

# Rosemount™ 5408 Level Transmitter

with Modbus® Protocol



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# 1 About this guide

This Quick Start Guide provides basic guidelines for the Rosemount 5408 Level Transmitter with Modbus® Protocol.

## **⚠ WARNING**

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

- Ensure the transmitter is installed by qualified personnel and in accordance with applicable code of practice.
- Use the equipment only as specified in this Quick Start Guide. Failure to do so may impair the protection provided by the equipment.
- For installations in hazardous locations, the transmitter must be installed according to the Rosemount 5408 Product Certifications document and System Control Drawing (D7000005-811).
- Repair, e.g. substitution of components, etc. may jeopardize safety and is under no circumstances allowed.

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.
- In Explosion-proof/Flameproof installations, do not remove the transmitter covers when power is applied to the unit.
- Both transmitter covers must be fully engaged to meet Explosion-proof/Flameproof requirements.

Electrical shock could cause death or serious injury.

- In Explosion-proof/Flameproof installations, avoid contact with the leads and terminals. High voltage that may be present on leads can cause electrical shock.
- Ensure the mains power to the transmitter is off and the lines to any other external power source are disconnected or not powered while wiring the transmitter.

**⚠ WARNING**

Process leaks could result in death or serious injury.

- Ensure that the transmitter is handled carefully. If the process seal is damaged, gas might escape from the tank.

**⚠ 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.

**⚠ CAUTION**

Hot surfaces

The flange and process seal may be hot at high process temperatures. Allow to cool before servicing.



## 2 Confirm approval type

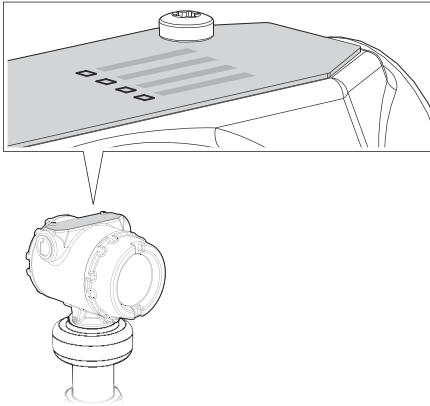
For hazardous locations transmitters labeled with multiple approval types:

### Procedure

Permanently mark the checkbox of the selected approval type(s).

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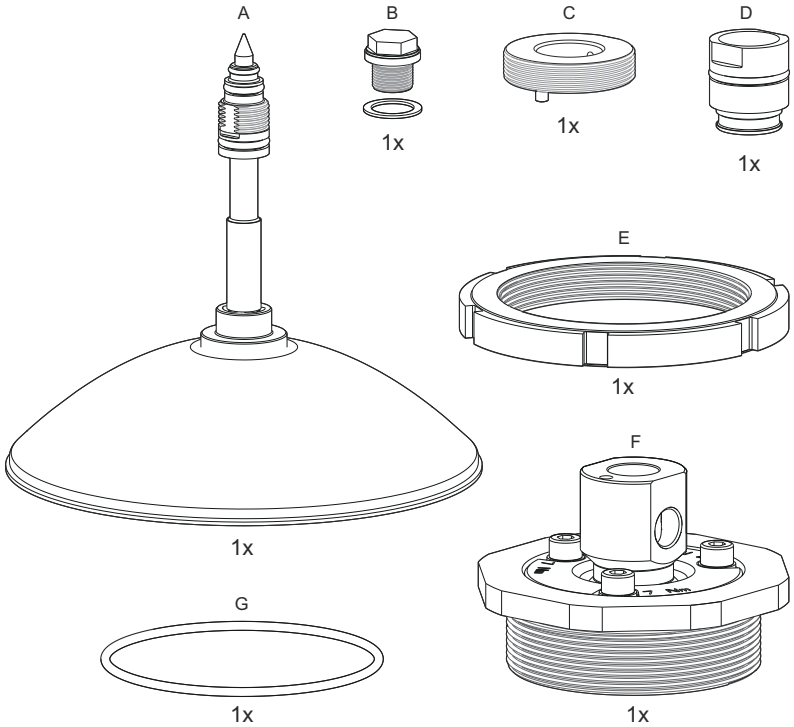
**Figure 2-1: Label with Multiple Approval Types**



### 3 Components of the parabolic antenna

#### 3.1 Components of the threaded version

**Figure 3-1: Components**



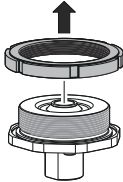
- A. Antenna
- B. Purge plug kit (blind plug and bonded seal)
- C. Threaded sleeve
- D. M20 adapter
- E. Lock nut BSPP (G) 3 1/2-in.
- F. Antenna adapter with ball joint
- G. O-ring

## 4 Mount the transmitter

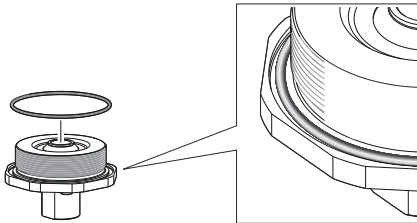
### 4.1 Mount the threaded version

#### Procedure

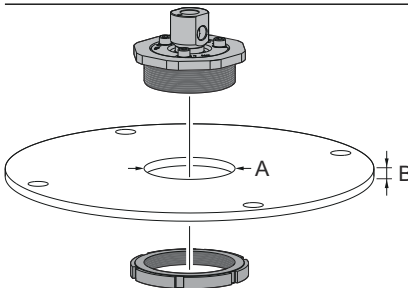
1. Remove the lock nut.



