SF WRF SOLIDS HANDLING RETROFIT

PROJECT #0019

OPERATION & MAINTENANCE INSTRUCTIONS

Volume 2 - Instrumentation
Specification Sec. 409106 thru 409109

AUGUST 31, 2022

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BY
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QUALITY ELECTRICAL SYSTEMS

SF WRF Solids Handling Retrofit
Operation & Maintenance Instructions
Specification Sections 409106 thru 409109 – Instrumentation

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SF WRF Solids Handling Retrofit
Operation & Maintenance Instructions
Specification Sections 409106 thru 409109 – Instrumentation

Table of Contents

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Certificate of Warranty

Quality Electrical Systems Inc. is pleased to certify that the equipment purchased for the job listed below is covered by Quality Electrical Systems Inc. and the respective original equipment manufacturers for a period of 18 months from the date of shipment or 12 months from the date of start-up or (beneficial use by the owner) whichever comes first.

This warranty covers failures due to defects in materials and workmanship only. Failures due to improper use, abuse, physical damage, utility surge or acts of nature are not covered.

In the event of a failure Quality Electrical Systems working with the equipment manufacture will replace or repair the equipment (at its' sole discretion). Replaced or repaired equipment will be covered by this same warranty until the expiration thereof. Replacement or repair of equipment does not reset the warranty period.

Repairs or modifications to the equipment by anyone other than Quality Electrical Systems Inc. will void the warranty entirely.

Warranty coverage is limited to the value of the replacement or repair of the equipment supplied by Quality Electrical System Inc. and in no way implies coverage of any other costs associated with the failure or loss of use of the equipment.

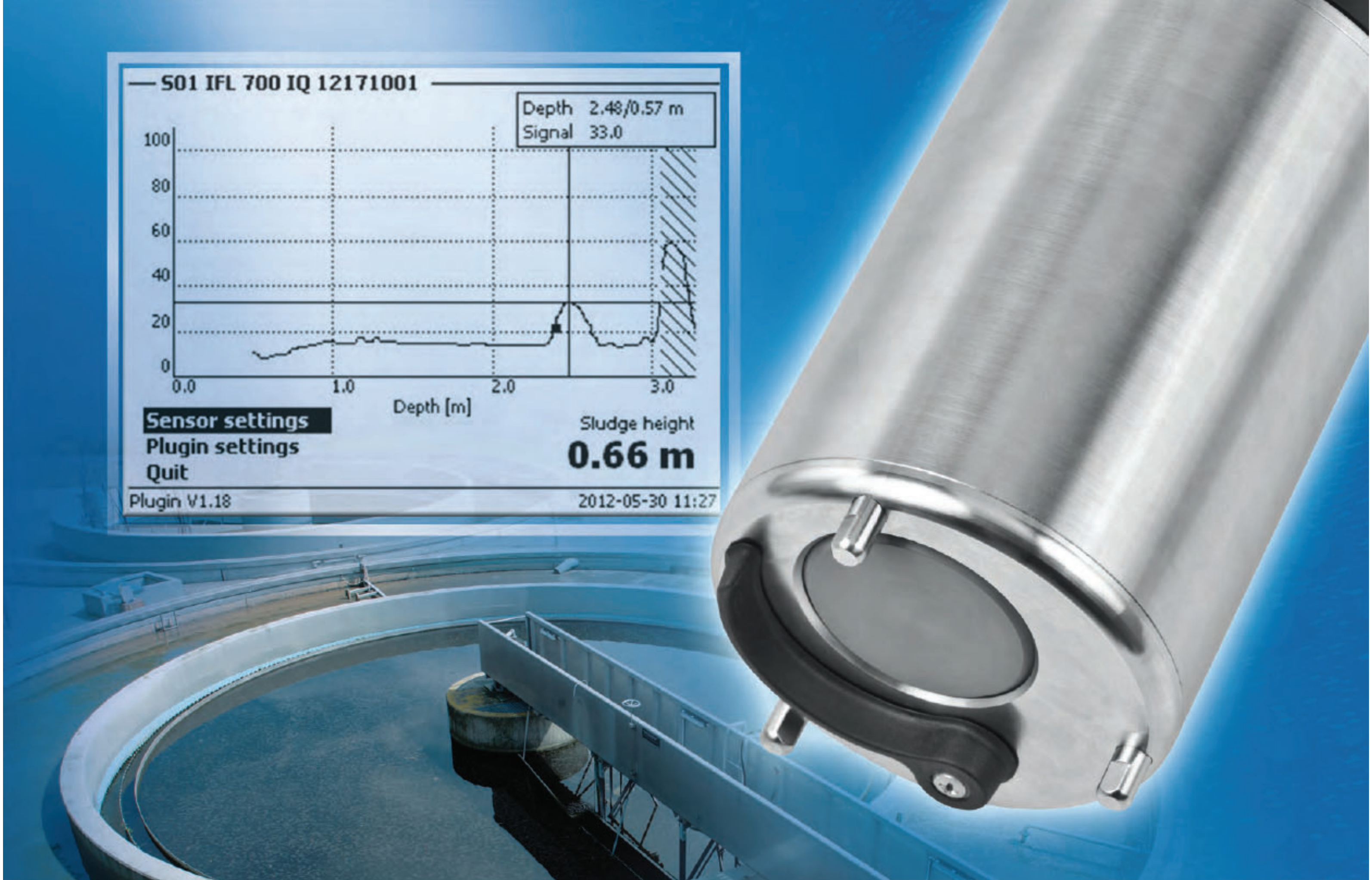
Project Name: SF WRF SOLIDS HANDLING RETROFIT
Project No.: 001962
Customer: MorrisElectric
Owner: [Owner City of Spanish Fork
Date: 12 Sep 2022
Shipment Date: [Ship Date.]
Startup Date: [Startup Date]

Ken Worton
Quality Electrical Systems, Inc.

SPANISH FORK WRF SOLIDS HANDLING RETROFIT

INSTRUMENT BILL OF MATERIAL

QTY.	DESCRIPTION	PART NUMBER	MANUFACTURER
	INSTRUMENTS		
LE/LIT-1101	LEVEL TRANSMITTER NON-CONTACT, RADAR	5408A1SHA1E51R6AACAA4DA1Q4	ROSEMOUNT
LE/LIT-1101	REMOTE DISPLAY (PD6770-0K0 PRE-DIG)	751AM7NA	ROSEMOUNT
LE/LIT-1102	LEVEL TRANSMITTER NON-CONTACT, ULTRASONIC IFL700IQ	481200Y	XYLEM-YSI
1	REMOTE DISPLAY- TERMINAL	System 282	XYLEM-YSI
PIT-3103	PRESURE TRANSMITTER	3051TG1A2B21AM4Q4	ROSEMOUNT
PI-1104A	PRESSURE GAUGE, 0-30PSI	451279SS04LXLLPDC4 30#	ASHCROFT
PSL-1104	PRESSURE SWITCH, SINGLE SET-POINT	PPDN7GGB 25- 30#	ASHCROFT
	ISOLATION RING	8106TSS02TV150XDJH7	ASHCROFT
	ASSEMBLE & TEST		FACTORY
PI-1104B	PRESSURE GAUGE, 0-160PSI	451279SS04LXLLPDC4 160#	ASHCROFT
PSH-1104	PRESSURE SWITCH, SINGLE SET-POINT	PPDN7GGB25- 200#	ASHCROFT
	ISOLATION RING	8106TSS02TV150XDJH7	ASHCROFT
	ASSEMBLE & TEST		FACTORY
PI-1204A	PRESSURE GAUGE, 0-30PSI	451279SS04LXLLPDC4 30#	ASHCROFT
PSL-1204	PRESSURE SWITCH, SINGLE SET-POINT	PPDN7GGB25- 30#	ASHCROFT
	ISOLATION RING	8106TSS02TV150XDJH7	ASHCROFT
	ASSEMBLE & TEST		FACTORY
PI-1204B	PRESSURE GAUGE, 0-150PSI	451279SS04LXLLPDC4 150#	ASHCROFT
PSH-1204	PRESSURE SWITCH, SINGLE SET-POINT	PPDN7GGB25- 200#	ASHCROFT
	ISOLATION RING	8106TSS02TV150XDJH7	ASHCROFT
	ASSEMBLE & TEST		FACTORY



Interface level measurement with the IFL 700 IQ digital sensor

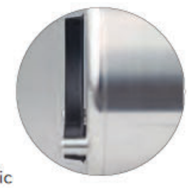
New sensor for the IQSN!

a xylem brand

Features

- Intelligent signal processing results in more reliable readings: Filter out of undesired signals caused by floating sludge, internal fittings or moving skimmers
- Ready-to-go with simple system configuration
- Detailed display of echo profile for visualization and maximum user benefit
- Maintenance-free cleaning system with automatic adjustment of cleaning intervals

Echo profile on the 2020 XT



Automatic cleaning system

IFL 700 IQ

Technical Data

Measurement method	Ultrasound echo measurement
Measurement range	0.4 m - 15 m
Resolution	0.01 m
Accuracy	0.03 m
Signal filters	Yes
Flow speed	Max. 4 m/s
Physical dimensions	Length 442 mm; max. diameter 105 mm
Weight	Approx. 3.6 kg
Immersion depth	Min. 5 cm; max. 3 m
Protection class	Sensor with SACIQ cable connected: IP 68; 0.3 bar
Pressure resistance	The sensor with connected SACIQ cable complies with the requirements of article 3(3), 97/23/EU guideline.
Permitted pH range of medium	4 ... 12
Permitted temperature range	Medium: > 0° ... +50°C; Storage and transport: -5° ... +50°C
Materials	Shaft and baseplate: stainless steel 1.4571 Plug head and transition unit: POM Ultrasound unit: PVC-C Cleaning system: Grade 2 Titanium (shaft) and Grivory
Equipment safety, Standards	EN 61010-1; UL 61010-1; CAN/CSA C22.2#61010-1
Electric data	Nominal voltage 24 VDC, provided by the IQ Sensor Net system
Power consumption	2.8 W
Certifications	CE, cETL, ETL
Verwendbares System	IQ Sensor Net System 2020 XT

Ordering information

Model	Description	Order No.
IFL 700 IQ	Digital ultrasound interface level sensor with automatic cleaning system	481200
IFL 701 IQ	Digital ultrasound interface level sensor	481201

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SPECIFICATIONS

DOCUMENT #W101

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Parameters:

Dissolved Oxygen (optical or electrochemical)
pH
ORP/Redox
Conductivity/Salinity
Temperature
Turbidity*
TSS (total suspended solids)*
Ammonium
Nitrate
Potassium
COD (chemical oxygen demand)*
TOC (total organic carbon)*
DOC (dissolved organic carbon share of TOC)*
SAC (spectral absorption coefficient)*
BOD (biochemical oxygen demand)*

* ultrasonic cleaning for sensors

YSI IQ SensorNet 182 Terminals

Continuous Water Quality Monitoring for Process Control

The YSI **IQ SensorNet 182, 182 XT and 182 XT-4** are modular water quality terminals for complete process control designed for wastewater. The network can accept additional sensors easily at any time and grow as your facility grows. Benefits include better network visibility and management, early detection of network failures, improved compliance with regulatory targets, and cost savings (energy, pump/blower maintenance, labor).

- 3-year instrument warranty
- User-replaceable cables and sensors. Many sensors provide ultrasonic cleaning.
- Centralized power supply along entire network; 2-wire cable provides power and communications
- Lightning protection along network
- Tactile buttons; easily use while wearing gloves
- Modular expansion from 1 to 4 sensors
- Digital outputs available
- LED status light
- Programmable access permission
- System redundancy if two terminals are used; use in location or move from point to point

Building a system is easy...choose the IQ SensorNet terminal, determine which modules are needed (control, communications, etc.), determine distances for cabling and select parameters.

182 Terminal Stacked on Modules

Model 182	Model 182 XT	Model 182 XT-4
1-2 Sensors	1-2 Sensors	1-4 Sensors
2 mA Outputs	4 mA Outputs	5 mA Outputs
3 relays	5 relays	6 relays

YSI.com/IQSN182

IQ SensorNet 182, 182 XT, 182 XT-4 Terminal/Controller Specifications

Certifications	ETL, cETL (conforms with relevant UL and Canadian standards), CE
Electromagnetic Compatibility	EN 61326, Class B; FCC Class A, EMC for indispensable operation
Integrated Lightning Protection	According to EN 61326 enhanced over-voltage protection for *entire system*, implemented in each component
Cable	2-wire with shield for power supply and communications; resistant to polarity reversal; comprehensive EMC shield control; cable topology within network can be in the form of a line, tree, star or multiple star
	Total cable length max. = 1000 m (3280 ft) without signal amplifying; with signal amplifying module MIQ/JBR add an additional 1000 m
Radio	Radio transmission Class 1 with a range of 100 m (328 ft); max 300 m (984 ft)
Module Coupling at Rear	Combined mechanical and electrical connection for rapid coupling to modules; no wiring required
Display	Graphic display; resolution 128 x 64 pixels; visible area 72 x 40 mm (2.83 x 1.57 in); backlit
Control Keys/Buttons	5 operation keys: 3 master keys for Measurement (M), Calibration (C), Set/System settings (S)
	2 function keys for confirmation/switching menu OK (OK) and Escape (ESC)
	2 knobs for quick selection of software functions and input of alphanumeric values (up), (down)
Electrical	100 to 240 VAC (50/60 Hz), 24 V AC/DC
Temperature Conditions	Operating Temperature: -4 to 131 °F (-20 to 55 °C)
	Storage Temperature: -13 to 149 °F (-25 to 65 °C)
Enclosure	Material: PC-20% (Polycarbonate with 20% fiberglass)
	Rating: IP-66, equivalent to NEMA 4X (not suitable for conduit connection)
	Dimensions for 182: 144 W x 144 H x 95 D mm (5.67 W x 5.67 H x 3.74 D in)
	Dimensions for 182 XT and 182 XT-4: 144 W x 144 D x 143 D mm (5.67 W x 5.67 H x 5.63 D in)
	Weight for 182: 1 kg (2.2 lbs)
	Weight for 182 XT and 182 XT-4: 1.5 kg (3.31 lbs)
	Warranty: 3 years

IQ SensorNet 182, 182 XT, 182 XT-4 Module (DIQ) Specifications

Module Coupling at Front	Combined mechanical and electrical connection for rapid docking and removal of the terminal and docking additional modules
Module Coupling at Rear	Combined mechanical and electrical connection for docking additional modules; a total of 3 modules as a stacked mounted unit
Cable Feeds	4 screw cable glands M 16 x 105
Terminal Connections	Screw terminal strips; terminal area for solid connectors 0.2 to 4.0 mm for flexible connectors 0.2 to 2.5 mm; accessible through cover Used for connecting sensors or as an input/output or for looping through/branching of the IQ SensorNet cable
Additional Functions	Two LEDs (yellow and red) for monitoring the operating voltage; lightning protection; connection resistant to reversed polarity; integrated local identity; integrated switchable terminal resistor (SN terminator)
Enclosure	Material: PC 20% GF (Polycarbonate with 20% fiberglass)
	Rating: IP-66, equivalent to NEMA 4X (not suitable for conduit connection)
	Dimensions: 95 W x 95 H x 58 D mm (3.74 W x 3.74 H x 2.38 D in)
	Warranty: 3 years

IQ SensorNet 182, 182 XT, 182 XT-4 Ordering Information (order terminal, modules, cables, sensors separately)*

DIQ/S 182 Item #472 000Y	Central terminal/controller unit only. Required to be installed once at any point, remains in the system and cannot be removed. With 2 analog outputs and 3 relays. Up to 2 sensors can be connected.
DIQ/S 182 XT Item #472 001Y	Central terminal/controller unit only. Required to be installed once at any point, remains in the system and cannot be removed. With 4 analog outputs and 5 relays. Up to 2 sensors be connected.
DIQ/S 182 XT-4 Item #472 015Y	Central terminal/controller unit only. Required to be installed once at any point, remains in the system and cannot be removed. With 5 analog outputs and 6 relays. Up to 4 sensors be connected.

* There are 11 additional options to order the 182 terminals as part of a kit. Please visit www.YSI.com/IQSN182 to see all available models.

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Tel +1 937.767.7241 800.897.4151 (US)
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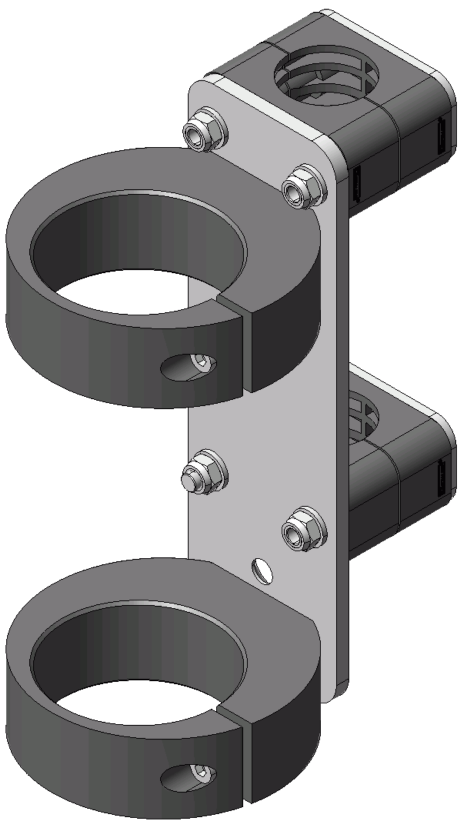
Installation instructions

EH/WB

Sensor holder



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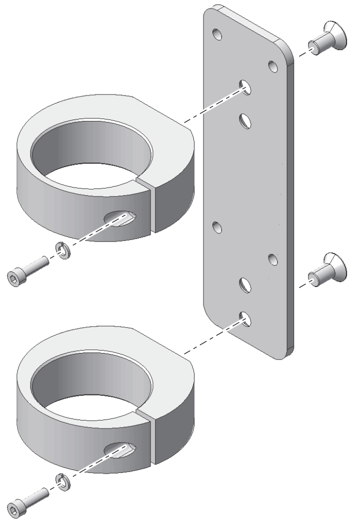
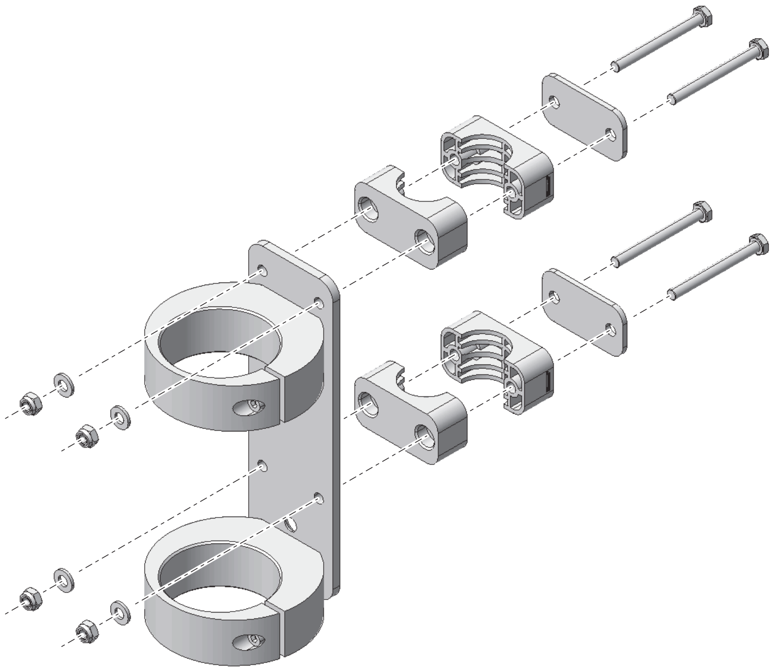
Assembly



- Screw the two sensor holders to the adapter plate. When doing so, use the outer holes of the adapter plate (see figure).

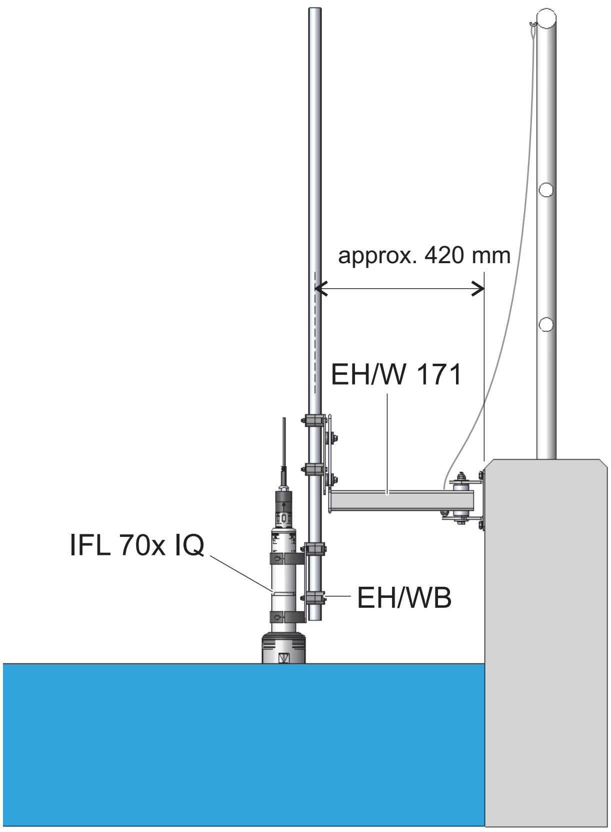


- At first, connect the two pipe clips with the adapter plate loosely.
- Attach the equipment to be installed (e.g. sensor) to the sensor holder.

Technical data

Dimensions	Clamping diameter	Sensor holder: 60 mm Pipe clips: 30 mm or 3/4 "
Materials	All metal parts	Stainless steel 1.4301 (V2A)
	Sensor holder	POM
	Pipe clips	PA

Application example



Mounting Hardware – Controllers/Modules

Handrail Mounting – Option 1

- SSH/IQ & MR/SD 170
  - Use for up to 3 modules + a 2020 terminal
  - Or, for a Cleaning Air Box

MR/SD 170 Order No.: 109 286Y

Mounting kit for sun shields, suitable for horizontal or vertical pipe rails with diameters of 0.98 to 2.36 in. (25 - 60 mm). Sun shield not included.

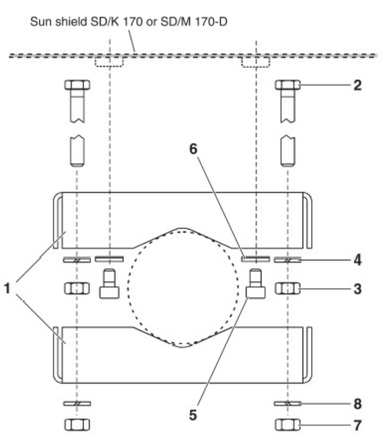
Material	Stainless steel 1.4301

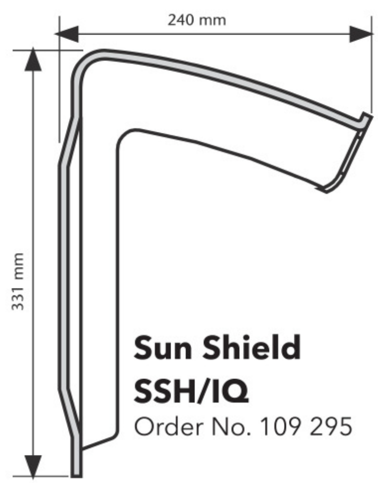
SSH/IQ Order No.: 109 295Y

Sunshield for mounting series 171, 170 and IQ SensorNet monitors on a Vario Mounting Stand.

Dimensions	13.03 x 13.54 x 9.45 in. (331 x 344 x 240 mm) (H x W x D)
Material	ASA (Dust gray color)

MR/SD 170





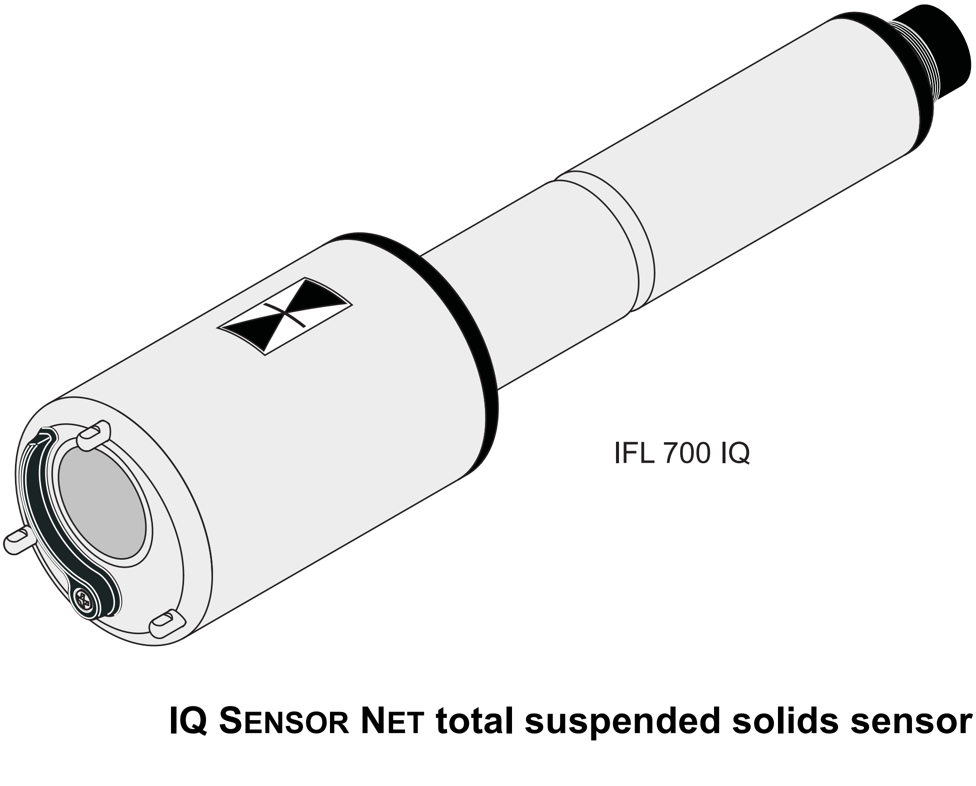
Sun Shield
SSH/IQ
Order No. 109 295

a xylem brand

a xylem brand

Operating manual

IFL 700 IQ
IFL 701 IQ



IFL 700 IQ

IQ SENSOR NET total suspended solids sensor

ba76129e01 10/2012

Note
For the most recent version of the manual, please visit www.ysi.com.

