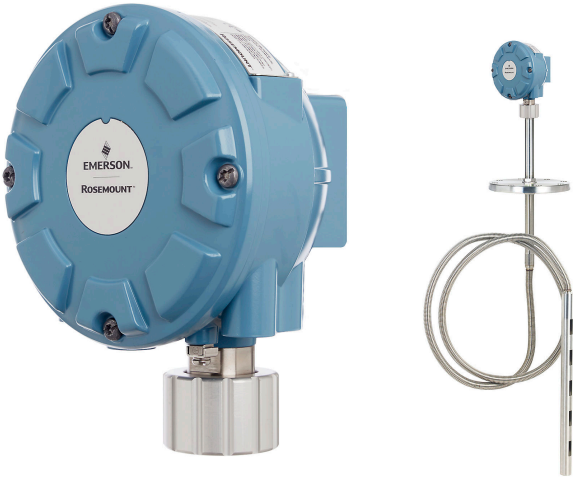


# Rosemount™ 2240S Multi-input Temperature Transmitter



**Contents**

About this guide..... 3

Overview..... 6

General information..... 8

Sensor installation..... 9

Rosemount 2240S Installation..... 17

Configuration and operation.....39

# 1 About this guide

This Quick Start Guide provides basic guidelines for installation and configuration of the Rosemount 2240S Multi-input Temperature Transmitter.

## NOTICE

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

For equipment service or support needs, contact your local Emerson Automation Solutions/Rosemount Tank Gauging representative.

## Spare Parts

Any substitution of non-recognized spare parts may jeopardize safety. Repair, e.g. substitution of components etc, may also jeopardize safety and is under no circumstances allowed.

Rosemount Tank Radar AB will not take any responsibility for faults, accidents, etc caused by non-recognized spare parts or any repair which is not made by Rosemount Tank Radar AB.

## ▲ 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 your local Emerson Sales Representative.

## ▲ WARNING

WARNING - Substitution of components may impair Intrinsic Safety.

WARNING - To prevent ignition of flammable or combustible atmospheres, disconnect power before servicing.

AVERTISSEMENT - La substitution de composants peut compromettre la sécurité intrinsèque.

AVERTISSEMENT - Ne pas ouvrir en cas de présence d'atmosphère explosive.

**⚠ WARNING****Failure to follow safe installation and servicing guidelines could result in death or serious injury.**

Ensure only qualified personnel perform the installation.

Use the equipment only as specified in this manual. Failure to do so may impair the protection provided by the equipment.

Do not perform any service other than those contained in this manual unless you are qualified.

To prevent ignition of flammable or combustible atmospheres, disconnect power before servicing.

Substitution of components may impair Intrinsic Safety.

**⚠ WARNING****Explosions could result in death or serious injury**

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

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

Do not remove the gauge cover in explosive atmospheres when the circuit is alive.

**⚠ WARNING****High voltage that may be present on leads could cause electrical shock.**

Avoid contact with the leads and terminals.

Ensure the mains power to the device is off and the lines to any other external power source are disconnected or not powered while wiring the device.

**⚠ WARNING****Electrical shock could cause death or serious injury.**

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

**⚠ WARNING****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.

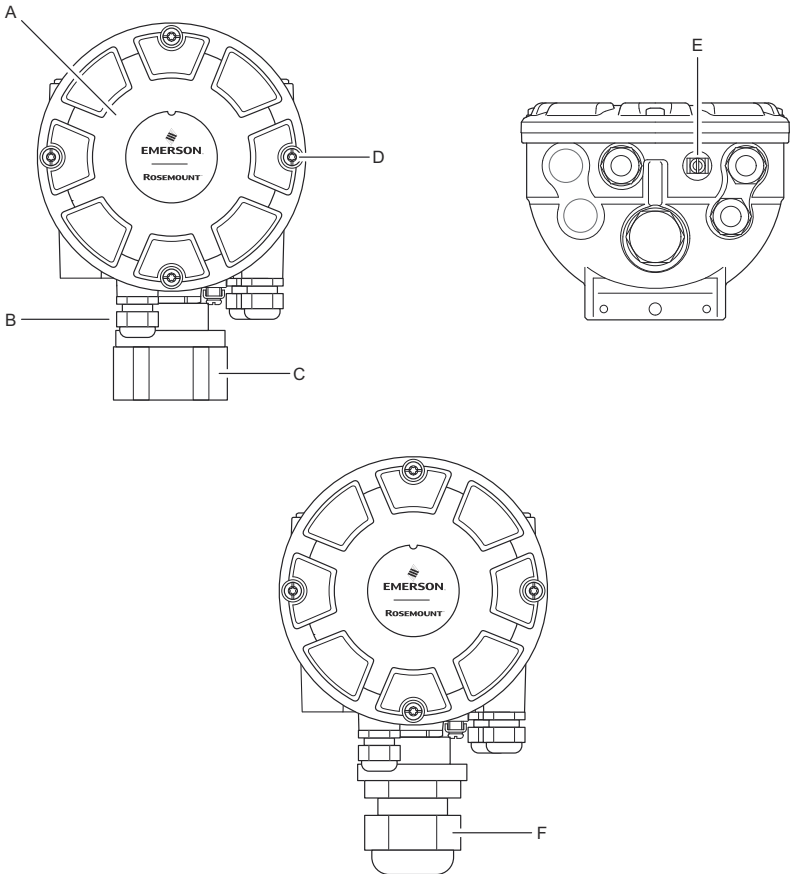
Physical security is an important part of any security program and fundamental to protecting your system. Restrict physical access by unauthorized personnel to protect end users' assets. This is true for all systems used within the facility.

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## 2 Overview

### 2.1 Components

**Figure 2-1: Rosemount 2240S Components**



- A. Cover.
- B. Entries (x 3) of type ½ - 14 NPT.
- C. Lock nut for connection of Multi Spot Temperature sensor and Water Level Sensors.
- D. Cover screws (x 4).
- E. External ground screw.
- F. M32 Cable gland (option for remote mounting).

## 2.2 Getting started

### 2.2.1 Start up a Rosemount Tank Gauging system

To start up a Rosemount Tank Gauging system do the following:

#### Procedure

1. Install the TankMaster software on the control room PC.
2. Prepare the start-up by recording the information that will be needed for configuration of the various devices as described in the Rosemount Tank Gauging [System Configuration Manual](#).
3. Connect the Rosemount 2460 System Hub to the TankMaster PC. The system hub may be connected via Modbus TCP, a Rosemount 2180 Field Bus Modem, or directly via RS232 or RS485 interface.
4. Connect the Rosemount 2410 Tank Hub to the Rosemount 2460 System Hub.
5. Connect the field devices, such as a Rosemount 5900S Radar Level Gauge and a Rosemount 2240S Multi-input Temperature Transmitter, to the Rosemount 2410 Tank Hub via the Tankbus.
6. Configure the Rosemount 2460 System Hub (if included in the system) by using the **TankMaster WinSetup** configuration software.
7. Configure the Rosemount 2410 Tank Hub by using the **TankMaster WinSetup** configuration software.
8. Configure field devices, such as the Rosemount 5900S and the Rosemount 2240S, by using the **TankMaster WinSetup** configuration software.

## 3 General information

### 3.1 Service support

For service support contact the nearest Emerson Automation Solutions /Rosemount Tank Gauging representative. Contact information can be found on the web site [www.Emerson.com](http://www.Emerson.com).

### 3.2 Product certifications

See the Rosemount 2240S [Product Certifications](#) document for detailed information on the existing approvals and certifications.

### 3.3 Product recycling/disposal

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



## 4 Sensor installation

### 4.1 Installation considerations

A Multiple Spot Temperature sensor (MST) and Water Level Sensor (WLS), such as Rosemount 565, 566, or 765, must be installed on the tank before installing the Rosemount 2240S Multi-input Temperature Transmitter.

The sensor is normally anchored to the bottom of the tank by attaching a weight at the end of the tube. A tank expands when it is filled or warmed up, causing the roof to move slightly upwards. The weight has a shackle which allows the tube to follow the expansion.

