

Rosemount™ 148 Temperature Transmitter



CE

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 am to 7:00 pm 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 an Emerson Sales Representative.

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1 Introduction

1.1 Safety messages

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

WARNING

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

Ensure 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.
- 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.

Physical access

- Unauthorized personnel may potentially cause significant damage to and/or misconfiguration of end users' equipment. This could be intentional or unintentional and needs to be protected against.
 - Physical security is an important part of any security program and fundamental to protecting your system. Restrict physical access by unauthorized personnel to protect end users' assets. This is true for all systems used within the facility.
-

1.2 Overview

This manual is designed to assist in the installation, operation, and maintenance of the Rosemount™ 148 Temperature Transmitter.

Introduction

- Transmitter and manual overview
- Things to consider
- How to return the transmitter

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

Configuration

- Configuring the transmitter

Operation and Maintenance

- Explanation of hardware maintenance

Transmitter

Features of the Rosemount 148 include:

- Accepts inputs from a wide variety of RTD and thermocouple sensors
- Electronics that are completely encapsulated in silicone and enclosed in a plastic housing, making the transmitter extremely durable, and ensuring long-term reliability.
- A compact size and multiple housing options allow mounting flexibility in the field
- Model code option that allows it to be assembled to any sensor, thermowell, and extension accessory

Refer to the following literature for a full range of compatible connection heads, sensors, and thermowells provided by Emerson:

- Rosemount 214C Temperature Sensors [Product Data Sheet](#)
- Rosemount Volume 1 Temperature Sensors and Accessories [Product Data Sheet](#)
- Rosemount DIN-Style Temperature Sensors and Thermowells (Metric) [Product Data Sheet](#)

Table 1-1: Headmount Revisions

| Software release date | Identify device | | Review instructions |
|-----------------------|-------------------------|--|---------------------|
| | NAMUR software revision | NAMUR hardware revision ⁽¹⁾ | Reference Manual |
| June 2019 | 1.0.1 | 1.0.2 | 00809-0100-4148 |

(1) NAMUR Software Revision is located in the hardware tag of the device.

1.3 Considerations

1.3.1 General

Electrical temperature sensors such as RTDs and thermocouples produce low-level signals proportional to the sensed temperature. The Rosemount™ 148 Temperature Transmitter 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 transmitted to the control room via two wires.

1.3.2 Mechanical

Location

Take into account the need for access to the transmitter when choosing an installation location.

Special mounting

Special hardware is available for mounting a Rosemount 148 head mount transmitter to a DIN rail.

1.3.3 Electrical

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

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

1.3.4 Environmental

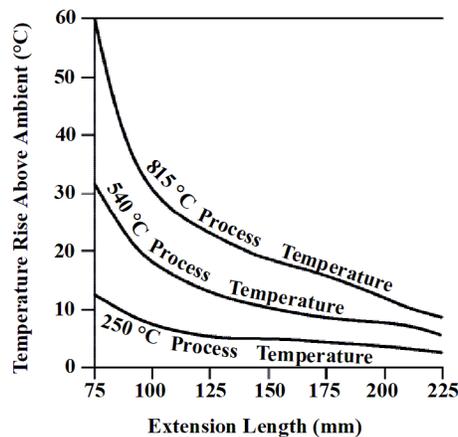
The transmitter electronics module is permanently sealed within the housing, resisting moisture and corrosive damage. Verify that the operating atmosphere of the transmitter is consistent with the appropriate hazardous locations certifications.

Temperature effects

The transmitter will operate within specifications for ambient temperatures between -40 and 85 °C (-40 and 185 °F). Heat from the process is transferred from the thermowell to the transmitter housing. If the expected process temperature is near or above specification limits, consider using 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 148 Transmitter Connection Head Temperature Rise vs. Extension Length



Example

The transmitter specification limit is 85 °C (185 °F). If the ambient temperature is 55 °C (131 °F) and the process temperature to be measured is 800 °C (1472 °F), the maximum permissible connection head temperature rise is the transmitter specification limit minus the ambient temperature (moves from 85 to 55 °C), or 30 °C (86 °F).