Contact
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Tel: +1 937-767-7241
800-765-4974
Email: environmental@ysi.com
Internet: www.ysi.com

IFL 70x IQ - Contents

1 Overview

1.1 How to use this component operating manual

Structure of the IQ SENSOR NET operating manual

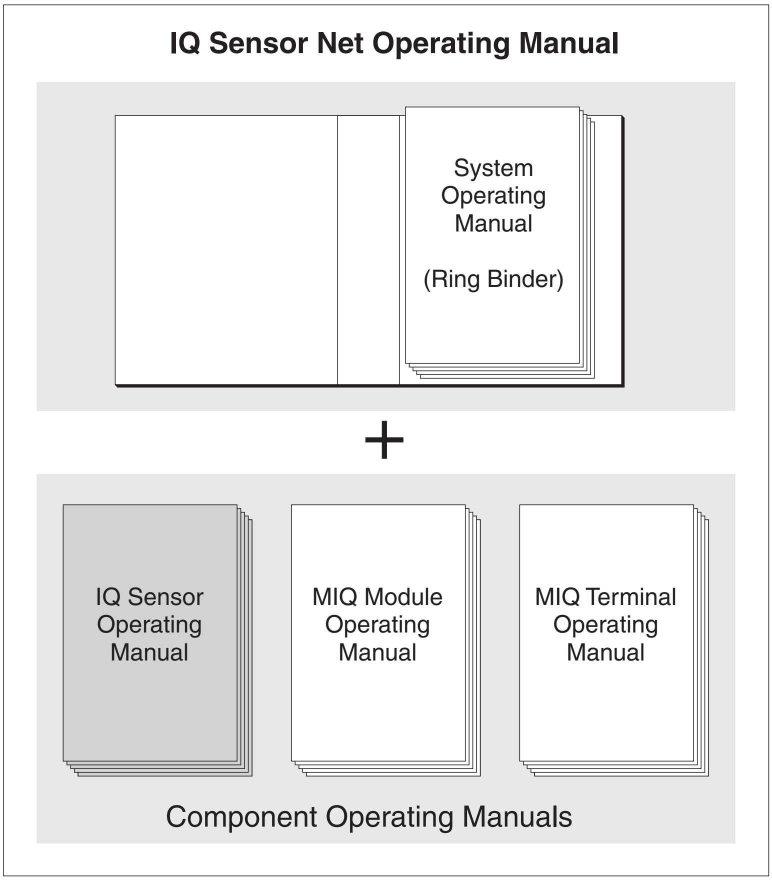


Fig. 1-1 Structure of the IQ SENSOR NET *operating manual*

The IQ SENSOR NET operating manual has a modular structure like the IQ SENSOR NET system itself. It consists of a system operating manual and the operating manuals of all the components used.

Please file this component operating manual into the ring binder of the system operating manual.

1.2 Structure of the IFL 70x IQ sludge level sensor

Structure

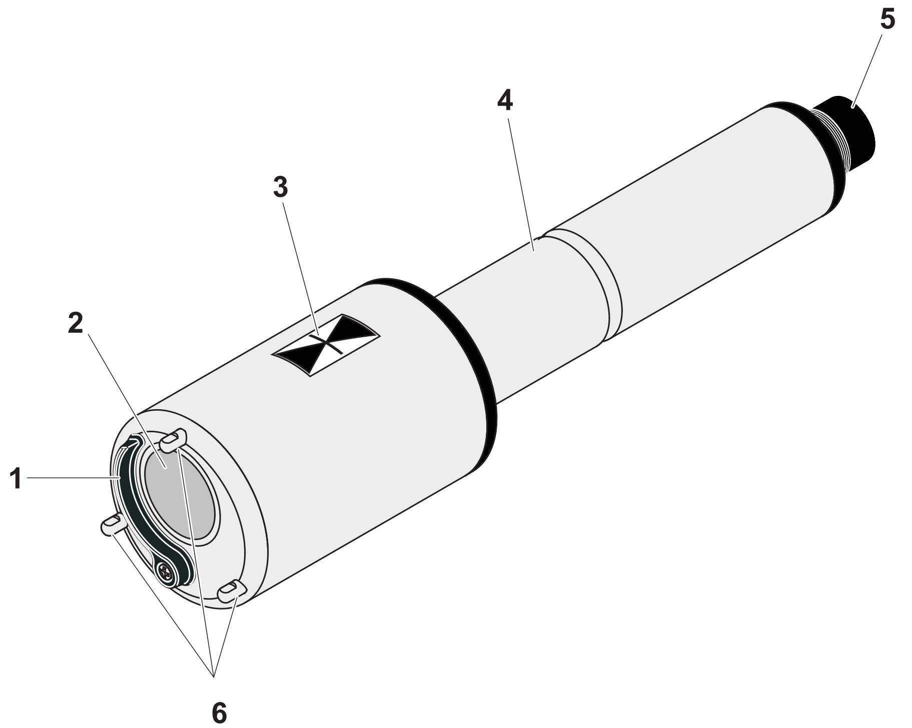


Fig. 1-2 Structure of the sludge level sensor (example: IFL 700 IQ)

1	Wiper (only IFL 700 IQ)
2	Ultrasonic transducer
3	Marking for immersion depth 0.1 m
4	Shaft
5	Plug head connector
6	Leg supports

Measuring principle

The IFL 70x IQ is based on the ultrasonic measuring principle. Ultrasonic waves transmitted by the ultrasonic transducer are totally or partly reflected by layers at which the density of the measuring medium changes (e.g. sludge blanket, bottom of the basin), and then received again. Based on the reflection intervals, the distance between the levels and the ultrasonic transducer is determined:

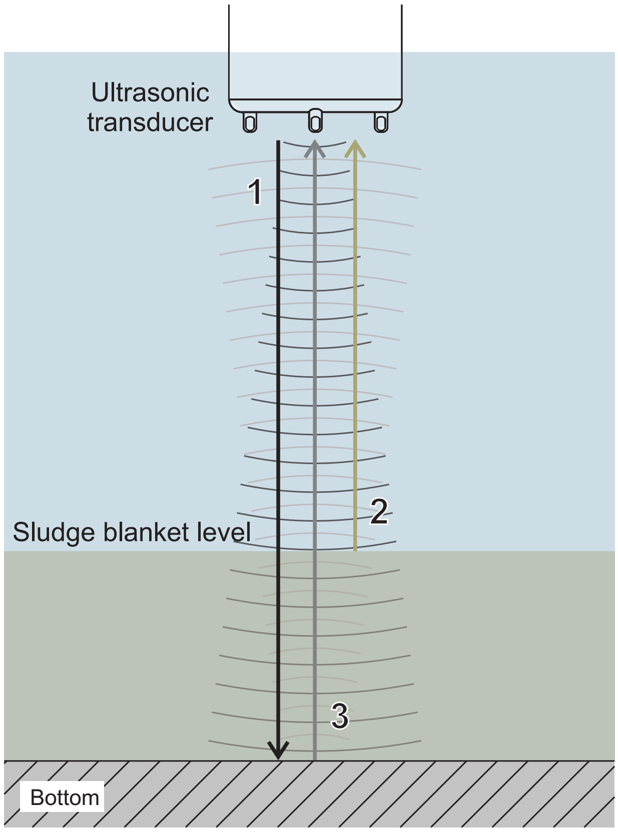


Fig. 1-3 Principle of the ultrasonic measurement

1	Transmitted ultrasonic waves
2	Echo reflected by the sludge blanket (short reflection interval)
3	Echo reflected by the bottom area (long reflection interval)

Wiper (cleaning system)

The IFL 700 IQ sensor has a mechanical wiper that effectively cleans gas bubbles and dirt off the ultrasonic transducer. The wiper operates contactless and is maintenance-free and wear-free.

1.3 Recommended fields of application

Sludge level control and monitoring in waste water treatment.

Detailed information on the subject of sludge level measurement is given for example in the DWA information sheet no. 256 "Prozessmesstechnik auf Kläranlagen, Teil 8: Messeinrichtungen zur Bestimmung des Schlammspiegels" (Process measuring technique at wastewater treatment plants, part 8: Instrumentation for determination of the sludge level".

2 Safety instructions

2.1 Safety information

2.1.1 Safety information in the operating manual

This operating manual provides important information on the safe operation of the product. Read this operating manual thoroughly and make yourself familiar with the product before putting it into operation or working with it. The operating manual must be kept in the vicinity of the meter so you can always find the information you need.

Important safety instructions are highlighted in this operating manual. They are indicated by the warning symbol (triangle) in the left column. The signal word (e.g. "CAUTION") indicates the danger level:

WARNING
indicates a possibly dangerous situation that can lead to serious (irreversible) injury or death if the safety instruction is not followed.

CAUTION
indicates a possibly dangerous situation that can lead to slight (reversible) injury if the safety instruction is not followed.

NOTE
indicates a situation where goods might be damaged if the actions mentioned are not taken.

2.1.2 Safety signs on the product

Note all labels, information signs and safety symbols on the product. A warning symbol (triangle) without text refers to safety information in this operating manual.

2.1.3 Further documents providing safety information

The following documents provide additional information, which you should observe for your safety when working with the measuring system:

- Operating manuals of other components of the IQ SENSOR NET system (power packs, controller, accessories)
- Safety datasheets of calibration and maintenance equipment (e.g. cleaning solutions).

2.2 Safe operation

2.2.1 Authorized use

The authorized use of the IFL 70x IQ consists of its use as a sludge level sensor in the IQ SENSOR NET. Only the operation and running of the product according to the instructions and technical specifications given in this operating manual is authorized (see chapter 7 TECHNICAL DATA). Any other use is considered unauthorized.

2.2.2 Requirements for safe operation

Note the following points for safe operation:

- The product may only be operated according to the authorized use specified above.
- The product may only be supplied with power by the energy sources mentioned in this operating manual.
- The product may only be operated under the environmental conditions mentioned in this operating manual.
- The product may not be opened.

2.2.3 Unauthorized use

The product must not be put into operation if:

- it is visibly damaged (e.g. after being transported)
- it was stored under adverse conditions for a lengthy period of time (storing conditions, see chapter 7 TECHNICAL DATA).

3 Commissioning

3.1 IQ SENSOR NET system requirements

Software statuses of the controller and terminal components

The operation of the IFL 70x IQ requires the following software versions in the IQ SENSOR NET:

• MIQ/MC2	Controller software:	Version 3.35 or higher
• MIQ/TC 2020 XT	Terminal software:	Version 3.35 or higher

3.2 Scope of delivery

- Sludge level sensor IFL 700 IQ or IFL 701 IQ
- Operating manual

3.3 Installation

3.3.1 General information

NOTE
Sharp objects can damage the ultrasonic transducer. Please be careful, especially when handling sharp tools, when cleaning and during transport.

NOTE (only IFL 700 IQ)
If the sensor is connected to the IQ SENSOR NET, the mechanical wiper may start moving unexpectedly. Make sure that the swivel range of the wiper is always free. Only put the sensor down on its leg supports on a flat surface with the ultrasonic transducer pointing downward.

3.3.2 General installation conditions

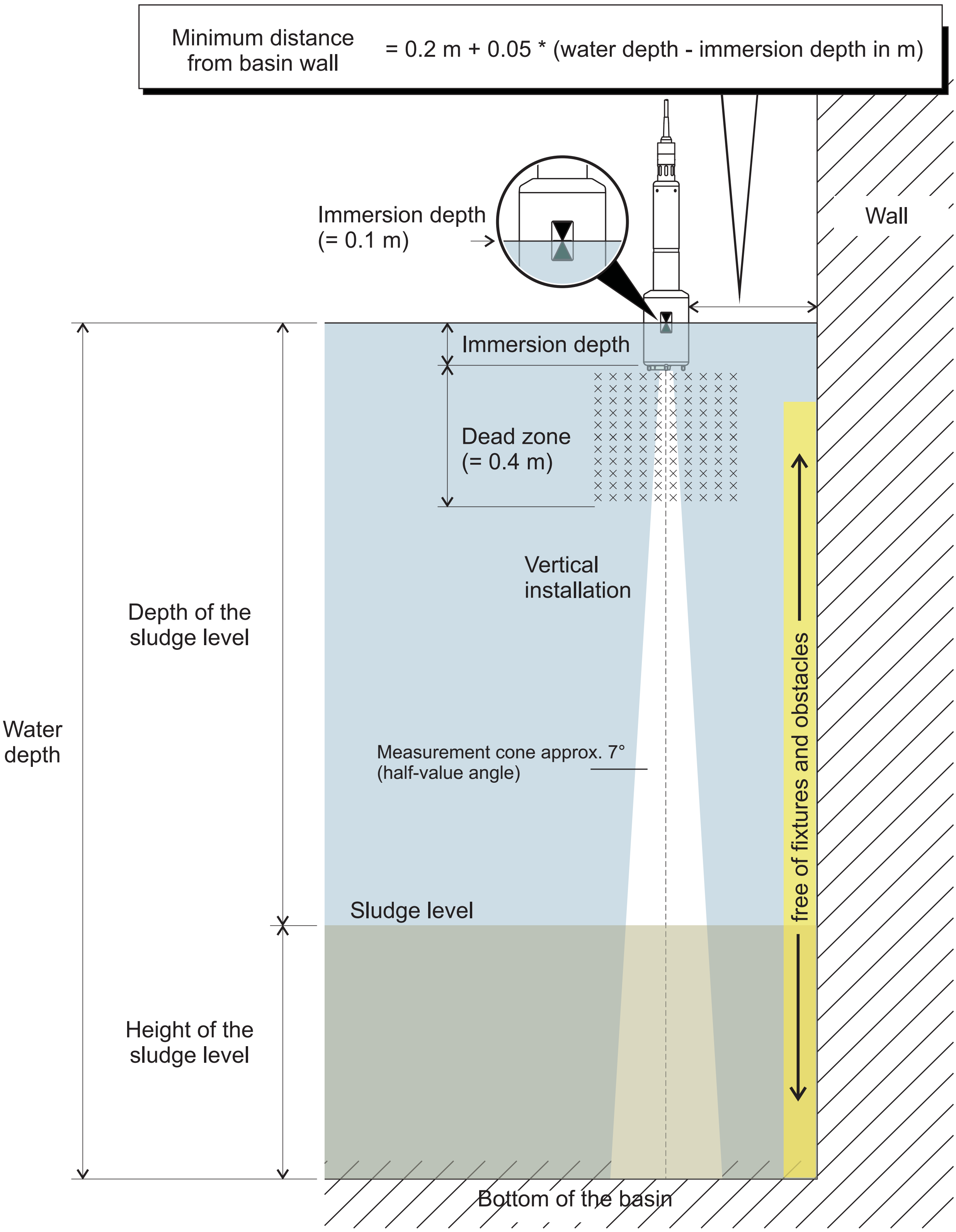


Fig. 3-1 Ideal installation environment

Sensor installation

The following conditions should always be met:

- Vertical
- Sufficient distance from the basin wall (minimum distance, see formula in Fig. 3-1).
  If the distance to the wall of the basin is small, the wall should be rather smooth.
- Immersion depth (0.05 m ... 3 m)
- Minimum distance between the sensor bottom and sludge blanket = 0.4 m ("dead zone").

Ideally, at the installation location the ultrasonic cone is free of barriers that move the sensor from its position or cross the measuring cone and thus cause interfering echoes.
Additional measures are required in order to minimize negative impacts (see section 3.3.5).

3.3.3 Influence of permanently installed fixtures

Permanently installed fixtures in the vicinity of the measuring cone reflect the ultrasonic waves transmitted and thus cause interfering echoes.

If there are permanently installed fixtures in the expectation range of the sludge blanket level, it is not possible to clearly assign an echo to a sludge level. In this case, a different installation location must be selected (e.g. with a greater distance from the wall). Alternatively, the evaluation range can be adjusted.

3.3.4 Influence of gas bubbles and suspended particles

Gas bubbles and suspended particles reduce the propagation of ultrasonic waves. A high concentration of gas bubbles and suspended particles can in extreme cases lower the range of the sensor.

If there are range problems, the sensor must be immersed deeper (note the dead zone and maximum depth of immersion).

With the IFL 700 IQ sensor, the mechanical wiper removes gas bubbles and dirt from the surface of the ultrasonic transducer.

3.3.5 Short-term interferences due to obstacles

Certain events may for a short period of time affect or interrupt the measurement. In waste water treatment plants, these events are normally:

- Moving scrapers that displace an installed sensor from its measuring position or cross its measuring cone.
- Fixtures permanently installed in the basin such as pipes or scrapers that are touched by the measuring cone of a sensor on a scraper bridge when rotating.

Interferences due to obstacles can be suppressed with the aid of certain settings (see setting table, section 3.5).
The default settings may have to be adjusted as necessary.

A tilting armature is available for installation in basins with a chain scraper or linear scraper for scum removal. Thus the sensor is temporarily pulled out of the basin by the moving scraper.

3.3.6 Connecting the sensor

Connection cable

A sensor connection cable of the SACIQ or SACIQ SW type is required to connect the sensor. The cable is available in different lengths. Compared to the SACIQ standard model, the SACIQ SW sensor connection cable is optimized concerning its resistance to corrosion. Information on this and other IQ SENSOR NET accessories is given in the YSI catalog and on the Internet.

How to connect the SACIQ (SW) sensor connection cable to the terminal strip of an MIQ module is described in chapter 3 INSTALLATION of the IQ SENSOR NET system operating manual.

Are the plug connections dry?

Before connecting the sensor and sensor connection cable, please make sure the plug connections are dry. If moisture gets into the plug connections, first dry the plug connections (dab them dry or blow them dry using compressed air).

Do not suspend the sensor on the sensor connection cable. Use a sensor holder or an armature. Information on this and other IQ SENSOR NET accessories is given in the YSI catalog and on the Internet.

Connecting the sensor to the sensor connection cable

1	Take the protective caps off the plug connections of the sensor and the SACIQ (SW) sensor connection cable and keep them safe.

2	Plug the socket of the SACIQ (SW) sensor connection cable onto the plug head connector of the sensor. At the same time, rotate the socket so that the pin in the plug head connector (1) clicks into one of the two holes in the socket.
3	Then screw the coupling ring (2) of the sensor connection cable onto the sensor up to the stop.

NOTE (only IFL 700 IQ)
If the sensor is connected to the IQ SENSOR NET, the mechanical wiper may start moving unexpectedly. Make sure that the swivel range of the wiper is always free. Only put the sensor down its leg supports on a flat surface with the ultrasonic transducer pointing downward.

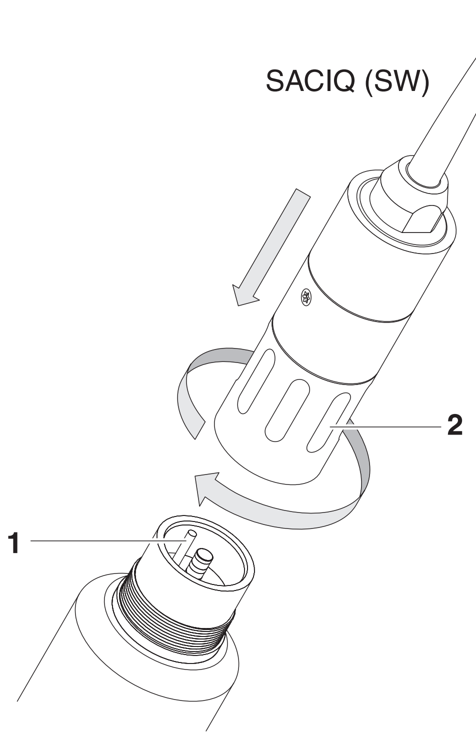


Fig. 3-2 Connecting the sensor

3.4 Initial commissioning

Prerequisite for the display of measured values of the IFL 70x IQ on a terminal of the IQ SENSOR NET system is the current software version of the controller and the terminal.
The current software is available on the Internet under www.YSI.com.

1	Install the sensor at the measuring location and establish the connection to the IQ SENSOR NET. (see section 3.3).
2	Using **<▲▼>**, select the IFL 70x IQ sensor in the measured value display.
3	Open the *Display/Options* / *Extended sensor functions* menu. The display shows the echo profile and certain special menus.
4	Open the *Sensor settings* / menu.
5	Adjust the following settings for the measuring location (*Sensor settings*): ● *Immersion depth* ● *Extended settings* / *Temperature* (average water temperature at mean water depth) ● *Water depth* (water depth to the bottom of the basin at the measuring location)

Setting of *Temperature*
If the average water temperature fluctuates due to seasonal changes we recommend to adjust the mean temperature on the instrument according to the current season.

Setting of *Water depth*
The *Water depth* setting should be consistent with reality as much as possible. Therefore, we recommend to determine the water depth at the measuring location and enter it.

6	Using *Save and quit*, confirm the settings and switch to the display of the echo profile.

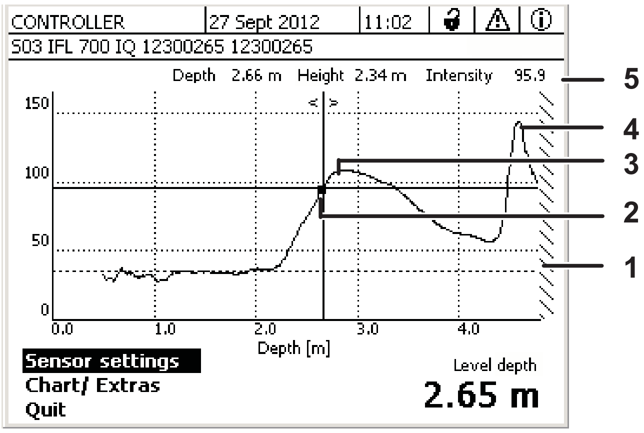


Fig. 3-3 Sample echo profile (sludge blanket height)

1	Entered *Water depth* (shaded)
2	Move the cursor along the profile (with **<◀ ▶>**)
3	*Topmost echo*: First rise of the sludge concentration viewed from the surface of the water
4	*Strongest echo*: Most concentrated sludge (greatest intensity)
5	Status line (values at the cursor position)

If the sensor does not provide the expected measured value (e.g. measured value too high, too low or too fluctuating), there are further settings, filters and functions available with which you can optimize the evaluation of the echo profile to meet your requirements (*Sensor settings*, see section 3.5).

6	Use **<M>** to switch over between the measured value display and echo profile. The echo profile is continued to be represented in the background and can quickly be displayed. or Use *Quit* to exit the *Extended sensor functions* menu. The representation of the echo profile is thus terminated. The echo profile can be reactivated with the *Display/Options / Extended sensor functions* menu.

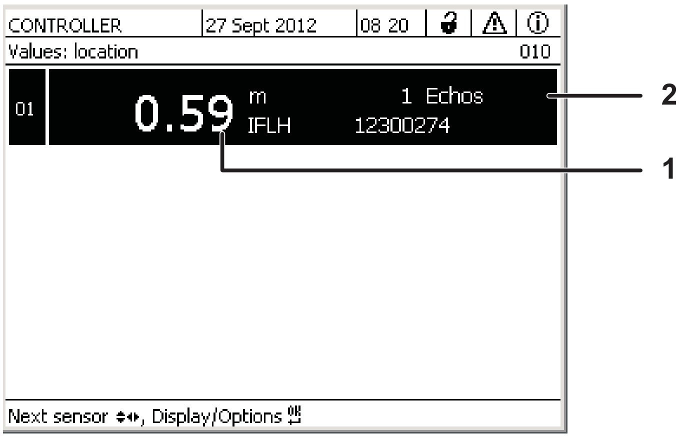


Fig. 3-4 Measured value display with main and secondary measured value

1	Measured value
2	Number of echoes found

3.5 Setting table for the IFL 70x IQ

Default values are marked in bold.

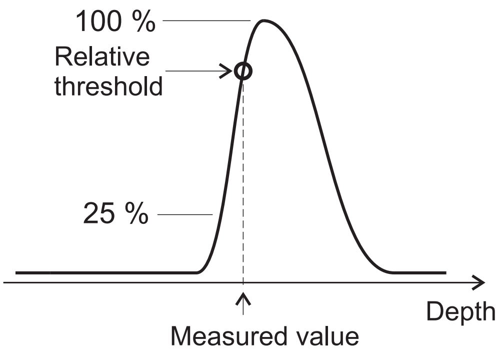
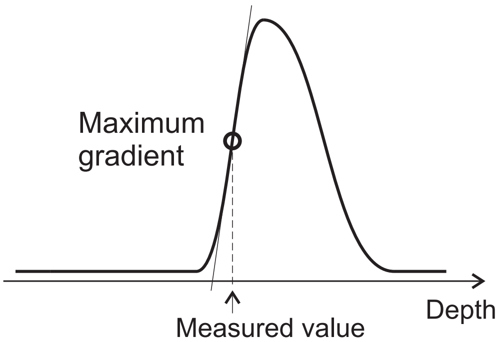
3.5.1 *Sensor settings* menu

Carrying out settings

The sensor settings can be accessed from the following menus:

- Using **<S>**, switch from the measured value display to the main menu of the settings. Then navigate to the setting menu (setting table) of the sensor. The exact procedure is given in the relevant IQ SENSOR NET system operating manual.
- Using **<▲▼>**, select the IFL 70x IQ sensor in the measured value display. Using **<M>**, open the *Display/Options* / *Extended sensor functions* menu. Open the *Sensor settings* menu.

