Reference Manual
00809-0100-4848, Rev BB
September 2019

Rosemount™ 848T Wireless Temperature Transmitter

CE IEC WirelessHART

ROSEMOUNT™

EMERSON™

NOTICE

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

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

Customer Central

United States: 1 800 999 9307

Asia Pacific: 65 77 8211

Europe/Middle East/Africa: 49 8153 9390

National Response Center

1 800 654 7768 (24 hours a day)

Equipment service needs

⚠ 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 Sales Representative.

⚠ WARNING

Explosions could result in death or serious injury.

Installation of this transmitter in an explosive environment must be in accordance with the appropriate local, national, and international standards, codes, and practices. Review the approvals section of this manual for any restrictions associated with a safe installation.

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

Process leaks could result in death or serious injury.

Install and tighten thermowells and sensors before applying pressure.

Electrical shock could cause death or serious injury.

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

This device complies with Part 15 of the FCC Rules. Operation is subject to the following conditions:

This device may not cause harmful interference.

This device must accept any interference received, including interference that may cause undesired operation.

This device must be installed to ensure a minimum antenna separation distance of 8 in. (20 cm) from all persons.

The power module may be replaced in a hazardous area. The power module has surface resistivity greater than one gigaohm and must be properly installed in the wireless device enclosure. Care must be taken during transportation to and from the point of installation to prevent electrostatic charge build-up.

Physical access

Unauthorized personnel may pontentially cause significant damage to and/or misconfiguration of end users' equipment. This could be international 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 unathorized personnel end users assets. This is true for all systems used within the facility.

NOTICE

The Rosemount 848T Wireless and all other wireless devices should be installed only after the Wireless Gateway has been installed and is functioning properly. Wireless devices should also be powered up in order of proximity from the Wireless Gateway, beginning with the closest. This will result in a simpler and faster network installation.

Shipping considerations for wireless products (lithium batteries):

The unit was shipped to you without the power module installed. Remove the power module prior to shipping.

Each power module contains two "C" size primary lithium batteries. Primary lithium batteries are regulated in transportation by the U. S. Department of Transportation, and are also covered by IATA (International Air Transport Association), ICAO (International Civil Aviation Organization), and ARD (European Ground Transportation of Dangerous Goods). It is the responsibility of the shipper to ensure compliance with these or any other local requirements. Consult current regulations and requirements before shipping.

Contents

1 Introduction

1.1 Using this manual

This manual is designed to assist in the installation, operation, and maintenance of Rosemount™ 848T Wireless Temperature Transmitter.

Introduction

- Manual and Transmitter Overview
- Considerations
- Return of Materials
- Product Recycling/Disposal

Configuration

- Introduction
- Bench Top Configuration
- Default Settings
- Device Network Configuration
- Sensor Configuration
- Advanced Configuration

Installation

- Wireless Considerations
- Sensor Connections
- Physical Installation
- 4-20 Milliamp Inputs

Commissioning

- Insert Power Module
- Network Status
- Verify Operation

Operation and Maintenance

- Calibration
- Power Module Replacement

Troubleshooting

- General Information

Specifications and Reference Data

- Specification

- Dimensional drawings
- Ordering Information

Product Certifications

- Product Certifications
- Installation Drawings

Rosemount 848T Wireless Temperature Transmitter

Features of the Rosemount 848T Wireless include:

- Up to four independently configurable RTD, thermocouple, ohm, millivolt, and 4–20 mA inputs
- Eight user-configurable alerts for process and device variables
- Efficient wireless network utilization by sending all four sensor readings in one transmitted message
- Installation and operational savings for high density applications

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

- Rosemount Volume 1 Temperature Sensors and Accessories (English)
- Rosemount DIN-Style Temperature Sensors and Thermowells (Metric)

1.2 Safety messages

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

⚠ WARNING

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

Make sure only qualified personnel perform the installation.

Explosions could result in death or serious injury.

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

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

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.

⚠ WARNING

Electrical shock could cause death or serious injury.

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

The power module with the wireless unit contains two “C” size cells. Each of the primary lithium/thionyl chloride battery contains approximately 2.5 grams of lithium, for a total of 5 grams in each power module. Under normal conditions, the battery materials are self-contained and are not reactive as long as the batteries and the module integrity are maintained. Care should be taken to prevent thermal, electrical or mechanical damage. Contacts should be protected to prevent premature discharge.

Battery hazards remain when cells are discharged.

Power modules should be stored in a clean and dry area. For maximum life, storage temperature should not exceed 30 °C.

1.3 Considerations

1.3.1 General

Electrical temperature sensors such as RTDs and thermocouples produce low-level signals proportional to their sensed temperature. The Rosemount 848T converts this signal into a robust *Wireless*HART® digital signal.

1.3.2 Commissioning

The transmitter can be commissioned before or after installation. It may be useful to commission it on the bench, before installation, to ensure proper operation and to become familiar with its functionality. When applicable, make sure the instruments are installed in accordance with intrinsically safe or non-incendive field wiring practices. The device will be powered whenever the power module is installed. To avoid depleting the power module, make sure it is removed when the device is not in use.

1.3.3 Mechanical

Location

When choosing an installation location and position, take into account the need for access to the transmitter. For best performance, the antenna should be vertical with the conduit entries facing downward. The antenna should have space between objects in a parallel metal plane, such as pipes or metal framework, as they may adversely affect the performance of the antenna. Place the antenna 18–36 in. (0.46–0.91 m) from any solid metal surface, building, or structure.

Note
The antenna can only rotate backwards.

1.3.4 Electrical

Power module

The Rosemount 848T Wireless Temperature Transmitter is self-powered. The power module with the wireless unit contains two “C” size primary lithium/thionyl chloride batteries. Each battery contains approximately two-and-a-half grams of lithium, for a total of five grams in each power module. Under normal conditions, the battery materials are self-contained and are not reactive as long as the batteries and the power module are maintained. Care should be taken to prevent thermal, electrical or mechanical damage. Contacts should be protected to prevent premature discharge.

⚠ Use caution when handling the power module, it may be damaged if dropped from heights in excess of 20 feet (6 m).

Sensors

Make sensor connections through the conduit entries on the bottom of the enclosure. Be sure to provide adequate clearance for cover removal.

1.3.5 Environmental

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).

Note
If the ambient temperature is outside of the specification limit, consider moving the transmitter to a location within the specified limits.

1.4 Return of materials

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

⚠ The center will ask for the following information:

- Product model
- Serial numbers
- The last process material to which the product was exposed

The center will provide:

- A Return Material Authorization (RMA) number
- Instructions and procedures that are necessary to return goods that were exposed to hazardous substances

For other locations outside North America, contact an Emerson Process Management sales representative for further instructions.

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

1.4.1 Shipping considerations for wireless products (Lithium batteries)

The unit was shipped to you without the power module installed. Please remove the power module prior to shipping the unit.

Primary lithium batteries (charged or discharged) are regulated in transportation by the U.S. Department of Transportation, and are also covered by IATA (International Air Transport Association), ICAO (International Civil Aviation Organization), and ARD (European Ground Transportation of Dangerous Goods). It is the responsibility of the shipper to ensure compliance with these or any other local requirements. Please consult current regulations and requirements before shipping.

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 Configuration

2.1 Overview

This section contains information on configuration and verification that should be performed prior to installation.

Field Communicator and AMS Wireless Configurator instructions are included for performing configuration functions. Additionally, Field Communicator Fast Key sequences are identified for each software function.

Example of Fast Key sequence listing

Fast Keys	1, 2, 3, etc.

2.2 Safety messages

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

⚠ WARNING

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

Make sure only qualified personnel perform the installation.

Explosions could result in death or serious injury.

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

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

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.

⚠ WARNING

This device complies with Part 15 of the FCC Rules. Operation is subject to the following conditions:

This device may not cause harmful interference. This device must accept any interference received, including interference that may cause undesired operation.

This device must be installed to ensure a minimum antenna separation distance of 8 in. (20 cm) from all persons.

⚠ WARNING

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.

2.3 Bench top configuration

Bench top configuration requires a Field Communicator or AMS Wireless Configurator. Connect the Field Communicator leads to the terminals labeled "COMM" on the terminal block, as shown in Figure 2-1.

Bench top configuration is testing of the transmitter and verifying the transmitter configuration data. Configuring the transmitter on the bench prior to installation ensures all network settings are working correctly.

When using a Field Communicator, any configuration changes made must be sent to the transmitter using the **Send** key (**F2**). AMS Wireless Configurator changes are implemented by selecting the **Apply** button.

