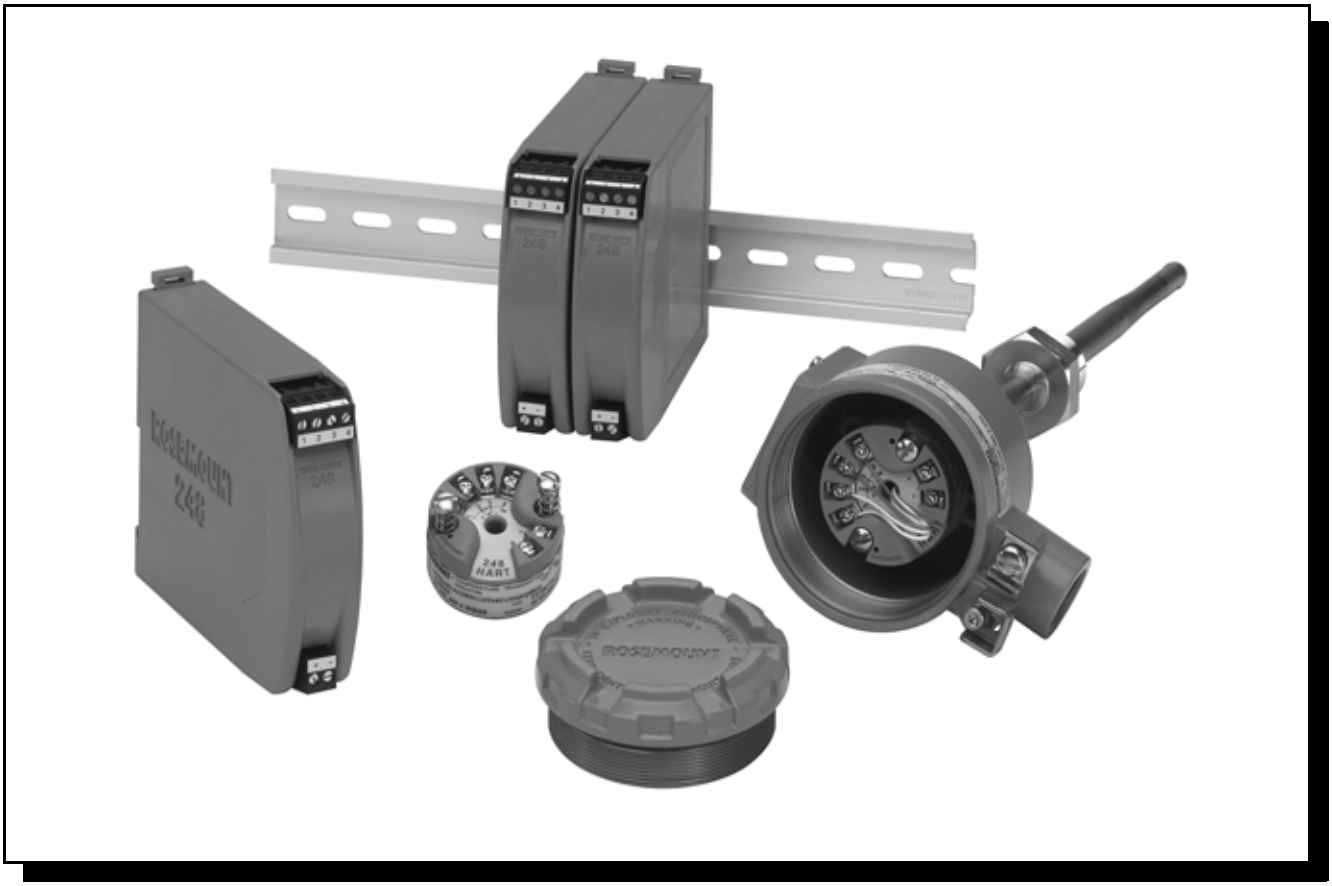
Reference Manual
00809-0100-4825, Rev BB
August 2005

Rosemount 248 Transmitter and Temperature Monitoring Assembly



HART® FIELD COMMUNICATIONS PROTOCOL

ROSEMOUNT®

www.rosemount.com

EMERSON™
Process Management

Reference Manual
00809-0100-4825, Rev BB
August 2005

Rosemount 248 Transmitter and Temperature Monitoring Assembly

Rosemount 248 Hardware Revision	
Headmount	**4**
Railmount	**1**
HART® Device Revision	**5.1**
HART Communicator Field Device Revision	**Dev v1, DD v1**

NOTICE

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

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 (⚠). Please refer to the following safety messages before performing an operation preceded by this symbol.

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 375 Field Communicator in an explosive atmosphere, make sure the instruments in the loop are installed in accordance with intrinsically safe or non-intrinsic field wiring practices.
- Verify that the operating atmosphere of the transmitter is consistent with the appropriate hazardous locations certifications.
- All connection head covers must be fully engaged to meet explosion-proof requirements.

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.

OVERVIEW

Manual

This manual is designed to assist in the installation, operation, and maintenance of the Rosemount 248 Temperature Monitoring Assembly.

Section 1: Introduction
- Transmitter and Manual Overview
- Things to considerations
- How to return the transmitter

Section 2: Installation
- How to mount the transmitter
- How to Install the transmitter
- How to set the switches to ensure proper use
- How to wire and power up the transmitter

Section 3: Configuration
- Commissioning to transmitter
- How to use the 375 Field Communicator to configure the transmitter

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- Calibration the transmitter
- Explanation of hardware maintenance and diagnostic messages

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- Dimensional drawings
- Ordering Information

Section B: Product Certifications
- Product Certifications/Hazardous Locations Certifications
- Installation Drawings

Transmitter

Features of the Rosemount 248 include:
- Accepts inputs from a wide variety of RTD and thermocouple sensors
- Configuration using HART protocol
- Electronics that are completely encapsulated in epoxy and enclosed in a plastic housing, making the transmitter extremely durable and ensuring long-term reliability
- A compact size and three housing options allowing mounting flexibility in the field
- Assembly including the transmitter, sensor, housing, thermowell, and extension accessories that can be ordered in one model number

Refer to the following literature for additional connection heads, sensors, and thermowells that may not be available in the Rosemount 248 model structure:
- Temperature Sensors and Assemblies Product Data Sheet, Volume 1 (document number 00813-0100-2654)
- Temperature Sensors and Assemblies Product Data Sheet, Volume 2 (document number 00813-0200-2654)
- Temperature sensors and Assemblies Product Data Sheet, Volume 3 (document number 00813-0301-2654)

CONSIDERATIONS

General

Electrical temperature sensors such as RTDs and thermocouples produce low-level signals proportional to their sensed temperature. The Rosemount 248 converts the low-level sensor signal to a standard 4–20 mA dc signal that is relatively insensitive to lead length and electrical noise. This current signal is then transmitted to the control room via two wires.

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 before connecting a HART communicator in an explosive atmosphere. For more information, see “Commissioning” on page 3-2.

Mechanical

Location

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

Special Mounting

Special mounting hardware is available for mounting a Rosemount 248 head mount transmitter to a DIN rail.

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. A resistance between 250 and 1100 ohms must be present in the loop for communication with a 375 Field Communicator.

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

Environmental

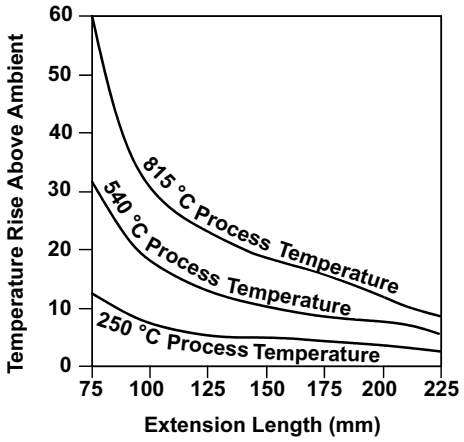
The transmitter electronics module is permanently sealed within the housing, resisting moisture and corrosive damage. Verify that the operating atmosphere of the transmitter is consistent with the appropriate hazardous locations certifications.

Temperature Effects

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

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

Figure 1-1. Rosemount 248 Transmitter Connection Head Temperature Rise vs. Extension Length



3044-0123A

Example

The transmitter specification limit is 85 °C. If the ambient temperature is 55 °C and the process temperature to be measured is 800 °C, the maximum permissible connection head temperature rise is the transmitter specification limit minus the ambient temperature (moves 85 to 55 °C), or 30 °C.

In this case, an extension of 100 mm meets this requirement, but 125 mm provides a margin of 8 °C, thereby reducing any temperature effects in the transmitter.

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

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.

Outside North America, contact a local Emerson Process Management representative.

Section 2 Installation

SAFETY MESSAGES

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- Do not remove the connection head cover in explosive atmospheres when the circuit is live.
- Before connecting a communicator in an explosive atmosphere, make sure the instruments in the loop are installed in accordance with instrinsically 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.

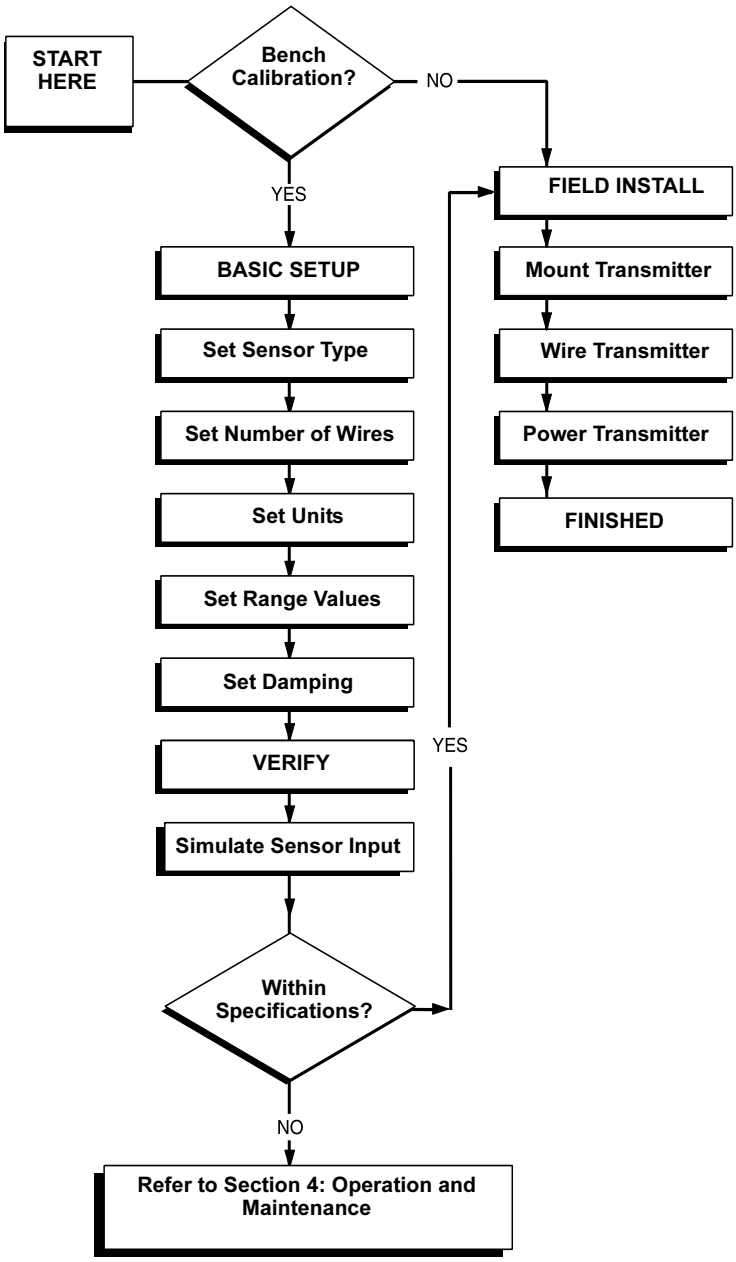
Process leaks could result in death or serious injury.

- 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.

Figure 2-1. Installation Flowchart



MOUNTING

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

The Rosemount 248R installs directly to a wall or to a DIN rail.

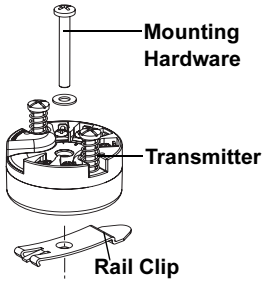
The Rosemount 248H installs

- 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

Mounting a Rosemount 248H to a DIN Rail

To attach a head mount transmitter to a DIN rail, assemble the appropriate rail mounting kit (part number 00248-1601-0001) to the transmitter as shown in Figure 2-2.

Figure 2-2. Assembling Rail Clip Hardware to a Rosemount 248



INSTALLATION

The Rosemount 248 can be ordered assembled to a sensor and thermowell or as a stand-alone unit. If ordered without the sensor assembly, use the following guidelines when installing the transmitter with an integral sensor assembly.

Typical European and Asia Pacific Installation

Head Mount Transmitter with DIN Plate Style Sensor

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

2. Assemble the transmitter to the sensor. Push the transmitter mounting screws through the sensor mounting plate and insert the snap rings (optional) into the transmitter mounting screw groove.

3. Wire the sensor to the transmitter (see “Sensor Wiring Diagrams” on page 2-10).

4. 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. Insert the assembly into the thermowell.

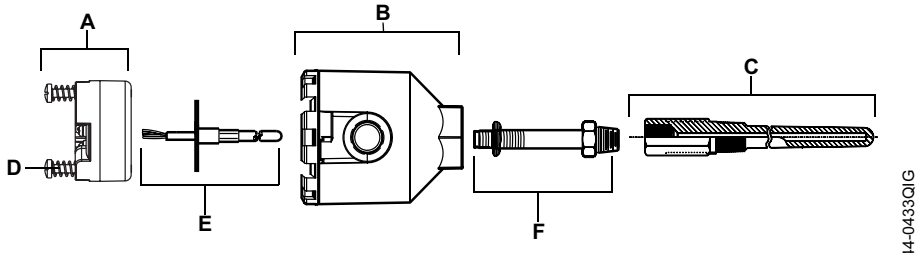
5. Slip the shielded cable though the cable gland

6. Attach a cable gland into the shielded cable.

7. Insert the shielded cable leads into the connection head through the cable entry. Connect and tighten the cable gland.

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

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

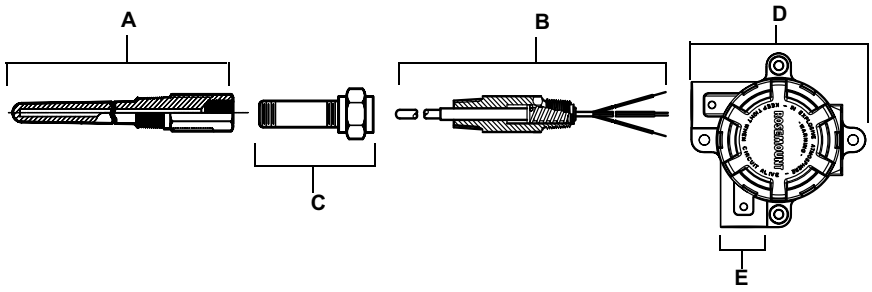


A = Rosemount 248 Transmitter	D = Transmitter Mounting Screws
B = Connection Head	E = Integral Mount Sensor with Flying Leads
C = Thermowell	F = Extension

Typical North and South American Installation

Head Mount Transmitter with Threaded Sensor

1. Attach the thermowell to the pipe or process container wall. Install and tighten thermowells before applying process pressure.
2. Attach necessary extension nipples and adapters to the thermowell. Seal the nipple and adapter threads with silicone tape.
3. Screw the sensor into the thermowell. Install drain seals if required for severe environments or to satisfy code requirements.
4. 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.
5. Mount the transmitter-sensor assembly into the thermowell. Seal adapter threads with silicone tape.
6. Install conduit for field wiring to the conduit entry of the universal head. Seal conduit threads with silicone tape.
7. Pull the field wiring leads through the conduit into the universal head. Attach the sensor and power leads to the transmitter. Avoid contact with other terminals.
8. Install and tighten the universal head cover. Enclosure covers must be fully engaged to meet explosion-proof requirements.



A = Threaded Thermowell
B = Threaded Style Sensor
C = Standard Extension
D = Universal Head
E = Conduit Entry

Rail Mount Transmitter with Integral Mount Sensor

The least complicated assembly uses:

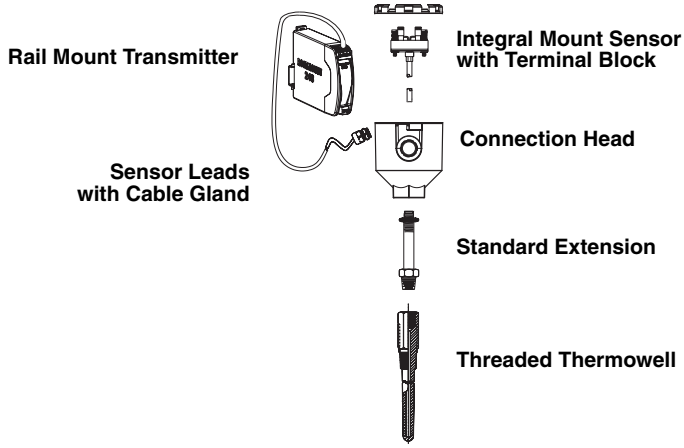
- an integral mount sensor with terminal block
- an integral DIN style connection head
- a standard extension
- a threaded thermowell

Refer to the Metric Product Data Sheet (document number 00813-0101-2654) for complete sensor and mounting accessory information.

To complete the assembly, follow the procedure described below.

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 the sensor to the connection head and mount the entire assembly to the thermowell.
4. Attach sufficient lengths of sensor lead wire to the sensor terminal block.
5. ⚠ Attach and 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. ⚠ Attach the sensor and power leads to the transmitter. Avoid contact with leads and terminals.

