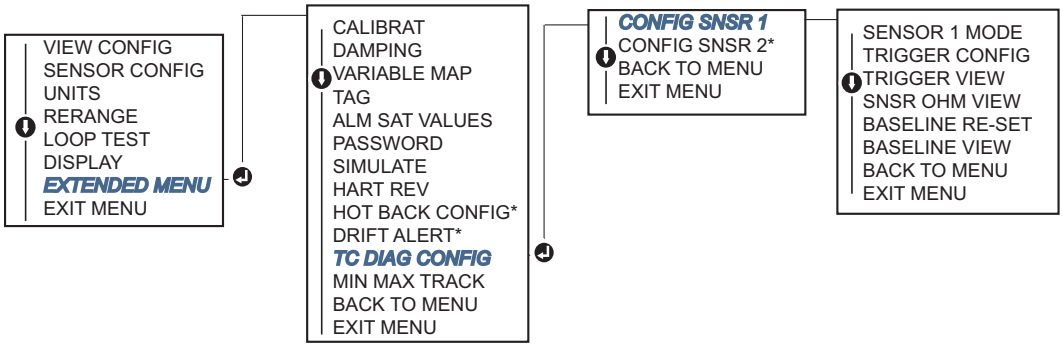
Reset Baseline Resistance: Launches a method to recalculate the Baseline value (which may take several seconds).

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 2-21. Configuring T/C Diagnostic with LOI



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

2.11.4 Minimum/maximum 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 and Field 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.

Configure min/max tracking with a Field Communicator

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

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

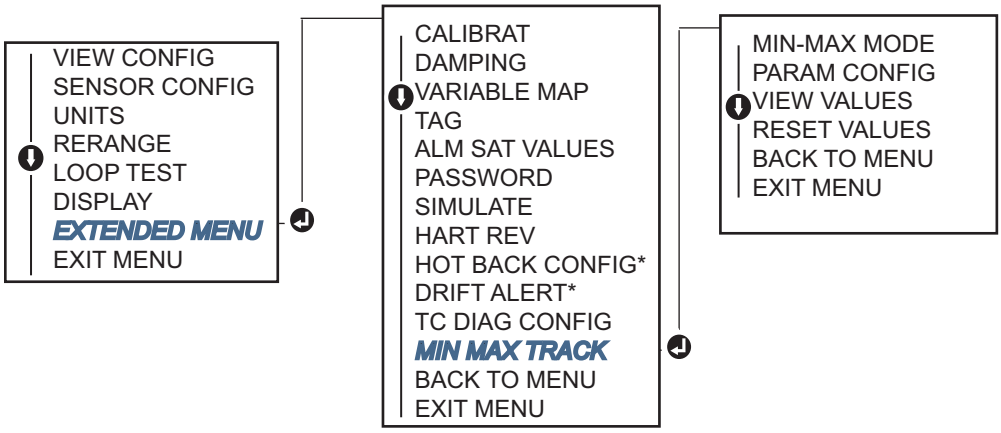
Configure min/max tracking with a AMS Device Manager

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**; select the button for **Configure Min/Max Tracking**.
4. Follow the screen prompts to Enable and configure the settings for the diagnostic.

Configure min/max with LOI

Reference the figure below to find the path to Configure Min/Max in the LOI menu.

Figure 2-22. Configuring Min/Max Tracking with LOI



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

2.12 Establishing multi drop communication

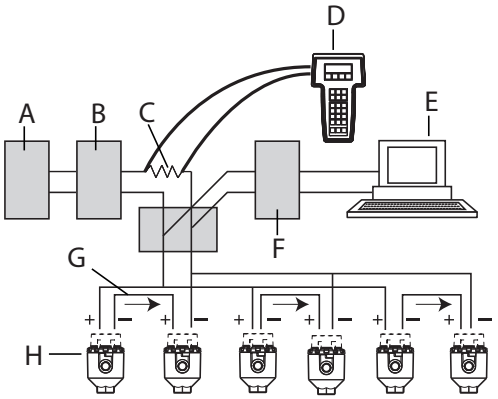
Multi dropping refers to the connection of several transmitters to a single communications transmission line. Communication between the host and the transmitters takes place digitally with the analog output of the transmitters deactivated.

Many Rosemount transmitters can be multi dropped. 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 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 multi dropped 644 transmitter the same as in a standard point-to-point installation.

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

Figure 2-23. Typical Multi Dropped Network



A. Power supply
B. Power supply impedance
C. 250 Ω
D. Hand held terminal
E. Computer or DCS
F. HART Interface
G. 4-20 mA
H. 644 HART transmitter

Note
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 multi drop 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 multi drop 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 multi dropped loop must have a unique poll address.

Changing transmitter address with a Field Communicator

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

Device Dashboard Fast Keys	1, 2, 1

Changing transmitter address with 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, select **Apply**.
3. In HART Revision 7 mode:
   a. In the HART tab, select the **Change Polling Address** button.

2.13 Using the transmitter with the HART Tri-Loop

To prepare the 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 (TV)
- Quaternary Variable (QV)

When using the 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.

Setting the burst mode with 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

Setting the burst mode 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 **HART** tab find the Burst Mode Configuration group box and fill in the necessary content.
4. Select **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 16.

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 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 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 16) 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 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 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 644 variable map as shown.

Variable	Mapping
PV	Sensor 1 or Sensor average
SV	Sensor 2
TV	Differential temperature
QV	As desired

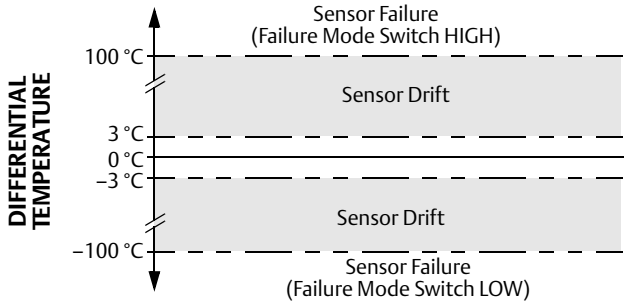
2. Configure Channel 1 of the HART Tri-Loop as TV (differential temperature). If either sensor should fail, the differential temperature output will be +9999 or –9999 (high or low saturation), depending on the position of the Failure Mode Switch (see "Set the alarm switch" on page 48).

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 2-24.

Figure 2-24. Tracking Sensor Drift and Sensor Failure with Differential Temperature



Section 3 Hardware Installation

Overview . . . . . page 45
Safety messages . . . . . page 45
Considerations . . . . . page 46
Installation procedures . . . . . page 47

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 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 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.

3.2.1 Warnings

⚠ 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

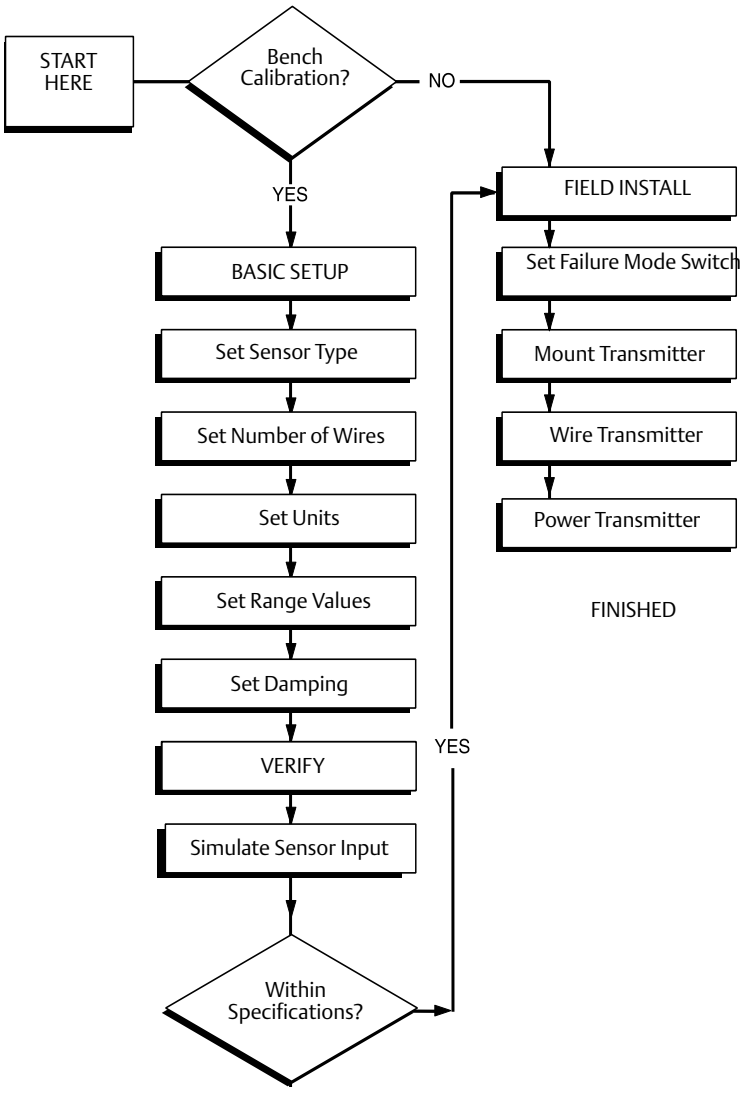
Measurement accuracy depends upon proper installation of the transmitter. Mount the transmitter close to the process and use minimum wiring to achieve best accuracy. Keep in mind the need for easy access, personnel safety, practical field calibration, and a suitable transmitter environment. Install the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



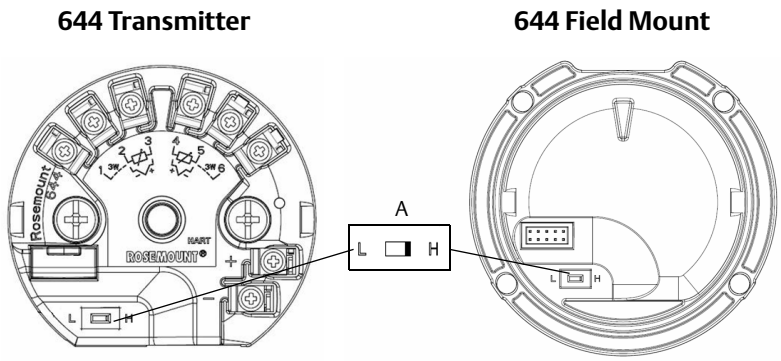
3.4.1 Set the alarm switch

Make certain that 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.

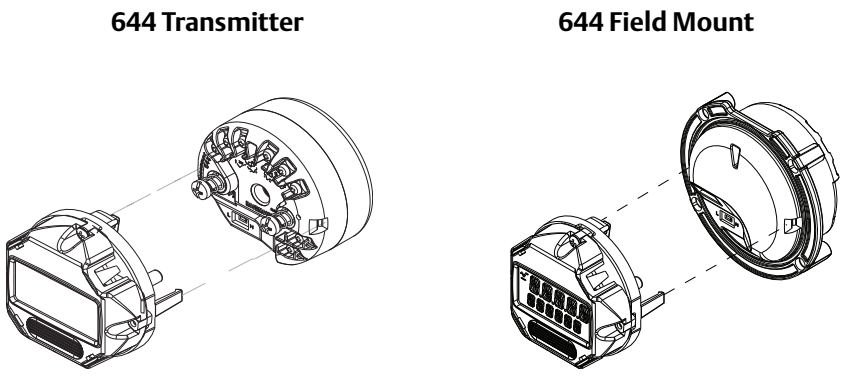
Figure 3-2. Failure Switch Location



A. Alarm switch

Note
If using an LCD Display or LOI, first remove the display by detaching it from the top of the 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 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.

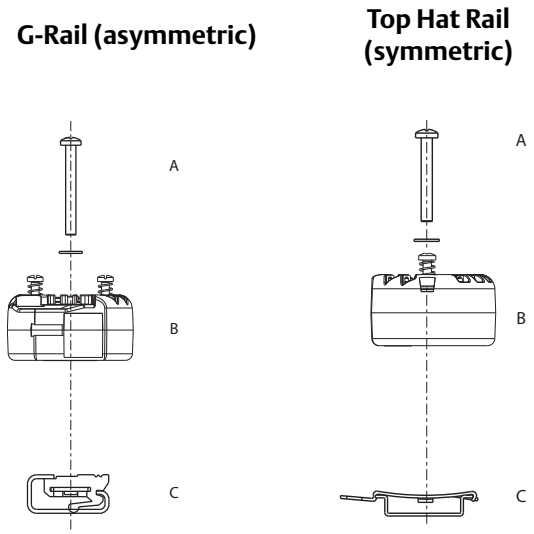
The 644 field mount installs in a field mount housing, directly mounted on a sensor or apart from a sensor assembly using an optional bracket.

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

Mounting a 644 Head Mount 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 "Field mount transmitter with threaded sensor installation".

Figure 3-4. Assembling Rail Clip Hardware to a 644



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

Head mount transmitter with DIN plate style sensor installation

⚠ 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 64).

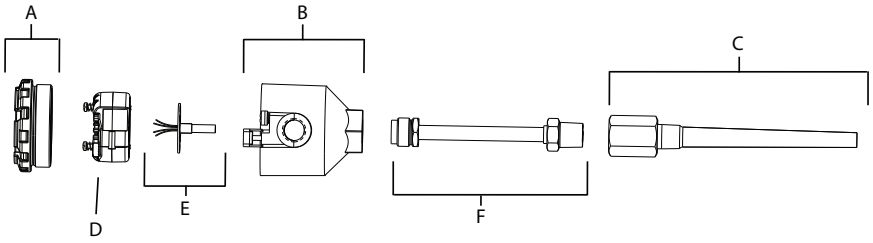
5. Insert the transmitter-sensor assembly into the connection head. Thread the transmitter mounting screw into the connection head mounting holes. Assemble the extension to the connection head by tightening the threaded connections of the extension to the housing. Insert the assembly into the thermowell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

⚠ 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. 644 Transmitter
E. Integral mount sensor with flying leads
F. Extension

(1) If using a Threaded type sensor with a connection head, Reference steps 1-6 below in "Head mount transmitter with threaded sensor installation" on page 51.

Head mount transmitter with threaded sensor installation

⚠ 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. To verify the correct installation of Integral Transient Protection (option code T1) on the Rosemount 644 device, confirm the following steps have been completed:

   a. Ensure the transient protector unit is firmly connected to the transmitter puck assembly.

   b. Ensure the transient protector power leads are adequately secured under the transmitter power terminal screws.

   c. Verify the transient protector's ground wire is secured to the internal ground screw found within the universal head.

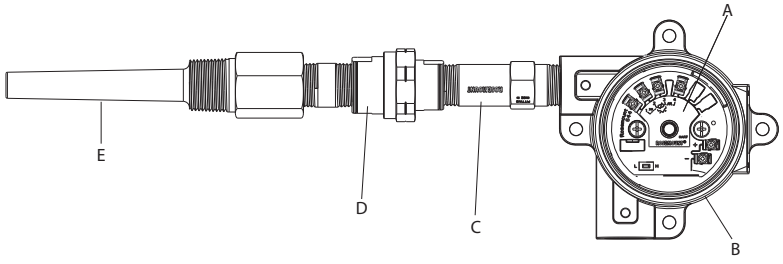
Note
The transient protector requires the use of an enclosure of at least 3.5 in (89 mm) in diameter.

6. 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.

7. Seal adapter threads with thread sealant.

8. 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 58). Avoid contact with other terminals.

⚠ 9. Install and tighten the universal head cover. Enclosure covers must be fully engaged to meet explosion-proof requirements.



A. 644 Transmitter
B. Universal junction box
C. Threaded style sensor
D. Extension
E. Threaded thermowell

Field mount transmitter with threaded sensor installation

⚠ 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.

3. Seal the nipple and adapter threads with silicone tape.

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

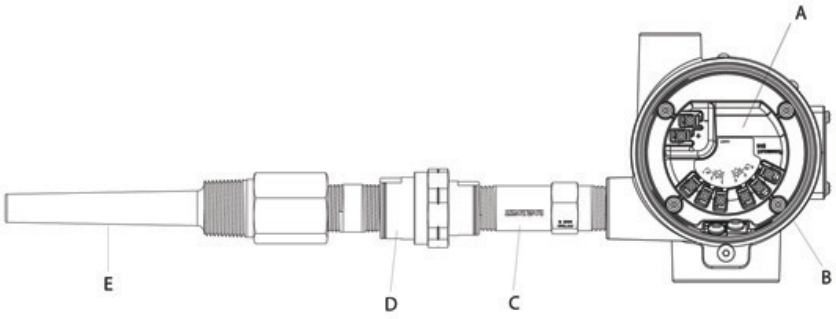
5. Verify the transmitter failure mode switch is in the desired position.

6. Mount the transmitter-sensor assembly into the thermowell, or remote mount if desired.

7. Seal adapter threads with silicone tape.

8. Pull the field wiring leads through the conduit into the field mount housing. Wire the sensor and power leads to the transmitter. Avoid contact with other terminals.

⚠ 9. Install and tighten the covers of two compartments. Enclosure covers must be fully engaged to meet explosion-proof requirements.



A. 644 Field Mount
B. Field mount housing
C. Threaded style sensor
D. Extension
E. Threaded thermowell

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.

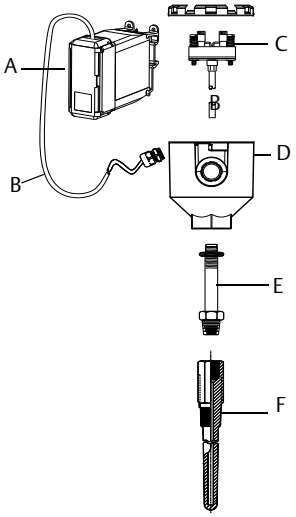
4. Attach and connect sufficient lengths of sensor lead wire from the connection head to the sensor terminal block.

⚠ 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.

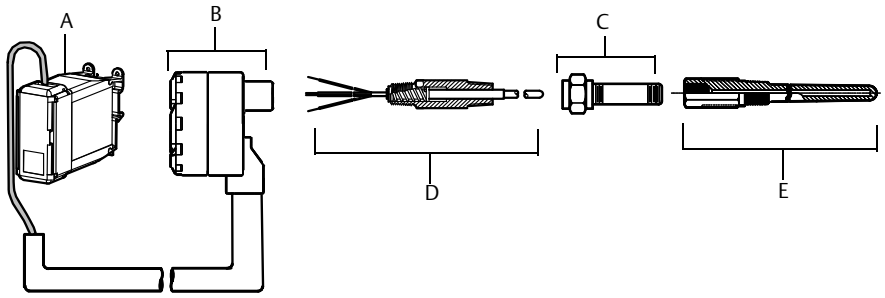
6. Attach the sensor lead wires to the connection head terminals.

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.o

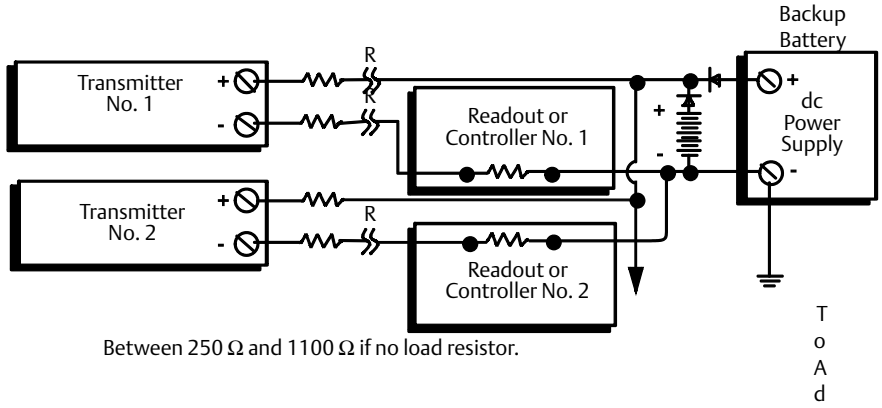


A. Rail mount transmitter
B. Threaded sensor connection head
C. Standard extension
D. Threaded style sensor
E. Threaded thermowell

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



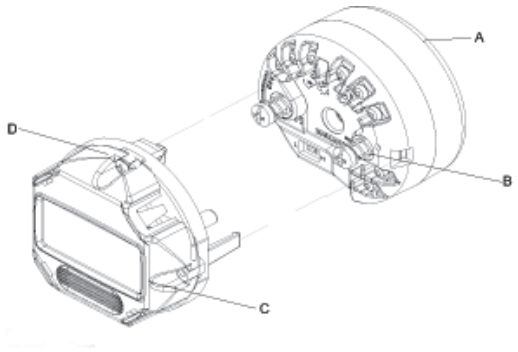
3.4.5 LCD display installation

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 which includes:

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

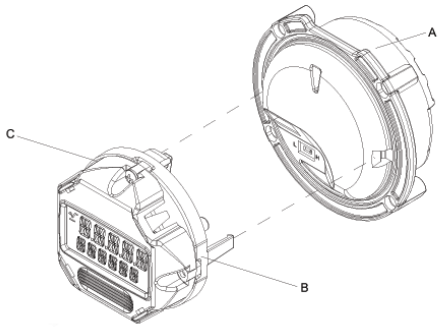
Figure 3-6. Display Connection

644 Transmitter



A. 644 Transmitter
B. Mounting Screw and springs
C. LCD Display
D. LCD Rotation Screws

644 Field Mount



A. 644 Field Mount
B. LCD Display
C. LCD 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° 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.

Note
Observe the following LCD display temperature limits:
Operating: –40 to 175 °F (–40 to 80 °C)
Storage: 0 to 185 °F (–40 to 85 °C)

Section 4 Electrical Installation

Overview . . . . . page 57
Safety messages . . . . . page 57
Wiring and powering the transmitter . . . . . page 58

4.1 Overview

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

4.2.1 Warnings

⚠ 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 this 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 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.

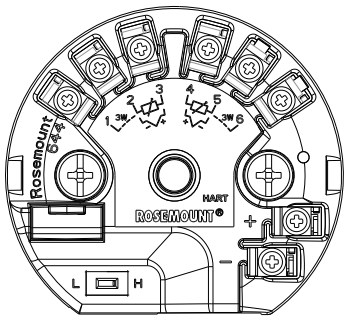
Note
Do not apply high voltage (e.g., ac line voltage) to the transmitter terminals. Abnormally high voltage can damage the unit. (Sensor and transmitter power terminals are rated to 42.4 Vdc. A constant 42.4 volts across the sensor terminals may damage the unit.)

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 19 when making sensor connections.

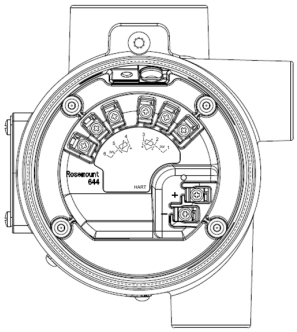
The sensor wiring diagram is located on the device's top label below the terminal screws. See Figure 4-1 and Figure 4-2 for where to find and how to correctly wire all sensor types to the 644 transmitter.

Figure 4-1. Wiring Diagram Location

644 Head Mount Transmitter



644 Field Mount Transmitter



4.3.1 Sensor connections

⚠ The 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.

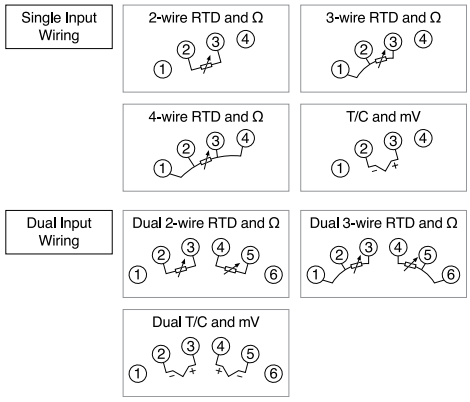
Figure 4-2. Sensor Wiring Diagrams

**Rosemount Inc. provides a 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.

- HART Head Mount



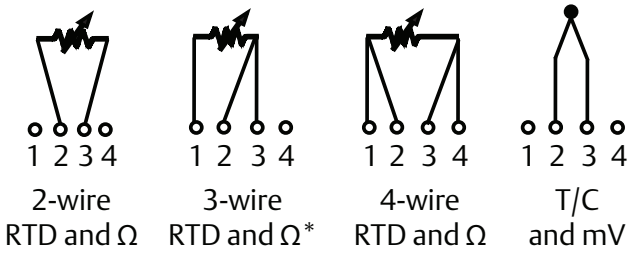




- HART Rail Mount
- Fieldbus
- PROFIBUS®

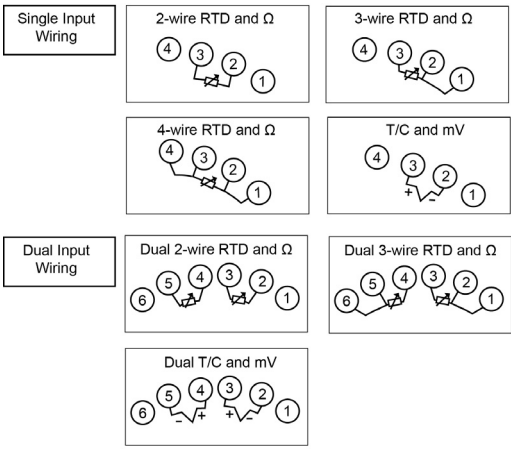






- HART Field Mount





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-wire, 3-wire or 4-wire. If the transmitter is mounted remotely from a 3-wire 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.

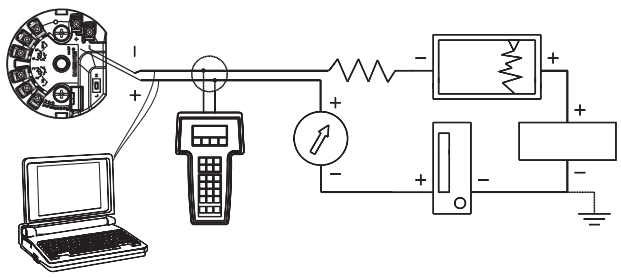
Note
For HART transmitters, the use of two grounded thermocouples with a dual option Rosemount 644 Transmitter is not recommended. For applications in which the use of two thermocouples is desired, connect either two ungrounded thermocouples, one grounded and one ungrounded thermocouple, or one dual element thermocouple.

4.3.2 Power the transmitter

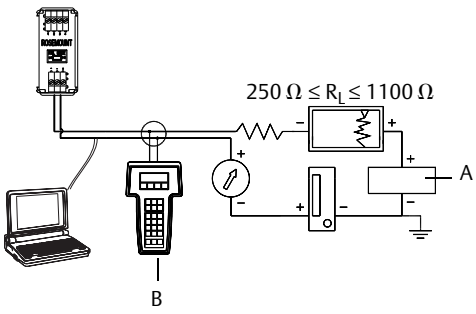
1. An external power supply is required to operate the transmitter.
2. Remove the housing cover (if applicable).
3. Connect the positive power lead to the “+” terminal. Connect the negative power lead to the “–” terminal.
   - If a transient protector is being used, the power leads will now be connected to the top of the transient protector unit. See the transient label for indication of “+” and “-” terminal connections.
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).

Figure 4-3. Powering the Transmitter for Bench Configuration

644 Head Mount and Field Mount



644 Rail Mount



A. Power supply
B. Field Communicator

Note

- 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:

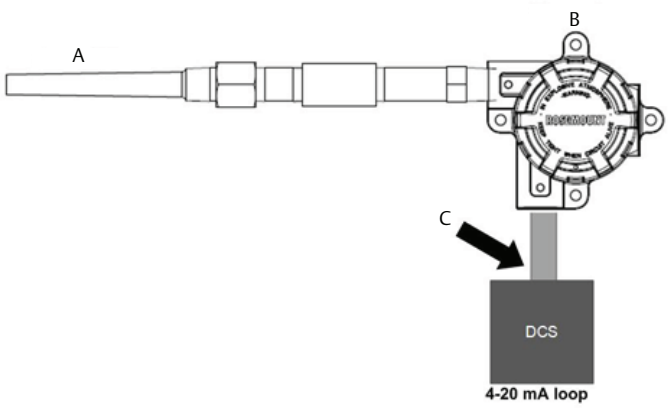
- Trimmed close and insulated from touching the transmitter housing
- Connected to the next shield if cable is routed through a junction box
- Connected to a good earth ground at the power supply end

Ungrounded thermocouple, mV, Ohm, and RTD 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

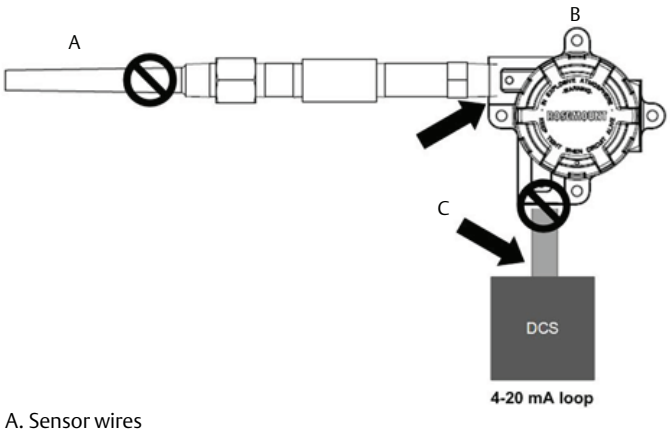
1. Connect sensor wiring shield to the transmitter housing.
2. Ensure the sensor shield is electrically isolated from surrounding fixtures that may be grounded.
3. Ground signal wiring shield at the power supply end.



A. Sensor wires
B. Transmitter
C. Shield ground point

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.



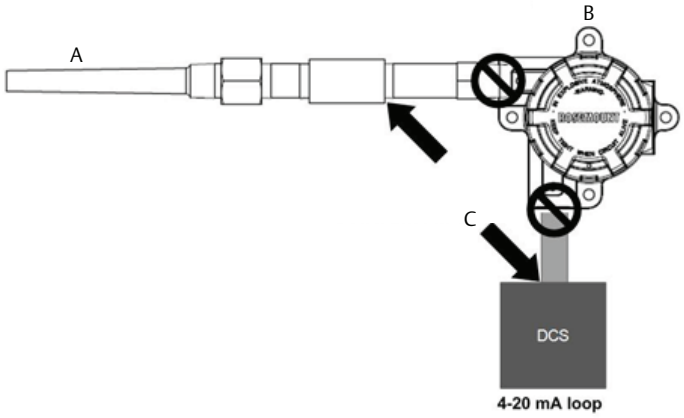
A. Sensor wires
B. Transmitter
C. Shield ground point

5. Connect shields together, electrically isolated from the transmitter.

Option 3

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

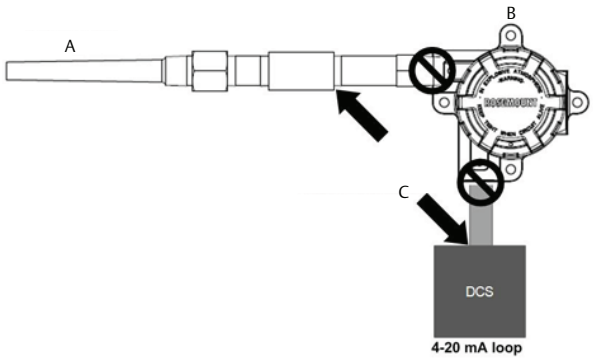


A. Sensor wires
B. Transmitter
C. Shield ground point

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.