In this case, an extension of 100 mm (3.94 -in.) meets this requirement, but 125 mm (4.92 -in.) provides a margin of 8 °C (46.4 °F), thereby reducing any temperature effects in the transmitter.

1.4 Return of materials

To expedite the return process in North America, call the Emerson National Response Center toll-free at 1-800-654-7768. This center, available 24 hours a day, can assist 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 of North America, contact a local Emerson representative.

1.5 Product recycling/disposal

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

2 Installation

2.1 Safety messages

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Ensure 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.
- 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.

Physical access

- Unauthorized personnel may potentially cause significant damage to and/or misconfiguration of end users' equipment. This could be intentional or unintentional and needs to be protected against.
 - Physical security is an important part of any security program and fundamental to protecting your system. Restrict physical access by unauthorized personnel to protect end users' assets. This is true for all systems used within the facility.
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2.2 Mounting

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

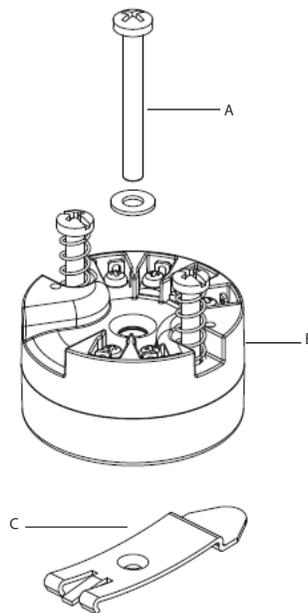
The Rosemount™ 148 Temperature Transmitter installs:

- 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

2.2.1 Mounting a Rosemount 148 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 2-1](#).

Figure 2-1: Assembling Rail Clip Hardware to a Rosemount 148



- A. Mounting hardware
- B. Transmitter
- C. Rail clip

2.3 Installation

The Rosemount™ 148 Temperature Transmitter can be ordered assembled to a sensor with the XA option code 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.

2.3.1 Head mount transmitter with DIN plate style sensor

This type of installation is typical in Europe and Asia Pacific.

Procedure

1. Attach the thermowell to the pipe or process container wall.
2. Install and tighten thermowells before applying process pressure.
3. Assemble the transmitter to the sensor.
 - a) Push the transmitter mounting screws through the sensor mounting plate.
 - b) Insert the snap rings (optional) into the transmitter mounting screw groove.
4. Wire the sensor to the transmitter.
5. Insert the transmitter-sensor assembly into the connection head.
 - a) Thread the transmitter mounting screw into the connection head mounting holes.
 - b) Assemble the extension to the connection head.
 - c) Insert the assembly into the thermowell.
6. Slip the shielded cable through the cable gland.
7. Attach a cable gland into the shielded cable.
8. Insert the shielded cable leads into the connection head through the cable entry.
9. Connect and tighten the cable gland.
10. Connect the shielded power cable leads to the transmitter power terminals.
Avoid contact with sensor leads and sensor connections.
11. Install and tighten the connection head cover.

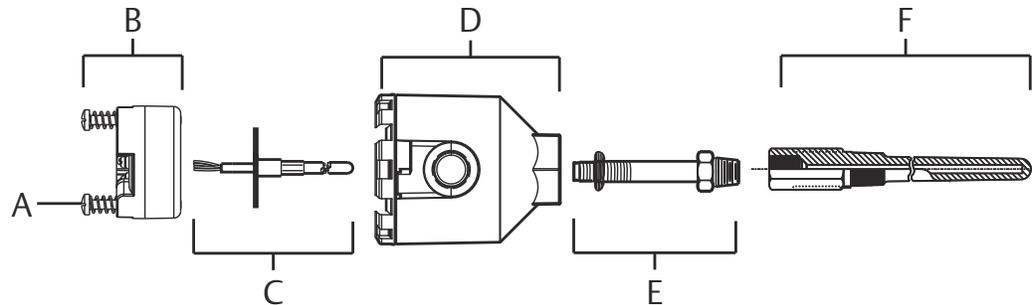
⚠ WARNING

Explosions

Make sure enclosure covers are fully engaged to meet explosion-proof requirements.