Setting	Selection/values	Explanation
Measuring mode		Details see Fig. 3-1 in section 3.3.2
	Sludge level height	Position of the sludge blanket level in relation to the bottom of the basin (SLH).
	Sludge level depth	Position of the sludge blanket level in relation to the surface of the water (SLD).
Unit		Selection of the unit for the distance
	m	Meter
	ft	Foot
Immersion depth	*0.05 ... **0.10** ... 3.00 m*	Distance between the surface of the ultrasonic transducer (underside of the sensor) and the surface of the water (see Fig. 3-1 in section 3.3.2).
Water depth	*0 ... **6** ... 18 m*	Vertical distance between the surface of the water and the bottom of the basin at the measuring location (see Fig. 3-1 in section 3.3.2). The water depth can be determined by plumbing.

<table>
<tr><th>Setting</th><th>Selection/values</th><th>Explanation</th></tr>
<tr><td>Method</td><td></td><td>The rising side of the echo is evaluated for the measured value determination. One of two methods can be selected for this.</td></tr>
<tr><td></td><td>Rel. threshold</td><td>The measured value is equivalent to the point where the intensity of the echo reaches the adjusted relative threshold. The value relates to the maximum of the echo intensity (100 %):

</td></tr>
<tr><td></td><td>Maximum gradient</td><td>The measured value is equivalent to the point with the maximum gradient:

</td></tr>
<tr><td>Rel. threshold value</td><td>25 ... 75 ... 100 %</td><td>Threshold value for evaluation according to the Rel. threshold method.</td></tr>
</table>

Setting	Selection/values	Explanation
Echo selection		With this setting, the echo to be evaluated is determined. The echo is automatically identified according to the criterion that was set.
	Topmost echo	The topmost echo (from the surface of the water) is used for calculating the measured value. To ensure that a weak echo can be identified among the surrounding echoes, the interfering echoes can be suppressed with the setting, *Minimum intensity*.
	Strongest echo	The echo with the greatest intensity is output as the measured value. With spongy sludge, the bottom echo is the strongest echo of the echo profile. To avoid taking the bottom echo as the sludge echo, the *Water depth* and/or *Evaluation range* setting should be adjusted in such a way that the bottom echo is not taken into account.
Follow echo	*On* ***Off***	Filter effecting that a new echo is only evaluated if the new echo is in the vicinity of the echo previously determined. The tolerance range moves with each new valid echo.
Minimum intensity	*5 ...* ***30*** *... 100*	Filter that ignores echoes with low intensity.
Evaluation range		Filter that ignores measured values outside the selected range.
	Complete	The entire area between the end of the dead zone and the bottom of the basin is displayed.
	Limited *Start* *End*	Filter that reduces the measuring range to the limits required. Thus, interfering echoes of any fixtures installed in the basin can be ignored.

Setting	Selection/values	Explanation
Establishing time	*0 ... **120** ... 600 sec*	Filter that ignores (interfering) echoes whose residence time within the ultrasonic cone is shorter than the time defined here. Example: To ignore a scraper, the maximum duration of its visibility in the ultrasonic cone has to be entered.
Temperature	*0.0 ... **15.0** ... 50.0*	The temperature affects the speed of sound in the measuring medium. This effect can be taken into account by entering the temperature value. Enter the average water temperature at the average water depth of the basin. If there are seasonal fluctuations of the average water temperature we recommend to set a different average temperature for summer and winter.
Save and quit		The sensor stores all changed settings and the display switches to the next higher level.
Quit		The display switches to the next higher level without saving the new settings.

3.5.2 *Display/Extras* menu

Carrying out settings

Using **<▲▼>**, select the IFL 70x IQ sensor in the measured value display. Using **<M>**, open the *Display/Options* / *Extended sensor functions* menu. Open the *Sensor settings* menu.

Setting	Selection/values	Explanation
X-axis (depth)	***Complete***	The complete height from the ultrasonic transducer to the bottom is displayed.
	Evaluation range	The complete *Evaluation range* is displayed.
	Zoom range *Begin* *End*	The display on the screen is limited to the section set here.
Y-axis (intensity)	***Auto***	The strongest echo is displayed with the complete intensity.
	Zoom range *Begin* *End*	The display on the screen is limited to the section set here.
Displayed profile		This setting only effects the display of the echo profile. The current measured value is still determined with the filter settings.
	Unfiltered	Displays the echo profile without any filters.
	Filtered	Displays the echo profile with all filters.
Apply		Closes the *Display/Extras* menu.
Scraper test	(only with IFL 700 IQ)	The wiper moves once (function test).

4 Measuring

1	Submerse the sensor in the sample.
2	Read the measured value on the terminal of the IQ SENSOR NET system.

Factors affecting the measured value

The following factors have an impact on the measured value:

- The environmental conditions at the measuring location deviate too much from the sensor settings (*Immersion depth*, *Water depth*, *Temperature*)
- The distance between the ultrasonic transducer and the sludge level is too small (dead zone, see also section 3.3.3)
- Moving fixtures cross the measuring cone or the installation location of the sensor
- Foreign bodies or air bubbles are in front of or on the ultrasonic transducer.

5 Maintenance, cleaning, accessories

5.1 General information

WARNING

Contact with the sample can be dangerous for the user! Depending on the type of sample, suitable protective measures must be taken (protective clothing, protective goggles, etc.).

We recommend to clean the shaft and ultrasonic transducer surface of the sensor if the sensor has been in the measuring solution without operating for a lengthy period of time.

5.2 Cleaning of the sensor shaft and ultrasonic transducer surface

NOTE

Sharp objects can damage the ultrasonic transducer. Please be careful, especially when handling sharp tools, when cleaning and during transport.

NOTE (only IFL 700 IQ)

If the sensor is connected to the IQ SENSOR NET, the mechanical wiper may start moving unexpectedly. Prior to cleaning the sensor, activate the maintenance condition. Thus the wiper is switched off.

With normal operation (e.g. municipal wastewater) we recommend cleaning the sensor in the following cases:

- if there is any pollution (according to visual check)
- if the sensor was in the measuring medium but not in operation for a longer period of time
- if you suspect the echo intensity to be too low

Cleaning agents

Contamination	Cleaning agents
For sludge and loosely adhering dirt, or biological deposits	Soft cloth or soft brush, warm tap water with detergent
Salt and / or lime deposits	Acetic acid (volume percentage = 20 %), soft cloth or soft sponge

We do not recommend unscrewing the sensor from the sensor connection cable when cleaning the sensor shaft and measuring windows. Otherwise, moisture and/or dirt can get into the plug connection where it can cause contact problems.

If you need to disconnect the sensor from the sensor connection cable, please note the following points:

- Before disconnecting the sensor from the SACIQ (SW) sensor connection cable, remove any larger pieces of contamination from the sensor, particularly in the area of the plug connection (brush it off in a bucket of tap water, wash it off with a hose or wipe it off with a cloth).
- Unscrew the sensor from the SACIQ (SW) sensor connection cable.
- Always place a protective cap on the plug head of the sensor and on the SACIQ (SW) sensor connection cable so that no moisture or dirt can get into the contacting surfaces.
- In corrosive environments, close the socket of the sensor connection cable with the screwable SACIQ-Plug when it is dry in order to protect the electrical contacts from corrosion. The protective plug is available as an accessory (see section 5.3 ACCESSORIES). It is always included in the scope of delivery of the SACIQ SW sensor connection cable .

Cleaning

1	Switch on the maintenance condition for the sensor.
2	Pull the sensor out of the sample.
3	Get rid of any coarse impurities on the sensor (brush it off in a bucket of tap water, wash it down with a hose or wash it off with a cloth).

NOTE
Carefully clean the wiper of the IFL 700 IQ from outside.

4	Clean the sensor shaft and the surface of the ultrasonic transducer as explained in the point CLEANING AGENTS, page 1.
5	Then, rinse it thoroughly with tap water.

5.3 Accessories

Information on IQ SENSOR NET accessories is given in the YSI catalog and on the Internet.

6 What to do if...

Mechanical damage to the sensor

Cause	Remedy
	– Return the sensor

Display "----" (no valid measured value)

Cause	Remedy
Sensor is permanently in the air	Immerse the sensor in water (see section 3.3.2)
There are too many air bubbles in the water or on the ultrasonic transducer	Select a measurement location free of air bubbles
Sensor is dirty	– Clean the sensor and/or its environment – Check the function of the wiper (see section 3.5)
Thread algae floating in front of the sensor	Remove the thread algae from the sensor or its environment
In the selected *Evaluation range*, no echo is available that meets all settings	– Check whether there is a sludge blanket in the selected *Evaluation range* – Check whether the settings are suitable for the application.
Defective sensor	Contact the service department

The measured value is not within the expected range

Cause	Remedy
The *Water depth* is not set correctly (e.g., the bottom echo or multiple echoes between the bottom of the basin and the surface of the water are interpreted as measured value echoes.)	Set the *Water depth* and *Immersion depth* correctly
In the *Evaluation range* there are permanently installed fixtures that continually generate interfering echoes	– Select a measurement location without permanent interfering echoes. – If necessary, limit the *Evaluation range* so that any permanent interfering echoes are outside the *Evaluation range*.
In the *Evaluation range* there are moving fixtures (scrapers) that temporarily generate echoes.	– Limit the *Evaluation range* so that the water depth of the scraper is not in the *Evaluation range*. – Set the *Establishing time* correctly – Set *Follow echo* to *Yes*.
The sensor is cyclically moved out of the water by the scraper.	– Set the *Establishing time* correctly – Set *Follow echo* to *Yes*.

Number and position of the echoes changing often

Cause	Remedy
Small temporary interfering echoes (e.g. sludge flakes sinking slowly)	– Check *Echo selection* (*Topmost echo* or *Strongest echo*) – A higher value for the *Minimum intensity* filter ignores echoes from small, slowly sinking sludge fields.
New sludge blankets developing (e.g. a new sludge blanket developing on top of an old, concentrated sludge blanket).	– Check *Echo selection* (*Topmost echo* or *Strongest echo*) – *Follow echo* (change setting to *Yes*) – Set the *Evaluation range* to the range expected for the sludge level

Intensity of the existing echoes changing

Cause	Remedy
Temporary effect of air bubbles or thread algae	– Select a measurement location that has permanently few air bubbles. – Remove any thread algae from the sensor and its environment – Clean the sensor Check the wiper – Check *Echo selection* (*Topmost echo* or *Strongest echo*) – *Follow echo* (change setting to *Yes*) – Set the *Evaluation range* to the range expected for the sludge level
The sludge blanket level is very high, or the sedimentation behavior is insufficient	Check and adjust the process

7 Technical data

7.1 Measurement characteristics

Measuring principle

Ultrasound echo measurement

Measuring ranges and resolution

Measured parameter	Measuring ranges	Resolution	Accuracy
Distance	0.4 ... 15 m from ultrasonic transducer surface	0.01 m	0.1 m

Conversion to sludge level depth (from the surface of the water) or sludge level height (from the bottom of the basin)

7.2 Application characteristics

Allowed temperature range

Measuring medium	0 °C ... + 50 °C (32 ... 122°F)
Storage/transport	- 5 °C ... + 50 °C (23 ... 122 °F)

Allowed pH range of the measuring medium

4 ... 12

Pressure resistance

Sensor with connected SACIQ (SW) sensor connection cable:

Max. allowed overpressure: $3*10^5$ Pa (0.3 bar)

Type of protection

Sensor with connected SACIQ (SW) sensor connection cable:
IP X8; 0.3 bar ($3*10^5$ Pa)

Immersion depth

min. 5 cm; max. 3 m

Flow speed

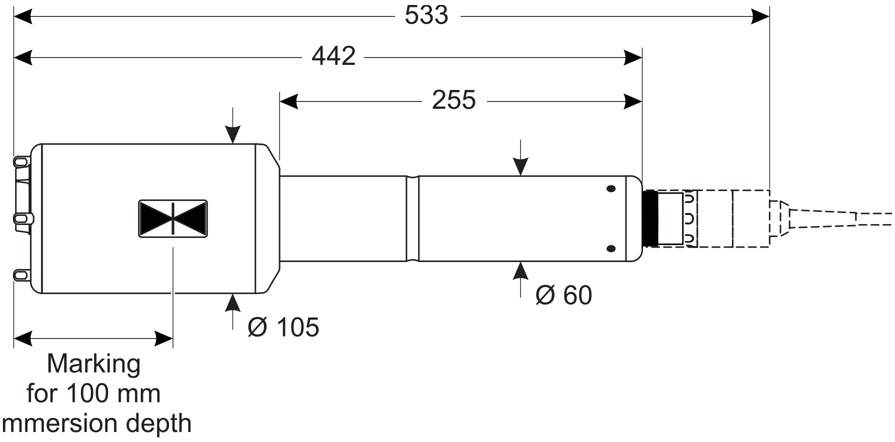
max. 3 m/s

Operating position

Vertical with ultrasonic transducer pointing downward

7.3 General data

Dimensions (in mm)



Weight (without sensor connection cable)

IFL 700 IQ	3.9 kg
IFL 701 IQ	3.7 kg

Connection technique

Connection via SACIQ (SW) sensor connection cable

Material

Shaft and enclosure	V4A stainless steel 1.4571 POM
Base plate	V4A stainless steel 1.4571
Ultrasonic transducer surface	PVC-C
Wiper (only IFL 700 IQ)	Grivory
Wiper driving shaft (only IFL 700 IQ)	Titan (grade 2)
Plug head connector housing	POM
Plug, 3-pole	ETFE (blue) Tefzel®

Cleaning system (only IFL 700 IQ)

Mechanical wiper, maintenance-free

Instrument safety

Applicable norms	– EN 61010-1 – UL 61010-1 – CAN/CSA C22.2#61010-1

7.4 Electrical data

Nominal voltage	Max. 24VDC via the IQ SENSOR NET (for more details, see chapter TECHNICAL DATA of the IQ SENSOR NET system operating manual)
Power consumption	5.5 W (maximum power consumption) 3.0 W (average power consumption) If the sensor is supplied with power by an MIQ/Blue PS module, only the average power consumption has to be taken into account.
Protective class	III

8 Indexes

8.1 Explanation of the messages

This chapter contains a list of all the message codes and related message texts that can occur in the log book of the IQ SENSOR NET system for the IFL 70x IQ sensor.

Information on the contents and structure of the log book and the structure of the message code is given in the LOG BOOK chapter of the IQ SENSOR NET system operating manual.

The last three digits of the message code form the component code. It identifies the component (active component) that caused the message:

Some error messages contain an internal error code, starting with "#".

Module code	Component
3C1	IFL 700 IQ
3C2	IFL 701 IQ

8.1.1 Error messages

Message code	Message text
EI13Cx	*Operational voltage too low* ** Check installation and cable lengths, Follow installation instructions* ** Power supply module(s) overloaded, add power supply module(s)* ** Check terminal and module connections* ** Defective components, replace components*
EI23Cx	*Operational voltage too low, no operation possible* ** Check installation and cable lengths, Follow installation instructions* ** Power supply module(s) overloaded, add power supply module(s)* ** Check terminal and module connections* ** Defective components,* *replace components*
ES13Cx	*Component hardware defective* ** Contact service*
ESA3Cx	*No sludge level can be determined in the selected evaluation range* ** Clean and immerse the sensor* ** Check all settings, especially for immersion depth, water depth, values to be ignored*
ESB3Cx	*Erroneous sensor position* ** Check the sensor fixations and fix the sensor in a vertical measuring position*

Message code	Message text
ESC3Cx	*Sensor defective*

8.1.2 Info messages

The sensor does not generate any info messages.

8.2 Status info

The status info is a coded piece of information on the current status of a sensor. Each sensor sends this status info to the controller. The status info of sensors consists of 32 bits, each of which can have the value 0 or 1.

Status info, general structure

0 1 2 3 4 5 6 7	8 9 10 11 12 13 14 15	
1 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0	(general)
0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0	(internal)
16 17 18 19 20 21 22 23	24 25 26 27 28 29 30 31	

The bits 0 - 15 are reserved for general information.
The bits 16 - 21 are reserved for internal service information.

You obtain the status info:

- via a manual query in the *Setup*/*Serviceinfo*/*List of all components* menu (see system operating manual)
- by an automated query
  - of a superordinate process control (e. g. when connected to the Profibus)
  - from the IQ Data Server (see IQ SENSOR NET Software Pack operating manual)

The evaluation of the status info, e.g. in the case of an automated query, has to be made individually for each bit.

Status info IFL 70x IQ

Status bit	Explanation
Bit 0	*Component hardware defective*
Bit 1-31	-

9 Contact Information

9.1 Ordering & Technical Support

Telephone:	(800) 897-4151 (937) 767-7241 Monday through Friday, 8:00 AM to 5:00 PM ET
Fax:	(937) 767-1058
Email:	environmental@ysi.com
Mail:	YSI Incorporated 1725 Brannum Lane Yellow Springs, OH 45387 USA
Internet:	www.ysi.com

When placing an order please have the following information available:

YSI account number (if available)	Name and Phone Number
Model number or brief description	Billing and shipping address
Quantity	Purchase Order or Credit Card

9.2 Service Information

YSI has authorized service centers throughout the United States and Internationally. For the nearest service center information, please visit www.ysi.com and click ‘Support’ or contact YSI Technical Support directly at 800-897-4151.

When returning a product for service, include the Product Return form with cleaning certification. The form must be completely filled out for an YSI Service Center to accept the instrument for service. The Product Return form may be downloaded at www.ysi.com and clicking on the ‘Support‘ tab.

a xylem brand

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Email: environmental@ysi.com
Internet: www.ysi.com

Product Data Sheet
00813-0100-4408, Rev BK
October 2021

Rosemount™ 5408 and 5408:SIS Level Transmitters

Non-Contacting Radar

- Unique energy-efficient two-wire FMCW radar technology for optimal performance
- Engineered and user tested for best-in-class safety, reliability, and ease-of-use
- Forty years of continuous product improvement
- Intuitive commissioning experience driven by wizards and adaptive graphics
- Rosemount 5408:SIS, optimal for safety applications and IEC 61508 certified to SIL 2
- Safe, easy, and remote proof testing without process interruptions

ROSEMOUNT™

EMERSON™

Introduction

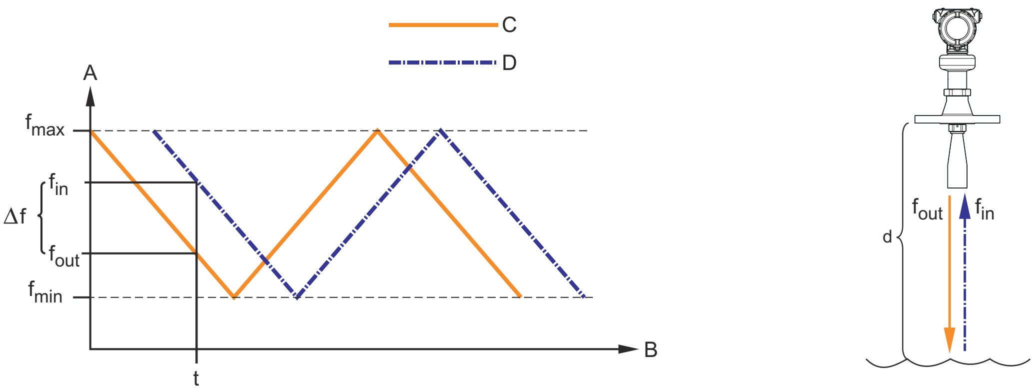
Measurement principle

The Rosemount 5408 is a two-wire transmitter for continuous level measurements using fast-sweep Frequency Modulated Continuous Wave (FMCW) technology.

The transmitter continuously emits signal sweeps with a constantly varying frequency towards the product surface. Since the transmitter continuously changes the frequency of the transmitted signal, there will be a difference in frequency between the transmitted and the reflected signals (see Figure 1).

The frequency of the reflected signal is subtracted from the frequency of the signal transmitted at that moment, resulting in a low frequency signal which is proportional to the distance to the product surface. This signal is further processed to obtain fast, reliable, and highly accurate level measurements.

Figure 1: FMCW-method



$\Delta f \sim d$=distance

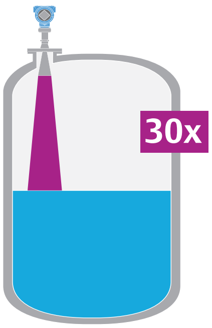
A. Frequency (GHz)
B. Time (s)
C. Transmitted signal
D. Reflected signal

Contents

Technology to redefine reliability

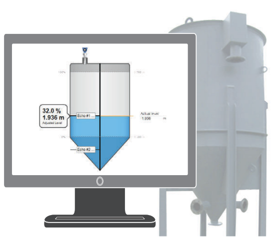
The Rosemount 5408 and 5408:SIS are optimized for reliable and accurate performance even in challenging process conditions. FMCW technology maximizes radar signal strength and produces a robust and reliable measurement (with 30 times more power on the surface than traditional two-wire non-contacting radars).

The transmitters are self-powered for up to two seconds to maintain operation despite cable glitches or lightning. The minimum lift-off voltage is 9 Vdc for FOUNDATION™ Fieldbus and 12 Vdc for HART®.



Ease-of-use at every touch point

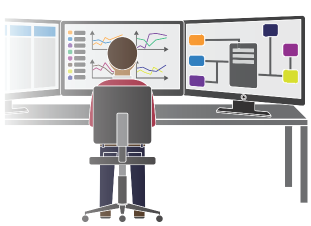
The Rosemount 5408 and 5408:SIS are designed to simplify operator tasks. They deliver ease-of-use at every touch point, from the pictorial user instructions and graphical intuitive wizards to the PTFE seal that requires no O-ring material for simplifying model selection.



Dedicated to safety

The Smart Diagnostics Suite provides operators with early alerts in case of antenna build-up, weak power supply, or abnormal surface conditions. Also, a local memory enables full insight into the last seven days of measurements, alerts, and echo profiles.

The Rosemount 5408:SIS is the ideal choice for functional safety such as overfill prevention. It is safety certified (SIL 2/SIL 3), supports long proof-test intervals guaranteed to suit your schedule, and can be tested remotely without any process interruption.

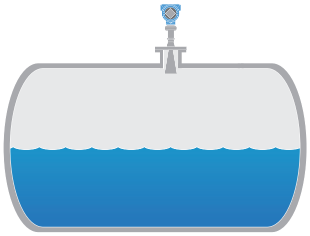


Application examples

The Rosemount 5408 and 5408:SIS are ideal for level measurements over a broad range of liquid and solids applications. The transmitters are virtually unaffected by changing density, temperature, pressure, media dielectric, pH, and viscosity. Non-contacting radar level is ideal for harsh conditions such as corrosive and sticky media, or when internal tank obstructions are a limiting factor.

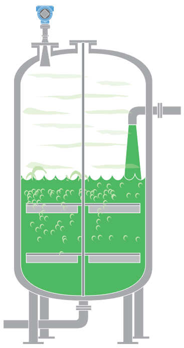
Storage and buffer tanks

The Rosemount 5408 provides accurate and reliable level measurement for both metallic or non-metallic vessels containing almost any liquid (e.g. oil, gas condensate, water, chemicals).



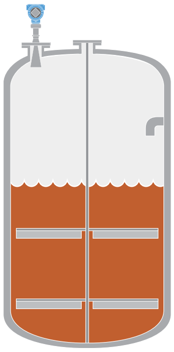
Reactors

The Rosemount 5408 is ideal for the most challenging applications, including reactors where there can be agitation, foaming, and condensation, as well as high temperatures and pressures.



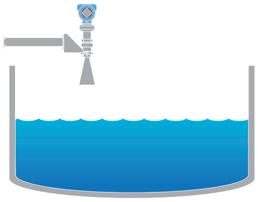
Blenders and mixers

The Rosemount 5408 can help you withstand the rigors of blenders and mixing tanks. Easy to install and commission, it is also unaffected by virtually any fluid property change.



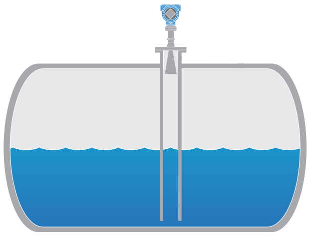
Open atmospheric applications

The Rosemount 5408 measures reliably in open applications, from short range sumps or ponds to long range dams.



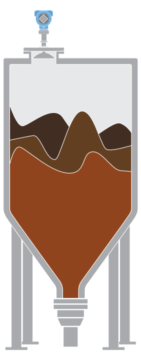
Still pipe and chamber installations

The Rosemount 5408 is a great choice for level measurement in tanks with small diameter still pipes. It may also be used in chambers, but guided wave radar is generally the best fit for these applications. For more information on using the Rosemount 5408 in still pipes and chambers refer to the Best Practices for Using Radar in Still Pipes and Chambers Technical Note.



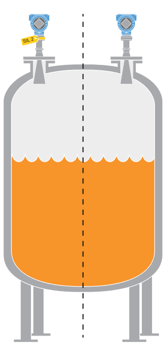
Bulk solids

The Rosemount 5408 is the ideal solution for small- to medium-sized silos with rapid level changes. The narrow beam avoids internal obstructions while still keeping good level measurement.