A. Sensor wires
B. Transmitter
C. Shield ground point

4.3.4 Wiring with a Rosemount 333 HART Tri-Loop™ (HART/4–20 mA only)

Use the dual-sensor option 644 transmitter that is operating with two sensors in conjunction with a 333 HART Tri-Loop HART-to-Analog Signal Converter to acquire an independent 4–20 mA analog output signal for each sensor input. The 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 19 for basic installation information. Refer to the 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 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.

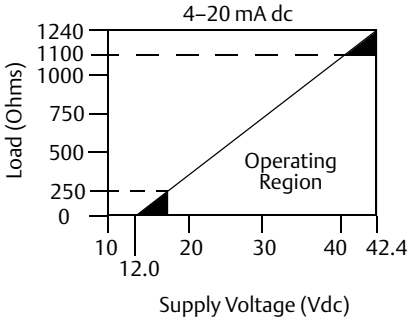
The power supplied to the transmitter is determined by the total loop resistance and should not drop below the lift-off voltage. The lift-off voltage is the minimum supply voltage required for any given total loop resistance. If the power drops below the lift-off voltage while the transmitter is being 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 4-4. Load Limits

Maximum Load = 40.8 X (Supply Voltage - 12.0)



Section 5 Operation and Maintenance

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Safety messages . . . . . page 67
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Trim the analog output . . . . . page 72
Transmitter-sensor matching . . . . . page 74
Switching HART Revision . . . . . page 76

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.

5.2.1 Warnings

⚠ WARNING

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

- Make sure only qualified personnel perform the installation.

Explosions could resultin 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 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.

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 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:

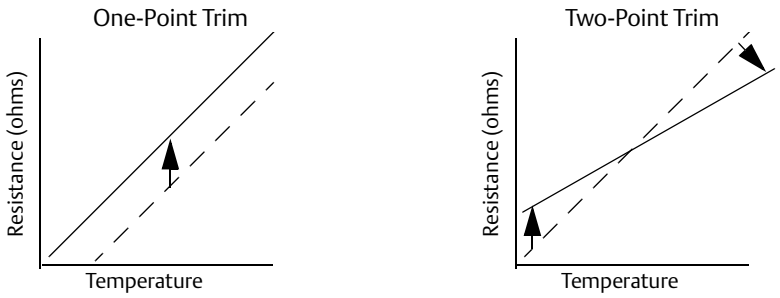
1. Connect sensor to transmitter. Place sensor in bath between range points.
2. Enter known bath temperature using the Field Communicator.

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.



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

Performing a sensor trim using a Field Communicator

1. Connect the calibration device or sensor to the transmitter. (If using an active calibrator, see "Active calibrator and EMF compensation" on page 71)

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."

Performing a sensor trim using AMS Device Manager

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

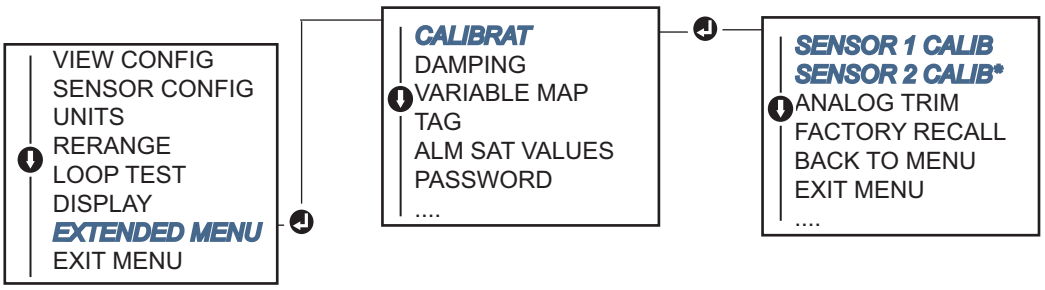
2. On the main Overview tab, select the **Calibrate Sensor(s)** button near the bottom of the window.

3. Follow the screen prompts through the Sensor Trimming process.

Performing a sensor trim using LOI

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.

Recall factory trim – sensor, using a Field Communicator

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

Device Dashboard Fast Keys	3, 4, 4, 2

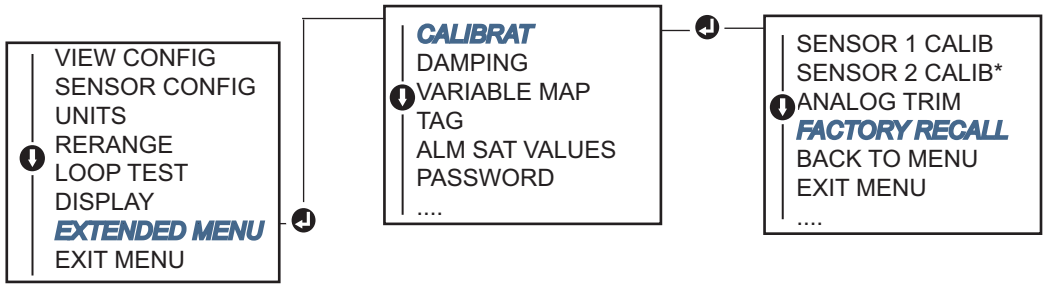
Recall factory trim – sensor, using AMS Device Manager

1. Right click on the device and select **Service Tools**.
2. On the Sensor Calibration tab, select the **Restore Factory Calibration**.
3. Follow the screen prompts through the restoring of the calibration settings.

Recall factory trim – sensor, using LOI

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.

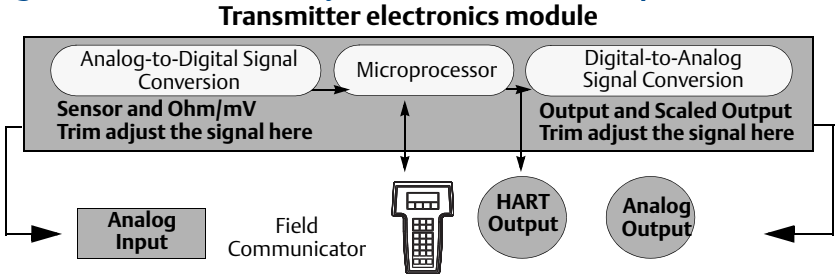
If a reading difference is experienced and is greater than the plant’s accuracy specification allows, perform a sensor trim with “Active Calibrator Mode” disabled. In this case, an active calibrator capable of tolerating pulsating sensor current must be used or the actual sensors must be connected to 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 36).

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:

Performing an analog output trim using a 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

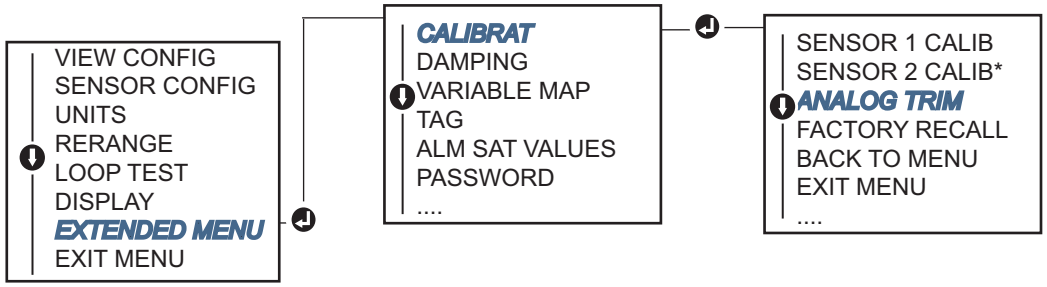
Performing an analog output trim using AMS Device Manager

1. Right click on the device and select **Service Tools**.
2. In the left navigation pane select **Maintenance**.
3. Find the **Analog Calibration** tab and click on the **Analog Trim** button.
4. Follow the screen prompts through the Analog Trimming process.

Performing an analog output trim using LOI

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 Performing a 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.

Performing an analog output trim using a 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

Performing an analog output trim using AMS Device Manager

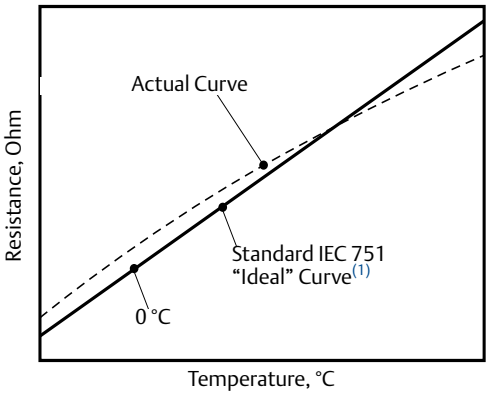
1. Right click on the device and select **Service Tools.**
2. In the left navigation pane select **Maintenance**.
3. Find the **Analog Calibration** tab and select the **Scaled Trim** button.
4. Follow the screen prompts through the Analog Trimming process.

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 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	
644	±0.15 °C	644	±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	
644	±0.10 °C	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:

$$R_t = R_o + R_o\alpha\,[t - \delta(0.01t-1)(0.01t) - \beta(0.01t - 1)(0.01t)^3]$$

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 a 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 select “Set CVD Coefficients” button to be guided through steps. You may also select “Show CVD Coefficients” button to see the current coefficients loaded into the device.
4. Select **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 Switching HART Revision 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 Switching HART Revision using a Field Communicator

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

Device Dashboard Fast Keys	2, 2, 8, 3

5.7.3 Switching HART Revision with AMS Device Manager

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

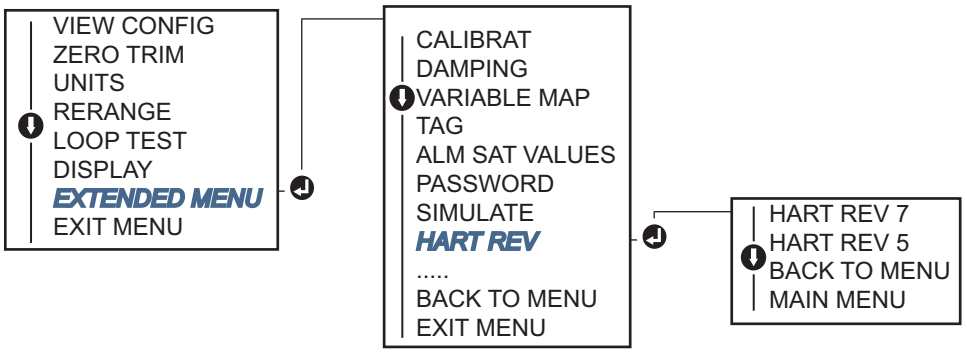
1. In the left navigation pane choose **Manual Setup** and click on the **HART** tab.
2. Select the **Change HART Revision** button and follow the prompts.

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 Switching HART Revision with LOI

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

Figure 5-7. Switching the HART Revision with the LOI



Section 6 Troubleshooting

Overview . . . . . page 77
Safety messages . . . . . page 77
Troubleshooting the 4-20 mA/HART output . . . . . page 78
Diagnostic messages . . . . . page 80

6.1 Overview

Table 6-1 on page 78 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 6-1 on page 78 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 (⚠). 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 this 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

Table 6-1. Rosemount 644 Troubleshooting Table for 4-20 mA 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.

Table 6-1. Rosemount 644 Troubleshooting Table for 4-20 mA Output

Symptom or issue	Potential source	Corrective action
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 LCD/LOI Display, a Field Communicator, or an AMS® Device Manager system. Use the tables below to diagnose particular status messages.

- Failed
- Maintenance
- Advisory

6.4.1 Diagnostic messages: Failed

Table 6-2. Status: Failed – Fix Now

Alert name	LCD screen	LOI screen	Problem	Recommended action
Electronics Failure	ALARM DEVICE ALARM FAIL	ALARM DEVICE ALARM FAIL	If diagnostics indicate and electronics failure, essential electronics in the device have failed. For example, the transmitter may have experienced an electronics failure while attempting to store information.	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.

Table 6-2. Status: Failed – Fix Now

Alert name	LCD screen	LOI screen	Problem	Recommended action
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 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 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.

Alert name	LCD screen	LOI screen	Problem	Recommended action
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 screen	LOI screen	Problem	Recommended action
LCD is not displaying correctly or at all	644 HART 7	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 that 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

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644 safety certified identification . . . . . page 83
Installation in SIS application . . . . . page 84
Commissioning . . . . . page 84
Configuration . . . . . page 85
Alarm and saturation levels . . . . . page 85
644 SIS operation and maintenance . . . . . page 86
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7.1 SIS certification

The 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 644 Temperature Transmitter is classified as a Type B device according to IEC61508, having a hardware fault tolerance of 0.

The 644 HART Head Mount and Field Mount Transmitters are certified to IEC 61508 for single transmitter use in SIS up to SIL 2 and redundant transmitter use in SIS up to SIL 3.

7.2 644 safety certified identification

All 644 HART Head Mount and Field Mount Transmitters must be identified as safety certified before installing into a SIS.

To identify a safety certified 644, make sure the device satisfies number 1 below as well as 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 pre-assembled, 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. You can also identify a certified 644 by its Device Revision which can be found using any HART compliant communicator.

   For the 644, certified device revisions are as follows:

   – Device Revision 8.x (HART 5)
   – Device Revision 9.x (HART 7)

7.3 Installation in SIS application

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

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

Environmental and operational limits are available in the 644 Product Data Sheet (document number 00813-0100-4728). This document can be found at http://www2.emersonprocess.com/en-US/documentation/Pages/DocSearch.aspx.

7.4 Commissioning

The 644 Safety Certified Transmitter can be commissioned by a person with competent knowledge of Rosemount temperature transmitters and the configuration device being used. Refer to "System readiness" on page 8 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 644 Safety Certified Transmitter using a 375/475 Field Communicator, use the Table C-1 on page 161.

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 (LOI) to communicate with and verify the initial configuration or any configuration changes made to the 644 prior to operating in Safety Mode. All configuration methods outlined in Section 3 are the same for the safety certified 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

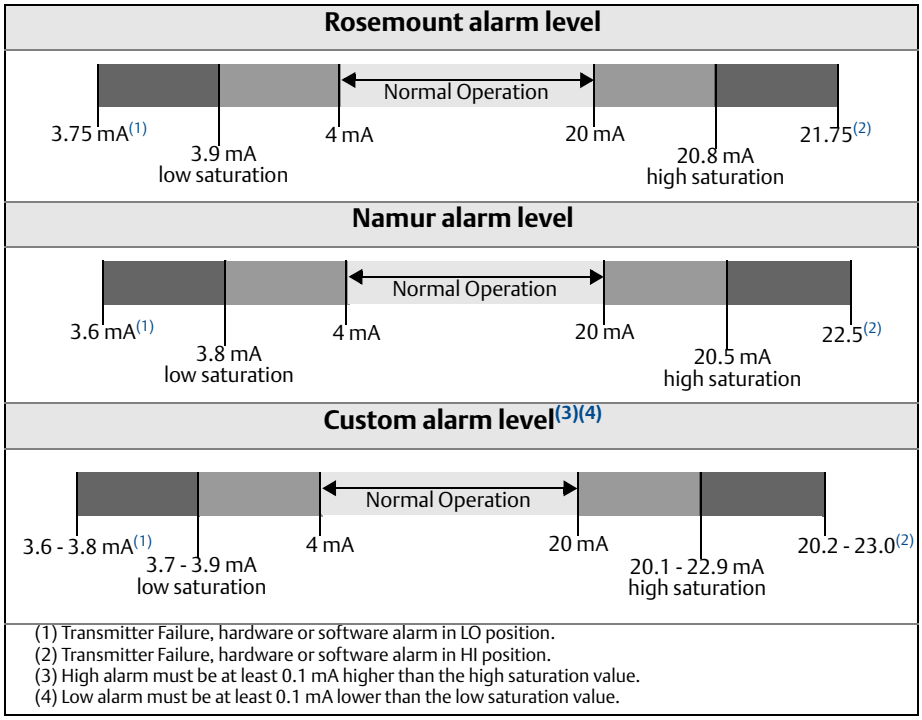
The 644 features software driven alarm diagnostics. The independent circuit is designed to provide backup alarm output if the microprocessor software fails. The transmitter will go to a high or low output current for internally detected failures. The connected PLC must monitor the transmitter current 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 2003) operation. Figure 7-1 on page 86 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



(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.

7.7 644 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.rosemount.com/safety. Use Table C-1 on page 161 to perform Loop Test, Review – Device Variables, and view Status.

The required proof test intervals depends upon the transmitter configuration and the temperature sensor(s) in use along with other factors. Refer to the Rosemount 644 FMEDA report for further information.

7.7.2 Partial proof test

Conducting the Partial Proof Test detects approximately 63% of transmitter DU failures, and approximately 90% of temperature sensor(s) DU failures, not detected by the 644 safety-certified automatic diagnostics, for a typical overall assembly coverage of 67%.

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 Comprehensive proof test

Conducting the Comprehensive Proof Test, which includes the Partial Proof Test, detects approximately 96% of transmitter DU failures and approximately 99% of temperature sensor(s) DU failures, not detected by the 644 safety-certified automatic diagnostics, for a typical overall assembly coverage of 96%.

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

7.7.4 Comprehensive proof test 3

Proof test 3 includes a comprehensive transmitter proof test, along with a partial sensor proof test. Conducting Proof test 3 detects approximately 96% of transmitter DU failures and approximately 90% of temperature sensor(s) DU failures, not detected by the 644 safety-certified automatic diagnostics, for a typical overall assembly coverage of approximately 95%.

1. Bypass the safety PLC or take other appropriate action to avoid a false trip.
2. Execute steps 2 through 6 of the Partial proof test (see 7.7.2).
3. Disconnect Sensor 1 and connect a calibrated sensor simulator in its place.
4. Using at least 2 simulated temperature points, verify the transmitter output remains within the required accuracy.
5. If sensor 2 is used, repeat steps 3 and 4.
6. Restore sensor connections to the transmitter.
7. Verify the housing temperature value is reasonable.
8. Check that sensor value(s) are reasonable in comparison to an independent measurement, such as basic process control system (BPCS) value.
9. Restore the loop to full operation. Remove the bypass from the safety PLC or otherwise restore normal operations.
10. Document the test results per the plant's requirements.

Visual inspection

Not required

Special tools

Not required

Product repair

The 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 http://www.emersonprocess.com/rosemount/safety/safetyCertTemp.htm.

7.8 Specifications

The 644 must be operated in accordance to the functional and performance specifications provided in the Rosemount 644 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 http://www2.emersonprocess.com/en-US/brands/rosemount/Safety-Products/Pages/index.aspx.

7.8.2 SIS safety transmitter failure values

IEC 61508 Safety Certified SIL 2 Claim Limit

Safety accuracy: Span > = 100 °C ± 2%[(1)] of process variable span
Span < 100 °C ± 2 °C
Safety response time: 5 seconds

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

(1) A 2% variation of the transmitter mA output is allowed before a safety trip. Trip values in the DCS or safety logic solver should be derated by 2%

Appendix A Specifications and Reference Data

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4–20 mA / HART specifications . . . . . page 96
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Ordering information . . . . . page 108
Specifications and reference data for 644 HART Head Mount . . . . . page 119

A.1 Specifications

A.1.1 Functional

Inputs

User-selectable; sensor terminals rated to 42.4 Vdc. See"Accuracy" on page 98 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.

LCD display with Local Operator Interface

An optional 14 digit, 2 line integral LCD display operates with a floating or fixed decimal point. The LOI includes all features and functionality available in the regular display with an added 2-button configuration capability directly at the display interface. The LOI also has optional Password Protection for secure operations. The LOI is available on the 644 HART Head Mount and Field Mount products.

For more information on the LOI configuration options or further functionality that the LOI offers, see Appendix D: Local Operator Interface (LOI).

Humidity limits

0–95% relative humidity

Update time

≤ 0.5 seconds per sensor

Accuracy

(default configuration) PT 100

HART (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
644 Head (HART)	Captivated screw terminals permanently fixed to terminal block
644 Head (FF/PROFIBUS)	Compression screw terminals permanently fixed to terminal block
644 Field Mount (HART)	Captivated screw terminals permanently fixed to terminal block
644Rail (HART)	Compression screw permanently fixed to front panel

Field Communicator connections

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

Materials of construction

Electronics housing and terminal block	
644H/F	GE polyphenylene oxide glass reinforced
644R	Polycarbonate
Enclosure (options J5, J6, R1, R2, D1 and D2)	
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 644R attaches directly to a wall or a DIN rail. The 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
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)
M4	LCD Display with Local Operator Interface	35 g (1.34 oz)
J1, J2	Universal Head, 3-conduits, Standard Cover	200 g (7.05 oz)
J1, J2	Universal head, 3-conduits, Meter Cover	307 g (10.83 oz)
J3, J4	Cast SST Universal head, 3-conduits, Standard Cover	2016 g (71.11 oz)
J3, J4	Cast SST Universal head, 3-conduits, Meter Cover	2122 g (74.85 oz)
J5, J6	Aluminum 2-conduits, Universal Head, Standard Cover	577 g (20.35 oz)
J5, J6	Aluminum 2-conduits, Universal Head, Meter Cover	667 g (23.53 oz)
J7, J8	Cast SST Universal Head 2-conduits, Standard, Cover	1620 g (57.14 oz)
J7, J8	Cast SST Universal Head 2-conduits, Meter Cover	1730 g (61.02 oz)
R1, R2	Aluminum Connection Head, Standard Cover	523 g (18.45 oz)
R1, R2	Aluminum Connection Head, Meter Cover	618 g (21.79 oz)
R3, R4	Cast SST Connection Head, Standard Cover	1615 g (56.97 oz)
R3, R4	Cast SST Connection Head, Meter Cover	1747 g (61.62 oz)
D1, D2	HART, Field Mount Transmitter, Aluminum, Meter Cover, Standard Cover	1128 g (39.79 oz)

Weight (stainless steel housing for biotechnology, pharmaceutical industries, and sanitary applications)

Option 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 (644H/F)

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 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 five years
- Thermocouples: ±0.5% of reading or 0.5 °C, whichever is greater, for five 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 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/s^2) peak acceleration

Sensor connections

Figure A-1. 644 HART Head Mount

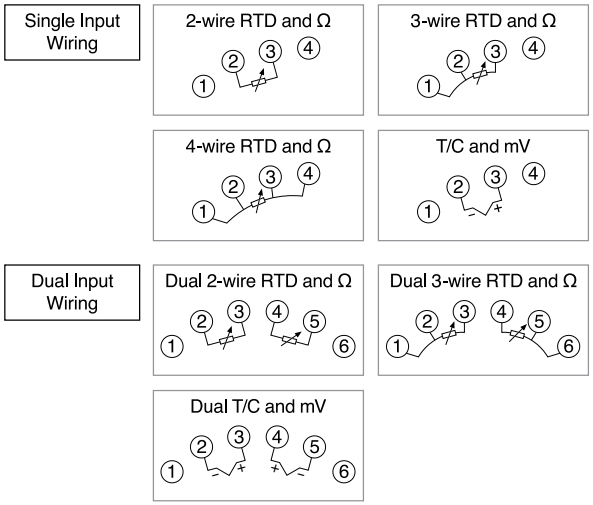


Figure A-2. 644 HART Field Mount

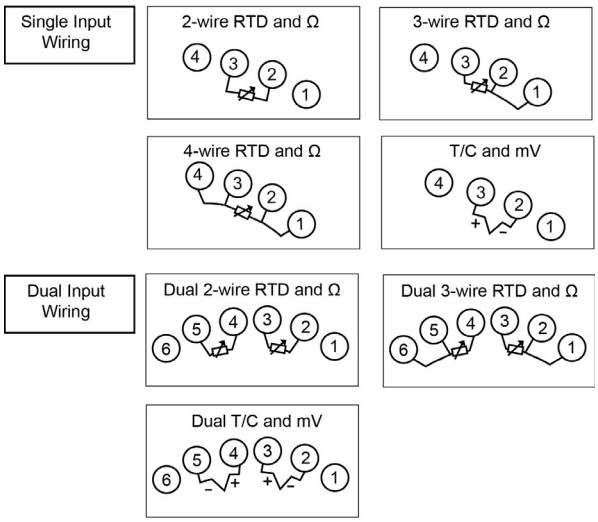
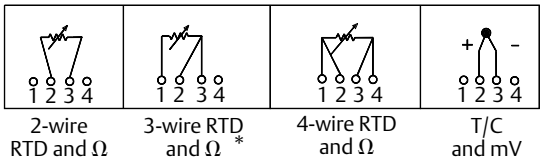


Figure A-3. 644 Sensor Connection Diagram: 644 Fieldbus and PROFIBUS PA Head Mount and 644 Rail Mount



* Rosemount Inc. 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.

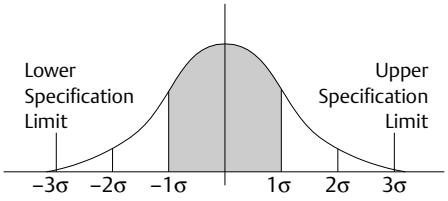
Conformance to specifications

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[(1)]. Our commitment to continual improvement ensures that product design, reliability, and performance will improve annually.

For example, the Reference Accuracy distribution for the 644 is shown to the right. Our Specification Limits are ± 0.15 °C, but, as the shaded area shows, approximately 68% of the units perform three times better than the limits. Therefore, it is very likely you will receive a device that performs much better than our published specifications.

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-4. Typical Accuracy



Accuracy distribution shown is for the 644, Pt 100 RTD sensor, Range 0 to 100 °C.

A.2 4–20 mA / HART specifications

Communication requirements

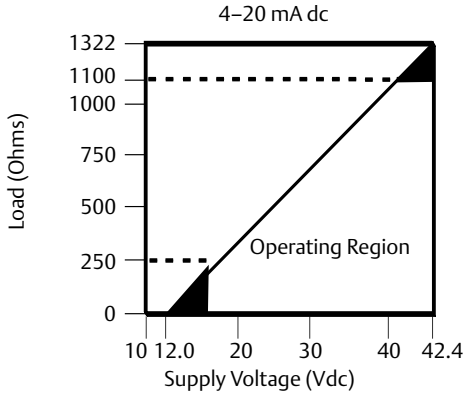
Transmitter power terminals are rated to 42.4 Vdc. A Field Communicator requires a loop resistance between 250 – 1100 ohms. The 644 HART device does not communicate when power is below 12 Vdc at the transmitter terminals.

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

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)



Temperature limits

	Operating limit	Storage limit
With LCD Display[1]	–40 to 175 °F –40 to 80 °C	–50 to 185 °F –45 to 85 °C
Without LCD Display	–40 to 185 °F –40 to 85 °C	–50 to 230 °F –46 to 110 °C

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

Hardware and software failure mode

The 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).

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 6.0 seconds after power is applied, when damping value is set to 0 seconds.

External transient protection

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

Integral transient protection (option code T1)

The transient protector helps to prevent damage to the transmitter from transients induced on the loop wiring by lightning, welding, heavy electrical equipment, or switch gears. The transient protection electronics are contained in an add-on assembly that attaches to the standard transmitter device face. The external ground lug assembly (code G1) is included with the Transient Protector. The transient protector has been tested per the following standard:

- IEEE C62.41-1991 (IEEE 587)/ Location Categories B3.
  6kV/3kA peak (1.2 50 Ωs Wave 8 20 Ωs Combination Wave)
  6kV/0.5kA peak (100 kHz Ring Wave) EFT, 4kVpeak, 2.5kHz,
  5*50nS
- Loop resistance added by protector: 22 ohms max.
- Nominal clamping voltages: 90 V (common mode), 77 V (normal mode)

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

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]
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
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

Table A-3. Ambient Temperature Effect

Sensor options	Sensor reference	Input range (°C)	Temperature effects per 1.0 °C (1.8 °F) change in ambient temperature[1]	Range	D/A effect[2]
2-, 3-, 4-wire RTDs					
Pt 100 (α = 0.00385)	IEC 751	-200 to 850	0.003 °C (0.0054 °F)	Entire Sensor Input Range	0.001% of span
Pt 200 (α = 0.00385)	IEC 751	-200 to 850	0.004 °C (0.0072 °F)	Entire Sensor Input Range	0.001% of span
Pt 500 (α = 0.00385)	IEC 751	-200 to 850	0.003 °C (0.0054 °F)	Entire Sensor Input Range	0.001% of span
Pt 1000 (α = 0.00385)	IEC 751	-200 to 300	0.003 °C (0.0054 °F)	Entire Sensor Input Range	0.001% of span
Pt 100 (α = 0.003916)	JIS 1604	-200 to 645	0.003 °C (0.0054 °F)	Entire Sensor Input Range	0.001% of span
Pt 200 (α = 0.003916)	JIS 1604	-200 to 645	0.004 °C (0.0072 °F)	Entire Sensor Input Range	0.001% of span
Ni 120	Edison Curve No. 7	-70 to 300	0.003 °C (0.0054 °F)	Entire Sensor Input Range	0.001% of span
Cu 10	Edison Copper Winding No. 15	-50 to 250	0.03 °C (0.054 °F)	Entire Sensor Input Range	0.001% of span
Pt 50 (α = 0.00391)	GOST 6651-94	-200 to 550	0.004 °C (0.0072 °F)	Entire Sensor Input Range	0.001% of span
Pt 100 (α = 0.00391)	GOST 6651-94	-200 to 550	0.003 °C (0.0054 °F)	Entire Sensor Input Range	0.001% of span
Cu 50 (α = 0.00426)	GOST 6651-94	-50 to 200	0.008 °C (0.0144 °F)	Entire Sensor Input Range	0.001% of span
Cu 50 (α = 0.00428)	GOST 6651-94	-185 to 200	0.008 °C (0.0144 °F)	Entire Sensor Input Range	0.001% of span
Cu 100 (α = 0.00426)	GOST 6651-94	-50 to 200	0.004 °C (0.0072 °F)	Entire Sensor Input Range	0.001% of span
Cu 100 (α = 0.00428)	GOST 6651-94	-185 to 200	0.004 °C (0.0072 °F)	Entire Sensor Input Range	0.001% of span
Thermocouples					
Type B	NIST Monograph 175, IEC 584	100 to 1820	0.014 °C	T ≥ 1000 °C	0.001% of span
			0.032 °C – (0.0025% of (T – 300)	300 °C ≤ T < 1000 °C	0.001% of span
			0.054 °C – (0.011% of (T – 100)	100 °C ≤ T < 300 °C	0.001% of span
Type E	NIST Monograph 175, IEC 584	-200 to 1000	0.005 °C + (0.0043% of T)	All	0.001% of span
Type J	NIST Monograph 175, IEC 584	-180 to 760	0.0054 °C + (0.00029%of T)	T ≥ 0 °C	0.001% of span
			0.0054 °C + (0.0025% of absolute value T)	T < 0 °C	0.001% of span
Type K	NIST Monograph 175, IEC 584	-180 to 1372	0.0061 °C + (0.0054% of T)	T ≥ 0 °C	0.001% of span
			0.0061 °C + (0.0025% of absolute value T)	T < 0 °C	0.001% of span
Type N	NIST Monograph 175, IEC 584	-200 to 1300	0.0068 °C + (0.00036% of T)	All	0.001% of span
Type R	NIST Monograph 175, IEC 584	0 to 1768	0.016 °C	T ≥ 200 °C	0.001% of span
			0.023 °C – (0.0036% of T)	T < 200 °C	0.001% of span
Type S	NIST Monograph 175, IEC 584	0 to 1768	0.016 °C	T ≥ 200 °C	0.001% of span
			0.023 °C – (0.0036% of T)	T < 200 °C	0.001% of span
Type T	NIST Monograph 175, IEC 584	-200 to 400	0.0064 °C	T ≥ 0 °C	0.001% of span
			0.0064 °C +(0.0043% of absolute value T)	T < 0 °C	0.001% of span
DIN Type L	DIN 43710	-200 to 900	0.0054 °C + (0.00029% of T)	T ≥ 0 °C	0.001% of span
			0.0054 °C + (0.0025% of absolute value T)	T < 0 °C	0.001% of span
DIN Type U	DIN 43710	-200 to 600	0.0064 °C	T ≥ 0 °C	0.001% of span
			0.0064 °C + (0.0043% of absolute value T)	T < 0 °C	0.001% of span
Type W5Re/W26Re	ASTM E 988-96	0 to 2000	0.016 °C	T ≥ 200 °C	0.001% of span
			0.023 °C – (0.0036% of T)	T < 200 °C	0.001% of span

Table A-3. Ambient Temperature Effect

Sensor options	Sensor reference	Input range (°C)	Temperature effects per 1.0 °C (1.8 °F) change in ambient temperature[1]	Range	D/A effect[2]
GOST Type L	GOST R 8.585-2001	-200 to 800	0.007 °C	T ≥ 0 °C	0.001% of span
			0.007 °C – (0.003% of absolute value T)	T < 0 °C	0.001% of span
Other input types					
Millivolt Input		-10 to 100 mV	0.0005 mV	Entire Sensor Input Range	0.001% of span
2-, 3-, 4-wire Ohm		0 to 2000 Ω	0.0084 Ω	Entire Sensor Input Range	0.001% of span

(1) Change in ambient is with reference to the calibration temperature of the transmitter 68 °F (20 °C) from factory.
(2) Does not apply to FOUNDATION fieldbus.