2. Mount the O-ring.



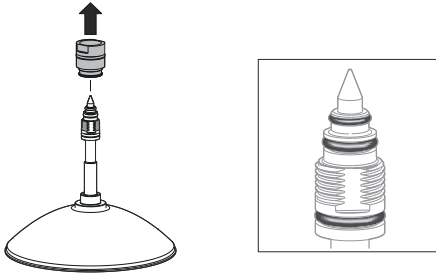
3. Mount the antenna adapter on the mounting flange plate. Ensure the antenna adapter fits tightly to the mounting flange plate.



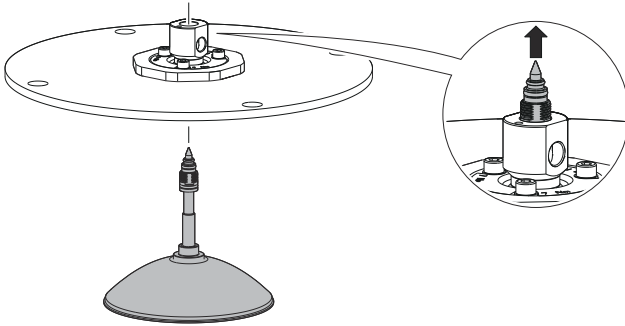
A.  $\varnothing 3.98 \pm 0.02$  in. ( $\varnothing 101 \pm 0.6$  mm) or G 3½-in.

B. Max. 0.59 in. (15 mm)

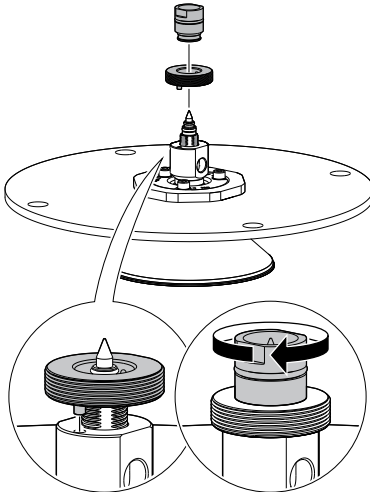
4. Remove the M20 adapter and visually inspect the O-rings for damage and dirt.




5. Carefully insert the antenna.



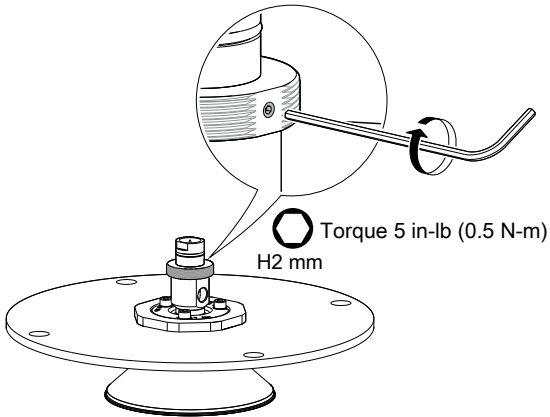
6. Secure the antenna.



 Torque 180 in-lb (20 N-m)  
27 mm



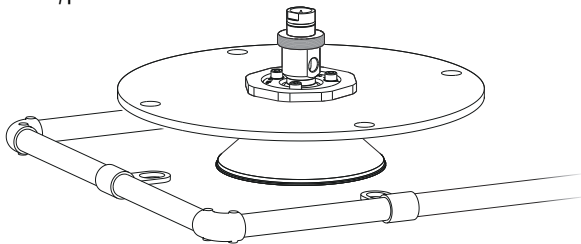
7. Tighten the set screw.



8. Position the antenna assembly onto the mounting frame.

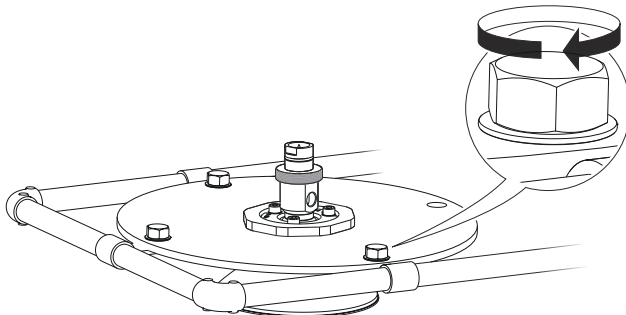
**Example**

Deck/platform mounted



9. Tighten the bolts and nuts.

It is recommended that insulating bushes are fitted to the mounting bolts.