#### Multiple Spot Temperature sensor

- Be careful with the flexible protection tube
- Temperature and Water Level Sensors should be located as far away as possible from heating coils and mixers.
- In case the flexible tube is damaged, please contact Emerson Automation Solutions/Rosemount Tank Gauging.
- Do not attempt to fix or rebuild the temperature sensor since this may cause serious malfunctions

#### Water Level Sensor

- Handle the Water Level Sensor carefully
- Leave the sensor protection on until the final positioning in the tank

### 4.2 Multiple Spot Temperature sensor

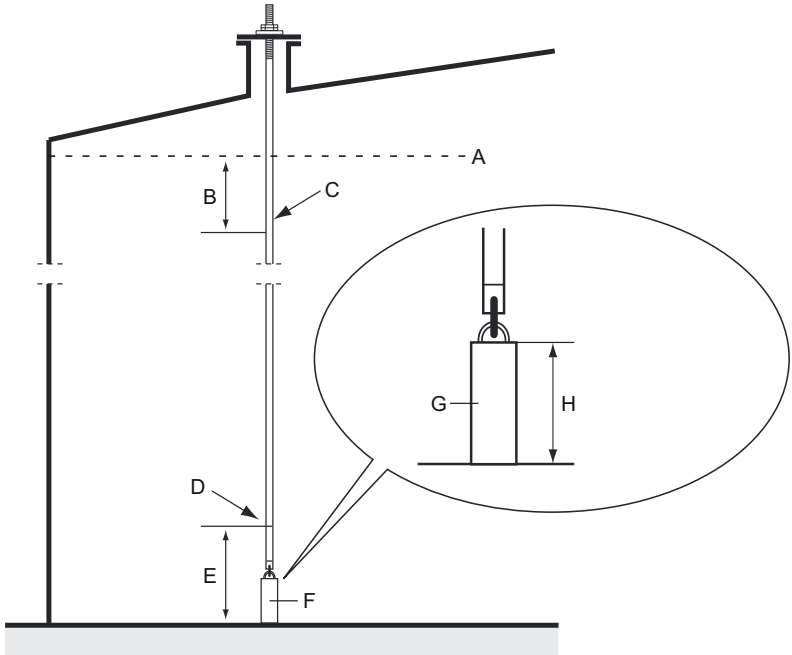
A Multiple Spot Temperature sensor (MST) typically measures the temperature with a number of Pt100 elements placed at different heights to provide a temperature profile and average temperature of the product. The spot elements are placed in a flexible gas tight tube made of stainless steel which can be anchored to the tank bottom.

Up to 16 Pt100 temperature elements can be connected to a Rosemount 2240S Multi-input Temperature Transmitter.

### 4.2.1 Installation on fixed roof tanks

On fixed roof tanks the MST is attached to a flange mounted on a suitable nozzle.

**Figure 4-1: Installation of Multiple Spot Temperature Elements on Fixed Roof Tanks**

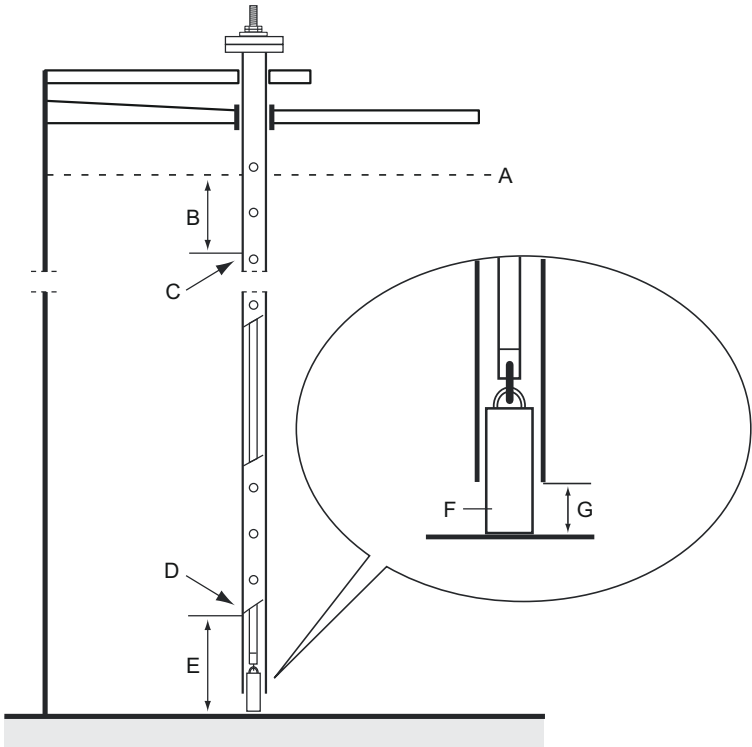


- A. Maximum product level
- B. Recommended: 0.5 to 1 m (1.6 to 3.3 ft) below maximum filling level
- C. Upper spot element
- D. First spot element
- E. Minimum 1 m (3.3 ft)
- F. Anchor weight
- G. 2-15 kg (4.4-33 lbs)
- H. 150-350 mm (5.9-13.8 in.)

#### 4.2.2 Installation on floating roof tanks

On floating roof tanks the temperature elements can be mounted in a still-pipe as illustrated in Figure 4-2 or in other suitable roof openings.

**Figure 4-2: Installation of Multiple Spot Temperature Elements in Still-pipe**



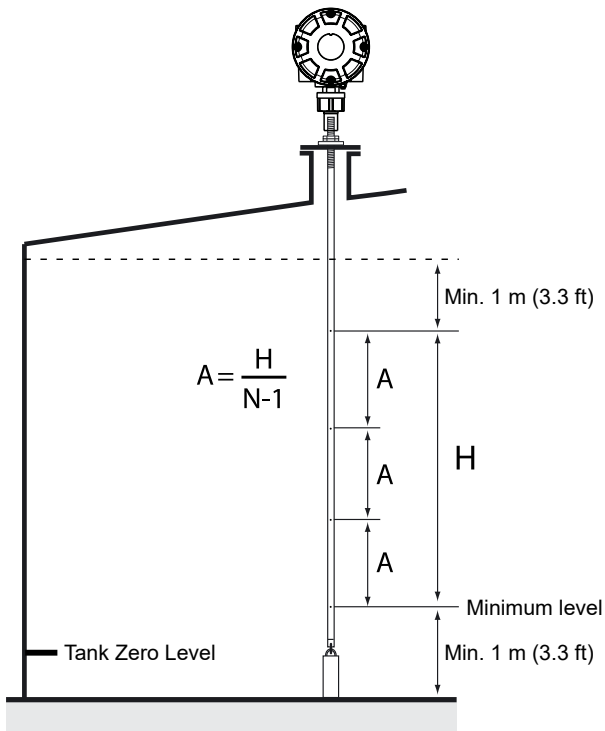
- A. Maximum level
- B. Minimum 1 m (3.3 ft)
- C. Upper spot element
- D. First spot element
- E. Minimum 1 m (3.3 ft)
- F. 2-15 kg (4.4-33 lbs)
- G. 100 mm (3.9 in.)

#### 4.2.3 Custody transfer applications

For Custody Transfer applications, API MPMS chapter 7 recommends a minimum of one temperature element per 3 meters (10 feet) as

illustrated in [Figure 4-3](#). Emerson Automation Solutions may in some cases recommend even more temperature elements for Custody Transfer tanks, depending on how the tanks are operated.

**Figure 4-3: Recommended Position of Temperature Elements for Custody Transfer Applications**



**Table 4-1: Number of Spot Sensors for Various Tube Lengths**

Tube length	Number of temp. elements
< 9 m	4
9 - 15 m	5
> 15 m	6

**Example**

5 spot sensors and H=10 m.

$$A = 10 / (5 - 1) = 2.5 \text{ m.}$$

The position of a temperature element is measured from the Tank Zero Level. See the Rosemount Tank Gauging [System Configuration](#)

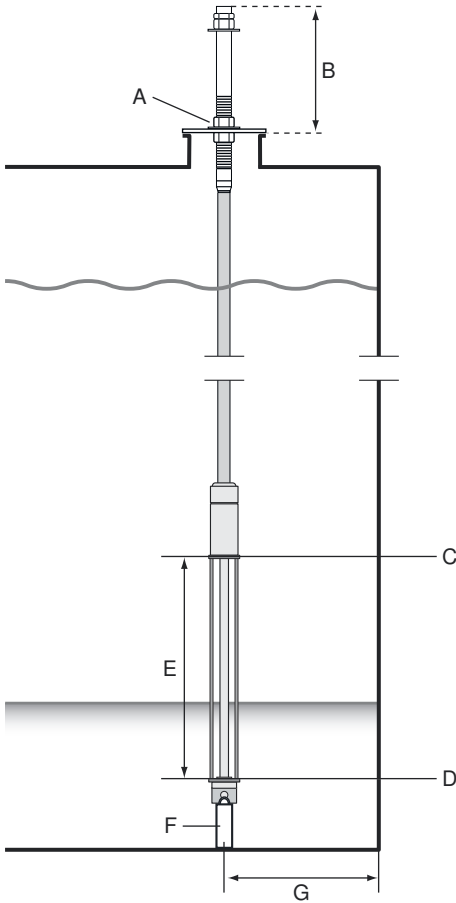
[Manual](#) for more information about how to use the TankMaster WinSetup software to configure temperature elements for average temperature calculations.

### 4.3 Water Level Sensor

The water level sensor (WLS) probe, with integrated temperature elements, is attached at the lower end of the flexible protection tube. A weight is attached to stabilize the tube as illustrated in [Figure 4-4](#). At the upper part of the sensor probe, nuts are placed at the middle of the threaded section, 350 mm below the top of the probe. This is intended as a starting point for adjusting the vertical position of the probe.