Table A-4. Transmitter Accuracy when ordered with Option Code P8

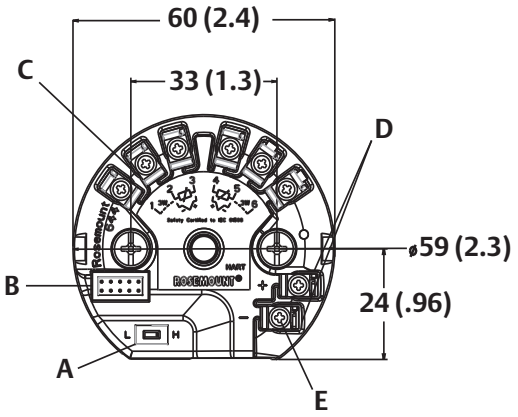
Sensor options	Sensor reference	Input ranges		Minimum span[1]		Digital accuracy[2]		D/A accuracy[3][4]
2-, 3-, 4-wire RTDs		°C	°F	°C	°F	°C	°F	
Pt 100 (a = 0.00385)	IEC 751	–200 to 850	–328 to 1562	10	18	± 0.10	± 0.18	±0.02% of span
Pt 200 (a = 0.00385)	IEC 751	–200 to 850	–328 to 1562	10	18	± 0.22	± 0.40	±0.02% of span
Pt 500 (a = 0.00385)	IEC 751	–200 to 850	–328 to 1562	10	18	± 0.14	± 0.25	±0.02% of span
Pt 1000 (a = 0.00385)	IEC 751	–200 to 300	–328 to 572	10	18	± 0.10	± 0.18	±0.02% of span
Pt 100 (a = 0.003916)	JIS 1604	–200 to 645	–328 to 1193	10	18	± 0.10	± 0.18	±0.02% of span
Pt 200 (a = 0.003916)	JIS 1604	–200 to 645	–328 to 1193	10	18	± 0.22	± 0.40	±0.02% of span
Ni 120	Edison Curve No. 7	–70 to 300	–94 to 572	10	18	± 0.08	± 0.14	±0.02% of span
Cu 10	Edison Copper Winding No. 15	–50 to 250	–58 to 482	10	18	±1.00	± 1.80	±0.02% of span
Pt 50 (a=0.00391)	GOST 6651-94	–200 to 550	–328 to 1022	10	18	±0.20	±0.36	±0.02% of span
Pt 100 (a=0.00391)	GOST 6651-94	–200 to 550	–328 to 1022	10	18	±0.10	±0.18	±0.02% of span
Cu 50 (a=0.00426)	GOST 6651-94	–50 to 200	–58 to 392	10	18	±0.34	±0.61	±0.02% of span
Cu 50 (a=0.00428)	GOST 6651-94	–185 to 200	–301 to 392	10	18	±0.34	±0.61	±0.02% of span
Cu 100 (a=0.00426)	GOST 6651-94	–50 to 200	–58 to 392	10	18	±0.17	±0.31	±0.02% of span
Cu 100 (a=0.00428)	GOST 6651-94	–185 to 200	–301 to 392	10	18	±0.17	±0.31	±0.02% of span
Thermocouples[5]								
Type B[6]	NIST Monograph 175, IEC 584	100 to 1820	212 to 3308	25	45	± 0.75	± 1.35	±0.02% of span
Type E	NIST Monograph 175, IEC 584	–200 to 1000	–328 to 1832	25	45	± 0.20	± 0.36	±0.02% of span
Type J	NIST Monograph 175, IEC 584	–180 to 760	–292 to 1400	25	45	± 0.25	± 0.45	±0.02% of span
Type K[7]	NIST Monograph 175, IEC 584	–180 to 1372	–292 to 2501	25	45	± 0.25	± 0.45	±0.02% of span
Type N	NIST Monograph 175, IEC 584	–200 to 1300	–328 to 2372	25	45	± 0.40	± 0.72	±0.02% of span
Type R	NIST Monograph 175, IEC 584	0 to 1768	32 to 3214	25	45	± 0.60	± 1.08	±0.02% of span
Type S	NIST Monograph 175, IEC 584	0 to 1768	32 to 3214	25	45	± 0.50	± 0.90	±0.02% of span
Type T	NIST Monograph 175, IEC 584	–200 to 400	–328 to 752	25	45	± 0.25	± 0.45	±0.02% of span
DIN Type L	DIN 43710	–200 to 900	–328 to 1652	25	45	± 0.35	± 0.63	±0.02% of span
DIN Type U	DIN 43710	–200 to 600	–328 to 1112	25	45	± 0.35	± 0.63	±0.02% of span
Type W5Re/W26Re	ASTM E 988-96	0 to 2000	32 to 3632	25	45	± 0.70	± 1.26	±0.02% of span
GOST Type L	GOST R 8.585-2001	–200 to 800	–392 to 1472	25	45	± 0.25	± 0.45	±0.02% of span
Other input types								
Millivolt Input		–10 to 100 mV		3 mV		±0.015 mV		±0.02% of span
2-, 3-, 4-wire Ohm Input		0 to 2000 ohms		20 ohm		±0.35 ohm		±0.02% of span

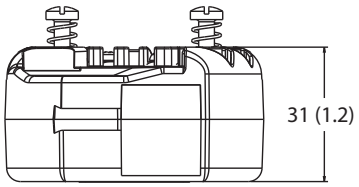
(1) No minimum or maximum span restrictions within the input ranges. Recommended minimum span will hold noise within accuracy specification with damping at zero seconds.
(2) Digital accuracy: Digital output can be accessed by the Field Communicator.
(3) Total Analog accuracy is the sum of digital and D/A accuracies.
(4) Applies to HART / 4-20 mA devices.
(5) Total digital accuracy for thermocouple measurement: sum of digital accuracy +0.25 °C (0.45 °F) (cold junction accuracy).
(6) Digital accuracy for NIST Type B is ±3.0 °C (±5.4 °F) from 100 to 300 °C (212 to 572 °F).
(7) Digital accuracy for NIST Type K is ±0.50 °C (±0.9 °F) from –180 to –90 °C (–292 to –130 °F).

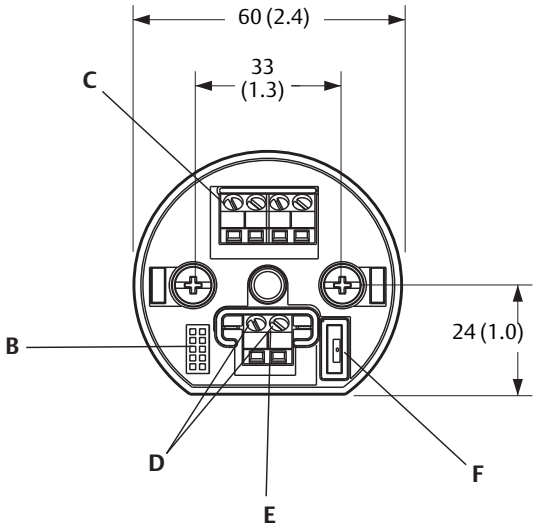
A.3 Dimensional drawings

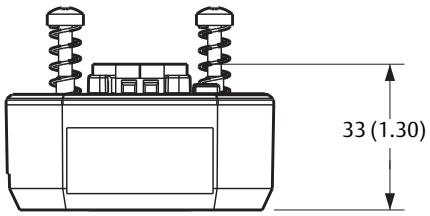
644H (DIN A Head Mount)

HART device shown with captivated screw terminals	FOUNDATION fieldbus and PROFIBUS device shown with standard compression screw terminals







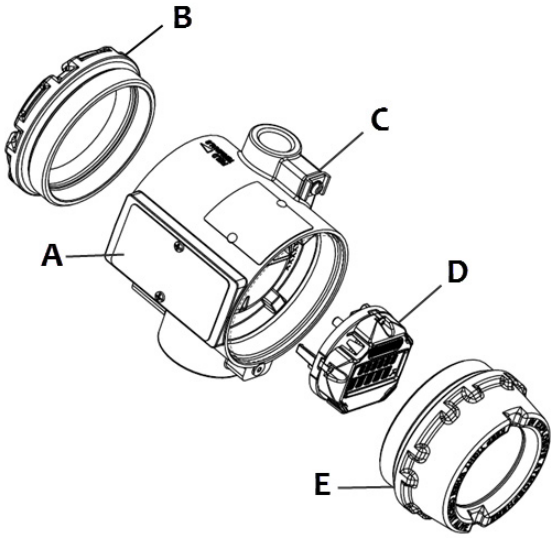


Dimensions are in millimeters (inches).

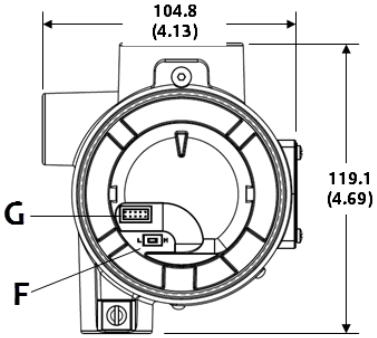
A.Failure mode switch
B. Display connection
C. Sensor terminals
D. Communication terminals
E. Power terminals
F. Simulation switch

644 Field Mount

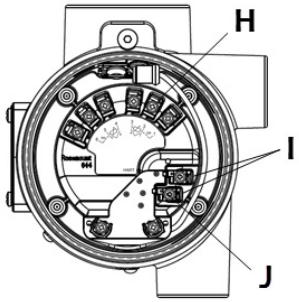
Transmitter exploded view



Display compartment

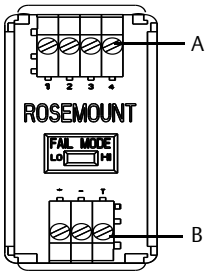


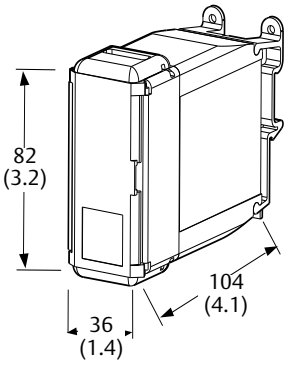
Terminal compartment with optional transient protector



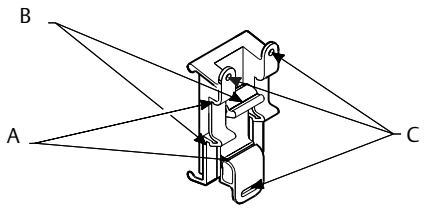
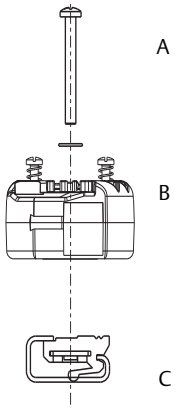
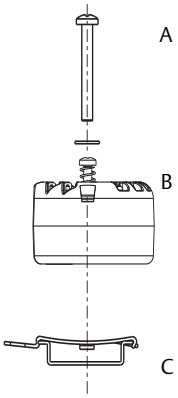
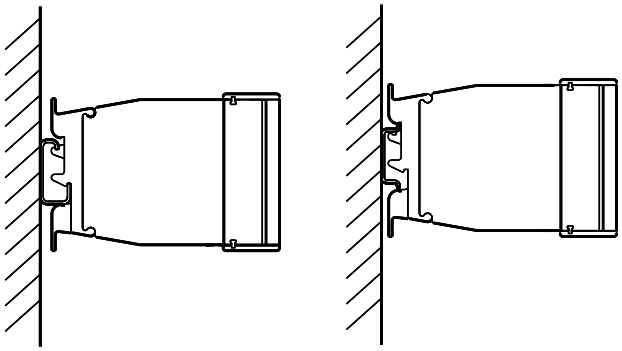
A. Nameplate
B. Cover
C. Housing with electronics module
D. LCD display
E. Display cover
F. Failure mode switch
G. Display connection
H. Sensor terminals
I. Communication terminals
J. Power terminals

644 Rail Mount





A. Sensor terminals
B. Power terminals

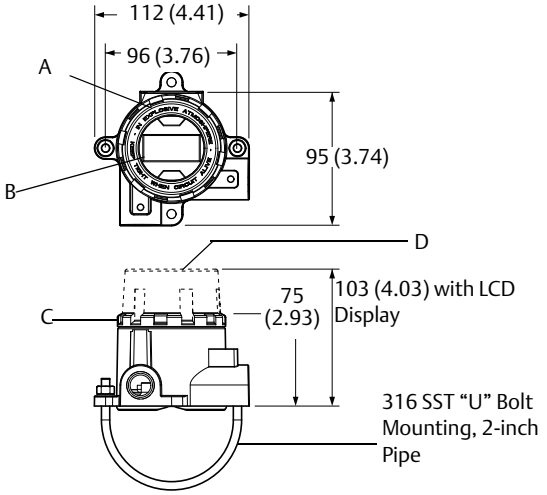
<table>
<tr><th colspan="3">Mounting Kits for 644 Head Mount</th></tr>
<tr><th rowspan="2">644R Rail & Walls Clips</th><th colspan="2">644H Rail Clips</th></tr>
<tr><th>G-Rail (asymmetric)</th><th>Top Hat Rail (symmetric)</th></tr>
<tr><td>
</td><td>
</td><td>
</td></tr>
<tr><td colspan="3">

(part number 03044-4103-0001)

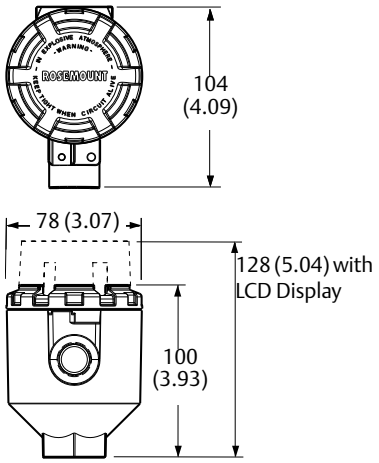
A. Top hat rail grooves
B. G-rail grooves
C. Screw holes for mounting to a wall
D. Mounting hardware
E. Transmitter
F. Rail clip</td></tr>
</table>

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

Threaded-Sensor Universal Head (Option code J5, J6, J7 or J8)

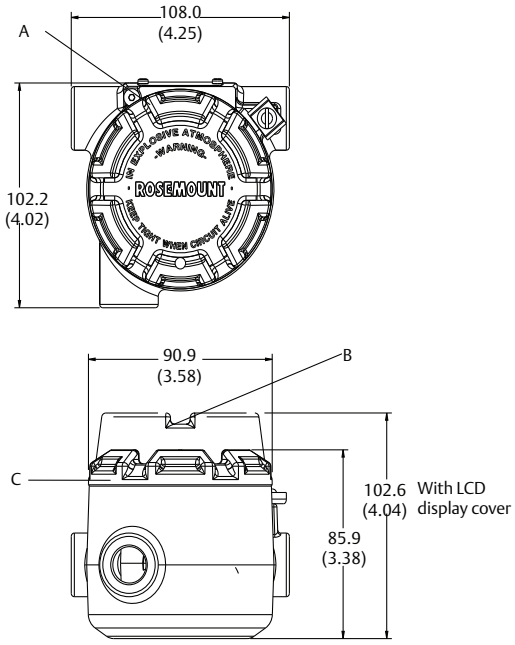


DIN Style Sensor Connection Head (Option code R1, R2, R3 or R4)

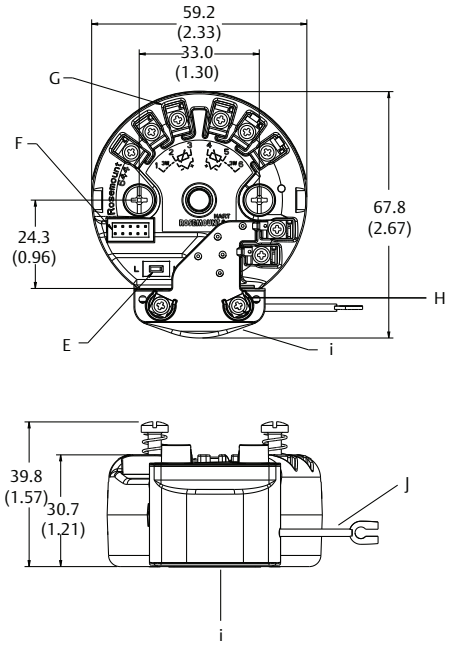


Note: A "U" Bolt is shipped with each universal head unless assembly option XA is ordered.

Threaded Sensor Universal Head, 3-conduit (Option code J1 or J2)



Rosemount 644 with Transient Protector (Option code T1)



A. Label
B. Display cover
C. Standard cover
D. Meter cover
E.Failure mode switch
F. Display connection
G. Sensor terminals
H. Power terminals
I. Transient protector
J. Ground wire

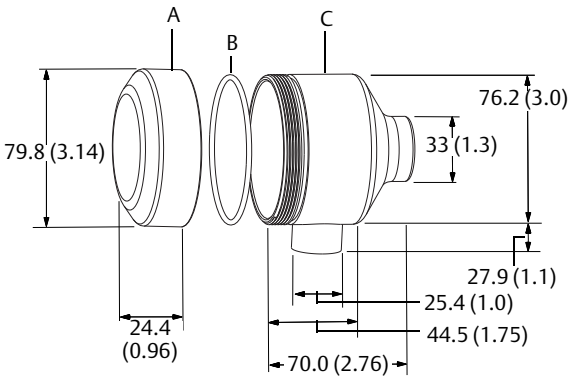
Note: Option code T1 requires the use of J1, J2, J3 or J4 enclosure option.

Dimensions are in millimeters (inches).

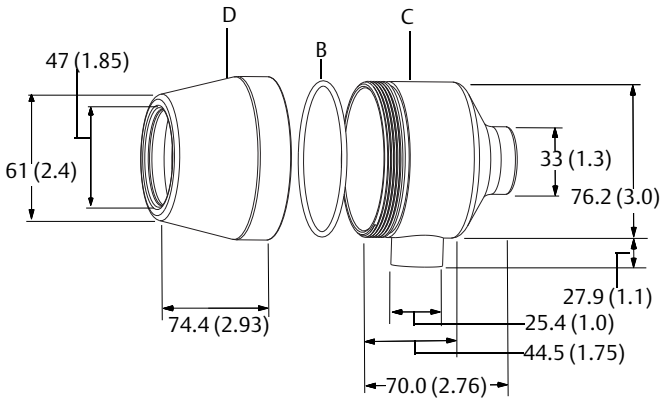
Stainless Steel Housing for Biotechnology, Pharmaceutical Industries, and Sanitary Applications

Sanitary Housing (Option Code S1, S2, S3, S4)

Standard cover



LCD display cover



A. Standard cover
B. O-Ring
C. Housing
D. LCD Display Cover

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 Revisions 5 and 7 (Option Code A), FOUNDATION fieldbus (Option Code F) or PROFIBUS PA (Option Code W)
- DIN A Head Mount, Field Mount, or Rail Mount transmitter 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)
- Integral Transient Protection (Option Code T1)

Table A-5. Rosemount 644 Smart 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)					★
F	Field Mount - Single Sensor Input (HART only)					★
D	Field 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		**Head**			**Rail**	
Hazardous Locations Certificates (consult factory for availability [1])		**A**	**F**	**W**	**A**	
NA	No approval	●	●	●	●	★
E5	FM Explosion-proof; Dust Ignition-proof	●	●	●	–	★
I5	FM Intrinsically Safe; Non-incendive	●	●	●	●	★

Table A-5. Rosemount 644 Smart 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

Product certifications		Head			Rail	
		A	F	W	A	
K5	FM Explosion-proof; Intrinsically Safe; Non-incendive; Dust Ignition-proof	●	●	●	–	★
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	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	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	ATEX Intrinsic Safety	●	●	●	●	★
E7	IECEx Flameproof	●	●	●	–	★
I7	IECEx Intrinsic Safety	●	●	●	●	★
N7	IECEx Type n	●	●	●	–	★
NG	IECEx Type n Component	●	●	●	●	★
K7	IECEx Flameproof; Intrinsic Safety; Type n; Dust	●	–	–	–	★
I2	INMETRO Intrinsic Safety	●	–	–	–	★
E4	TIIS Flameproof	●	●	–	–	★
E2	INMETRO Flameproof	●	●	●	–	★

Table A-5. Rosemount 644 Smart 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

Options

					Head			Rail	
PlantWeb® standard diagnostic functionality					**A**	**F**	**W**	**A**	
DC	Diagnostics: Hot Backup and Sensor Drift Alert				●	–	–	–	★
DA1	HART Sensor and Process Diagnostic Suite: Thermocouple Diagnostic and Min/Max Tracking				●	–	–	–	★
Enclosure options					**Head**			**Rail**	
	Housing style	**Material**	**Entry size**	**Diameter**					
J5 (2) (3)	Universal Junction Box, 2 entries	Aluminum	M20 X 1.5	3 in (76 mm)	●	●	●	–	★
J6 (3)	Universal Junction Box, 2 entries	Aluminum	1/2–14 NPT	3 in (76 mm)	●	●	●	–	★
R1	Rosemount Connection Head, 2 entries	Aluminum	M20 X 1.5	3 in (76 mm)	●	●	●	–	★
R2	Rosemount Connection Head, 2 entries	Aluminum	1/2–14 NPT	3 in (76 mm)	●	●	●	–	★
J1 (2)	Universal Junction Box, 3 entries	Aluminum	M20 X 1.5	3.5 in (89 mm)	●	●	●	–	★
D1 (2)(4)	Field Mount Housing, Separate Terminal Compartment	Aluminum	M20 X 1.5	3.5 in (89 mm)	–	–	–	–	★
D2 (4)	Field Mount Housing, Separate Terminal Compartment	Aluminum	1/2–14 NPT	3.5 in (89 mm)	–	–	–	–	★
J3 (2)	Universal Junction Box, 3 entries	Cast SST	M20 X 1.5	3.5 in (89 mm)	●	●	●	–	
J4	Universal Junction Box, 3 entries	Cast SST	1/2–14 NPT	3.5 in (89 mm)	●	●	●	–	
J7 (2)(3)	Universal Junction Box, 2 entries	Cast SST	M20 X 1.5	3 in (76 mm)	●	●	●	–	
J8 (3)	Universal Junction Box, 2 entries	Cast SST	1/2–14 NPT	3 in (76 mm)	●	●	●	–	
R3	Rosemount Connection Head, 2 entries	Cast SST	M20 X 1.5	3 in (76 mm)	●	●	●	–	
R4	Rosemount Connection Head, 2 entries	Cast SST	1/2–14 NPT	3 in (76 mm)	●	●	●	–	
S1	Connection Head, 2 entries	Polished SST	1/2–14 NPT	3 in (76 mm)	●	●	●	–	
S2	Connection Head, 2 entries	Polished SST	1/2–14 NPSM	3 in (76 mm)	●	●	●	–	
S3	Connection Head, 2 entries	Polished SST	M20 X 1.5	3 in (76 mm)	●	●	●	–	
S4	Connection Head, 2 entries	Polished SST	M20 X 1.5, M24 X 1.4	3 in (76 mm)	●	●	●	–	
Mounting bracket					**A**	**F**	**W**	**A**	
B4 (5)	316 SST U-bolt Mounting Bracket, 2-in pipe mount				●	●	●	–	★
B5 (5)	“L” Mounting Bracket for 2-inch pipe or panel mounting				●	●	●	–	★

Table A-5. Rosemount 644 Smart 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

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		**A**	**F**	**W**	**A**	
P8[(6)]	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		**Head**			**Rail**	
C2	Transmitter-Sensor Matching - Trim to Specific Rosemount RTD Calibration Schedule (CVD constants)	●	●	●	●	★
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	●	–	–	–	★
Shipboard certification						
SBS	American Bureau of Shipping (ABS) Type Approval	●	●	●	–	★
SBV	Bureau Veritas (BV) Type Approval	●	●	●	–	★
SDN	Det Norske Veritas (DNV) Type Approval	●	●	●	–	★
SLL	Lloyd's Register (LR) Type Approval	●	●	●	–	★
External ground						
G1	External ground lug assembly (see “External ground screw assembly” on page 118)	●	●	●	–	★

Table A-5. Rosemount 644 Smart 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

Transient protection						
T1[7]	Integral Transient Protector	●	–	–	–	★
Cable gland option						
G2	Cable gland (7.5 mm - 11.99 mm)	●	●	●	–	★
G7	Cable gland, M20x1.5, Ex e, Blue Polyamide (5 mm - 9 mm)	●	●	●	–	★
Cover chain option		**A**	**F**	**W**	**A**	
G3	Cover chain	●	●	●	–	★
Conduit electrical connector						
GE[8]	M12, 4-pin, Male Connector (eurofast®)	●	●	●	–	★
GM[8]	A size Mini, 4-pin, Male Connector (minifast®)	●	●	●	–	★
External label						
EL	External label for ATEX Intrinsic Safety	●	●	●	–	★
HART revision configuration						
HR5	Configured for HART Revision 5	●	–	–	–	★
HR7[9]	Configured for HART Revision 7	●	–	–	–	★
Assemble to options						
XA	Sensor Specified Separately and Assembled to Transmitter	●	●	●	–	★
Extended product warranty		**Head**			**Rail**	
		A	F	W	A	
WR3	3-year limited warranty	●	●	●	●	★
WR5	5-year limited warranty	●	●	●	●	★

Typical rail mount model number: 644 R A I5
Typical head mount model number: 644 S A I5 DC DA1 J5 M5
Typical field mount model number: 644 F A I5 DC DA1 D1 M4 T1

(1) See Table A-6 for the validity of enclosures with individual approval options.
(2) When ordered with XA, 1/2-in. NPT enclosure will come equipped with an M20 adapter with the sensor installed as a process ready.
(3) Enclosure ships equipped with 50.8 mm (2-in) SST pipe bracket for mounting.
(4) Available with Transmitter Type 644F or 644D only.
(5) Bracket assembly only available with 3-Conduit housings J1, J2, J3, J4, D1, and D2.
(6) See Table A-4 for Enhanced Accuracy specifications.
(7) Transient Protection option requires the use of J1, J2, J3, J4, D1, or D2.
(8) 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.
(9) Configures the HART output to HART Revision 7. The device can be field configured to HART Revision 5 if needed.