Figure 2-3. Typical Rail Mount Transmitter Mounting Configuration Using Integral Mount Sensor and Assembly



Rail Mount Transmitter with Threaded Sensor

The least complicated assembly uses:

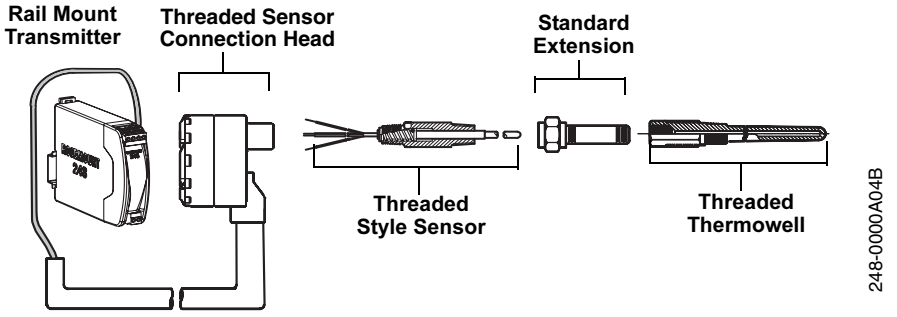
- a threaded sensor with flying heads
- a threaded sensor connection head
- a union and nipple extension assembly
- a threaded thermowell

Refer to Volume 1 of the Rosemount Sensors Product Data Sheet (document number 00813-0100-2654) for complete sensor and mounting accessory information.

To complete the assembly, follow the procedure described below.

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 silicone tape.
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. ⚠ Attach the sensor and power leads to the transmitter. Avoid contact with leads and terminals.

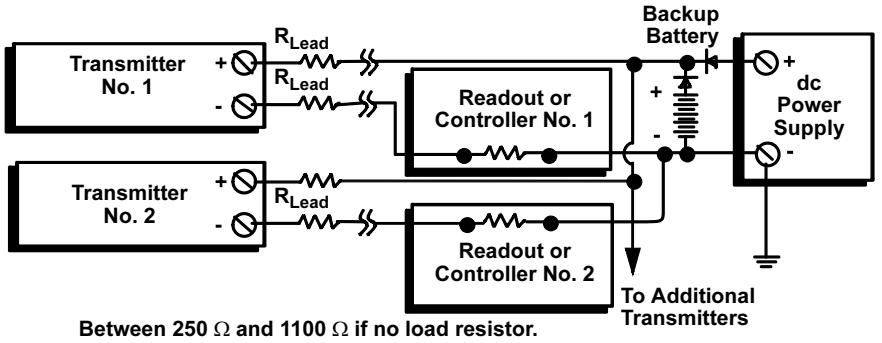
Figure 2-4. Typical Rail Mount Transmitter Mounting Configuration Using Threaded Style Sensor and Assembly



MULTICHANNEL INSTALLATIONS

Several transmitters can be connected to a single master power supply, as shown in Figure 2-5. 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 2-5 prevent unwanted charging or discharging of the back-up battery.

Figure 2-5. Multichannel Installations



SET THE SWITCHES

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 alarm depending on the failure mode configuration. (Saturation levels are 3.90 mA for standard configuration (3.8 mA if configured for NAMUR-compliant operation) on the low end and 20.5 mA for standard or NAMUR-compliant configuration on the high end, if the sensor temperature is outside of range limits.) These values are also custom configurable by the factory or using the 375 Field Communicator or AMS. See “Alarm and Saturation” on page 3-11 for instructions on how to change the alarm and saturation levels with the 375 Field Communicator.

NOTE
Microprocessor failures cause high alarm regardless of alarm direction (high or low) choice.

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 “Software Detected Failure Mode” on page A-2 for standard and NAMUR-compliant operation parameters.

WIRING

⚠ All power to the transmitter is supplied over the signal wiring. Use ordinary copper wire of sufficient size to ensure that the voltage across the transmitter power terminals does not drop below 12.0 V dc. Verify that the operating atmosphere of the transmitter is consistent with the appropriate hazardous locations certifications. Use extreme caution when making contact with the leads and terminals.

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

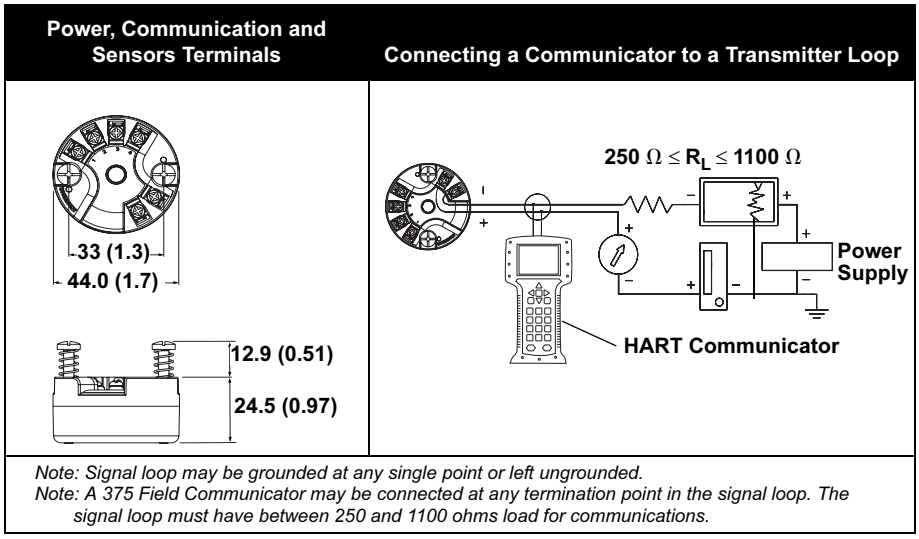
Do not apply high voltage (e.g., ac line voltage) to the transmitter terminals. Abnormally high voltage can damage the unit. (Sensor and transmitter power terminals are rated to 42.4 V dc.) Use extreme caution when making contact with the leads and terminals.

For multichannel installations, see above. The transmitters will accept inputs from a variety of RTD and thermocouple types. Refer to Figure 2-7 on page 2-10 when making sensor connections.

Use the following steps to wire the transmitter:

1. Remove the terminal block cover (if applicable).
2. Connect the positive power lead to the "**+**" terminal. Connect the negative power lead to the "**–**" terminal (see Figure 2-6). Use extreme caution when making contact with the leads and terminals.
3. Tighten the terminal screws.
4. Reattach and tighten the cover (if applicable). All connection head covers must be fully engaged to meet explosion-proof requirements.
5. Apply power (see "Power Supply").

Figure 2-6. Rosemount 248 Wiring

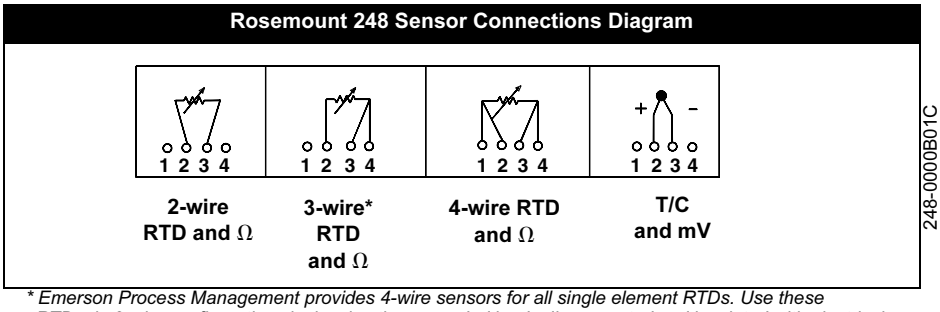


Note: Signal loop may be grounded at any single point or left ungrounded.
Note: A 375 Field Communicator may be connected at any termination point in the signal loop. The signal loop must have between 250 and 1100 ohms load for communications.

Sensor Connections

The Rosemount 248 is compatible with a number of RTD and thermocouple sensor types. Figure 2-7 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 compression terminals and tighten the screws. Use extreme caution when making contact with the leads and terminals.

Figure 2-7. Sensor Wiring Diagrams



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

Thermocouple or Millivolt Inputs

The thermocouple can be connected directly to the transmitter. Use appropriate thermocouple extension wire if mounting the transmitter remotely from the sensor. Make millivolt input 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 and 4-wire designs. 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.

Table 2-1. Examples of Approximate Basic Error

Sensor Input	Approximate Basic Error
4-wire RTD	None (independent of lead wire resistance)
3-wire RTD	± 1.0 Ω in reading per ohm of unbalanced lead wire resistance (Unbalanced lead wire resistance = maximum imbalance between any two leads.)
2-wire RTD	1.0 Ω in reading per ohm of lead wire resistance

Examples of Approximate Lead Wire Resistance Effect Calculations

Given:

Total cable length:	150 m
Imbalance of the lead wires at 20 °C:	0.5 Ω
Resistance/length (18 AWG Cu):	0.025 Ω/m °C
Temperature coefficient of Cu (α_{Cu}):	0.039 Ω/Ω °C
Temperature coefficient of Pt(α_{Pt}):	0.00385 Ω/Ω °C
Change in Ambient Temperature (ΔT_{amb}):	25 °C
RTD Resistance at 0 °C (R_o):	100 Ω (for Pt 100 RTD)

- Pt100 4-wire RTD: No lead wire resistance effect.
- Pt100 3-wire RTD:

$$\text{Basic Error} = \frac{\text{Imbalance of Lead Wires}}{(\alpha_{Pt} \times R_o)}$$

$$\text{Error due to amb. temp. variation} = \frac{(\alpha_{Cu}) \times (\Delta T_{amb}) \times (\text{Imbalance of Lead Wires})}{(\alpha_{Pt}) \times (R_o)}$$

Lead wire imbalance seen by the transmitter = 0.5 Ω

$$\text{Basic error} = \frac{0.5\ \Omega}{(0.00385\ \Omega / \Omega\ °C) \times (100\ \Omega)} = 1.3\ °C$$

Error due to amb. temp. var. of ± 25 °C

$$= \frac{(0.0039\ \Omega / \Omega\ °C) \times (25\ °C) \times (0.5\ \Omega)}{(0.00385\ \Omega / \Omega\ °C) \times (100\Omega)} = \pm 0.13°C$$

- Pt100 2-wire RTD:

$$\text{Basic Error} = \frac{\text{Lead Wire Resistance}}{(\alpha_{Pt} \times R_o)}$$

$$\text{Error due to amb. temp. variation} = \frac{(\alpha_{Cu}) \times (\Delta T_{amb}) \times (\text{Lead Wire Resistance})}{(\alpha_{Pt}) \times (R_o)}$$

Lead wire resistance seen by the transmitter = 150 m × 2 wires × 0.025 Ω/m = 7.5 Ω

$$\text{Basic error} = \frac{7.5\ \Omega}{(0.00385\ \Omega / \Omega\ °C) \times (100\ \Omega)} = 19.5\ °C$$

Error due to amb. temp. var. of ± 25 °C

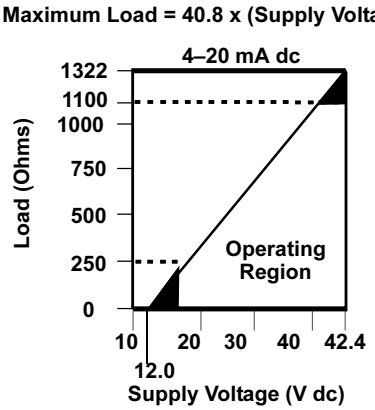
$$= \frac{(0.0039\ \Omega / \Omega\ °C) \times (25\ °C) \times (7.5\ \Omega)}{(0.00385\ \Omega / \Omega\ °C) \times (100\Omega)} = \pm 1.9\ °C$$

POWER SUPPLY

To communicate with a transmitter, an 18.1 V dc minimum power supply is required. The power supplied to the transmitter should not drop below the transmitter lift-off voltage (see Figure 2-8). If the power drops below the lift-off voltage while the transmitter is being configured, the transmitter may interpret the configuration information incorrectly.

The dc power supply should provide power with less than 2 percent 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 pieces of equipment in the loop. Note that the resistance of intrinsic safety barriers, if used, must be included.

Figure 2-8. Load Limits



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Surges/Transients

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

Ground the Transmitter

The transmitter will operate with the current signal loop either floating or grounded. However, the extra noise in floating systems affects many types of readout devices. If the signal appears noisy or erratic, grounding the current signal loop at a single point may solve the problem. The best place to ground the loop is at the negative terminal of the power supply. Do not ground the current signal loop at more than one point.

The transmitter is electrically isolated to 500 V ac rms (707 V dc), so the input circuit may also be grounded at any single point. When using a grounded thermocouple, the grounded junction serves as this point.

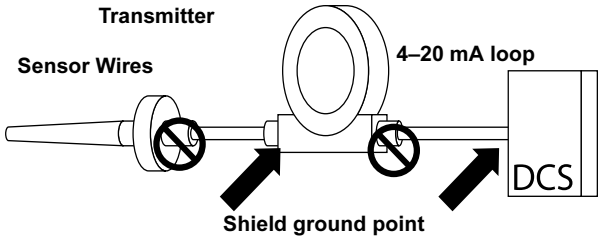
NOTE
Do not ground the signal wire at both ends.

Ungrounded Thermocouple, mV, and RTD/Ohm Inputs

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

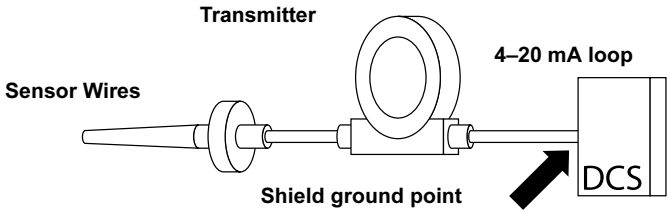
Option 1:

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



Option 2 (for ungrounded housing):

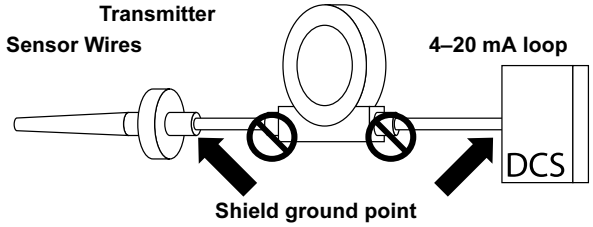
1. Connect signal wiring shield to the sensor wiring shield.
2. Ensure the two shields are tied together and electrically isolated from the transmitter housing.
3. Ground shield at the power supply end only.
4. Ensure that the sensor shield is electrically isolated from the surrounding grounded fixtures.



Connect shields together, electrically isolated from the transmitter

Option 3:

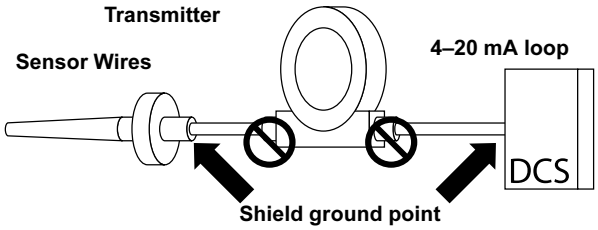
1. Ground sensor wiring shield at the sensor, if possible.
2. Ensure that the sensor wiring and signal wiring shields are electrically isolated from the transmitter housing.
3. Do not connect the signal wiring shield to the sensor wiring shield.
4. Ground signal wiring shield at the power supply end.



Grounded Thermocouple Inputs

Option 4

1. Ground sensor wiring shield at the sensor.
2. Ensure that the sensor wiring and signal wiring shields are electrically isolated from the transmitter housing.
3. Do not connect the signal wiring shield to the sensor wiring shield.
4. Ground signal wiring shield at the power supply end.



Section 3 Configuration

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 (⚠). Please refer to the following safety messages before performing an operation preceded by this symbol.

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 communicator in an explosive atmosphere, make sure the instruments in the loop are installed in accordance with instrinsically safe or non-incendive field wiring practices.
- When sending or requesting data that would disrupt the loop or change the output of the transmitter, set the process application loop to manual.
- 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.

COMMISSIONING

The Rosemount 248 must be configured for certain basic variables to operate. 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.

Commissioning consists of testing the transmitter and verifying transmitter configuration data. The Rosemount 248 can be commissioned either before (off-line) or after (on-line) installation. During on-line configuration, the transmitter is connected to a HART 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 HART 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. Commissioning the transmitter on the bench before installation using a 375 Field Communicator or AMS™ Suite: Intelligent Device Manager ensures that all transmitter components are in working order.

⚠ To commission on the bench, connect the transmitter and the HART Communicator (or AMS) as shown in Figure 2-6 on page 2-9. Make sure the instruments in the loop are installed according to intrinsically-safe or non-incendive field wiring practices before connecting a communication in an explosive atmosphere. Connect HART Communicator or AMS leads at any termination point in the signal loop. Connect the communication leads to the "COMM" terminals, located on the terminal block. Do not connect to the "TEST" terminals. Set the transmitter jumpers to avoid transmitter damage caused by the plant environment.

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 HART Communicator 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.

AMS

One of the key benefits of intelligent devices is the ease of device configuration. When used with AMS, the Rosemount 248 is easy to configure and provides instant and accurate alerts and alarms. The screens use a color-coding to indicate to give visual indication of the transmitter health and to indicate any changes that may need to be made or written to the transmitter.

- Gray screens: indicates that all information has been written to the transmitter
- Yellow on screen: changes have been made in the software but not sent to the transmitter
- Green on screen: all current changes on screen have been written to the transmitter
- Red on screen: indicates an alarm or alert that requires immediate investigation

Apply AMS Changes

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

1. From the bottom of the screen, click **Apply**.
2. An "Apply Parameter Modification" screen appears, enter desired information and click **OK**.
3. After carefully reading the warning provided, select **OK**.