**Postrequisites**

1. Adjust the inclination of the antenna (see [Adjust the inclination of the antenna](#)).
2. Plug and seal the air purge entry (see [Plug and seal the air purge entry](#)).

## 5 Adjust the inclination of the antenna

### Prerequisites

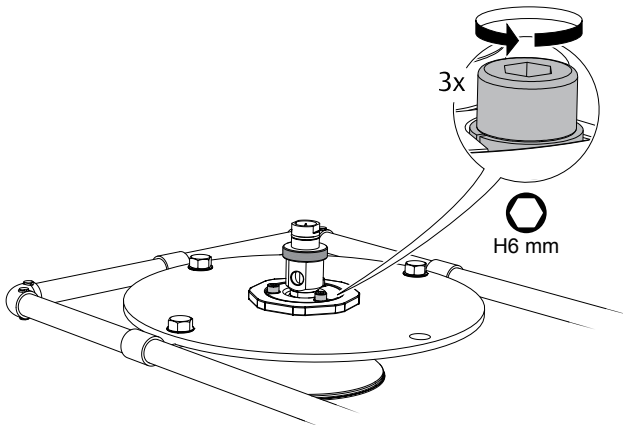
#### **⚠ WARNING**

Contents may be under pressure.

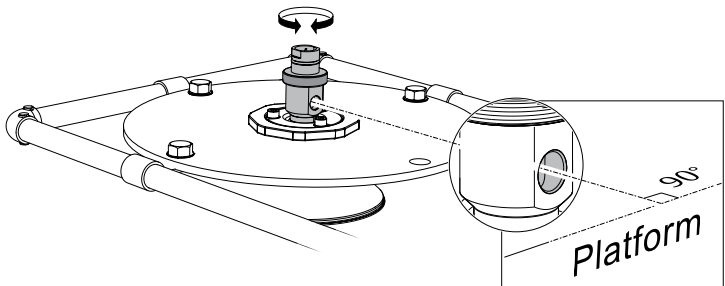
- Do not loosen the M8 screws while in operation. Attempting to do so may release pressurized gases, resulting in serious injury or death.

### Procedure

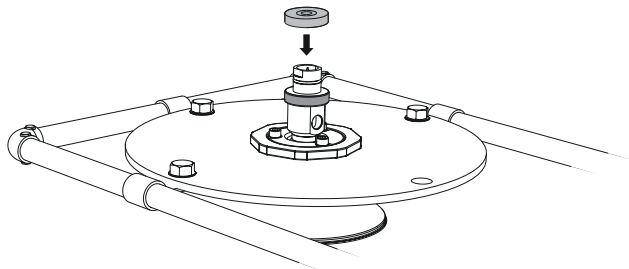
1. Loosen the M8 screws until the antenna can rotate smoothly.



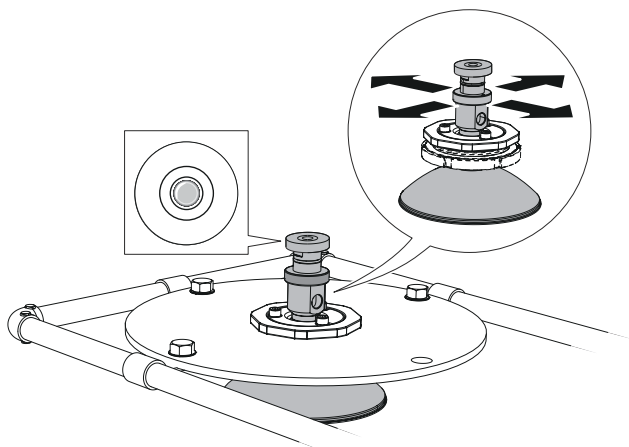
2. Rotate the antenna so the air purge connection is directed toward the host platform/structure.



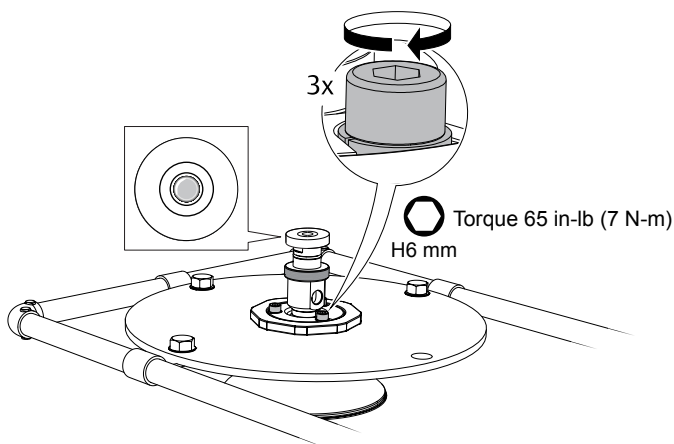
3. Place the supplied circular level on top of the antenna assembly.