AMS Wireless Configurator

AMS Wireless Configurator is capable of connecting to devices directly, using a HART® modem, or wirelessly using the Emerson Smart Wireless Gateway. When configuring the device, double click the device icon or right click and select **Configure**.

2.3.1 Connection diagrams

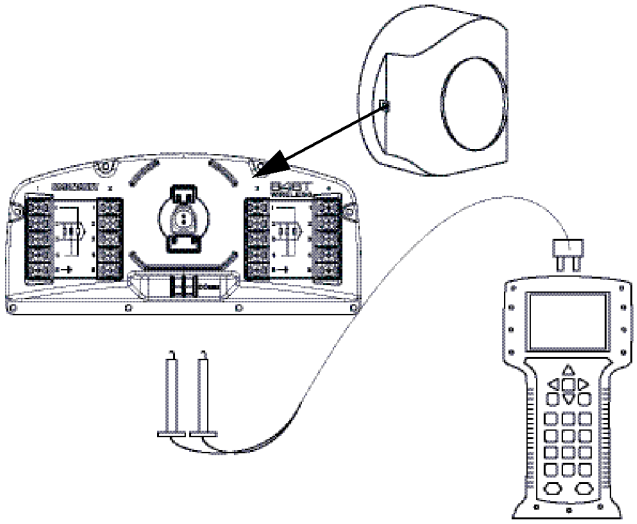
Bench hook-up

Connect the bench equipment as shown in Figure 2-1 and turn the Field Communicator on by selecting the **ON/OFF** key or log into AMS Wireless Configurator. The Field Communicator or AMS Wireless Configurator will search for a HART® compatible device and indicate when it is connected. If the Field Communicator or AMS Wireless Configurator fail to connect, it indicates that no device was found. Refer to Troubleshooting.

Field hook-up

The wiring for a field hook-up for a Field Communicator or AMS Wireless Configurator, illustrated in Figure 2-1, by connecting at "COMM" on the transmitter terminal block.

Figure 2-1: Field Communicator Connection



2.4 Default settings

The Rosemount™ 848T Wireless Transmitter default configuration is shown below:

Sensor 1	Type J Thermocouple
Sensor 2	Type J Thermocouple
Sensor 3	Type J Thermocouple
Sensor 4	Type J Thermocouple
Engineering Units	°C
Number of Lead Wires	2
Sensor Alerts	Disabled
Network ID	Factory Generated Network Parameters
Join Key	Factory Generated Network Parameters
Update Rate	1 Minute

Use the C1 option code to have the factory configure each sensor individually. This option also enables factory configuration of process alerts, update rate, and channel tag. This option code is not required to configure the self-organizing network parameters, or to set all of the sensors identically.

2.5 Device network configuration

2.5.1 Join device to network

Fast Keys	1, 12

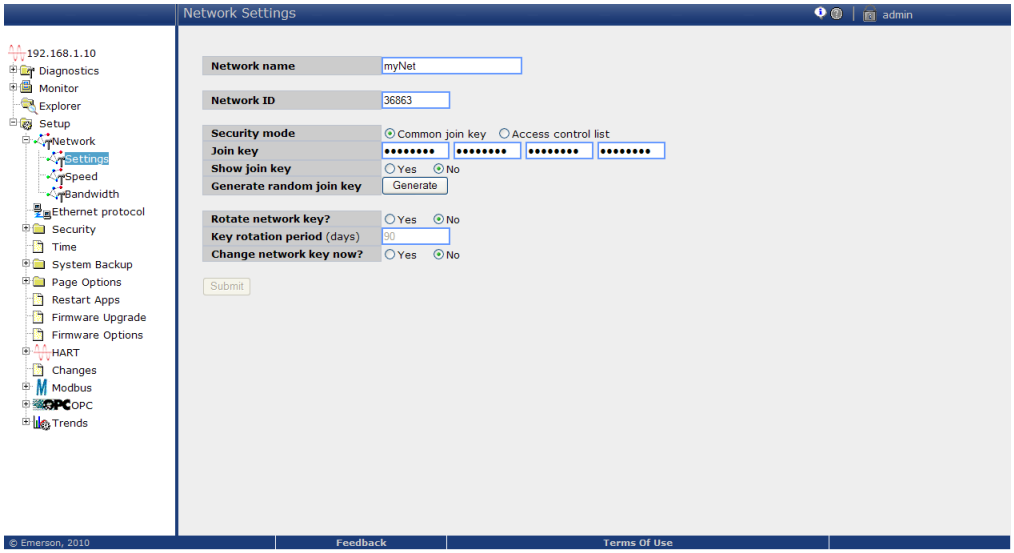
The transmitter must be configured in order to communicate with the Gateway, and ultimately with the host system. This step is the wireless equivalent of connecting wires from the transmitter to the host system.

Procedure

1. From the *Home* screen, select **2: Configure**.
2. Select **1: Guided Setup**.
3. Select **1: Join Device to Network**, and follow the on-screen instructions to complete the configuration.

   Using a Field Communicator or AMS Wireless Configurator, enter the network ID and join key so they match the network ID and join key of the Gateway, and other devices in the network. If the network ID and join key do not match the Gateway, the transmitter will not communicate with the network. The network ID and join key can be obtained from the Gateway on the **Setup** → **Network** → **Settings** page on the web server.

Figure 2-2: Wireless Gateway



2.5.2 Configure update rate

Fast Keys	2, 1, 2

The update rate is the frequency a new measurement is taken and transmitted over the wireless network. The default setting for update rate is one minute. This may be changed at commissioning, or at any time using AMS Wireless Configurator. The update rate is user selectable, and can be configured between four seconds and 60 minutes.

Procedure

1. From the *Home* screen, select **2: Configure**.

2. Select **1: Guided Setup**.
3. Select **2: Configure Update Rate**, then follow the on-screen instructions to complete the configuration.

   If using a Gateway, select **Yes** to enable optimizations. If using a third party *Wireless*HART® Gateway, select **No** to disable optimizations and consult the manufacturer's Gateway manual.

2.6 Sensor configuration

2.6.1 Configure sensor type

Fast Keys	2, 1, 3

Every temperature sensor has unique characteristics, to achieve the most accurate measurement, configure the input channels of the Rosemount 848T to match the specific sensor type.

Procedure

1. From the *Home* screen, select **2: Configure**.
2. Select **1: Guided Setup**.
3. Select **3: Configure Sensors**, then follow the on-screen instructions to complete the configuration.

   Each input can be independently configured on the Rosemount 848T. Select the desired sensor type and number of lead wires for each sensor input. If an input is not being used, **Not Used** should be selected for the sensor type. Refer to the Figure 3-4.

2.6.2 Configure engineering units

Fast Keys	2, 1, 3, 3

Each input can be configured on the Rosemount 848T for different engineering units. The supported units are °C, °F, °R, °K, millivolts, ohms, and milliamps.

Procedure

1. From the *Home* screen, select **2: Configure**.
2. Select **1: Guided Setup**.
3. Select **3: Configure Sensors**.
4. Select **3: Configure Device Engineering Units**, then follow the on-screen instructions to complete the configuration.

2.6.3 Removing the power module

After the sensor and network parameters have been configured, remove the power module and close the housing cover. The power module should only be inserted when the device is ready for commissioning.

Use caution when handling the power module; it may be damaged if dropped.

2.7 Advanced configuration (optional)

2.7.1 Configure process alerts

Fast Keys	2, 1, 5

Alerts allow the user to set the transmitter to provide a notification when the measurement readings exceed the specified temperature range. A high and low alert may be established for each sensor input. A process alert is transmitted if the trigger points are exceeded and alert mode is ON. An alert is displayed on a Field Communicator or on the AMS Wireless Configurator status screen, and will reset when the value is once again within the user-configured range.

Note
The high alert value must be set higher than the low alert value, and both values must be within the temperature sensor limits.

Procedure

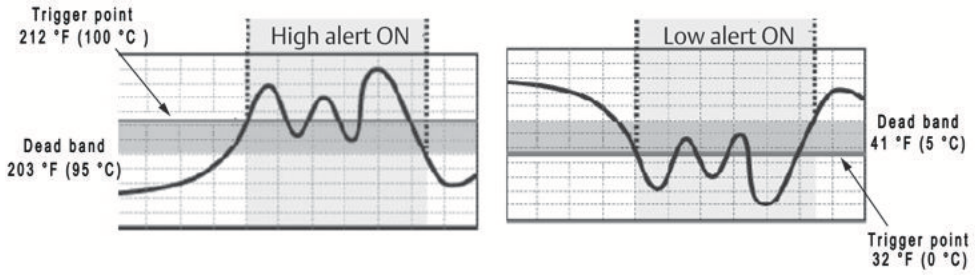
1. From the *Home* screen, select **2: Configure**.
2. Select **1: Guided Setup**.
3. Select **5: Process Alerts**, then follow the on-screen instructions to complete the configuration process.