375 FIELD COMMUNICATOR

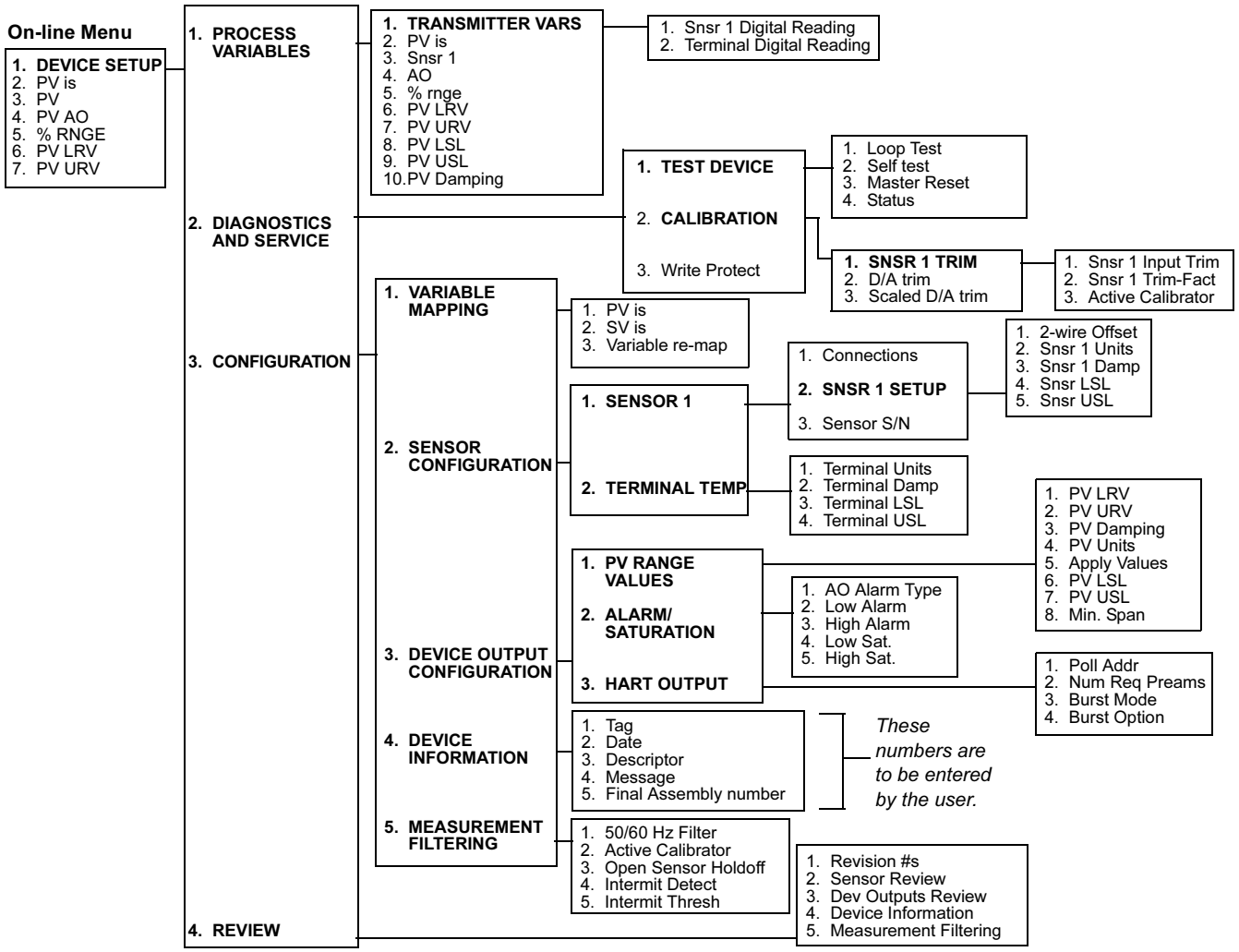
⚠ The HART Communicator exchanges information with the transmitter from the control room, the instrument site, or any wiring termination point in the loop. To facilitate communication, connect the HART Communicator in parallel with the transmitter (see Figure 2-6). Use the loop connection ports on the rear panel of the HART Communicator. The connections are non-polarized. Do not make connections to the serial port or the NiCad recharger jack in explosive atmospheres. Before connecting the HART 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.

When using a HART Communicator, any configuration changes made must be sent to the transmitter by using the “Send” key (F2).

For more information regarding the 375 Field Communicator, please see the 375 Field Communicator Reference Manual (http://www.fieldcommunicator.com/suppmanu.htm).

HART Menu Tree

Options listed in bold type indicate that a selection provides other options. For ease of operation, changing calibration and setup, such as sensor type, number of wires, and range values, can be completed in several locations



The review menu lists all of the information stored in the Rosemount 248. This includes device information, measuring element, output configuration, and software

Fast Key Sequence

Table 3-1 lists the fast key sequences for common transmitter functions.

Table 3-1. Rosemount 248 Fast Key Sequence

Function	Fast Keys
Active Calibrator	1, 2, 2, 1, 3
Alarm/Saturation	1, 3, 3, 2
AO Alarm Type	1, 3, 3, 2, 1
Burst Mode	1, 3, 3, 3, 3
Burst Option	1, 3, 3, 3, 4
Calibration	1, 2, 2
Configuration	1, 3
D/A Trim	1, 2, 2, 2
Damping Values	1, 1, 10
Date	1, 3, 4, 2
Descriptor	1, 3, 4, 3
Device Info	1, 3, 4
Device Output Configuration	1, 3, 3
Diagnostics and Service	1, 2
Filter 50/60 Hz	1, 3, 5, 1
Hardware Rev	1, 4, 1
Hart Output	1, 3, 3, 3
Intermittent Detect	1, 3, 5, 4
Loop Test	1, 2, 1, 1
LRV (Lower Range Value)	1, 1, 6
LSL (Lower Sensor Limit)	1, 1, 8
Measurement Filtering	1, 3, 5
Message	1, 3, 4, 4
Num Req Preams	1, 3, 3, 3, 2
Open Sensor Holdoff	1, 3, 5, 3
Percent Range	1, 1, 5

Function	Fast Key
Poll Address	1, 3, 3, 3, 1
Process Temperature	1, 1
Process Variables	1, 1
PV Damping	1, 3, 3, 1, 3
PV Unit	1, 3, 3, 1, 4
Range Values	1, 3, 3, 1
Review	1, 4
Scaled D/A Trim	1, 2, 2, 3
Sensor Connection	1, 3, 2, 1, 1
Sensor 1 Setup	1, 3, 2, 1, 2
Sensor Serial Number	1, 3, 2, 1, 3
Sensor 1 Trim	1, 2, 2, 1
Sensor 1 Trim-Factory	1, 2, 2, 1, 2
Sensor Type	1, 3, 2, 1, 1
Software Revision	1, 4, 1
Status	1, 2, 1, 4
Tag	1, 3, 4, 1
Terminal Temperature	1, 3, 2, 2,
Test Device	1, 2, 1
URV (Upper Range Value)	1, 1, 7
USL (Upper Sensor Limit)	1, 1, 9
Variable Mapping	1, 3, 1
Variable Re-Map	1, 3, 1, 3
Write Protect	1, 2, 3
2-Wire Offset	1, 3, 2, 1, 2, 1

Review Configuration Data

Before operating the Rosemount 248 in an actual installation, review all of the factory-set configuration data to ensure that it reflects the current application.

Review

Fast Key Sequence	1, 4

When activating the *Review* function, scroll through the configuration data list to check each process variable. If changes to the transmitter configuration data are necessary, refer to “Configuration” below.

Check Output

Before performing other transmitter on-line operations, review the Rosemount 248 digital output parameters to ensure that the transmitter is operating properly.

Process Variables

Fast Key Sequence	1, 1

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 primary variable is the 4 –20 mA analog signal. The secondary variable is the transmitter terminal temperature.

Configuration

The Rosemount 248 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.

Variable Mapping

Fast Key Sequence	1, 3, 1

The *Variable Mapping* menu displays the sequence of the process variables. When using the Rosemount 248 you can select *5 Variable Re-Map* to change this configuration. When the *Select PV* screen appears *Snsr 1* must be selected. Either *Sensor 1*, *Terminal Temperature*, or *not used* can be selected for the remaining variables. The primary variable is the 4–20 mA analog signal.

Select Sensor Type

Fast Key Sequence	1, 3, 2, 1, 1

The *Connections* command allows selection of the sensor type and the number of sensor wires to be connected. Select from the following sensors:

- 2-, 3-, or 4-wire Pt 100, Pt 200, Pt 500, Pt 1000 RTDs: α = 0.00385 Ω/°C
- 2-, 3-, or 4-wire Pt 100: α = 0.003916 Ω/°C
- 2-, 3-, or 4-wire Ni 120 nickel RTDs
- 2-, 3-, or 4-wire Cu 10 RTDs
- IEC/NIST/DIN Type B, E, J, K, R, S, T thermocouples
- DIN type L, U thermocouples
- ASTM Type W5Re/W26Re thermocouple
- –10 to 100 millivolts
- 2-, 3-, or 4-wire 0 to 2000 ohms

A complete line of temperature sensors, thermowells, and accessory mounting hardware is available from Emerson Process Management.

Set Output Units

Fast Key Sequence	1, 3, 2, 1, 2, 2

The *Set Output Unit* command sets the desired primary variable units. Set the transmitter output to one of the following engineering units:

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

50/60 Hz Filter

Fast Key Sequence	1, 3, 5, 1

The *50/60 Hz Filter* command sets the transmitter electronic filter to reject the frequency of the AC power supply in the plant.

Terminal Temperature

Fast Key Sequence	1, 3, 2, 2

The *Terminal Temp* command sets the terminal temperature units to indicate the temperature at the transmitter terminals.

Process Variable (PV) Damping

Fast Key Sequence	1, 3, 3, 1, 3

The *PV Damp* command 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 0 and 32 seconds.

The value chosen for damping affects the response time of the transmitter. When set to zero (or disabled), the damping function is off and the transmitter output reacts to changes in input as quickly as the intermittent sensor algorithm allows (refer to “Intermittent Threshold” on page 3-12) for a description of the intermittent sensor algorithm). Increasing the damping value increases the transmitter response time.

With damping enabled, the transmitter outputs values according to the following relationship. At time t

Damping Value = $P + (N - P) \times \left(1 - e^{\frac{-t}{T}}\right)$

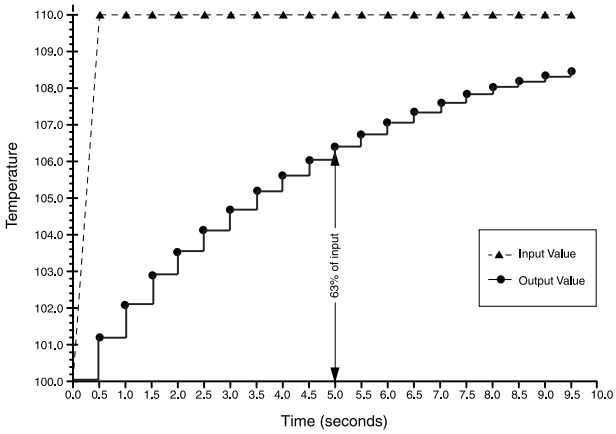
P =previous damped value
N =new sensor value
T = damping time constant
U =update rate

At the time 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.

After one damping time constant following a sensor input step change, the transmitter output will be at 63.2% of that change. The output will continue to approach the input according to the damping equation above.

For example, as illustrated in Figure 3-1, if the temperature undergoes a step change from 100 degrees to 110 degrees, and the damping is set to 5.0 seconds, the transmitter calculates and reports a new reading using the damping equation. At 5.0 seconds, the transmitter outputs 106.3 degrees, or 63.2% of the input change, and the output continues to approach the input curve according to the equation above.

Figure 3-1. Change in Input vs. Change in Output with Damping Set to Five Seconds



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2-Wire RTD Offset

Fast Key Sequence	1, 3, 2, 1, 2, 1

The *2-Wire RTD Offset* command allows the user to input the measured lead wire resistance, which will result in the transmitter adjusting its temperature measurement to correct the error caused by this resistance. Due to a lack of lead wire compensation within the RTD, temperature measurements made with a 2-wire RTD are often inaccurate. See “Sensor Lead Wire Resistance Effect– RTD Input” on page 2-10 for more information.

To utilize this feature perform the following steps:

1. Measure the lead wire resistance of both RTD leads after installing the 2-wire RTD and the Rosemount 248.
2. From the HOME screen, select 1 *Device Setup*, *3 Configuration*, *2 Sensor Configuration, 1 Sensor 1, 2 Snsr 1 Setup,* and *1 2-Wire Offset*.
3. Enter the total measured resistance of the two RTD leads at the *2-Wire Offset* prompt. Enter this resistance as a negative (–) value to ensure proper adjustment.The transmitter then adjusts its temperature measurement to correct the error caused by lead wire resistance.

Information Variables

Access the transmitter information variables on-line using the HART Communicator or other suitable communications device. The following is a list of transmitter information variables. These variables include device identifiers, factory-set configuration variables, and other information. A description of each variable, the corresponding fast key sequence, and a review of its purposes are provided.

Tag

Fast Key Sequence	1, 3, 4, 1

The *Tag* variable is the easiest way to identify and distinguish between transmitters in multi-transmitter environments. Use it to label transmitters electronically according to the requirements of the application. The tag defined is automatically displayed when a 375 Field Communicator establishes contact with the transmitter at power-up. The tag may be up to eight characters long and has no impact on the primary variable readings of the transmitter.

Date

Fast Key Sequence	1, 3, 4, 2

The *Date* command 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 375 Field Communicator.

Descriptor

Fast Key Sequence	1, 3, 4, 3

The *Descriptor* variable provides a longer user-defined electronic label to assist with more specific transmitter identification than is available with the tag variable. The descriptor may be up to 16 characters long and has no impact on the operation of the transmitter or the 375 Field Communicator.

Message

Fast Key Sequence	1, 3, 4, 4

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 375 Field Communicator.

Sensor Serial Number

Fast Key Sequence	1, 3, 2, 1, 4

The *Sensor S/N* variable provides a location to list the serial number of the attached sensor. It is useful for identifying sensors and tracking sensor calibration information.

Diagnostics and Service

Test Device

Fast Key Sequence	1, 2, 1

The *Test Device* command initiates a more extensive diagnostics routine than that performed continuously by the transmitter. The *Test Device* menu lists the following options:

- *1 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. See “Loop Test” below for more information.
- *2 Self Test* initiates a transmitter self test. Error codes are displayed if there is a problem.
- *3 Master Reset* sends out a command that restarts and tests the transmitter. A master reset is like briefly powering down the transmitter. Configuration data remains unchanged after a master reset.
- *4 Status* lists error codes. **ON** indicates a problem, and **OFF** means there are no problems.

Loop Test

Fast Key Sequence	1, 2, 1, 1

The *Loop Test* command verifies the output of the transmitter, the integrity of the loop, and the operations of any recorders or similar devices installed in the loop. To initiate a loop test, perform the following procedure:

1. Connect a reference meter to the transmitter. To do so, shunt the transmitter power through the meter at some point in the loop.
2. From the **HOME** screen, select *1 Device Setup*, *2 Diag/Serv*, *1 Test Device*, *1 Loop Test* before performing a loop test.
3. Select a discreet milliampere level for the transmitter to output. At the **CHOOSE ANALOG OUTPUT** prompt, select *1 4mA*, *2 20mA*, or select *3 other* to manually input a value between 4 and 20 mA.
4. Check the current meter installed in the test loop to verify that it reads the value that was commanded to output. If the readings do not match, either the transmitter requires an output trim or the current meter is malfunctioning.

After completing the test procedure, the display returns to the loop test screen and another output value can be chosen.

Master Reset

Fast Key Sequence	1, 2, 1, 3

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

Active Calibrator

Fast Key Sequence	1, 2, 2, 1, 3

The *Active Calibrator Mode* command enables or disables the pulsating current feature. The transmitter ordinarily operates with pulsating current so that sensor diagnostic functions, such as open sensor detection and EMF compensation, can be performed correctly. Some calibration equipment requires steady current to function properly. By enabling the Active Calibrator Mode the transmitter stops sending pulsating current to the sensor and supples a steady current. Disabling the Active Calibrator returns the transmitter to its normal operating state of sending a pulsating current to the sensor, thus enabling the sensor diagnostic functions.

The Active Calibrator Mode is volatile and will be automatically disabled when power is cycled or when a Master Reset is performed using the 375 Field Communicator.

NOTE
The Active Calibrator Mode must be disabled before returning the transmitter to the process. This will ensure that the full diagnostic capabilities of the Rosemount 248 are available.

Disabling or enabling the Active Calibrator Mode will not change any of the sensor trim values stored in the transmitter.

Sensor Review

Fast Key Sequence	1, 4, 2

The *Signal Condition* command allows viewing or changing the primary variable lower and upper range values, sensor percent of range, and sensor damping.

Write Protect

Fast Key Sequence	1, 2, 3

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

1. From the **HOME** screen select *1 Device Setup*, *2 Diag/Service*, *3 Write Protect.*
2. Select *Enable WP*.

NOTE
To disable write protect on the Rosemount 248, repeat the procedure, replacing *Enable WP* with *Disable WP*.

HART Output

Fast Key Sequence	1, 3, 3, 3

The *HART Output* command allows the user to make changes to the multidrop address, initiate burst mode, or make changes to the burst options.

Alarm and Saturation

Fast Key Sequence	1, 3, 3, 2

The *Alarm/Saturation* command allows the alarm settings (Hi or Low) and saturation values to be viewed and changed. To change the alarm values and saturation values, select the value to be changed, either *2 Low Alarm*, *3 High Alarm*, *4 Low Sat.*, or *5 High Sat*. Enter the desired new value, which must fall within the guidelines given below.

- The low alarm value must be between 3.50 and 3.75 mA
- The high alarm value must be between 21.0 and 23.0 mA
- The low saturation level must be between the low alarm value plus 0.1 mA and 3.9 mA.

Example: The low alarm value has been set to 3.7 mA. Therefore, the low saturation level, S, must be $3.8 \leq S \leq 3.9$ mA.

- The high saturation level must be between 20.5 mA and the high alarm value minus 0.1 mA.

Example: The high alarm value has been set to 20.8 mA. Therefore, the low saturation level, S, must be $20.5 \leq S \leq 20.7$ mA.

See “Failure Mode” on page 2-8 for Failure Mode considerations.

Rerange

Reranging the transmitter sets the measurement range to the limits of expected readings. 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 your application.

PV Range Values

Fast Key Sequence	PV URV = 6 PV LRV = 7

The *PV URV* and *PV LRV* commands, found in the *PV Range Values* menu screen, allow the user to set the transmitter’s lower and upper range values using limits of expected readings. 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. From the *PV Range Values* screen select *1 PV LRV* to change the lower range value and *2 PV URV* to change the upper range value.

NOTE:
The rerange functions should not be confused with the trim 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.

Intermittent Sensor Detect (Advanced Feature)

The Intermittent Sensor Detect feature is designed to guard against 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 Detect 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 HART communicator.

Transmitter Behavior with Intermittent Sensor Detect ON

When the Intermittent Sensor Detect feature is switched **ON**, the transmitter can eliminate the output pulse caused by intermittent open sensor conditions. Process temperature changes (ΔT) within the threshold value will be tracked normally by the transmitter's output. A ΔT greater than the threshold value will activate the intermittent sensor algorithm. True open sensor conditions will cause the transmitter to go into alarm.