As an option, the tube may be stabilized by putting a concentric weight above the WLS probe, instead of at the end, in order to ensure that measurements are performed as close to the tank bottom as possible. Also, the eyebolt at the end of the tube can be removed.

**Figure 4-4: Water Level Sensor with Integrated Temperature Sensors**



- A. Nuts to adjust vertical position of the sensor probe
- B. 350 mm (13.8 in.)
- C. Upper Sensor Limit (100%)
- D. Lower Sensor Limit (0%)
- E. WLS Probe Active Length  
Standard: 500 mm (19.7 in.)  
Option: 1000 mm (39.4 in.)
- F. Weight
- G. Recommended minimum distance: 1 m (3.3 ft)

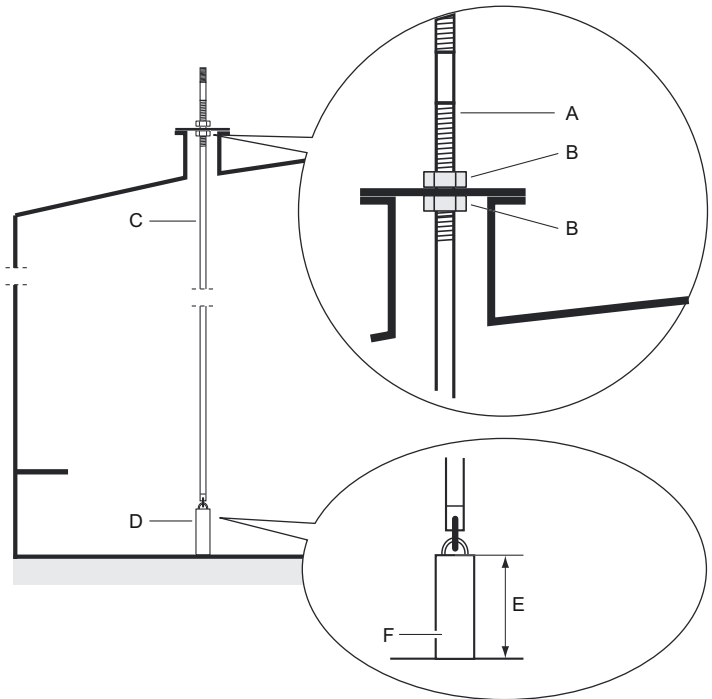
## 4.4 Installing a temperature sensor tube

Follow these steps to install the temperature sensor tube:

### Procedure

1. Mount the anchor weight on the tube.
2. Mount the tube so that the threads at the top of the tube fits the nozzle flange as illustrated in [Figure 4-5](#).

**Figure 4-5: Adjusting the Temperature Sensor Tube**



- A. Threads
- B. Lock nut
- C. Tube
- D. Anchor weight
- E. 150-350 mm (5.9-13.8 in.)
- F. 2-15 kg (4.4-33 lbs)

3. When the tube is placed on the nozzle, adjust the vertical position with the lock nuts. If a weight is placed at the end of the tube, it should barely touch the tank bottom.

---

**Note**

Ensure that the flexible protection tube is in a vertical position to obtain correct measurement data.

---

4. Install the Rosemount 2240S Multi-Input Temperature Transmitter.



## 5 Rosemount 2240S Installation

### 5.1 Installation considerations

The information in this section covers installation considerations for the Rosemount 2240S Multi-input Temperature Transmitter in order to achieve a proper installation and optimum measurement performance.

In order to reduce the required cabling, Rosemount Tank Gauging devices, including the Rosemount 2240S, are designed for daisy-chain connection of the Tankbus and shield grounding to other field devices.

The Rosemount 2240S is designed for installation:

- on top of the MST/WLS
- on top of Rosemount 614 cone
- remote on a pipe or wall

With remote mounting of the Rosemount 2240S, the nut and sleeve at the bottom of the 2240S can be replaced by a M32 cable gland, see [Components](#). See also Ordering Information in the Rosemount 2240S [Product Data Sheet](#).

When the Rosemount 2240S transmitter is installed in a hazardous area, ensure that the installation requirements according to [Hazardous areas](#) are complied with.

Ensure that the recommended cable glands/conduits are used.

Ensure that the Tankbus is correctly terminated, see [Termination](#).

Ensure that grounding is performed according to national and local electrical codes, see [Grounding](#).

Do not install the Rosemount 2240S in non-intended applications, for example environments where it may be exposed to extremely intense magnetic fields or extreme weather conditions.

Ensure that the Rosemount 2240S is installed such that it is not exposed to higher pressure and temperature than specified in [Product Data Sheet](#).

It is the responsibility of the user to ensure that the device meets the specific inside tank installation requirements such as:

- chemical compatibility of wetted materials
- design/operation pressure and temperature

## 5.2 Mechanical installation

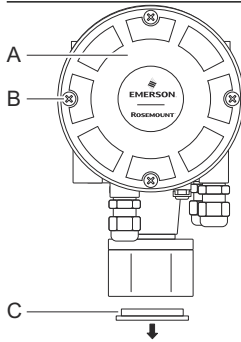
### 5.2.1 Mounting on top of a temperature sensor/WLS

#### Prerequisites

Ensure that the temperature and water level sensors are properly installed as described in [Sensor installation](#).

#### Procedure

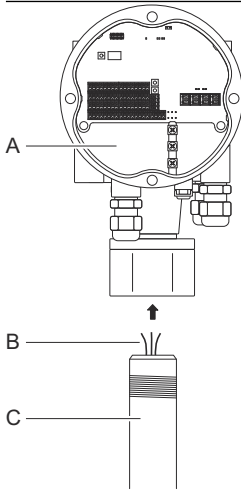
1. Unscrew the four screws and remove the cover.



- A. Cover
- B. Cover screws (x4)
- C. Plug

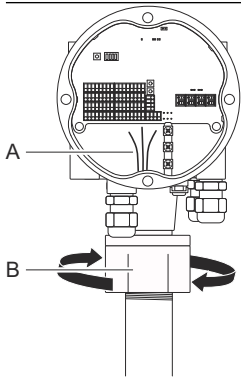
2. Remove the plug that protects the cable entry at the bottom of the Rosemount 2240S transmitter housing.

3. Attach the Rosemount 2240S transmitter on top of the temperature sensor tube.



- A. Terminal compartment
- B. Sensor wires
- C. Sensor tube

4. Run the sensor wires into the terminal compartment.
5. Tighten the nut on the transmitter by hand.



- A. Sensor wires
- B. Nut

### Postrequisites

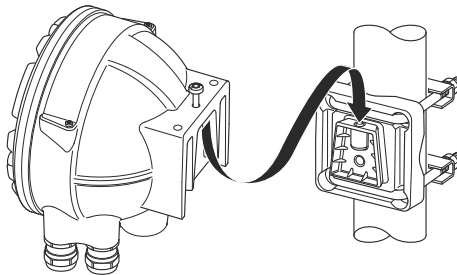
Proceed with electrical installation of Tankbus, temperature elements, and water level sensor.

### 5.2.2 Mounting on a pipe

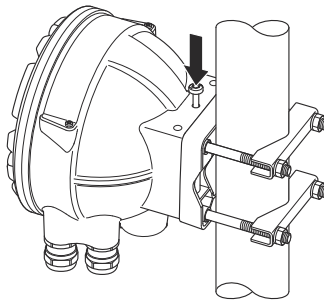
To mount Rosemount 2240S on a pipe, do the following:

#### Procedure

1. Use the four nuts to fasten the bracket on a vertical pipe. A suitable pipe size is 1 to 2 inches.
2. Attach the Rosemount 2240S transmitter to the bracket.



3. Secure the transmitter with the screw on top of the bracket.



4. Proceed with electrical installation of Tankbus, temperature elements, and water level sensor.

### 5.2.3 Wall mounting

To mount the Rosemount 2240S on a wall, do the following:

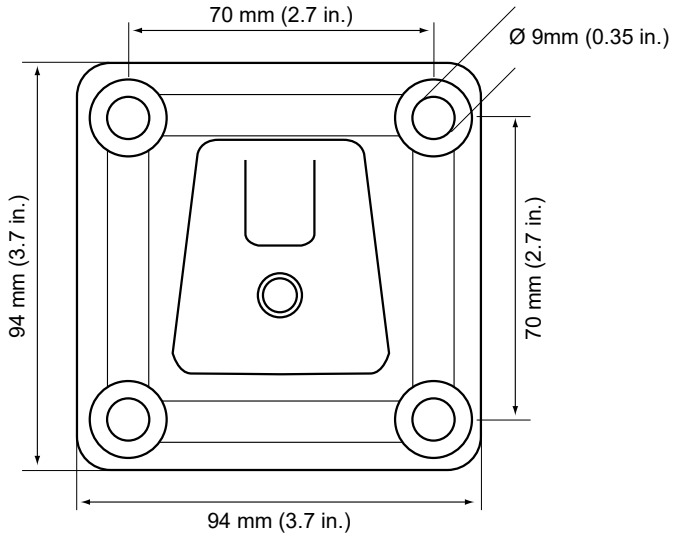
#### Procedure

1. Drill four 9 mm (0.35 in.) holes in the wall to fit the hole pattern of the bracket.

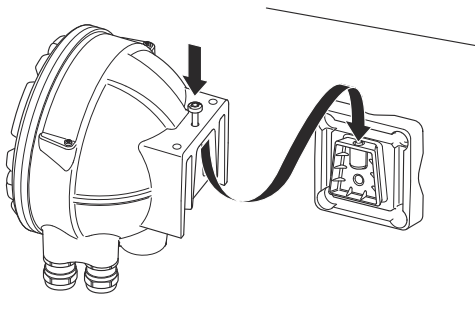
2. Mount the bracket on the wall by using four M8 screws and flat washers.