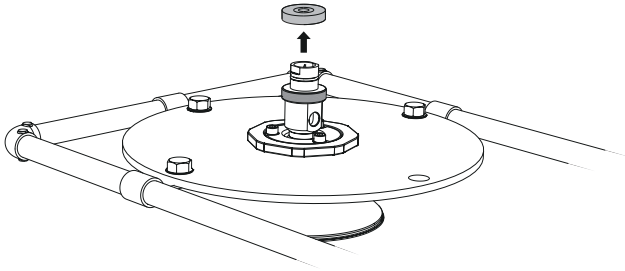
4. Adjust the inclination of the antenna.



5. Gradually tighten the M8 screws.

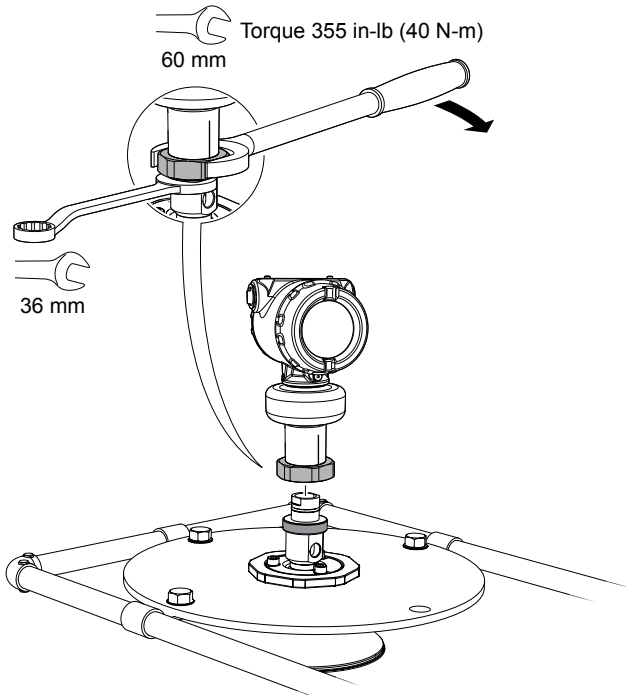
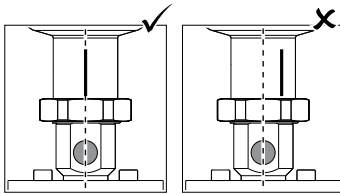


6. Remove the circular level.



7. Mount the transmitter head.

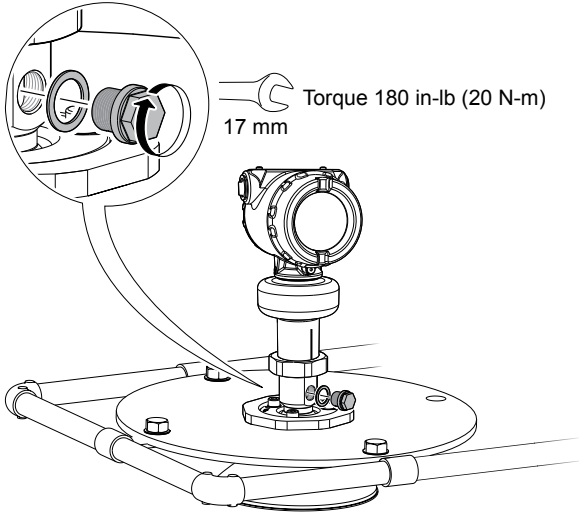
Align the marking on the sensor module with the air purge connection.



## 6 Plug and seal the air purge entry

### Procedure

Plug and seal the entry with the supplied blind plug and bonded seal.



## 7 Adjust display orientation (optional)

To improve field access to wiring or to better view the optional LCD display:

### Prerequisites

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#### Note

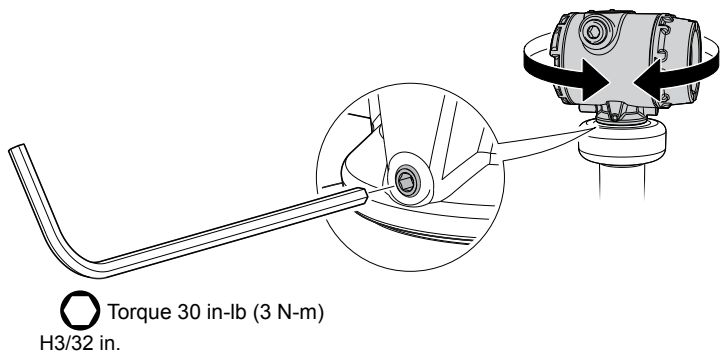
In high vibration applications, the transmitter housing must be fully engaged into the sensor module to meet the vibration test specifications. This is achieved by rotating the transmitter housing clockwise to thread limit.