The threshold value of the Rosemount 248 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.

Transmitter Behavior with Intermittent Sensor Detect OFF

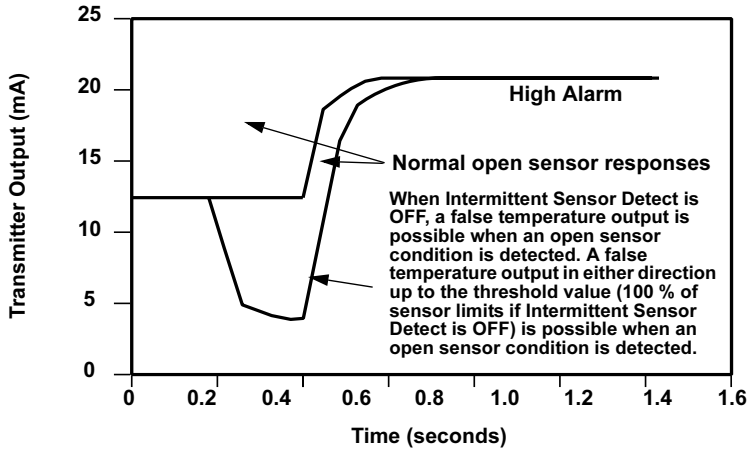
When the Intermittent Sensor Detect feature is switched **OFF**, the transmitter tracks all process temperature changes, even if they are the consequence of an intermittent sensor. (The transmitter in effect behaves as though the threshold value had been set at 100%.) The output delay due to the intermittent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

Intermittent Threshold

Fast Key Sequence	1, 3, 5, 4

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 (see Figure 3-3 on page 3-14) up to the threshold value (100% of sensor limits if Intermittent Sensor Detect is **OFF)**. Unless rapid response rate is necessary, the suggested setting of the Intermittent Sensor Detect mechanism is **ON** with 0.2% threshold.

Figure 3-2. Open Sensor Response



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Open Sensor Holdoff

Fast Key Sequence	1, 3, 5, 3

The *Open Sensor Holdoff* option, at the normal setting, enables the Rosemount 248 to best tolerate heavy EMI disturbances without producing brief periods of alarm. This is accomplished through the software by having the transmitter perform additional verification of the open sensor status prior to activating the transmitter alarm. If the additional verification shows that the open sensor condition is not valid, the transmitter will not go into alarm.

For users of the Rosemount 248 that desire a more immediate open sensor detection, the Open Sensor Holdoff option can be changed to a fast setting. With this setting, the transmitter will report an open sensor condition without additional verification of the open condition.

MULTIDROP COMMUNICATION

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

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

A 375 Field Communicator can test, configure, and format a multidropped Rosemount 248 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.

Figure 3-3. Typical Multidropped Network

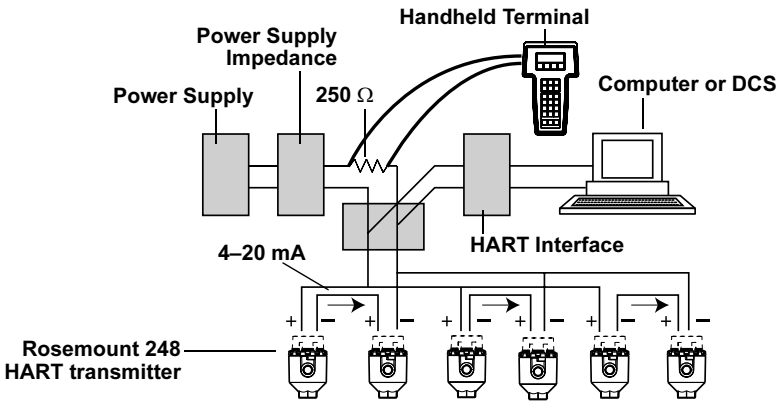


Figure 3-3 shows a typical multidrop network. Do not use this figure as an installation diagram. Contact Emerson Process Management product support with specific requirements for multidrop applications.

NOTE
Rosemount 248 transmitters are set to address 0 at the factory, allowing them to operate in the standard point-to-point manner with a 4–20 mA output signal. To activate multidrop communication, the transmitter address must be changed to a number between 1 and 15. This change deactivates the 4–20 mA analog output, sending it to 4 mA. The failure mode current also is disabled.

Section 4 Operation and Maintenance

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 (⚠). Please refer to the following safety messages before performing an operation preceded by this symbol.

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 375 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.
- When sending or requesting data that would disrupt the loop or change the output of the transmitter, set the process application loop to manual.
- 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.

CALIBRATION

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

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

Calibration of the Rosemount 248 may include the following procedures:

- Sensor Input Trim: digitally alter the transmitter's interpretation of the input signal
- Output Trim: calibrates the transmitter to a 4–20 mA reference scale
- Scaled Output Trim: calibrates the transmitter to a user-selectable reference scale.

Trim the Transmitter

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

- Sensor Input Trim
- Output Trim
- Output Scaled Trim

Sensor Input Trim

Fast Key Sequence	1, 2, 2, 1, 1

Perform a sensor trim if the transmitters 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 your site-standard input source is NIST-traceable, the trim functions will not maintain the NIST-traceability of the system.

The *Sensor Input Trim* command allows the transmitter's interpretation of the input signal to be digitally altered (see Figure 4-1). The sensor input calibration trims the combined sensor and transmitter system to a site standard using a known temperature source. Sensor trimming is suitable for validation procedures or for applications that require calibrating the sensor and transmitter together.

Use the following procedure to perform a sensor trim with a Rosemount 248.

1. Connect the calibration device or sensor to the transmitter. Refer to Figure 2-6 on page 2-9 or inside of the transmitter terminal side cover for sensor wiring diagrams. (If using an active calibrator, please see "Active Calibrator" on page 3-10)
2. Connect the communicator to the transmitter loop.
3. From the Home screen, select *1 Device Setup*, *2 Diag/Service*, *2 Calibration*, *1 Sensor 1 Trim*, *1 Sensor 1 Input Trim* to prepare to trim the sensor.

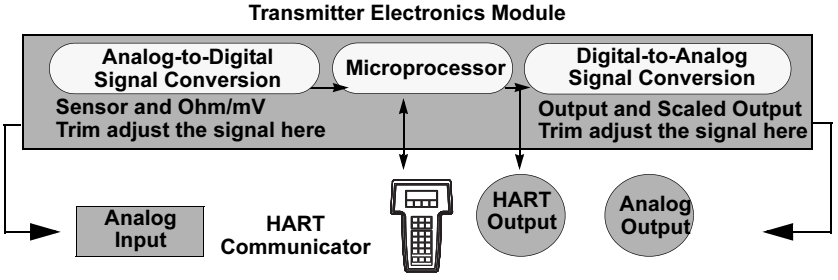
⚠ 4. Set the control loop to manual and select **OK**.

5. Answer the Active Calibration question.
6. Select *1 Lower Only* or *2 Lower and Upper* at the **SELECT SENSOR TRIM POINTS** prompt.
7. Adjust the calibration device to the desired trim value (must be within the selected sensor limits). If a combined sensor and transmitter system are being trimmed, expose the sensor to a known temperature and allow the temperature reading to stabilize. Use a bath, furnace or isothermal block, measured with a site-standard thermometer, as the known temperature source.
8. Select **OK** once the temperature stabilizes. The communicator displays the output value the transmitter associates with the input value provided by the calibration device.
9. Enter the lower or upper trim point, depending on the selection in Step 6.

Output Trim or Scaled 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 (see "Loop Test" on page 3-9).

Figure 4-1. Dynamics of Smart Temperature Measurement



Output Trim

Fast Key Sequence	1, 2, 2, 2

The *D/A Trim* command allows the transmitter's conversion of the input signal to a 4–20 mA output to be altered (see Figure 4-1 on page 4-3). Adjust the analog output signal at regular intervals to maintain measurement precision. To perform a digital-to-analog trim, perform the following procedure:

1. From the **HOME** screen, select *1 Device setup*, *2 Diag/Service*, *2 Calibration*, *2 D/A trim*. Set the control loop to manual and select **OK**.
2. Connect an accurate reference meter to the transmitter at the **CONNECT REFERENCE METER** prompt. To do so, shunt the power to the transmitter through the reference meter at some point in the loop. Select **OK** after connecting the reference meter.
3. Select **OK** at the **SETTING FLD DEV OUTPUT TO 4 MA** prompt. The transmitter outputs 4.00 mA.
4. Record the actual value from the reference meter, and enter it at the **ENTER METER VALUE** prompt. The communicator prompts the user to verify whether or not the output value equals the value on the reference meter.
5. If the reference meter value equals the transmitter output value, then select *1 Yes* and go to step 6. If the reference meter value does not equal the transmitter output value, then select *2 No* and go to step 4.
6. Select **OK** at the **SETTING FLD DEV OUTPUT TO 20 MA** prompt and repeat steps 4 and 5 until the reference meter value equals the transmitter output value.
7. Return the control loop to automatic control and select **OK**.

Scaled Output Trim

Fast Key Sequence	1, 2, 2, 3

The *Scaled D/A Trim* command matches the 4 and 20 mA 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 ”Output Trim” procedure.

HARDWARE

Maintenance

The Rosemount 248 has no moving parts and requires minimal scheduled maintenance.

Sensor Checkout

To determine whether the sensor is at fault, replace it with another sensor or connect a test sensor locally at the transmitter to test remote sensor wiring. Do not remove the thermowell while in operation. Select any standard, off-the-shelf sensor for use with a Rosemount 248, or consult the factory for a replacement special sensor and transmitter combination.

DIAGNOSTIC MESSAGES

Hardware

If a malfunction is suspected despite the absence of diagnostics messages on the HART Communicator display, follow the procedures described in Table 4-1 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 the problem.

Table 4-1. Rosemount 248 Troubleshooting Chart

Symptom	Potential Source	Corrective Action
Transmitter Does Not Communicate with HART Communicator	Loop Wiring	• Check for a minimum of 250 ohms resistance between the power supply and 375 Field Communicator connection. • Check for adequate voltage to the transmitter. If a 375 Field Communicator is connected and 250 ohms resistance is in the loop, the transmitter requires a minimum of 12.0 V at the terminals to operate (over entire 3.75 to 23 mA operating range). • Check for intermittent shorts, open circuits, and multiple grounds. • Specify the transmitter by tag number. For certain non-standard transmitter installations, it may be necessary, because of excessive line length, to specify the transmitter tag number to initiate communications.
High Output	Sensor Input Failure or Connection	• Connect a 375 Field Communicator and enter the transmitter test mode to isolate 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 V dc (over entire 3.75 to 23 mA operating range).
	Electronics Module	• Connect a 375 Field Communicator and enter the transmitter status mode to isolate module failure. • Connect a 375 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 V dc at the transmitter terminals (over entire 3.75 to 23 mA operating range). • Check for intermittent shorts, open circuits, and multiple grounds. • Connect a 375 Field Communicator and enter the Loop test mode to generate signals of 4 mA, 20 mA, and user-selected values.
	Electronics Module	• Connect a 375 Field Communicator and enter the transmitter test mode to isolate module failure.
Low Output or No Output	Sensor Element	• Connect a 375 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 V dc (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 375 Field Communicator and enter the Loop test mode. • Check wire insulation to detect possible shorts to ground.
	Electronics Module	• Connect a 375 Field Communicator and check the sensor limits to ensure calibration adjustments are within the sensor range. • Connect a 375 Field Communicator and enter the Transmitter test mode to isolate an electronics module failure.

375 Field Communicator

Table 4-2 provides a guide to diagnostic messages used by the 375 Field Communicator.

Variable parameters within the text of a message are indicated with the notation <*variable parameter*>. Reference to the name of another message is identified by the notation *[another message]*.

Table 4-2. 375 Field Communicator Diagnostics Messages

Message	Description
Add item for ALL device types or only for this ONE device type	Asks the user whether the hot key item being added should be added for all device types or only for the type of device that is connected.
Command Not Implemented	The connected device does not support this function.
Communication Error	Either a device sends back a response indicating that the message it received was unintelligible, or the 375 Field Communicator cannot understand the response from the device.
Configuration memory not compatible with connected device	The configuration stored in memory is incompatible with the device to which a transfer has been requested.
Device Busy	The connected device is busy performing another task.
Device Disconnected	Device fails to respond to a command.
Device write protected	Device is in write-protect mode. Data can not be written.
Device write protected. Do you still want to shut off?	Device is in write-protect mode. Press YES to turn the 375 Field Communicator off and lose the unsent data.
Display value of variable on hotkey menu?	Asks whether the value of the variable should be displayed adjacent to its label on the hotkey menu if the item being added to the hotkey menu is a variable.
Download data from configuration memory to device	Prompts user to press SEND softkey to initiate a memory to device transfer.
Exceed field width	Indicates that the field width for the current arithmetic variable exceeds the device- specified description edit format.
Exceed precision	Indicates that the precision for the current arithmetic variable exceeds the device- specified description edit format.
Ignore next 50 occurrences of status?	Asked after displaying device status. Softkey answer determines whether next 50 occurrences of device status will be ignored or displayed.
Illegal character	An invalid character for the variable type was entered.
Illegal date	The day portion of the date is invalid.
Illegal month	The month portion of the date is invalid.
Illegal year	The year portion of the date is invalid.
Incomplete exponent	The exponent of a scientific notation floating point variable is incomplete.
Incomplete field	The value entered is not complete for the variable type.
Looking for a device	Polling for multidropped devices at addresses 1–15.
Mark as read only variable on hotkey menu?	Asks whether the user should be allowed to edit the variable from the hotkey menu if the item being added to the hotkey menu is a variable.
No device configuration in configuration memory	There is no configuration saved in memory available to re-configure off-line or transfer to a device.
No Device Found	Poll of address zero fails to find a device, or poll of all addresses fails to find a device if auto-poll is enabled.
No hotkey menu available for this device.	There is no menu named “hotkey” defined in the device description for this device.
No offline devices available.	There are no device descriptions available to be used to configure a device offline.
No simulation devices available.	There are no device descriptions available to simulate a device.
No UPLOAD_VARIABLES in ddl for this device	There is no menu named “upload_variables” defined in the device description for this device. This menu is required for offline configuration.
No Valid Items	The selected menu or edit display contains no valid items.
OFF KEY DISABLED	Appears when the user attempts to turn the 375 Field Communicator off before sending modified data or before completing a method.
Online device disconnected with unsent data. RETRY or OK to lose data.	There is unsent data for a previously connected device. Press RETRY to send data, or press OK to disconnect and lose unsent data.
Out of memory for hotkey configuration. Delete unnecessary items.	There is no more memory available to store additional hotkey items. Unnecessary items should be deleted to make space available.

Message	Description
Overwrite existing configuration memory	Requests permission to overwrite existing configuration either by a device-to-memory transfer or by an offline configuration. User answers using the softkeys.
Press OK.	Press the OK softkey. This message usually appears after an error message from the application or as a result of HART communications.
Restore device value?	The edited value that was sent to a device was not properly implemented. Restoring the device value returns the variable to its original value.
Save data from device to configuration memory	Prompts user to press SAVE softkey to initiate a device-to-memory transfer.
Saving data to configuration memory.	Data is being transferred from a device to configuration memory.
Sending data to device.	Data is being transferred from configuration memory to a device.
There are write only variables which have not been edited. Please edit them.	There are write-only variables which have not been set by the user. These variables should be set or invalid values may be sent to the device.
There is unsent data. Send it before shutting off?	Press YES to send unsent data and turn the 375 Field Communicator off. Press NO to turn the 375 Field Communicator off and lose the unsent data.
Too few data bytes received	Command returns fewer data bytes than expected as determined by the device description.
Transmitter Fault	Device returns a command response indicating a fault with the connected device.
Units for <variable label> has changed. Unit must be sent before editing, or invalid data will be sent.	The engineering units for this variable have been edited. Send engineering units to the device before editing this variable.
Unsent data to online device. SEND or LOSE data	There is unsent data for a previously connected device which must be sent or thrown away before connecting to another device.
Use up/down arrows to change contrast. Press DONE when done.	Gives direction to change the contrast of the 375 Field Communicator display.
Value out of range	The user-entered value is either not within the range for the given type and size of variable or not within the min/max specified by the device.
<message> occurred reading/writing <variable label>	Either a read/write command indicates too few data bytes received, transmitter fault, invalid response code, invalid response command, invalid reply data field, or failed pre- or post-read method; or a response code of any class other than SUCCESS is returned reading a particular variable.
<variable label> has an unknown value. Unit must be sent before editing, or invalid data will be sent.	A variable related to this variable has been edited. Send related variable to the device before editing this variable.

Appendix A Specifications and Reference Data

TRANSMITTER SPECIFICATIONS

Functional Specifications

Inputs
User-selectable. See “Transmitter Accuracy and Ambient Temperature Effects” on page A-5 for sensor options.

Output
2-wire 4–20 mA, linear with temperature or input; digital output signal superimposed on 4–20 mA signal, available for a HART communicator or control system interface

Isolation
Input/output isolation tested to 500 V ac rms (707 V dc) at 50/60 Hz

Power Supply
An external power supply is required. The transmitter operates on 12.0 to 42.4 V dc transmitter terminal voltage with load resistance between 250 and 1100 ohms. A minimum of 17.75 V dc power supply is required with a load of 250 ohms. Transmitter power terminals are rated to 42.4 V dc. A HART Communicator requires a loop resistance between 250 and 1100 ohms. Do not communicate with the transmitter when power is below 12 V dc at the transmitter terminals.

Humidity Limits
0–99% relative humidity, non-condensing

NAMUR Recommendations
The Rosemount 248 meets the following NAMUR recommendations:

- NE 21 – Electromagnetic compatibility (EMC) for Process and Laboratory Apparatus
- NE 43 – Standard of the signal level breakdown information of digital transmitters
- NE 89 – Standard of temperature transmitters with digital signal processing

Transient Protection

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

Temperature Limits

Operating Limit

- –40 to 185 °F (–40 to 85 °C)

Storage Limit

- –58 to 248 °F (–50 to 120 °C)

Turn-on Time

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

Update Rate

Less than 0.5 seconds

Custom Alarm and Saturation Levels

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

Software Detected Failure Mode

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) operation. The values for standard and NAMUR-compliant operation are as follows:

Table A-1. Operation Parameters

	Standard (1)	NAMUR NE43- Compliant(1)
Linear Output:	$3.9 \leq I \leq 20.5$	$3.8 \leq I \leq 20.5$
Fail High:	$21 \leq I \leq 23$ (default)	$21 \leq I \leq 23$ (default)
Fail Low:	$I \leq 3.75$	$I \leq 3.6$

(1) Measured in milliamperes

Certain hardware failures, such as microprocessor failures, will always drive the output to greater than 23 mA.