   The user configures the trigger point and dead band for each high and low alert and when the measurement value exceeds the trigger point it activates the alert. The alert deactivates when the measurement value falls outside the dead band range.

Example

For the following illustration, the alert is active when the value rises above 212 °F (100 °C) or falls below 32 °F (0 °C). The alert turns off when the value falls below 203 °F (95 °C) or rises above 41 °F (5 °C). Dead band is a buffer so the alerts do not toggle on and off when the temperature measurement is close to the trigger point.

	High alert configuration	**Low alert configuration**
Trigger point	212 °F (100 °C)	32 °F (0 °C)
Dead band	41 °F (5 °C)	41 °F (5 °C)



2.7.2 Device temperature engineering units

Fast Keys	2, 2, 8, 3

The device temperature reported can be configured for different engineering units.

To select the sensor temperature unit:

Procedure

1. From the *Home* screen, select **2: Configure**.
2. Select **2: Manual Setup**.
3. Select **8: Device Temperature**.
4. Select **3: Unit**.

2.7.3 Write protect

Fast Keys	2, 2, 7, 1

The Rosemount 848T has a software write protect security feature.

To view write protect security settings:

Procedure

1. From the *Home* screen, select **2: Configure**.
2. Select **2: Manual Setup**.
3. Select **7: Security**.
4. Select **1: Write Protect**.

2.7.4 AC power filter

Fast Keys	2, 2, 10, 2

The AC power filter can be set to reject line power noise at either 50 or 60 Hz.

Procedure

1. From the *Home* screen, select **2: Configure**.

2. Select **2: Manual Setup**.
3. Select **10: Power**.
4. Select **2: AC Power Filter**.

2.7.5 Device tag

Fast Keys	2, 2, 9, 1

The Rosemount 848T HART device tag (eight characters) can be configured to identify the device.

Procedure

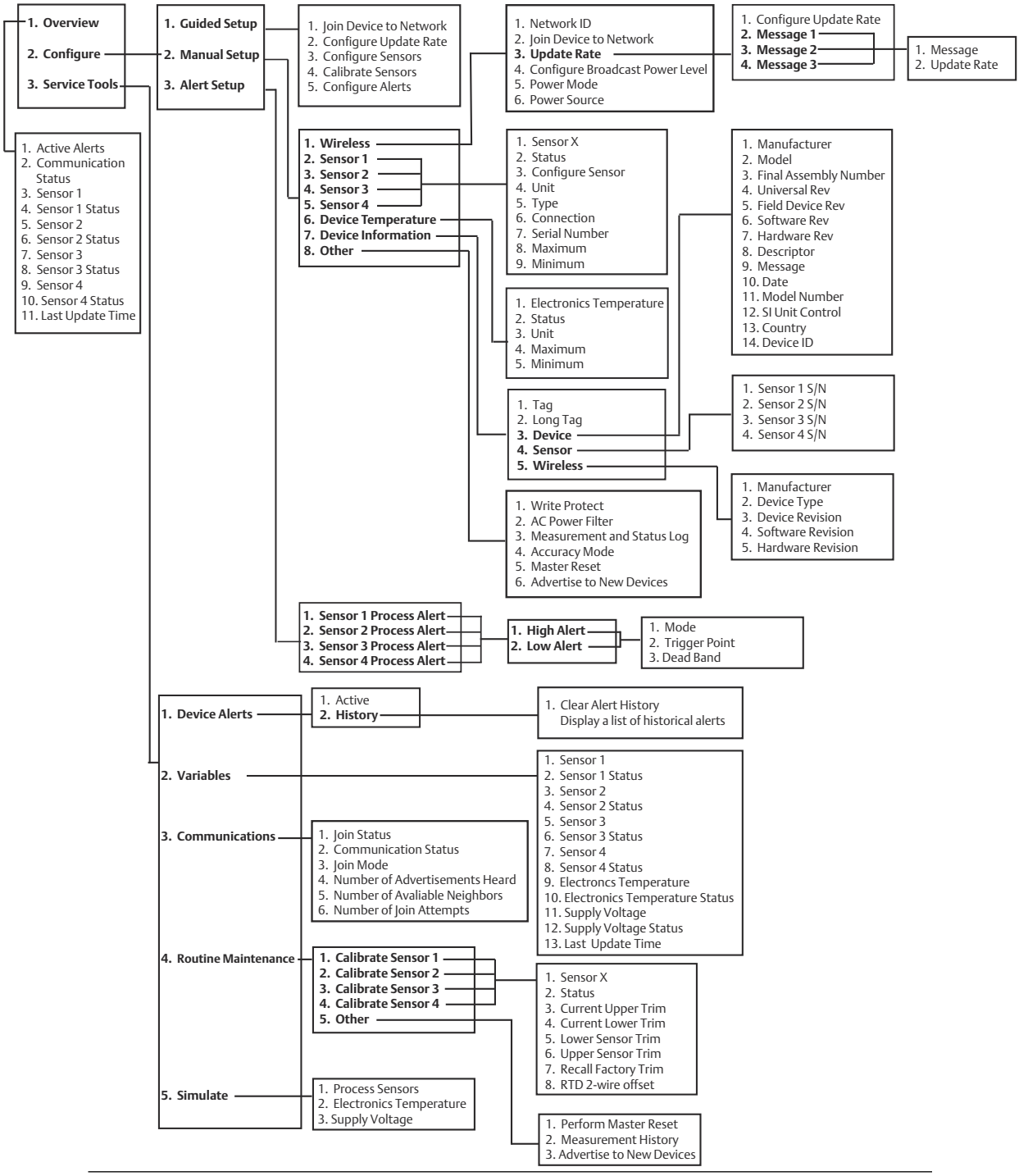
1. From the *Home* screen, select **2: Configure**.
2. Select **2: Manual Setup**.
3. Select **7: Device Information**.
4. Select **1: Tag**(1).

2.7.6 HART menu tree

Options listed in bold type indicate 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.

*(1) A long tag (consisting of 32 characters) can be configured using the Fast Key sequence by selecting **2: Long Tag**.*

Figure 2-3: Field Communicator Menu Tree



2.7.7 Fast Key sequences

Table 2-1 lists the Fast Key sequences for common transmitter functions.

Note
The Fast Key sequences assume that Device v3, DD v1 is being used.

Table 2-1: Rosemount 848T Wireless Fast Key Sequence

Function	Key sequence	Menu items
Device Information	1, 13	Tag, Long Tag, Descriptor, Message, Date, SI Unit Restriction, Country and Sensors
Guided Setup	2, 1	Join Device to Network, Configure Update Rate, Configure Sensors, Calibrate Sensors, Process Alerts
Manual Setup	2, 2	Wireless, Sensor 1, Sensor 2, Sensor 3, Sensor 4, Hart, Security, Device Temperature, Device Information, Power
Wireless	2, 2, 1	Network ID, Join Device to Network, Broadcast Information, including Update Rate and Messages
Sensor Calibration	3, 4, 2–5	Sensor Status, Current Upper Trim, Current Lower Trim, Lower Sensor Trim, Upper Sensor Trim, Recall Factory Trim, RTD 2 Wire Offset

3 Installation

3.1 Safety messages

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

⚠ WARNING

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

Make sure only qualified personnel perform the installation.

Explosions could result in death or serious injury.

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

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

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.

Device cover is on a hinge and in certain installation configurations, the cover could swing open. Use caution when opening transmitter cover.