---

### Procedure

1. Loosen the set screw until the transmitter housing can rotate smoothly.
  2. First, rotate the housing clockwise to the desired location. If the desired location cannot be achieved due to thread limit, rotate the housing counterclockwise to the desired location (up to 360° from thread limit).
  3. Re-tighten the set screw.
- 

**Figure 7-1: Rotate the Transmitter Housing**



## 8 Prepare the electrical connections

### 8.1 Cable selection

**RS-485 bus** Use shielded twisted pair wiring with a characteristic impedance of  $120\ \Omega$  (typically 24 AWG).

**Power supply** Use 24-14 AWG wire. Twisted pairs and shielded wiring are recommended for environments with high EMI (electromagnetic interference).

Use wire rated at least  $5\ ^\circ\text{C}$  above maximum ambient temperature.

### 8.2 Cable gland/conduit

For explosion-proof/flameproof installations, only use cable glands or conduit entry devices certified explosion-proof or flameproof.

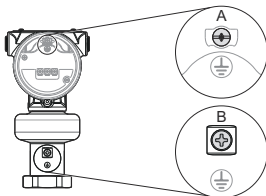
### 8.3 Grounding

Make sure grounding is done according to national and local electrical codes. Failure to do so may impair the protection provided by the equipment.

#### Transmitter housing

The most effective grounding method is direct connection to earth ground with minimal impedance. There are two grounding screw connections provided (see [Figure 8-1](#)).

**Figure 8-1: Ground Screws**



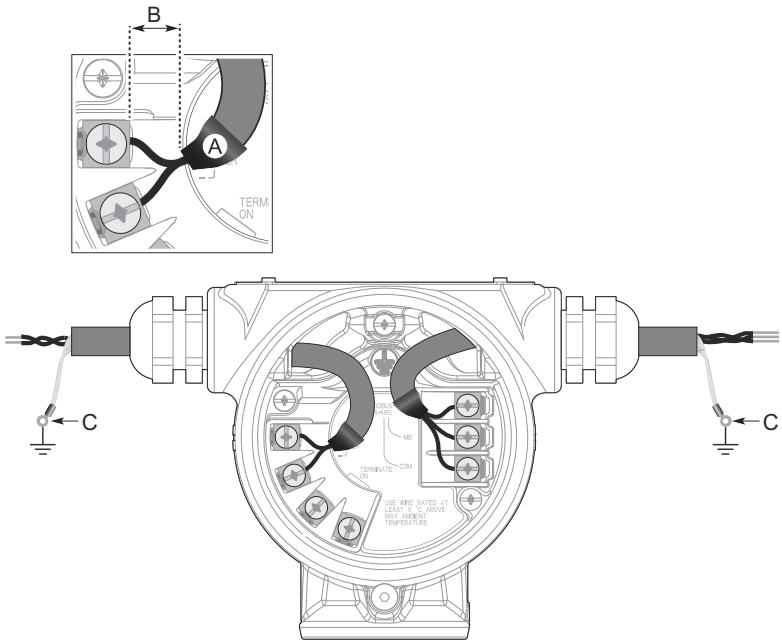
- A. Internal ground screw  
B. External ground screw

#### Cable shield grounding

Make sure the instrument cable shield is:

- Trimmed close and insulated from touching the transmitter housing.
- Connected to a good earth ground at the power supply end.



**Figure 8-2: Cable Shield**

- A. Insulate shield and drain wire
- B. Minimize distance
- C. Connect drain wire to a good earth ground

**Note**

Do not ground the shield and its drain wire at the transmitter. If the cable shield touches the transmitter housing, it can create ground loops and interfere with communications.

**Common signal reference ground for RS-485**

Best practice is to connect a third reference wire to the "COM" terminal (common signal reference ground).