Physical Specifications

HART Communicator Connections

Communication Terminal: Clips permanently fixed to the terminals

Materials of Construction

Electronics Housing

- Noryl® glass reinforced

Universal (option code U) and Rosemount® Connection (option code A) Heads

- Housing: Low-copper aluminum (option codes U and A)
  Stainless Steel (option codes G and H)
- Paint: Polyurethane
- Cover O-Ring: Buna–N

BUZ Head (option code B)

- Housing: Aluminum
- Paint: Aluminum lacquer
- O-Ring Seal: Rubber

Mounting

The Rosemount 248R attaches directly to a wall or a DIN rail. The Rosemount 248H installs in a connection head or universal head mounted directly on a sensor assembly or apart from a sensor assembly using a universal head. The Rosemount 248H can also mount to a DIN rail using an optional mounting clip (see Table A-10).

Weight

Code	Options	Weight
248H	Head Mount Transmitter	42 g (1.5 oz)
248R	Rail Mount Transmitter	250g (8.8 oz)
U	Universal Head	520 g (18.4 oz)
B	BUZ Head	240 g (8.5 oz)
C	Polypropylene Head	90 g (3.2 oz)
A	Rosemount Connection Head	524 g (18.5 oz)
S	Polished Stainless Steel Head	537 g (18.9 oz)
G	Rosemount Connection Head (SST)	1700 g (60 oz)
H	Universal Head (SST)	1700 g (60 oz)

Enclosure Ratings

The Universal (option code U) and Rosemount Connection (option code A) Heads are NEMA 4X, IP66, and IP68. The Universal Head with 1/2-in. NPT threads is CSA Enclosure Type 4X. The BUZ head (option code B) is IP54.

Performance Specifications

EMC (ElectroMagnetic Compatibility) NAMUR NE21 Standard

The Rosemount 248 meets the requirements for NAMUR NE21 Rating

Susceptibility	Parameter	Influence
ESD	• 6 kV contact discharge • 8 kV air discharge	None
Radiated	• 80 – 1000 MHz at 10 V/m AM	None
Burst	• 1 kV for I.O.	None
Surge	• 0.5 kV line–line • 1 kV line–ground	None
Conducted	• 150 kHz to 80 MHz at 10 V	None

CE Mark

The Rosemount 248 meets all requirements listed under IEC 61326: Amendment 1, 1998.

Power Supply Effect

Less than ±0.005% of span per volt

Vibration Effect

The Rosemount 248 is tested to the following specifications with no effect on performance:

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

Stability

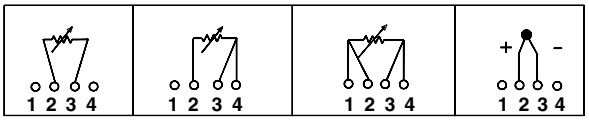
For RTD and thermocouple inputs the transmitter will have a stability of ±0.1% of reading or 0.1 °C (whichever is greater) for twelve months

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.

Sensor Connections

Rosemount 248 Sensor Connections Diagram



2-wire RTD and Ω | **3-wire* RTD and Ω** | **4-wire RTD and Ω** | **T/C and mV**

248-0000B01C

* *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.*

Transmitter Accuracy and Ambient Temperature Effects

NOTE
The accuracy and ambient temperature effect is the greater of the fixed and percent of span values (see example below).

Table A-2. Rosemount 248 Transmitter Input Options, Accuracy, and Ambient Temperature Effects

Sensor	Transmitter Input Ranges		Accuracy		Temperature Effects per 1.0 °C (1.8 °C) Change in Ambient Temperature[1]	
	°C	°F	Fixed	% of Span	Fixed	% of Span
2-, 3-, 4-wire RTDs						
Pt 100[2] (α = 0.00385)	–200 to 850	–328 to 1562	0.2 °C (0.36 °F)	±0.1	0.006 °C (0.011 °F)	±0.004
Pt 100[3] (α = 0.003916)	–200 to 645	–328 to 1193	0.2 °C (0.36 °F)	±0.1	0.006 °C (0.011 °F)	±0.004
Pt 200[2]	–200 to 850	–328 to 1562	1.17 °C (2.11 °F)	±0.1	0.018 °C (0.032 °F)	±0.004
Pt 500[2]	–200 to 850	–328 to 1562	0.47 °C (0.85 °F)	±0.1	0.018 °C (0.032 °F)	±0.004
Pt 1000[2]	–200 to 300	–328 to 572	0.23 °C (0.41 °F)	±0.1	0.010 °C (0.018 °F)	±0.004
Ni 120[4]	–70 to 300	–94 to 572	0.16 °C (0.29 °F)	±0.1	0.004 °C (0.007 °F)	±0.004
Cu 10[5]	–50 to 250	–58 to 482	2 °C (3.60 °F)	±0.1	0.06 °C (0.108 °F)	±0.004
Thermocouples[6]						
Type B[7]	100 to 1820	212 to 3308	1.5 °C (2.70 °F)	±0.1	0.056 °C (0.101 °F)	±0.004
Type E[7]	–50 to 1000	–58 to 1832	0.4 °C (0.72 °F)	±0.1	0.016 °C (0.029 °F)	±0.004
Type J[7]	–180 to 760	–292 to 1400	0.5 °C (0.90 °F)	±0.1	0.016 °C (0.029 °F)	±0.004
Type K[7]	–180 to 1372	–292 to 2502	0.5 °C (0.90 °F)	±0.1	0.02 °C (0.036 °F)	±0.004
Type N[7]	–200 to 1300	–328 to 2372	0.8 °C (1.44 °F)	±0.1	0.02 °C (0.036 °F)	±0.004
Type R[7]	0 to 1768	32 to 3214	1.2 °C (2.16 °F)	±0.1	0.06 °C (0.108 °F)	±0.004
Type S[7]	0 to 1768	32 to 3214	1 °C (1.80 °F)	±0.1	0.06 °C (0.108 °F)	±0.004
Type T[7]	–200 to 400	–328 to 752	0.5 °C (0.90 °F)	±0.1	0.02 °C (0.036 °F)	±0.004
DIN Type L[8]	–200 to 900	–328 to 1652	0.7 °C (1.26 °F)	±0.1	0.022 °C (0.040 °F)	±0.004
DIN Type U[8]	–200 to 600	–328 to 1112	0.7 °C (1.26 °F)	±0.1	0.026 °C (0.047 °F)	±0.004
Type W5Re/W26Re[9]	0 to 2000	32 to 3632	1.4 °C (2.52 °F)	±0.1	0.064 °C (0.115°F)	±0.004
Millivolt Input	–10 to 100 mV		0.03 mV	±0.1	0.001 mV	±0.004
2-, 3-, 4-wire Ohm Input	0 to 2000 ohms		0.7 ohm	±0.1	0.028 ohm	±0.004

(1) Change in ambient is with reference to the calibration temperature of the transmitter (68 °F (20 °C) from factory.
(2) IEC 751, 1995
(3) JIS 1604, 1981
(4) Edison Curve No. 7
(5) Edison Copper Winding No. 15
(6) Total accuracy for thermocouple measurement: sum of accuracy +0.5 °C.
(7) NIST Monograph 175, IEC 584
(8) DIN 43710
(9) ASTME 988-96

Transmitter Accuracy Example

When using a Pt 100 (a = 0.00385) sensor input with a 0 to 100 °C span: Accuracy would be ±0.2 °C.

Transmitter Temperature Effects Example

Transmitters can be installed in locations where the ambient temperature is between –40 and 85 °C (–40 and 185 °F). In order to maintain excellent accuracy performance, each transmitter is individually characterized over this ambient temperature range at the factory.

When using a Pt 100 (α = 0.00385) sensor input with a 0-100 °C span at 30 °C ambient temperature-Temperature Effects: 0.006 °C x (30 - 20) = 0.06 °C

Total Transmitter Error

Worst Case Transmitter Error: Accuracy + Temperature Effects = 0.2 °C + 0.06 °C = 0.26 °C

Total Probable Transmitter Error: $\sqrt{0.2^2 + 0.06^2} = 0.21°C$

SENSOR SPECIFICATIONS

Thermocouples – IEC 584

Applicable to sensors offered in Table A-5 on page A-10 and Table A-6 on page A-12

Construction

Rosemount DIN plate and 1/2-in. adapter style thermocouples are manufactured from selected materials to meet IEC 584 Tolerance Class 1. The junction of these wires is laser-welded to form a pure joint, maintaining circuit integrity and ensuring highest accuracy.

Lead Wires

Internal – 18 SWG (16 AWG) solid wire (max), 19 SWG (18 AWG) solid wire (min.). External extension leads, type J and K – 0.8 mm minimum stranded wire, PTFE insulation. Color coded per IEC 584

Insulation Resistance

1000 megaohms minimum insulation resistance when measured at 500 V dc at room temperature.

Table A-3. Characteristics of DIN Plate and 1/2-in. NPT Adapter Style Thermocouples

Characteristics	Type J	Type K
Alloys (wire color)	Fe (+ black), CuNi (- white)	NiCr (+ green), NiAl (- white)
Sheath Material	1.4541 (AISI 321)	Inconel 600
Temp Range (°C)	– 40 to 750	– 40 to 1000
Tolerance, DIN EN 60584-2	±1.5 °C or ±0.4% of measured temp, whichever is greater	

Thermocouples – ASTM E- 230

Applicable to sensors offered in Table A-7 on page A-14

Construction

Rosemount 1/2-in. adapter style thermocouples are manufactured using ISA Type J or K wire with special limits of error accuracy. The junction of these wires is fusion-welded to form a pure joint, to maintain the integrity of the circuit and to ensure the highest accuracy.

Lead Wires

Thermocouple, internal – 16 AWG solid wire (max), 18 AWG solid wire (min.). External lead wire – 20 AWG wire, PTFE insulation. Color coded per ASTM E-230

Insulation Resistance

100 megaohms minimum insulation resistance when measured at 100 V dc at room temperature

Table A-4. Characteristics of DIN Plate and 1/2-in. NPT Adapter Style Thermocouples

Characteristics	Type J	Type K
Alloys (wire color)	Iron/Constantan (white/red)	Chromel/Alumel (yellow/red)
Temp Range	0 to 760 °C (32 to 1400 °F)	0 to 1150°C (32 to 2102 °F)
Tolerance	±1.1 °C or ±0.4% of measured temp, whichever is greater	± 1.1 °C or ±0.4% of measured temp, whichever is greater
Sheath Material	304 SST	Inconel

RTDs

Sensor Type
100 ohm RTD at 0 °C, α = 0.00385 ohms/ohm/°C.

Accuracy
Meets IEC 751 Class B tolerances

Temperature Range
–50 to 450 °C (–58 to 842 °F)

Self Heating
0.15 °K/mW when measured per method defined in DIN EN 60751:1996 or 16 mW minimum power dissipation required to cause a 1 °C (1.8 °F) temperature measurement error in water flowing at 0.91 m/s (3 ft/s)

Thermal Response Time
9 seconds maximum required to reach 50% sensor response when tested in flowing water according to IEC 751 or 12 seconds maximum required to reach 63.2% sensor response in water flowing at 0.91 m/s (3 ft/s).

Immersion Error
60 mm minimum usable depth of immersion when tested according to IEC 751.

Insulation Resistance
500 megaohms minimum insulation resistance when measured at 500 V dc at room temperature.

Sheath Material
321 SST with mineral-insulated cable construction.

Lead Wires
PTFE insulated, coated 22 gauge stranded copper wire.

Thermowells

Materials
Barstock Thermowells: 316L SST (1.4404)
Tubular Thermowells: 1.4571 (316 Ti)

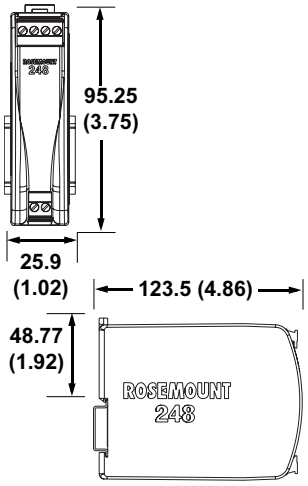
Construction
Thermowell bodies are either machined from solid barstock or manufactured using swaged tubes. Flange mounts are seal welded to the thermowell body with the exception of Class 900 flanges and above, which are full penetration welded. Surface finish of machined stems is 0.8 μm (32 μ in. CLA.N6).

Material certification (option code Q8) and pressure testing (option code R01) are available. Flanged thermowells generally conform to the specifications of ASME B 16.5 (ANSI), DIN 2519, 2527, 2633, 2635, and DIN 2526 Type C

Other thermowell materials and styles are available in Volume 1, 2, and 3 of the Temperature Sensor and Accessories Product Data Sheet.

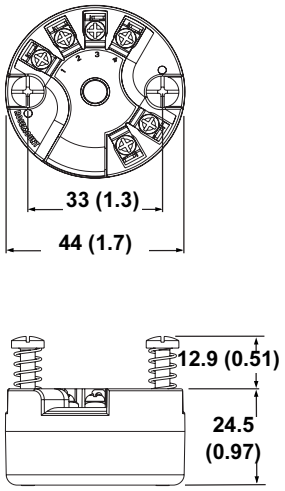
DIMENSIONAL DRAWINGS

248R Railmount Transmitter



248H Headmount Transmitter

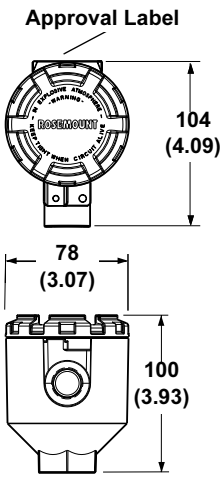
(enlarged)



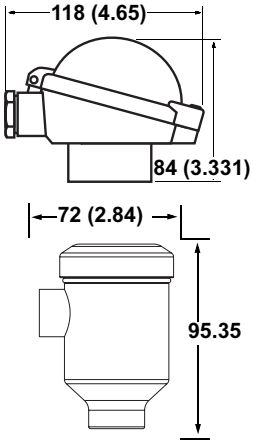
Dimensions are in millimeters (inches)

Enclosures

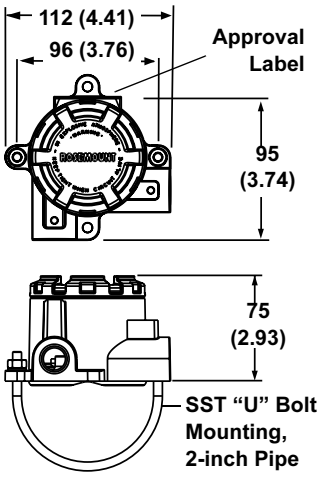
Connection Head



BUZ and Polypropylene Heads (option codes B and C) and Mini SST Head (option code S)



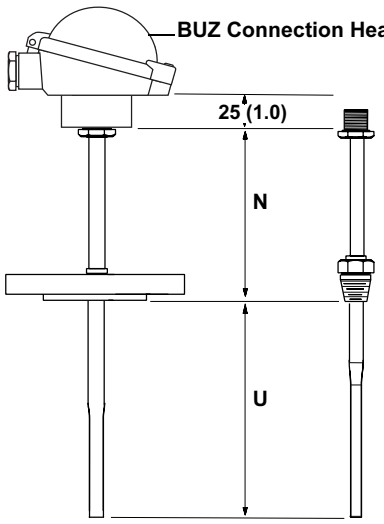
Universal Head(1) (option codes H and U)



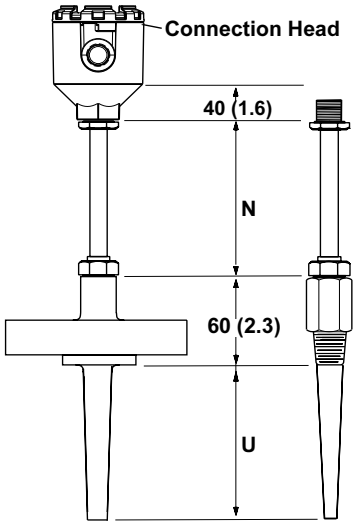
(1) *A "U" Bolt is shipped with each universal head unless a sensor is ordered assembled to the enclosure. However, since the head can be integrally mounted to the sensor it may not need to be used.*

Examples of 248 Transmitter and Sensor Assemblies with Thermowells

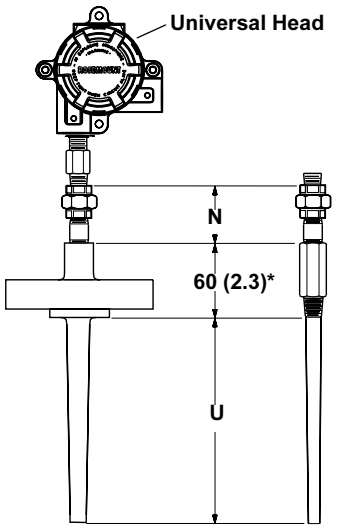
Tubular Thermowell and DIN Plate Style Sensor



Barstock Thermowell and DIN Plate Style Sensor



Barstock Thermowell, Nipple-Union Extension, and 1/2-in. NPT Spring Loaded Sensor



SENSORS_0000B01E, 0000C01C, 0000A01I

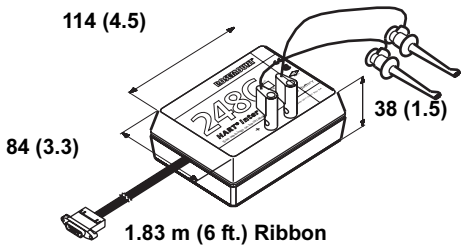
** 80 (3.2) for Class 900 flanges and larger*

N = Extension Length, U= Thermowell Immersion Length, Dimensions are in millimeters (inches)

SEE ORDERING TABLES FOR MORE ASSEMBLY OPTIONS

248C Configuration Interface

Option 1: HART Interface Box



248I3300A01A

ORDERING INFORMATION

Table A-5. Rosemount 248 Transmitter with or without DIN Plate Style Sensor and Tubular Thermowells (millimeters)