Table A-6. 644 Enclosure Options Valid With Individual Approval Codes

Code	Hazardous location approval description	Enclosure options valid with approval
NA	No approval	J1, J2, J3, J4, R1, R2, R3, R4, J5, J6, J7, J8, S1, S2, S3, S4, D1, D2
E5	FM Explosion-proof; Dust Ignition-proof	J1, J2, J3, J4, R1, R2, R3, R4, J5, J6, J7, J8, D1, D2
I5	FM Intrinsically Safe; Non-incendive	J1, J2, J3, J4, R1, R2, R3, R4, J5, J6, J7, J8, D1, D2
K5	FM Explosion-proof; Intrinsically Safe; Non-incendive; Dust Ignition-proof	J1, J2, J3, J4, R1, R2, R3, R4, J5, J6, J7, J8, D1, D2
NK	IECEx Dust	J1, J2, J3, J4, R1, R2, R3, R4, J5, J6, J7, J8, D1, D2
KC	FM and CSA Intrinsically Safe and Non-incendive	Only available with Rail mount device
KB	FM and CSA: Explosion-proof; Intrinsically Safe; Non-incendive; Dust Ignition-proof	J2, J4, R2, R4, J6, J8, D2
KD	FM, CSA and ATEX Explosion-proof, Intrinsically Safe	J2, J4, R2, R4, J6, J8, D2
I6	CSA Intrinsically Safe	J1, J2, J3, J4, R1, R2, R3, R4, J5, J6, J7, J8, D1, D2
K6	CSA Explosion-proof; Intrinsically Safe; Non-incendive; Dust Ignition-proof	J2, J4, R2, R4, J6, J8, D2
I3	China Intrinsic Safety	J1, J2, J3, J4, R1, R2, R3, R4, J5, J6, J7, J8
E3	China Flameproof	R1, R2, R3, R4, J5, J6, J7, J8
N3	China Type n	R1, R2, R3, R4, J5, J6, J7, J8
E1	ATEX Flameproof	J1, J2, J3, J4, R1, R2, R3, R4, J5, J6, J7, J8, D1, D2
N1	ATEX Type n	J1, J2, J3, J4, R1, R2, R3, R4, J5, J6, J7, J8, D1, D2
NC	ATEX Type n Component	None
K1	ATEX Flameproof; Intrinsic Safety; Type n; Dust	J1, J2, J3, J4, R1, R2, R3, R4, J5, J6, J7, J8, D1, D2
ND	ATEX Dust Ignition-Proof	J1, J2, J3, J4, R1, R2, R3, R4, J5, J6, J7, J8, D1, D2
KA	CSA and ATEX: Explosion-proof; Intrinsically Safe; Non-incendive	J2, J4, R2, R4, J6, J8, D2
I1	ATEX Intrinsic Safety	J1, J2, J3, J4, R1, R2, R3, R4, J5, J6, J7, J8, S1, S2, S3, S4, D1, D2
E7	IECEx Flameproof	J1, J2, J3, J4, R1, R2, R3, R4, J5, J6, J7, J8, D1, D2
I7	IECEx Intrinsic Safety	J1, J2, J3, J4, R1, R2, R3, R4, J5, J6, J7, J8, S1, S2, S3, S4, D1, D2
N7	IECEx Type n	J1, J2, J3, J4, R1, R2, R3, R4, J5, J6, J7, J8, D1, D2
NG	IECEx Type n Component	None
K7	IECEx Flameproof; Intrinsic Safety; Type n; Dust	J1, J2, J3, J4, R1, R2, R3, R4, J5, J6, J7, J8, D1, D2
I2	INMETRO Intrinsic Safety	J1, J2, J3, J4, R1, R2, R3, R4, J5, J6, J7, J8
E4	TIIS Flameproof	J6
E2	INMETRO Flameproof	R1, R2, R3, R4, J5, J6, J7, J8
K2	INMETRO Flameproof, Intrinsic Safety	R1, R2, R3, R4, J5, J6, J7, J8
KM	Technical Regulations Customs Union (EAC) Flameproof, Intrinsic Safety	J1, J2, J3, J4, J5, J6, J7, J8, R1, R2, R3, R4, S1, S2, S3, S4
IM	Technical Regulations Customs Union (EAC) Intrinsic Safety	J1, J2, J3, J4, J5, J6, J7, J8, R1, R2, R3, R4, S1, S2, S3, S4
EM	Technical Regulations Customs Union (EAC) Flameproof	J1, J2, J3, J4, J5, J6, J7, J8, R1, R2, R3, R4, S1, S2, S3, S4

Table A-7. Enclosure Spares

Description	Part number
Universal Head, Aluminum, Standard cover, 2-conduit - M20 entries	00644-4420-0002
Universal Head, Aluminum, Display cover, 2-conduit - M20 entries	00644-4420-0102
Universal Head, Aluminum, Standard cover, 2-conduit - 1/2 - 14 NPT entries	00644-4420-0001
Universal Head, Aluminum, Display cover, 2-conduit - 1/2 - 14 NPT entries	00644-4420-0101
Universal Head, SST, Standard cover, 2-conduit - M20 entries	00644-4433-0002
Universal Head, SST, Display cover, 2-conduit - M20 entries	00644-4433-0102
Universal Head, SST, Standard cover, 2-conduit - 1/2 - 14 NPT entries	00644-4433-0001
Universal Head, SST, Display cover, 2-conduit - 1/2 - 14 NPT entries	00644-4433-0101
Connection Head, Aluminum, Standard cover, 2-conduit - M20 x 1/2 ANPT entries	00644-4410-0021
Connection Head, Aluminum, Display cover, 2-conduit - M20 x 1/2 ANPT entries	00644-4410-0121
Connection Head, Aluminum, Standard cover, 2-conduit - 1/2 - 14 NPT x 1/2 ANPT entries	00644-4410-0011
Connection Head, Aluminum, Display cover, 2-conduit - 1/2 - 14 NPT x 1/2 ANPT entries	00644-4410-0111
Connection Head, SST, Standard cover, 2-conduit - M20 X 1/2 ANPT entries	00644-4411-0021
Connection Head, SST, Display cover, 2-conduit - M20 X 1/2 ANPT entries	00644-4411-0121
Connection Head, SST, Standard cover, 2-conduit - 1/2 - 14 NPT x 1/2 ANPT entries	00644-4411-0011
Connection Head, SST, Display cover, 2-conduit - 1/2 - 14 NPT x 1/2 ANPT entries	00644-4411-0111
Connection Head, Polished SST, Standard cover, 2-conduit - M20 x 1.5 entries	00079-0312-0033
Connection Head, Polished SST, Display cover, 2-conduit - M20 x 1.5 entries	00079-0312-0133
Connection Head, Polished SST, Standard cover, 2-conduit - M20 x 1.5 / M24 x 1.5 entries	00079-0312-0034
Connection Head, Polished SST, Display cover, 2-conduit - M20 x 1.5 / M24 x 1.5 entries	00079-0312-0134
Connection Head, Polished SST, Standard cover, 2-conduit -1/2 -14 NPT entries	00079-0312-0011
Connection Head, Polished SST, Display cover, 2-conduit - 1/2 -14 NPT entries	00079-0312-0111
Connection Head, Polished SST, Standard cover, 2-conduit - 1/2 -14 NPSM entries	00079-0312-0022
Connection Head, Polished SST, Display cover, 2-conduit - 1/2 -14 NPSM entries	00079-0312-0122
Universal Head, Aluminum, Standard cover, 3-conduit - M20 entries	00644-4439-0001
Universal Head, Aluminum, Display cover, 3-conduit - M20 entries	00644-4439-0101
Universal Head, Aluminum, Standard cover, 3-conduit - 1/2 - 14 NPT entries	00644-4439-0002
Universal Head, Aluminum, Display cover, 3-conduit - 1/2 - 14 NPT entries	00644-4439-0102
Universal Head, SST, Standard cover, 3-conduit - M20 entries	00644-4439-0003
Universal Head, SST, Display cover, 3-conduit - M20 entries	00644-4439-0103
Universal Head, SST, Standard cover, 3-conduit - 1/2 - 14 NPT entries	00644-4439-0004
Universal Head, SST, Display cover, 3-conduit - 1/2 - 14 NPT entries	00644-4439-0104

Table A-8. Display Kit Spares

Description	Part number
Display only	
644 HART LCD Display (option M5)	00644-7630-0001
644 HART Local Operator Interface (option M4)	00644-7630-1001
644 FOUNDATION fieldbus LCD Display (option M5)	00644-4430-0002
644 PROFIBUS PA LCD Display (option M5)	00644-4430-0002
644 HART Legacy display Kit (option M5 - Device Rev 7)	00644-4430-0002

Table A-8. Display Kit Spares

Description	Part number
Display with aluminum meter cover	
Rosemount 644 HART LCD Display (option M5)(1)	00644-7630-0011
Rosemount 644 HART LCD Display (option M5)(2)	00644-7630-0111
Display with aluminum cover	
Rosemount 644 HART Local Operator Interface (option M4)(1)	00644-7630-1011
Rosemount 644 HART Local Operator Interface (option M4)(2)	00644-7630-1111
Rosemount 644 FOUNDATION Fieldbus LCD Display (option M5)(1)	00644-4430-0001
Rosemount 644 PROFIBUS PA LCD Display (option M5)(1)	00644-4430-0001
Rosemount 644 HART Legacy display Kit (option M5)(1)	00644-4430-0001
Display with SST meter cover	
Rosemount 644 HART LCD Display (option M5)(1)	00644-7630-0021
Rosemount 644 HART LCD Display (option M5)(2)	00644-7630-0121
Rosemount 644 HART Local Operator Interface (option M4)(1)	00644-7630-1021
Rosemount 644 HART Local Operator Interface (option M4)(2)	00644-7630-1121
Rosemount 644 FOUNDATION Fieldbus LCD Display (option M5)(1)	00644-4430-0011
Rosemount 644 PROFIBUS PA LCD Display (option M5)(1)	00644-4430-0011
Rosemount 644 HART Legacy display Kit (option M5)(1)	00644-4430-0011

(1) Covers provided are compatible with the 3-in (76 mm) Universal Junction Box and Rosemount Connection Head enclosure styles.

(2) Cover provided is compatible with the 3.5-in (89 mm) Universal Junction Box and Field Mount enclosure styles.

Table A-9. Transient Protection Spares

Description	Part number
Transient Protector without Enclosure	00644-4437-0001
Transient Protector with Universal Head, Aluminum, Standard cover, 3-conduit - M20	00644-4438-0001
Transient Protector with Universal Head, Aluminum, Display cover, 3-conduit - M20	00644-4438-0101
Transient Protector with Universal Head, Aluminum, Standard cover, 3-conduit - 1/2 NPT	00644-4438-0002
Transient Protector with Universal Head, Aluminum, Display cover, 3-conduit - 1/2 NPT	00644-4438-0102
Transient Protector with Universal Head, SST, Standard cover, 3-conduit - M20	00644-4438-0003
Transient Protector with Universal Head, SST, Display cover, 3-conduit - M20	00644-4438-0103
Transient Protector with Universal Head, SST, Standard cover, 3-conduit - 1/2 NPT	00644-4438-0004
Transient Protector with Universal Head, SST, Display cover, 3-conduit - 1/2 NPT	00644-4438-0104

Table A-10. Miscellaneous Accessories

Description	Part number
Ground Screw Assembly Kit (1)	00644-4431-0001
Ground Screw Assembly Kit (2)	00644-4431-0002
Mounting Screws and Springs	00644-4424-0001
Hardware Kit for mounting a Rosemount 644 Head mount to a DIN rail (includes clips for symmetrical and asymmetrical rails)	00644-5301-0010
U-Bolt mounting Kit 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
Snap Rings Kit (used for assembly to a DIN sensor)	00644-4432-0001
Cover Clamp Assembly	00644-4434-0001
Terminal Block, 13mm M4 Mounting Screws	00065-0305-0001
U-bolt Mounting Bracket, 2-in pipe mount, 2g vibration rating with SST enclosure - 316 SST (option B4)	00644-7610-0001
L - Mounting Bracket for 2-inch pipe or panel mounting, SST, 2g vibration rating (option B5)	00644-7611-0001

(1) Compatible with the 3-in (76 mm) Universal Junction Box and Rosemount Connection Head enclosure styles.

(2) Compatible with the 3.5-in (89 mm) Universal Junction Box and Field Mount enclosure styles.

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

A.4.1 Configuration

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.

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 sec.
Line Voltage Filter	50 Hz
Alarm	High (21.75 mA)
LCD (when installed)	Engineering Units and mA
Tag	See “Tagging” on page 117.
HART Revision	5

A.4.2 Tagging

Hardware tag

- 13 characters total
- Tags are adhesive or metal labels
- Tag is permanently attached to transmitter

Software tag

HART Revision 5

A HART Revision 5 Transmitter can store up to 8 characters for the HART software tag and defaults to the first 8 characters of the hardware tag.

HART Revision 7

A HART Revision 7 Transmitter can store the same 8 character tag as the Revision 5 but has a additional and separate long software tag that can be configured for up to 32 characters. The long software tag is available when option code HR7 is ordered.

A.4.3 Considerations

Special mounting considerations

See “Mounting Kits for 644 Head Mount” on page 105 for the special hardware that is available to:

- Mount a 644H to a DIN rail.
- Retrofit a new 644H to replace an existing 644H transmitter in an existing threaded sensor connection head.

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.

Option code	External ground screw assembly included?
E5, I1, I2, I5, I6, I7, K5, K6, NA, I3, KB	No–Order option code G1
E1, E2, E3, E4, E7, K7, N1, N7, ND, K1, K2, KA, NK, N3, KD, T1	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	Customization available
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 characters ■ **Hardware Tag**: 13 Characters ■ **Software Tag**: 8 Characters ■ Sensor Type and Connection ■ Measurement Range and Units ■ Damping Value ■ **Failure Mode:** High or Low ■ **Hot Backup:** Mode and PV ■ **Sensor Drift Alert:** Mode, Limit and Units ■ **Display Configuration**: Choose what will be shown on the LCD display ■ **Custom Alarm and saturation levels**: Choose custom High and Low Alarm and Saturation levels ■ **Security information:** Write Protection, HART Lock and Local Operator Interface Password
	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.
	A1, CN, or C8: Alarm Level Configuration	■ **A1:** NAMUR Alarm and Saturation Levels, with High Alarm configured ■ **CN:** NAMUR Alarm and Saturation Levels, with Low Alarm configured ■ **C8:** Low Alarm (Standard Rosemount Alarm and Saturation Values)
	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 644 Head mount and Field Mount devices are 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 644 Quick Start Guide or Reference Manual for more instructions. ■ **Long Software Tag:** 32 Characters

A.5 Specifications and reference data for 644 HART Head Mount

(Device Revision 7 or previous)

A.5.1 Functional specifications

Inputs

User-selectable; sensor terminals rated to 42.4 Vdc. See "Accuracy" on page 98 for sensor options.

Output

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

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 sec. single sensor mode

≤1.0 sec. dual sensor mode

Accuracy

(default configuration) PT 100

HART (0-100 °C): ±0.18 °C

A.5.2 Physical specifications

Electrical connections

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

Field Communicator connections

Communication terminals	
644H	Clips permanently fixed to terminal block

Materials of construction

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

Stainless steel housing for biotechnology, pharmaceutical industries, and sanitary applications

Housing and Standard Meter Cover

- 316 SST

Cover O-ring

- Buna-N

Mounting

The 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 "Mounting Kits for 644 Head Mount" on page 105 for the special hardware that is available to:

- Mount a 644H to a DIN rail. (see page 103)
- Retrofit a new 644H to replace an existing 644H transmitter in an existing threaded sensor connection head.

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)

Stainless steel housing for biotechnology, pharmaceutical industries, and sanitary applications

Option 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 (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.5.3 Performance specifications

EMC (Electromagnetic Compatibility) NAMUR NE 21 Standard

The 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	■ 10 kHz to 80 MHz at 10V	< 1.0%

CE EMC compliance testing

The 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.

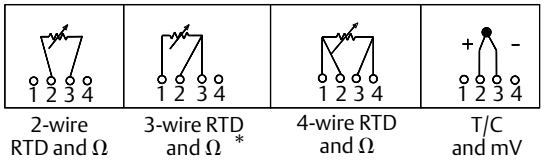
Vibration effect

The 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 644 Sensor connections diagram



* Rosemount Inc. 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 8 characters for the HART protocol
- Order software tag with C1 option code

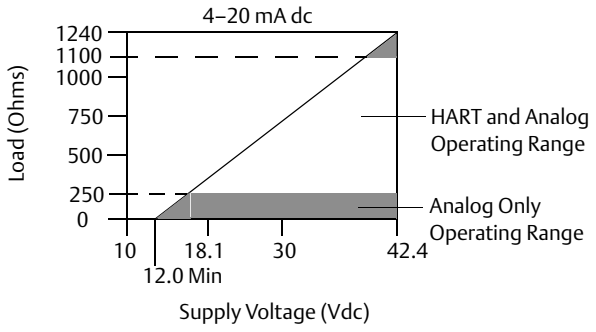
A.5.4 4–20 mA/HART specifications

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

Hardware and software failure mode

The 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 97 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.

External transient protection

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

Configuration

For standard configuration information, see “Configuration” on page 117.

Table A-11. 644 HART Legacy Display Kits

	Kit part number
Display Only	00644-4430-0002
Display and Aluminum, Housing Cover(1)	00644-4430-0001
Display and SST Housing Cover(1)	00644-4430-0011

(1) Covers provided are compatible with the 3 in (76mm) Universal Junction Box and Rosemount Connection Head enclosure styles.

Appendix B Product Certifications

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European Directive Information . . . . . page 127
Hazardous Locations Certifications . . . . . page 127

B.1 European Directive Information

A copy of the EC Declaration of Conformity can be found at the end of the Quick Start Guide. The most recent revision of the EC Declaration of Conformity can be found at www.rosemount.com.

B.1.1 Ordinary Location Certification from FM Approvals

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

B.1.2 Installing Equipment in North America

The US National Electrical Code (NEC) and the Canadian Electrical Code (CEC) permit the use of Division marked equipment in Zones and Zone marked equipment in Divisions. The markings must be suitable for the area classification, gas, and temperature class. This information is clearly defined in the respective codes.

B.1.3 Hazardous Locations Certifications

USA

E5 USA Explosionproof, Non-Incendive, Dust-Ignitionproof
Certificate: [XP & DIP]: 3006278; [NI]: 3008880 & 3044581
Standards: FM Class 3600: 2011, FM Class 3615: 2006, FM Class 3616: 2011, FM Class 3810: 2005, NEMA-250: 250: 2003, ANSI/IEC 60529: 2004
Markings: XP CL I, DIV 1, GP B, C, D; DIP CL II / III, GP E, F, G; (-50°C ≤ Ta ≤ +85°C); Type 4X; See I5 description for Non-Incendive markings

I5 USA Intrinsic Safety and Non-Incendive
Certificate: 3008880 [Headmount Fieldbus/Profibus, Railmount HART]
Standards: FM Class 3600: 1998, FM Class 3610: 2010, FM Class 3611: 2004, FM Class 3810: 2005, NEMA - 250: 1991.
Markings: IS CL I / II / III, DIV I, GP A, B, C, D, E, F, G; NI CL I, DIV 2, GP A, B, C, D.

Special Conditions for Safe Use (X):

1. When no enclosure option is selected, the Model 644 Temperature Transmitter shall be installed in an enclosure meeting the requirements of ANSI/ISA S82.01 and S82.03 or other applicable ordinary location standards.
2. Option code K5 is only applicable with Rosemount J5 Universal Head (M20 x 1.5) or Rosemount J6 Universal Head ($^1/_2$-14 NPT) enclosure.
3. An enclosure options must be selected to maintain a Type 4X rating.

Certificate: 3044581 [Headmount HART]
Standards: FM Class 3600: 2011, FM Class 3610: 2010, FM Class 3611: 2004, FM Class 3810: 2005, ANSI/NEMA - 250: 1991, ANSI/IEC 60529: 2004; ANSI/ISA 60079-0: 2009; ANSI/ISA 60079-11: 2009.
Markings: [No Enclosure]: IS CL I, DIV I, GP A, B, C, D T4; CL I ZONE 0 AEx ia IIC T4 Ga; NI CL I, DIV 2, GP A, B, C, D T5 [With Enclosure]: IS CL I / II / III, DIV 1, GP A, B, C, D, E, F, G; NI CL I, DIV 2, GP A, B, C, D.

Special Conditions for Safe Use (X):

1. When no enclosure option is selected, the Model 644 Temperature Transmitter shall be installed in a final enclosure meeting type of protection IP20 and meeting the requirements of ANSI/ISA 61010-1 and ANSI/ISA 60079-0.
2. The Model 644 optional housings may contain aluminum and is considered a potential risk of ignition by impact or friction. Care must be taken during installation and use to prevent impact and friction.

Canada

I6 Canada Intrinsic Safety and Division 2
Certificate: 1091070
Standards: CAN/CSA C22.2 No. 0-10, CSA Std C22.2 No. 25-1966, CAN/CSA-C22.2 No. 94-M91, CSA Std C22.2 No. 142-M1987, CAN/CSA-C22.2 No. 157-92, CSA Std C22.2 No. 213-M1987, C22.2 No 60529-05.
Markings: [HART] IS CL I GP A, B, C, D T4/T6; CL I, ZONE 0 IIC; CL I, DIV 2, GP A, B, C, D [Fieldbus/PROFIBUS] IS CL I GP A, B, C, D T4; CL I, ZONE 0 IIC; CL I, DIV 2, GP A, B, C, D.

K6 Canada Explosionproof, Dust-Ignitionproof, Intrinsic Safety and Division 2
Certificate: 1091070
Standards: CAN/CSA C22.2 No. 0-10, CSA Std C22.2 No. 25-1966, CSA Std. C22.2 No. 30-M1986, CAN/CSA-C22.2 No. 94-M91, CSA Std C22.2 No. 142-M1987, CAN/CSA-C22.2 No. 157-92, CSA Std C22.2 No. 213-M1987, C22.2 No 60529-05
Markings: CL I / II / III, DIV 1, GP B, C, D, E, F, G
See I6 description for Intrinsic Safety and Division 2 markings

Europe

E1 ATEX Flameproof
Certificate: FM12ATEX0065X
Standards: EN 60079-0: 2012, EN 60079-1: 2007, EN 60529:1991 +A1:2000
Markings: Ex II 2 G Ex d IIC T6...T1 Gb, T6(-50 °C ≤ Ta ≤ +40 °C), T5...T1(-50 °C ≤ Ta ≤ +60 °C);
See Table B-1 for process temperatures

Special Conditions for Safe Use (X):

1. See certificate for ambient temperature range.
2. The non-metallic label may store an electrostatic charge and become a source of ignition in Group III environments.
3. Guard the LCD cover against impact energies greater than 4 joules.
4. Consult the manufacturer if dimensional information on the flameproof joints is necessary.

I1 ATEX Intrinsic Safety
Certificate: [Headmount HART]: Baseefa12ATEX0101X
[Headmount Fieldbus/PROFIBUS]: Baseefa03ATEX0499X
[Railmount HART]: BAS00ATEX1033X
Standards: EN 60079-0: 2012, EN 60079-11: 2012
Markings: [HART]: ⟨Ex⟩II 1 G Ex ia IIC T6...T4 Ga; [Fieldbus/Profibus]: ⟨Ex⟩II 1 G Ex ia IIC T4 Ga;
See Table B-2 for Entity Parameters and Temperature Classifications.

Special Condition for Safe Use (X):

1. The equipment must be installed in an enclosure which affords it a degree of protection of at least IP20 in accordance with the requirements of IEC 60529. Non-metallic enclosures must have a surface resistance of less than 1GΩ; light alloy or zirconium enclosures must be protected from impact and friction when installed in a Zone 0 environment.

2. When fitted with the Transient Protector Assembly, the equipment is not capable of withstanding the 500V test as defined in Clause 6.3.13 of EN 60079-11:2012. This must be taken into account during installation.

N1 ATEX Type n - with enclosure
Certificate: BAS00ATEX3145
Standards: EN 60079-0: 2012, EN 60079-15: 2010
Markings: II 3 G Ex nA IIC T5 Gc (-40 °C ≤ Ta ≤ +70 °C)

NC ATEX Type n - without enclosure
Certificate: [Headmount Fieldbus/Profibus, Railmount HART]: Baseefa13ATEX0093X
[Headmount HART]: Baseefa12ATEX0102U.
Standards: EN 60079-0: 2012, EN 60079-15: 2010
Markings: [Headmount Fieldbus/Profibus, Railmount HART]: ⟨Ex⟩ II 3 G Ex nA IIC T5 Gc (-40 °C ≤ Ta ≤ +70 °C) [Headmount HART]: ⟨Ex⟩ II 3 G Ex nA IIC T6...T5 Gc; T6 (-60 °C ≤ Ta ≤ +40 °C);T5(-60 °C ≤ Ta ≤+85 °C)

Special Condition for Safe Use (X):

1. The Model 644 Temperature Transmitter 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 and EN 60079-15.

2. When fitted with the Transient Protector Assembly, the equipment is not capable of withstanding the 500V test as defined in Clause 6.3.13 of EN 60079-11:2012. This must be taken into account during installation.

ND ATEX Dust
Certificate: FM12ATEX0065X
Standards: EN 60079-0: 2012, EN 60079-31: 2009, EN 60529:1991 +A1:2000
Markings: ⟨Ex⟩ II 2 D Ex tb IIIC T130 °C Db, (-40 °C ≤ Ta ≤ +70 °C); IP66
See Table B-1 for process temperatures

Special Conditions for Safe Use (X):

1. See certificate for ambient temperature range.
2. The non-metallic label may store an electrostatic charge and become a source of ignition in Group III environments.
3. Guard the LCD cover against impact energies greater than 4 joules.
4. Consult the manufacturer if dimensional information on the flameproof joints is necessary.

International

E7 IECEX Flameproof
Certificate: IECEx FMG 12.0022X
Standards: IEC 60079-0: 2011, IEC 60079-1: 2007
Markings: Ex d IIC T6...T1 Gb, T6(-50 °C ≤ Ta ≤ +40 °C), T5...T1(-50 °C ≤ Ta≤ +60 °C);
See Table B-1 for process temperatures.

Special Conditions for Safe Use (X):

1. See certificate for ambient temperature range.
2. The non-metallic label may store an electrostatic charge and become a source of ignition in Group III environments.
3. Guard the LCD cover against impact energies greater than 4 joules.
4. Consult the manufacturer if dimensional information on the flameproof joints is necessary.

I7 IECEX Intrinsic Safety
Certificate: [Headmount HART]: IECEx BAS 12.0069X
[Headmount Fieldbus/PROFIBUS, Railmount HART]: IECEx BAS 07.0053X
Standards: IEC 60079-0: 2011, IEC 60079-11: 2011
Markings: Ex ia IIC T6...T4 Ga
See Table B-2 for Entity Parameters and Temperature Classifications

Special Condition for Safe Use (X):

1. The equipment must be installed in an enclosure which affords it a degree of protection of at least IP20 in accordance with the requirements of IEC 60529. Non-metallic enclosures must have a surface resistance of less than 1GΩ; light alloy or zirconium enclosures must be protected from impact and friction when installed in a Zone 0 environment.
2. When fitted with the Transient Protector Assembly, the equipment is not capable of withstanding the 500V test as defined in Clause 6.3.13 of IEC 60079-11:2011. This must be taken into account during installation.

N7 IECEx Type n - with enclosure
Certificate: IECEx BAS 07.0055
Standards Used: IEC 60079-0:2011, IEC 60079-15:2010
Markings: Ex nA IIC T5 Gc (-40 °C ≤ Ta ≤ +70 °C)

NG IECEx Type n - no enclosure
Certificate: [Headmount Fieldbus/Profibus, Railmount HART]: IECEx BAS 12.0053X
[Headmount HART]: IECEx BAS 12.0070U
Standards: IEC 60079-0: 2011, IEC 60079-15: 2010
Markings: [Headmount Fieldbus/Profibus, Railmount HART]: Ex nA IIC T5 Gc
(-40 °C ≤ Ta ≤ +70 °C)
[Headmount HART]: Ex nA IIC T6...T5 Gc; T6(-60 °C ≤ Ta ≤ +40 °C); T5
(-60 °C ≤ Ta ≤ +85°C)

Special Condition for Safe Use (X):

1. The Model 644 Temperature Transmitter 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 and EN 60079-15.

2. When fitted with the Transient Protector Assembly, the equipment is not capable of withstanding the 500V test. This must be taken into account during installation.

NK IECEx Dust
Certificate: IECEx FMG 12.0022X
Standards: IEC 60079-0: 2011, IEC 60079-31: 2008
Markings: Ex tb IIIC T130 °C Db, (-40 °C ≤ Ta ≤ +70 °C); IP66
See Table B-1 for process temperatures

Special Conditions for Safe Use (X):

1. See certificate for ambient temperature range.
2. The non-metallic label may store an electrostatic charge and become a source of ignition in Group III environments.
3. Guard the LCD cover against impact energies greater than 4 joules.
4. Consult the manufacturer if dimensional information on the flameproof joints is necessary.

Brazil

E2 INMETRO Flameproof
Certificate: NCC 12.1147X
Standards: ABNT NBR IEC 60079-0:2008, ABNT NBR IEC 60079-1:2009, NBR 8094:1983
Markings: Ex d IIC T6...T1 (-40 °C ≤ Ta ≤ +65 °C) Gb; IP66W

Special Conditions for Safe Use (X):

1. Care must be taken to ensure that the surface temperature does not exceed 85°C when RTDs or thermocouples are fitted to the transmitter.

2. The mechanical and chemical characteristics of the process fluid must be evaluated in order not to cause deterioration or corrosion to the temperature probes.

3. For information on the dimensions of explosion-proof joints, the manufacturer should be contacted.

I2 INMETRO Intrinsic Safety
Certificate: CEPEL 02.0096X
Standards: ABNT NBR IEC 60079-0:2008, ABNT NBR IEC 60079-11:2009, ABNT NBR IEC 60079-26:2008, ABNT NBR IEC 60529:2009
Markings: Ex ia IIC T* Ga; IP66W
See Table B-2 for Entity Parameters and Temperature Classifications

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. Light allow or zirconium enclosures must be protected from impact and friction when installed.
3. When the maximum ambient temperature at the place of installation is greater than 50 °C, the equipment shall be installed with adequate insulation cables the minimum temperature of 90 °C.

China

E3 China Flameproof
Certificate: GYJ111385
Standards Used: GB3836.1-2000, GB3836.2-2000, GB12476.1-2000
Markings: Ex d IIC T6; DIP A20 Ta 95 °C; IP66

Special Conditions for Safe Use (X):

1. Temperature Assembly using temperature sensor type 65, 68, 75, 183, 185 are certified.
2. The ambient temperature range is:

Gas/dust	Ambient temperature
Gas	-40 °C ≤ Ta ≤ +65 °C
Dust	-40 °C ≤ Ta ≤ +85 °C

3. The earth connection facility in the enclosure should be connected reliably.

4. During installation, use and maintain in explosive gas atmospheres, observe the warning "Do not open when energized".

   During installation, use and maintain in explosive dust atmosphere, observe the warning "Do not open when an explosive dust atmosphere is present".

5. During installation, there should be no mixture harmful to flameproof housing.

6. During installation in hazardous location, cable glands, conduits and blanking plugs, certified by state-appointed inspection bodies with Ex d II C, DIP A20 IP66 degree, should be used.

7. Maintenance should be done in a non-hazardous location.

8. During installation, use and maintain in explosive dust atmosphere, product enclosure should be cleaned to avoid dust accumulation, but compressed air should not be used.

9. End users is not permitted to change any components inside, but to settle the problem in conjunction with manufacturer to avoid damage to the product.

10. During installation, use and maintenance of this product, observe the following standards:

    GB3836.13-1997 "Electrical apparatus for explosive gas atmospheres Part 13: Repair and overhaul for apparatus used in explosive gas atmospheres"

    GB3836.15-2000 "Electrical apparatus for explosive gas atmospheres Part 15: Electrical installations in hazardous area (other than mines)"

    GB3836.16-2006 "Electrical apparatus for explosive gas atmospheres Part 16: Inspection and maintenance of electrical installation (other than mines)"

    GB50257-1996 "Code for construction and acceptance of electric device for explosion atmospheres and fire hazard electrical equipment installation engineering".