Safety applications

The Rosemount 5408:SIS is the ideal choice for safety functions such as overfill prevention, level deviation monitoring or dry-run prevention.



Access information when you need it with asset tags

Newly shipped devices include a unique QR code asset tag that enables you to access serialized information directly from the device. With this capability, you can:

- Access device drawings, diagrams, technical documentation, and troubleshooting information in your MyEmerson account
- Improve mean time to repair and maintain efficiency
- Ensure confidence that you have located the correct device
- Eliminate the time-consuming process of locating and transcribing nameplates to view asset information

Ordering information

Online product configurator

Many products are configurable online using our Product Configurator. Select the **Configure** button or visit our website to start. With this tool's built-in logic and continuous validation, you can configure your products more quickly and accurately.

Specifications and options

See the Specifications and options section for more details on each configuration. Specification and selection of product materials, options, or components must be made by the purchaser of the equipment. See the Material selection section for more information.

Related information

Performance specifications
Functional specifications
Physical specifications
Material selection

Model codes

Model codes contain the details related to each product. Exact model codes will vary; an example of a typical model code is shown in Figure 2.

Figure 2: Model Code Example

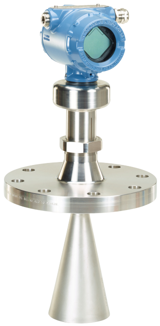
5408 F 1 S H A 1 E5 1 R 3 AB CAB 3	M5 DA1 EF2 QT
1	2

1. Required model components (choices available on most)
2. Additional options (variety of features and functions that may be added to products)

Optimizing lead time

The starred offerings (★) represent the most common options and should be selected for best delivery. The non-starred offerings are subject to additional delivery lead time.

Rosemount 5408 Level Transmitter ordering information



The Rosemount 5408 is a two-wire non-contacting radar transmitter for level measurements on both liquid and solid materials. It uses a unique energy efficient radar technology based on the FMCW principle to ensure reliable performance even in challenging conditions.

CONFIGURE > VIEW PRODUCT >

5408A1SHA1E51R6AACAA4DA1Q4

Required model components

Model

Code	Description	
5408	Radar Level Transmitter	★

Profile

Code	Description	
A	Standard monitoring & control applications	★

Measurement type

Code	Description	
1	Liquid level measurement	★
3	Solids level measurement	★
4	Liquid & solids level measurement	★

Performance class

Code	Description	Reference accuracy	
A	Ultra accuracy	±0.04 in. (±1 mm)	★
S	Standard	±0.08 in. (±2 mm)	★

Signal output

Code	Description	
H	4–20 mA with digital signal based on HART® revision 6 protocol (HART revision 7 available as option)	★
F	FOUNDATION™ Fieldbus	★
U(1)	Rosemount 2410 Tank Hub connectivity	★

(1) *Not available with performance class code A (ultra accuracy).*

Housing material

Code	Description	
A	Aluminum	★
S	Stainless steel (SST)	★

Conduit/cable threads

Code	Description	
1	½-14 NPT	★
2	M20 x 1.5	★
3(1)	G½	

(1) *G½ thread form is not available with hazardous locations approvals.*

Hazardous locations certifications

Code	Description	
NA	None	★
E1	ATEX Flameproof	★
I1	ATEX Intrinsic Safety	★
N1	ATEX Type n	★
IA	ATEX FISCO Intrinsic Safety	★
E5	USA Explosion-proof, Dust Ignition-proof	★
I5	USA Intrinsically Safe; Nonincendive	★
IE	USA FISCO Intrinsic Safety	★
E6	Canadian Explosion-proof, Dust Ignition-proof	★
I6	Canadian Intrinsically Safe; Nonincendive	★
IF	Canadian FISCO Intrinsic Safety	★
E7	IECEx Flameproof, Dust Ignition-proof	★
I7	IECEx Intrinsic Safety	★
N7	IECEx Type n	★
IG	IECEx FISCO Intrinsic Safety	★
E2	INMETRO Flameproof	★
I2	INMETRO Intrinsic Safety	★
N2	INMETRO Type n	★
IB	INMETRO FISCO Intrinsic Safety	★
E3	China Flameproof	★
I3	China Intrinsic Safety	★
N3	China Type n	★
IC	China FISCO Intrinsic Safety	★
E4	Japan Flameproof	★

Code	Description	
ID	Japan FISCO Intrinsic Safety	★
EP	Republic of Korea Flameproof	★
IP	Republic of Korea Intrinsic Safety	★
EM(1)	Technical Regulations Customs Union (EAC) Flameproof	★
IM(1)	Technical Regulations Customs Union (EAC) Intrinsic Safety	★
NM(1)	Technical Regulations Customs Union (EAC) Type n	★
IN(1)	Technical Regulations Customs Union (EAC) FISCO Intrinsic Safety	★

(1) *Not available with performance class code A (ultra accuracy).*

Materials of construction

Code	Description	Available antenna types	
1	316/316L/EN 1.4404	Cone, parabolic	★
7	All PTFE wetted parts	Process seal	★
2	Alloy C-276 (UNS N10276) with protective plate	Cone	
3	Alloy 400 (UNS N04400) with protective plate	Cone	
H	Alloy C-276 (UNS N10276) process connection, flange, and antenna	Cone	
M	Alloy 400 (UNS N04400) process connection, flange, and antenna	Cone	

Process connection type

Code	Description	Available antenna types	
F(1)	Flat Face flange	Cone, parabolic	★
R(2)	Raised Face flange	All	★
N	NPT thread	Cone	★
G	BSPP (G) thread	Cone, parabolic	★
B	Bracket mounting	All	★
C	Tri Clamp	Process seal	★
W	Welded connection	Parabolic	★
T	Ring Type Joint (RTJ) flange	Cone	

(1) *Type A flat face for EN 1092-1 flanges.*
(2) *Type B1 raised face for EN 1092-1 flanges.*

Related information

Availability of process connections

Process connection size

Code	Description	Available antenna types	
A	1½-in.	Cone	★
2	2-in./DN50/50A	Cone, process seal	★
3	3-in./DN80/80A	Cone, process seal	★
B	3½-in.	Parabolic	★
4	4-in./DN100/100A	Cone, process seal	★
6	6-in./DN150/150A	Cone	★
8	8-in./DN200/200A	Cone, parabolic	★
T	10-in./DN250/250A	Parabolic	★
Z	None (use when ordering bracket mounting)	All	★

Related information

Availability of process connections

Process connection rating

Code	Description	Note	
ZZ	For use with non-flange process connection type		★
ASME flanges			
AA	ASME B16.5 Class 150		★
AB	ASME B16.5 Class 300		★
AC	ASME B16.5 Class 600		★
AD	ASME B16.5 Class 900		★
EN flanges		Note	
DK	EN1092-1 PN6		★
DA	EN1092-1 PN16	PN10 and PN16 dimensions are identical for DN50 to DN150	★
DB	EN1092-1 PN40	PN25 and PN40 dimensions are identical for DN50 to DN150	★
DC	EN1092-1 PN63		★
DD	EN1092-1 PN100		★
JIS flanges			
JK	JIS 5K		★
JA	JIS 10K		★
JB	JIS 20K		★

Related information

Availability of process connections

Antenna type

For applications where saturated steam may occur, consult factory.

Code	Description	Operating pressure	Operating temperature	
CAA	Cone antenna (PTFE seal)	-15 to 363 psig (-1 to 25 bar)	-76 to 392 °F (-60 to 200 °C)	★
CAB	Cone antenna (PTFE seal)	-15 to 725 psig (-1 to 50 bar)(1)	-40 to 302 °F (-40 to 150 °C)	★
CAC	Cone antenna (PTFE seal)	-15 to 1450 psig (-1 to 100 bar)	-40 to 212 °F (-40 to 100 °C)	★
CAD	Cone antenna (PTFE seal)	-15 to 44 psig (-1 to 3 bar)	-76 to 482 °F (-60 to 250 °C)	★
CBF	Cone antenna (PEEK seal, FVMQ)	-15 to 754 psig (-1 to 52 bar)	-76 to 338 °F (-60 to 170 °C)	★
CBK	Cone antenna (PEEK seal, Kalrez® 6375)	-15 to 754 psig (-1 to 52 bar)	5 to 482 °F (-15 to 250 °C)	★
CBM	Cone antenna (PEEK seal, FKM)	-15 to 754 psig (-1 to 52 bar)	-13 to 428 °F (-25 to 220 °C)	★
CBV	Cone antenna (PEEK seal, Viton®)	-15 to 754 psig (-1 to 52 bar)	-22 to 392 °F (-30 to 200 °C)	★
SAA	Process seal antenna	-15 to 363 psig (-1 to 25 bar)(2)	-76 to 392 °F (-60 to 200 °C)(2)	★
PAS	Parabolic antenna, swivel mount	-7 to 43 psig (-0.5 to 3 bar)	-67 to 392 °F (-55 to 200 °C)	★

(1) *Pressure limit is derated for process temperatures above 100 °F (38 °C).*
(2) *The final rating depends on the selected process connection.*

Related information

Process temperature and pressure rating

Antenna size

Code	Description	Available antenna types	
A(1)	1½-in. (DN40)	Cone (PTFE seal)	★
2	2-in. (DN50)	Cone, process seal	★
3	3-in. (DN80)	Cone, process seal	★
4	4-in. (DN100)	Cone, process seal	★
8	8-in. (DN200)	Parabolic	★

(1) *1½-in. (DN40) cone antenna is available for 1½-in. NPT threaded connection and materials of construction code 1 (316/316L/EN 1.4404).*

Additional options

Antenna extensions

Code	Description	Total length	Available antenna sizes	
S1	Extended cone antenna	23.6-in. (600 mm)	All except 1½-in. (DN40)	★
S2	Extended cone antenna, segmented	47.2-in. (1200 mm)		★

Purging connection

Option code PC1 is for cone antennas only, and requires matching flange and antenna sizes. Note that all parabolic antennas come with an integrated air purge connection.

A minimum gasket thickness of 0.125 in. (3.2 mm) is required for flanges with protective plate design.

Code	Description	
PC1	Purging connector (purge ring)	★

Related information

Air purging

Display

Code	Description	
M5	LCD display	★

Related information

LCD display

Diagnostic functionality

Code	Description	
DA1	HART Smart Diagnostics Suite	★
D01	FOUNDATION Fieldbus Smart Diagnostics Suite	★

Related information

Smart Diagnostics Suite

Smart level test

This option is only available with 4-20 mA HART protocol.

Code	Description	
ET	Smart Echo Level Test	★

Related information

Smart echo level test

HART revision configuration

Code	Description	
HR7	4-20 mA with digital signal based on HART revision 7 protocol	★

Open air applications configuration

This option is only available with parabolic antenna, 3-in. (DN80) and 4-in. (DN100) process seal antennas, and 4-in. (DN100) cone antenna.

Code	Description	
OA	Open air applications configuration; LPR (Level Probing Radar)	★

Factory configuration

Code	Description	
C1	Factory configuration per Configuration Data Sheet	★

Alarm limits

Code	Description	
C4	NAMUR alarm and saturation levels, high alarm	★
C5	NAMUR alarm and saturation levels, low alarm	★
C8(1)	Standard Rosemount alarm and saturation levels, low alarm	★

(1) *The standard alarm setting is high.*

Welding standard for flanges

Only applies to flanged process connections with welded construction or protective plate design; only applicable to cone antennas.

Flanged process connections with protective plate design are only available with ASME IX (option code AW).

Code	Description	
AW	According to ASME IX	★
EW	According to EN-ISO	★

Country certification

CRN is not available with EN1092-1 or JIS B2220 flanges, neither for ASME B16.5 flanges in materials of construction code M.

Code	Description	
J1	Canadian Registration (CRN)	★

Special quality assurance

Code	Description	
Q4	Calibration data certificate	★
QG	Calibration certificate and GOST verification certificate (only for end-destination country Russia)	

Hydrostatic testing

Hydrostatic testing is only available for cone antennas and process seal antennas with flanged process connections.

Code	Description	
Q5	Hydrostatic testing, including certificate	★

Material traceability certification

Certificate includes all pressure retaining and wetted parts.

Code	Description	
Q8	Material traceability certification per EN 10204 3.1 (2.1 for non-metallic)	★

Hygienic certification

Only available for process seal antennas with Tri Clamp connection.

Code	Description	
QA	Certificate of compliance to 3-A®	★

Food and Drug Administration (FDA) statement

Only available for process seal antennas with Tri Clamp connection.

Code	Description	
QH(1)	Certificate of compliance to FDA 21CFR110, Subpart C: Food and Drug Administration - Current Good Manufacturing Practice in Manufacturing, Packing, or Holding Human Food	★

(1) *Applicable only to wetted parts.*

Materials certification

The materials certification is not available with parabolic antenna.

Code	Description	
Q15	NACE® material recommendation per NACE MR0175/ISO 15156	★
Q25	NACE material recommendation per NACE MR0103/ISO 17945	★
Q35	NACE material recommendation per NACE MR0175/ISO 15156 and NACE MR0103/ISO 17945	★

Welding procedure qualification record documentation

Only applies to flanged process connections with welded construction or protective plate design; only applicable to cone antennas.

Code	Description	
Q66	Welding Procedure Qualification Record (WPQR)	★
Q67	Welder Performance Qualification (WPQ)	★
Q68	Welding Procedure Specification (WPS)	★
Q79	WPQR/WPQ/WPS	★

Dye penetration test certificate

Only applies to flanged process connections with welded construction or protective plate design; only applicable to cone antennas.

Code	Description	
Q73	Certificate of liquid penetrant inspection	★

Positive material identification certificate

Code	Description	
Q76	Positive material identification certificate of conformance	★

Overfill prevention

Code	Description	
U1	Overfill prevention according to WHG/TUV	★

Shipboard approvals

Transmitters with aluminum housing are not approved for open deck installations; for use only in engine room, pump room, etc.

Code	Description	
SBS	American Bureau of Shipping Type Approval	★
SDN	Det Norske Veritas Germanischer Lloyd (DNV GL) Type Approval	★
SLL	Lloyd's Register Type Approval	★
SBV	Bureau Veritas Type Approval	★
SRS	Russian Maritime Register of Shipping	★

Extended product warranty

Rosemount extended warranties have a limited warranty of three or five years from date of shipment.

Code	Description	
WR3	3-year limited warranty	★
WR5	5-year limited warranty	★

Conduit electrical connector (shipped uninstalled)

Requires ½-14 NPT conduit/cable threads (code 1). Available with Intrinsically Safe approvals only.

Code	Description	
EC	M 12, 4-pin, male connector (eurofast®)	★
MC	A size Mini, 4-pin, male connector (minifast®)	★

Specials

Code	Description	
PXXXX	Custom engineered solutions beyond standard model codes. Consult factory for details.	

Related information

Engineered solutions

Rosemount 5408:SIS Level Transmitter ordering information

Safety certified to IEC 61508 for SIL2 applications with SIL3 capability, the Rosemount 5408:SIS reduces cost of risk, increases efficiency, and protects your staff and the environment.

CONFIGURE > VIEW PRODUCT >

Required model components

Model

Code	Description	
5408	Radar Level Transmitter	★

Profile

Code	Description	
F(1)	Functional safety / SIS applications	★

(1) *The Rosemount 5408:SIS has two operational modes: Safety (SIS) and Control/Monitoring. Safety (SIS) mode must be set when used in Safety Instrumented Systems. Control/Monitoring mode is intended for use in a Basic Process Control System (BPCS).*

Measurement type

Code	Description	
1	Liquid level measurement	★
4(1)	Liquid & solids level measurement	★

(1) *Note that for the Rosemount 5408:SIS (profile code F), solids level measurement is only available when operating in Control/Monitoring mode.*

Performance class

Code	Description	Reference accuracy	
A	Ultra accuracy	±0.04 in. (±1 mm)	★
S	Standard	±0.08 in. (±2 mm)	★

Signal output

Code	Description	
H	4–20 mA with digital signal based on HART® revision 6 protocol (HART revision 7 available as option)	★

Housing material

Code	Description	
A	Aluminum	★
S	Stainless steel (SST)	★

Conduit/cable threads

Code	Description	
1	½-14 NPT	★
2	M20 x 1.5	★
3(1)	G½	

(1) *G½ thread form is not available with hazardous locations approvals.*

Hazardous locations certifications

Code	Description	
NA	None	★
E1	ATEX Flameproof	★
I1	ATEX Intrinsic Safety	★
N1	ATEX Type n	★
E5	USA Explosion-proof, Dust Ignition-proof	★
I5	USA Intrinsically Safe; Nonincendive	★
E6	Canadian Explosion-proof, Dust Ignition-proof	★
I6	Canadian Intrinsically Safe; Nonincendive	★
E7	IECEx Flameproof, Dust Ignition-proof	★
I7	IECEx Intrinsic Safety	★
N7	IECEx Type n	★
E2	INMETRO Flameproof	★
I2	INMETRO Intrinsic Safety	★
N2	INMETRO Type n	★
E3	China Flameproof	★
I3	China Intrinsic Safety	★
N3	China Type n	★
E4	Japan Flameproof	★
EP	Republic of Korea Flameproof	★
IP	Republic of Korea Intrinsic Safety	★
EM(1)	Technical Regulations Customs Union (EAC) Flameproof	★
IM(1)	Technical Regulations Customs Union (EAC) Intrinsic Safety	★
NM(1)	Technical Regulations Customs Union (EAC) Type n	★

(1) *Not available with performance class code A (ultra accuracy).*

Materials of construction

Code	Description	Available antenna types	
1	316/316L/EN 1.4404	Cone, parabolic	★
7	All PTFE wetted parts	Process seal	★
2	Alloy C-276 (UNS N10276) with protective plate	Cone	
3	Alloy 400 (UNS N04400) with protective plate	Cone	
H	Alloy C-276 (UNS N10276) process connection, flange, and antenna	Cone	
M	Alloy 400 (UNS N04400) process connection, flange, and antenna	Cone	

Process connection type

Code	Description	Available antenna types	
F(1)	Flat Face flange	Cone, parabolic	★
R(2)	Raised Face flange	All	★
N	NPT thread	Cone	★
G	BSPP (G) thread	Cone, parabolic	★
C	Tri Clamp	Process seal	★
W	Welded connection	Parabolic	★
T	Ring Type Joint (RTJ) flange	Cone	

(1) *Type A flat face for EN 1092-1 flanges.*
(2) *Type B1 raised face for EN 1092-1 flanges.*

Related information

Availability of process connections

Process connection size

Code	Description	Available antenna types	
A	1½-in.	Cone	★
2	2-in./DN50/50A	Cone, process seal	★
3	3-in./DN80/80A	Cone, process seal	★
B	3½-in.	Parabolic	★
4	4-in./DN100/100A	Cone, process seal	★
6	6-in./DN150/150A	Cone	★
8	8-in./DN200/200A	Cone, parabolic	★
T	10-in./DN250/250A	Parabolic	★

Related information

Availability of process connections

Process connection rating

Code	Description		
ZZ	For use with non-flange process connection type		★
ASME flanges			
AA	ASME B16.5 Class 150		★
AB	ASME B16.5 Class 300		★
AC	ASME B16.5 Class 600		★
AD	ASME B16.5 Class 900		★
EN flanges		Note	
DK	EN1092-1 PN6		★
DA	EN1092-1 PN16	PN10 and PN16 dimensions are identical for DN50 to DN150	★
DB	EN1092-1 PN40	PN25 and PN40 dimensions are identical for DN50 to DN150	★
DC	EN1092-1 PN63		★
DD	EN1092-1 PN100		★
JIS flanges			
JK	JIS 5K		★
JA	JIS 10K		★
JB	JIS 20K		★

Related information

Availability of process connections

Antenna type

For applications where saturated steam may occur, consult factory.

Code	Description	Operating pressure	Operating temperature	
CAA	Cone antenna (PTFE seal)	-15 to 363 psig (-1 to 25 bar)	-76 to 392 °F (-60 to 200 °C)	★
CAB	Cone antenna (PTFE seal)	-15 to 725 psig (-1 to 50 bar)(1)	-40 to 302 °F (-40 to 150 °C)	★
CAC	Cone antenna (PTFE seal)	-15 to 1450 psig (-1 to 100 bar)	-40 to 212 °F (-40 to 100 °C)	★
CAD	Cone antenna (PTFE seal)	-15 to 44 psig (-1 to 3 bar)	-76 to 482 °F (-60 to 250 °C)	★
CBF	Cone antenna (PEEK seal, FVMQ)	-15 to 754 psig (-1 to 52 bar)	-76 to 338 °F (-60 to 170 °C)	★
CBK	Cone antenna (PEEK seal, Kalrez® 6375)	-15 to 754 psig (-1 to 52 bar)	5 to 482 °F (-15 to 250 °C)	★
CBM	Cone antenna (PEEK seal, FKM)	-15 to 754 psig (-1 to 52 bar)	-13 to 428 °F (-25 to 220 °C)	★
CBV	Cone antenna (PEEK seal, Viton®)	-15 to 754 psig (-1 to 52 bar)	-22 to 392 °F (-30 to 200 °C)	★
SAA	Process seal antenna	-15 to 363 psig (-1 to 25 bar)(2)	-76 to 392 °F (-60 to 200 °C)(2)	★
PAS	Parabolic antenna, swivel mount	-7 to 43 psig (-0.5 to 3 bar)	-67 to 392 °F (-55 to 200 °C)	★

(1) *Pressure limit is derated for process temperatures above 100 °F (38 °C).*
(2) *The final rating depends on the selected process connection.*

Related information

Process temperature and pressure rating

Antenna size

Code	Description	Available antenna types	
2	2-in. (DN50)	Cone, process seal	★
3	3-in. (DN80)	Cone, process seal	★
4	4-in. (DN100)	Cone, process seal	★
8	8-in. (DN200)	Parabolic	★

Additional options

Antenna extensions

Code	Description	Total length	Available antenna sizes	
S1	Extended cone antenna	23.6-in. (600 mm)	All except 1½-in. (DN40)	★
S2	Extended cone antenna, segmented	47.2-in. (1200 mm)		★

Purging connection

Option code PC1 is for cone antennas only, and requires matching flange and antenna sizes. Note that all parabolic antennas come with an integrated air purge connection.

A minimum gasket thickness of 0.125 in. (3.2 mm) is required for flanges with protective plate design.

Code	Description	
PC1	Purging connector (purge ring)	★

Related information

Air purging

Display

Code	Description	
M5	LCD display	★

Related information

LCD display

Functional safety options

Code	Description	
EF2	Extended SIS package	★

Diagnostic functionality

Code	Description	
DA1	HART Smart Diagnostics Suite	★

Related information

Smart Diagnostics Suite

Smart level test

Code	Description	
ET	Smart Echo Level Test	★

Related information

Smart echo level test

HART revision configuration

Code	Description	
HR7	4-20 mA with digital signal based on HART revision 7 protocol	★

Factory configuration

Code	Description	
C1	Factory configuration per Configuration Data Sheet	★

Alarm limits

Code	Description	
C4	NAMUR alarm and saturation levels, high alarm	★
C5	NAMUR alarm and saturation levels, low alarm	★
C8(1)	Standard Rosemount alarm and saturation levels, low alarm	★

(1) *The standard alarm setting is high.*

Welding standard for flanges

Only applies to flanged process connections with welded construction or protective plate design; only applicable to cone antennas.

Flanged process connections with protective plate design are only available with ASME IX (option code AW).

Code	Description	
AW	According to ASME IX	★
EW	According to EN-ISO	★

Country certification

CRN is not available with EN1092-1 or JIS B2220 flanges, neither for ASME B16.5 flanges in materials of construction code M.

Code	Description	
J1	Canadian Registration (CRN)	★

Special quality assurance

Code	Description	
Q4	Calibration data certificate	★
QG	Calibration certificate and GOST verification certificate (only for end-destination country Russia)	

Hydrostatic testing

Hydrostatic testing is only available for cone antennas and process seal antennas with flanged process connections.

Code	Description	
Q5	Hydrostatic testing, including certificate	★

Material traceability certification

Certificate includes all pressure retaining and wetted parts.

Code	Description	
Q8	Material traceability certification per EN 10204 3.1 (2.1 for non-metallic)	★

Hygienic certification

Only available for process seal antennas with Tri Clamp connection.

Code	Description	
QA	Certificate of compliance to 3-A®	★

Food and Drug Administration (FDA) statement

Only available for process seal antennas with Tri Clamp connection.

Code	Description	
QH(1)	Certificate of compliance to FDA 21CFR110, Subpart C: Food and Drug Administration - Current Good Manufacturing Practice in Manufacturing, Packing, or Holding Human Food	★

(1) *Applicable only to wetted parts.*

Quality certification for safety

Code	Description	
QS	Certificate of FMEDA Data	★
QT	Safety-certified to IEC 61508 with certificate of FMEDA data	★

Materials certification

The materials certification is not available with parabolic antenna.

Code	Description	
Q15	NACE® material recommendation per NACE MR0175/ISO 15156	★
Q25	NACE material recommendation per NACE MR0103/ISO 17945	★
Q35	NACE material recommendation per NACE MR0175/ISO 15156 and NACE MR0103/ISO 17945	★

Welding procedure qualification record documentation

Only applies to flanged process connections with welded construction or protective plate design; only applicable to cone antennas.

Code	Description	
Q66	Welding Procedure Qualification Record (WPQR)	★
Q67	Welder Performance Qualification (WPQ)	★
Q68	Welding Procedure Specification (WPS)	★
Q79	WPQR/WPQ/WPS	★

Dye penetration test certificate

Only applies to flanged process connections with welded construction or protective plate design; only applicable to cone antennas.