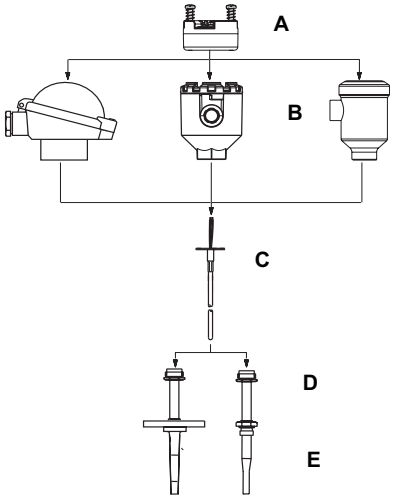
	Product Description
248H	Smart DIN B Head Mount Temperature Transmitter

Code	Output Protocol
A	HART Communication Protocol

Code	Product Certifications	Enclosure Option Codes Permitted
Hazardous Area Certificates (consult factory for availability)		
I1	CENELEC Intrinsic Safety	A, B, N, G, S
E1	CENELEC ATEX Flame-Proof	A, G
N1	CENELEC Type n	A, B, G
NC(1)	CENELEC Type n Component	N
ND	CENELEC Dust Ignition Proof	A, G
I5	FM Intrinsic Safety and Class I, Division 2	A, B, N, G
E5	FM Explosion-Proof	A, G
K5	FM Intrinsic Safety, Explosion-Proof, and Class I, Division 2	A, G
I6	CSA Intrinsic Safety and Class I, Division 2	A, B, N, G
K6	CSA Intrinsic Safety, Explosion-Proof, and Class I, Division 2	A, G
I7	SAA Intrinsic Safety	A, B, N, G
E7	SAA Flame-Proof	A, G
N7	SAA Type n	A, B, G
I2	CEPEL Intrinsic Safety	A, B, N, G
I4	JIS Intrinsic Safety	A, B, N, G
E4	JIS Flame-Proof	A, G
NA	No Approvals	A, B, N, G, S

Code	Enclosures
A	Rosemount Connection Head, DIN IP68, Aluminum
B	BUZ Connection Head, DIN IP54, Aluminum
C(2)	Polypropylene COnnection Head, DIN
G	Rosemount Connection Head, DIN IP 68, Stainless Steel
S(2)	Connection Head, DIN B IP 66, Polished Stainless Steel
N	No Enclosure

Code	Cable/Conduit Entry for Enclosures
1	M20 x 1.5
2(3)	1/2-inch NPT
0	No Enclosure



Code	Sensor Type	Style	Type
ZR	PT 100 RTD	DIN Plate	4-Wire, Single Element, IEC
ZJ	Type J Thermocouple	DIN Plate	Ungrounded, Single Element, IEC
ZK	Type K Thermocouple	DIN Plate	Ungrounded, Single Element, IEC
XA(4)	Sensor Specified Separately and Assembled to the Transmitter		NA
NS(5)	No Sensor	NA	NA

continued on next page

Table A-5 continued

Code	Options
Extension Length	
N050	50 mm (1.97-in.)
N115	115 mm (4.53-in.)
N130	130 mm (5.12-in.)
Stepped Stem Tubular Thermowells, 1.4571 (316 Ti) NAMUR–Compliant	
G02	Thread Mount, 1/2-in. BSPT (R1/2)
G04	Thread Mount, 3/4-in. BSPT (R3/4)
G20	Thread Mount, 1/2-in. BSPF (G1/2)
G22	Thread Mount, 3/4-in. BSPF (G3/4)
G38	Thread Mount, 1/2-in. NPT
G40	Thread Mount, 3/4-in. NPT
L02	Flange Mount, 1-in. Class 150
H02	Flange Mount, DN 25 PN 16
H08	Flange Mount, DN 25 PN 25/40
H14	Flange Mount, DN 40 PN 25/40
Immersion Length	
U075	75 mm (2.95-in.)
U100	100 mm (3.94-in.)
U115	115 mm (4.53-in.)
U160	160 mm (6.30-in.)
U200	200 mm (7.87-in.)
U225	225 mm (8.86-in.)
U250	250 mm (9.84-in.)
U300	300 mm (11.8-in.)
U400	400 mm (15.7-in.)
Special Options	
C1	Factory Custom Configuration of Alarm and Saturation Levels, Date, Descriptor and Message Field
A1	Analog Output Levels Compliant with NAMUR-Recommendations, NE43: High Alarm
CN	Analog Output Levels Compliant with NAMUR-Recommendations, NE43: Low Alarm
C4	5-Point Calibration (Use option code Q4 to generate a calibration certificate)
Q4	Calibration Certificate (3-Point standard; use option codes C4 with Q4 for a 5-Point Calibration Certificate)
F6	60 Hz line Voltage Filter
Q8	Thermowell Material Certificate
R01	Thermowell External Pressure Test
Typical Model Number:	**248H A E1 A 1 ZR N050 G22 U160 Q4**

Additional Options Available
This data sheet contains a sample of the many temperature assembly options Emerson Process Management has available. Refer to the following product data sheets or contact a sales representative for more choices.

- Temperature Sensor and Accessories, Volume 1 (document number 00813-0100-2654)
- Temperature Sensor and Accessories, Volume 2 (document number 00813-0200-2654)
- Temperature Sensor and Accessories, Volume 3 (document number 00813-0301-2654)

(1) The Rosemount 248H with CENELEC Type n Component Approval is not approved as a stand alone unit. Additional system certification is required. Transmitters must be installed such that it is protected to at least the requirements of IP54.
(2) Consult factory for availability
(3) A 1/2-in. thread adapter is used when Enclosure option code A or B is ordered with Sensor Type option codes ZR, ZJ, or ZK.
(4) Only specify this code if the sensor assembly is ordered though a separate model number (from one of the Sensor Product Data Sheets).
(5) Only available with Enclosure option code N.

Table A-6. Rosemount 248 Transmitter with or without DIN Plate or 1/2-in. Adapter Style Sensor and Barstock Thermowells (millimeters)

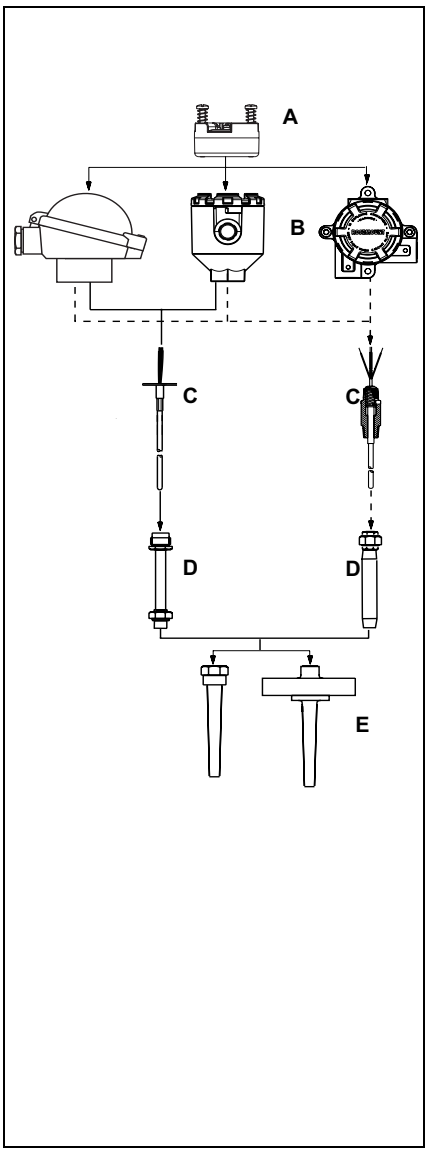
Model	Product Description
248H	Smart DIN B Head Mount Temperature Transmitter

Code	Output Protocol
A	HART Communication Protocol

Code	Product Certifications	Enclosure Options Codes Permitted
Hazardous Area Certificates (consult factory for availability)		
I1	CENELEC Intrinsic Safety	A, B, U, N, G, H, S
E1	CENELEC ATEX Flame-Proof	A, U, G, H
N1	CENELEC Type n	A, B, U, G, H
NC(1)	CENELEC Type n Component	N
ND	CENELEC Dust Ignition Proof	A, U, G, H
I5	FM Intrinsic Safety and Class I, Division 2	A, B, U, N, G, H
E5	FM Explosion-Proof	A, U, G, H
K5	FM Intrinsic Safety, Explosion-Proof, and Class I, Division 2	A, U, G, H
I6	CSA Intrinsic Safety and Class I, Division 2	A, B, U, N, G, H
K6	CSA Intrinsic Safety, Explosion-Proof, and Class I, Division 2	A, U, G, H
I7	SAA Intrinsic Safety	A, B, U, N, G, H
E7	SAA Flame-Proof	A, U, G, H
N7	SAA Type n	A, B, U, G, H
I2	CEPEL Intrinsic Safety	A, B, U, N, G, H
I4	JIS Intrinsic Safety	A, B, U, N, G, H
E4	JIS Flame-Proof	A, U, G, H
NA	No Approvals	A, B, U, N, G, H, S

Code	Enclosures
A	Rosemount Connection Head, DIN IP68, Aluminum
B	BUZ Connection Head, DIN IP54, Aluminum
C(2)	Polypropylene Connection Head
G	Rosemount Connection Head, DIN IP 68, Stainless Steel
H	Universal Connection Head, DIN IP 68, Stainless
S(2)	Connection Head, DIN B IP 66, Polished Stainless Steel
U(3)	Universal Connection Head, DIN IP68, Aluminum
N	No Enclosure

Code	Cable/Conduit Entry for Enclosure
1(4)	M20 x 1.5
2(5)	1/2-inch NPT
0	No Enclosure



Code	Sensor Type	Style	Type
DR	PT 100 RTD	DIN Plate	4-Wire, Single Element, IEC
DJ	Type J Thermocouple	DIN Plate	Ungrounded, Single Element, IEC
DK	Type K Thermocouple	DIN Plate	Ungrounded, Single Element, IEC
AR	PT 100 RTD	1/2-in. Adapter, Spring Loaded	4-Wire, Single Element, IEC
AJ	Type J Thermocouple	1/2-in. Adapter, Spring Loaded	Ungrounded, Single Element, IEC
AK	Type K Thermocouple	1/2-in. Adapter, Spring Loaded	Ungrounded, Single Element, IEC
XA(6)	Sensor Specified Separately and Assembled to the Transmitter		NA
NS(7)	No Sensor	NA	NA

continued on next page

Table A-6 continued

Code	Options
Extension Length	
N035	35 mm (1.38-in.)
N080	80 mm (3.15-in.)
N110	110 mm (4.33-in.)
N135	135 mm (5.32-in.)
N150	150 mm (5.90-in.)
Tapered Barstock Thermowell Process Connection, 316L (1.4404)	
T08	Thread Mount, 1/2-in. BSPT (R1/2)
T10	Thread Mount, 3/4-in. BSPT (R3/4)
T26	Thread Mount, 1/2-in. BSPF (G1/2)
T28	Thread Mount, 3/4-in. BSPF (G3/4)
T44	Thread Mount, 1/2-in. NPT
T46	Thread Mount, 3/4-in. NPT
T48	Thread Mount, 1-inch NPT
T90	Thread Mount, M24 x 1.5
T98	Thread Mount, M20 x 1.5
F04	Flange Mount, 1-in. Class 150
F10	Flange Mount, 1 1/2-in. Class 150
F16	Flange Mount, 2-in. Class 150
F28	Flange Mount, 1 1/2-in. Class 300
F46	Flange Mount, 1 1/2-in. Class 600
F64	Flange Mount, 1/2-in. Class 900/1500
D04	Flange Mount, DN 25 PN 16
D10	Flange Mount, DN 25 PN 25/40
D16	Flange Mount, DN 40 PN 16
Immersion Length	
U075	75 mm (2.95-in.)
U100	100 mm (3.94-in.)
U150	150 mm (5.91-in.)
U225	225 mm (8.86-in.)
U250	250 mm (9.84-in.)
U300	300 mm (11.8-in.)
Special Options	
C1	Factory Custom Configuration of Alarm and Saturation Levels, Date, Descriptor and Message Field
A1	Analog Output Levels Compliant with NAMUR-Recommendations, NE43: High Alarm
CN	Analog Output Levels Compliant with NAMUR-Recommendations, NE43: Low Alarm
C4	5-Point Calibration (Use option code Q4 to generate a calibration certificate)
Q4	Calibration Certificate (3-Point standard; use option codes C4 with Q4 for a 5-Point Calibration Certificate)
F6	60 Hz line Voltage Filter
Q8	Thermowell Material Certificate
R01	Thermowell External Pressure Test

Typical Model Number: 248H A I1 A 1 DR N080 T08 U250 CN

Additional Options Available

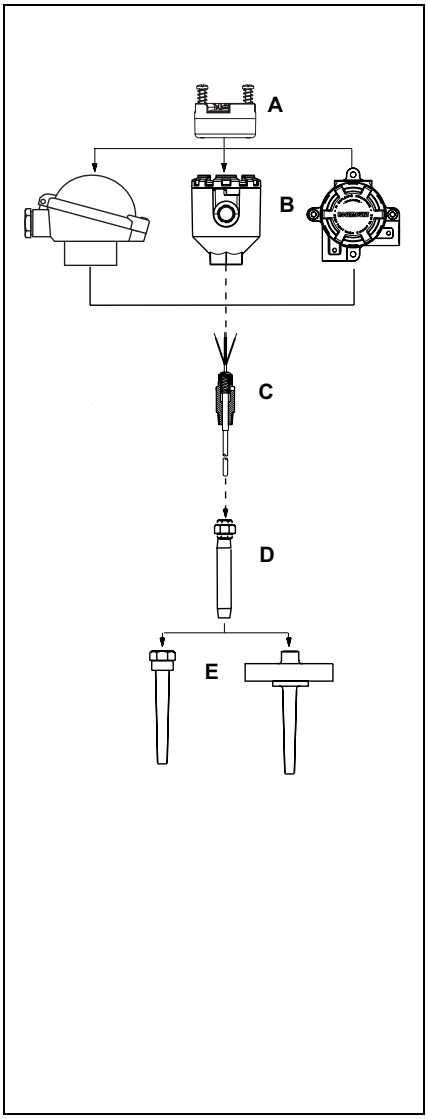
This data sheet contains a sample of the many temperature assembly options Emerson Process Management has available. Refer to the following product data sheets or contact a sales representative for more choices.

- Temperature Sensor and Accessories, Volume 1 (document number 00813-0100-2654)
- Temperature Sensor and Accessories, Volume 2 (document number 00813-0200-2654)
- Temperature Sensor and Accessories, Volume 3 (document number 00813-0301-2654)

(1) The Rosemount 248H with CENELEC Type n Component Approval is not approved as a stand alone unit. Additional system certification is required. Transmitters must be installed such that it is protected to at least the requirements of IP54.
(2) Consult factory for availability.
(3) Enclosure option code U cannot be used with Sensor Type option codes DR, DJ, or DK.
(4) An M20 x 1.5 thread adapter is used when Enclosure option code U is ordered with Sensor Type option codes AR, AJ, or AK.
(5) A 1/2-in. thread adapter is used when Enclosure option code B is ordered.
(6) Only specify this code if the sensor assembly is ordered though a separate model number (from one of the Sensor Product Data Sheets).
(7) Only available with Enclosure option codes N or U.

Table A-7. Rosemount 248 Transmitter with or without 1/2-in. NPT Spring Loaded Sensor and Barstock Thermowells (inches)

Model	Product Description		
248H	Smart DIN B Head Mount Temperature Transmitter		
Code	**Output Protocol**		
A	HART Communication Protocol		
Code	**Product Certifications**		**Enclosure Options Codes Permitted**
Hazardous Area Certificates (consult factory for availability)			
I1	CENELEC Intrinsic Safety		A, B, U, N, G, H, S
E1	CENELEC ATEX Flame-Proof		A, U, G, H
N1	CENELEC Type n		A, B, U, G, H
NC(1)	CENELEC Type n Component		N
ND	CENELEC Dust Ignition Proof		A, U, G, H
I5	FM Intrinsic Safety and Class I, Division 2		A, B, U, N, G, H
E5	FM Explosion-Proof		A, U, G, H
K5	FM Intrinsic Safety, Explosion-Proof, and Class I, Division 2		A, U, G, H
I6	CSA Intrinsic Safety and Class I, Division 2		A, B, U, N, G, H
K6	CSA Intrinsic Safety, Explosion-Proof, and Class I, Division 2		A, U, G, H
I7	SAA Intrinsic Safety		A, B, U, N, G, H
E7	SAA Flame-Proof		A, U, G, H
N7	SAA Type n		A, B, U, G, H
I2	CEPEL Intrinsic Safety		A, B, U, N, G, H
I4	JIS Intrinsic Safety		A, B, U, N, G, H
E4	JIS Flame-Proof		A, U, G, H
NA	No Approvals		A, B, U, N, G, H, S
Code	**Enclosures**		
A	Rosemount Connection Head, DIN IP68, Aluminum		
B	BUZ Connection Head, DIN IP54, Aluminum		
C(5)	Polypropylene Connection Head		
G	Rosemount Connection Head, DIN IP 68, Stainless Steel		
H	Universal Connection Head, DIN IP 68, Stainless Steel		
S(5)	Connection Head, DIN B IP 66, Polished Stainless Steel		
U(6)	Universal Connection Head, DIN IP68, Aluminum		
N	No Enclosure		
Code	**Cable/Conduit Entry**		
2(2)	1/2-inch NPT		
0	No Enclosure		