Example

Figure 2-2: Typical European and Asia Pacific Installation



- A. Transmitter mounting screws
- B. Rosemount™ 148 Transmitter
- C. Integral mount sensor with flying leads
- D. Connection head
- E. Extension
- F. Thermowell

2.3.2 Head mount transmitter with threaded sensor

This type of installation is typical in North and South America.

Procedure

1. Attach the thermowell to the pipe or process container wall.
2. Install and tighten the thermowell before applying process pressure.
3. Attach necessary extension nipples and adapters to the thermowell.
4. Seal the nipple and adapter threads with silicone tape.
5. Screw the sensor into the thermowell.
6. Install drain seals if required for severe environments or to satisfy code requirements.
7. Pull the sensor wiring leads through the universal head and transmitter.
8. Mount the transmitter in the universal head by threading the transmitter mounting screws into the universal head mounting holes.
9. Mount the transmitter-sensor assembly into the thermowell.
10. Seal adapter threads with silicone tape.
11. Install conduit for field wiring to the conduit entry of the universal head.
12. Seal conduit threads with silicone tape.
13. Pull the field wiring leads through the conduit into the universal head.
14. Attach the sensor and power leads to the transmitter.
Avoid contact with other terminals.
15. Install and tighten the universal head cover.

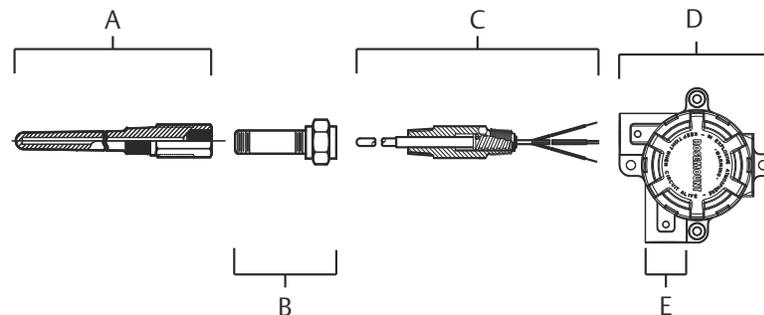
⚠ WARNING

Explosions

Fully engage enclosure covers to meet explosion-proof requirements.

Example

Figure 2-3: Typical North and South American Installation



- A. Threaded thermowell
- B. Standard extension
- C. Threaded style sensor
- D. Universal head
- E. Conduit entry

2.4 Set the switches

2.4.1 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. If the sensor (process) temperature value is out of range, the transmitter outputs default saturation values. Low end saturation levels are either 3.90 or 3.80 mA and the high end saturation level is 20.5 mA. Corresponding NAMUR compliant operation levels are 3.80 and 20.5 mA. These values are also custom configurable by the factory or using the Rosemount 148 PC Programmer interface. See [Configuration](#) for instructions on how to change the alarm and saturation levels with the 148 PC Programmer.

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 operations. See (★) for standard and NAMUR-compliant operation parameters in the Rosemount 148 [Product Data Sheet](#).

2.5 Wiring

⚠ WARNING

Electrical shock could cause death or serious injury.

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

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.

NOTICE

Do not apply high voltage (e.g., AC line voltage) to the transmitter terminals, since abnormally high voltage can damage the unit. (Sensor and transmitter power terminals are rated to 42.4 Vdc).

Note

The transmitters will accept inputs from a variety of RTD and thermocouple types. Refer to [Figure 2-5](#) when making sensor connections.