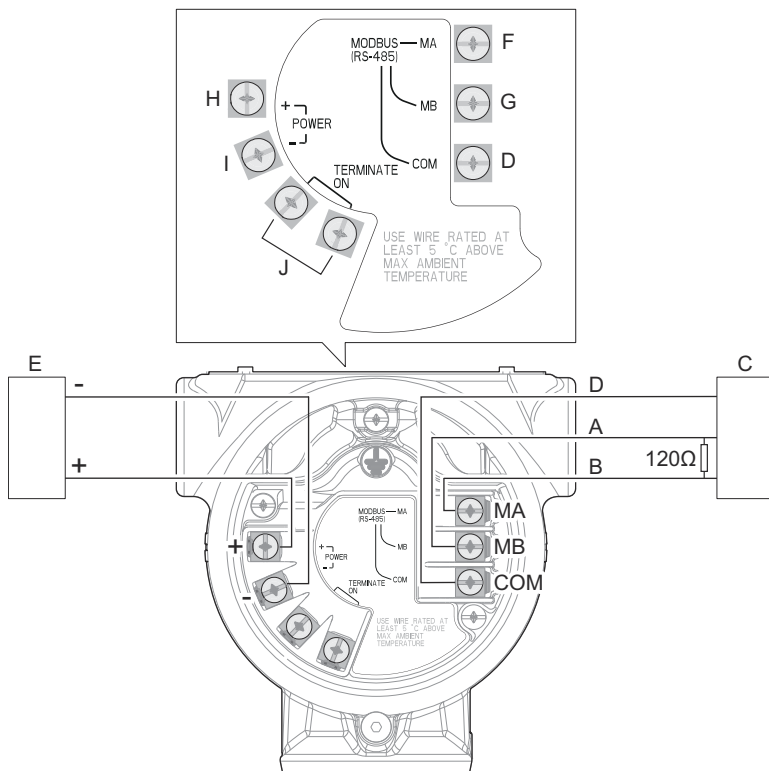
If a common reference wire is not used, then the "COM" terminal should be connected to the "-" power terminal. The common mode difference between the host RS-485 and the negative power supply must be between -7 V and +12 V.

**8.4 Power supply**

The transmitter operates on 9-36 Vdc at the transmitter terminals.

## 8.5 Wiring diagram

**Figure 8-3: Modbus® RS-485 Communication**



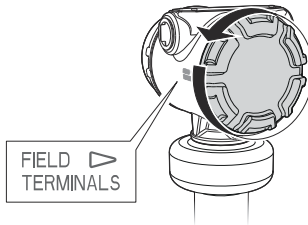
- A. "A" line
- B. "B" line
- C. Modbus RS-485 host
- D. Common signal reference ground
- E. Power supply
- F. Modbus RS-485 B connection (RX/TX+)<sup>(1)</sup>
- G. Modbus RS-485 A connection (RX/TX-)<sup>(1)</sup>
- H. Positive power input terminal
- I. Negative power input terminal
- J. Built-in 120  $\Omega$  termination resistor (connect jumper if last device on the bus)

(1) The designation of the connectors do not follow the EIA-485 standard, which states that RX/TX- should be referred to as 'A' and RX/TX+ as 'B'.

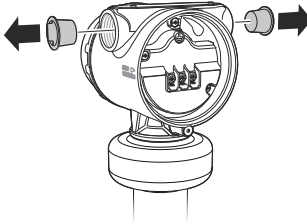
## 9 Connect wiring and power up

### Procedure

1. ⚠ Verify the power supply is disconnected.
2. Remove the cover.

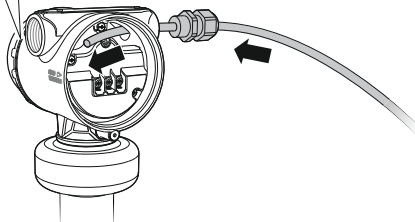
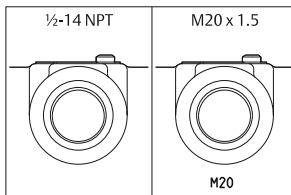


3. Remove the plastic plugs.



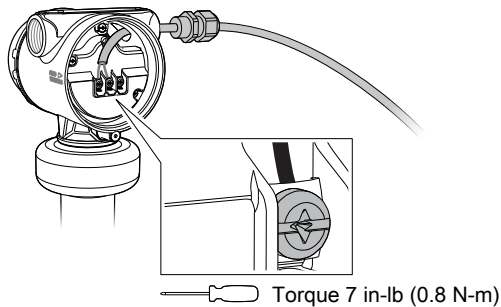
4. Pull the cable through the cable gland/conduit. <sup>(2)</sup>

Identification of thread size and type:

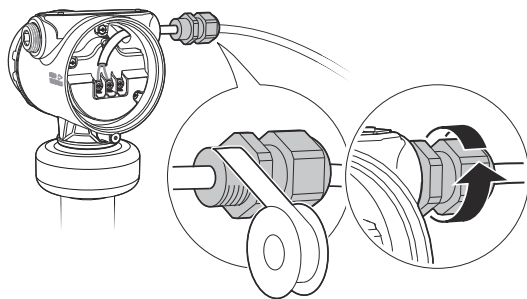


<sup>(2)</sup> Unless marked, the conduit/cable entries in the transmitter housing use a ½-14 NPT thread form.

- 5. Connect the cable wires (see [Wiring diagram](#)).



- 6. Ensure proper grounding (see [Grounding](#)).
- 7. Tighten the cable gland.
- Apply PTFE tape or other sealant to the threads.

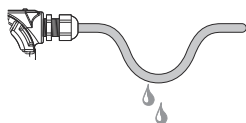


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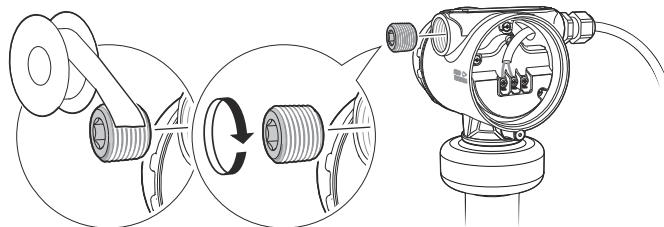
**Note**

Make sure to arrange the wiring with a drip loop.