    GB15577-1995 "Safe regulation for explosive dust atmospheres"

    GB12476.2-2006 "Electrical apparatus for use in the presence of combustible dust Part 1-2: Electrical apparatus protected by enclosures and surface temperature limitation-Selection, installation and maintenance"

I3 China Intrinsic Safety
Certificate: GYJ111384X
Standards Used: GB3836.1-2000, GB3836.4-2000
Markings: Ex ia IIC T4/T5/T6

Special Conditions for Safe Use (X):

1. The ambient temperature range is:

   For 644 Fieldbus, Profibus, and Legacy 644 HART

Transmitter output	Maximum input power: (W)	T code	Ambient temperature
A	0.67	T6	-60 °C ≤ Ta ≤ +40 °C
	0.67	T5	-60 °C ≤ Ta ≤+50 °C
	1	T5	-60 °C ≤ Ta ≤ +40 °C
	1	T4	-60 °C ≤ Ta ≤ +80 °C
F or W	1.3	T4	-60 °C ≤ Ta ≤ +60 °C
	5.32	T4	-60 °C ≤ Ta ≤ +60 °C

For Enhanced 644 HART

Maximum input power: (W)	T code	Ambient temperature
0.67	T6	-60 °C ≤ Ta ≤ +40 °C
0.67	T5	-60 °C ≤ Ta ≤ +50 °C
1.3	T4	-60 °C ≤ Ta ≤ +40 °C
5.32	T4	-60 °C ≤ Ta ≤ +80 °C

2. Parameters are:

For 644 Fieldbus, Profibus, and Legacy 644 HART

Terminals of power supply (+, -)

Transmitter output	Maximum input voltage: U_i (V)	Maximum input current: I_i (mA)	Maximum input power: P_i (W)	Maximum internal parameters:	
				C_i (nF)	L_i(mH)
A	30	200	0.67/1	10	0
F, W	30	300	1.3	2.1	0
F, W (FISCO)	17.5	380	5.32	2.1	0

Terminals of sensor (1,2,3,4)

Transmitter output	Maximum output voltage: U_o (V)	Maximum output current: I_o (mA)	Maximum output power: P_o (W)	Maximum internal parameters:	
				C_o (nF)	L_o(mH)
A	13.6	80	0.08	75	0
F, W	13.9	23	0.079	7.7	0

For Enhanced 644 HART

Terminals of power supply (+, -)

Maximum input voltage: U_i (V)	Maximum input current: I_i (mA)	Maximum input power: P_i (W)	Maximum internal parameters:	
			C_i (nF)	L_i(mH)
30	150 (Ta ≤ +80 °C) 170 (Ta ≤ +70 °C) 190 (Ta ≤ +60 °C)	0.67/0.8	3.3	0

Terminals of sensor (1,2,3,4)

Maximum output voltage: U_o (V)	Maximum output current: I_o (mA)	Maximum output power: P_o (W)	Gas group	Maximum internal parameters:	
				C_o (nF)	L_o(mH)
13.6	80	0.08	IIC	0.816	5.79
			IIB	5.196	23.4
			IIA	18.596	48.06

3. This product complies to the requirements for FISCO field devices specified in IEC60079-27: 2008. For the connection of an intrinsically safe circuit in accordance FISCO model, FISCO parameters of this product are as above.

4. The product should be used with Ex-certified associated apparatus to establish explosion protection system that can be used in explosive gas atmospheres. Wiring and terminals should comply with the instruction manual of the product and associated apparatus.

5. The cables between this product and associated apparatus should be shielded cables (the cables must have insulated shield). The shielded has to be grounded reliably in non-hazardous area.

6. End users are not permitted to change any components insides, but to settle the problem in conjunction with manufacturer to avoid damage to the product.

7. During installation, use and maintenance of this product, observe the following standards:

   GB3836.13-1997 “Electrical apparatus for explosive gas atmospheres Part 13: Repair and overhaul for apparatus used in explosive gas atmospheres”

   GB3836.15-2000 “Electrical apparatus for explosive gas atmospheres Part 15: Electrical installations in hazardous area (other than mines)”

   GB3836.16-2006 “Electrical apparatus for explosive gas atmospheres Part 16: Inspection and maintenance of electrical installation (other than mines)”

   GB50257-1996 “Code for construction and acceptance of electric device for explosion atmospheres and fire hazard electrical equipment installation engineering”.

N3 China Type n
Certificate: GYJ101421
Standards Used: GB3836.1-2000, GB3836.8-2003
Markings: Ex nA nL IIC T5/T6

Special Conditions for Safe Use (X):

1. The relation among T code, ambient temperature range is as following:

   When Options do not select Enhanced Performance:

T code	Ambient temperature
T5	-40 °C ≤ Ta ≤ +70 °C

   When Options select Enhanced Performance:

T code	Ambient temperature
T6	-60 °C ≤ Ta ≤ +40 °C
T5	-60 °C ≤ Ta ≤ +85 °C

2. Maximum input voltage: 42.4V.

3. Cable glands, conduit or blanking plugs, certified by NEPSI with Ex e or Ex n protection type and appropriate thread type and IP54 degree, should be used on external connections and redundant cable entries.

4. Maintenance should be done in non-hazardous location.

5. End users are not permitted to change any components inside, but to settle the problem in conjunction with manufacturer to avoid damage to the product.

6. During installation, use and maintenance of this product, observe the following standards:

   GB3836.13-1997 “Electrical apparatus for explosive gas atmospheres Part 13: Repair and overhaul for apparatus used in explosive gas atmospheres”

   GB3836.15-2000 “Electrical apparatus for explosive gas atmospheres Part 15: Electrical installations in hazardous area (other than mines)”

   GB3836.16-2006 “Electrical apparatus for explosive gas atmospheres Part 16: Inspection and maintenance of electrical installation (other than mines)”

   GB50257-1996 “Code for construction and acceptance of electric device for explosion atmospheres and fire hazard electrical equipment installation engineering”

EAC - Belarus, Kazakhstan, Russia

EM Technical Regulation Customs Union (EAC) Flameproof
Certificate: RU C-US.GB05.B.00289
Standards: GOST R IEC 60079-0-2011, GOST IEC 60079-1-2011
Markings: 1Ex d IIC T6...T1 Gb X, T6(-50 °C ≤ Ta ≤ +40 °C), T5...T1(-50 °C ≤ Ta ≤ +60 °C); IP65/IP66/IP68

Special Condition for Safe Use (X):

See certificate for special conditions.

IM Technical Regulation Customs Union (EAC) Intrinsic Safety
Certificate: RU C-US.GB05.B.00289
Standards: GOST R IEC 60079-0-2011, GOST R IEC 60079-11-2010
Markings: [HART]: 0Ex ia IIC T4...T6 Ga X; [Fieldbus/Profibus]: 0Ex ia IIC T4 Ga X

Special Conditions for Safe Use (X):

See certificate for special conditions

Japan

E4 Japan Flameproof
Certificate: TC20671 [J2 with LCD], TC20672 [J2], TC20673 [J6 with LCD], TC20674 [J6]
Markings: Ex d IIC T5

Combinations

K1 Combination of E1, I1, N1, and ND

K2 Combination of E2 and I2

K5 Combination of E5 and I5

K7 Combination of E7, I7, and N7

KA Combination of K1 and K6

KB Combination of K5 and K6

KC Combination of I5 and I6

KD Combination of E1, E5, K6, I1, I5

Additional Certifications

SBS American Bureau of Shipping (ABS) Type Approval
Certificate: 11-HS771994A-1-PDA
ABS Rules: 2013 Steel Vessels Rules 1-1-4/7.7, 1-1-Appendix 3, 4-8-3/1.7, 4-8-3/13.1

SBV Bureau Veritas (BV) Type Approval
Certificate: 26325/A2 BV
Requirements: Bureau Veritas Rules for the Classification of Steel Ships
Application: Class notations: AUT-UMS, AUT-CCS, AUT-PORT and AUT-IMS

SDN Det Norske Veritas (DNV) Type Approval
Certificate: A-13246
Intended Use: Det Norske Veritas' Rules for Classification of Ships, High Speed & Light Craft and Det Norske Veritas' Offshore Standards
Application: Location Classes: Temperature: D; Humidity: B; Vibration: A; EMC: B; Enclosure: B/IP66: A, C/IP66: SST

SLL Lloyds Register (LR) Type Approval
Certificate: 11/60002
Application: For use in environmental categories ENV1, ENV2, ENV3 and ENV5.

Tables

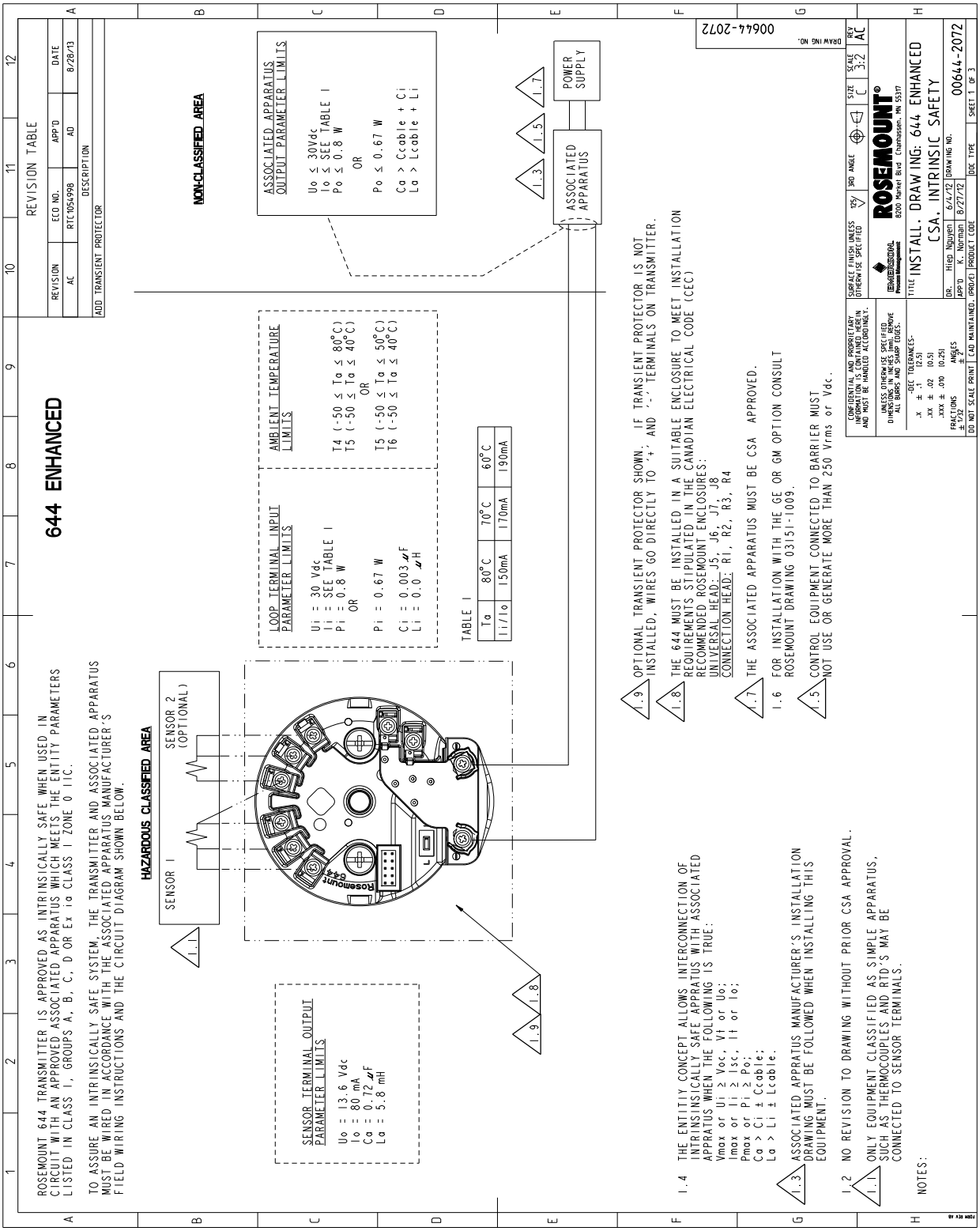
Table B-1. Process Temperatures

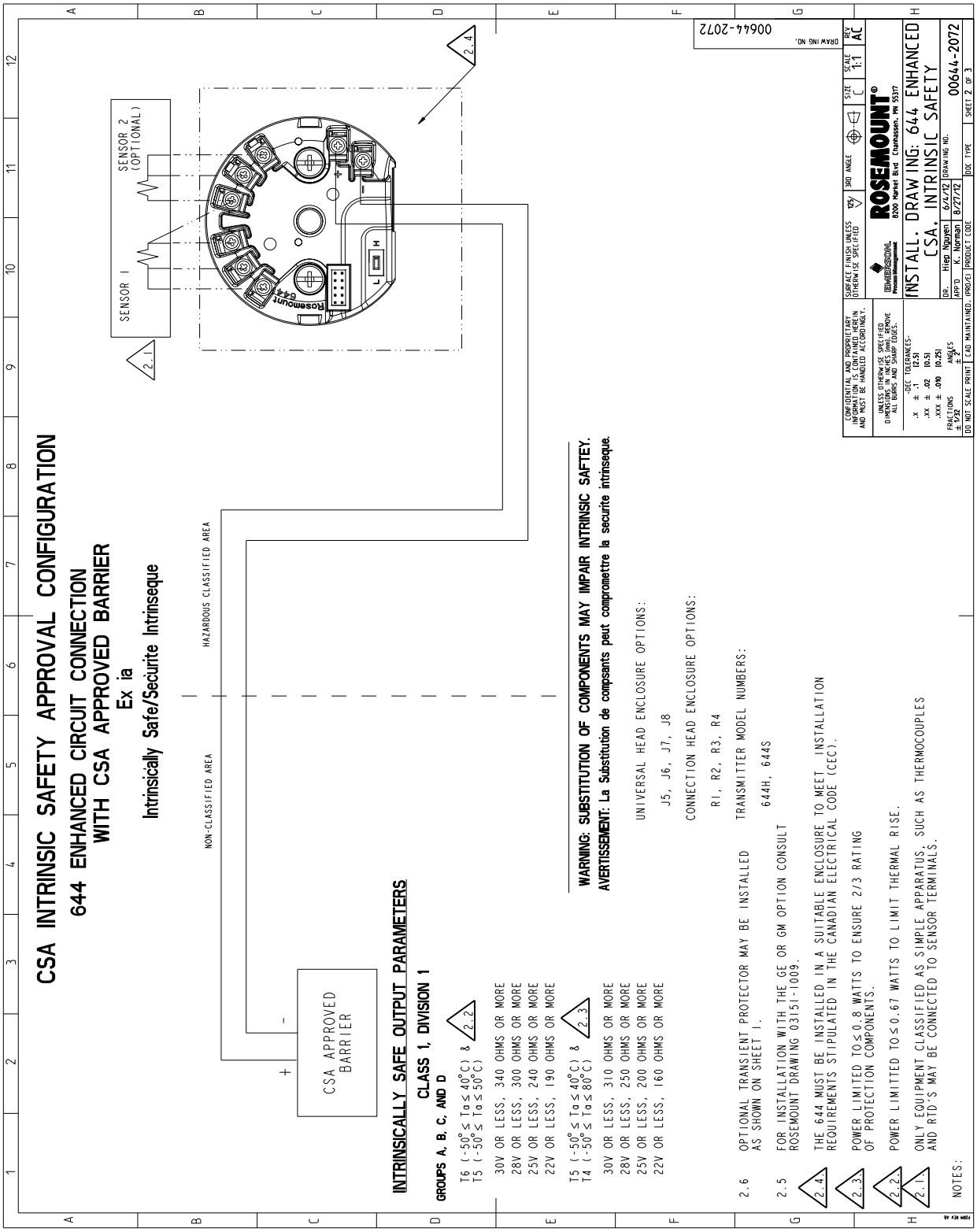
		T6	T5	T4	T3	T2	T1	T130
Max Ambient		+40°C	+60°C	+60°C	+60°C	+60°C	+60°C	+70°C
		Transmitter with LCD display						
Sensor Extension	0”	55°C	70°C	95°C	95°C	95°C	95°C	95°C
	3”	55°C	70°C	100°C	100°C	100°C	100°C	100°C
	6”	60°C	70°C	100°C	100°C	100°C	100°C	100°C
	9”	65°C	75°C	110°C	110°C	110°C	110°C	110°C
		Transmitter without LCD display						
	0”	55°C	70°C	100°C	170°C	280°C	440°C	100°C
	3”	55°C	70°C	110°C	190°C	300°C	450°C	110°C
	6”	60°C	70°C	120°C	200°C	300°C	450°C	110°C
	9”	65°C	75°C	130°C	200°C	300°C	450°C	120°C

Table B-2. Entity Parameters

	Fieldbus/PROFIBUS	HART 7 (Legacy)	HART (Enhanced)
Voltage Ui (V)	30	30	30
Current Ii (mA)	300	200	150 for Ta ≤ 80 °C 170 for Ta ≤ 70 °C 190 for Ta ≤ 60 °C
Power Pi (W)	1.3 @ T4 (-50 °C ≤ Ta ≤+60 °C)	0.67 @ T6(-60 °C ≤ Ta ≤ +40 °C) 0.67 @ T5(-60 °C ≤ Ta ≤ +50 °C) 1.0 @ T5(-60 °C ≤ Ta ≤ +40 °C) 1.0 @ T4(-60 °C ≤ Ta ≤ +80 °C)	0.67 @ T6(-60 °C ≤ Ta ≤ +40 °C) 0.67 @ T5(-60 °C ≤ Ta ≤ +50 °C) 0.80 @ T5(-60 °C ≤ Ta ≤ +40 °C) 0.80 @ T4(-60 °C ≤ Ta ≤ +80 °C)
Capacitance Ci (nF)	2.1	10	3.3
Inductance Li (mH)	0	0	0

Figure B-1. CSA Intrinsic Safety Installation Drawing 00644-2072. Rev AC




CSA INTRINSIC SAFETY APPROVAL CONFIGURATION
644 ENHANCED CIRCUIT CONNECTION
WITH CSA APPROVED BARRIER
Ex ia
Intrinsically Safe/Securite Intrinseque
NON-CLASSIFIED AREA
HAZARDOUS CLASSIFIED AREA
CSA APPROVED BARRIER
SENSOR 1
SENSOR 2 (OPTIONAL)
INTRINSICALLY SAFE OUTPUT PARAMETERS
CLASS 1, DIVISION 1
GROUPS A, B, C, AND D
T6 (-50° ≤ Ta ≤ 40°C) & T5 (-50° ≤ Ta ≤ 50°C)
30V OR LESS, 340 OHMS OR MORE
28V OR LESS, 300 OHMS OR MORE
25V OR LESS, 240 OHMS OR MORE
22V OR LESS, 190 OHMS OR MORE
T5 (-50° ≤ Ta ≤ 40°C) & T4 (-50° ≤ Ta ≤ 80°C)
30V OR LESS, 310 OHMS OR MORE
28V OR LESS, 250 OHMS OR MORE
25V OR LESS, 200 OHMS OR MORE
22V OR LESS, 160 OHMS OR MORE
WARNING: SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFTEY.
AVERTISSEMENT: La Substitution de composants peut compromettre la securite intrinseque.
UNIVERSAL HEAD ENCLOSURE OPTIONS:
J5, J6, J7, J8
CONNECTION HEAD ENCLOSURE OPTIONS:
R1, R2, R3, R4
TRANSMITTER MODEL NUMBERS:
644H, 644S
2.6 OPTIONAL TRANSIENT PROTECTOR MAY BE INSTALLED AS SHOWN ON SHEET 1.
2.5 FOR INSTALLATION WITH THE GE OR GM OPTION CONSULT ROSEMOUNT DRAWING 03151-1009.
2.4 THE 644 MUST BE INSTALLED IN A SUITABLE ENCLOSURE TO MEET INSTALLATION REQUIREMENTS STIPULATED IN THE CANADIAN ELECTRICAL CODE (CEC).
2.3 POWER LIMITED TO ≤ 0.8 WATTS TO ENSURE 2/3 RATING OF PROTECTION COMPONENTS.
2.2 POWER LIMITED TO ≤ 0.67 WATTS TO LIMIT THERMAL RISE.
2.1 ONLY EQUIPMENT CLASSIFIED AS SIMPLE APPARATUS, SUCH AS THERMOCOUPLES AND RTD'S MAY BE CONNECTED TO SENSOR TERMINALS.
NOTES:
DRAWING NO. 00644-2072
REV AL
SCALE 1:1
SIZE C
SHEET 2 OF 3
ROSEMOUNT
8200 Market Blvd Chanhassen, MN 55317
INSTALL. DRAWING: 644 ENHANCED CSA, INTRINSIC SAFETY
00644-2072
DR. Hiep Nguyen 6/4/12
APP'D K. Norman 8/27/12
CAD MAINTAINED, PROJECT CODE
DOC TYPE
DO NOT SCALE PRINT
CONFIDENTIAL AND PROPRIETARY INFORMATION IS CONTAINED HEREIN AND MUST BE HANDLED ACCORDINGLY.
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES ALL BURRS AND SHARP EDGES.
DEC TOLERANCES
.X ± .1 [2.5]
.XX ± .02 [0.5]
.XXX ± .010 [0.25]
FRACTIONS ± 1/32 ANGLES ± 2°
SURFACE FINISH UNLESS OTHERWISE SPECIFIED 125
3RD ANGLE
Rosemount 644
H
L

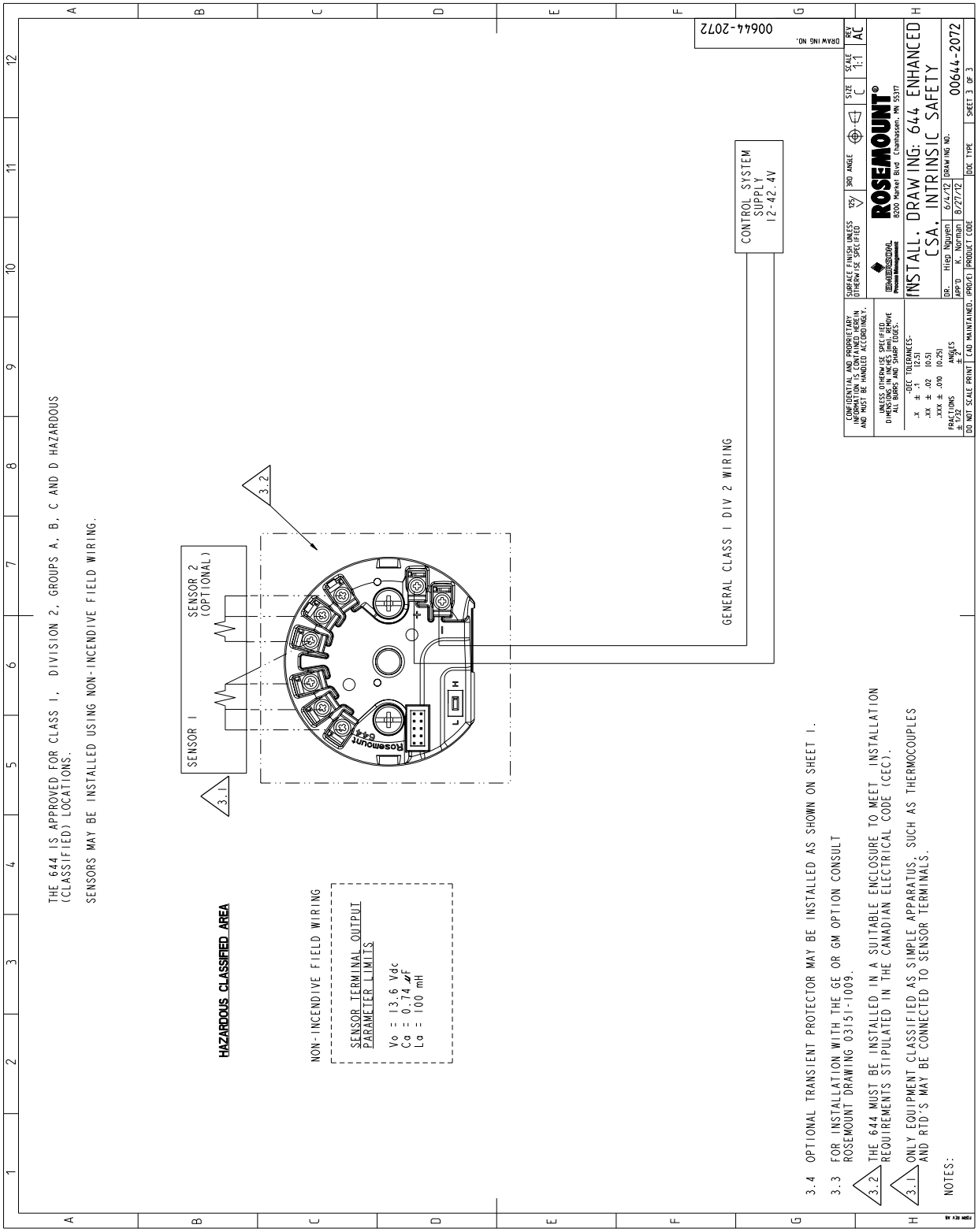

00644-2072
INSTALL. DRAWING: 644 ENHANCED CSA, INTRINSIC SAFETY
ROSEMOUNT
8200 Market Blvd Chanhassen, MN 55317
CONFIDENTIAL AND PROPRIETARY. INFORMATION IS CONTAINED HEREIN AND MUST BE HANDLED ACCORDINGLY.
UNLESS OTHERWISE SPECIFIED DIMENSIONS IN INCHES [mm]. REMOVE ALL BURRS AND SHARP EDGES.
SURFACE FINISH UNLESS OTHERWISE SPECIFIED
3RD ANGLE
SIZE C
SCALE 1:1
REV AC
DR. Hiep Nguyen 6/4/12
APP'D K.C. Northam 8/27/12
DRAWING NO. 00644-2072
DOC TYPE
SHEET 3 OF 3
DO NOT SCALE PRINT
CAD MAINTAINED
PRODUCT CODE
THE 644 IS APPROVED FOR CLASS I, DIVISION 2, GROUPS A, B, C AND D HAZARDOUS (CLASSIFIED) LOCATIONS.
SENSORS MAY BE INSTALLED USING NON-INCENDIVE FIELD WIRING.
HAZARDOUS CLASSIFIED AREA
NON-INCENDIVE FIELD WIRING
SENSOR TERMINAL OUTPUT PARAMETER LIMITS
Vo = 13.6 Vdc
Ca = 0.74 µF
La = 100 mH
SENSOR 1
SENSOR 2 (OPTIONAL)
3.1
3.2
Rosemount 644
H
L
GENERAL CLASS I DIV 2 WIRING
CONTROL SYSTEM SUPPLY 12-42.4V
NOTES:
3.1 ONLY EQUIPMENT CLASSIFIED AS SIMPLE APPARATUS, SUCH AS THERMOCOUPLES AND RTD'S MAY BE CONNECTED TO SENSOR TERMINALS.
3.2 THE 644 MUST BE INSTALLED IN A SUITABLE ENCLOSURE TO MEET INSTALLATION REQUIREMENTS STIPULATED IN THE CANADIAN ELECTRICAL CODE (CEC).
3.3 FOR INSTALLATION WITH THE GE OR GM OPTION CONSULT ROSEMOUNT DRAWING 03151-1009.
3.4 OPTIONAL TRANSIENT PROTECTOR MAY BE INSTALLED AS SHOWN ON SHEET 1.