Code	Description	
Q73	Certificate of liquid penetrant inspection	★

Positive material identification certificate

Code	Description	
Q76	Positive material identification certificate of conformance	★

Overfill prevention

Code	Description	
U1	Overfill prevention according to WHG/TUV	★

Shipboard approvals

Transmitters with aluminum housing are not approved for open deck installations; for use only in engine room, pump room, etc.

Code	Description	
SBS	American Bureau of Shipping Type Approval	★
SDN	Det Norske Veritas Germanischer Lloyd (DNV GL) Type Approval	★
SLL	Lloyd's Register Type Approval	★
SBV	Bureau Veritas Type Approval	★
SRS	Russian Maritime Register of Shipping	★

Extended product warranty

Rosemount extended warranties have a limited warranty of three or five years from date of shipment.

Code	Description	
WR3	3-year limited warranty	★
WR5	5-year limited warranty	★

Paint option for aluminum housing

Code	Description	
PY1	Housing and covers in yellow per RAL 1003	★
PY2	Covers in yellow per RAL 1003	★
PR1	Housing and covers in red per RAL 3002	★
PR2	Covers in red per RAL 3002	★
PO1	Housing and covers in orange per Munsell 2.5 YR 6/14	★
PO2	Covers in orange per Munsell 2.5 YR 6/14	★

Conduit electrical connector (shipped uninstalled)

Requires ½-14 NPT conduit/cable threads (code 1). Available with Intrinsically Safe approvals only.

Code	Description	
EC	M 12, 4-pin, male connector (eurofast®)	★
MC	A size Mini, 4-pin, male connector (minifast®)	★

Specials

Code	Description	
PXXXX	Custom engineered solutions beyond standard model codes. Consult factory for details.	

Related information

Engineered solutions

Availability of process connections

Table 1: Cone Antenna - 316/316L SST/EN 1.4404 (Type vs. Size and Rating)

Process connection size	Process connection rating								
	Thread[1]	ASME B16.5 flanges[2]		EN1092-1 flanges[2]				JIS B2220 flanges[2]	
		Class 150/300[3]	Class 600/900[3]	PN16[4]	PN40[4]	PN63[5]	PN100[5]	10K[3]	20K[5]
1½-in.	G, N	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2-in./DN50/50A	G, N	R	R, T	F	F, R	F, R	F	R	R
3-in./DN80/80A	G, N	R	R, T	F, R	F, R	F, R	F, R	R	R
4-in./DN100/100A	G, N	R	R, T	F, R	F, R	F	F	R	R
6-in./DN150/150A	N/A	R	N/A	F, R	F, R	F	N/A	R	R
8-in./DN200/200A	N/A	R	N/A	F, R	F, R	N/A	N/A	R	R

(1) *BSPP (G) thread (process connection type code G); N = NPT thread (process connection type code N)*

(2) *F = Flat Face (process connection type code F); R = Raised Face (process connection type code R); T = Ring Type Joint (process connection type code T)*

(3) *Forged one-piece flange or welded construction according to EN-ISO 1092-1.*

(4) *Welded construction for type A flat face; forged one-piece flange or welded construction for type B1 raised face.*
(5) *Welded construction.*

Table 2: Cone Antenna - Alloy C-276 and Alloy 400 (Type vs. Size and Rating)

Process connection size	Process connection rating								
	Thread(1)	ASME B16.5 flanges(2)(3)			EN1092-1 flanges(2)(4)(6)			JIS B2220 flanges(2)(6)	
		Class 150	Class 300	Class 600	PN16	PN40	PN63	10K	20K
1½-in.	N	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2-in./DN50/50A	N	R(5)	R(5)	R(5)	R	R	R	R	R
3-in./DN80/80A	N/A	R(5)	R(5)	R(6)	R	R	R	R	R
4-in./DN100/100A	N/A	R(5)	R(5)	N/A	R	R	R	R	R
6-in./DN150/150A	N/A	R(5)	R(6)	N/A	R	R	R	R	R
8-in./DN200/200A	N/A	R(6)	N/A	N/A	R	R	N/A	R	R

(1) *N = NPT thread (process connection type code N)*
(2) *R = Raised Face (process connection type code R)*
(3) *Welded construction for materials of construction codes H and M.*
(4) *Backing flange in flat face.*
(5) *Available with materials of construction codes 2, 3, H, and M.*
(6) *Only available with protective plate design (materials of construction codes 2 and 3).*

Table 3: Process Seal Antenna (Type vs. Size and Rating)

Process connection size	Process connection rating						
	Tri Clamp(1)	ASME B16.5 flanges(2)(3)		EN1092-1 flanges(2)(3)			JIS B2220 flanges(2)(3)
		Class 150	Class 300	PN6	PN16	PN40	10K
2-in./DN50/50A	C	R	R	R	R	R	R
3-in./DN80/80A	C	R	R	R	R	R	R
4-in./DN100/100A	C	R	R	R	R	R	R

(1) *C = Tri Clamp (process connection type code C)*
(2) *Forged one-piece flange.*
(3) *R = Raised Face (process connection type code R)*

Table 4: Parabolic Antenna (Type vs. Size and Rating)

Process connection size	Process connection rating				
	Thread(1)	Welded(2)	ASME B16.5 Class 150 flange(3)	EN1092-1 PN6 flange(4)	JIS B2220 5K flange(3)
3½-in.	G	W	N/A	N/A	N/A
8-in./DN200/200A	N/A	N/A	R	F	R
10-in./DN250/250A	N/A	N/A	R	F	R

(1) *G = BSPP (G) thread (process connection type code G)*
(2) *W = Welded connection (process connection type code W)*
(3) *R = Raised Face face (process connection type code R)*
(4) *F = Flat Face face (process connection type code F)*

Related information

Standard flanges

Accessories

Table 5: Accessories

HART modem and cable	
03300-7004-0002	MACTek® VIATOR® HART modem and cables (USB connection)
Flushing connection rings for process seal antenna(1)	
DP0002-2111-S6	2-in. ANSI, ¼-in. NPT connection
DP0002-3111-S6	3-in. ANSI, ¼-in. NPT connection
DP0002-4111-S6	4-in. ANSI/DN100, ¼-in. NPT connection
DP0002-5111-S6	DN50, ¼-in. NPT connection
DP0002-8111-S6	DN80, ¼-in. NPT connection

(1) *Not available with Canadian Registration Number (CRN).*

Performance specifications

General

Conformance to specification (±3σ [Sigma])

Technology leadership, advanced manufacturing techniques, and statistical process control ensure specification conformance to at least ±3σ.

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 to1060 mbar)
- Relative humidity: 25-75%
- Damping: Default value, 2 s

Instrument accuracy (under reference conditions)

- Ultra accuracy: ±0.04 in. (±1 mm)(1)
- Standard: ±0.08 in. (±2 mm)(1)

Repeatability

±0.04 in. (±1 mm)

Ambient temperature effect

±0.04 in. (±1 mm)/10 K(2)

(1) 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.

Sensor update rate

- 4-20 mA HART®: Minimum 1 update per second
- FOUNDATION™ Fieldbus: Minimum 2 updates per second

Maximum level rate

40 mm/s as default, adjustable up to 200 mm/s

Measuring range

Table 6: Maximum Measuring Range, ft. (m)

Model	Performance class	
	Standard	Ultra accuracy
Rosemount 5408	130 (40)	50 (15)
Rosemount 5408:SIS(1)	130 (40) in Control/Monitoring mode 82 (25) in Safety (SIS) mode	50 (15)

(1) *The Rosemount 5408:SIS has two operational modes: Safety (SIS) and Control/Monitoring. Safety (SIS) mode must be set when used in Safety Instrumented Systems. Control/Monitoring mode is intended for use in a Basic Process Control System (BPCS).*

Note that a combination of adverse process conditions, such as heavy turbulence, foam, and condensation, together with products with poor reflection may affect the measuring range.

Measuring range for solids

The figures given in Table 7 should be considered as guidelines; the total measuring range may differ depending on other contributing application conditions such as product filling, how the product piles up, silo diameter vs. angle of repose, internal obstacles within the silo, dust, condensation, antenna build up, etc.

Table 7: Recommended Measuring Range for Solids, ft. (m)

Antenna	Light powder(1)	Light granulates and pellets(2)	Heavy powder(3)	Grains (4)	Larger particles(5)
1½-in. (DN40) cone	16 (5)	33 (10)	66 (20)	66 (20)	82 (25)
2-in. (DN50) cone/process seal(6)	16 (5)	33 (10)	82 (25)	82 (25)	98 (30)
3-in. (DN80) cone/process seal(6) 4-in. (DN100) process seal(6)	49 (15)	66 (20)	98 (30)	98 (30)	130 (40)
4-in. (DN100) cone(6)	66 (20)	98 (30)	130 (40)	130 (40)	130 (40)
8-in. (DN200) parabolic(7)	115 (35)	130 (40)	130 (40)	130 (40)	130 (40)

(1) *Plastic powder, etc. (Dielectric constant: 1.2)*
(2) *Plastic pellets, etc. (Dielectric constant: 1.35)*
(3) *Lime powder, cement, sand, etc. (Dielectric constant: 1.5)*
(4) *Kernels, brans, etc. (Dielectric constant: 1.5)*
(5) *Wood chips/pellets, etc. (Dielectric constant: 1.7)*
(6) *Cone and process seal antennas are the preferred choice for most solid applications. For specific recommendations in dusty applications, see section "Dust management" in the Measuring Level and Volume of Solid Materials Technical Note.*
(7) *Recommended for longer measuring ranges, typically > 66 ft (20 m).*

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

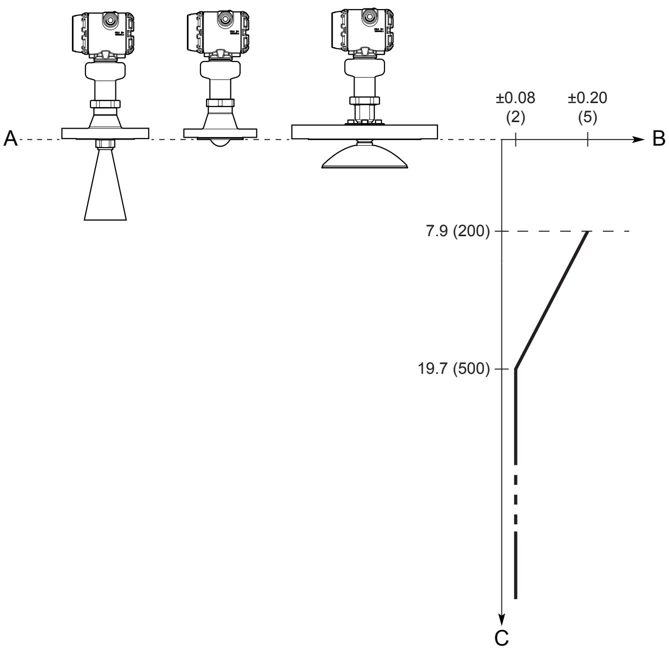
Accuracy over measuring range

The measuring range is limited by the blind zone at the very top of the tank. In the blind zone, the accuracy exceeds ±0.20 in. (±5 mm) and measurements may not be possible. Measurements close to the blind zone will have reduced accuracy (see Figure 3).

For the extended cone antennas, the reduced accuracy zone ends 11.8 in. (30 cm) below the antenna end.

The accuracy in still pipe/chamber installations depends on how well the antenna size matches the pipe size. For more details, refer to the Best Practices for Using Radar in Still Pipes and Chambers Technical Note.

Figure 3: Accuracy Over Measuring Range



A. *Device Reference Point*
B. *Accuracy in inches (millimeters)*
C. *Distance in inches (millimeters)*

Environment

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. For further details, see the Rosemount 5408 and 5408:SIS with HART® Reference Manual and Rosemount 5408 with FOUNDATION™ Fieldbus Reference Manual.

Electromagnetic compatibility (EMC)

- EMC Directive (2014/30/EU): EN 61326-1
- EN 61326-2-3
- NAMUR recommendations NE21[3]

For Rosemount 5408:SIS, the blue plug on the terminal block must be connected.

Pressure Equipment Directive (PED)

Complies with 2014/68/EU article 4.3

Built-in lightning protection

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

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

Functional specifications

General

Field of application

Continuous level measurements for tank monitoring, process control, and overfill prevention on a broad range of liquids, slurries, and solids.

Ideal for applications with varying and harsh process conditions, such as heavy turbulence, foaming, product build-up, condensing vapors, sticky, viscous, corrosive, and crystallizing products.

Measurement principle

Frequency Modulated Continuous Wave (FMCW)

Frequency range

24.05 to 27.0 (26.5[4]) GHz

Maximum output power

-5 dBm (0.32 mW)

Internal power consumption

< 1 W in normal operation

Humidity

0 - 100% relative humidity, non-condensing

Turn-on time

< 40 s[5]

(3) 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.
(4) 26.5 GHz in Australia, New Zealand, and Russia, and for LPR (Level Probing Radar), option code OA.

Functional safety

The Rosemount 5408:SIS Level Transmitter is IEC 61508 certified to:

- Low and high demand: Type B element
- SIL 2 for random integrity @ HFT=0
- SIL 3 for random integrity @ HFT=1
- SIL 3 for systematic capability

Related information

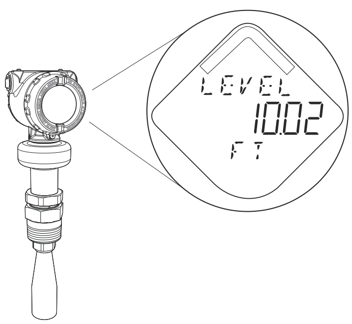
Functional Safety Certificate
Rosemount 5408:SIS Safety Manual

Display and configuration

LCD display

- Toggles between selected output variables
- Shows diagnostic information (alerts)

Figure 4: LCD Display



Remote display

Data can be read remotely using the Rosemount 751 Field Signal Indicator for 4-20 mA / HART® (see Product Data Sheet), or the Rosemount 752 Remote Indicator for FOUNDATION™ Fieldbus (see Product Data Sheet).

Configuration tools

- Rosemount Radar Master Plus for Rosemount 5408 Series (accessible through any Field Device Integration (FDI) based tool, e.g AMS Instrument Inspector Application[6])
- Device Descriptor (DD) based systems, e.g. AMS Device Manager, handheld communicator, and DeltaV™, or any other EDDL or enhanced-EDDL host
- Device Type Manager (DTM™) based systems, e.g. AMS Device Manager, Yokogawa Fieldmate/PRM, E+H FieldCare® , and PACTware™
- Field Device Integration (FDI) based systems, e.g. AMS Instrument Inspector Application

(5) Time from when power is applied to the transmitter until performance is within specifications.
(6) For additional information, visit Emerson.com/RosemountRadarMasterPlus.

Damping

User selectable (default is 2 s, minimum is 0 s)[7]

Output units

- Level and distance: ft., in., m, cm, mm
- Level rate: ft/s, in./min, in./s, m/h, m/s
- Volume: ft^3, $in.^3$, yd^3, US gal, imperial gal, barrel (bbl), m^3, l
- Temperature: °F, °C
- Signal strength: mV

Output variables

Variable	4-20 mA[1]	Digital output	LCD display
Level	✓	✓	✓
Distance (ullage)	✓	✓	✓
Volume	✓	✓	✓
Scaled variable[2]	✓	✓	✓
Electronics temperature	N/A	✓	✓
Signal quality[2]	N/A	✓	✓
Level rate	N/A	✓	✓
Signal strength	N/A	✓	✓
Percent of range[3]	N/A	✓	✓
Percent of range auxiliary	N/A	✓	✓
User-defined[2]	✓	✓	✓

(1) *Not applicable for FOUNDATION™ Fieldbus.*
(2) *Only for transmitters ordered with Smart Diagnostics Suite.*
(3) *4–20 mA HART® protocol only.*

4-20 mA HART

Output

Two-wire, 4-20 mA. Digital process variable is superimposed on 4-20 mA signal, and available to any host that conforms to the HART protocol. The digital HART® signal can be used in multidrop mode.

HART Revision

- Revision 6 (default)
- Revision 7 (option code HR7)

The HART revision can be switched in field.

(7) The Damping parameter defines how fast the device responds to level changes (step response). A high value makes the level steady but the device reacts slowly to level changes in the tank.

Power supply

Transmitter operates on 12-42.4 Vdc transmitter terminal voltage (12-30 Vdc in Intrinsically Safe installations).

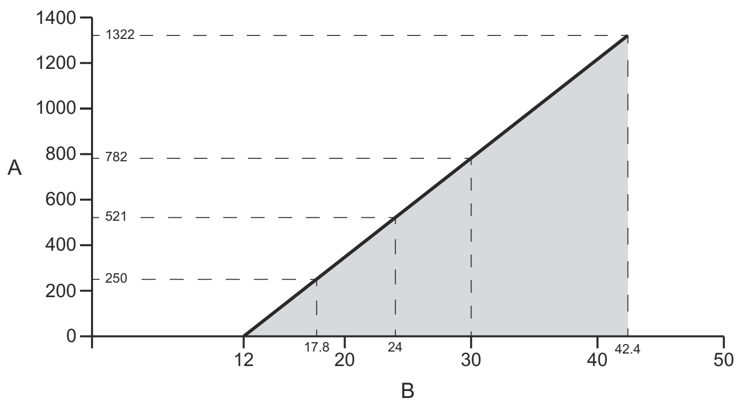
Power consumption

Max. 1 W, current max. 23 mA

Load limitations

For HART® communication, a minimum loop resistance of 250 Ω is required. Maximum loop resistance is determined by the voltage level of the external power supply.

Figure 5: Load Limits



Maximum Loop Resistance = 43.5 * (External Power Supply Voltage - 12)

A. Loop Resistance (Ohms)
B. External Power Supply Voltage (Vdc)

Cable selection

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 °C above maximum ambient temperature.

Two wires can be safely connected to each terminal screw.

Analog signal on alarm

The transmitter automatically and continuously performs self-diagnostic routines. If a failure or a measurement error is detected, the analog signal will be driven offscale to alert the user. High or low failure mode is user-configurable.

Table 8: Signal on Alarm

Standard	High	Low
Rosemount standard	≥ 21.75 mA (default)	≤ 3.75 mA (option code C8)
NAMUR NE43	≥ 22.50 mA (option code C4)	≤ 3.6 mA (option code C5)

Analog saturation levels

The transmitter will drive the output to high or low saturation values if measurement goes outside the 4-20 mA range values.

Table 9: Saturation Levels

Standard	High	Low
Rosemount standard (default and option code C8)	20.8 mA	3.9 mA
NAMUR NE43 (option code C4 and C5)	20.5 mA	3.8 mA

FOUNDATION™ Fieldbus

Power supply

The transmitter operates on 9-32 Vdc (9-30 Vdc in Intrinsically Safe installations and 9-17.5 Vdc for FISCO) at the transmitter terminals.

Cable selection

Recommended wiring is 18 AWG twisted shielded pair, referred to as Fieldbus type A cable.

Use wire rated at least 5 °C above maximum ambient temperature.

Two wires can be safely connected to each terminal screw.

Quiescent current draw

22 mA

Blocks and execution time

Block	Execution time
1 Resource	N/A
2 Transducer	N/A
6 Analog Input (AI)	10 ms
1 Proportional/Integrate/Derivate (PID)	15 ms
1 Signal Characterizer (SGCR)	10 ms
1 Integrator (INT)	10 ms
1 Arithmetic (ARTH)	10 ms
1 Input Selector (ISEL)	10 ms
1 Control Selector (CS)	10 ms
1 Output Splitter (OS)	10 ms

FOUNDATION Fieldbus class (basic or Link Master)

Link Master (LAS)

Number of available VCRs

Maximum 20, including one fixed

FOUNDATION Fieldbus instantiation

Yes

Conforming FOUNDATION Fieldbus

ITK 6.3.1

FOUNDATION Fieldbus alerts

- Field diagnostics alerts
- Plantweb™ Insight alerts

Rosemount 2410 Tank Hub connectivity

Requires Rosemount 5408 with signal output code U.

Note
Rosemount 5408 Level Transmitter with signal output code F cannot be upgraded to signal output code U.

Power supply

The transmitter operates on FISCO 9.0 - 17.5 Vdc polarity insensitive (from Rosemount 2410 Tank Hub).

Cable selection

0.5-1.5 mm² (AWG 22-16), twisted shielded pairs, to be connected to the intrinsically safe side of the Rosemount 2410 Tank Hub.

Bus current draw

21 mA (nominal)

Built-in Tankbus terminator

Yes (to be connected if required)

Daisy chain possibility

Yes

Diagnostics

Alerts

The transmitter is compliant with NAMUR NE 107 Field Diagnostics for standardized device diagnostic information.

Tools and logging in Rosemount Radar Master Plus

Rosemount Radar Master Plus, embedded in Instrument Inspector, enables easy and powerful troubleshooting with the echo curve tool as well as the measurement and alert log.

The measurement and alert log holds records of the last seven days of level readings and echo curve profiles, as well as the 50 last alert events. The logs can be transferred from the transmitter's internal memory to a local computer and be presented in a graphical time line, enabling analysis of historical behaviors.

Smart Diagnostics Suite

Signal Quality Metrics

Diagnostics package that monitors the relations between surface, noise, and threshold. The function can be used to detect abnormal conditions in the process such as antenna contamination or sudden loss of signal strength. Signal Quality is available as output variable and it comes with user configurable alerts.

Power Advisory

The transmitter automatically measures and monitors the input voltage. If the voltage is too low, operators will be provided with an early alert.

Scaled Variable

The scaled variable configuration allows the user to convert a transmitter variable into an alternative measurement, such as flow, mass, or calibrated level (e.g. five-point point verification).

User Defined Variable

Allows designating more than 200 variables in the device as output variable.

Smart echo level test

The function allows you to test the behavior of the transmitter in a real tank environment without raising the level. During the test, a virtual surface echo is superimposed onto the radar signal, and the transmitter will output a level corresponding to the echo position.

The test verifies the integrity of the signal processing, and can be used to test the alarm limits in the host system, output of the transmitter, and transmitter configuration (for example the upper/lower range values).

Process temperature and pressure rating

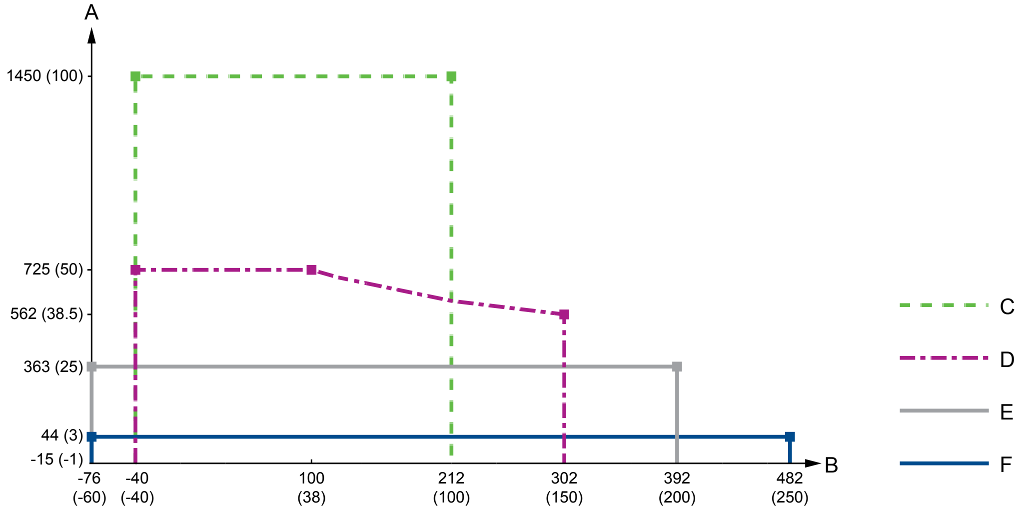
The following figures give the process temperature limits (measured at the lower part of the flange, Tri Clamp, or threaded connection) and pressure rating for different antenna types.

Final rating may be lower depending on flange selection.

For antenna type code CAB, at 100 °F (38 °C), the rating decreases with increasing temperature per ASME B16.5 Table 2-2.2, Class 300.

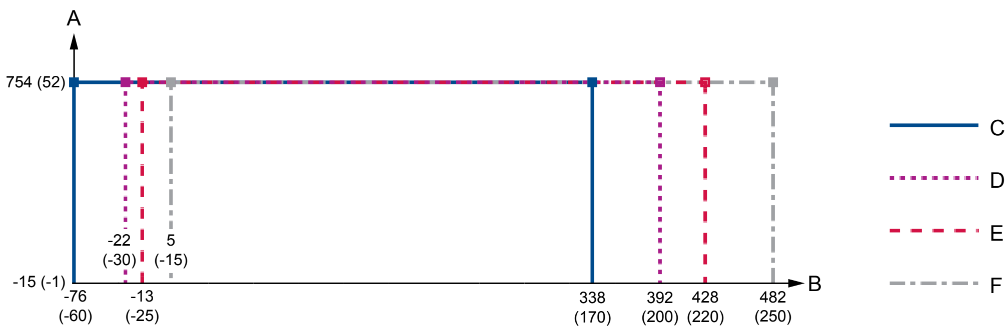
Note
For applications where saturated steam may occur, consult factory.