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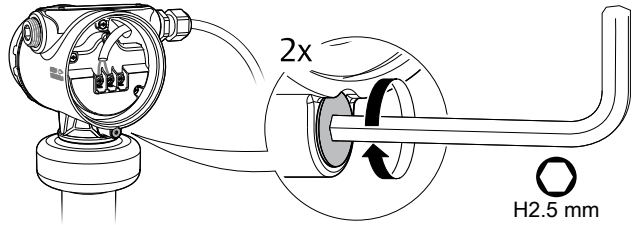


- 8. Seal any unused ports with the enclosed metal plug.
- Apply PTFE tape or other sealant to the threads.



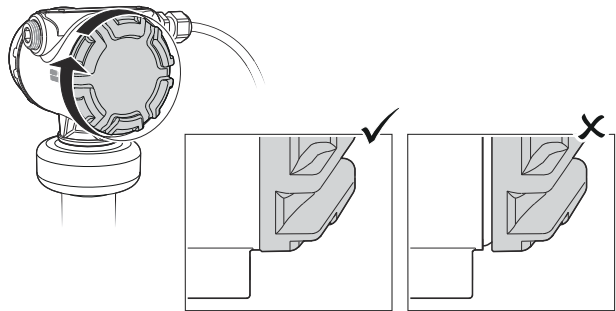
9. Attach and tighten the cover.

- a) Verify the cover jam screw is completely threaded into the housing.



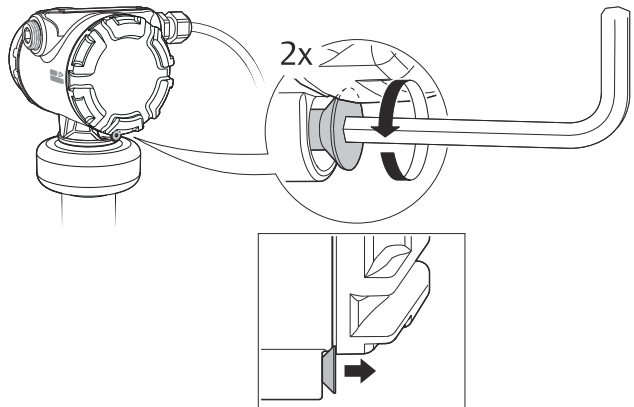
- b) Attach and tighten the cover.

⚠ Make sure the cover is fully engaged. There should be no gap between the cover and the housing.



- c) Turn the jam screw counterclockwise until it contacts the cover.

⚠ Required for explosion-proof/flameproof installations only.



- d) Turn the jam screw an additional  $\frac{1}{2}$  turn counterclockwise to secure the cover.
10. Connect the power supply.

## 10 Performance specifications

### 10.1 General

#### 10.1.1 Reference conditions

- Measurement target: Stationary metal plate, no disturbing objects
- Temperature: 59 to 77 °F (15 to 25 °C)
- Ambient pressure: 14 to 15 psi (960 to 1060 mbar)
- Relative humidity: 25-75%
- Damping: Default value, 0 s

#### 10.1.2 Instrument accuracy (under reference conditions)

**Range < 130 ft. (40 m)** ±0.12 in. (±3 mm)<sup>(3)</sup>

**Range > 130 ft. (40 m)** ±0.25 in. (±6 mm)<sup>(3)</sup>

#### 10.1.3 Measuring range

10 to 262 ft. (3 to 80 m)

#### 10.1.4 Repeatability

±0.04 in. (±1 mm)

#### 10.1.5 Ambient temperature effect

±0.04 in. (±1 mm)/10 K<sup>(4)</sup>

#### 10.1.6 Sensor update rate

##### Measuring rate

10 Hz

##### Burst rate

5 Hz (or configurable 2 to 10 Hz)

#### 10.1.7 Beam width

4.5°

(3) Refers to inaccuracy according to IEC 60770-1 when excluding installation dependent offset. See the IEC 60770-1 standard for a definition of radar specific performance parameters and if applicable corresponding test procedures.

(4) Ambient temperature effect specification valid over temperature range -40 °F to 176 °F (-40 °C to 80 °C).

## 10.2 Environment

### 10.2.1 Vibration resistance

- 2 g at 10-180 Hz according to IEC 61298-3, level “field with general application”
- IACS UR E10 test 7

For compliance with these standards, the transmitter housing must be fully engaged into the sensor module. This is achieved by rotating the transmitter housing clockwise to thread limit.