3.2 Wireless considerations

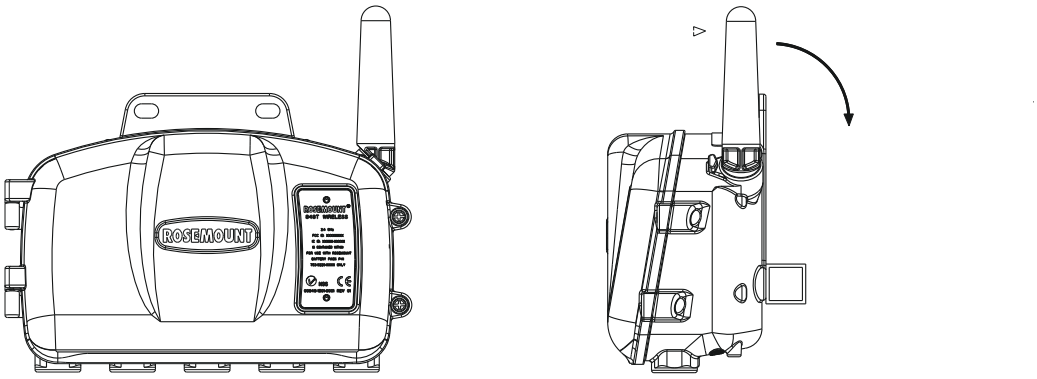
Power up sequence

The Power Module should not be installed on any wireless device until the Wireless Gateway (“Gateway”) is installed and functioning properly. Wireless devices should also be powered up in order of proximity from the Gateway, beginning with the closest. This will result in a simpler and faster network installation. Enable Active Advertising on the Gateway to ensure that new devices join the network faster. For more information, see the Emerson Wireless 1420 Gateway.

Antenna position

The antenna should be positioned vertically and it should be approximately 3 ft. (1 m) from any large structure, building, or conductive surface to allow for clear communication to other devices.

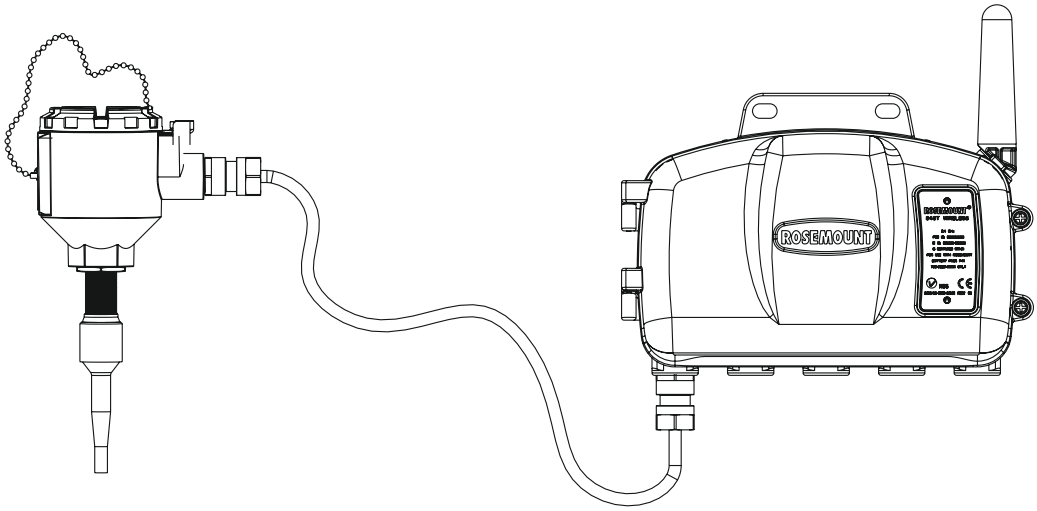
Figure 3-1: Antenna Position



Conduit plug

The temporary orange plugs should be replaced with the included conduit plugs using approved thread sealant.

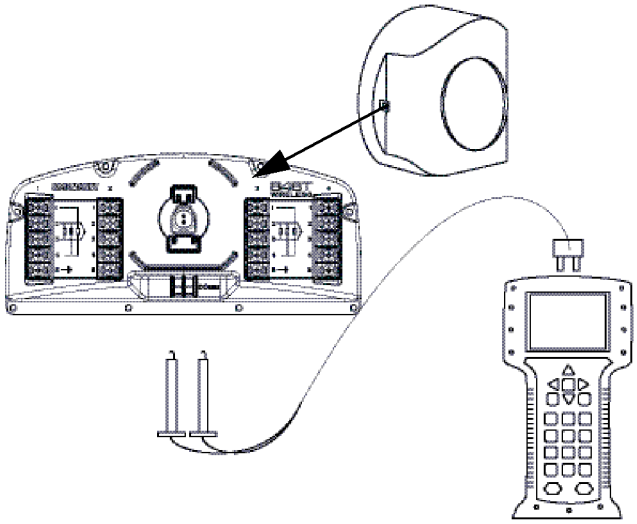
Figure 3-2: Conduit Plug



Field Communicator connections

The Power Module needs to be connected for the Field Communicator to interface with the Rosemount™ 848T Wireless.

Figure 3-3: Field Communicator Connection Diagram



3.3 Sensor connections

The Rosemount 848T is compatible with a number of RTD and thermocouple sensor types.

Figure 3-4 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.

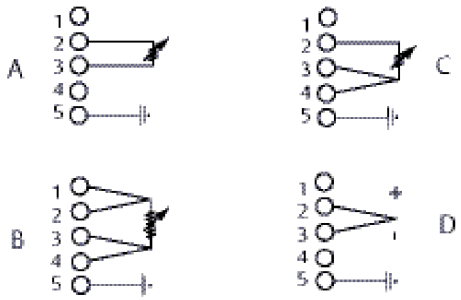
Thermocouple or millivolt inputs

Use appropriate thermocouple extension wire to remote mount the transmitter from the sensor. Make millivolt input connections with copper wire. Use shielding for long runs of wire.

RTD or ohm inputs

There are various RTD configurations, including the 2-, 3-, and 4-wire, used in industrial applications. A 3- or 4-wire RTD operates within specification, without recalibration, for lead wire resistances up to 60 ohms per lead. This is the equivalent of 6,000 ft of 20 AWG wire. For a 2-wire RTD, both RTD leads are in series with the sensor element, so an error can occur in lead lengths that exceed one foot of 20 AWG wire. This error can be eliminated by using a 3- or 4-wire RTD.

Figure 3-4: Sensor Wiring Connections

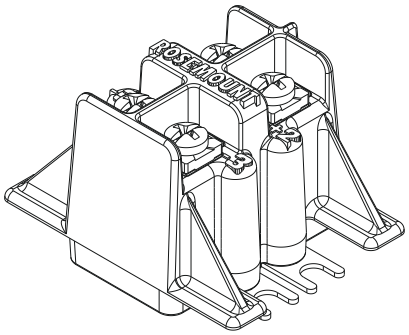


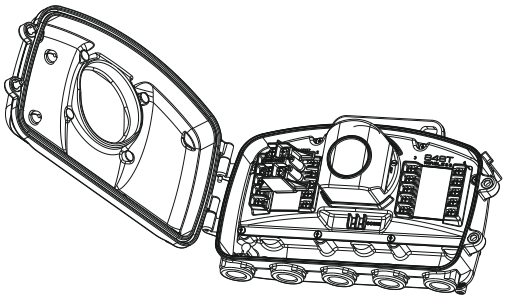
A	2-wire RTD, ohm
B	4-wire RTD, ohm
C	3-wire RTD, ohm
D	Thermocouple, millivolt

Refer to Grounding practices for more information on sensor grounding practices.

3.3.1 0-10 Volts inputs

The 848T Wireless voltage adapter allows voltage measurement from 1-10 volts. For this capability, one or two adapters are required. Each adapter accommodates two voltage inputs, and can be installed interchangeably on inputs 1 and 2 or 3 and 4.



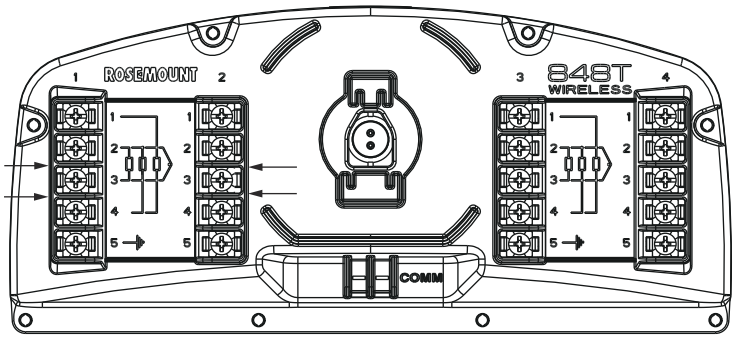


To install voltage adapter:

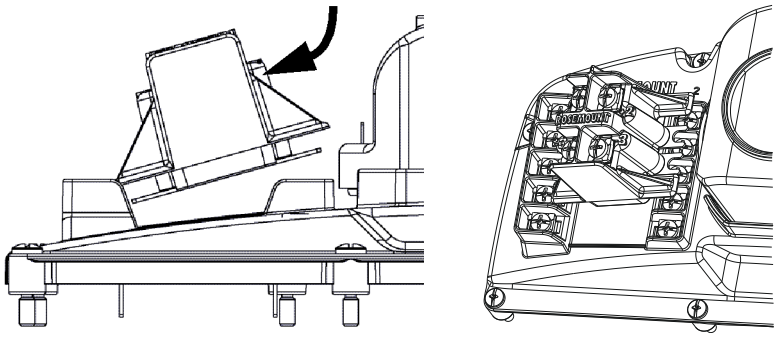
Procedure

1. Open terminal screws 2 and 3 on BOTH inputs.

Note
The screws are captive and should NOT be completely removed by using excess force.