Figure 6: Cone Antenna (PTFE Seal)



A. *Pressure psig (bar)*
B. *Temperature °F (°C)*
C. *Code CAC*
D. *Code CAB*
E. *Code CAA*
F. *Code CAD*

Figure 7: Cone Antenna (PEEK Seal)



A. *Pressure psig (bar)*
B. *Temperature °F (°C)*
C. *Code CBF (FVMQ)*
D. *Code CBV (Viton®)*
E. *Code CBM (FKM)*
F. *Code CBK (Kalrez® 6375)*

Figure 8: Process Seal Antenna with Tri Clamp

A. *Pressure psig (bar)*
B. *Temperature °F (°C)*

Figure 9: 2-in. Process Seal Antenna with Flange

A. *Pressure psig (bar)*
B. *Temperature °F (°C)*

Figure 10: 3-in. Process Seal Antenna with Flange

A. *Pressure psig (bar)*
B. *Temperature °F (°C)*

Figure 11: 4-in. Process Seal Antenna with Flange

A. *Pressure psig (bar)*
B. *Temperature °F (°C)*

Figure 12: Parabolic Antenna

A. *Pressure psig (bar)*
B. *Temperature °F (°C)*

Cryogenic applications

Operating temperature at flange

See Figure 6 to Figure 12 for antenna type specific operating limits.

Operating temperature in tank

-320.8 to 482 °F (-196 to 250 °C)

Ambient temperature limits

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

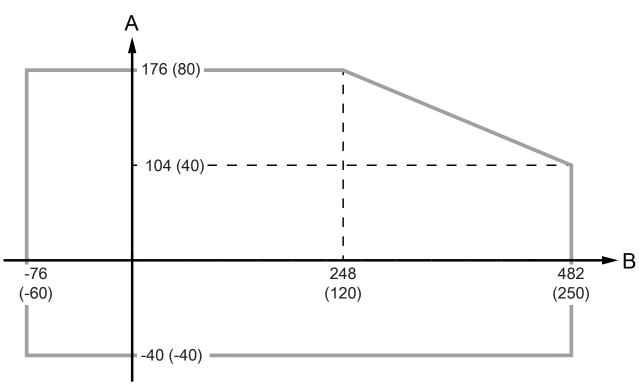
Table 10: Ambient Temperature Limits

Description	Operating limit	Storage limit(1)
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(2)		-40 °F to 176 °F (-40 °C to 80 °C)

(1) *The minimum storage temperature is -22 °F (-30 °C) for the cone antenna with Kalrez® 6375 O-ring (antenna type code CBK).*
(2) *LCD display may not be readable and LCD display updates will be slower at temperatures below -4 °F (-20 °C).*

The ambient temperature limits may be further restricted by the process temperature as described by Figure 13.

Figure 13: 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.

Flange rating

ASME

- 316 SST according to ASME B16.5 Table 2-2.2
- 316L SST according to ASME B16.5 Table 2-2.3 (for protective plate design)(8)
- Alloy C-276 (UNS N10276) according to ASME B16.5 Table 2-3.8
- Alloy 400 (UNS N04400) according to ASME B16.5 Table 2-3.4

EN

- 1.4404 according to EN 1092-1 material group 13E0

JIS

- 316 SST according to JIS B2220 material group No. 2.2
- 316L SST according to JIS B2220 material group No. 2.3 (for protective plate design)(8)

Conditions used for flange strength calculations

Table 11: 316/316L SST (EN 1.4404) Flanges

Item	ASME	EN, JIS
Bolting material	SA193 B8M CL.2, SA193 B7(1), or SA320 L7(1)	EN 1515-1/2, ISO 3506 A4-70, or Bumax® 88(1)
Gasket(2)	Soft (1a) with min. thickness 1.6 mm or Spiral wound gasket with nonmetallic filler (1b)	Soft (EN 1514-1) with min. thickness 1.6 mm or Spiral wound gasket with nonmetallic filler (EN 1514-2)
Flange material	Stainless steel A182 Gr. F316 and EN 10222-5-1.4404	
Hub material(3)	Stainless steel SA479 316 and EN 10272-1.4404	

(1) *Only applicable to forged one-piece flanges.*
(2) *Not applicable to process seal antenna (features an integrated gasket). Use of extra gasket may result in faulty installation.*
(3) *Only applicable to flanges with welded construction.*

(8) Flange rating according to backing flange.

Table 12: Flanges with Protective Plate Design

Item	ASME	EN, JIS
Bolting material	SA193 B8M Cl.2	EN 1515-1/2, ISO 3506 A4-70
Gasket(1)	Soft (1a) with min. thickness 1.6 mm or Spiral wound gasket with nonmetallic filler (1b)	Soft (EN 1514-1) with min. thickness 1.6 mm or Spiral wound gasket with nonmetallic filler (EN 1514-2)
Flange material	Stainless steel A182 Gr. F316L/F316 and EN 10222-5-1.4404	
Hub material	SB574 Gr. N10276 (solution annealed condition) or SB164 Gr. N04400 (solution annealed condition)	

(1) *Note that a minimum gasket thickness of 0.125 in. (3.2 mm) is required when using an air purge ring (option code PC1).*

Table 13: Alloy C-276 (UNS N10276) Flanges

Item	ASME	EN, JIS
Bolting material	UNS N10276	UNS N10276
Gasket	Soft (1a) with min. thickness 1.6 mm or Spiral wound gasket with nonmetallic filler (1b)	Soft (EN 1514-1) with min. thickness 1.6 mm or Spiral wound gasket with nonmetallic filler (EN 1514-2)
Flange material	SB462 Gr. N10276 (solution annealed condition) or SB575 Gr. N10276 (solution annealed condition)	
Hub material	SB574 Gr. N10276 (solution annealed condition)	

Table 14: Alloy 400 (UNS N04400) Flanges

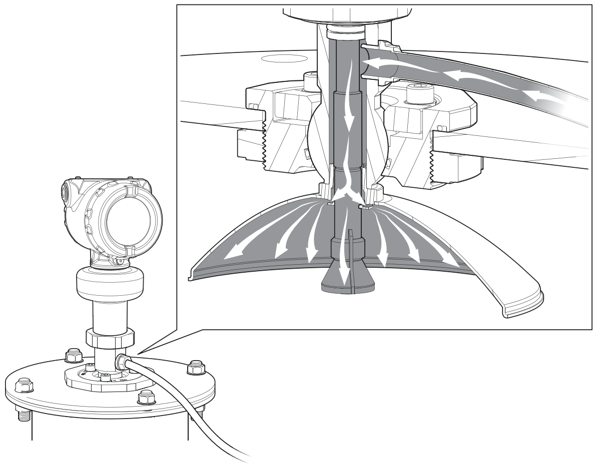
Item	ASME	EN, JIS
Bolting material	UNS N04400	UNS N04400
Gasket	Soft (1a) with min. thickness 1.6 mm or Spiral wound gasket with nonmetallic filler (1b)	Soft (EN 1514-1) with min. thickness 1.6 mm or Spiral wound gasket with nonmetallic filler (EN 1514-2)
Flange material	SB/B564 Gr. N04400 (solution annealed condition) or SB/B127 Gr. N04400 (solution annealed condition)	
Hub material	SB164 Gr. N04400 (solution annealed condition)	

Air purging

An air purge connection can prevent clogging of the antenna in extreme applications with dirt or heavy coating. To determine if air purging is needed, inspect the tank internal conditions at the location intended for the transmitter. If there is normally a thick layer of product build-up there, air purging is most likely needed. Typical purging media to use is air.

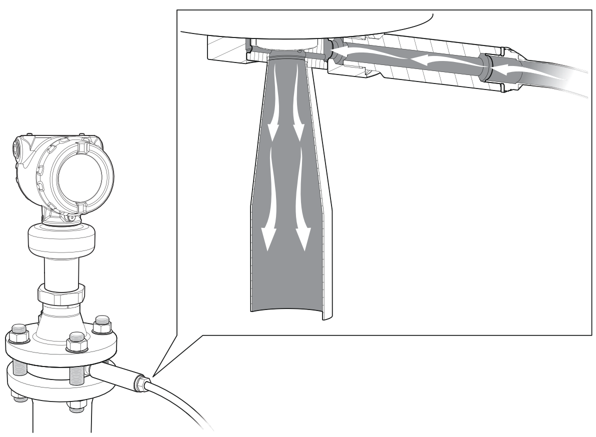
All parabolic antennas come with an integrated air purge connection (see Figure 14).

Figure 14: Air Purging for Parabolic Antenna



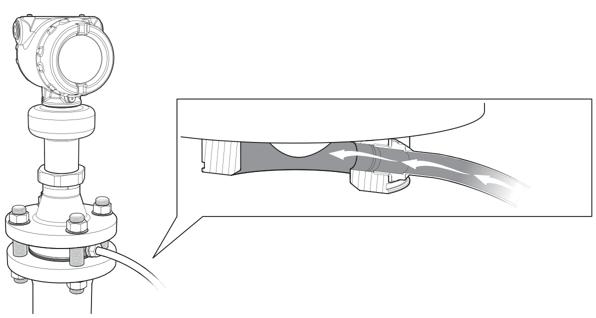
An air purge connection is also available for cone antennas with flanged connection by selecting option code PC1. This option consists of an antenna with purge holes and a separate air purge ring (see Figure 15).

Figure 15: Air Purging for Cone Antenna



Flushing connection rings are available as accessory for use with process seal antennas.

Figure 16: Air Purging for Process Seal Antenna



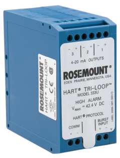
Incoming air supply specification

- Maximum pressure: 190 psi (13 bar)
- Recommended pressure: 100 to 115 psi (7 to 8 bar)
- Inlet/outlet connection: BSPP (G) ⅜-in.
- Air consumption: 252 gal/min at 65 psi (955 l/min at 4.5 bar)

System integration

Rosemount 333 HART® Tri-Loop™

By sending the digital HART signal to the optional HART Tri-Loop, it is possible to have up to three additional 4–20 mA analog signals.



See the Rosemount 333 HART Tri-Loop Product Data Sheet for additional information.

Emerson Wireless 775 THUM™ Adapter

The optional Emerson Wireless 775 THUM Adapter can be mounted directly on the transmitter or by using a remote mounting kit.

IEC 62591 (*Wireless*HART®) enables access to multivariable data and diagnostics, and adds wireless to almost any measurement point.

See the Emerson Wireless 775 THUM Adapter Product Data Sheet and Technical Note for additional information.

Physical specifications

Material selection

Emerson provides a variety of Rosemount products with various product options and configurations including materials of construction that can be expected to perform well in a wide range of applications. The Rosemount product information presented is intended as a guide for the purchaser to make an appropriate selection for the application. It is the purchaser's sole responsibility to make a careful analysis of all process parameters (such as all chemical components, temperature, pressure, flow rate, abrasives, contaminants, etc.), when specifying product, materials, options, and components for the particular application. Emerson is not in a position to evaluate or guarantee the compatibility of the process fluid or other process parameters with the product, options, configuration or materials of construction selected.

Transmissible Spongiform Encephalopathy (TSE) declaration

This declaration is applicable to Tri Clamp connections.

Emerson certifies no process wetted components used in this product contain substances of animal origin. Materials used in the production or processing of wetted components for this product meet the requirements stated in EMA/410/01 Rev. 3 and ISO 22442-1:2015. Wetted components in this product are considered free of TSE.

Engineered solutions

When standard model codes are not sufficient to fulfill requirements, please consult the factory to explore possible Engineered Solutions. This is typically, but not exclusively, related to the choice of wetted materials or the design of a process connection. These Engineered Solutions are part of the expanded offerings and may be subject to additional delivery lead time. For ordering, factory will supply a special P-labeled numeric option code that should be added at the end of the standard model string.

Housing and enclosure

Electrical connections

Two cable/conduit entries (½-14 NPT, M20 x 1.5, or G½)

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

Materials

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

Weight

- Aluminum housing: 6.2 lb (2.8 kg)(9)
- Stainless steel housing: 10.0 lb (4.5 kg)(9)

Ingress protection

IP 66/67/68(10) and NEMA® 4X

Tank connection

The tank connection consists of a tank seal, a flange, NPT or BSPP (G) threads, Tri Clamp, or a specific welded connection with swivel feature for parabolic antenna.

Flange dimensions

Follows ASME B16.5, JIS B2220, and EN 1092-1 standards. For more information, see Standard flanges.

Tri Clamp connection

Follows ISO 2852 standard.

(9) Fully functional transmitter with sensor module, housing, terminal block, LCD display, and covers.
(10) The transmitter meets IP 68 at 9.8 ft. (3 m) for 30 minutes.

Antenna versions

Cone antenna

- Best choice for most applications, including closed vessels, still pipe/chamber installations, and open air applications
- Extended cone antennas are available for tall nozzles (option code S1 and S2). Depending on measurement conditions, a reduction of sensitivity close to antenna end might be present.

Process seal antenna

- All PTFE wetted parts ideal for use in corrosive and hygienic applications
- Suitable for applications with heavy condensation/build-up

Parabolic antenna

- Alternative for long measuring ranges in combination with conditions such as low reflective media
- Suitable for a broad range of solid materials (may need air purging in dusty environments)

Material exposed to tank atmosphere

Cone antenna, PTFE seal

- 316/316L SST (EN 1.4404), Alloy C-276 (UNS N10276), or Alloy 400 (UNS N04400)
- PTFE fluoropolymer

Cone antenna, PEEK seal

- 316/316L SST (EN 1.4404), Alloy C-276 (UNS N10276), or Alloy 400 (UNS N04400)
- PEEK polyetheretherketone
- FVMQ fluorosilicone, Kalrez® 6375 perfluoroelastomer, FKM fluoroelastomer, or Viton® fluoroelastomer (O-ring)

Process seal antenna

- PTFE fluoropolymer

Parabolic antenna

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

Installation considerations

Before installing the transmitter, follow recommendations for mounting position, sufficient free space, nozzle requirements, etc.

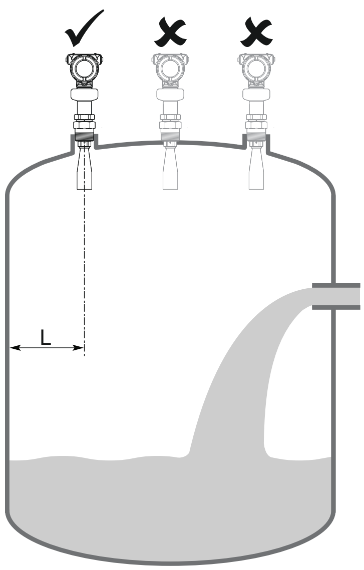
Mounting position

When finding an appropriate location on the tank for the transmitter, the conditions of the tank must be carefully considered.

Consider the following guidelines when mounting the transmitter:

- For optimal performance, the transmitter should be installed in locations with a clear and unobstructed view of the product surface.
- The transmitter should be mounted with as few internal structures as possible within the signal beam.
- Do not install the transmitter in the center of the tank.
- Do not mount close to or above the inlet stream.
- Multiple Rosemount 5408 transmitters can be used in the same tank without interfering with each other.

Figure 17: Recommended Mounting Position



Free space requirements

If the transmitter is mounted close to a wall or other tank obstruction such as heating coils and ladders, noise might appear in the measurement signal. Therefore the following minimum clearance, according to Table 15, must be maintained.

For easy access to the transmitter, mount it with sufficient service space (see Table 16).

Figure 18: Free Space Requirements

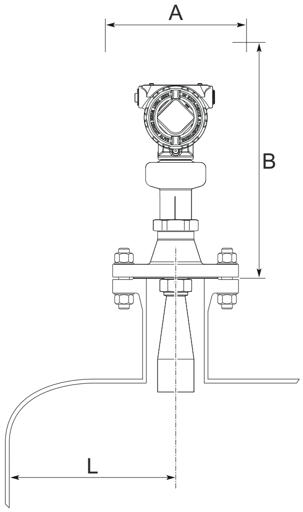


Table 15: Distance to Tank Wall (L)

Application	Minimum	Recommended
Liquids	8 in. (200 mm)	½ of tank radius
Solids	8 in. (200 mm)	⅔ of tank radius

Table 16: Free Space Requirements

Description	Distance
Service space width (A)	20 in. (500 mm)
Service space height (B)	24 in. (600 mm)

Antenna size

Choose as large antenna diameter as possible. A larger antenna diameter concentrates the radar beam and ensures maximum antenna gain. Increased antenna gain permits greater margin for weak surface echoes.

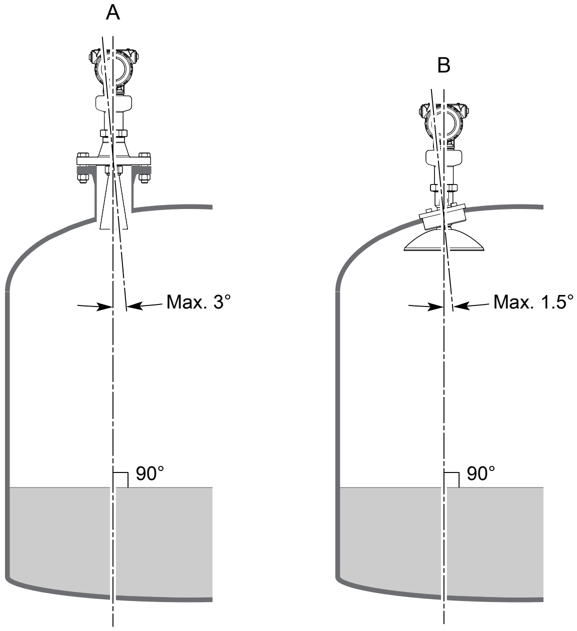
In addition, a larger antenna diameter results in a smaller beam angle and thereby, less interference from any internal structures in the tank.

Antenna inclination

Ensure the antenna is aligned perpendicular to the product surface (see Figure 19). The parabolic antenna comes with a swivel connection that adjusts for angled tank roofs.

Note that if the surface echo is weak in solids applications, then a small inclination of the parabolic antenna toward the surface slope may improve the performance.

Figure 19: Inclination



A. Cone antenna/process seal antenna
B. Parabolic antenna

Non-metallic tanks

Nearby objects outside the tank may cause disturbing radar echoes. Wherever possible, the transmitter should be positioned so that objects close to the tank are kept outside the signal beam.

Beam width and beam angle

The transmitter should be mounted with as few internal structures as possible within the signal beam. Refer to Table 17 for beam angle and Table 18 for beam width at different distances.

Figure 20: Beam Angle and Beam Width

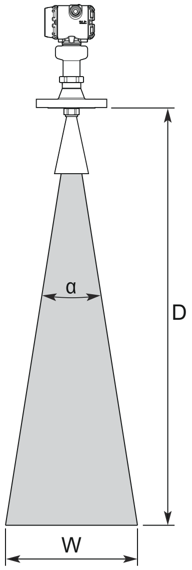


Table 17: Beam Angle

Antenna size	Beam angle (α)
1½-in. (DN 40) cone	22°
2-in. (DN50) cone/process seal	18°
3-in. (DN80) cone/process seal	14°
4-in. (DN100) cone/process seal	10°
8-in. (DN200) parabolic	4.5°

Table 18: Beam Width, ft. (m)

Distance (D)	Beam width (W)				
	1½-in. cone	2-in. cone/process seal	3-in. cone/process seal	4-in. cone/process seal	Parabolic
16 (5)	6.2 (1.9)	5.2 (1.6)	4.0 (1.2)	2.9 (0.9)	1.3 (0.4)
33 (10)	12.8 (3.9)	10.4 (3.2)	8.1 (2.5)	5.7 (1.8)	2.6 (0.8)
49 (15)	19.0 (5.8)	15.6 (4.8)	12.1 (3.7)	8.6 (2.6)	3.9 (1.2)
66 (20)	25.6 (7.8)	20.8 (6.3)	16.1 (4.9)	11.5 (3.5)	5.2 (1.6)
82 (25)	31.8 (9.7)	26.0 (7.9)	20.1 (6.1)	14.3 (4.4)	6.4 (2.0)
98 (30)	38.4 (11.7)	31.2 (9.5)	24.2 (7.4)	17.2 (5.3)	7.7 (2.4)
131 (40)	51.2 (15.6)	41.6 (12.7)	32.2 (9.8)	23.0 (7.0)	10.3 (3.1)

Nozzle requirements

To allow the microwaves to propagate undisturbed, the nozzle dimensions should be kept within the specified limits as given in Table 19, Table 20, and Table 21.

Nozzle requirements for cone antenna

For best performance, the cone antenna should extend at least 0.4 in. (10 mm) below the nozzle. If required, use the extended cone antenna versions (option code S1 or S2).

However, the antenna can be recessed in smooth nozzles up to 4 ft. (1.2 m). Note that if the inside of the nozzle has irregularities (e.g. due to bad welding, rust, or deposit), then use the extend cone antenna.

Figure 21: Mounting of the Cone Antenna

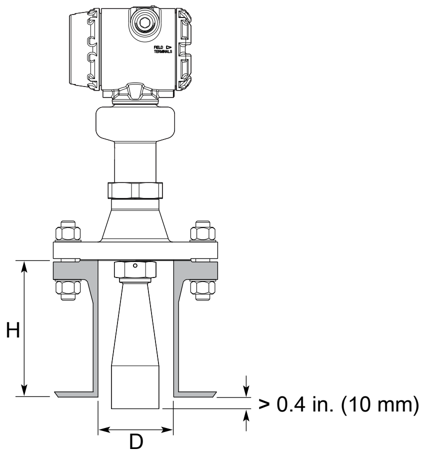


Table 19: Nozzle Requirements for Cone Antenna, in Inches (Millimeters)

Antenna size	Minimum nozzle diameter (D)(1)	Recommended maximum nozzle height (H)(2)(3)	
		Antenna	Antenna with air purge ring (code PC1)
1½-in. (DN 40)	1.50 (38.1)	5.59 (142)	N/A
2-in. (DN50)	1.94 (49.3)	5.71 (145)	4.69 (119)
3-in. (DN80)	2.80 (71.0)	5.63 (143)	4.61 (117)
4-in. (DN100)	3.78 (96.0)	6.54 (166)	5.51 (140)

(1) *The antennas are sized to fit within schedule 80 or lower schedules.*
(2) *The values are valid for cone antennas without antenna extension.*
(3) *For liquid applications, the cone antenna can be recessed in smooth nozzles up to 4 ft. (1.2 m), but note that the accuracy may be reduced in the region close to the nozzle.*

Nozzle requirements for process seal antenna

The antenna can be used on nozzles up to 4 ft. (1.2 m). Disturbing objects inside the nozzle may impact the measurement, and should therefore be avoided.

Figure 22: Mounting of the Process Seal Antenna

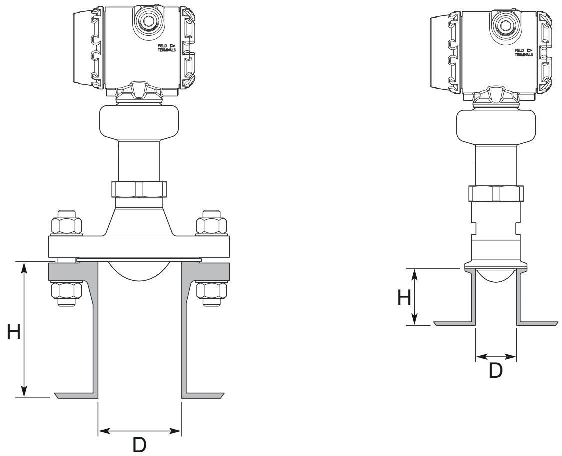


Table 20: Nozzle Requirements for Process Seal Antenna

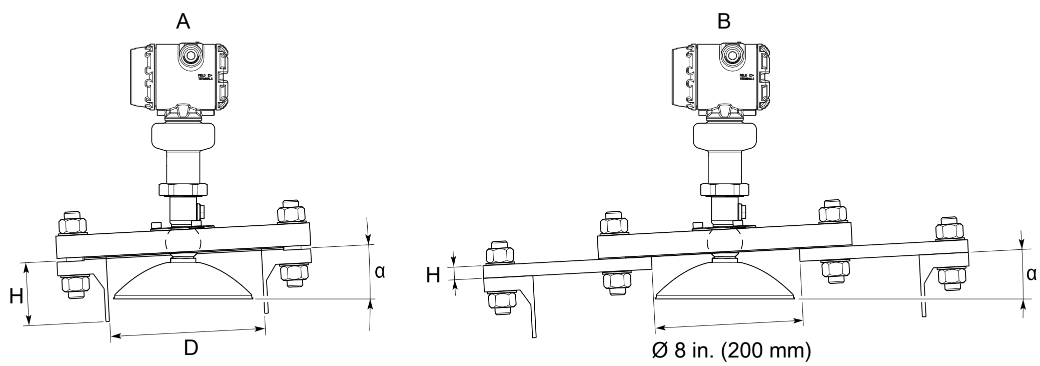
Antenna size	Minimum nozzle diameter (D)(1)	Recommended maximum nozzle height (H)(2)
2-in. (DN50)	1.77 in. (45 mm)	4 ft. (1.2 m)
3-in. (DN80)	2.76 in. (70 mm)	4 ft. (1.2 m)
4-in. (DN100)	2.76 in. (70 mm)	4 ft. (1.2 m)

(1) *The antennas are sized to fit within schedule 120 or lower schedules.*
(2) *For hygienic applications, the nozzle height (H) must not exceed two times the nozzle diameter (D) to ensure cleanability. Maximum nozzle height is 5 in. (127 mm).*

Nozzle requirements for parabolic antenna

See Table 21 for nozzle height recommendations at different inclination angle.