### 10.2.2 Electromagnetic compatibility (EMC)

- EMC Directive (2014/30/EU): EN 61326-1
- EN 61326-2-3
- NAMUR recommendations NE21<sup>(5)</sup>

Tests are performed with the recommended electrical wiring using a third wire interconnecting the COM terminals of the RS-485 network, termination at each end, and good protective earth.

### 10.2.3 Built-in lightning protection

EN 61326, IEC 61000-4-5, level 6kV

### 10.2.4 Radio approvals

- Radio Equipment Directive (2014/53/EU): ETSI EN 302 372, ETSI EN 302 729 and EN 62479
- Part 15 of the FCC Rules
- Industry Canada RSS 211

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<sup>(5)</sup> In challenging applications where the dynamic of the transmitter sensitivity is utilized by multiple factors such as small aperture antenna, very low product dielectric constant and/or turbulent surface, the margin for additional influence due to extreme EMC may be limited.



# 11 Functional specifications

## 11.1 General

### 11.1.1 Field of application

Measurement of waves, sea level and air gap in offshore, maritime and coastal environments.

### 11.1.2 Measurement principle

Frequency Modulated Continuous Wave (FMCW)

### 11.1.3 Frequency range

24.05 to 26.5 GHz

### 11.1.4 Maximum output power

-5 dBm (0.32 mW)

### 11.1.5 Power consumption

Max. 1 W, average < 0.4 W

### 11.1.6 Humidity

0 - 100% relative humidity, non-condensing

### 11.1.7 Turn-on time

< 10 s<sup>(6)</sup>

## 11.2 Temperature limits

Verify that the operating atmosphere of the transmitter housing is consistent with the appropriate hazardous locations certifications, see the [Product Certifications](#) document.

**Table 11-1: Ambient Temperature Limits**

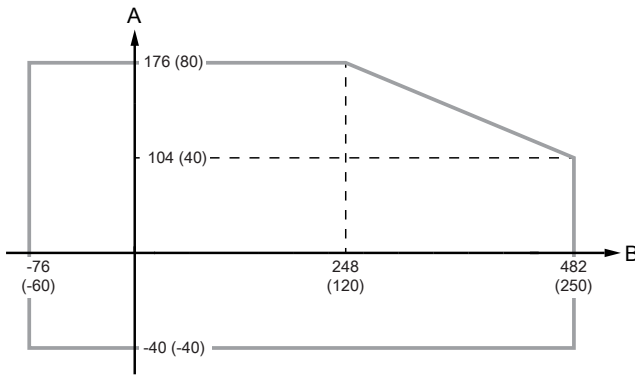
Description	Operating limit	Storage limit
Without LCD display	-40 °F to 176 °F (-40 °C to 80 °C)	-58 °F to 176 °F (-50 °C to 80 °C)
With LCD display <sup>(1)</sup>		-40 °F to 176 °F (-40 °C to 80 °C)

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

(6) Time from when power is applied to the transmitter until performance is within specifications.

The ambient temperature limits may be further restricted by the process temperature as described by [Figure 11-1](#).

**Figure 11-1: Ambient Temperature vs. Process Temperature**



A. Ambient temperature °F (°C)

B. Process temperature °F (°C)

Aside from ambient temperature variations, heat from the process may be transferred to the transmitter housing. Being exposed to a high process temperature without extra cooling for an extended period of time may cause the electronics temperature to exceed the allowed limit and thereby affect the transmitter's performance and reliability. The latter are potential risks whenever a transmitter has shut down due to high electronics temperature. The transmitter will warn about the electronics temperature being out of limits.

## 12 Physical specifications

### 12.1 Housing and enclosure

#### 12.1.1 Electrical connections

Two cable/conduit entries ( $\frac{1}{2}$ -14 NPT or M20 x 1.5)

Optional adapters: M12 4-pin male eurofast connector or A size Mini 4-pin male minifast connector

#### 12.1.2 Materials

- Electronics housing: Stainless Steel Grade CF-8M (ASTM A743)
- Sensor module: 316L SST

#### 12.1.3 Weight

- Stainless steel housing: 10.0 lb (4.5 kg)<sup>(7)</sup>
- Parabolic antenna assembly: 8.8 lb (4.0 kg)<sup>(8)</sup>

#### 12.1.4 Ingress protection

IP 66/67/68<sup>(9)</sup> and NEMA<sup>®</sup> 4X

## 12.2 Material exposed to tank atmosphere

### Parabolic antenna

- 316/316L SST (EN 1.4404)
- PTFE fluoropolymer
- FVMQ fluorosilicone (O-ring)

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<sup>(7)</sup> Fully functional transmitter with sensor module, housing, terminal block, LCD display, and covers.

<sup>(8)</sup> Weight does not include mounting flange plate.




<sup>(9)</sup> The transmitter meets IP 68 at 9.8 ft. (3 m) for 30 minutes.



**Quick Start Guide**  
**00825-0800-4408, Rev. AA**  
**February 2020**




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