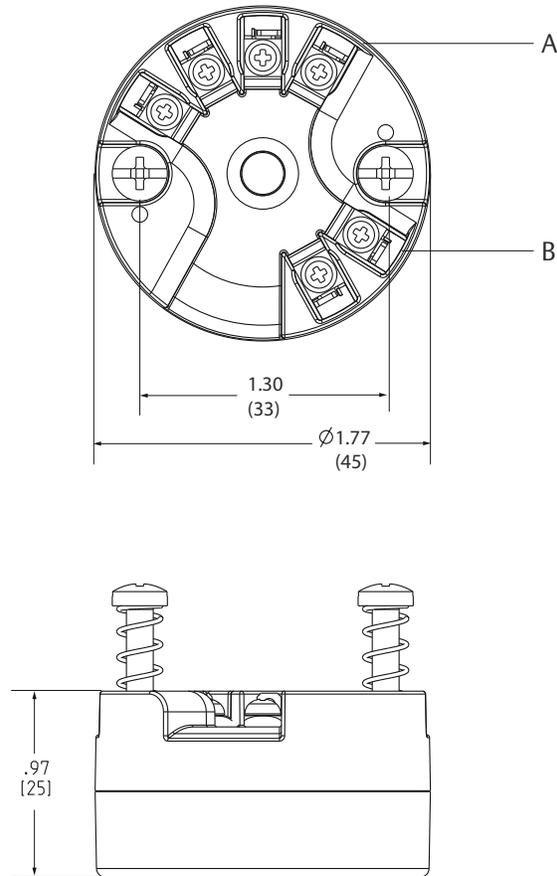
Use the following steps to wire the transmitter:

Procedure

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 2-4](#). 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](#)”)

Example

Figure 2-4: Rosemount 148 Wiring



- A. Sensor terminals
- B. Power/communication terminals

Signal loop may be grounded at any single point or left ungrounded.

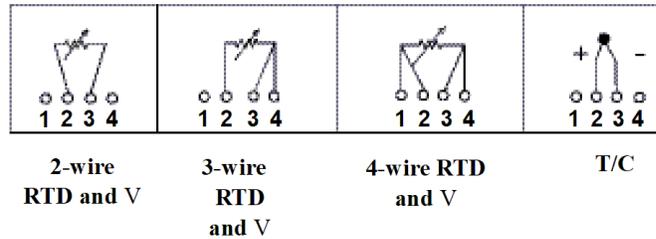
2.5.1 Sensor connections

The Rosemount™ 148 is compatible with a number of RTD and thermocouple sensor types. Figure 2-5 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.

⚠ CAUTION

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

Figure 2-5: Rosemount 148 Sensor Connections Diagram



Thermocouple

The thermocouple can be connected directly to the transmitter. Use appropriate thermocouple extension wire if mounting the transmitter remotely from the sensor.

RTD or ohm inputs

The Rosemount 148 will accept a variety of RTD configurations, including 2-, 3-, and 4-wire designs. If the transmitter is mounted remotely from a 3- or 4-wire RTD, it will operate within specifications, without recalibration, for lead wire resistances of up to 60 Ω per lead (equivalent to 6,000 ft. 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 ft. of 20 AWG wire (approximately 0.05 $^{\circ}\text{C}/\text{ft.}$). For longer runs, attach a third or fourth lead as described above.

Sensor lead wire resistance effect-RTD input

For 2- and 3-wire RTDs, an additional lead wire resistance error is induced with ambient temperature variations. Using the same type of wire on all lead wires will make the installation as accurate as possible.

When using a 4-wire RTD, the effect of lead resistance is eliminated and has no impact on accuracy. 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 | $\pm 1.0 \Omega$ 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_0): | 100 Ω (for Pt 100 RTD) |

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

$$\text{Basic Error} = \frac{\text{Imbalance of Lead Wires}}{(\alpha_{Pt} \times R_0)}$$

$$\text{Error due to amb. temp. variation} = \frac{(\alpha_{Cu}) \times (\Delta T_{amb}) \times (\text{Imbalance of Lead Wires})}{(\alpha_{Pt}) \times (R_0)}$$