**Note**

Countersunk screws are not suitable.



3. Attach the Rosemount 2240S transmitter to the bracket and tighten the screw.



**Postrequisites**

Proceed with electrical installation of Tankbus, temperature elements, and water level sensor.

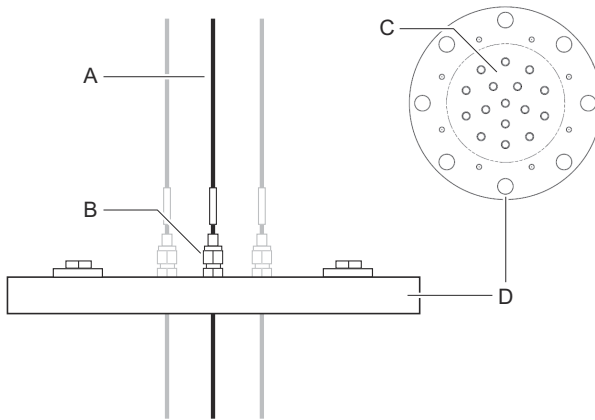
**5.2.4 Mounting the connection cone and Rosemount 614 sensor**

**Prerequisites**

Ensure that sensors are properly installed in the tank.

## Procedure

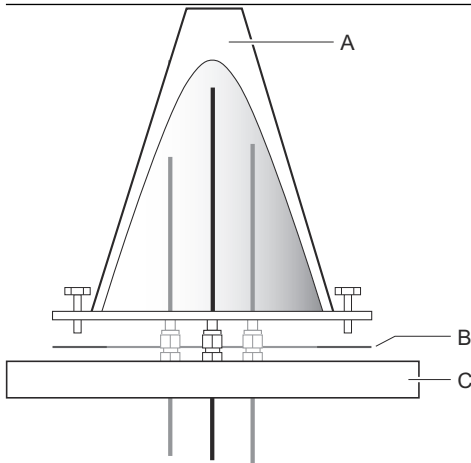
1. Attach the Rosemount 614 temperature sensors to the flange.



- A. Sensor wires
- B. Sensor fittings
- C. Holes for sensor wires
- D. Flange

2. Torque the sensor fittings to the recommended value of maximum 16 Nm. See drawing D7000 005-451.  
Note that sensor fittings should not be opened once installed.

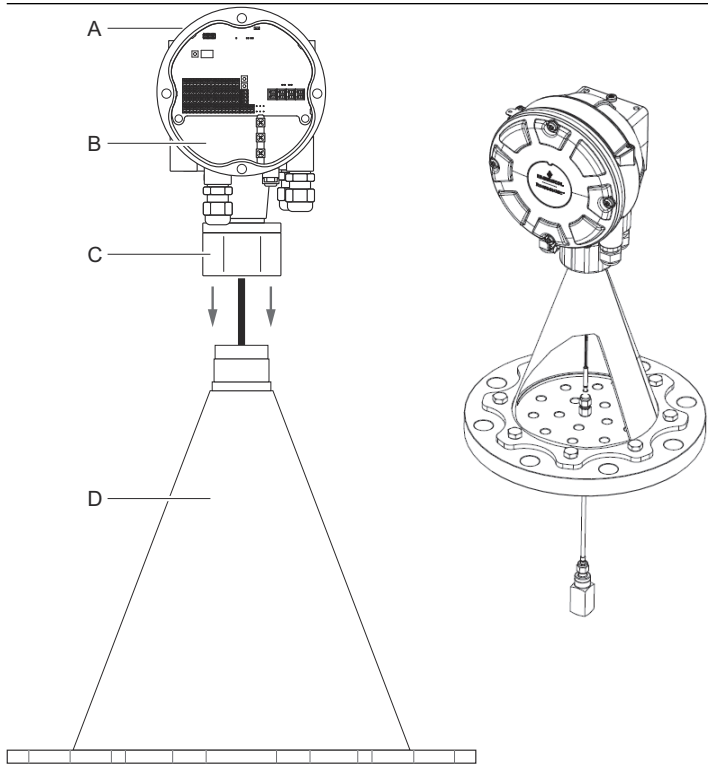
3. Attach the connection cone to the flange. Gasket and screws are shipped with the cone.



- A. *Connection cone*  
B. *Gasket*  
C. *Flange*
- 

4. Pull the wires up through the opening at the top of the connection cone.
5. Remove the cover from the Rosemount 2240S terminal compartment.

6. Place the transmitter on top of the connection cone.



- A. Rosemount 2240S transmitter
- B. Terminal compartment
- C. Nut
- D. Connection cone

7. Tighten the nut by hand.
8. Run the temperature sensor wires through the sleeve at the bottom of the transmitter housing into the terminal compartment.

### Postrequisites

Wire the temperature sensors to the Rosemount 2240S transmitter terminal block.



## 5.3 Electrical installation

### 5.3.1 Cable/conduit entries

The electronics housing has three entries for ½ - 14 NPT glands. Optional M20×1.5, minifast and eurofast adapters are also available.

For remote mounting, the nut and sleeve on the Rosemount 2240S can be replaced with a M32 gland for connection of temperature sensors/WLS.

Connections must be made in accordance with local or plant electrical codes.

Make sure that unused ports are properly sealed to prevent moisture or other contamination from entering the terminal block compartment of the electronics housing.

---

#### Note

Use the enclosed metal plugs to seal unused ports. The plastic plugs mounted at delivery are not sufficient as seal!

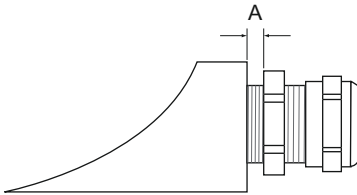
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#### Note

Thread sealing (PTFE) tape or paste on male threads of conduit is required to provide a water/dust tight conduit seal and to meet the required degree of ingress protection as well as to enable future removal of the plug/gland.

---

**Figure 5-1: Cable Entry with NPT Threaded Gland**



*A. The NPT threaded gland leaves a number of threads outside the housing*

---

Ensure that glands for the cable entries meet the following requirements:

- IP class 66 and 67
- material: metal (recommended)

### 5.3.2 Power requirements

The Rosemount 2240S temperature transmitter is powered over the Tankbus by the Rosemount 2410 Tank Hub. The Rosemount 2240S has a current consumption of 30 mA.

When installed in a FOUNDATION™ Fieldbus system, the Rosemount 2240S is powered by the FF segment.

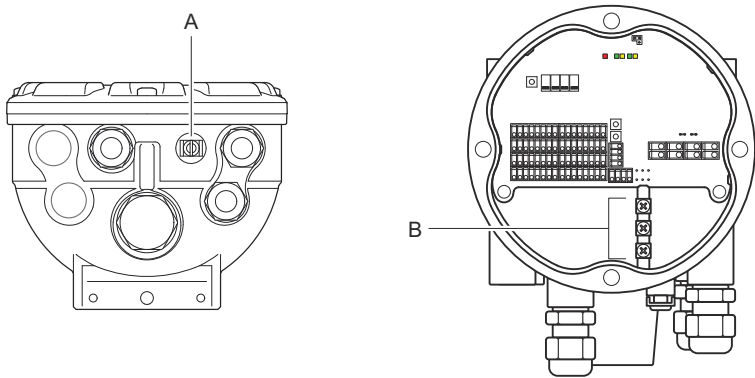
### 5.3.3 Grounding

The housing should always be grounded in accordance with national and local electrical codes. Failure to do so may impair the protection provided by the equipment. The most effective grounding method is direct connection to earth ground with minimal impedance.

There is an external grounding screw located at the bottom of the housing and three internal grounding screws located inside the housing, see [Figure 5-2](#). The internal ground screws are identified by a ground symbol: ⊕

Use the external ground terminal on the transmitter to ground the housing.

**Figure 5-2: Grounding Terminals**



- A. External ground terminal
- B. Internal ground terminals

#### Note

Grounding the transmitter using the threaded conduit connection may not provide a sufficient ground. Make sure the connection provides a sufficiently low impedance.