Figure B-2. CSA Intrinsic Safety Installation Drawing 00644-1064, Rev. AB

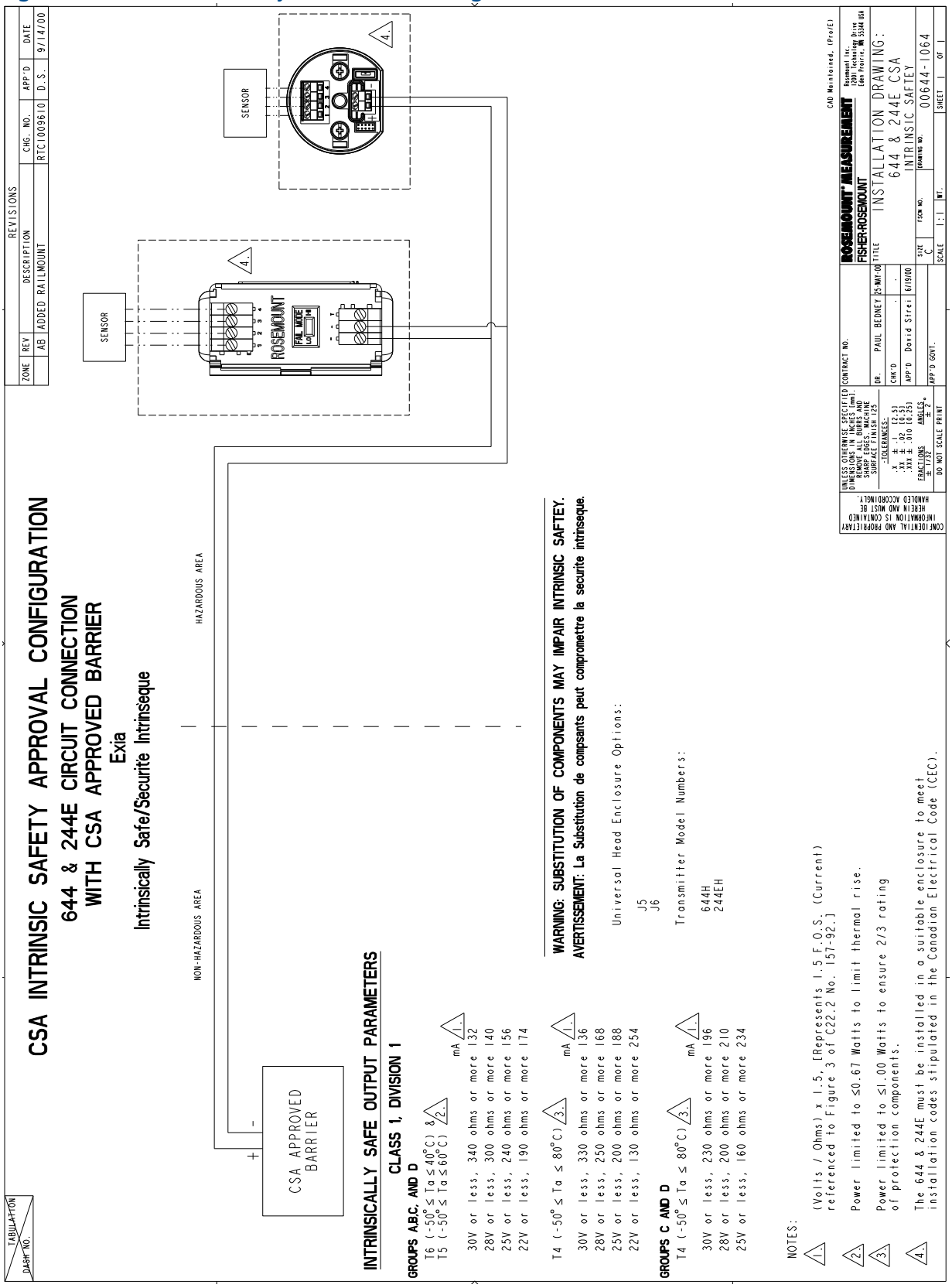
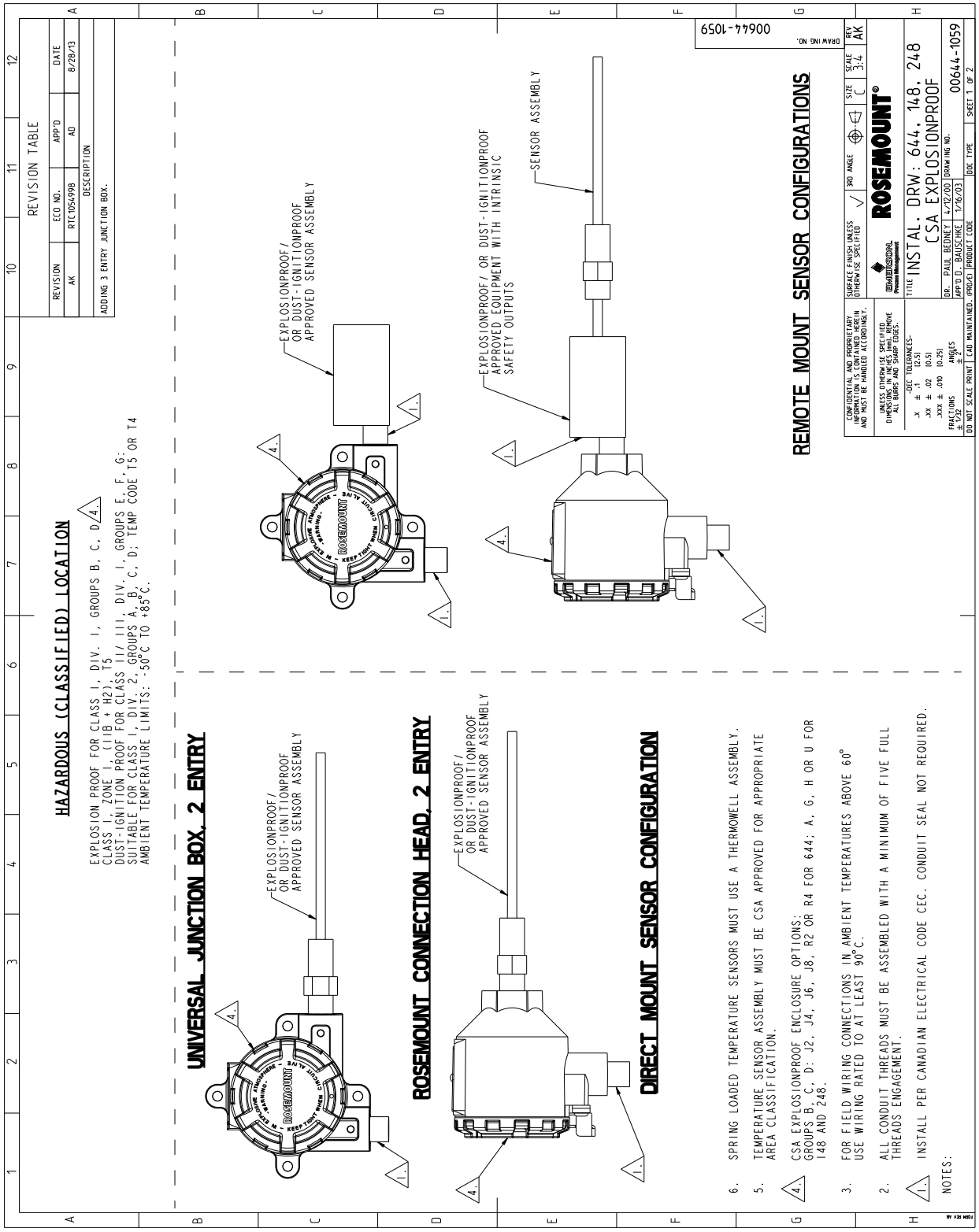


Figure B-3. CSA Explosion-Proof Installation Drawing 00644-1059, Rev. AK



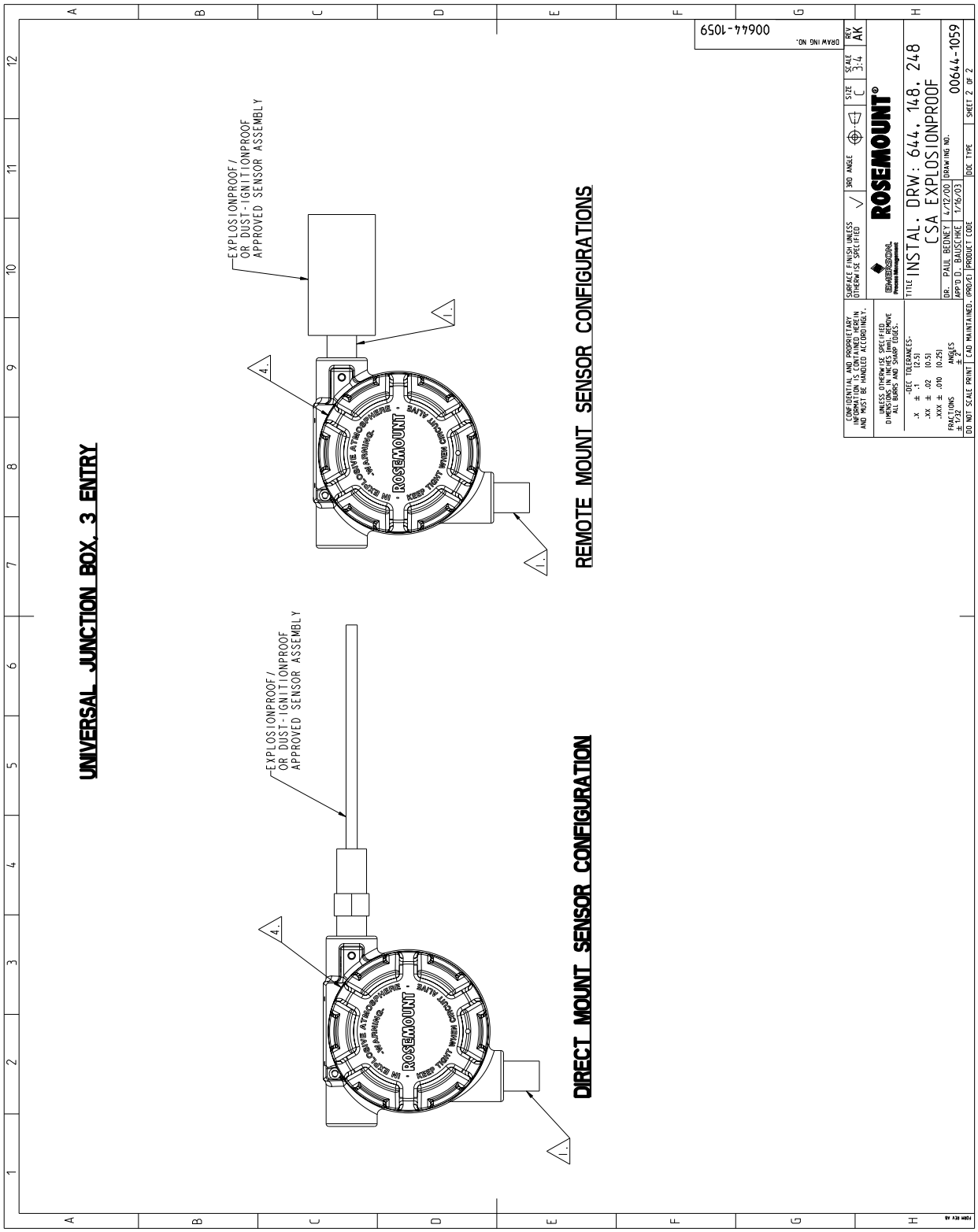
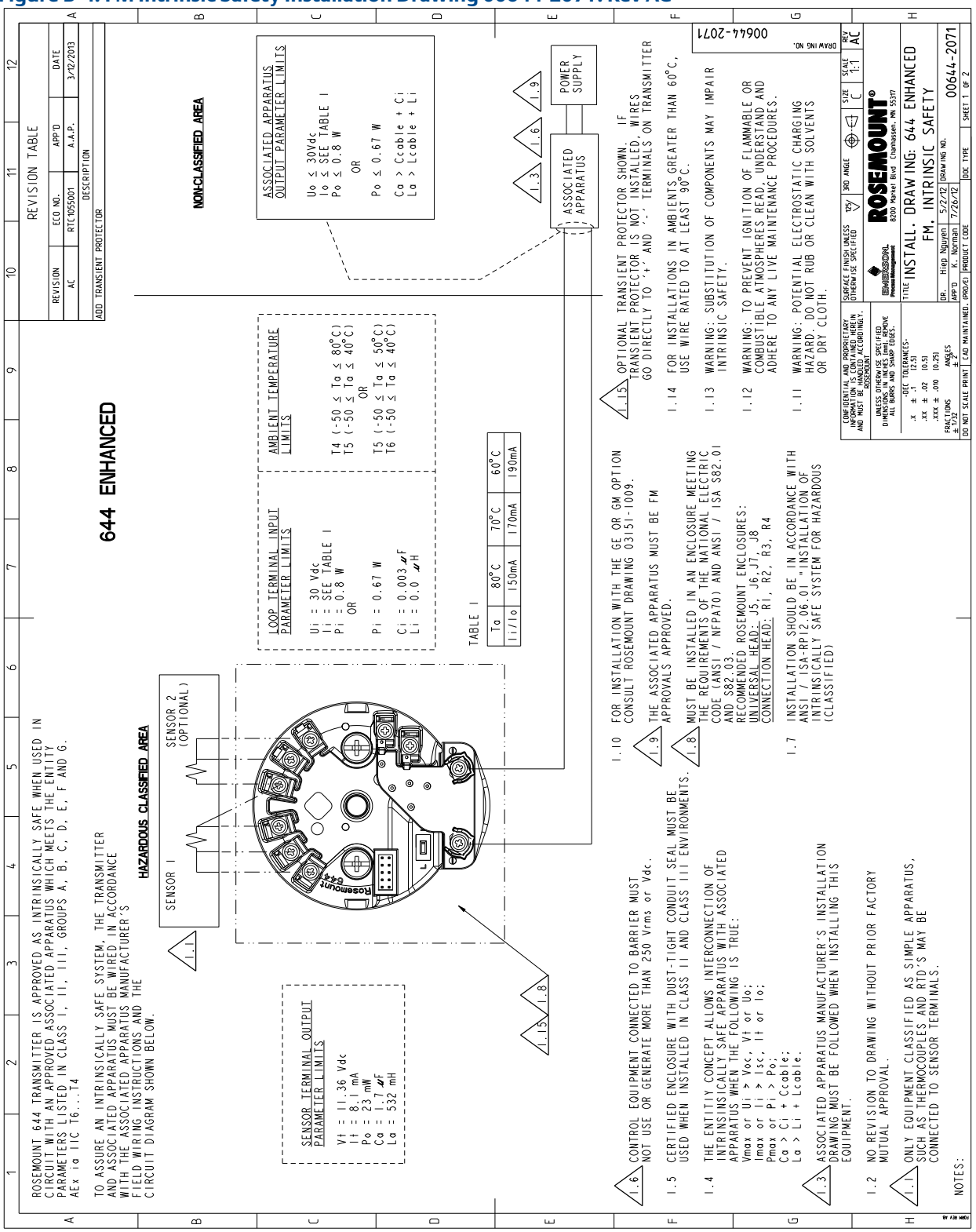

UNIVERSAL JUNCTION BOX, 3 ENTRY
EXPLOSIONPROOF / OR DUST-IGNITIONPROOF APPROVED SENSOR ASSEMBLY
ROSEMOUNT
REMOTE MOUNT SENSOR CONFIGURATIONS
DIRECT MOUNT SENSOR CONFIGURATION
DRAWING NO. 00644-1059
INSTAL. DRW: 644, 148, 248
CSA EXPLOSIONPROOF
ROSEMOUNT
00644-1059

Figure B-4. FM Intrinsic Safety Installation Drawing 00644-2071. Rev AC



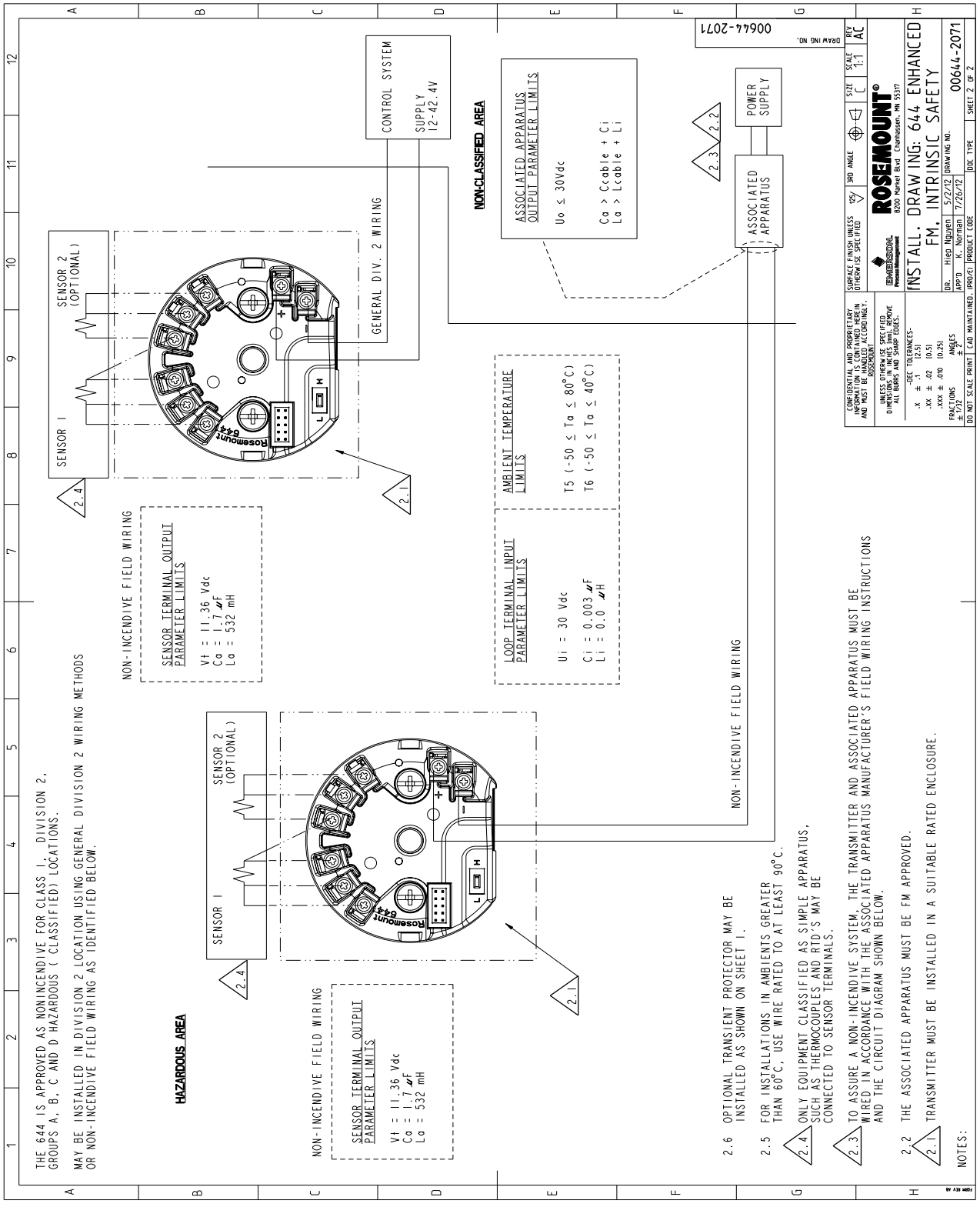
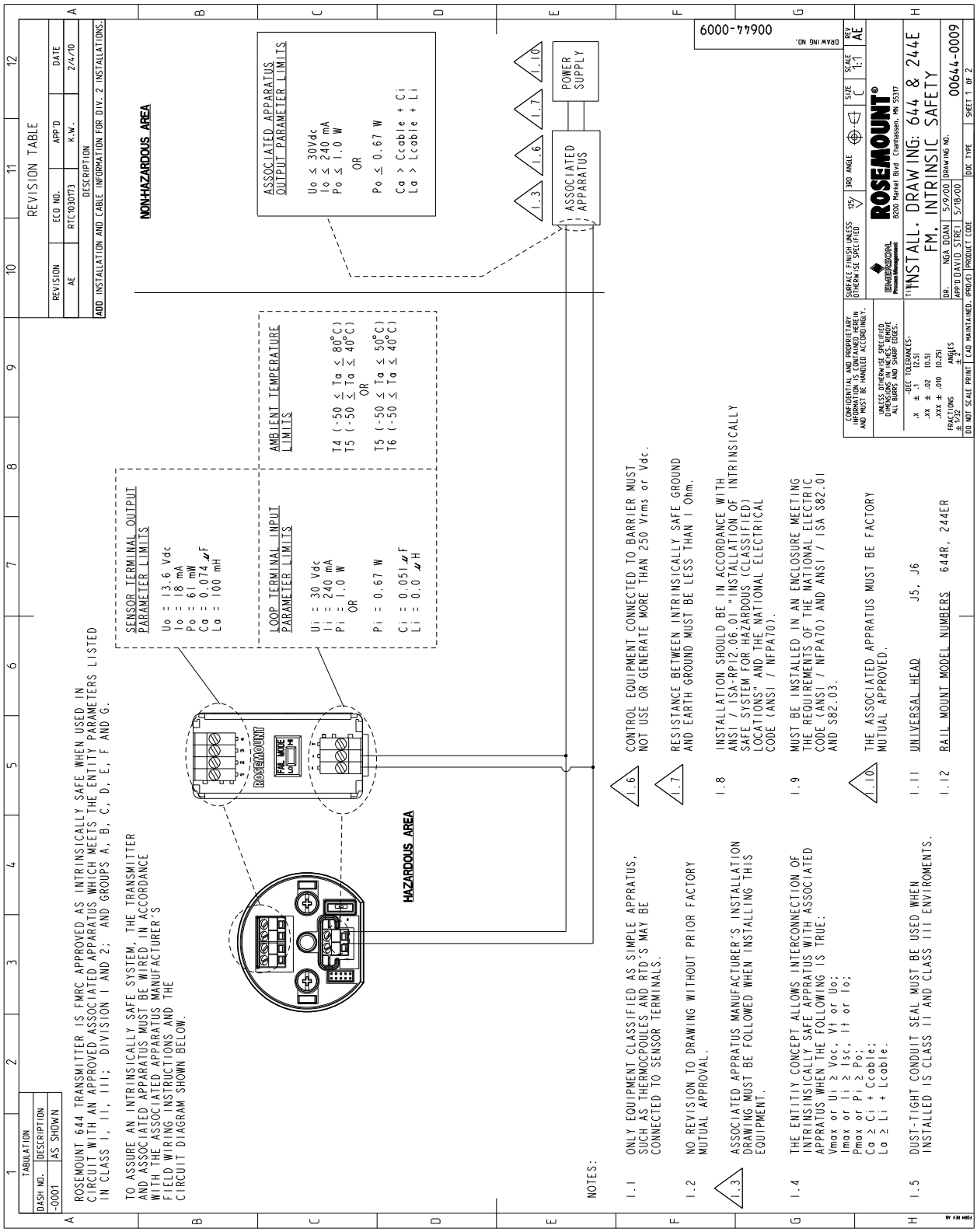

THE 644 IS APPROVED AS NONINCENDIVE FOR CLASS I, DIVISION 2, GROUPS A, B, C AND D HAZARDOUS (CLASSIFIED) LOCATIONS.
MAY BE INSTALLED IN DIVISION 2 LOCATION USING GENERAL DIVISION 2 WIRING METHODS OR NON-INCENDIVE FIELD WIRING AS IDENTIFIED BELOW.
HAZARDOUS AREA
NON-INCENDIVE FIELD WIRING
SENSOR TERMINAL OUTPUT PARAMETER LIMITS
Vt = 11.36 Vdc
Ca = 1.7 µF
La = 532 mH
SENSOR 1
SENSOR 2 (OPTIONAL)
2.4
2.1
NON-INCENDIVE FIELD WIRING
SENSOR TERMINAL OUTPUT PARAMETER LIMITS
Vt = 11.36 Vdc
Ca = 1.7 µF
La = 532 mH
SENSOR 1
SENSOR 2 (OPTIONAL)
2.4
2.1
GENERAL DIV. 2 WIRING
CONTROL SYSTEM
SUPPLY
12-42.4V
NON-CLASSIFIED AREA
ASSOCIATED APPARATUS OUTPUT PARAMETER LIMITS
Uo ≤ 30Vdc
Ca > Ccable + Ci
La > Lcable + Li
2.3
2.2
POWER SUPPLY
ASSOCIATED APPARATUS
NON-INCENDIVE FIELD WIRING
LOOP TERMINAL INPUT PARAMETER LIMITS
Ui = 30 Vdc
Ci = 0.003 µF
Li = 0.0 µH
AMBIENT TEMPERATURE LIMITS
T5 (-50 ≤ Ta ≤ 80°C)
T6 (-50 ≤ Ta ≤ 40°C)
2.6 OPTIONAL TRANSIENT PROTECTOR MAY BE INSTALLED AS SHOWN ON SHEET 1.
2.5 FOR INSTALLATIONS IN AMBIENTS GREATER THAN 60°C, USE WIRE RATED TO AT LEAST 90°C.
2.4 ONLY EQUIPMENT CLASSIFIED AS SIMPLE APPARATUS, SUCH AS THERMOCOUPLES AND RTD'S MAY BE CONNECTED TO SENSOR TERMINALS.
2.3 TO ASSURE A NON-INCENDIVE SYSTEM, THE TRANSMITTER AND ASSOCIATED APPARATUS MUST BE WIRED IN ACCORDANCE WITH THE ASSOCIATED APPARATUS MANUFACTURER'S FIELD WIRING INSTRUCTIONS AND THE CIRCUIT DIAGRAM SHOWN BELOW.
2.2 THE ASSOCIATED APPARATUS MUST BE FM APPROVED.
2.1 TRANSMITTER MUST BE INSTALLED IN A SUITABLE RATED ENCLOSURE.
NOTES:
DRAWING NO. 00644-2071
ROSEMOUNT
8200 Market Blvd Chanhassen, MN 55317
INSTALL. DRAWING: 644 ENHANCED FM, INTRINSIC SAFETY
00644-2071
SIZE C
SCALE 1:1
REV AC
SHEET 2 OF 2

Figure B-5. FM Intrinsic Safety Installation Drawing 00644-0009, Rev. AE Sheet 1 of 2