Code	Sensor Type	Style	Type
UR	PT 100 RTD	1/2-in. Adapter, Spring Loaded	4-Wire, Single Element, IEC
UJ	Type J Thermocouple	1/2-in. Adapter, Spring Loaded	Ungrounded, Single Element, ASTM
UK	Type K Thermocouple	1/2-in. Adapter, Spring Loaded	Ungrounded, Single Element, ASTM
XA(3)	Sensor Specified Separately and Assembled to the Transmitter		NA
NS(4)	No Sensor	NA	NA

continued on next page

Table A-7 continued

Code	Options
Extension Length	
N003	3-in (76.2 mm)
N006	6-in. (152.4 mm)
Tapered Barstock Thermowell Process Connection, 316L (1.4404)	
T25	Thread Mount, 3/4-in. NPT
T27	Thread Mount, 1-in. NPT
F34	Flange Mount, 1 1/2-in. Class 900/1500
F58	Flange Mount, 1-in. Class 150
F60	Flange Mount, 1 1/2-in. Class 150
F62	Flange Mount, 2-in. Class 150
F78	Flange Mount, 1 1/2-in. Class 300
F96	Flange Mount, 1 1/2-in. Class 600
Immersion Length (Lagging length is 0.5-in)	
U002	2-in. (50.8 mm)
U003	3-in. (76.2 mm)
U004	4-in. (101.6 mm)
U005	5-in. (127 mm)
U006	6-in. (152.4 mm)
U007	7-in. (177.8 mm)
U008	8-in. (203.2 mm)
U009	9-in. (228.6 mm)
U010	10-in. (254 mm)
U012	12-in. (304.8 mm)
U015	15-in. (381 mm)
U018	18-in. (457.2 mm)
Special Options	
C1	Factory Custom Configuration of Alarm and Saturation Levels, Date, Descriptor and Message Field
A1	Analog Output Levels Compliant with NAMUR-Recommendations, NE43: High Alarm
CN	Analog Output Levels Compliant with NAMUR-Recommendations, NE43: Low Alarm
C4	5-Point Calibration (Use option code Q4 to generate a calibration certificate)
Q4	Calibration Certificate (3-Point standard; use option codes C4 with Q4 for a 5-Point Calibration Certificate)
F6	60 Hz line Voltage Filter
Q8	Thermowell Material Certificate
R01	Thermowell External Pressure Test
Typical Model Number: 248H A K5 U 2 UR N003 T25 U004 F6	

Additional Options Available
This data sheet contains a sample of the many temperature assembly options Emerson Process Management has available. Refer to the following product data sheets or contact a sales representative for more choices.
- Temperature Sensor and Accessories, Volume 1 (document number 00813-0100-2654)
- Temperature Sensor and Accessories, Volume 2 (document number 00813-0200-2654)
- Temperature Sensor and Accessories, Volume 3 (document number 00813-0301-2654)

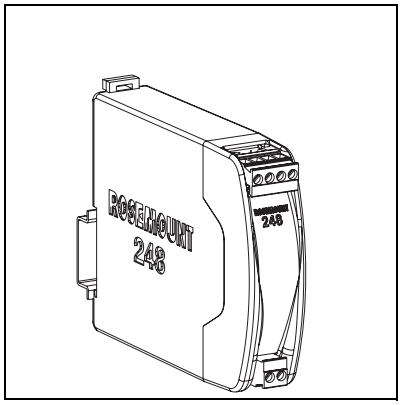
(1) The Rosemount 248H with CENELEC Type n Component Approval is not approved as a stand alone unit. Additional system certification is required. Transmitters must be installed such that it is protected to at least the requirements of IP54.
(2) A 1/2-in. thread adapter is used when Enclosure option code B is ordered with Sensor Type option codes UR, UJ, or UK
(3) Only specify this code if the sensor assembly is ordered though a separate model number (from one of the Sensor Product Data Sheets).
(4) Only available with Enclosure option codes N or U.
(5) Consult factory for availability.
(6) Enclosure option code U cannot be used with Sensor Type option codes DR, DJ, or DK.

Table A-8. 248C Configuration Interface

Model	Product Description
248C(1)	PC-based HART Configuration Software
Code	**Communication Hardware Options**
0	Software Only (no Modem)
1	Software with 248C HART Interface Box (Serial Interface with Transmitter Power Supply)
2	Software with Serial HART Modem
3	Software with USB (Universal Serial Bus) HART Modem
Typical Model Number: 248C 1	

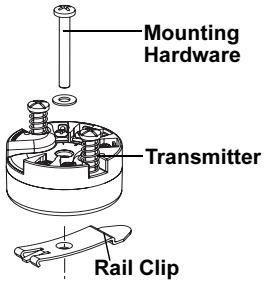
Table A-9. 248R Railmount Transmitter

Model	Product Description
248R	Smart DIN Rail Mount Temperature Transmitter
Code	**Output Protocol**
A	4-20mA with Digital Signal based on HART Protocol
Code	Product Certifications
I1	ATEX Intrinsic Safety
NC	ATEX Type n Component
I5	FM Intrinsic Safety and Class I, Division 2
I6	CSA Intrinsic Safety and Class I, Division 2
I7(1)	IECEx Intrinsic Safety
I2(1)	CEPEL Intrinsic Safety
I4(1)	JIS Intrinsic Safety
NA	No Approvals



Code	Options
Special Options	
C1	Factory Customer Configuration of Alarm and Saturation Levels, Date, Descriptor and Message Field
A1	Analog Output Levels Compliant with NAMUR-Recommendations, NE43: High Alarm
CN	Analog Output Levels Compliant with NAMUR-Recommendations, NE43: Low Alarm
C4	5-Point Calibration (Use option code Q4 to generate a calibration certificate)
Q4	Calibration Certificate (3-Point standard; use option codes C4 with Q4 for a 5-Point Calibration Certificate)
F6	60 Hz Line-Voltage Filter
Typical Model Number: 248R A I1 Q4	
(1) Consult Factory for availability	

Table A-10. Rosemount 248 Transmitter Accessories and Spare Parts List



Part Description	Part Number
Aluminum Alloy Universal Head – M20 Entries	00644-4420-0002
Aluminum Alloy Universal Head – 1/2 NPT Entries	00644-4420-0001
Aluminum Alloy Rosemount Connection Head – M20 Conduit Entry, M24 Instrument Entry	00644-4410-0023
Aluminum Alloy Rosemount Connection Head – 1/2 NPT Conduit Entry and M24 Instrument Entry	00644-4410-0013
Aluminum Alloy BUZ Head – M20 Conduit Entry, M24 Instrument Entry	00644-4196-0023
Aluminum Alloy BUZ Head – M20 Conduit Entry and 1/2 NPT Instrument Entry	00644-4196-0021
External Ground Screw Assembly Kit	00644-4431-0001
Kit, Hardware for Mounting a Rosemount 248 to a DIN Rail (see left picture-top hat rail, symmetric)	00248-1601-0001
Standard Cover for Universal or Rosemount Connection Heads	03031-0292-0001
Snap Rings Kit (used to assemble to a DIN sensor)	00644-4432-0001

Hardware Tag

- no charge
- 20 characters maximum
- transmitter enclosure, sensor, and thermowell if applicable will be tagged in accordance with customer requirements

Software Tag

- no charge
- the transmitter can store up to 8 characters. If no characters are specified, the first 8 characters of the hardware tag are the default.

Configuration

When ordering a transmitter and sensor assembly in one model number, the transmitter will be configured for the sensor that is ordered.

When a transmitter is ordered alone, the transmitter will be shipped as follows (unless specified):

Sensor Type	RTD, Pt 100 (α=0.00385, 4-wire)
4 mA Value	0 °C
20 mA Value	100 °C
Damping	5 seconds
Output	Linear with temperature
Failure Mode	High/Upscale
Line Voltage Filter	50 Hz
Tag	See Hardware Tag

Options

The following table lists the requirements necessary to specify a custom configuration.

Option Code	Requirements/ Specification
C1: Factory Configuration Data (CDS required)	Date: day/month/year Descriptor: 16 alphanumeric characters Message: 32 alphanumeric character Analog Output: Alarm and saturation levels
A1: NAMUR-Compliant, High Alarm	See Table A-1 on page A-2
CN: NAMUR-Compliant, Low Alarm	See Table A-1 on page A-2
Q4: Calibration Certificate	Will include 3-Point calibration at 0, 50, and 100% analog and digital output points
C4: Five Point Calibration	Will include 5-point calibration at 0, 25, 50, 75, and 100% analog and digital output points. Use with Calibration Certificate Q4.
F6: 60 Hz Line Filter	Calibrated to a 60 Hz line voltage filter instead of 50 Hz filter

Appendix B Product Certifications

HAZARDOUS LOCATIONS CERTIFICATIONS

North American Approvals[1]

Factory Mutual (FM) Approvals

I5 FM Intrinsic Safety and Non-incendive
Intrinsically Safe for Class I/II/III, Division 1, Groups A, B, C, D, E, F, and G. Non-incendive Field Circuit for Class I, Division 2, Groups A, B, C, and D. Intrinsically Safe and non-incendive when installed in accordance with Rosemount drawing 00248-1055.

Temperature Codes:
T5 (T_{amb} = –40 to 75 °C)
T6 (T_{amb} = –40 to 40 °C)

TABLE 1. Entity Parameters

Loop/Power	Sensor
U_i = 30 Vdc	U_o = 45 Vdc
I_i = 130 mA	I_o = 26 mA
P_i = 1.0 W	P_o = 290 mW
C_i = 3.6 nF	C_o = 0.4 nF
L_i = 13.8 µH	L_o = 49.2 mH

E5 FM Explosion-Proof
Explosion-Proof for Class I, Division 1, Groups B, C, and D. Dust Ignition Proof for Class II/III, Division 1, Groups E, F, G when installed in accordance with Rosemount drawing 00644-1049.

Temperature Codes:
T5 (T_{amb} = –40 to 85 °C)

Canadian Standards Association (CSA) Approvals

I6 CSA Intrinsically Safe and Class I, Division 2
Intrinsically Safe for Class I, Division 1, Groups A, B, C, and D when installed in accordance with Rosemount drawing 00248-1056.

Temperature Codes:
T5 (T_{amb} = –50 to 60 °C)
T6 (T_{amb} = –50 to 40 °C)

Suitable for use in Class I, Division 2, Groups A, B, C, and D.

(1) Please check with factory for availability of approvals.

K6 CSA Intrinsically Safe, Explosion-Proof, and Class I, Division 2. Combination of I6 and Explosion-Proof for Class I, Division 1, Groups B, C, and D; Class II, Division 1, Groups E, F, and G; Class III, Division 1 hazardous locations, when installed in accordance with Rosemount drawing 00644-1059.

Suitable for Class I, Division 2, Groups A,B, C, and D.

Ambient Temperature Limit: –50 to 85°C

European Approvals(1)

CENELEC Approvals

I1 CENELEC Intrinsic Safety
Certificate Number: BASEEFA03ATEX0030X
ATEX Marking: Ex II 1 G
CE 1180
EEx ia IIC

Temperature Codes:
T5 ($-60 \le T_{amb} \le 80$ °C)
T6 ($-60 \le T_{amb} \le 60$ °C)

Special Conditions for Safe Use (X):

The apparatus must be installed in an enclosure which affords it a degree of protection of at least IP20. Non-metallic enclosures must have a surface resistance of less than 1 GOHM; light alloy or zirconium enclosures must be protected from impact and friction when installed.

E1 CENELEC Flame-Proof Approval
Certificate Number: KEMA99ATEX8715
ATEX Marking: Ex II 2 G
CE 1180
EEx d IIC

Temperature Codes:
T6 ($-40 \le T_{amb} \le 65$ °C)

N1 CENELEC Type n
Certificate Number: BAS00ATEX3145
ATEX Marking: Ex II 3G
EEx nL IIC

Temperature Codes:
T5 ($-40 \le T_{amb} \le 70$ °C)

NC CENELEC Type n Component
Certificate Number: BASEEFA03ATEX0032U
ATEX Marking: Ex II 3G
EEx nA IIC

Temperature Codes:
T5 ($-60 \le T_{amb} \le 80$°C)
T6 ($-60 \le T_{amb} \le 60$°C)

ND CENELEC Dust Ignition-Proof
ATEX Marking: Ex II 1 D
CE 1180

Australian Approvals(1)

IECEx Scheme Approvals

I7 IECEx Intrinsic Safety
Ex ia IIC

E7 IECEx Explosion-Proof
Ex d IIC

N7 IECEx Type n
Ex n

Brazilian Approval(1)

Centro de Pesquisas de Energia Eletrica (CEPEL) Approval

I2 CEPEL Intrinsic Safety

Japanese Approvals(1)

Japanese Industrial Standard (JIS) Approvals

I4 JIS Intrinsic Safety

E4 JIS Explosion-Proof

Combination Approvals(1)

K5 Combination of I5 and E5.

INSTALLATION DRAWINGS

The installation guidelines presented by the drawings must be followed in order to maintain certified ratings for installed transmitters.

Rosemount Drawing 00248-1055, Rev AD, 2 Sheets
Factory Mutual Intrinsic Safety and Non-Incendive Installation Drawing

Rosemount Drawing 00644-1049, Rev AD, 1 Sheet
Factory Mutual Explosion-proof Installation Drawing

Rosemount Drawing 00248-1056, Rev AB, 1 Sheet
CSA Explosion-Proof and Non-Incendive Installation Drawing

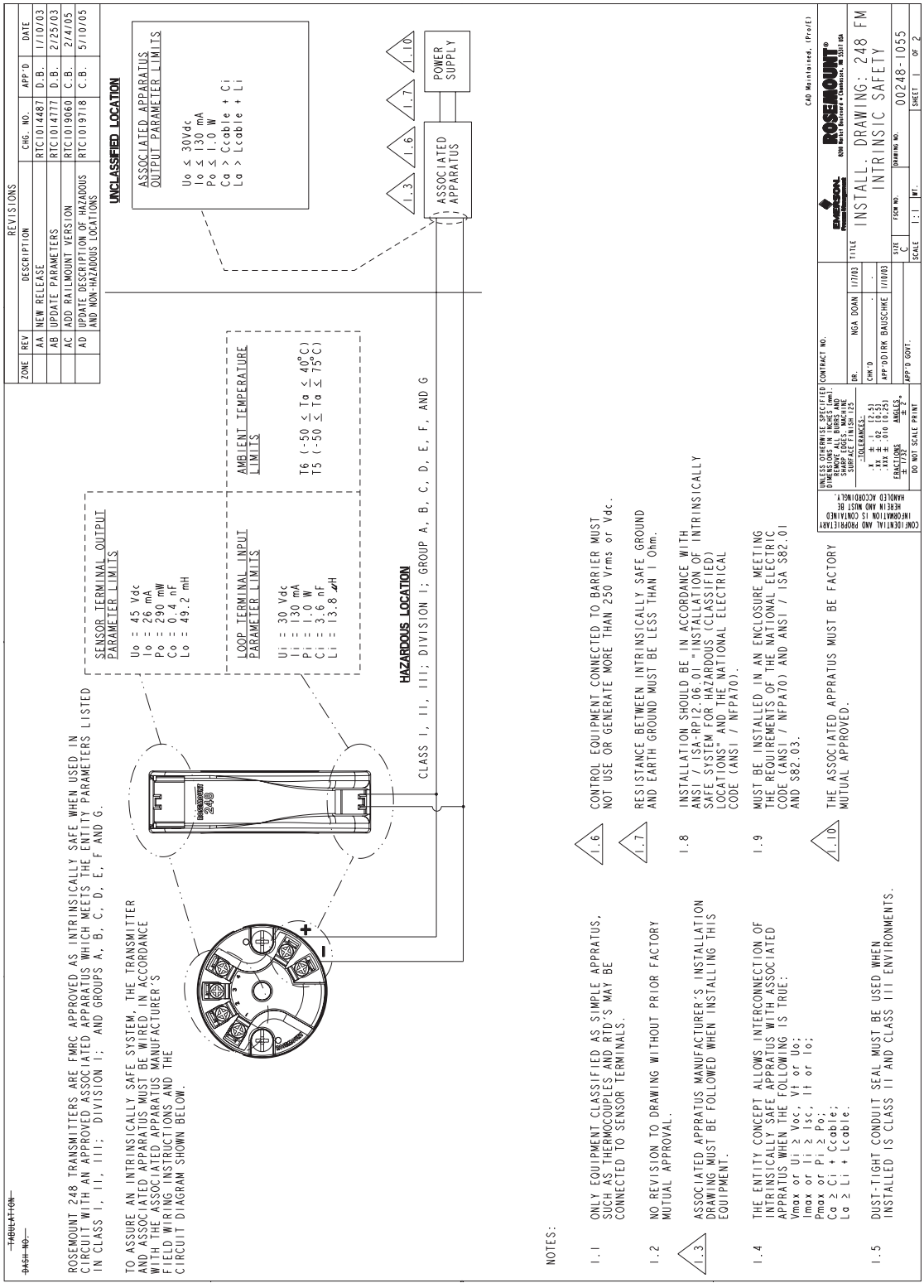
Rosemount Drawing 00248-1057, Rev AD, 1 Sheet
IECEX Intrinsic Safety Installation Drawing

Rosemount Drawing 00644-1059, Rev AE, 1 Sheet
CSA Explosion-proof Installation Drawing

IMPORTANT
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 used from the unused approval type(s).