## Grounding - FOUNDATION™ Fieldbus

Signal wiring of the fieldbus segment can not be grounded. Grounding out one of the signal wires may shut down the entire fieldbus segment.

### Shield wire ground

To protect the fieldbus segment (Tankbus) from noise, grounding techniques for shield wire usually require a single grounding point to avoid creating a ground loop. The ground point is typically at the power supply.

In the Rosemount Tank Gauging system, a ground point is located at the Rosemount 2410 Tank Hub which acts as the power supply for devices on the Tankbus.

The Rosemount Tank Gauging devices are designed for “daisy-chain” connection of shield wiring in order to enable a continuous shield throughout the Tankbus network.

The shield loop-through terminal in the Rosemount 2240S is not connected to ground in order to provide electrical continuity to “daisy-chained” Tankbus cables.

### 5.3.4 Cable selection

Use shielded twisted pair wiring for the Rosemount 2240S in order to comply with FISCO<sup>(1)</sup> requirements and EMC regulations. The preferred cable is referred to as type “A” fieldbus cable. The cables must be suitable for the supply voltage and approved for use in hazardous areas, where applicable. In the U.S. explosion-proof conduits may be used in the vicinity of the vessel.

Use 22 AWG to 16 AWG (0.5 to 1.5 mm<sup>2</sup>) in order to minimize the voltage drop to the transmitter.

The FISCO specification requires that cables comply with the following parameters:

**Table 5-1: FISCO Cable Parameters**

Parameter <sup>(1)</sup>	Value
Loop resistance	15 Ω/km to 150 Ω/km
Loop inductance	0.4 mH/km to 1 mH/km
Capacitance	45 nF/km to 200 nF/km
Maximum length of each spur <sup>(2)</sup> cable	60 m in apparatus class IIC and IIB

(1) See IEC 61158-2 and IEC/TS 60079-27:2002.

**Table 5-1: FISCO Cable Parameters (continued)**

Parameter <sup>(1)</sup>	Value
Maximum cable length including trunk <sup>(3)</sup> and spurs	1000 m in apparatus class IIC and 1900 m in apparatus class IIB

- (1) For further information see requirements of the IEC 61158-2 standard.  
 (2) A spur is an unterminated part of the network.  
 (3) A trunk is the longest cable path between two devices on the fieldbus network, and is the part of the network which has terminations at both ends. In the Rosemount Tank Gauging system, a trunk is typically located between the Rosemount 2410 Tank Hub and a segment coupler or the last device in a daisy-chain configuration.

### 5.3.5 Hazardous areas

When the Rosemount 2240S is installed in a hazardous area, national and local regulations and specifications in applicable certificates must be observed.

#### Note

When the temperature transmitter is powered from a certified Ex [ib] or AEx [ib] FISCO Power Supply with triplicated output voltage limitation meeting the requirements for two faults (“ia” voltage limitation), e.g. a Rosemount 2410 Tank Hub via the Tankbus, the FISCO codings according to Control Drawings 9240040-910 and 9240040-976, Note 8, apply, and the Rosemount 2240S can be connected to RTDs or other sensors located in Zone 0.

However, Rosemount 2240S with ATEX and IECEx Certifications as well as Zone classification in USA and Canada is also Ex-coded Ex ia or AEx ia (part of code) for both FISCO and Entity installations. In order to maintain this coding the Rosemount 2240S must be powered from a Power Supply coded Ex [ia] or AEx [ia]. Most general FISCO power supplies are, however, coded Ex [ib] for ATEX and IECEx and if the Rosemount 2240S is powered from such a Power Supply, which has not triplicated output voltage limitation, the Rosemount 2240S coding automatically becomes Ex ib.

This means that, in this case, neither the Rosemount 2240S itself nor any RTD or other sensors connected to the RTD terminals or RS485/Modbus terminals of the Rosemount 2240S may be located in Zone 0.

### 5.3.6 Tankbus

The Rosemount Tank Gauging system is easy to install and wire. Devices can be “daisy-chained” thus reducing the number of external junction boxes.

In a Rosemount Tank Gauging system devices communicate with a Rosemount 2410 Tank Hub via the intrinsically safe Tankbus. The

Tankbus complies with the FISCO<sup>(2)</sup> FOUNDATION Fieldbus standard. The Rosemount 2410 acts as power supply to the field devices on the Tankbus. A FISCO system enables more field devices to be connected to the segment compared to conventional IS systems based on the entity concept.

## Termination

A terminator is needed at each end of a FOUNDATION™ Fieldbus network. Generally, one terminator is placed in the fieldbus power supply, and the other one in the last device in the fieldbus network.

---

### Note

Ensure that there are **two** terminators on the fieldbus.

---

In a Rosemount Tank Gauging system the Rosemount 2410 Tank Hub acts as power supply. Since the tank hub normally is the first device in the fieldbus segment, the built-in termination is enabled at factory.

Other devices such as the standard version of the Rosemount 5900S Radar Level Gauge, the Rosemount 2230 Graphical Field Display, and the Rosemount 2240S Multi-input Temperature Transmitter also have built-in terminators which can easily be enabled by inserting a jumper in the terminal block when necessary.

If the Rosemount 2240S is not the last device in the fieldbus network, disconnect the termination jumper.

## Segment design

When designing a FISCO fieldbus segment a few requirements need to be considered. Cabling has to comply with FISCO requirements.

You will also have to ensure that the total operating current of the connected field devices is within the output capability of the Rosemount 2410 Tank Hub. The 2410 is able to deliver 250<sup>(3)</sup> mA. Consequently, the number of field devices has to be considered so that the total current consumption is less than 250 mA. See section "Power Budget" in the Rosemount 2410 [Reference Manual](#) (Document no. 00809-0100-2410) for more information.

Another requirement is to ensure that all field devices have at least 9 V input voltage at their terminals. Therefore you will have to take into account the voltage drop in the fieldbus cables.

Distances are normally quite short between the Rosemount 2410 Tank Hub and field devices on the tank. In many cases you can use existing cables as long as the FISCO requirements are fulfilled.

---

(2) FISCO=Fieldbus Intrinsically Safe Concept

(3) In Smart Wireless Systems the 2410 can deliver 200 mA on the Tankbus

See chapter “The Tankbus” in the Rosemount 2410 Tank Hub [Reference Manual](#) for more information on segment design of a Rosemount Tank Gauging system.

### 5.3.7 Tankbus wiring

To connect a Rosemount 2240S:

#### Prerequisites

---

#### Note

Ensure that o-rings and seats are in good condition prior to mounting the cover in order to maintain the specified level of ingress protection. The same requirements apply for cable inlets and outlets (or plugs). It is recommended that the O-ring is replaced when the cover is opened. O-rings are available as spare parts. Cables must be properly attached to the cable glands.

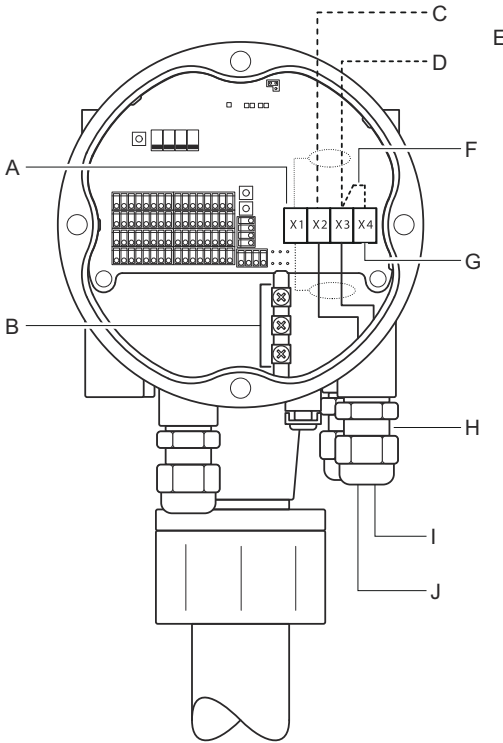
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#### Procedure

1. ⚠️ Ensure that the power supply is switched off.
2. Loosen the four screws and remove the cover from the terminal compartment.
3. Run the Tankbus wires through the appropriate cable glands or conduits.
4. Connect the Tankbus wires to the X2 and X3 terminals.
5. Connect the cable shield to the terminal marked X1.
6. In case the Rosemount 2240S is installed at the end of a Tankbus network, enable the termination by using a jumper between terminals X3 and X4.
7. Use metal plugs to seal unused ports.
8. In order to prevent water from entering the terminal compartment, ensure the cover sealing is placed in the correct position.
9. ⚠️ The cover on the terminal compartment should be tightened to mechanical stop (metal to metal).  
Make sure the cover is fully engaged to meet explosion-proof requirement and to prevent water from entering the terminal compartment.
10. Tighten the conduit/cable glands. Note that adapters are required for M20 glands.