Lead wire imbalance seen by the transmitter = 0.5 Ω

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

Error due to amb. temp. var. of $\pm 25 \text{ } ^\circ\text{C}$

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

- Pt100 2-wire RTD:

$$\text{Basic Error} = \frac{\text{Lead Wire Resistance}}{(\alpha_{Pt} \times R_0)}$$

$$\text{Error due to amb. temp. variation} = \frac{(\alpha_{Cu}) \times (\Delta T_{amb}) \times (\text{Lead Wire Resistance})}{(\alpha_{Pt}) \times (R_0)}$$

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

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

$$\begin{aligned} &\text{Error due to amb. temp. var. of } \pm 25 \text{ }^\circ\text{C} \\ &= \frac{(0.0039 \text{ } \Omega / \Omega \text{ }^\circ\text{C}) \times (25 \text{ }^\circ\text{C}) \times (7.5 \text{ } \Omega)}{(0.00385 \text{ } \Omega / \Omega \text{ }^\circ\text{C}) \times (100 \Omega)} = \pm 1.9 \text{ }^\circ\text{C} \end{aligned}$$

2.6 Power supply

The power supplied to the transmitter should not drop below the transmitter lift-off voltage of 12 Vdc.

2.6.1 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.

2.6.2 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 at 500 Vac rms (707 Vdc) at 50/60 Hz, 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, 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 the grounded housing option (the most common).

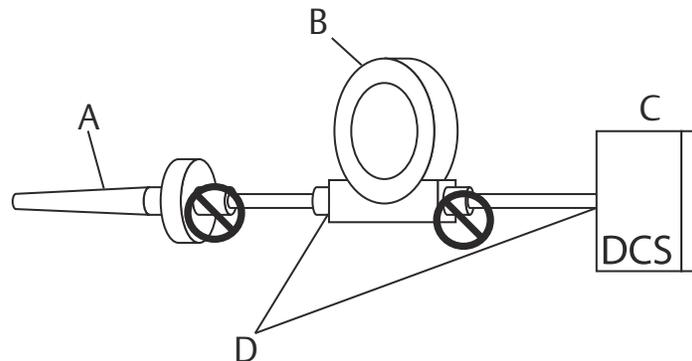
Ground the transmitter: Option 1

Use this method for grounded housing.

Procedure

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

Figure 2-6: Option 1L Grounded Housing



- A. Sensor wires
- B. Transmitters
- C. DCS host system
- D. Shield ground point

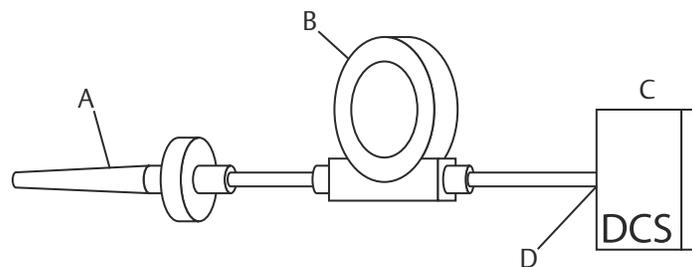
Ground the transmitter: Option 2

Use this method for grounded housing.

Procedure

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

Figure 2-7: Option 2 Grounded Housing



- A. Sensor wires
- B. Transmitters
- C. DCS host system
- D. Shield ground point

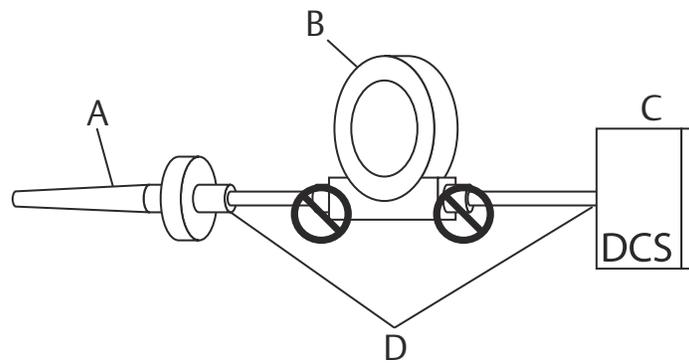
Ground the transmitter: Option 3

Use this method for grounded or ungrounded housing.