Sheet 2 of 2

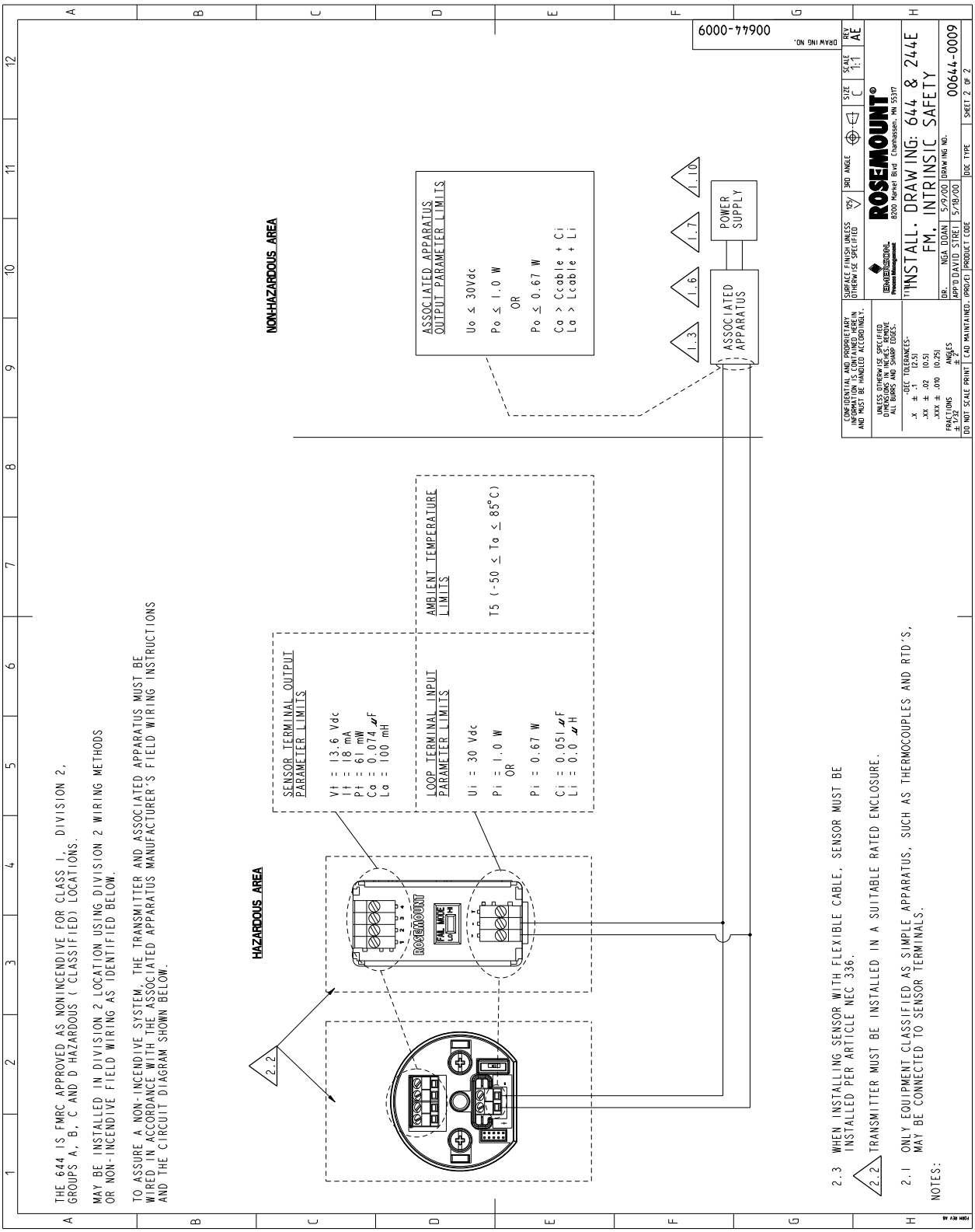
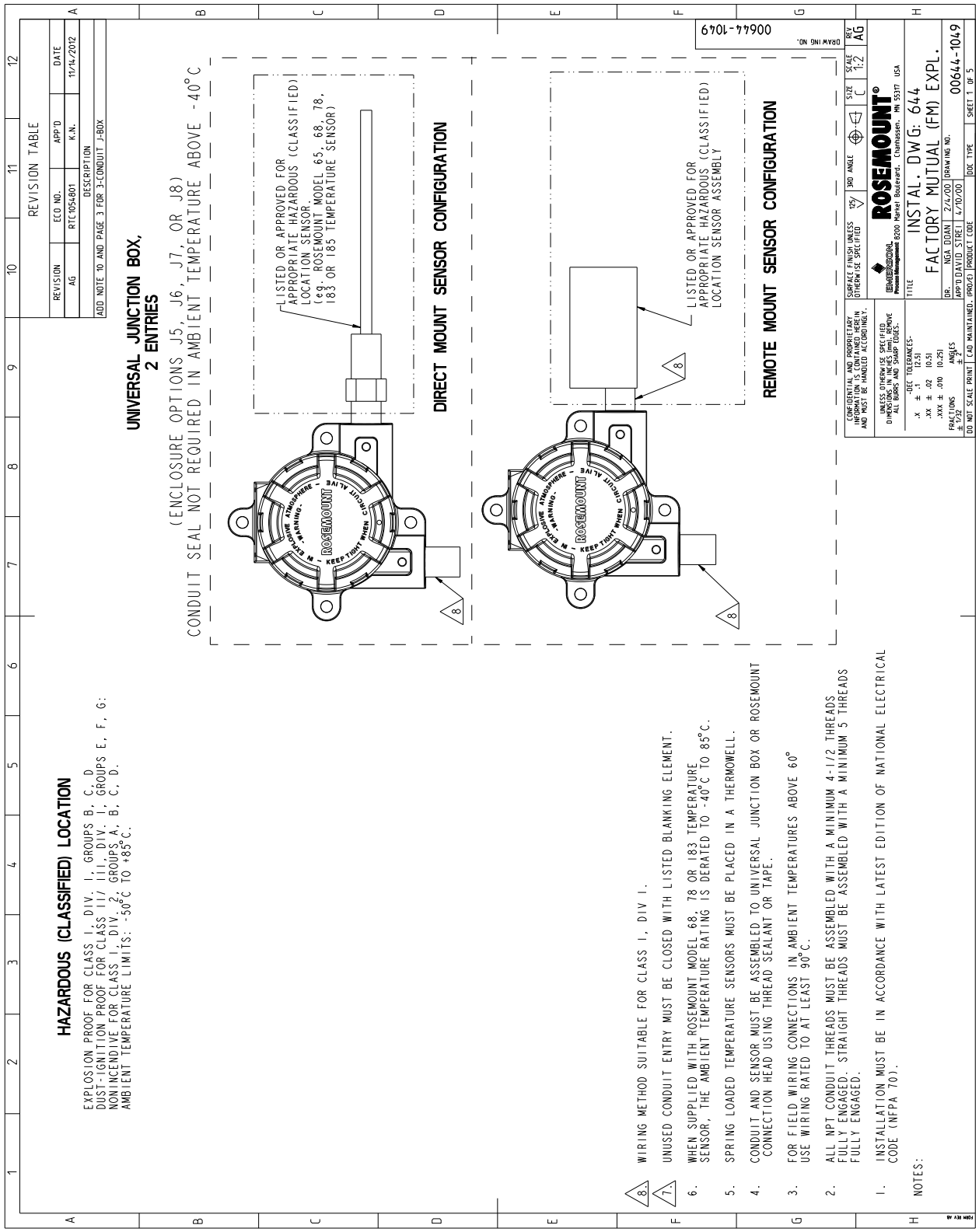
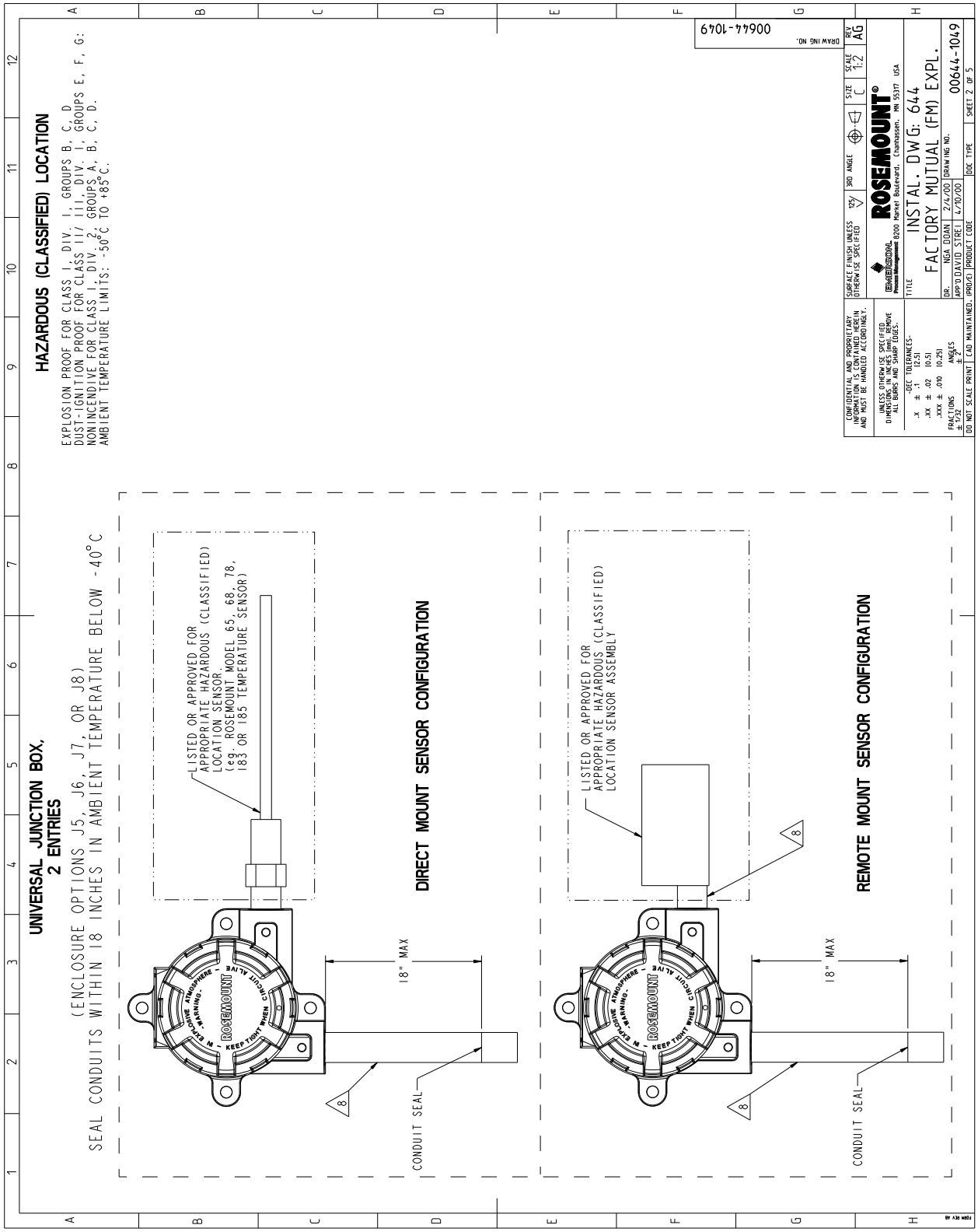
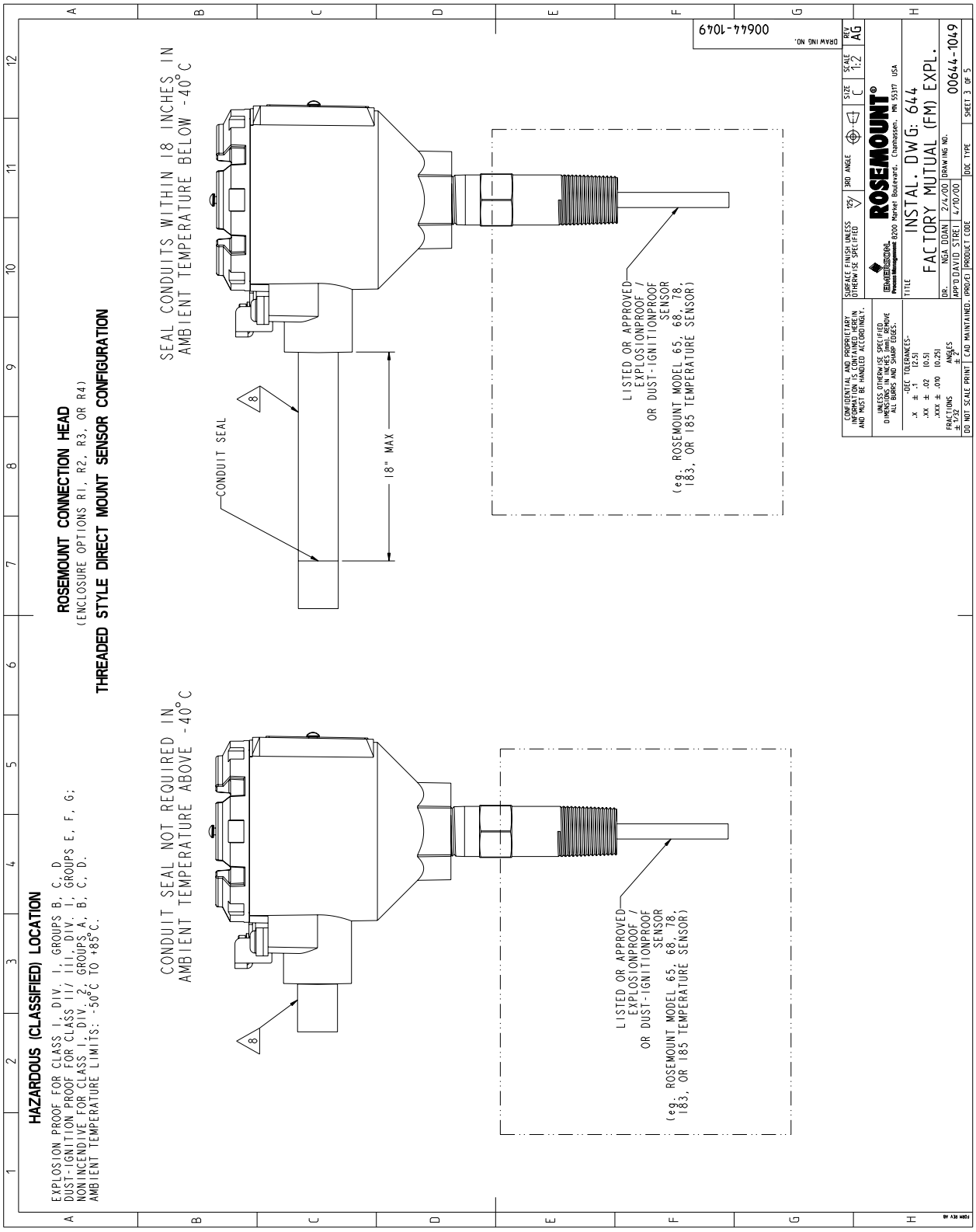
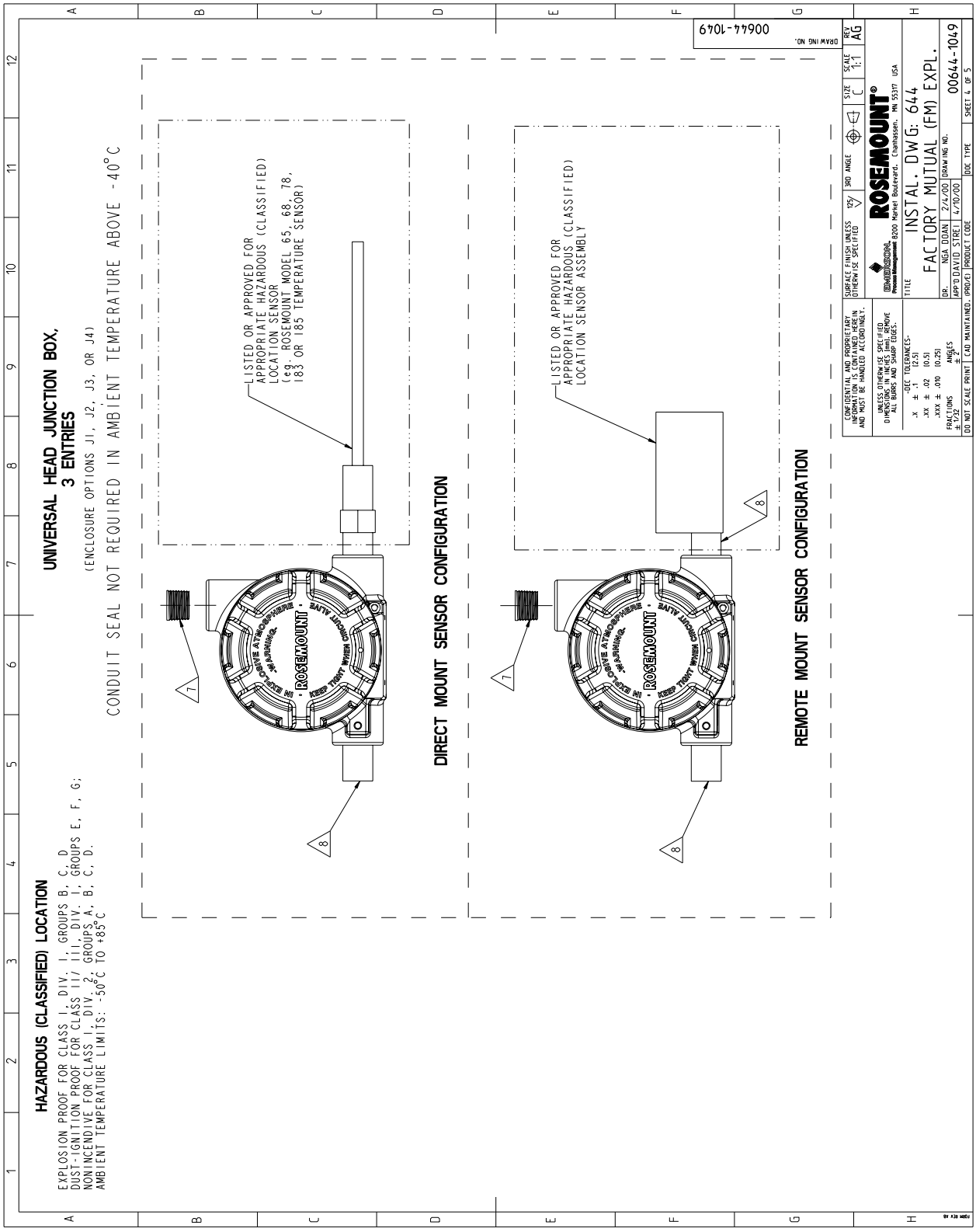

THE 644 IS FMRC APPROVED AS NONINCENDIVE FOR CLASS I, DIVISION 2, GROUPS A, B, C AND D HAZARDOUS (CLASSIFIED) LOCATIONS.
MAY BE INSTALLED IN DIVISION 2 LOCATION USING DIVISION 2 WIRING METHODS OR NON-INCENDIVE FIELD WIRING AS IDENTIFIED BELOW.
TO ASSURE A NON-INCENDIVE SYSTEM, THE TRANSMITTER AND ASSOCIATED APPARATUS MUST BE WIRED IN ACCORDANCE WITH THE ASSOCIATED APPARATUS MANUFACTURER'S FIELD WIRING INSTRUCTIONS AND THE CIRCUIT DIAGRAM SHOWN BELOW.
HAZARDOUS AREA
NON-HAZARDOUS AREA
SENSOR TERMINAL OUTPUT PARAMETER LIMITS
Vt = 13.6 Vdc
It = 18 mA
Pt = 61 mW
Ca = 0.074 µF
La = 100 mH
LOOP TERMINAL INPUT PARAMETER LIMITS
Ui = 30 Vdc
Pi = 1.0 W
OR
Pi = 0.67 W
Ci = 0.051 µF
Li = 0.0 µH
AMBIENT TEMPERATURE LIMITS
T5 (-50 ≤ Ta ≤ 85°C)
ASSOCIATED APPARATUS OUTPUT PARAMETER LIMITS
Uo ≤ 30Vdc
Po ≤ 1.0 W
OR
Po ≤ 0.67 W
Ca > Ccable + Ci
La > Lcable + Li
ASSOCIATED APPARATUS
POWER SUPPLY
2.1 ONLY EQUIPMENT CLASSIFIED AS SIMPLE APPARATUS, SUCH AS THERMOCOUPLES AND RTD'S, MAY BE CONNECTED TO SENSOR TERMINALS.
2.2 TRANSMITTER MUST BE INSTALLED IN A SUITABLE RATED ENCLOSURE.
2.3 WHEN INSTALLING SENSOR WITH FLEXIBLE CABLE, SENSOR MUST BE INSTALLED PER ARTICLE NEC 336.
NOTES:
ROSEMOUNT
FAIL MODE
CONFIDENTIAL AND PROPRIETARY INFORMATION IS CONTAINED HEREIN AND MUST BE HANDLED ACCORDINGLY.
UNLESS OTHERWISE SPECIFIED DIMENSIONS IN INCHES REMOVE ALL BURRS AND SHARP EDGES.
SURFACE FINISH UNLESS OTHERWISE SPECIFIED
3RD ANGLE
SIZE C
SCALE 1:1
REV AE
ROSEMOUNT
8200 Market Blvd Chanhassen, MN 55317
TITLE INSTALL. DRAWING: 644 & 244E FM, INTRINSIC SAFETY
DR. NGA DOAN 5/9/00
APP'D DAVID STREI 5/18/00
DRAWING NO. 00644-0009
DOC TYPE
SHEET 2 OF 2
DRAWING NO. 00644-0009
DO NOT SCALE PRINT | CAD MAINTAINED, (PROJ'E) | PRODUCT CODE

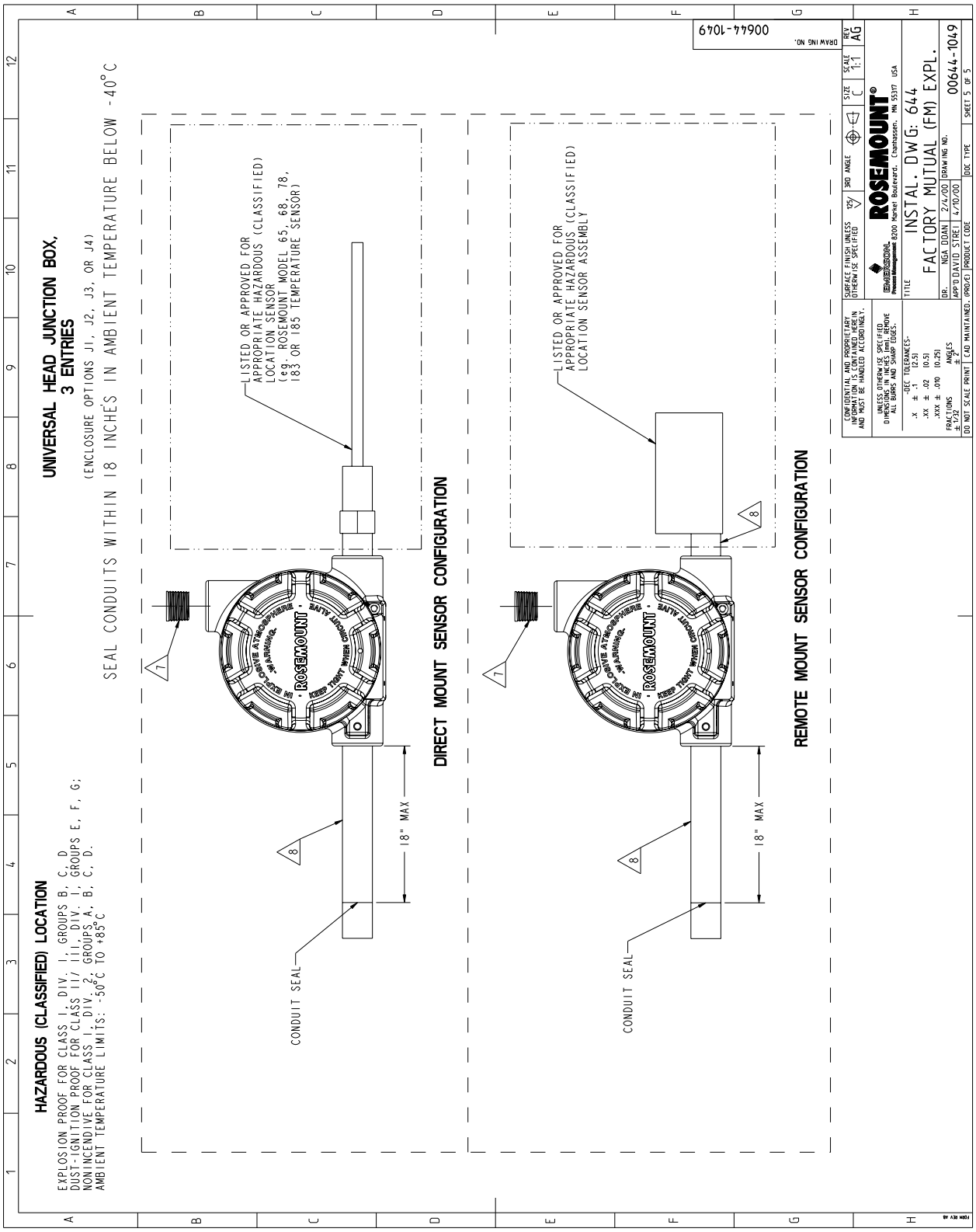
Figure B-6. FM Explosion-Proof Installation Drawing 00644-1049, Rev. AG




HAZARDOUS (CLASSIFIED) LOCATION
EXPLOSION PROOF FOR CLASS I, DIV. 1, GROUPS B, C, D
DUST-IGNITION PROOF FOR CLASS II/ III, DIV. 1, GROUPS E, F, G:
NONINCENDIVE FOR CLASS I, DIV. 2, GROUPS A, B, C, D.
AMBIENT TEMPERATURE LIMITS: -50°C TO +85°C.
UNIVERSAL JUNCTION BOX,
2 ENTRIES
(ENCLOSURE OPTIONS J5, J6, J7, OR J8)
SEAL CONDUITS WITHIN 18 INCHES IN AMBIENT TEMPERATURE BELOW -40°C
LISTED OR APPROVED FOR APPROPRIATE HAZARDOUS (CLASSIFIED) LOCATION SENSOR. (e.g. ROSEMOUNT MODEL 65, 68, 78, 183 OR 185 TEMPERATURE SENSOR)
DIRECT MOUNT SENSOR CONFIGURATION
18" MAX
CONDUIT SEAL
LISTED OR APPROVED FOR APPROPRIATE HAZARDOUS (CLASSIFIED) LOCATION SENSOR ASSEMBLY
REMOTE MOUNT SENSOR CONFIGURATION
18" MAX
CONDUIT SEAL
DRAWING NO. 00644-1049
REV AG
SIZE C
SCALE 1:2
ROSEMOUNT
8200 Market Boulevard, Chanhassen, MN 55317 USA
TITLE
INSTAL. DWG: 644
FACTORY MUTUAL (FM) EXPL.
DR. NGA DOAN 2/4/00
APP'D DAVID STREI 4/10/00
DRAWING NO. 00644-1049
DOC TYPE
SHEET 2 OF 5
PRODUCT CODE
CAD MAINTAINED (PRO/E)
DO NOT SCALE PRINT
CONFIDENTIAL AND PROPRIETARY INFORMATION IS CONTAINED HEREIN AND MUST BE HANDLED ACCORDINGLY.
UNLESS OTHERWISE SPECIFIED, DIMENSIONS IN INCHES [mm]. REMOVE ALL BURRS AND SHARP EDGES.
SURFACE FINISH UNLESS OTHERWISE SPECIFIED 125
3RD ANGLE


HAZARDOUS (CLASSIFIED) LOCATION
EXPLOSION PROOF FOR CLASS I, DIV. 1, GROUPS B, C, D
DUST-IGNITION PROOF FOR CLASS II/ III, DIV. 1, GROUPS E, F, G;
NONINCENDIVE FOR CLASS I, DIV. 2, GROUPS A, B, C, D.
AMBIENT TEMPERATURE LIMITS: -50°C TO +85°C.
THREADED STYLE DIRECT MOUNT SENSOR CONFIGURATION
ROSEMOUNT CONNECTION HEAD
(ENCLOSURE OPTIONS R1, R2, R3, OR R4)
SEAL CONDUITS WITHIN 18 INCHES IN AMBIENT TEMPERATURE BELOW -40°C
CONDUIT SEAL
18" MAX
LISTED OR APPROVED EXPLOSIONPROOF / OR DUST-IGNITIONPROOF SENSOR (eg. ROSEMOUNT MODEL 65, 68, 78, 183, OR 185 TEMPERATURE SENSOR)
CONDUIT SEAL NOT REQUIRED IN AMBIENT TEMPERATURE ABOVE -40°C
LISTED OR APPROVED EXPLOSIONPROOF / OR DUST-IGNITIONPROOF SENSOR (eg. ROSEMOUNT MODEL 65, 68, 78, 183, OR 185 TEMPERATURE SENSOR)
DRAWING NO. 00644-1049
SIZE C
SCALE 1:2
REV AG
ROSEMOUNT
8200 Market Boulevard. Chanhassen, MN 55317 USA
TITLE
INSTAL. DWG: 644
FACTORY MUTUAL (FM) EXPL.
DR. NGA DOAN 2/4/00
APP'D DAVID STREI 6/10/00
DRAWING NO. 00644-1049
SHEET 3 OF 5
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SURFACE FINISH UNLESS OTHERWISE SPECIFIED
3RD ANGLE
UNLESS OTHERWISE SPECIFIED DIMENSIONS IN INCHES [mm]. REMOVE ALL BURRS AND SHARP EDGES.
DO NOT SCALE PRINT
CAD MAINTAINED
PRODUCT CODE
DOC TYPE


HAZARDOUS (CLASSIFIED) LOCATION
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DUST-IGNITION PROOF FOR CLASS II/ III, DIV. 1, GROUPS E, F, G;
NONINCENDIVE FOR CLASS I, DIV. 2, GROUPS A, B, C, D.
AMBIENT TEMPERATURE LIMITS: -50°C TO +85°C
UNIVERSAL HEAD JUNCTION BOX,
3 ENTRIES
(ENCLOSURE OPTIONS J1, J2, J3, OR J4)
CONDUIT SEAL NOT REQUIRED IN AMBIENT TEMPERATURE ABOVE -40°C
LISTED OR APPROVED FOR
APPROPRIATE HAZARDOUS (CLASSIFIED)
LOCATION SENSOR
(eg. ROSEMOUNT MODEL 65, 68, 78,
183 OR 185 TEMPERATURE SENSOR)
DIRECT MOUNT SENSOR CONFIGURATION
LISTED OR APPROVED FOR
APPROPRIATE HAZARDOUS (CLASSIFIED)
LOCATION SENSOR ASSEMBLY
REMOTE MOUNT SENSOR CONFIGURATION
ROSEMOUNT
DRAWING NO. 00644-1049
ROSEMOUNT®
INSTAL. DWG: 644
FACTORY MUTUAL (FM) EXPL.
00644-1049
SHEET 4 OF 5


HAZARDOUS (CLASSIFIED) LOCATION
EXPLOSION PROOF FOR CLASS I, DIV. 1, GROUPS B, C, D
DUST-IGNITION PROOF FOR CLASS II/ III, DIV. 1, GROUPS E, F, G;
NONINCENDIVE FOR CLASS I, DIV. 2, GROUPS A, B, C, D.
AMBIENT TEMPERATURE LIMITS: -50°C TO +85°C
UNIVERSAL HEAD JUNCTION BOX,
3 ENTRIES
(ENCLOSURE OPTIONS J1, J2, J3, OR J4)
SEAL CONDUITS WITHIN 18 INCHES IN AMBIENT TEMPERATURE BELOW -40°C
LISTED OR APPROVED FOR APPROPRIATE HAZARDOUS (CLASSIFIED) LOCATION SENSOR (eg. ROSEMOUNT MODEL 65, 68, 78, 183 OR 185 TEMPERATURE SENSOR)
DIRECT MOUNT SENSOR CONFIGURATION
CONDUIT SEAL
18" MAX
LISTED OR APPROVED FOR APPROPRIATE HAZARDOUS (CLASSIFIED) LOCATION SENSOR ASSEMBLY
REMOTE MOUNT SENSOR CONFIGURATION
CONDUIT SEAL
18" MAX
DRAWING NO. 00644-1049
ROSEMOUNT
INSTAL. DWG: 644
FACTORY MUTUAL (FM) EXPL.
00644-1049

Appendix C Field Communicator Menu Trees and Fast Keys

C.1 Field Communicator menu trees

Figure C-1. Rosemount 644 HART Revision 5 Field Communicator Menu Tree - Overview

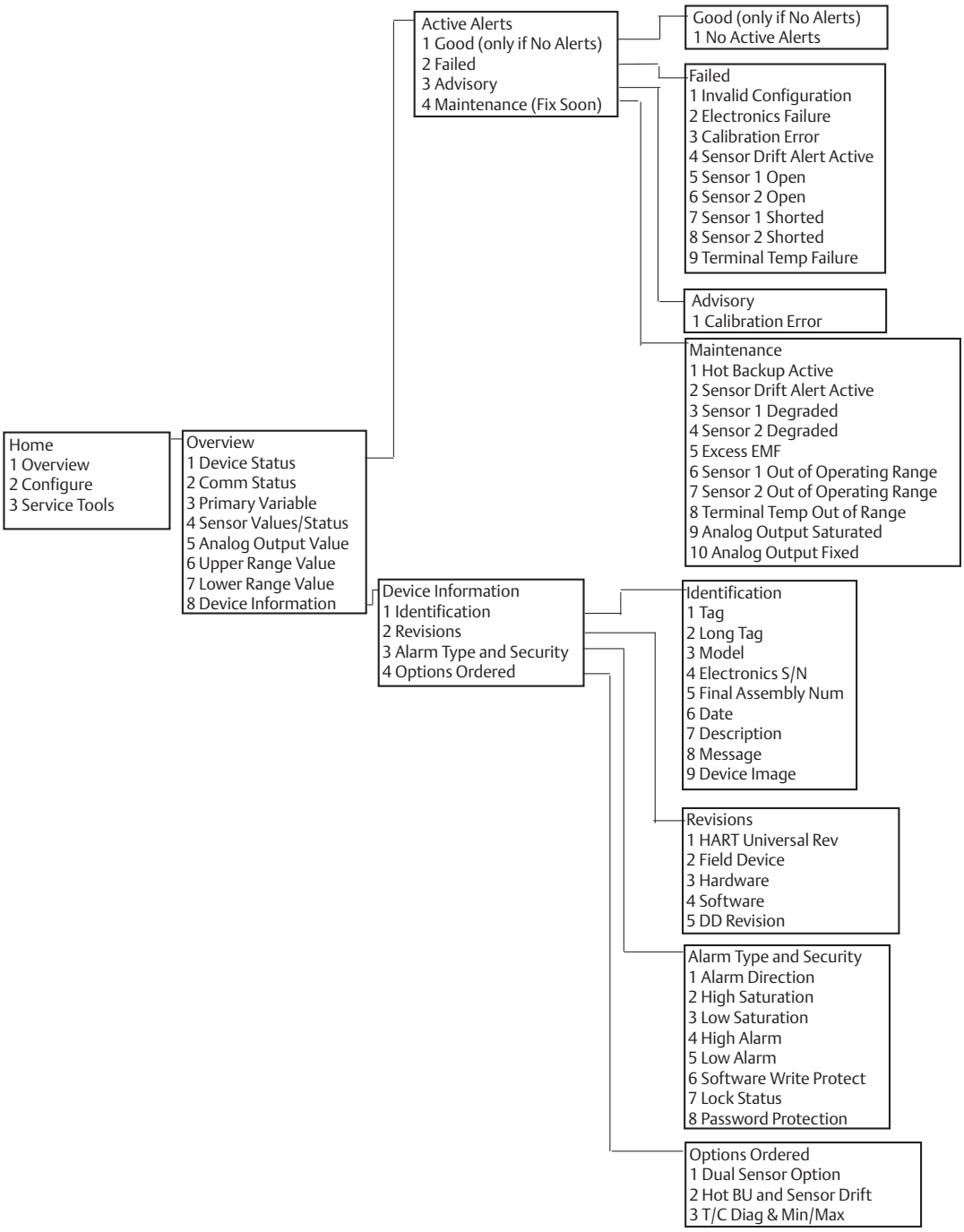


Figure C-2. Rosemount 644 HART Revision 5 Field Communicator Menu Tree - Configure

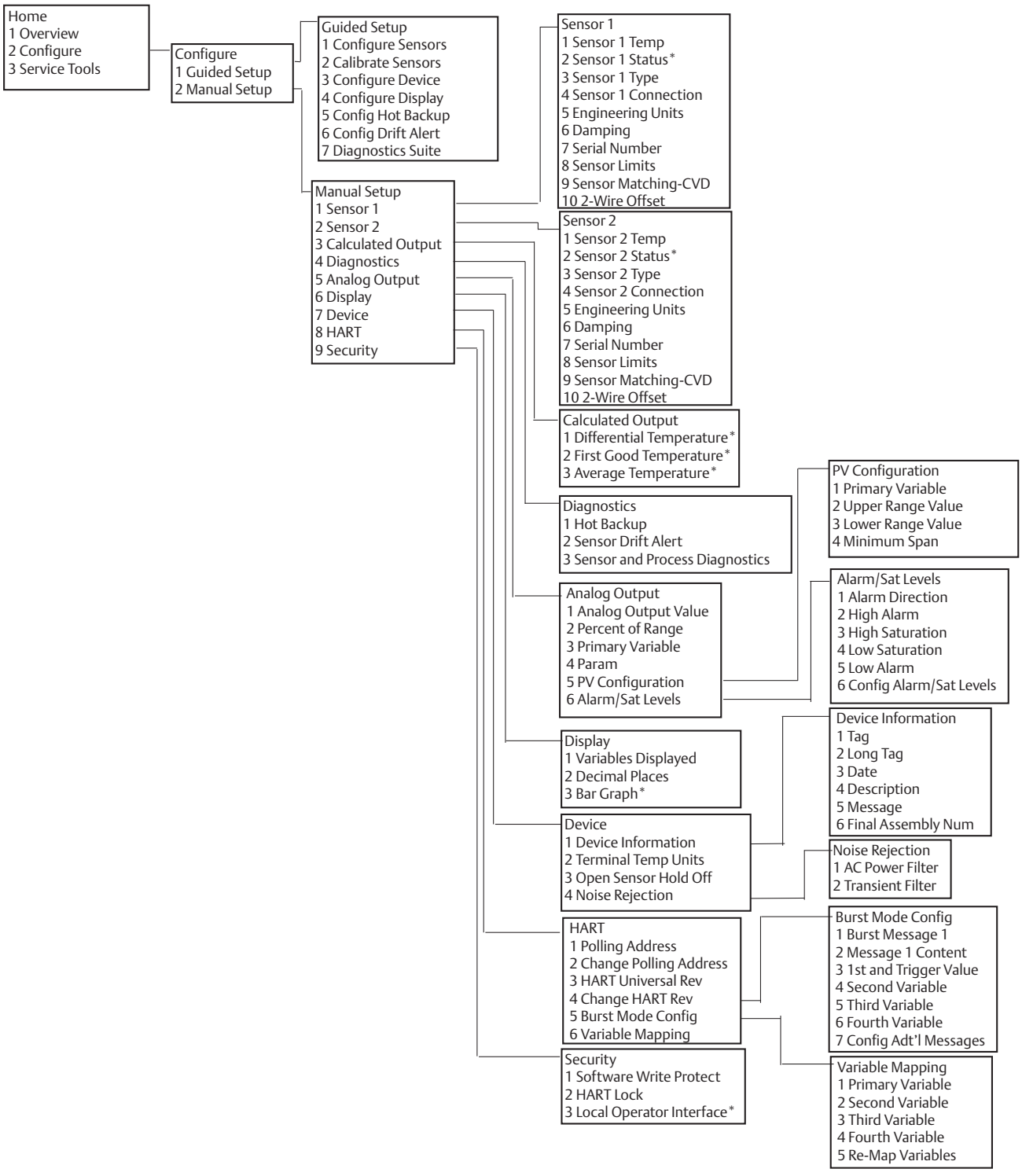


Figure C-3. Rosemount 644 HART Revision 5 Field Communicator Menu Tree – Service Tools