## Terminal compartment

**Figure 5-3: Rosemount 2240S Terminal Compartment**



- A. X1: Cable Shield
- B. Internal grounding terminals
- C. X2: Tankbus (+) output
- D. X3: Tankbus (-) output
- E. Daisy-chain connection to other field devices
- F. Jumper to invoke built-in termination
- G. X4: Tankbus terminator
- H. Cable glands for Tankbus wires and temperature elements
- I. X3: Tankbus (-) input
- J. X2: Tankbus (+) input

### 5.3.8 Daisy-chain connection

The Rosemount Tank Gauging system supports daisy-chain connection of devices to the Tankbus. To daisy-chain the Rosemount 2240S to other devices do the following:

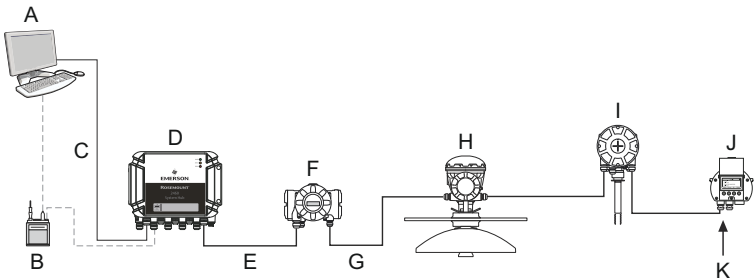
#### Procedure

1. ⚠ Make sure the power supply is switched off.
2. Loosen the four screws and remove the cover from the terminal compartment.
3. Disconnect the termination jumper from the X3 terminal.
4. Run the Tankbus cable into the Rosemount 2240S through an appropriate gland.
5. Connect the Tankbus wires to the **X2 output** and **X3 output** terminals.
6. Connect the cable shield to the X1 terminal.
7. ⚠ Attach and tighten the cover on the terminal compartment. Ensure the cover sealing is placed in the correct position.
8. Tighten the conduit/cable glands. Note that adapters are required for M20 glands.

#### Wiring diagram

A typical wiring diagram with a Rosemount 2240S is illustrated in [Figure 5-4](#). In this example, the Rosemount 2240S is daisy-chained to a Rosemount 5900S Radar Level Gauge and a Rosemount 2230 Graphical Field Display.



**Figure 5-4: Rosemount 2240S Wiring Diagram**

- A. Rosemount TankMaster
- B. Field Bus Modem
- C. Ethernet
- D. Rosemount 2460 System Hub
- E. TRL2 Modbus
- F. Rosemount 2410 Tank Hub
- G. Tankbus
- H. Rosemount 5900S Radar Level Gauge
- I. Rosemount 2240S Temperature Transmitter
- J. Rosemount 2230 Display
- K. Built-in terminator enabled on the last device

Ensure that there are only two terminators enabled on the Tankbus. As an example, in [Figure 5-4](#), one terminator is enabled in the Rosemount 2410 Tank Hub. The second terminator is enabled in the terminal compartment of the Rosemount 2230 Display since this is the last device on the Tankbus segment. Incorrect terminations may cause malfunctioning communication on the Tankbus.

### 5.3.9 Temperature element and Water Level Sensor wiring

The Rosemount 2240S is compatible with multiple element Resistance Temperature Detectors (RTDs). A Rosemount 2240S can connect up to sixteen 3- or 4-wire temperature spot elements.

Three connection types are supported: 3-wire with common return, 3-wire individual spot, and 4-wire individual spot. The Rosemount 2240S is also compatible with averaging sensor types. A maximum of 16 elements can be connected to a Rosemount 2240S transmitter.

The Rosemount 2240S is also equipped with a RS485/Modbus terminal for connection of a Water Level Sensor.

**Note**

If an averaging temperature detector is connected to the Rosemount 2240S, a DIP switch must be set.

When a Rosemount 2240S transmitter is mounted on top of a MST/WLS or a Rosemount 614 cone connection, the sensor wires will enter the terminal compartment through the sleeve at the bottom of the Rosemount 2240S housing.

In case a Rosemount 2240S is mounted on a pipe or a wall, the sleeve and nut can be replaced by an M32 cable gland.

**Number of temperature elements**

There are three wiring types that can be used for temperature elements connected to a Rosemount 2240S. The number of elements that can be connected varies depending on the type of temperature sensor that is used as illustrated in [Table 5-2](#).

**Table 5-2: Number of Temperature Elements for Various Temperature Sensors and Wiring Types**

Multiple Spot Temperature Sensor	3-wire common return	3-wire individual	4-wire individual
Rosemount 565	1-16 elements	1-16 elements	1-16 elements
Rosemount 566	1-16 elements	1-16 elements	1-16 elements
Rosemount 765	1-16 elements	1-14 elements	1-10 elements
Rosemount 614	NA	1-16 elements	1-16 elements

**Note**

Temperature elements must be connected in the order 1, 2, 3 etc. without any gaps (e.g 10 elements must be connected to channel 1-10).

**Note**

Use terminals “b”, “c”, and “d” for 3-wire connections.

See [Rosemount Tank Gauging System Data Sheet](#) for more information on various Multiple Spot Temperature Sensors.

**Connect the sensor wires**

To connect the sensor wires for a temperature detector to a Rosemount 2240S do the following:

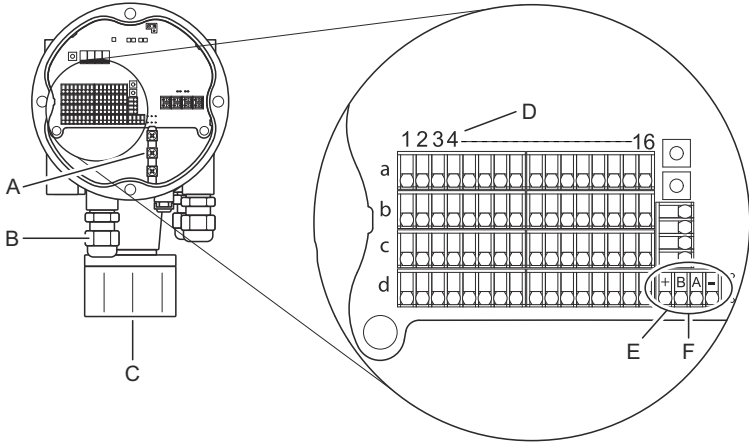
**Procedure**

1. ⚠ Make sure the power supply is switched off.

2. Loosen the four screws and remove the cover from the terminal compartment.
3. Run the wires for temperature elements and water level sensor through the sleeve at the bottom of the transmitter housing.  
If the Rosemount 2240S transmitter is mounted on a wall or pipe (remote mounting), run the sensor wires through the appropriate cable gland/conduit entry.
4. Connect the **temperature sensor** wires to the terminals marked "1" to "16" and "a", "b", "c", and "d".  
Refer to [Figure 5-6](#), [Figure 5-7](#), and [Figure 5-8](#) depending on the sensor type and measurement method that is used.
5. Connect the red, green, white, and black **water level sensor** wires to the **RS485/Modbus** terminal.
6. Connect the shield on the water level sensor cable to one of the ground terminals.
7. Make sure the cover sealing is placed in the correct position.
8. ⚠ Attach the cover on the terminal compartment and tighten the four screws.
9. Tighten the cable glands.

Terminal for connection of temperature elements

**Figure 5-5: Terminal for Connection of Temperature Elements**

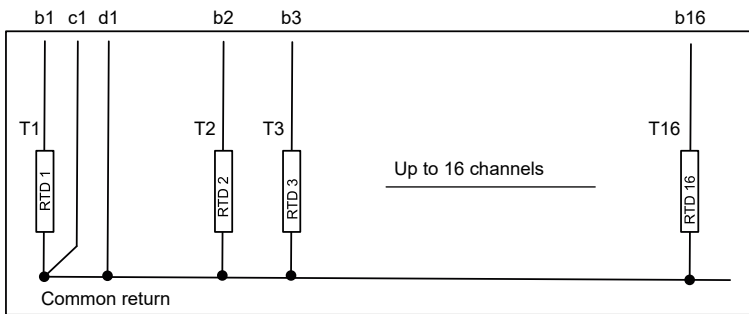


- A. Internal grounding terminals
- B. Cable entries
- C. Cable entry for integrated MST/WLS sensor
- D. RTD channel numbers ( 1 .. 16)
- E. RS485/Modbus terminal
- F. Wire color: Red (+), Green (B), White (A), Black (-)

Wiring methods

The following wiring methods are supported:

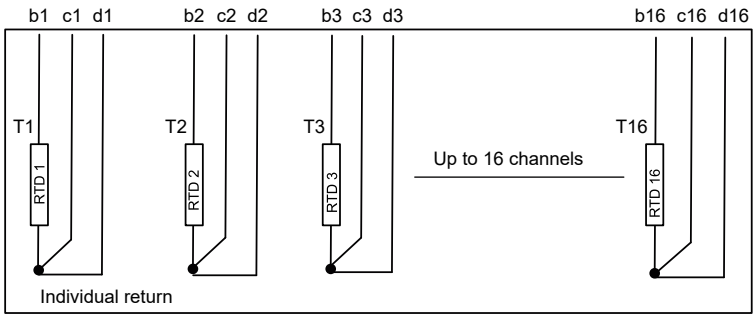
**Figure 5-6: 3-wire with Common Return**



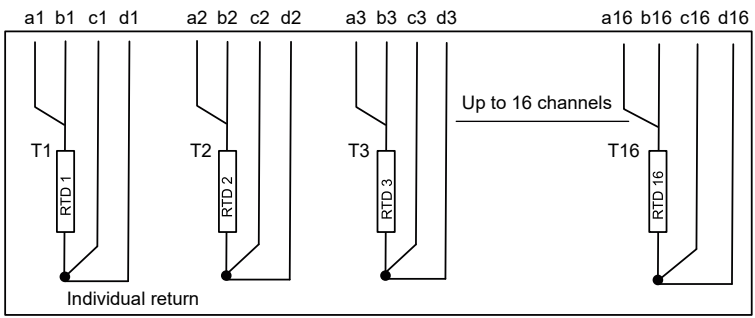
**Note**

Black wires (common/individual return) must always be connected to the c- and d- terminals on left-hand side of the terminal block.