Procedure

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.
Do not connect the signal wiring shield to the sensor wiring shield.
3. Ground signal wiring shield at the power supply end.

Figure 2-8: Option 3: Grounded or Ungrounded Housing



- A. Sensor wires
- B. Transmitters
- C. DCS host system
- D. Shield ground point

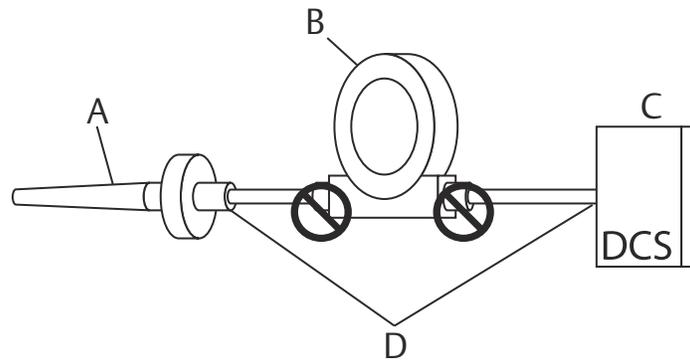
Ground the transmitter: Option 4

Use this method for grounded thermocouple inputs.

Procedure

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.
Do not connect the signal wiring shield to the sensor wiring shield.
3. Ground signal wiring shield at the power supply end.

Figure 2-9: Option 4: Grounded Thermocouple Inputs



- A. Sensor wires
 - B. Transmitters
 - C. DCS host system
 - D. Shield ground point
-

3 Configuration

3.2 Safety messages

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WARNING

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Ensure 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.
- 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.

Physical access

- Unauthorized personnel may potentially cause significant damage to and/or misconfiguration of end users' equipment. This could be intentional or unintentional and needs to be protected against.
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3.3 Rosemount 148 PC Programmer

The Rosemount™ 148 Temperature Transmitter must be configured for certain basis 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. Configuration consists of testing the transmitter and verifying transmitter configuration data.

Note

The Rosemount 148 must be configured before installation.

This can be done in one of two ways:

- Ordering factory configuration by Emerson
- Using the Rosemount 148 PC Programmer interface in a bench configuration setting

3.3.1 Software installation

Procedure

1. Place the Rosemount™ 148 PC Programmer CD_ROM into the drive.
2. Run setup.exe from Windows™ XP, 7, 8, or 10.
3. When first using the software, configure the appropriate COM ports by selecting **Port Settings** from the *Communicate* menu.
4. Install MACTek® Modem drivers completely before beginning bench configuration on the Rosemount 148 system.

Note

The software defaults to the first available COM port.

3.3.2 Rosemount 148 programming

Table 3-1: Programming Kit Spare Part Numbers

| Product description | Part number |
|---------------------------------------|-----------------|
| Programming software (CD) | 00148-1601-0002 |
| Rosemount 148 programmer kit — USB | 00148-1601-0003 |
| Rosemount 148 programmer kit — serial | 00148-1601-0004 |

3.3.3 PC Programmer hardware setup

The Rosemount™ 148 PC Programming Kit includes configuration software and a communication modem. The Rosemount 148 device will need an external power supply of 12–42.4 Vdc for configuration.

Procedure

1. Hook up the transmitter and a load resistor (250–1100 Ω) wired in series with the power supply.
2. Attach the modem in parallel with the load resistor and connect it to the PC.

Postrequisites

See [Table 3-1](#) for spare kit and re-order numbers.

3.3.4 Configuring with the Rosemount 148 PC Programmer

In order to operate properly, the Rosemount™ 148 has basic variables that need to be configured. Some of the variables are factory configured, however, some of the variables may need to be initially set up or revised. The first two tabs on the main screen are *Basic* and *Advanced Settings*, which include all of the configuration variables that can be set for the Rosemount 148. Any changes to the configuration must be sent to the transmitter by selecting the **Send to Transmitter** button on the right of the screen. The current configuration of the connected Rosemount 148 may be viewed by selecting the **Load From Transmitter** button.