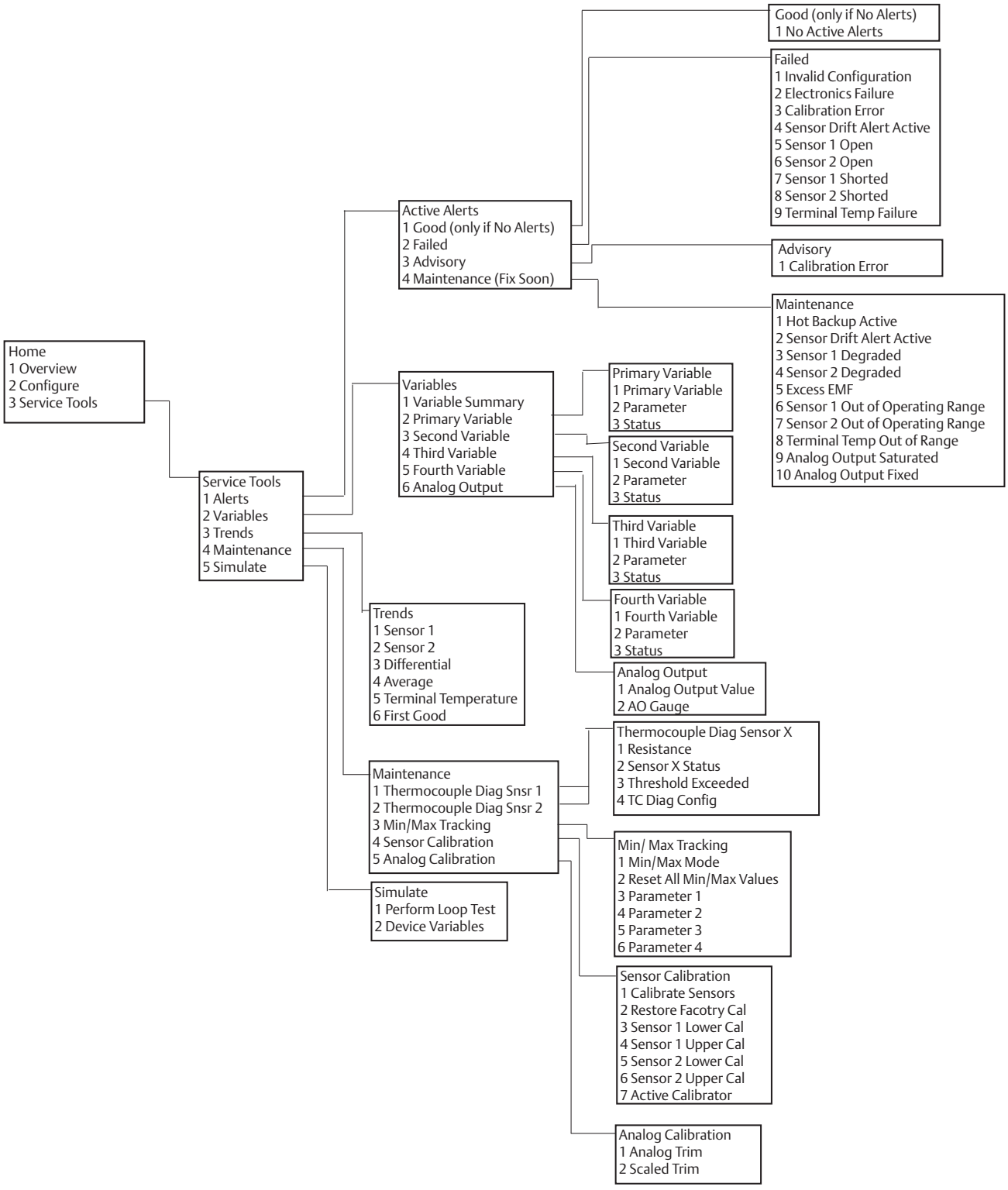


Figure C-4. Rosemount 644 HART Revision 7 Field Communicator Menu Tree – Overview

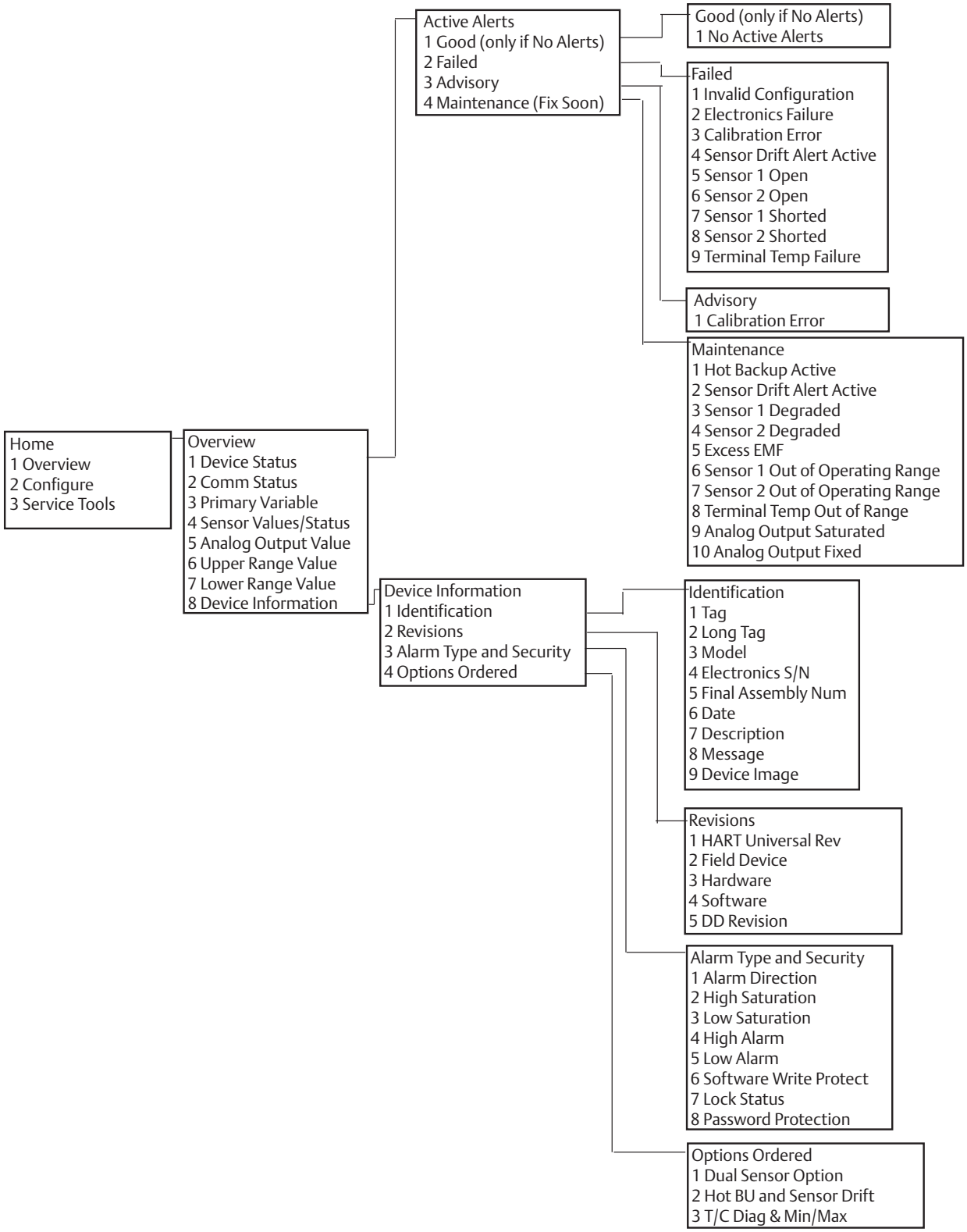


Figure C-5. Rosemount 644 HART Revision 7 Field Communicator Menu Tree - Configure

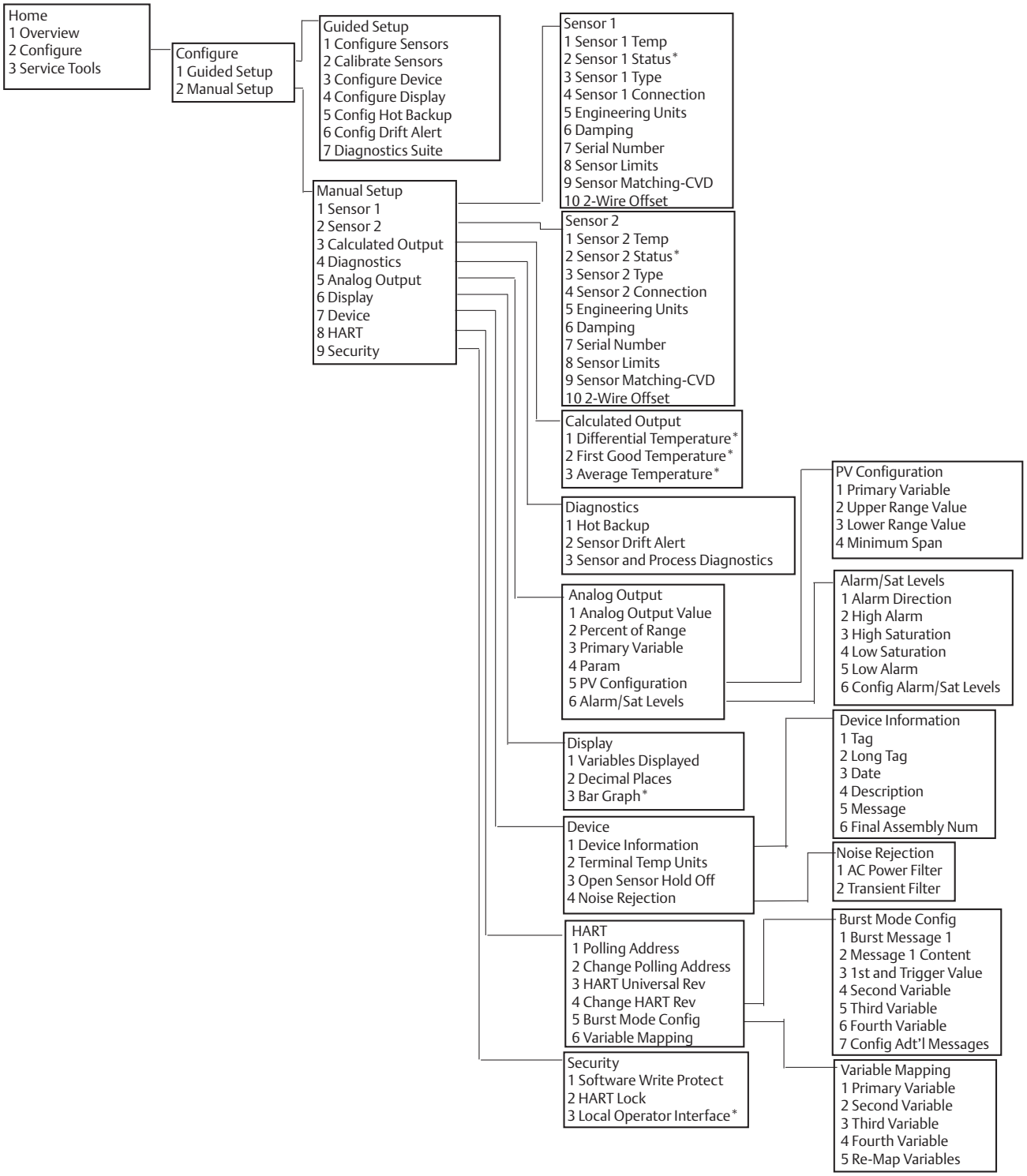
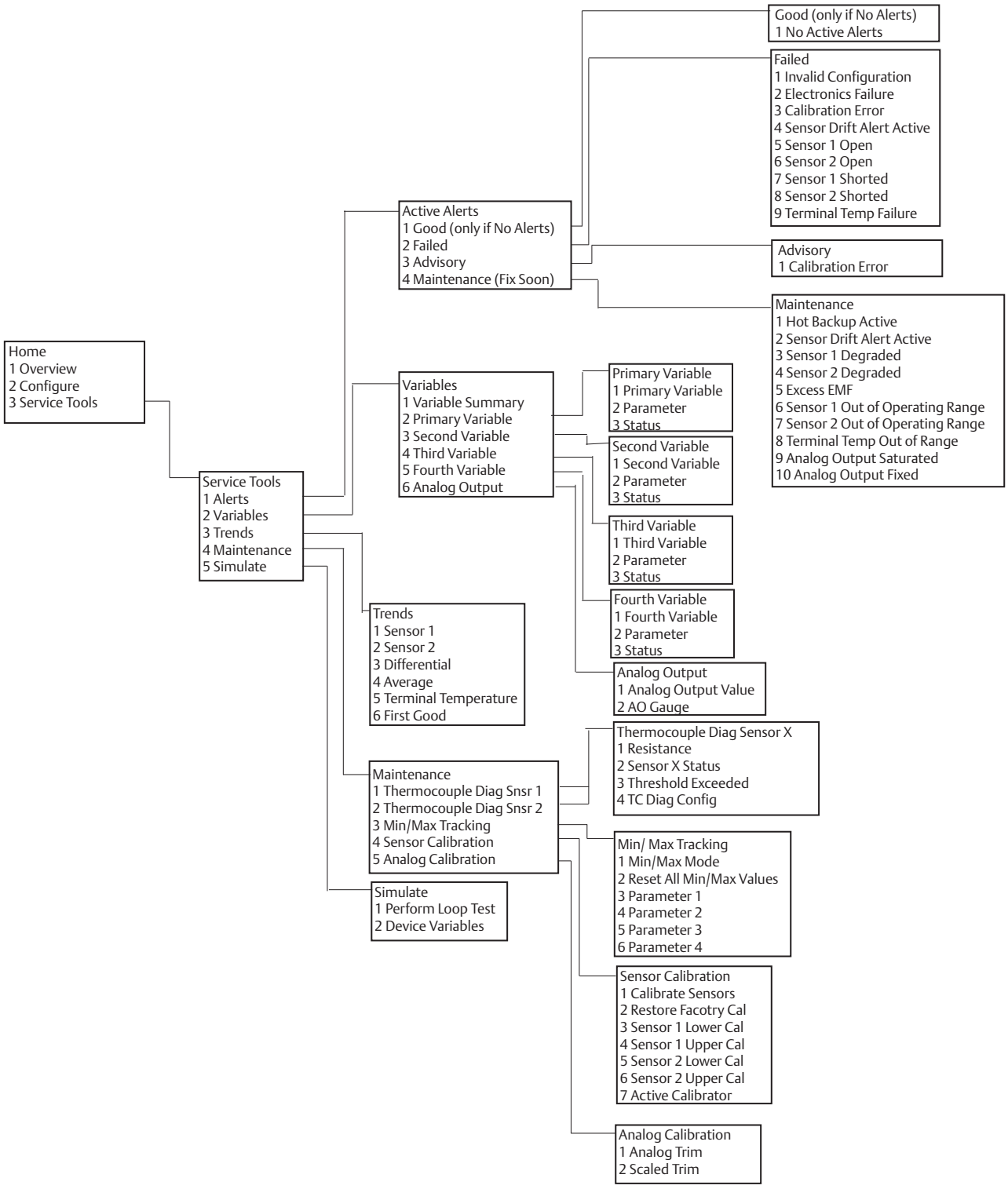


Figure C-6. Rosemount 644 HART Revision 7 Field Communicator Menu Tree – Service Tools



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	N/A	1, 2
Configure additional messages	N/A	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	N/A	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	N/A	3, 4, 6, 2
Lock Status	N/A	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 Hold off	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	N/A	2, 2, 1, 2
Sensor 2 Status	N/A	2, 2, 2, 2
Simulate Digital Signal	N/A	3, 5, 2

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	N/A	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 Hold off	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)

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Text entry . . . . . page 164
Timeout . . . . . page 166
Saving and canceling . . . . . page 166
LOI menu tree . . . . . page 167
LOI menu tree – extended menu . . . . . page 168

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 12 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

Step	Instruction	Current position (indicated by underline)
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: ,
- 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 163, 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.

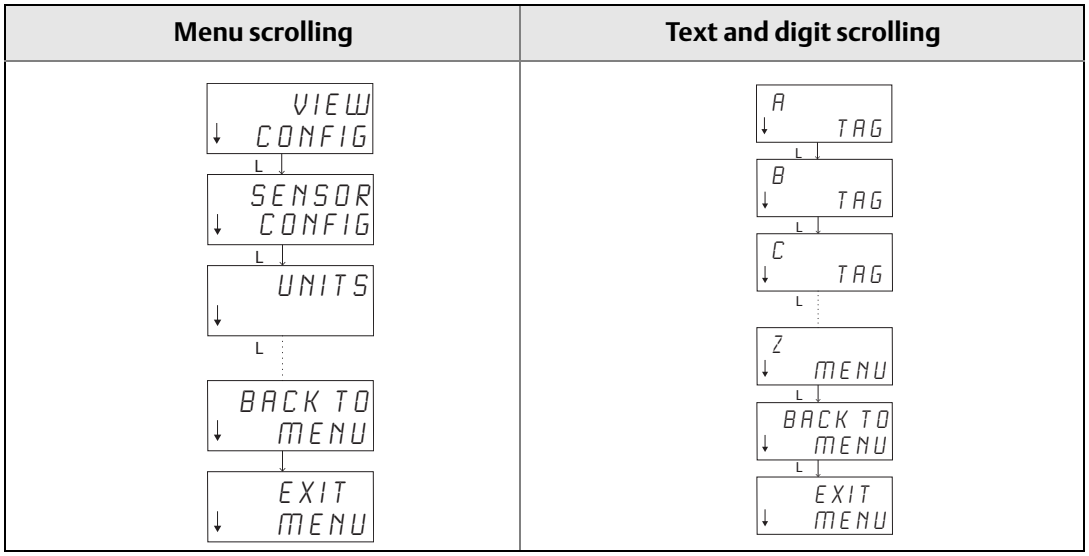
Menu scrolling

- Simply 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.

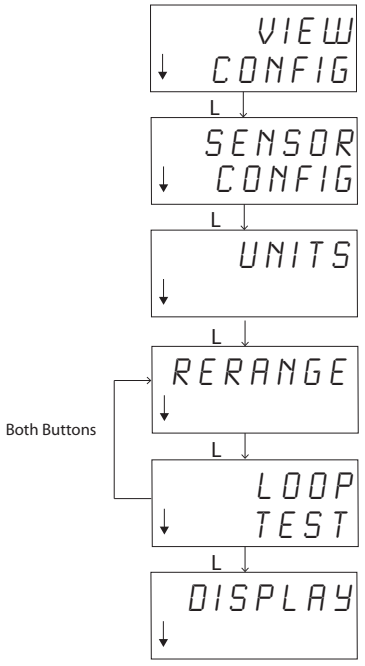
Figure D-1. Menu Scrolling/Text and Digit Scrolling



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.

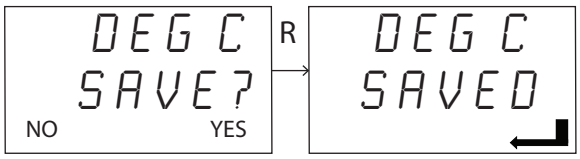
D.4 Saving and canceling

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:

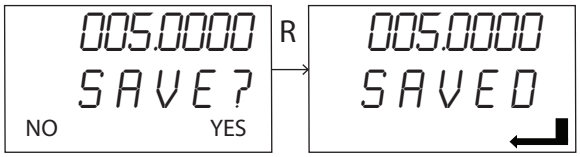
Saving

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:



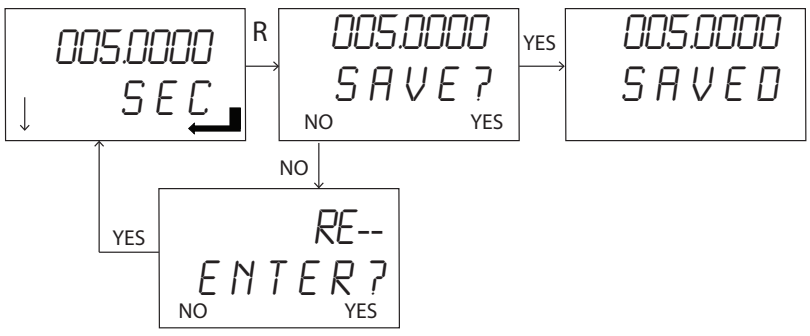
Saving text or values:



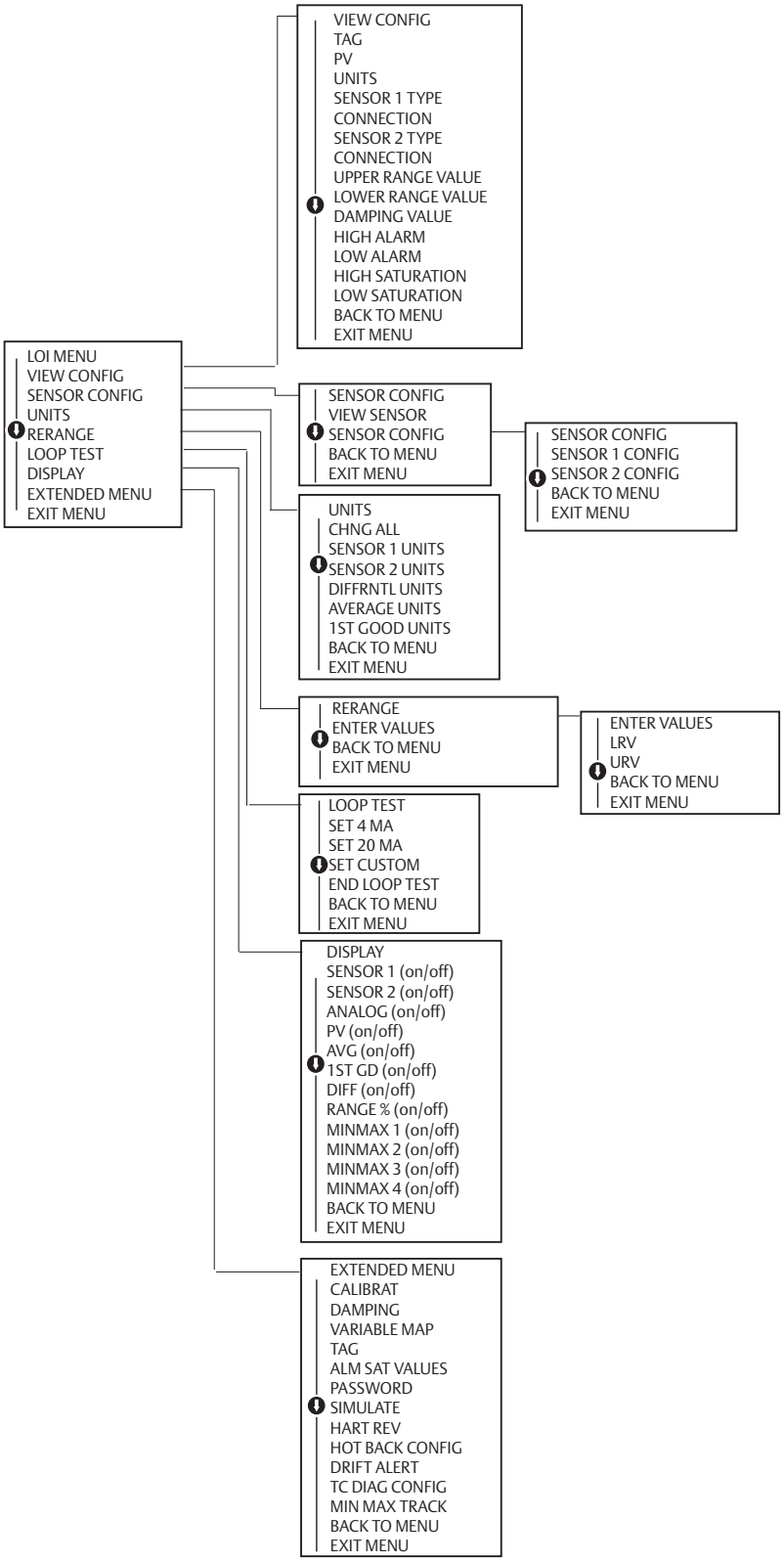
Canceling

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.

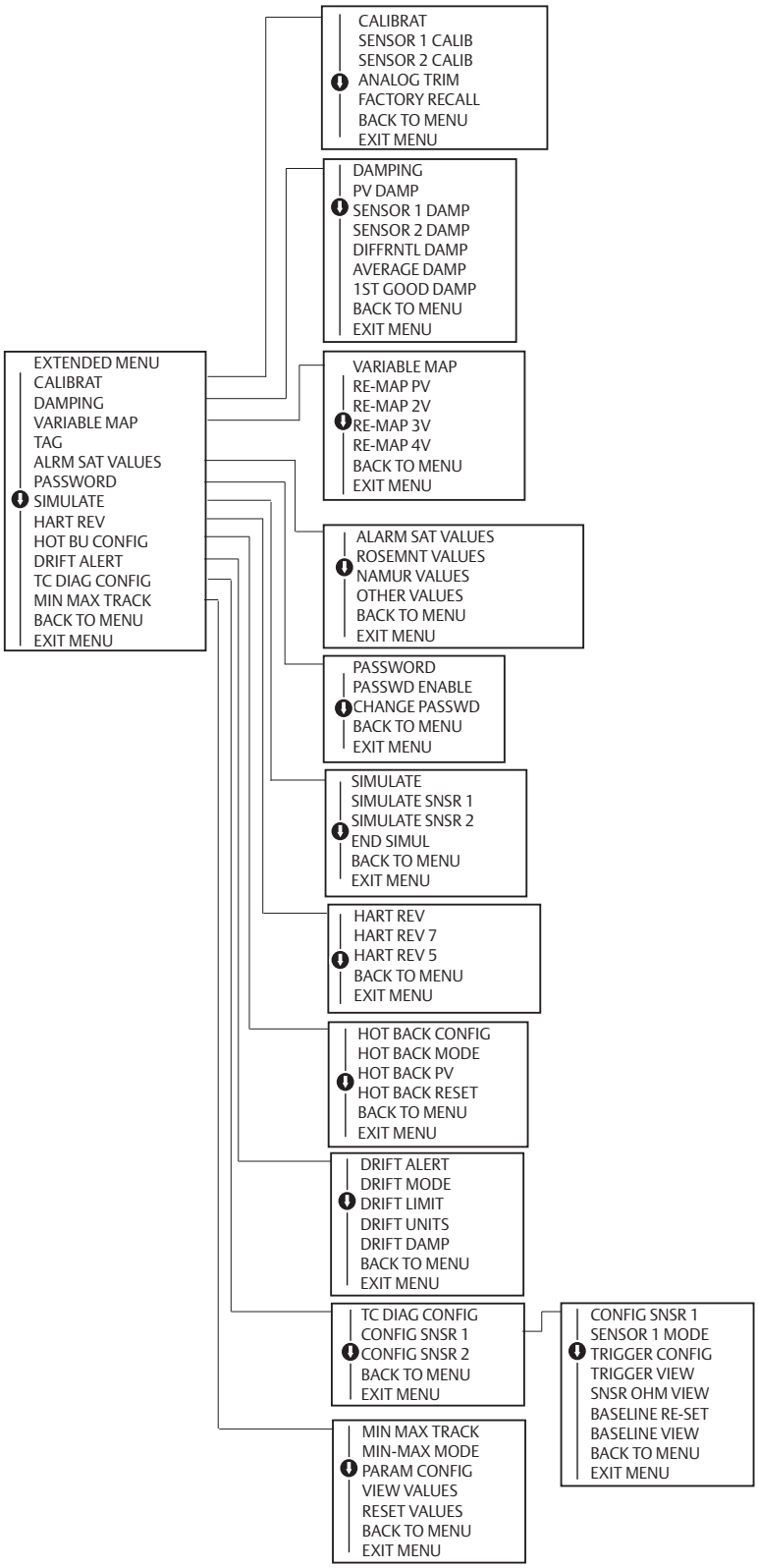
Canceling



D.5 LOI menu tree



D.6 LOI menu tree – extended menu



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Rosemount World Headquarters
Emerson Process Management
6021 Innovation Blvd
Shakopee, MN 55379, USA
+1 800 999 9307 or +1 952 906 8888
+1 952 949 7001
RFQ.RMD-RCC@EmersonProcess.com

North America Regional Office
Emerson Process Management
8200 Market Blvd.
Chanhassen, MN 55317, USA
+1 800 999 9307 or +1 952 906 8888
+1 952 949 7001
RMT-NA.RCCRFQ@emerson.com

Latin America Regional Office
Emerson Process Management
1300 Concord Terrace, Suite 400
Sunrise, Florida, 33323, USA
+1 954 846 5030
+1 954 846 5121
RFQ.RMD-RCC@EmersonProcess.com

Europe Regional Office
Emerson Process Management Europe GmbH
Neuhofstrasse 19a P.O. Box 1046
CH 6340 Baar
Switzerland
+41 41 768 6111
+41 (0) 41 768 6300
RFQ.RMD-RCC@EmersonProcess.com

Asia Pacific Regional Office
Emerson Process Management Asia Pacific Pte Ltd
1 Pandan Crescent
Singapore 128461
+65 6777 8211
+65 6777 0947
Enquiries@AP.EmersonProcess.com

Middle East and Africa Regional Office
Emerson Process Management
Emerson FZE P.O. Box 17033,
Jebel Ali Free Zone - South 2
Dubai, United Arab Emirates
+971 4 8118100
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