2. Angle adapter and slide spade lugs into terminals 2 and 3 on the left side, as shown in the figure below. Ensure that the positive and negative polarity indicators match on the adapter and the terminal block.



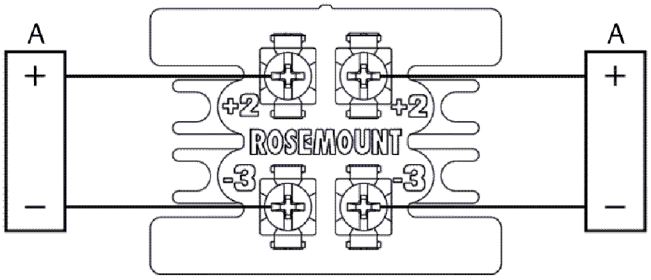
3. Lower right side of adapter into terminals 2 and 3 on the right side and center the adapter.
4. Tighten all terminal screws to lock divider in place.

3.3.2 Wiring 0-10 volt inputs on the voltage adapter

Wiring voltage 0-10 volt inputs using the adapter follows the same procedure as mV inputs and thermocouples.

Figure 3-5 below shows how to connect the voltage leads.

Figure 3-5: Voltage Leads Connection



A Voltage source (0 -10 V)

Adapter requirements

Procedure

1. The adapter is only designed to be used with the 1000 mV sensor type, found on device revisions 3 and above. If it is ordered pre-installed from the factory, this will be the default sensor type. If the adapter is ordered as a spare part, the user must configure the inputs to this sensor type. The user is responsible for converting the 0-1000 mV transmitter output into a 0-10 volt scale. The formula to do this is as follows:

$$\frac{\text{Transmitter output (in mV)}}{100} = \text{Actual reading (in V)}$$

2. If input type S004 ((1) dual channel voltage adapter) is ordered, it will be factory installed on channels 1 and 2. However, if the adapter is required to be installed on channels 3 and 4, the procedure to do so is a simple process. Confirm that channels 3 and 4 are configured for 1000 mV sensor input. After confirmation, remove the adapter from channels 1 and 2 and follow the steps provided in the 'Installing the Optional Voltage Adapter' section of this guide to install it on channels 3 and 4.

   Note
   In order to ensure the device remains within the accuracy specifications, the effect of source impedance must be checked. Loaded to unloaded, the impedance ratio cannot exceed 0.1 percent.

3. Using a digital voltmeter with sufficient resolution, compare the source voltage while disconnected and connected to the voltage adapter. Using a non-zero signal, the ratio of connected to disconnected should be ≥ 0.999, if it is smaller, it may be necessary to reduce the lead resistance between the source and the voltage divider, or to use a voltage source with lower internal resistance. If neither of these is practical, a sensor trim may be performed to compensate, assuming the source resistance is constant over the voltage range of interest the procedure for performing a Sensor trim.

3.3.3 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. A 3-wire sensor will not fully cancel lead resistance error because it cannot compensate for imbalances in resistance. Using the same type and length 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 3-1: Examples of Approximate Basic Error

Sensor Input	Approximate Basic Error
4-wire RTD	Negligible (independent of lead wire resistance up to 60 Ω per lead)
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
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)

3.3.4 Pt100 4-wire RTD

No lead wire resistance effect

3.3.5 Pt100 3-wire RTD

Lead wire imbalance seen by the transmitter = 0.5 Ω

$$\text{Basic Error} = \frac{0.5\ \Omega}{\left(0.00385\ \frac{\Omega}{\Omega\,^{\circ}\text{C}}\right) \times (100\ \Omega)} = 1.3\ ^{\circ}\text{C}$$

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

$$\frac{(\alpha_{Cu}) \times (\Delta T_{amb}) \times (\text{Imbalance of Lead Wires})}{(\alpha_{Pt} \times R_0)}$$

$$\frac{\left(0.0039\,\frac{\Omega}{\Omega\,^{\circ}C}\right)\times(25\,^{\circ}C)\times(0.5\,\Omega)}{\left(0.00385\,\frac{\Omega}{\Omega\,^{\circ}C}\right)\times(100\,\Omega)} = \pm 0.1266\,^{\circ}C$$

3.3.6 Pt100 2-wire RTD

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

Basic Error = $\frac{7.5\,\Omega}{\left(0.00385\,\frac{\Omega}{\Omega\,^{\circ}C}\right)\times(100\,\Omega)} = 19.5\,^{\circ}C$

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

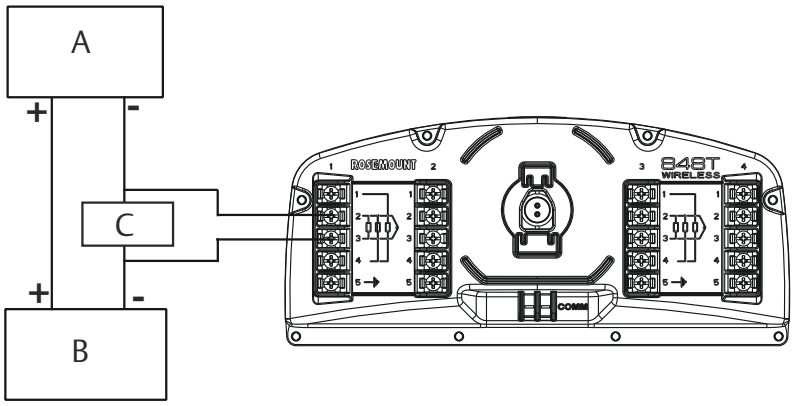
$$\frac{(\alpha_{Cu})\times(\Delta T_{amb})\times(\text{Lead Wires Resistance})}{(\alpha_{Pt}\times R_0)}$$

$$\frac{\left(0.0039\,\frac{\Omega}{\Omega\,^{\circ}C}\right)\times(25\,^{\circ}C)\times(7.5\,\Omega)}{\left(0.00385\,\frac{\Omega}{\Omega\,^{\circ}C}\right)\times(100\,\Omega)} = \pm 1.9\,^{\circ}C$$

3.3.7 4–20 milliamp inputs

This section details the wiring and configuration of the 848T to monitor a 4–20 mA signal using the S002 option code. This technique is used to capture data from a 4–20 mA device that does not have a connection to traditional loop control or monitoring system.The 848T measures millivolt signals, to monitor a 4–20 mA signal there must be a conversion to millivolt using a 5 ohm resistor to create a 20–100 mV signal. It is optimal to use a 5 ohm resistor with stable operation over the ambient temperature range where the 848T is located. See Figure 3-6 below for information on wiring.

Figure 3-6: 848T Wireless Terminal Diagram



A 4–20 mA device

B Power supply

C 5 ohm

Note

For a device to be Intrinsically Safe, it must operate on only one power source. By converting a 4–20 mA signal to a measurable millivolt signal, it is considered as a second power source in the terminal block of the 848T, and voids the Intrinsically Safe approval. This does not affect the division 2, non-incendive approvals so this configuration can still be installed and operated in division 2 areas. Also, this technique should not be applied to a 4–20 mA device currently connected to a loop control.

The mA signal should not be directly applied to the transmitter's millivolt terminals. Doing this without the resistor may damage the electronics. The voltage applied across the terminals should not exceed 1000 mV. Excessive voltage could damage the transmitter.

Using the Field Communicator or AMS, reconfigure the 848T sensor type to either 4–20 mA (Rosemount), 4–20 mA (NAMUR), 100 mV, or 1000mV. Note that when measuring voltages less than 100mV, the 100mV sensor type should be selected for best accuracy. The engineering units are user-selectable and can be either mA or mV. Table 3-2 shows the saturation and alarm thresholds for 4–20 mA (Rosemount) sensor type and Table 3-3 shows the saturation and alarm thresholds for 4–20 mA (NAMUR) sensor type.