Transmitter identification

The *Tag* variable is the easiest way to identify/distinguish between transmitters. It can be used to label transmitters electronically according to the requirements of the application. The tag may be up to eight characters in length, and does not impact the measurement of the transmitter.

Sensor configuration

The following sensors indicate the sensor type and the number of wires to be connected:

- 2-, 3-, or 4-wire Pt 100: $\alpha = 0.00385 \Omega/^\circ\text{C}$
- 2-, 3-, or 4-wire Pt 100: $\alpha = 0.003916 \Omega/^\circ\text{C}$
- 2-, 3-, or 4-wire Ni 120 nickel RTDs
- 2-, 3-, or 4-wire Cu 50: $\alpha = 0.00428 \Omega/^\circ\text{C}$
- 2-, 3-, or 4-wire Cu 100: $\alpha = 0.00426 \Omega/^\circ\text{C}$
- 2-, 3-, or 4-wire Cu 100: $\alpha = 0.00428 \Omega/^\circ\text{C}$
- IEC/NIST/DIN Type B, J, K, N, R, S Thermocouples
- 2-, 3-, or 4-wire 0–2000 ohms
- –10 to 100 Millivolts

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

Output configuration

The *Output configuration* area allows the user to set the desired measurement values for the transmitter:

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

The 4 mA and 20 mA measurement point will need to be set to determine the analog output based on the temperature reading.

The lower and upper range limit of the sensor type selected above can also be viewed.

Damping

The *Damping* value changes the response time of the transmitter to smooth variations in the 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 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 possible. 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 =

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

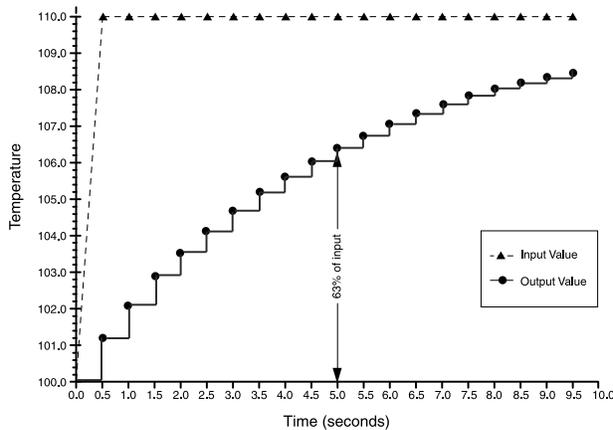
P = previous damped value
 N = new sensor value
 T = damping time constant
 U = update rate

At the time the damping time constant is set, the transmitter output is at 63 percent of the input changes 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 63.2 percent 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 100–110 °C, and the damping is set to five seconds, the transmitter calculates and reports a new reading using the damping equation. At five seconds, the transmitter outputs 106.3 °C, or 63.2 percent of the input change, and the output continues to approach the input curve according to the above equation.

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



Alarm and saturation

Alarm direction, low alarm level, high alarm level, low saturation, and high saturation values can be set here. Rosemount and NAMUR standard values can be found on [Failure mode](#) or user-configured values may be entered. The guidelines are as follows:

- Low alarm value must be between 3.50 and 3.75 mA
- High alarm value must be between 21.0 and 23.0 mA
- 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, so the low saturation level (S) must be 3.8–3.9 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, so the low saturation level (S) must be 20.5–20.7 mA.

See [Failure mode](#) considerations.

50/60 Hz selection

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

Write protect

Write protect safeguards the transmitter configuration data from accidental or unwarranted changes.