Figure 23: Mounting of the Parabolic Antenna



A. *Nozzle mounting*
B. *Flange mounting in manhole cover*

Table 21: Nozzle Requirements for Parabolic Antenna, in Inches (Millimeters)

Nozzle size (D)	Inclination angle (α)	Maximum nozzle height (H)[1]
Pipe schedule std, Ø 8 in. (200 mm)	0°	6.1 (155)
	3°	3.4 (85)
	6°	1.6 (40)
	9°	1.2 (30)
	12°	1.0 (25)
	15°	0.6 (15)
Pipe schedule std, Ø10 in. (250 mm)	0°	17.2 (440)
	3°	10.2 (260)
	6°	7.1 (180)
	9°	5.1 (130)
	12°	3.9 (100)
	15°	3.0 (75)

(1) *Note that the inside of the nozzle must be smooth (i.e. avoid bad welding, rust, or deposit).*

Still pipe/chamber installations

Installation in still pipe/chamber is recommended for tanks where there are excessive foaming or turbulence. Still pipe/chamber may also be used to avoid disturbing objects in the tank.

For more information and installation requirements, refer to the Best Practices for Using Radar in Still Pipes and Chambers Technical Note.

Still pipe

Consider the following still pipe requirements:

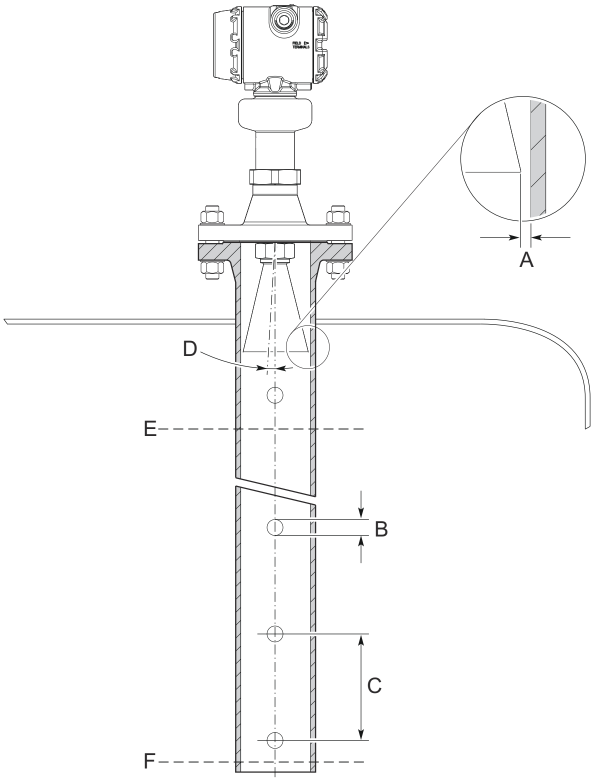
Pipe
- Pipes should be an all-metal material.
- Pipe should have a constant inside diameter.
- The inner surface must be smooth and clear of any rough edges. (Smooth pipe joints are acceptable, but may reduce accuracy.)
- The end of the pipe must extend beyond the zero level.

Holes
- Maximum hole diameter is 1 in. (25 mm).
- Minimum distance between holes is 6 in. (150 mm).
- Holes should be drilled on one side only and deburred.
- Drill one hole above maximum product surface.

Antenna
- All cone/process seal antenna sizes can be used for still pipe/chamber installations.
- The gap between the cone antenna and the still pipe should be maximum 0.2 in. (5 mm)[11]. Larger gaps may result in inaccuracies. If required, order a larger antenna and cut on location. See Table 37 for antenna dimensions.

(11) A larger gap is inevitable for the 4-in. cone antenna in pipes with a diameter larger than 4 in.

Figure 24: Still Pipe Requirements



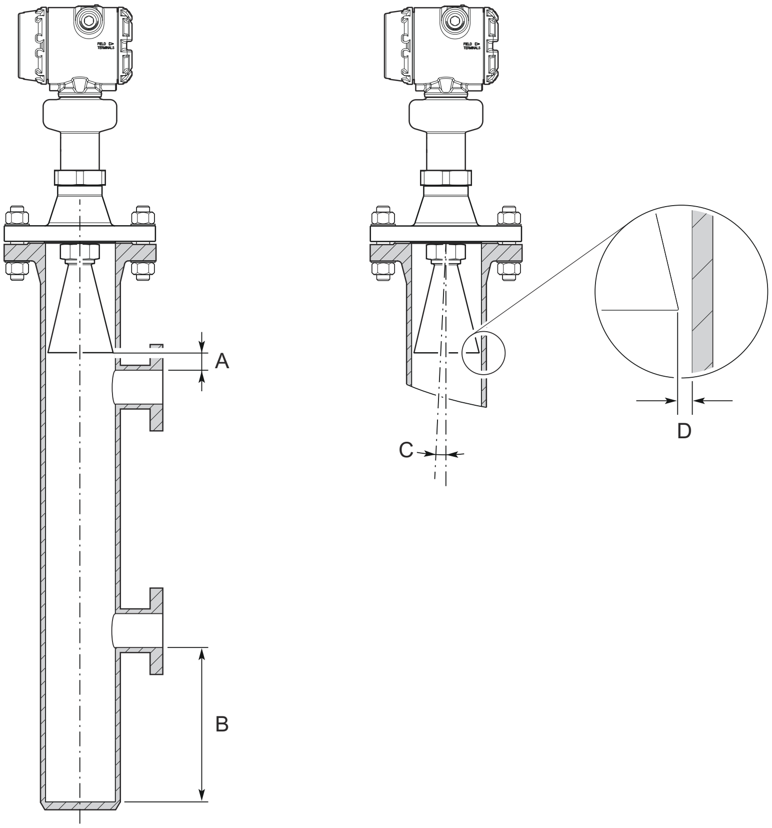
A. Maximum 0.2 in. (5 mm)
B. Maximum 1 in. (25 mm)
C. Minimum 6 in. (150 mm)
D. Maximum 1°
E. Level = 100%
F. Level = 0%

Chamber

Consider the following chamber requirements:

- Pipes should be an all-metal material.
- Pipe should have a constant inside diameter.
- Inlet pipes should not protrude into the inside of the stand pipe.
- The inner surface must be smooth and clear of any rough edges. (Smooth pipe joints are acceptable, but may reduce accuracy.)
- The gap between the cone antenna and the stand pipe should be maximum 0.2 in. (5 mm)[11]. Larger gaps may result in inaccuracies. If required, order a larger antenna and cut on location. See Table 37 for antenna dimensions.

Figure 25: Chamber Requirements



A. *Minimum 0.4 in. (10 mm)*
B. *Minimum 6 in. (150 mm)*
C. *Maximum 1°*
D. *Maximum 0.2 in. (5 mm)*

Ball valve installation

The transmitter can be isolated from the process by using a valve:

- Use a full-port ball valve.
- Ensure there is no edge between the ball valve and the nozzle or still pipe, the inside should be smooth.
- Valves can be combined with still pipes.
- The ball valve should have the same inner diameter as the still pipe.

Shipboard installations

Transmitters with aluminum housing are not approved for open deck installations; for use only in engine room, pump room, etc.

For application conditions and limitations refer to the applicable shipboard approval.

Product certifications

Rev 4.34

European directive information

A copy of the EU Declaration of Conformity can be found at the end of the Rosemount 5408 Product Certifications document. The most recent revision of the EU Declaration of Conformity can be found at Emerson.com/Rosemount.

Safety Instrumented Systems (SIS)

SIL 3 Capable: IEC 61508 certified for use in safety instrumented systems up to SIL 3 (Minimum requirement of single use (1oo1) for SIL 2 and redundant use (1oo2) for SIL 3).

Ordinary location certification

As standard, the transmitter has been examined and tested to determine that the design meets the basic electrical, mechanical, and fire protection requirements by a nationally recognized test laboratory (NRTL) as accredited by the Federal Occupational Safety and Health Administration (OSHA).

Telecommunication compliance

Measurement principle

Frequency Modulated Continuous Wave (FMCW), 26 GHz

Maximum output power

-5 dBm (0.32 mW)

Frequency range

24.05 to 27.0(12) GHz (TLPR)

24.05 to 26.5 GHz (LPR)

LPR (Level Probing Radar) equipment are devices for measurement of level in the open air or in a closed space. Model option “OA”. Hardware Version Identification Number (HVIN) is 5408L.

TLPR (Tank Level Probing Radar) equipment are devices for measurement of level in a closed space only (i.e metallic, concrete or reinforced fiberglass tanks, or similar enclosure structures made of comparable attenuating material). Hardware Version Identification Number (HVIN) is 5408T.

FCC

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not

(12) 26.5 GHz in Australia, New Zealand, and Russia.

occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

FCC ID	K8C5408L (for LPR)
	K8C5408T (for TLPR)

IC

This device complies with Industry Canada's licence-exempt RSS standard. Operation is subject to the following conditions:

1. This device may not cause interference.
2. This device must accept any interference received, including interference that may cause undesired operation.
3. The installation of the LPR/TLPR device shall be done by trained installers in strict compliance with the manufacturer's instructions.
4. The use of this device is on a "no-interference, no-protection" basis. That is, the user shall accept operations of high-powered radar in the same frequency band which may interfere with or damage this device. However, devices found to interfere with primary licensing operations will be required to be removed at the user's expense.
5. Devices operating under TLPR conditions (i.e. not operating in "Open Air" Mode) shall be installed and operated in a completely enclosed container to prevent RF emissions, which can otherwise interfere with aeronautical navigation.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux conditions suivantes:

1. l'appareil ne doit pas produire de brouillage.
2. l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.
3. L'installation d'un dispositif LPR ou TLPR doit être effectuée par des installateurs qualifiés, en pleine conformité avec les instructions du fabricant.
4. Ce dispositif ne peut être exploité qu'en régime de non-brouillage et de non-protection, c'est-à-dire que l'utilisateur doit accepter que des radars de haute puissance de la même bande de fréquences puissent brouiller ce dispositif ou même l'endommager. D'autre part, les capteurs de niveau qui perturbent une exploitation autorisée par licence de fonctionnement principal doivent être enlevés aux frais de leur utilisateur.
5. Un dispositif visé comme TLPR doit être installé et exploité dans un réservoir entièrement fermé afin de prévenir les rayonnements RF qui pourraient autrement perturber la navigation aéronautique.

Certificate	2827A-5408L (for LPR)
	2827A-5408T (for TLPR)

Radio Equipment Directive (RED) 2014/53/EU

This device complies with ETSI EN 302 372 (TLPR), ETSI EN 302 729 (LPR) and EN 62479.

For the receiver test that covers the influence of an interferer signal to the device, the performance criterion has at least the following level of performance according to ETSI TS 103 361 [6].

- Performance criterion: measurement value variation Δd over time during a distance measurement

- Level of performance: $\Delta d \leq \pm 2$ mm

LPR (Level Probing Radar), model code "OA"

Install at a separation distance of >4 km from Radio Astronomy sites, unless a special authorization has been provided by the responsible National regulatory authority (a list of Radio Astronomy sites may be found at www.craf.eu).

Between 4 km to 40 km around any Radio Astronomy site the LPR antenna height shall not exceed 15 m height above ground.

TLPR (Tank Level Probing Radar)

The device must be installed in closed tanks. Install according to requirements in ETSI EN 302 372 (Annex E).

Installing equipment in North America

The US National Electrical Code® (NEC) and the Canadian Electrical Code (CEC) permit the use of Division marked equipment in Zones and Zone marked equipment in Divisions. The markings must be suitable for the area classification, gas, and temperature class. This information is clearly defined in the respective codes.

USA

E5 Explosionproof (XP), Dust-Ignitionproof (DIP)

Certificate	FM-US FM16US0010X
Standards	FM Class 3600 – 2018; FM Class 3615 – 2018; FM Class 3810 – 2005; ANSI/ISA 60079-0 – 2013; ANSI/UL 60079-1 – 2015; ANSI/UL 60079-26 – 2017; ANSI/ISA 60079-31 – 2015; ANSI/NEMA® 250 – 1991; ANSI/IEC 60529 – 2014, ANSI/ISA 12.27.01:2011
Markings	XP CL I, DIV 1, GRPS A, B, C, D T6…T2 DIP CLII/III, DIV 1, GRPS E, F, G; T6…T3 CL I Zone 0/1 AEx db IIC T6…T2 Ga/Gb Zone 21 AEx tb IIIC T85 °C…T250 °C Db (-40 °C ≤ Ta ≤ +70 °C) (13); Type 4X/IP6X SINGLE SEAL

Specific Conditions of Use (X):

1. Flamepath joints are not for repair. Contact the manufacturer.
2. Plastic wire-on tag, Plastic part of Process Seal Antenna and Non-standard paint options (paint options other than Rosemount Blue) may cause risk from Electrostatic discharge. Avoid installation that could cause electrostatic build-up, and only clean with a damp cloth.
3. Appropriate cable, glands, and plugs need to be suitable for a temperature of 5 °C greater than the maximum specified ambient temperature for location where installed.
4. The Transmitter can be installed in the boundary wall between a Zone 0 and Zone 1 area. In this configuration, the process connection is installed in Zone 0, while the transmitter housing is installed in Zone 1. Refer to Control Drawing D7000002-885.
5. Cable entries must be used which maintain the ingress protection of the enclosure to at least IP6X and/or Type 4X rating. To maintain the ingress protection ratings, Covers and Sensor Module to be fully tightened and PTFE tape or pipe dope is required for cable entries and blanking plugs. See Instruction Manual on application requirements.

(13) Other temperature ranges may apply, see Specific Conditions of Use (X).

6. Install per Control drawing D7000002-885.
7. Using the box provided on the nameplate, the User shall permanently mark the type of protection chosen for the specific installation. Once the type of protection has been marked it shall not be changed.
8. Display glass shall be positioned in such a way as to minimize the risk of mechanical impact.
9. The applicable temperature class, ambient temperature range and process temperature range of the equipment is as follows:

Table 22: For Divisions:

Temperature class / Maximum surface temperature	Ambient temperature range	Process temperature range
Division Gas groups:		
T2	-40 °C ≤ Ta ≤ 70 °C	-40 °C to 250 °C
T3	-40 °C ≤ Ta ≤ 70 °C	-40 °C to 195 °C
T4	-40 °C ≤ Ta ≤ 70° C	-40 °C to 130 °C
T5	-40 °C ≤ Ta ≤ 70 °C	-40 °C to 95 °C
T6	-40 °C ≤ Ta ≤ 70 °C	-40 °C to 80 °C
Division Dust groups:		
T3	-50 °C ≤ Ta ≤ 70 °C	-50 °C to 160 °C
T4	-50 °C ≤ Ta ≤ 70 °C	-50 °C to 130 °C
T5	-50 °C ≤ Ta ≤ 70 °C	-50 °C to 95 °C
T6	-50 °C ≤ Ta ≤ 70 °C	-50 °C to 80 °C

Table 23: For Zones:

Temperature class / Maximum surface temperature	Ambient temperature range	Process temperature range
Zone Gas groups:		
T2	-50 °C ≤ Ta ≤ 70 °C	-50 °C to 250 °C
T3	-50 °C ≤ Ta ≤ 70 °C	-50 °C to 195 °C
T4	-50 °C ≤ Ta ≤ 70 °C	-50 °C to 130 °C
T5	-50 °C ≤ Ta ≤ 70 °C	-50 °C to 95 °C
T6	-50 °C ≤ Ta ≤ 70 °C	-50 °C to 80 °C
Zone Dust groups:		
T250°C	-60 °C ≤ Ta ≤ 70 °C	-60 °C to 250 °C
T200°C	-60 °C ≤ Ta ≤ 70 °C	-60 °C to 195 °C
T135°C	-60 °C ≤ Ta ≤ 70 °C	-60 °C to 130 °C
T100°C	-60 °C ≤ Ta ≤ 70 °C	-60 °C to 95 °C
T85°C	-60 °C ≤ Ta ≤ 70 °C	-60 °C to 80 °C

I5 Intrinsic Safety (IS), Non-Incendive (NI)

Certificate FM-US FM16US0010X

Standards	FM Class 3600 – 2018; FM Class 3610 – 2018; FM Class 3611 – 2018; FM Class 3810 – 2005; ANSI/ISA 60079-0 – 2013; ANSI/UL 60079-11 – 2014; ANSI/UL 60079-26 – 2017; ANSI/NEMA® 250 – 1991; ANSI/IEC 60529 – 2014; ANSI/ISA 12.27.01:2011
Markings	IS CL I, II, III DIV 1, GRPS A-G T4…T2 NI CL I, DIV 2, GRPS A-D T4…T2 S CL II, III DIV 2, GRPS E-G T4…T3 CL I Zone 0 AEx ia IIC T4…T2 Ga CL I Zone 0/1 AEx ib IIC T4…T2 Ga/Gb Zone 20 AEx ia IIIC T85°C…T250°C Da -60 (-55) °C ≤ Ta ≤ +70 °C When installed per Control Drawing D7000002-885 SINGLE SEAL

Safety parameter	HART®	Fieldbus
Voltage U_i	30 V	30 V
Current I_i	133 mA	300 mA
Power P_i	1.0 W	1.5 W
Capacitance C_i	7.3 nF	1.1 nF
Inductance L_i	0	0

Specific Conditions of Use (X):

1. The Model 5408 Level Transmitter will not pass the 500Vrms dielectric strength test between the circuits and the earth ground. This must be taken into account during installation.
2. Plastic wire-on tag, Plastic part of Process Seal Antenna and Non-standard paint options (paint options other than Rosemount Blue) may cause risk from Electrostatic discharge. Avoid installation that could cause electrostatic build-up, and only clean with a damp cloth.
3. Appropriate cable, glands, and plugs need to be suitable for a temperature of 5 °C greater than the maximum specified ambient temperature for location where installed.
4. The Transmitter can be installed in the boundary wall between a Zone 0 and Zone 1 area. In this configuration, the process connection is installed in Zone 0, while the transmitter housing is installed in Zone 1. Refer to Control Drawing D7000002-885.
5. Using the box provided on the nameplate, the User shall permanently mark the type of protection chosen for the specific installation. Once the type of protection has been marked it shall not be changed.
6. The applicable temperature class, ambient temperature range and process temperature range of the equipment is as follows:

Table 24: For Divisions:

Temperature class / Maximum surface temperature	Ambient temperature range[(1)]	Process temperature range[(1)]
Division Gas groups:		
T2	-60 (-55) °C ≤ Ta ≤ 70 °C	-60 (-55) °C to 250 °C
T3	-60 (-55) °C ≤ Ta ≤ 70 °C	-60 (-55) °C to 195 °C
T4	-60 (-55) °C ≤ Ta ≤ 70 °C	-60 (-55) °C to 130 °C
Division Dust groups:		
T3	-60 (-55) °C ≤ Ta ≤ 70 °C	-60 (-55) °C to 160 °C
T4	-60 (-55) °C ≤ Ta ≤ 70 °C	-60 (-55) °C to 130 °C
T5	-60 (-55) °C ≤ Ta ≤ 70 °C	-60 (-55) °C to 95 °C
T6	-60 (-55) °C ≤ Ta ≤ 70 °C	-60 (-55) °C to 80 °C

(1) *-55 °C for Fieldbus; -60 °C for HART*

Table 25: For Zones:

Temperature class / Maximum surface temperature	Ambient temperature range[(1)]	Process temperature range[(1)]
Zone Gas groups:		
T2	-60 (-55) °C ≤ Ta ≤ 70 °C	-60 (-55) °C to 250 °C
T3	-60 (-55) °C ≤ Ta ≤ 70 °C	-60 (-55) °C to 195 °C
T4	-60 (-55) °C ≤ Ta ≤ 70 °C	-60 (-55) °C to 130 °C
Zone Dust groups:		
T250°C	-60 (-55) °C ≤ Ta ≤ 70 °C	-60 (-55) °C to 250 °C
T200°C	-60 (-55) °C ≤ Ta ≤ 70 °C	-60 (-55) °C to 195 °C
T135°C	-60 (-55) °C ≤ Ta ≤ 70 °C	-60 (-55) °C to 130 °C
T100°C	-60 (-55) °C ≤ Ta ≤ 70 °C	-60 (-55) °C to 95 °C
T85°C	-60 (-55) °C ≤ Ta ≤ 70 °C	-60 (-55) °C to 80 °C

(1) *-55 °C for Fieldbus; -60 °C for HART*

IE FISCO

Certificate FM-US FM16US0010X

Standards FM Class 3600 – 2018; FM Class 3610 – 2018; FM Class 3611 – 2018; FM Class 3810 – 2005; ANSI/ISA 60079-0 – 2013; ANSI/UL 60079-11 – 2014; ANSI/UL 60079-26 – 2017; ANSI/NEMA® 250 – 1991; ANSI/IEC 60529 – 2014; ANSI/ISA 12.27.01:2011

Markings IS CL I, II, III DIV 1, GRPS A-G T4…T2
NI CL I, DIV 2, GRPS A-D T4…T2
S CL II, III DIV 2, GRPS E-G T4…T3
CL I Zone 0 AEx ia IIC T4…T2 Ga
CL I Zone 0/1 AEx ib IIC T4…T2 Ga/Gb
Zone 20 AEx ia IIIC T85°C…T250°C Da
-55 °C ≤ Ta ≤ +70°C

When installed per Control Drawing D7000002-885

SINGLE SEAL

Safety parameter	FISCO
Voltage U_i	17.5 V
Current I_i	380 mA
Power P_i	5.32 W
Capacitance C_i	1.1 nF
Inductance L_i	0

Specific Conditions of Use (X):

1. The Model 5408 Level Transmitter will not pass the 500Vrms dielectric strength test between the circuits and the earth ground. This must be taken into account during installation.
2. Plastic wire-on tag, Plastic part of Process Seal Antenna and Non-standard paint options (paint options other than Rosemount Blue) may cause risk from Electrostatic discharge. Avoid installation that could cause electrostatic build-up, and only clean with a damp cloth.
3. Appropriate cable, glands, and plugs need to be suitable for a temperature of 5°C greater than the maximum specified ambient temperature for location where installed.
4. The Transmitter can be installed in the boundary wall between a Zone 0 and Zone 1 area. In this configuration, the process connection is installed in Zone 0, while the transmitter housing is installed in Zone 1. Refer to Control Drawing D7000002-885.
5. Using the box provided on the nameplate, the User shall permanently mark the type of protection chosen for the specific installation. Once the type of protection has been marked it shall not be changed.
6. The applicable temperature class, ambient temperature range and process temperature range of the equipment is as follows:

Table 26: For Divisions:

Temperature class / Maximum surface temperature	Ambient temperature range	Process temperature range
Division Gas groups:		
T2	-55 °C ≤ Ta ≤ 70 °C	-55 °C to 250 °C
T3	-55 °C ≤ Ta ≤ 70 °C	-55 °C to 195 °C
T4	-55 °C ≤ Ta ≤ 70 °C	-55 °C to 130 °C
Division Dust groups:		
T3	-55 °C ≤ Ta ≤ 70 °C	-55 °C to 160 °C
T4	-55 °C ≤ Ta ≤ 70 °C	-55 °C to 130 °C
T5	-55 °C ≤ Ta ≤ 70 °C	-55 °C to 95 °C
T6	-55 °C ≤ Ta ≤ 70 °C	-55 °C to 80 °C

Table 27: For Zones:

Temperature class / Maximum surface temperature	Ambient temperature range	Process temperature range
Zone Gas groups:		
T2	-55 °C ≤ Ta ≤ 70 °C	-55 °C to 250 °C
T3	-55 °C ≤ Ta ≤ 70 °C	-55 °C to 195 °C
T4	-55 °C ≤ Ta ≤ 70 °C	-55 °C to 130 °C
Zone Dust groups:		
T250°C	-55 °C ≤ Ta ≤ 70 °C	-55 °C to 250 °C
T200°C	-55 °C ≤ Ta ≤ 70 °C	-55 °C to 195 °C
T135°C	-55 °C ≤ Ta ≤ 70 °C	-55 °C to 130 °C
T100°C	-55 °C ≤ Ta ≤ 70 °C	-55 °C to 95 °C
T85°C	-55 °C ≤ Ta ≤ 70 °C	-55 °C to 80 °C

Canada

E6 Explosionproof, Dust-Ignitionproof

Certificate FM-C FM16CA0011X

Standards C22.2 NO. 0.4-17:2017, C22.2 NO. 0.5-16:2016, C22.2 No. 25-17:2017, C22.2 No.30-M1986:1986 (R:2016), C22.2 No.94-M91:1991 (R:2011), C22.2 No. 61010-1:2004, CAN/CSA C22.2 No. 60079-0:2015 Ed. 3, C22.2 No. 60079-1:2016 Ed. 3, C22.2 No. 60079-26:2016; CAN/CSA-C22.2 No. 60079-31:2015, C22.2. 60529:2016, ANSI/ISA 12.27.01:2011

Markings XP CL I, DIV 1, GRPS A-D T6…T2

DIP CLII/III, DIV 1, GRPS E-G; T6…T3

Ex db IIC T6…T3 Gb

Ex tb IIIC T85°C…T250°C Db

(-40 °C ≤ Ta ≤ +70 °C) (14); Type 4X/IP6X

SINGLE SEAL

Specific Conditions of Use (X):

1. Flamepath joints are not for repair. Contact the manufacturer.
2. Plastic wire-on tag, Plastic part of Process Seal Antenna and Non-standard paint options (paint options other than Rosemount Blue) may cause risk from Electrostatic discharge. Avoid installation that could cause electrostatic build-up, and only clean with a damp cloth.
3. Appropriate cable, glands, and plugs need to be suitable for a temperature of 5 °C greater than the maximum specified ambient temperature for location where installed.
4. Metric Field Wiring Entries are not allowed for Divisions.
5. The Transmitter can be installed in the boundary wall between a Zone 0 and Zone 1 area. In this configuration, the process connection is installed in Zone 0, while the transmitter housing is installed in Zone 1. Refer to Control Drawing D7000002-885.