Table 3-2: 4–20 mA (Rosemount) Saturation and Alarm

Transmitter status	Analog input (mA)	Measured voltage (mV)	Analog region
Sensor Saturation	> 21.71	> 108.55	Upper Alarm
Sensor Out of Limits	20.8–21.71	104–108.55	Upper Saturation
Good	3.9–20.8	19.5–104	Normal Region
Sensor Out of Limits	3.79–3.9	18.95–19.5	Lower Saturation
Sensor Saturation	< 3.79	< 18.95	Lower Alarm

Table 3-3: 4–20 mA (NAMUR) Saturation and Alarm

Transmitter status	Analog input (mA)	Measured voltage (mV)	Analog region
Sensor Saturation	> 20.96	> 104.8	Upper Alarm
Sensor Out of Limits	20.5–20.96	102.5–104.8	Upper Saturation
Good	3.8–20.5	19–102.5	Normal Region
Sensor Out of Limits	3.64–3.8	18.2–19	Lower Saturation
Sensor Saturation	< 3.64	< 18.2	Lower Alarm

Because of resistor variances, the input must be calibrated with the resistor installed to meet the Accuracy specifications. For more information on lower and upper trim procedures, see Calibration.

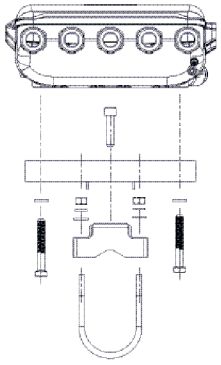
3.4 Physical installation

3.4.1 Remote mount

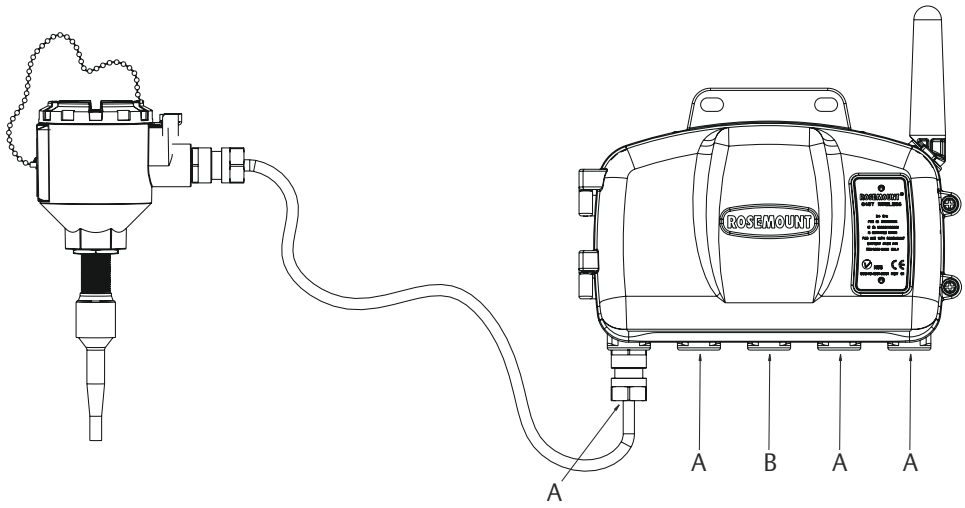
The Rosemount 848T is only intended to be installed in the Remote Mount configuration where the sensor is mounted separate from the Rosemount 848T housing, then connected to the transmitter using conduit or cable glands.

Procedure

1. Install the sensor according to standard installation practices. Be sure to use approved thread sealant on all connections.
2. To reduce sensor wiring length, mount the Rosemount 848T Wireless transmitter central to all of the measurements. When installing the Rosemount 848T wireless, the conduit entries need to be facing downward. If using the mounting bracket (Option Code B6), mount to a 2-in. pipe.



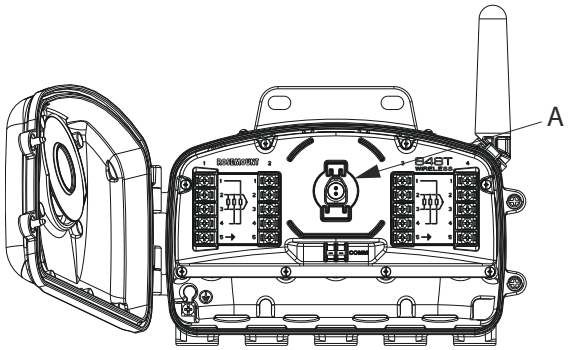
3. Run wiring (and conduit, if necessary) from the sensor to the Rosemount 848T. For an easier installation, use the outside conduit entries, as shown below. Any unused conduit entries should be sealed with an approved sealant using the included threaded conduit plug.



A Conduit entries

B Conduit plug

4. Pull the wiring through the threaded conduit entry of the Rosemount 848T.
5. Attach the sensor wiring to the terminals as indicated in Figure 3-4. Note that Terminal Screw 5 is for attaching the shield wire of the sensor to the device. See Grounding practices for more information.
6. To connect the power module, remove the plastic plug from the receptacle and discard.



A Plastic plug

7. After initial installation, close the housing cover securely. Always ensure a proper seal by installing the electronics housing cover so that metal touches metal, but do not over tighten.
8. Position the antenna vertically. The antenna should be approximately 3-ft. (1 m) from any large structures or buildings to allow clear communication to other devices.

3.4.2 Grounding practices

The transmitter operates with the housing floating or grounded. However, the extra noise in floating systems may impact many types of readout devices. If the signal appears noisy or erratic, grounding the transmitter at a single point may solve the problem.

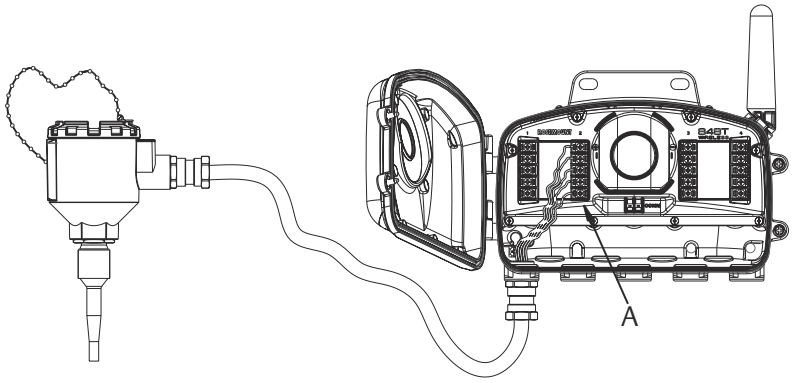
The electronics enclosure should be grounded according to local and national installation codes. This can be accomplished via the process connection, internal case grounding terminal, or the external grounding terminal.

Each process installation has different requirements for grounding, use the options recommended by the facility for the specific sensor type, or begin with the recommendations below.

Ungrounded thermocouple, mV, and RTD/ohm inputs option

Procedure

1. Connect sensor wiring shield to terminal screw 5 at the terminal block. Terminal screw 5 is internally connected to the housing.
2. Ensure the sensor wiring is electrically isolated from the transmitter housing.

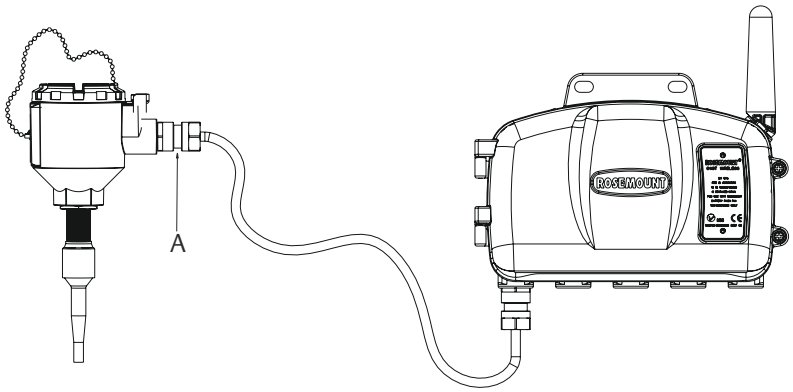


A Shield ground point

Grounded thermocouple option

Procedure

1. Ground the sensor wiring shield at the sensor.
2. Ensure the sensor wiring and shield is electrically isolated from the transmitter housing and terminal screw 5.