**Figure 5-7: 3-wire Individual Spot**



**Figure 5-8: 4-wire Individual Spot**



## Cable color coding

**Table 5-3: Cable Colors for the Rosemount 565/566/765 Temperature Sensors**

<b>Temperature Element</b>	<b>Color</b>
T1	Brown
T2	Red
T3	Orange
T4	Yellow
T5	Green
T6	Blue
T7	Violet
T8	Grey
T9	White
T10	Pink
T11	Brown/Black
T12	Red/Black
T13	Orange/Black
T14	Yellow/Black
T15	Green/Black
T16	Blue/Black

## 6 Configuration and operation

### 6.1 Introduction

This chapter provides information about configuration of the Rosemount 2240S Multi-input Temperature Transmitter regardless of the configuration tool used. However, you will find frequent references to TankMaster WinSetup, which is the recommended configuration tool.

It is important that configuration is properly prepared by listing the appropriate Modbus addresses, device tags, and tank tags.

#### 6.1.1 Configuration procedure

Basically, a Rosemount 2240S can be installed and configured by one of the following methods:

- As part of the installation of a Rosemount 2410 Tank Hub. This is the standard procedure when a new system is installed, see the Rosemount Tank Gauging [System Configuration Manual](#).
- As a separate device, connected to the Tankbus of a Rosemount 2410 in an existing Rosemount Tank Gauging system. The device is configured with a suitable tool, such as TankMaster WinSetup.
- As a separate device in a FOUNDATION™ Fieldbus system. AMS Device Manager may be used for configuration.

#### 6.1.2 Parameters

##### Temperature elements

The basic configuration includes parameters for a standard configuration which is sufficient in most cases. The following parameters are configured:

- number of temperature elements
- temperature element type (Spot or Average)
- position in tank
- temperature elements excluded from average calculation
- minimum distance between element and product surface for element to be included in average temperature calculation (insert distance)

## Water Level Sensor

Configuration of the water level sensor includes:

- level offset (difference between tank zero level and water zero level)
- probe length
- upper and lower dead zone

### 6.1.3 Configuration tools

Different tools are available for configuration of a Rosemount 2240S:

- Rosemount TankMaster Winsetup
- Field Communicator
- AMS Device Manager for FOUNDATION™ Fieldbus systems
- FOUNDATION Fieldbus hosts supporting DD4

The Rosemount TankMaster Winsetup is a user-friendly software package that includes basic configuration options as well as advanced configuration and service functions.

The WinSetup package provides you with powerful and easy-to-use tools for installation and configuration, see the Rosemount Tank Gauging [System Configuration Manual](#).

For DeltaV users, the DD can be found at [www.easydeltav.com](http://www.easydeltav.com). For other hosts that use Device Descriptions (DD) and DD Methods for device configuration, the latest DD versions can be found on Foundation's website at [www.fieldbus.org](http://www.fieldbus.org).

## 6.2 Basic configuration

Temperature elements and a Water Level Sensor can be connected to the Rosemount 2240S Multi-input Temperature Transmitter.

### 6.2.1 Temperature elements

The Rosemount 2240S Multi-input Temperature Transmitter supports the configuration options listed in [Table 6-1](#) for connected temperature elements. These options can be configured in TankMaster WinSetup via the **22XX ATD** window (the **Average Temperature Calculation** and **2240 MTT Temperature Sensor** tabs). For FOUNDATION™ Fieldbus systems the AMS Device Manager can be used.



**Table 6-1: Rosemount 2240S Temperature Element Configuration**

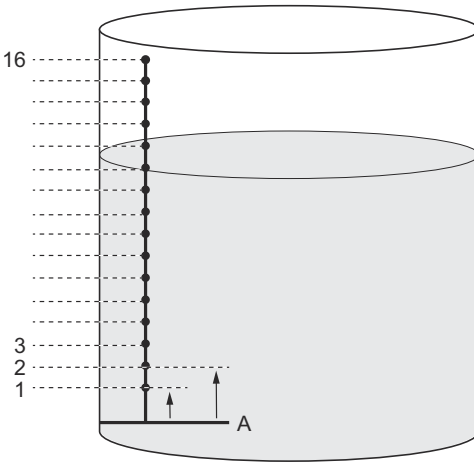
Settings	Description
Number of sensor temperature elements	Maximum 16 temperature elements <sup>(1)</sup> .
Sensor type	Spot or average sensor types are supported.
Temperature sensor element position in tank	Specify the position of each temperature element in the tank.
Exclude spot sensor element from tank average temperature calculation	You can exclude certain spot elements from the average temperature calculation.
Insert distance	Minimum distance between element and surface for element to be included in average calculation.
Default Sensor Configuration	This option controls whether the temperature sensor is automatically configured based on the "Averaging RTD" DIP switch setting, or if manual configuration is required. Default configuration means that the sensor is configured according to a specific default setting.
Conversion method	<ul style="list-style-type: none"> <li>• Auto</li> <li>• PT100 (spot)</li> <li>• CU90 (average)</li> <li>• CU90US</li> <li>• User-defined: <ul style="list-style-type: none"> <li>— linearization table</li> <li>— formula</li> <li>— individual formula</li> </ul> </li> </ul>
Temperature range	Measurement range of the temperature elements
Sensor wiring (Connection)	Type of sensor wiring: <ul style="list-style-type: none"> <li>• 3 wire spot or average with common return</li> <li>• 3 wire independent spot</li> <li>• 4 wire independent spot</li> </ul>

(1) The Rosemount 2460 System Hub supports 16 elements and the Rosemount 2160 Field Communication Unit supports a maximum of 14 temperature spot elements. However, Average Temperature will be correctly calculated by a Rosemount 2410 Tank Hub connected to a Rosemount 2240S with 16 temperature elements regardless if the tank hub is connected to a Rosemount 2460 or a Rosemount 2160.

### Temperature sensor element positions

The temperature elements are numbered from the bottom of the tank and upwards. Enter the position of each element, measured as the distance from the Zero Level (Dipping Datum Plate) to the temperature element. If you use average temperature elements, enter the position of the terminating level of each sensor element.

**Figure 6-1: Temperature Sensor Element Positions**



*A. Zero Level*

### Tank average temperature calculation

You can exclude certain spot elements from the average temperature calculation. This may be useful if, for example, the temperature close to the surface or close to the bottom of the tank deviates significantly from the temperature in the rest of the tank. This may also be accomplished by setting an appropriate value for the Insert Distance parameter.

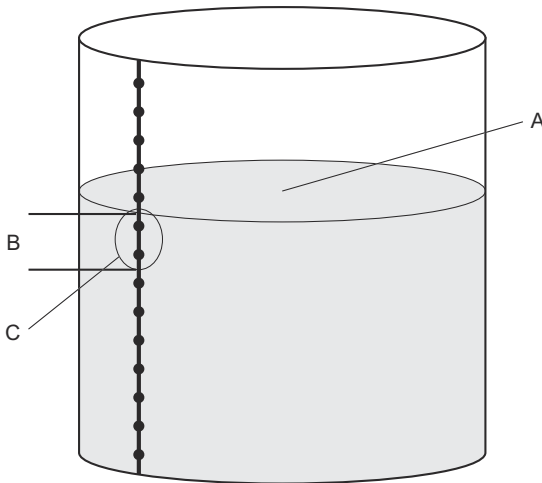
**Note**

A faulty temperature sensor will affect the temperature calculation.

### Insert distance

You can specify a minimum distance between the product surface and the first temperature spot element to be included in the average temperature calculation. If the temperature spot element is within or above the Insert Distance, the element will be excluded from the calculation.