3.3.5 Information

The transmitter *Information* tab can be selected from the main start up screen, and lists the transmitter information variables that can be viewed. The *Refresh* button must be clicked to update the view of the current state of the transmitter.

| | |
|---------------------------------|---|
| Sensor temperature | The sensor temperature readings are displayed in the units set in the <i>Basic Settings</i> . |
| Analog output (mA) | Displays the transmitter output, read by the host system, in milliamperes. |
| Transmitter temperature | Shows the reading used by the onboard RTD to compensate the cold junction of thermocouples. |
| Status indicator buttons | Two buttons that indicate if the device is in Sensor Malfunction or Transmitter Malfunction. |
| Device identification | This shows revisions for the software, hardware, and final assembly number. |

4 Operation and Maintenance

4.1 Safety messages

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

WARNING

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

Ensure 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.
- 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.

Physical access

- Unauthorized personnel may potentially cause significant damage to and/or misconfiguration of end users' equipment. This could be intentional or unintentional and needs to be protected against.
- Physical security is an important part of any security program and fundamental to protecting your system. Restrict physical access by unauthorized personnel to protect end users' assets. This is true for all systems used within the facility.

4.2 Hardware

The Rosemount™ 148 Temperature Transmitter has no moving parts and requires minimal scheduled maintenance.

4.2.1 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 148 Transmitter or consult the factory for a special replacement sensor and transmitter combination.

4.2.2 Diagnostic messages

If a malfunction is suspected, follow the procedures described in [Table 4-1](#) to verify that transmitter hardware and process connections are in good working order. Under each of the three major symptoms, specific suggestions are offered for solving the problem.

Table 4-1: Rosemount 148 Troubleshooting Chart

| Symptom | Potential source | Corrective action |
|-------------------------|------------------------------------|---|
| High output | Sensor input failure or connection | <ul style="list-style-type: none"> Check for a sensor open or short circuit. Check the process variable to see if it is out of range. |
| | Loop wiring | <ul style="list-style-type: none"> Check for dirty or defective terminals, interconnecting pins, or receptacles. |
| | Power supply | <ul style="list-style-type: none"> Check the output voltage of the power supply at the transmitter terminals. It should be 12.0–42.4 Vdc (over entire 3.75–23 mA operating range). |
| Erratic output | Loop wiring | <ul style="list-style-type: none"> Check for adequate voltage to the transmitter. It should be 12.0–42.4 Vdc at the transmitter terminals (over entire 3.75–23 mA operating range). Check for intermittent shorts, open circuits, and multiple grounds. |
| Low output or no output | Sensor element | <ul style="list-style-type: none"> Check the process variable to see if it is out of range. |

Table 4-1: Rosemount 148 Troubleshooting Chart (continued)

| Symptom | Potential source | Corrective action |
|---------|------------------|--|
| | Loop wiring | <ul style="list-style-type: none">• Check for adequate voltage to the transmitter. It should be 12.0–42.4 V dc (over entire 3.75–23 mA operating range).• Check for shorts and multiple grounds.• Check for proper polarity at the signal terminal.• Check the loop impedance.• Check wire insulation to detect possible shorts to ground. |

5 Reference Data

5.1 Product Certifications

To view current Rosemount™ 148 Temperature Transmitter Product Certifications, follow these steps:

Procedure

1. Go to [Emerson.com/Rosemount/Rosemount-148](https://www.emerson.com/Rosemount/Rosemount-148).
2. Scroll as needed to the green menu bar and select **Documents & Drawings**.
3. Select **Manuals & Guides**.
4. Select the appropriate Quick Start Guide.

5.2 Ordering Information, Specifications, and Drawings

To view current Rosemount 148 Ordering Information, Specifications, and Drawings, follow these steps:

Procedure

1. Go to [Emerson.com/Rosemount/Rosemount-148](https://www.emerson.com/Rosemount/Rosemount-148).
2. Scroll as needed to the green menu bar and select **Documents & Drawings**.
3. For installation drawings, select **Drawings & Schematics** and select the appropriate document.
4. For ordering information, specifications, and dimensional drawings, select **Data Sheets & Bulletins**.
5. Select the appropriate Product Data Sheet.

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