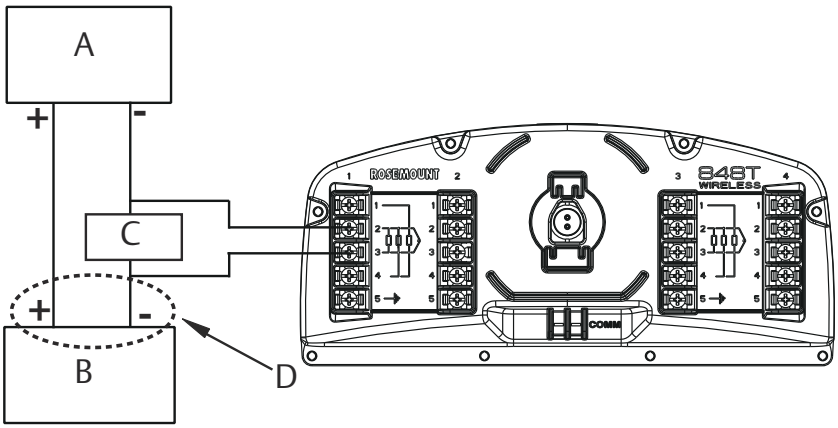


A Shield ground point

4–20 mA input option

Procedure

1. Ground the 4–20 mA signal at the power supply, making sure not to attach the signal shield to terminal screw 5.
2. The 4–20 mA signal shield should be electrically isolated from the Rosemount 848T Wireless housing and the 4–20 mA device to ensure a single point ground.



A 4–20 mA device

B Power supply

C 5 ohm

D Shield ground point

4 Commissioning

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

⚠ WARNING

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

Make sure only qualified personnel perform the installation.

Explosions could result in death or serious injury.

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

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

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.

Note
All wireless devices should be installed only after the Wireless Gateway has been installed and is functioning properly. Wireless devices should also be powered up in order of proximity from the Wireless Gateway, beginning with the closest. This will result in a simpler and faster network installation. For more information see Emerson Wireless 1420 Gateway.

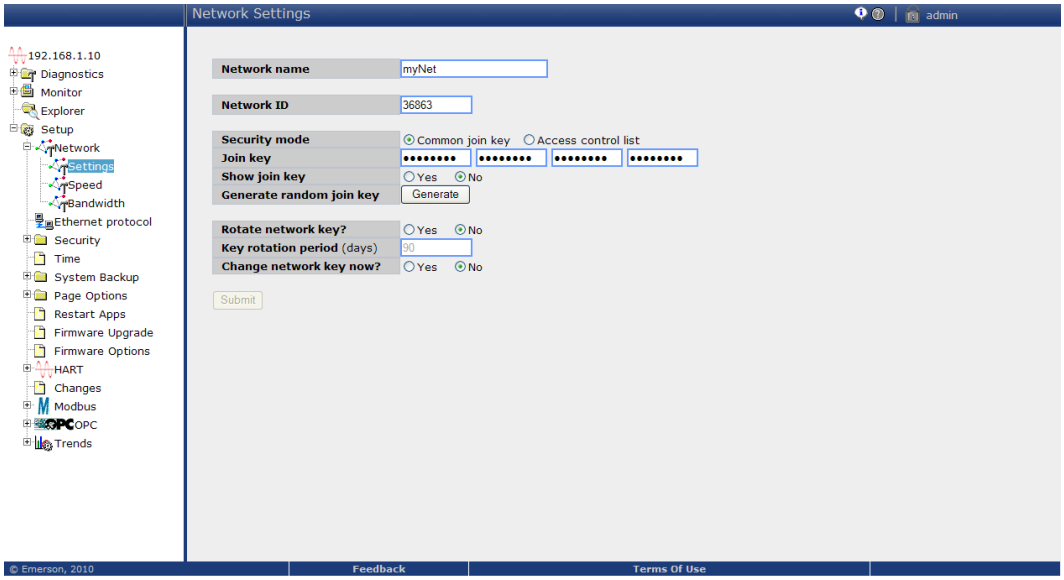
4.2 Insert power module

At commissioning, the power module needs to be inserted. If present, remove the plastic plug from the receptacle and insert the power module. Then close the housing cover, making sure to tighten the cover so that metal touches metal but do not overtighten.

4.3 Network status

If the Rosemount™ 848T Wireless Transmitter was configured with the network ID and join key and sufficient time has taken place for network polling, the transmitter should be connected to the network. To verify connectivity, open the Wireless Gateway's integral web interface and navigate to the explorer page.

Figure 4-1: Wireless Gateway Explorer Page



Note
It may take several minutes for the device to join the network.

This page displays the transmitter's HART tag, PV, SV, TV, QV, and Update Rate. If the device and sensors are working properly, a green status indicator is present for HART status. A red indicator means there is a problem with either the device, a sensor, or the communication path. If **Not Used** has been selected for a sensor, a yellow indicator is shown. For more information on a specific device, click on the tag name.

4.4 Verify operation

Operation can be verified using one of three methods: Field Communicator, the Wireless Gateway's integrated web interface, or using AMS Wireless Configurator.

Field Communicator

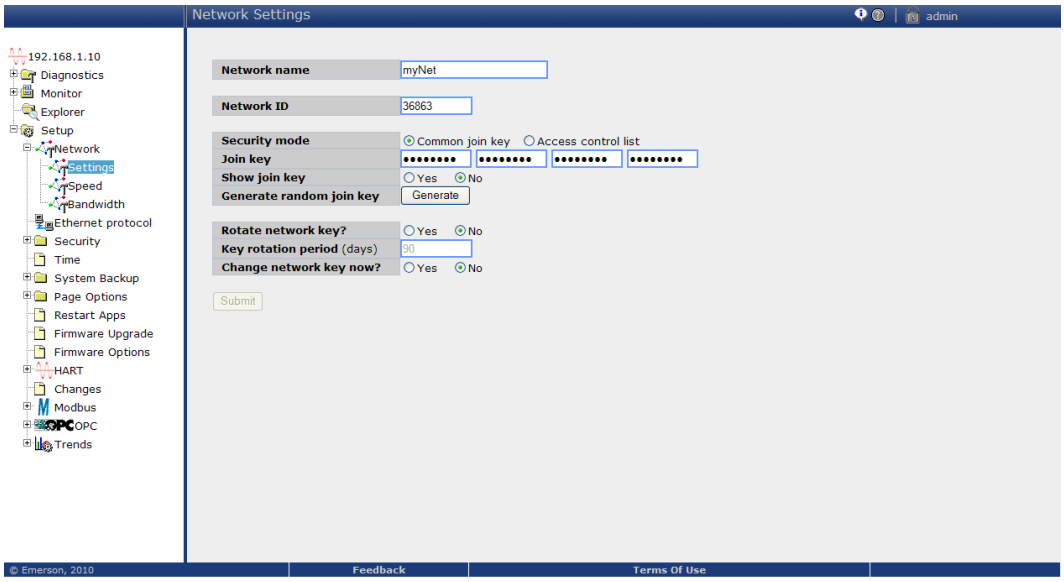
For HART communication, an 848T Wireless DD is required. For connecting with a Field Communicator, refer to Figure 3-3.

Function	Key Sequence	Menu Items
Communications	3, 3	Join Status, Communications Status, Join Mode, Number of Advertisements Heard, Number of Available Neighbors, Number of Join Attempt

Emerson Wireless Gateway

In the Gateway's integrated web interface, navigate to the Explorer page. This page shows whether the device has joined the network, and if it is communicating properly.

Figure 4-2: Wireless Gateway Explorer Page

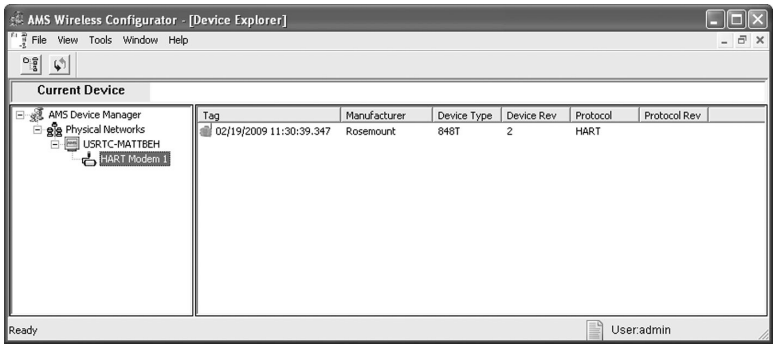


Note

If the device joins the network and immediately has an alarm present, it is likely due to sensor configuration. Check the sensor wiring (see Rosemount 848T Terminal Diagram Figure 4-2) and the sensor configuration (see 848T Fast Key sequences for handheld communicator).

4.4.1 AMS Wireless Configurator

When the device has joined the network, it will appear in the AMS Wireless Configurator as illustrated below.



5 Operation and Maintenance

5.1 Safety messages

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

⚠ WARNING

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

Make sure only qualified personnel perform the installation.