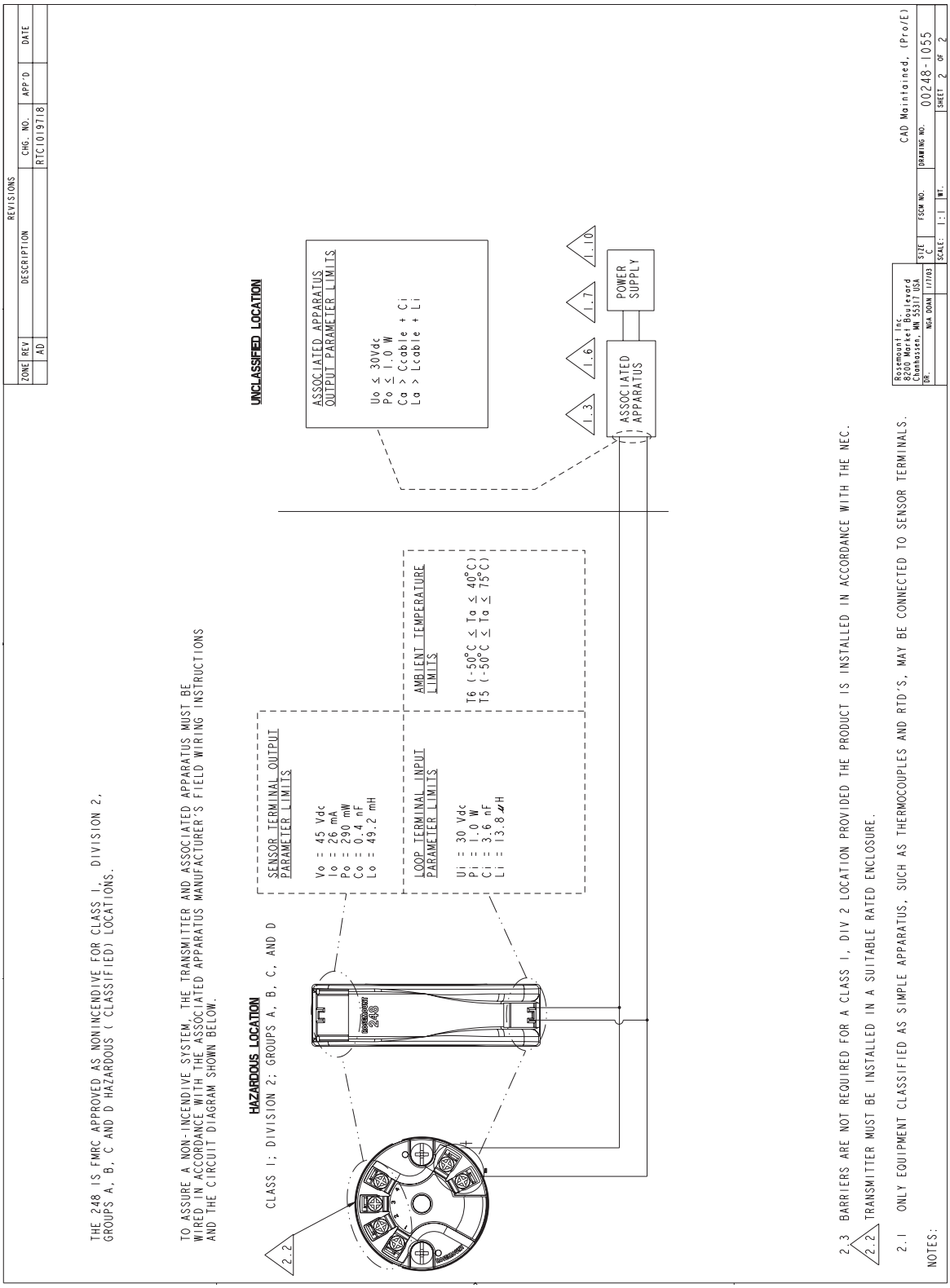
(1) Please check with factory for availability of approvals.

Figure B-1. FM Intrinsic Safety and Non-Incendive Installation Drawing 00248-1055, Rev. AD. Sheet 1 of 2



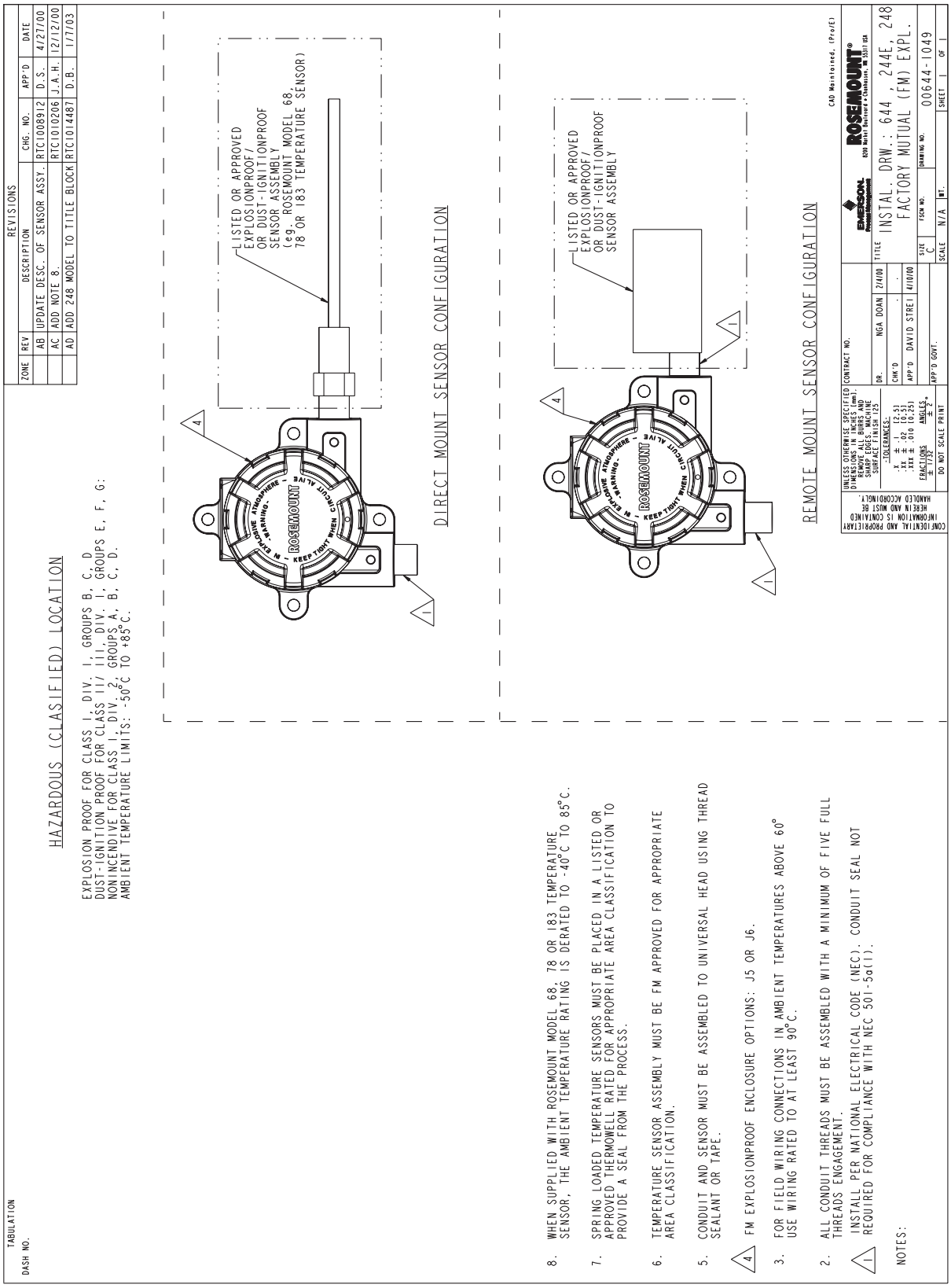
248-00248-1055A04A

Figure B-2. FM Intrinsic Safety and Non-Incendive Installation Drawing 00248-1055, Rev. AD. Sheet 2 of 2



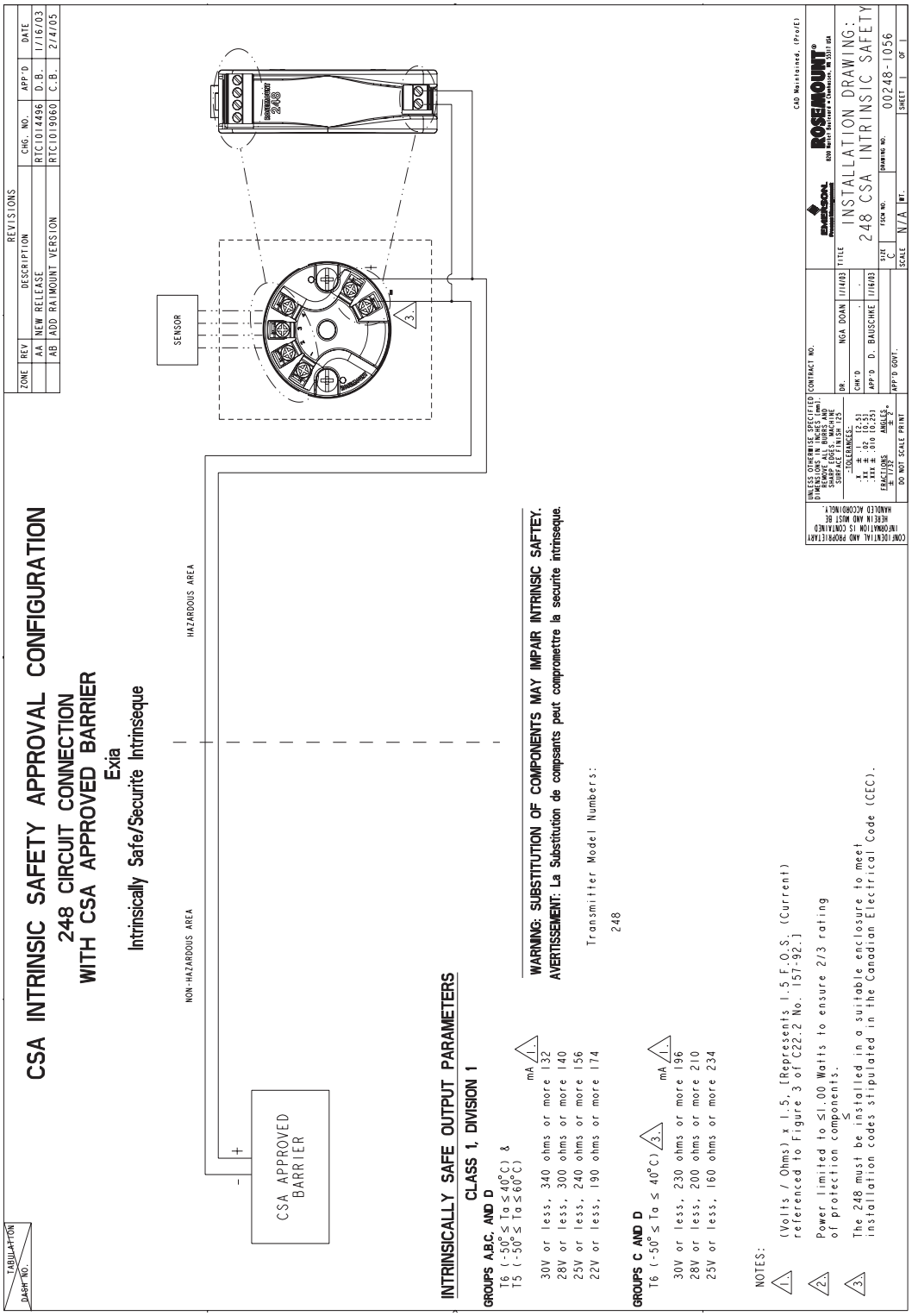
248-00248-1055B04A

Figure B-3. Factory Mutual (FM) Explosion-Proof Installation Drawing 00644-1049, Rev. AD



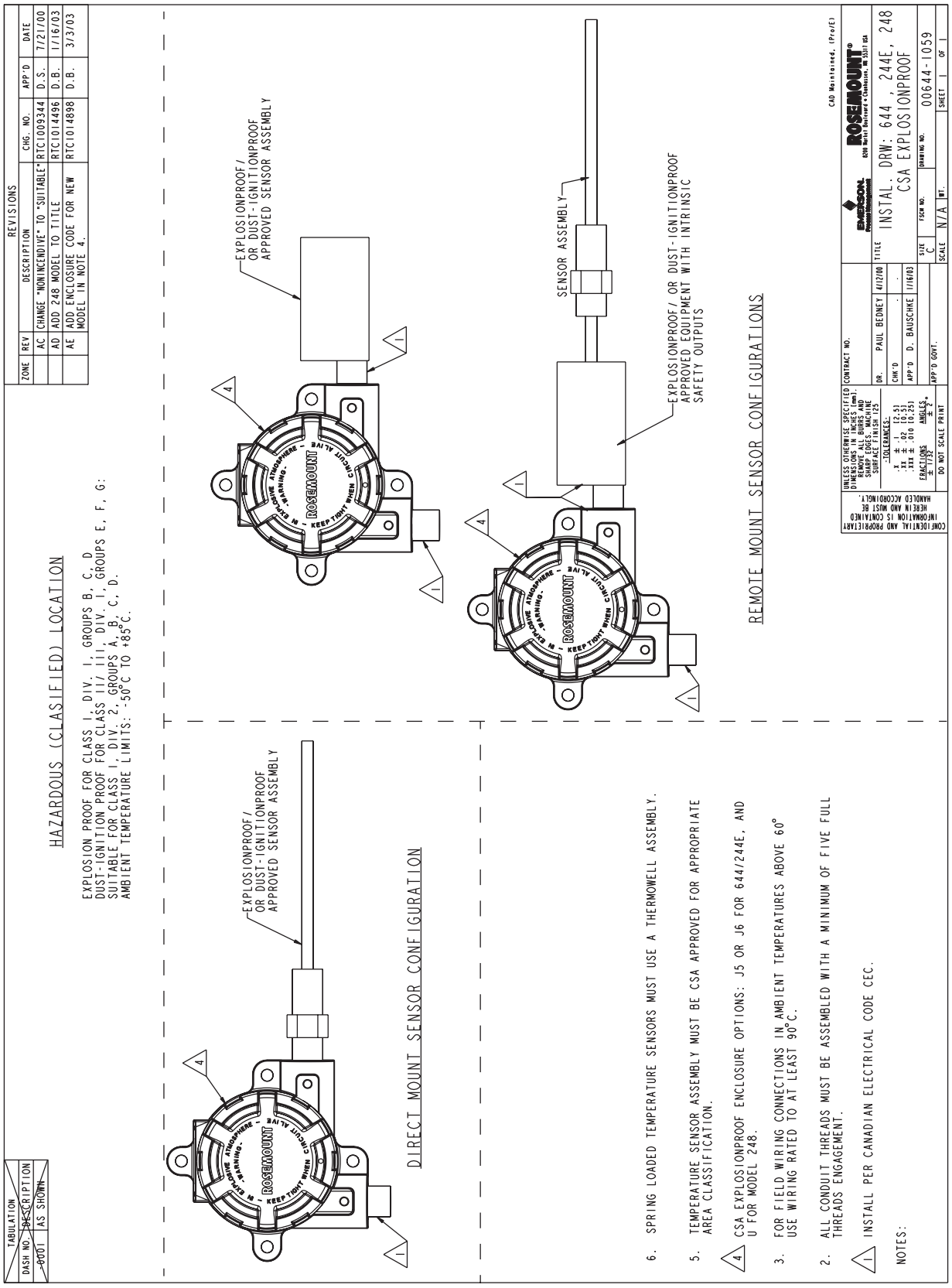
248-00644-1049A03A

Figure B-4. CSA I Explosion-Proof and Non-Incendive Installation Drawing 00248-1056, Rev. AB.



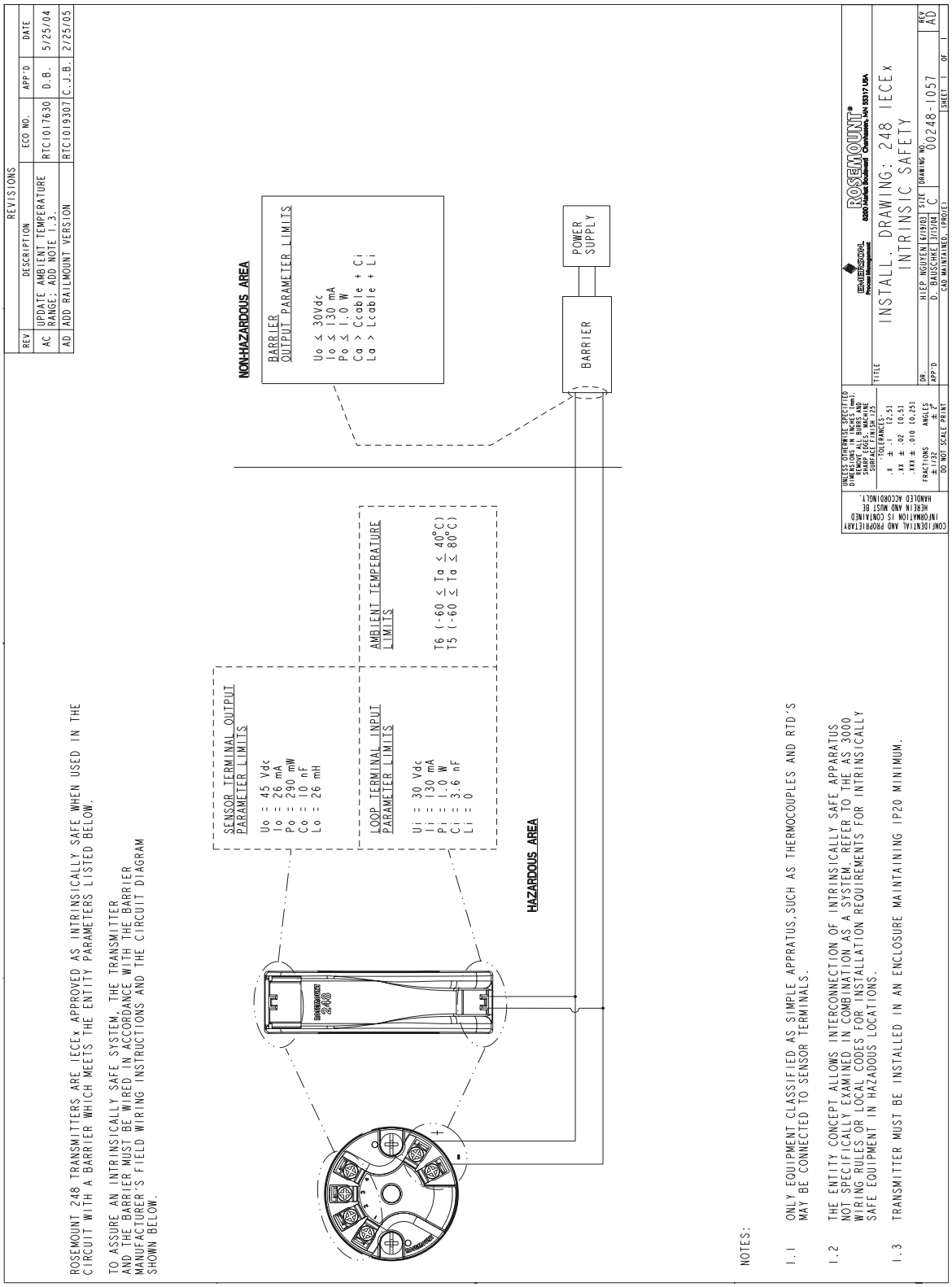
248-00248-1056A04A

Figure B-5. CSA Explosion-Proof Installation Drawing 00644-1059, Rev. AE.



248-00644-1059A03A

Figure B-6. IECEx Intrinsic Safety Installation Drawing 00248-1057, Rev. AD



248-00248-1057

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Reference Manual
00809-0100-4825, Rev BB
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