---

**Figure 6-2: Insert distance**

- A. Product surface
  - B. Insert Distance
  - C. These sensors are not included in the average temperature calculation
- 

This function may be useful if the temperature of the atmosphere above the product surface significantly deviates from the temperature of the product itself, resulting in large temperature gradients close to the product surface. By specifying an Insert Distance, temperature elements within this region can be excluded from average temperature calculations.

The Insert Distance function can also be used to compensate for inaccuracies in the measured temperature element positions, in order to make sure that elements above the product surface are not included in the average temperature calculation. If, for example, temperature element positions are measured with an accuracy of 10 mm, setting the minimum distance to at least 10 mm will guarantee that sensors above the surface are not included in the average temperature calculations.

### 6.3 LED signals

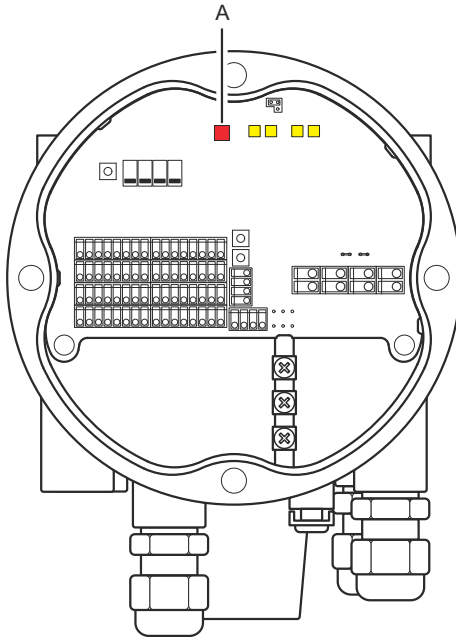
The Rosemount 2240S Multi-input Temperature Transmitter is equipped with Light Emitting Diodes (LED) in order to indicate status and communication.

### 6.3.1 Status LED

The status LED indicates:

- normal operation by flashing every other second
- calibration of the water level sensor
- error codes

**Figure 6-3: Status LED**



*A. Status LED (red)*

### Error codes

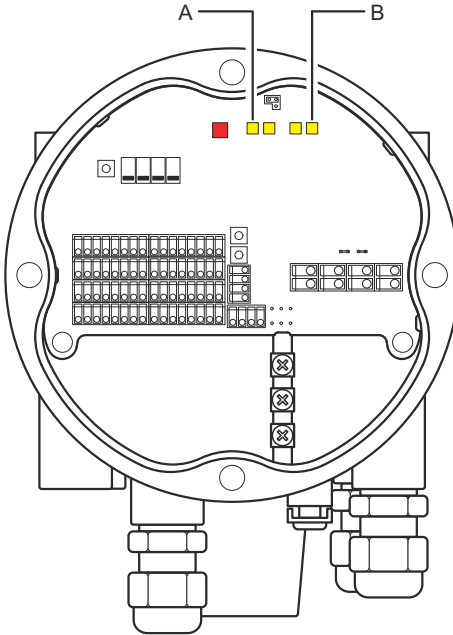
The status LED indicates error codes by using different blinking sequences. In normal operation the LED flashes once every other second. When an error occurs, the LED flashes a sequence that corresponds to a code number followed by a five second pause. This sequence is continuously repeated.

### 6.3.2 Communication LEDs

There are two pairs of LEDs that indicate communication status for the Rosemount 2240S Multi-input Temperature Transmitter:

- when a Water Level Sensor (WLS) is connected, two LED signals indicate that measurement and status information is communicated over the Sensor bus to the temperature transmitter
- two LEDs indicate that the temperature transmitter communicates with a Rosemount 2410 Tank Hub over the Tankbus

**Figure 6-4: Communication LEDs**



A. WLS - receive and transmit

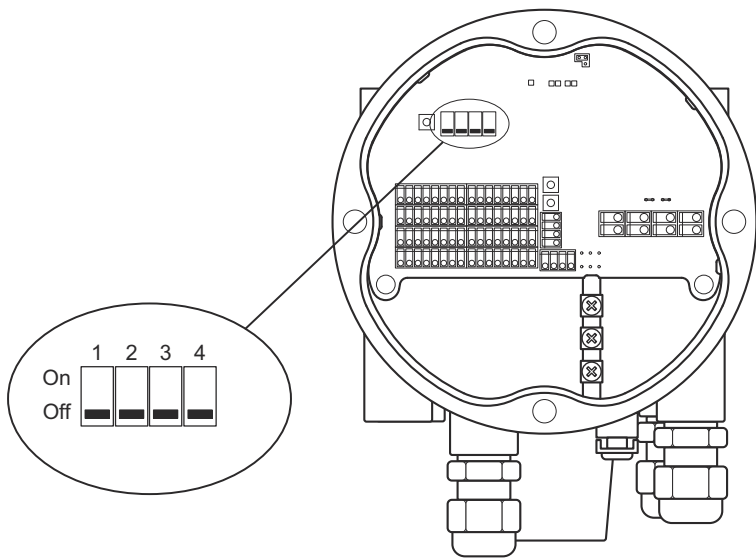
B. Tankbus - receive and transmit

## 6.4 Switches and reset buttons

### 6.4.1 DIP Switches

The Rosemount 2240S is equipped with four DIP switches, see [Figure 6-5](#).

**Figure 6-5: DIP Switches**



The switches control the following settings:

**Table 6-2: DIP Switches**

Number	Function	Description
1	SIMULATE	Enables simulation of temperature measurements and Field diagnostic alerts.
2	WRITE PROTECT	Enables write protection of configuration data.
3	SPARE	Not used.
4	AVERAGING RTD	Enables the use of an average temperature sensor.

#### The simulate switch

The **Simulate** switch can be used to simulate a resistance value from temperature elements. For FOUNDATION™ Fieldbus systems it enables simulation of Field Diagnostics alerts as well.

### The write protect switch

The **Write Protect** switch prevents unauthorized configuration changes by locking the Rosemount 2240S database registers.

### Configuration using the Average DIP switch

The Average switch enables configuration of the Rosemount 2240S according to the default settings in [Table 6-3](#).

**Table 6-3: Configuration Parameters**

Configuration Parameter	Switch in on position (Average)	Switch in off position (default)
Element Type	Average	Spot
Element Wiring	Common Return See <a href="#">Figure 5-6</a>	Common Return See <a href="#">Figure 5-6</a>
Conversion Method	Cu90	Pt100

In the **TankMaster WinSetup** configuration tool, default sensor configuration can be enabled in the configuration window for the Rosemount 2240S transmitter (**2240 MTT Temperature Sensor** tab in the **22XX ATD** window).

In case the installation does not match the default setting, you will have to configure the temperature sensor manually. See configuration of ATD devices in the Rosemount Tank Gauging [System Configuration Manual](#) for more information.

---

#### Note

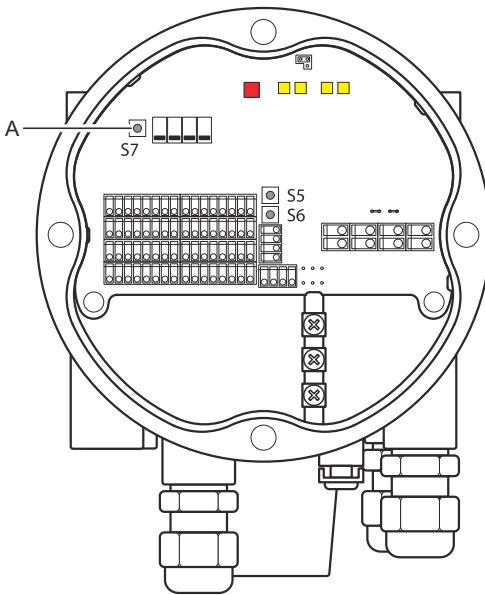
Manual configuration may override the switch settings.

---

### 6.4.2 Reset button

Use the reset button to force a restart of the processor.

**Figure 6-6: Reset Button**



A. Reset

## 6.5 Configuration using TankMaster WinSetup

The TankMaster software package provides you with powerful and easy-to-use tools for installation and configuration of a Rosemount Tank Gauging system. See the Rosemount Tank Gauging [System Configuration Manual](#) for more information on how to configure Auxiliary Tank Devices (ATD) such as the Rosemount 2240S.

### 6.5.1 Advanced configuration Average temperature calculation weight factor

You can specify a weight factor for each temperature element used in the tank average temperature calculation. This allows you to rate selected temperature elements with a larger impact on the average temperature calculation than the other elements. This is primarily used for LPG tanks.

#### Conversion methods

When using a resistance temperature element, the resistance values can be converted to temperature values by using:

- a linearization table



- a formula
- an individual formula for each temperature element

### Adjustment after sensor calibration

If the temperature sensor was ordered with sensor calibration including Callendar-Van Dusen constants the constants must be entered for each individual element using the conversion method "User Defined Individual Formula" to achieve maximum accuracy.

See the Rosemount Tank Gauging [System Configuration Manual](#) for more information.







**Quick Start Guide**  
**00825-0100-2240, Rev. AA**  
**February 2023**

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