Explosions could result in death or serious injury.

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

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

Process leaks could result in death or serious injury.

Do not remove the thermowell while in operation.

Install and tighten thermowells and sensors before applying pressure.

Electrical shock could cause death or serious injury.

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

5.2 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.

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

5.2.1 Sensor trim

Fast Keys	3, 4, 2-5

To calibrate the transmitter using the sensor trim function:

Procedure

1. Assemble and power the calibration system including the 848T, Field Communicator/AMS, power supply, and temperature input source.
2. From the *Home* Screen, select **3: Service Tools**.
3. Select **4: Maintenance**.
4. Select **2-5: Calibrate Sensor 1, 2, 3, or 4**.
5. Select **5: Lower Sensor Trim**.
6. Follow the on-screen instructions to complete the adjustment of the lower value.
7. Repeat the procedure for the upper value. Select **6: Upper Sensor Trim** and follow the on-screen instructions to complete the adjustment of the upper value.
8. Verify calibration.

5.2.2 Recall factory trim

Fast Keys	3, 4, 2-5, 7

Recalling factory trim recalls the factory-characterization of the standard sensor curve stored in the transmitter firmware.

Procedure

1. From the *Home* Screen, choose **3: Service Tools**.
2. Choose **4: Maintenance**.
3. Choose **2-5: Calibrate Sensor 1, 2, 3, or 4** depending on what selection is made.
4. Choose **7: Recall Factory Trim**.

5.3 Power module replacement

Expected power module life is six years at reference conditions.(2)

When power module replacement is required, open the cover and then remove the power module. Replace the power module (part number 701PBKKF) and close the cover making sure to tighten so that metal touches metal but do not over tighten.

Handling considerations

The power module with the wireless unit contains two “C” size primary lithium/thionyl chloride batteries. Each battery contains approximately two-and-a-half grams of lithium,

(2) *Reference conditions are 70 °F (21 °C), transmit rate of once per minute, and routing data for three additional network devices.*

for a total of five grams in each pack. Under normal conditions, the battery materials are self-contained and are not reactive as long as the batteries and the power module integrity are maintained. Care should be taken to prevent thermal, electrical or mechanical damage. Contacts should be protected to prevent premature discharge.

Use caution when handling the power module. The power module may be damaged if dropped from heights in excess of 20 feet.

⚠ Battery hazards remain even after cells are fully discharged.

Environmental considerations

As with any battery, local environmental rules and regulations should be consulted for proper management of spent power module. If no specific requirements exist, recycling through a qualified recycler is encouraged. Consult the materials safety data sheet for battery specific information.

Shipping considerations

The unit is shipped to you without the power module installed. Remove the power module from the unit prior to shipping.

Primary lithium batteries are regulated in transportation by the U.S. Department of Transportation, and are also covered by International Air Transport Association (IATA), International Civil Aviation Organization (ICAO), and European Ground Transportation of Dangerous Goods (ARD). It is the responsibility of the shipper to ensure compliance with these or any other local requirements.Consult current regulations and requirements before shipping.

5.4 Spare parts

Table 5-1: Spare Parts List

Part description	Part number
Long-life power module, Intrinsically Safe	701PBKKF
O-ring for Aluminum housing cover	00849-1603-0001
Captive screws for Aluminum housing cover	00849-1602-0001
Aluminum housing cover and captive screws (o-ring included)	00849-1601-0001
Electronics module	00849-1600-0001
Kit, Spare cable gland, ½-NPT, 7.5mm - 11.9mm (qty 1)	00648-9010-0001
Kit, Spare cable gland, ½-NPT, thin wire, 3mm - 8mm (qty 1)	00648-9010-0003
Mounting bracket for 2-in. pipe mount - SST bracket and bolts	00848-4350-2001
M20 cable gland adapter (qty 4)	00849-1605-0001

6 Troubleshooting

6.1 Safety messages

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

⚠ WARNING

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

Make sure only qualified personnel perform the installation.

Explosions could result in death or serious injury.

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

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

Process leaks could result in death or serious injury.

Do not remove the thermowell while in operation.

Install and tighten switches before applying pressure.

Electrical shock could cause death or serious injury.

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

6.2 General information

Table 6-1: Device Status with Recommended Actions

Device status	Description	Recommended actions
Electronics Failure	An electronics error has occurred that could impact the device measurement reading.	1. Reset the device. 2. Reconfirm all of the configuration items in the device. 3. Contact a service center if the condition persists.

Table 6-1: Device Status with Recommended Actions *(continued)*

Device status	Description	Recommended actions
Sensor Failure	The process temperature sensor cannot be read.	1. Check the sensor wiring connections and configuration. 2. Replace the temperature sensor. 3. Contact a service center if the condition persists.
Process Sensor Out of Limits	The process temperature sensor is out of the allowed operating range.	1. Verify that the appropriate sensor is selected for the application. 2. Replace the temperature sensor with an appropriate sensor type for the process temperature range. 3. Contact a service center if the condition persists.
Process Sensor Saturated	The process temperature value has saturated and can no longer track the actual process temperature measurement.	1. Verify that the process temperature is within the valid operating limits of the temperature sensor and device. 2. Replace the temperature sensor. 3. Contact a service center if the condition persists.
Sensor High Alert	The temperature measurement has gone above the high alert configured by the user. The alert is active.	1. Check the process sensors and process conditions. 2. Check the user configured alerts.
Sensor Low Alert	The temperature measurement has dropped below the low alert configured by the user. The alert is active.	1. Check the process sensors and process conditions. 2. Check the user configured alerts.
Process Sensor Excessive EMF	There is excess voltage on the process temperature sensors.	1. Check the sensor wiring and connections. 2. Replace the process sensor. 3. Contact a service center if the condition persists.
Cold Junction Temperature Out of Limits	The cold junction compensation temperature is outside of the allowed operating limits.	1. Verify that the electronics temperature is within the device operating range. 2. Contact a service center if the condition persists.
Electronics Temperature Out of Limits	The electronics temperature is outside of the operating range of the transmitter.	1. Make sure the device is installed in an environment within the device operating temperature range. 2. Contact a service center if the condition persists.

Table 6-1: Device Status with Recommended Actions *(continued)*

Device status	Description	Recommended actions
Electronics Temperature Failure	The electronics temperature is beyond the failure limits of the transmitter.	1. Make sure the device is installed in an environment within the device operating temperature range. 2. Contact a service center if the condition persists.
Simulation Active	The device is in simulation mode and may not report actual information.	1. Disable any simulation values. 2. Contact a service center if the condition persists.
Supply Voltage Failure	The supply voltage is too low for the device to function properly.	1. Replace the power module.
Supply Voltage Out of Range	Low supply voltage may affect the operation of the device.	1. Replace the power module.
High Power Active	The device is operating in a high power mode ideal for configuration situations. If the device is self-powered, using the high power mode for long periods of time will significantly reduce the life of the power module.	1. When configuring the device, activate high power mode. 2. Upon completion of configuration, disable high power mode.

Table 6-2: Wireless Network Troubleshooting

Symptom	Recommended actions
Device not joining the network	Verify Network ID and Join Key Wait longer (30 min.) Enable High Speed Operation on Smart Wireless Gateway Check the power module Verify the device is within range of at least one other device Verify network is in active network advertise Power Cycle device to try again Verify device is configured to join Send the “Force Join” command to the device See the Troubleshooting section of the Smart Wireless Gateway manual for more information.
Short Battery Life	Check that “Power Always On” mode is off Verify the device is not installed in extreme temperatures Verify that the device is not a network pinch point Check for excessive network rejoins from poor connectivity
Limited Bandwidth Error	Reduce the Update Rate on the transmitter Increase communication paths by adding more wireless points

7 Appendix A

7.1 Product certifications

To view current product certifications, follow these steps:

Procedure

1. Go to Emerson.com/Rosemount/848T Wireless Temperature Transmitter.
2. Scroll as needed to the green menu bar and click **Documents & Drawings**.
3. Click **Manuals & Guides**.
4. Select the appropriate **Quick Start Guide**.

7.2 Ordering, information, specifications, and dimensional drawings

To view current Rosemount 848T Wireless ordering information, specifications, and dimensional drawings, follow these steps:

Procedure

1. Go to Emerson.com/Rosemount/848T Wireless Temperature Transmitter.
2. Scroll as needed to the green menu bar and click **Documents & Drawings**.
3. Click Data **Sheets & Bulletins**.
4. Select the appropriate **Product Data Sheet**.

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