(14) Other temperature ranges may apply, see Specific Conditions of Use (X).

6. Cable entries must be used which maintain the ingress protection of the enclosure to at least IP6X and/or Type 4X rating. To maintain the ingress protection ratings, Covers and Sensor Module to be fully tightened and PTFE tape or pipe dope is required for cable entries and blanking plugs. See Instruction Manual on application requirements.
7. Install per Control Drawing D7000002-885.
8. Using the box provided on the nameplate, the User shall permanently mark the type of protection chosen for the specific installation. Once the type of protection has been marked it shall not be changed.
9. Display glass shall be positioned in such a way as to minimize the risk of mechanical impact.
10. The applicable temperature class, ambient temperature range and process temperature range of the equipment is as follows:

Table 28: For Divisions:

Temperature class / Maximum surface temperature	Ambient temperature range	Process temperature range
Division Gas groups:		
T2	-40 °C ≤ Ta ≤ 70 °C	-40 °C to 250 °C
T3	-40 °C ≤ Ta ≤ 70 °C	-40 °C to 195 °C
T4	-40 °C ≤ Ta ≤ 70 °C	-40 °C to 130 °C
T5	-40 °C ≤ Ta ≤ 70 °C	-40 °C to 95 °C
T6	-40 °C ≤ Ta ≤ 70 °C	-40 °C to 80 °C
Division Dust groups:		
T3	-50 °C ≤ Ta ≤ 70 °C	-50 °C to 160 °C
T4	-50 °C ≤ Ta ≤ 70 °C	-50 °C to 130 °C
T5	-50 °C ≤ Ta ≤ 70 °C	-50 °C to 95 °C
T6	-50 °C ≤ Ta ≤ 70 °C	-50 °C to 80 °C

Table 29: For Zones:

Temperature class / Maximum surface temperature	Ambient temperature range	Process temperature range
Zone Gas groups:		
T2	-50 °C ≤ Ta ≤ 70 °C	-50 °C to 250 °C
T3	-50 °C ≤ Ta ≤ 70 °C	-50 °C to 195 °C
T4	-50 °C ≤ Ta ≤ 70 °C	-50 °C to 130 °C
T5	-50 °C ≤ Ta ≤ 70 °C	-50 °C to 95 °C
T6	-50 °C ≤ Ta ≤ 70 °C	-50 °C to 80 °C
Zone Dust groups:		
T250°C	-60 °C ≤ Ta ≤ 70 °C	-60 °C to 250 °C
T200°C	-60 °C ≤ Ta ≤ 70 °C	-60 °C to 195 °C
T135°C	-60 °C ≤ Ta ≤ 70 °C	-60 °C to 130 °C
T100°C	-60 °C ≤ Ta ≤ 70 °C	-60 °C to 95 °C
T85°C	-60 °C ≤ Ta ≤ 70 °C	-60 °C to 80 °C

I6 Intrinsically Safe and Non-Incendive Systems

Certificate FM-C FM16CA0011X

Standards C22.2 NO. 0.4-17:2017, C22.2 NO. 0.5-16:2016, C22.2 No. 25-17:2017, C22.2 No.94-M91:1991 (R:2011), C22.2 No. 213-16:2016, C22.2 No. 61010-1:2004, CAN/CSA C22.2 No. 60079-0:2015 Ed. 3, CAN/CSAC22.2 No. 60079-11:2014 Ed. 2, CAN/CSAC22.2 No. 60079-15:2016 Ed.2, C22.2 No. 60079-26:2016, C22.2. 60529:2016, ANSI/ISA 12.27.01:2011

Markings IS CL I, II, III DIV 1, GRPS A-G T4...T2

NI CL I, DIV 2, GRPS A-D T4...T2

S CL II, III DIV 2, GRPS E-G T4...T3

Ex ia IIC T4...T2 Ga

Ex ib IIC T4...T2 Ga/Gb

Ex ia IIIC T85°C...T250°C Da

-60 (-55) °C ≤ Ta ≤ +70 °C

When installed per Control Drawing D7000002-885

SINGLE SEAL

Safety parameter	HART®	Fieldbus
Voltage U_i	30 V	30 V
Current I_i	133 mA	300 mA
Power P_i	1.0 W	1.5 W
Capacitance C_i	7.3 nF	1.1 nF
Inductance L_i	0	0

Specific Conditions of Use (X):

1. The Model 5408 Level Transmitter will not pass the 500Vrms dielectric strength test between the circuits and the earth ground. This must be taken into account during installation.
2. Plastic wire-on tag, Plastic part of Process Seal Antenna and Non-standard paint options (paint options other than Rosemount Blue) may cause risk from Electrostatic discharge. Avoid installation that could cause electrostatic build-up, and only clean with a damp cloth.
3. Appropriate cable, glands, and plugs need to be suitable for a temperature of 5 °C greater than the maximum specified ambient temperature for location where installed.
4. The Transmitter can be installed in the boundary wall between a Zone 0 and Zone 1 area. In this configuration, the process connection is installed in Zone 0, while the transmitter housing is installed in Zone 1. Refer to Control Drawing D7000002-885.
5. Using the box provided on the nameplate, the User shall permanently mark the type of protection chosen for the specific installation. Once the type of protection has been marked it shall not be changed.
6. The applicable temperature class, ambient temperature range and process temperature range of the equipment is as follows:

Table 30: For Divisions:

Temperature class / Maximum surface temperature	Ambient temperature range[(1)]	Process temperature range[(1)]
Division Gas groups:		
T2	-60 (-55) °C ≤ Ta ≤ 70 °C	-60 (-55) °C to 250 °C
T3	-60 (-55) °C ≤ Ta ≤ 70 °C	-60 (-55) °C to 195 °C
T4	-60 (-55) °C ≤ Ta ≤ 70 °C	-60 (-55) °C to 130 °C
Division Dust groups:		
T3	-60 (-55) °C ≤ Ta ≤ 70 °C	-60 (-55) °C to 160 °C
T4	-60 (-55) °C ≤ Ta ≤ 70 °C	-60 (-55) °C to 130 °C
T5	-60 (-55) °C ≤ Ta ≤ 70 °C	-60 (-55) °C to 95 °C
T6	-60 (-55) °C ≤ Ta ≤ 70 °C	-60 (-55) °C to 80 °C

(1) *-55 °C for Fieldbus; -60 °C for HART*

Table 31: For Zones:

Temperature class / Maximum surface temperature	Ambient temperature range[(1)]	Process temperature range[(1)]
Zone Gas groups:		
T2	-60 (-55) °C ≤ Ta ≤ 70 °C	-60 (-55) °C to 250 °C
T3	-60 (-55) °C ≤ Ta ≤ 70 °C	-60 (-55) °C to 195 °C
T4	-60 (-55) °C ≤ Ta ≤ 70 °C	-60 (-55) °C to 130 °C
Zone Dust groups:		
T250°C	-60 (-55) °C ≤ Ta ≤ 70 °C	-60 (-55) °C to 250 °C
T200°C	-60 (-55) °C ≤ Ta ≤ 70 °C	-60 (-55) °C to 195 °C
T135°C	-60 (-55) °C ≤ Ta ≤ 70 °C	-60 (-55) °C to 130 °C
T100°C	-60 (-55) °C ≤ Ta ≤ 70 °C	-60 (-55) °C to 95 °C
T85°C	-60 (-55) °C ≤ Ta ≤ 70 °C	-60 (-55) °C to 80 °C

(1) *-55 °C for Fieldbus; -60 °C for HART*

IF FISCO

Certificate FM-C FM16CA0011X

Standards C22.2 NO. 0.4-17:2017, C22.2 NO. 0.5-16:2016, C22.2 No. 25-17:2017, C22.2 No.94-M91:1991 (R:2011), C22.2 No. 213-16:2016, C22.2 No. 61010-11:2004, CAN/CSA C22.2 No. 60079-0:2015 Ed. 3, CAN/CSAC22.2 No. 60079-11:2014 Ed. 2, CAN/CSAC22.2 No. 60079-15:2016 Ed.2, C22.2 No. 60079-26:2016, C22.2. 60529:2016; ANSI/ISA 12.27.01:2011

Markings IS CL I, II, III DIV 1, GRPS A-G T4…T2

NI CL I, DIV 2, GRPS A-D T4…T2

S CL II, III DIV 2, GRPS E-G T4…T3

Ex ia IIC T4…T2 Ga

Ex ib IIC T4…T2 Ga/Gb

Ex ia IIIC T85°C…T250°C Da

-55 °C ≤ Ta ≤ +70°C

When installed per Control Drawing D7000002-885

SINGLE SEAL

Safety parameter	FISCO
Voltage U_i	17.5 V
Current I_i	380 mA
Power P_i	5.32 W
Capacitance C_i	1.1 nF
Inductance L_i	0

Specific Conditions of Use (X):

1. The Model 5408 Level Transmitter will not pass the 500Vrms dielectric strength test between the circuits and the earth ground. This must be taken into account during installation.
2. Plastic wire-on tag, Plastic part of Process Seal Antenna and Non-standard paint options (paint options other than Rosemount Blue) may cause risk from Electrostatic discharge. Avoid installation that could cause electrostatic build-up, and only clean with a damp cloth.
3. Appropriate cable, glands, and plugs need to be suitable for a temperature of 5°C greater than the maximum specified ambient temperature for location where installed.
4. The Transmitter can be installed in the boundary wall between a Zone 0 and Zone 1 area. In this configuration, the process connection is installed in Zone 0, while the transmitter housing is installed in Zone 1. Refer to Control Drawing D7000002-885.
5. Using the box provided on the nameplate, the User shall permanently mark the type of protection chosen for the specific installation. Once the type of protection has been marked it shall not be changed.
6. The applicable temperature class, ambient temperature range and process temperature range of the equipment is as follows:

Table 32: For Divisions:

Temperature class / Maximum surface temperature	Ambient temperature range	Process temperature range
Division Gas groups:		
T2	-55 °C ≤ Ta ≤ 70 °C	-55 °C to 250 °C
T3	-55 °C ≤ Ta ≤ 70 °C	-55 °C to 195 °C
T4	-55 °C ≤ Ta ≤ 70 °C	-55 °C to 130 °C
Division Dust groups:		
T3	-55 °C ≤ Ta ≤ 70 °C	-55 °C to 160 °C
T4	-55 °C ≤ Ta ≤ 70 °C	-55 °C to 130 °C
T5	-55 °C ≤ Ta ≤ 70 °C	-55 °C to 95 °C
T6	-55 °C ≤ Ta ≤ 70 °C	-55 °C to 80 °C

Table 33: For Zones:

Temperature class / Maximum surface temperature	Ambient temperature range	Process temperature range
Zone Gas groups:		
T2	-55 °C ≤ Ta ≤ 70 °C	-55 °C to 250 °C
T3	-55 °C ≤ Ta ≤ 70 °C	-55 °C to 195 °C
T4	-55 °C ≤ Ta ≤ 70 °C	-55 °C to 130 °C
Zone Dust groups:		
T250°C	-55 °C ≤ Ta ≤ 70°C	-55 °C to 250 °C
T200°C	-55 °C ≤ Ta ≤ 70°C	-55 °C to 195 °C
T135°C	-55 °C ≤ Ta ≤ 70°C	-55 °C to 130 °C
T100°C	-55 °C ≤ Ta ≤ 70°C	-55 °C to 95 °C
T85°C	-55 °C ≤ Ta ≤ 70°C	-55 °C to 80 °C

Europe

E1 ATEX Flameproof

Certificate	FM15ATEX0055X
Standards	EN IEC 60079-0:2018, EN 60079-1:2014, EN 60079-26:2015, EN 60079-31:2014, EN 60529+A1+A2:2013
Markings	Ex II 1/2G Ex db IIC T6...T2 Ga/Gb II 2D Ex tb IIIC T85°C... T250°C Db, IP6X -60 °C ≤ Ta ≤ +70 °C

Specific Conditions of Use (X):

1. Flamepath joints are not for repair. Contact the manufacturer.
2. Plastic wire-on tag, Plastic part of Process Seal Antenna and Non-standard paint options (paint options other than Rosemount Blue) may cause risk from Electrostatic discharge. Avoid installation that could cause electrostatic build-up, and only clean with a damp cloth.
3. Appropriate cable, glands, and plugs need to be suitable for a temperature of 5 °C greater than the maximum specified ambient temperature for location where installed.
4. The Transmitter can be installed in the boundary wall between EPL Ga and EPL Gb location. In this configuration, the process connection is EPL Ga, while the transmitter housing is EPL Gb. Refer to Control Drawing D7000002-885.
5. Cable entries must be used which maintain the ingress protection of the enclosure to at least IP6X. To maintain the ingress protection ratings, Covers and Sensor Module to be fully tightened and PTFE tape or pipe dope is required for cable entries and blanking plugs. See Instruction Manual on application requirements.
6. Install per Control Drawing D7000002-885.
7. Using the box provided on the nameplate, the User shall permanently mark the type of protection chosen for the specific installation. Once the type of protection has been marked it shall not be changed.
8. Display glass shall be positioned in such a way as to minimize the risk of mechanical impact.
9. The applicable temperature class, ambient temperature range and process temperature range of the equipment is as follows:

Temperature class / Maximum surface temperature	Ambient temperature range	Process temperature range
Gas & Dust groups:		
T2 / T250°C	-60 °C ≤ Ta ≤ 70 °C	-60 °C to 250 °C
T3 / T200°C	-60 °C ≤ Ta ≤ 70 °C	-60 °C to 195 °C
T4 / T135°C	-60 °C ≤ Ta ≤ 70 °C	-60 °C to 130 °C
T5 / T100°C	-60 °C ≤ Ta ≤ 70 °C	-60 °C to 95 °C
T6 / T85°C	-60 °C ≤ Ta ≤ 70 °C	-60 °C to 80 °C

I1 ATEX Intrinsic Safety

Certificate FM15ATEX0055X

Standards EN IEC 60079-0:2018, EN 60079-11:2012, EN 60079-26:2015, EN 60529:1991+A1:2000 +A2:2013

Markings Ex II 1G Ex ia IIC T4...T2 Ga
II 1/2G Ex ib IIC T4...T2 Ga/Gb
II 1D Ex ia IIIC T85°C...T250°C Da
-60 (-55) °C ≤ Ta ≤ +70 °C

Safety parameter	HART®	Fieldbus
Voltage U_i	30 V	30 V
Current I_i	133 mA	300 mA
Power P_i	1.0 W	1.5 W
Capacitance C_i	7.3 nF	1.1 nF
Inductance L_i	0	0

Specific Conditions of Use (X):

1. The Model 5408 Level Transmitter will not pass the 500Vrms dielectric strength test between the circuits and the earth ground. This must be taken into account during installation.
2. Plastic wire-on tag, Plastic part of Process Seal Antenna and Non-standard paint options (paint options other than Rosemount Blue) may cause risk from Electrostatic discharge. Avoid installation that could cause electrostatic build-up, and only clean with a damp cloth.
3. Appropriate cable, glands, and plugs need to be suitable for a temperature of 5 °C greater than the maximum specified ambient temperature for location where installed.
4. The Transmitter can be installed in the boundary wall between EPL Ga and EPL Gb location. In this configuration, the process connection is EPL Ga, while the transmitter housing is EPL Gb. Refer to Control Drawing D7000002-885.
5. Using the box provided on the nameplate, the User shall permanently mark the type of protection chosen for the specific installation. Once the type of protection has been marked it shall not be changed.
6. The applicable temperature class, ambient temperature range and process temperature range of the equipment is as follows:

Temperature class / Maximum surface temperature	Ambient temperature range[1]	Process temperature range[1]
Gas groups:		
T2	-60 (-55) °C ≤ Ta ≤ 70 °C	-60 (-55) °C to 250 °C
T3	-60 (-55) °C ≤ Ta ≤ 70 °C	-60 (-55) °C to 195 °C
T4	-60 (-55) °C ≤ Ta ≤ 70 °C	-60 (-55) °C to 130 °C
Dust groups:		
T250°C	-60 (-55) °C ≤ Ta ≤ 70 °C	-60 (-55) °C to 250 °C
T200°C	-60 (-55) °C ≤ Ta ≤ 70 °C	-60 (-55) °C to 195 °C
T135°C	-60 (-55) °C ≤ Ta ≤ 70 °C	-60 (-55) °C to 130 °C
T100°C	-60 (-55) °C ≤ Ta ≤ 70 °C	-60 (-55) °C to 95 °C
T85°C	-60 (-55) °C ≤ Ta ≤ 70 °C	-60 (-55) °C to 80 °C

(1) *-55 °C for Fieldbus; -60 °C for HART*

IA ATEX FISCO

Certificate FM15ATEX0055X

Standards EN IEC 60079-0:2018, EN 60079-11:2012, EN 60079-26:2015

Markings Ex II 1G Ex ia IIC T4…T2 Ga
II 1/2G Ex ib IIC T4…T2 Ga/Gb
II 1D Ex ia IIIC T85°C…T250°C Da
-55°C ≤ Ta ≤ +70°C

Safety parameter	FISCO
Voltage U_i	17.5 V
Current I_i	380 mA
Power P_i	5.32 W
Capacitance C_i	1.1 nF
Inductance L_i	0

Specific Conditions of Use (X):

1. The Model 5408 Level Transmitter will not pass the 500Vrms dielectric strength test between the circuits and the earth ground. This must be taken into account during installation.
2. Plastic wire-on tag, Plastic part of Process Seal Antenna and Non-standard paint options (paint options other than Rosemount Blue) may cause risk from Electrostatic discharge. Avoid installation that could cause electrostatic build-up, and only clean with a damp cloth.
3. Appropriate cable, glands, and plugs need to be suitable for a temperature of 5°C greater than the maximum specified ambient temperature for location where installed.
4. The Transmitter can be installed in the boundary wall between EPL Ga and EPL Gb location. In this configuration, the process connection is EPL Ga, while the transmitter housing is EPL Gb. Refer to Control Drawing D7000002-885.
5. Using the box provided on the nameplate, the User shall permanently mark the type of protection chosen for the specific installation. Once the type of protection has been marked it shall not be changed.

6. The applicable temperature class, ambient temperature range and process temperature range of the equipment is as follows:

Temperature class / Maximum surface temperature	Ambient temperature range	Process temperature range
Gas groups:		
T2	-55 °C ≤ Ta ≤ 70 °C	-55 °C to 250 °C
T3	-55 °C ≤ Ta ≤ 70 °C	-55 °C to 195 °C
T4	-55 °C ≤ Ta ≤ 70 °C	-55 °C to 130 °C
Dust groups:		
T250°C	-55 °C ≤ Ta ≤ 70 °C	-55 °C to 250 °C
T200°C	-55 °C ≤ Ta ≤ 70 °C	-55 °C to 195 °C
T135°C	-55 °C ≤ Ta ≤ 70 °C	-55 °C to 130 °C
T100°C	-55 °C ≤ Ta ≤ 70 °C	-55 °C to 95 °C
T85°C	-55 °C ≤ Ta ≤ 70 °C	-55 °C to 80 °C

N1 ATEX Type N: Non-Sparking

Certificate FM15ATEX0056X

Standards EN IEC 60079-0:2018, EN 60079-15:2010, EN 60529:1991+A1:2000 +A2:2013

Markings Ex II 3G Ex nA IIC T4...T2 Gc, IP65
(-34 °C ≤ Ta ≤ +70 °C)
V ≤ 42.4V, I ≤ 23 mA (HART®)
V ≤ 32V, I ≤ 22 mA (Fieldbus)

Specific Conditions of Use (X):

1. The Model 5408 Level Transmitter will not pass the 500Vrms dielectric strength test between the circuits and the earth ground. This must be taken into account during installation.
2. Plastic wire-on tag, Plastic part of Process Seal Antenna and Non-standard paint options (paint options other than Rosemount Blue) may cause risk from Electrostatic discharge. Avoid installation that could cause electrostatic build-up, and only clean with a damp cloth.
3. Cable entries must be used which maintain the ingress protection of the enclosure to at least IP65. To maintain the ingress protection ratings, Covers and Sensor Module to be fully tightened and PTFE tape or pipe dope is required for cable entries and blanking plugs. See Instruction Manual on application requirements.
4. The applicable temperature class, ambient temperature range and process temperature range of the equipment is as follows:

Temperature class	Ambient temperature range	Process temperature range
T2	-34 °C ≤ Ta ≤ 70 °C	-34 °C to 250 °C
T3	-34 °C ≤ Ta ≤ 70 °C	-34 °C to 195 °C
T4	-34 °C ≤ Ta ≤ 70 °C	-34 °C to 130 °C

International

E7 IECEx Flameproof

Certificate	IECEx FMG15.0033X
Standards	IEC 60079-0:2017, IEC 60079-1:2014; IEC 60079-26:2014, IEC 60079-31:2013
Markings	Ex db IIC T6…T2 Ga/Gb Ex tb IIIC T85°C…T250°C Db IP6X -60 °C ≤ Ta ≤ +70 °C

Specific Conditions of Use (X):

1. Flamepath joints are not for repair. Contact the manufacturer.
2. Plastic wire-on tag, Plastic part of Process Seal Antenna and Non-standard paint options (paint options other than Rosemount Blue) may cause risk from Electrostatic discharge. Avoid installation that could cause electrostatic build-up, and only clean with a damp cloth.
3. Appropriate cable, glands, and plugs need to be suitable for a temperature of 5 °C greater than the maximum specified ambient temperature for location where installed.
4. The Transmitter can be installed in the boundary wall between EPL Ga and EPL Gb. In this configuration, the process connection is EPL Ga, while the transmitter housing is EPL Gb. Refer to Control Drawing D7000002-885.
5. Cable entries must be used which maintain the ingress protection of the enclosure to at least IP6X. To maintain the ingress protection ratings, Covers and Sensor Module to be fully tightened and PTFE tape or pipe dope is required for cable entries and blanking plugs. See Instruction Manual on application requirements.
6. Install per Control Drawing D7000002-885.
7. Using the box provided on the nameplate, the User shall permanently mark the type of protection chosen for the specific installation. Once the type of protection has been marked it shall not be changed.
8. Display glass shall be positioned in such a way as to minimize the risk of mechanical impact.
9. The applicable temperature class, ambient temperature range and process temperature range of the equipment is as follows:

Temperature class / Maximum surface temperature	Ambient temperature range	Process temperature range
Gas & Dust groups:		
T2 / T250°C	-60 °C ≤ Ta ≤ 70 °C	-60 °C to 250 °C
T3 / T200°C	-60 °C ≤ Ta ≤ 70 °C	-60 °C to 195 °C
T4 / T135°C	-60 °C ≤ Ta ≤ 70 °C	-60 °C to 130 °C
T5 / T100°C	-60 °C ≤ Ta ≤ 70 °C	-60 °C to 95 °C
T6 / T85°C	-60 °C ≤ Ta ≤ 70 °C	-60 °C to 80 °C

I7 IECEx Intrinsic Safety

Certificate	IECEx FMG15.0033X
Standards	IEC 60079-0:2017, IEC 60079-11:2011, IEC 60079-26:2014, IEC 60529:2013
Markings	Ex ia IIC T4…T2 Ga Ex ib IIC T4…T2 Ga/Gb Ex ia IIIC T85°C…T250°C Da

-60 (-55) °C ≤ Ta ≤ +70 °C

Safety parameter	HART®	Fieldbus
Voltage U_i	30 V	30 V
Current I_i	133 mA	300 mA
Power P_i	1.0 W	1.5 W
Capacitance C_i	7.3 nF	1.1 nF
Inductance L_i	0	0

Specific Conditions of Use (X):

1. The Model 5408 Level Transmitter will not pass the 500Vrms dielectric strength test between the circuits and the earth ground. This must be taken into account during installation.
2. Plastic wire-on tag, Plastic part of Process Seal Antenna and Non-standard paint options (paint options other than Rosemount Blue) may cause risk from Electrostatic discharge. Avoid installation that could cause electrostatic build-up, and only clean with a damp cloth.
3. Appropriate cable, glands, and plugs need to be suitable for a temperature of 5 °C greater than the maximum specified ambient temperature for location where installed.
4. The Transmitter can be installed in the boundary wall between EPL Ga and EPL Gb. In this configuration, the process connection is EPL Ga, while the transmitter housing is EPL Gb. Refer to Control Drawing D7000002-885.
5. Using the box provided on the nameplate, the User shall permanently mark the type of protection chosen for the specific installation. Once the type of protection has been marked it shall not be changed.
6. The applicable temperature class, ambient temperature range and process temperature range of the equipment is as follows:

Temperature class / Maximum surface temperature	Ambient temperature range(1)	Process temperature range(1)
Gas groups:		
T2	-60 (-55) °C ≤ Ta ≤ 70 °C	-60 (-55) °C to 250 °C
T3	-60 (-55) °C ≤ Ta ≤ 70 °C	-60 (-55) °C to 195 °C
T4	-60 (-55) °C ≤ Ta ≤ 70 °C	-60 (-55) °C to 130 °C
Dust groups:		
T250°C	-60 (-55) °C ≤ Ta ≤ 70 °C	-60 (-55) °C to 250 °C
T200°C	-60 (-55) °C ≤ Ta ≤ 70 °C	-60 (-55) °C to 195 °C
T135°C	-60 (-55) °C ≤ Ta ≤ 70 °C	-60 (-55) °C to 130 °C
T100°C	-60 (-55) °C ≤ Ta ≤ 70 °C	-60 (-55) °C to 95 °C
T85°C	-60 (-55) °C ≤ Ta ≤ 70 °C	-60 (-55) °C to 80 °C

(1) *-55 °C for Fieldbus; -60 °C for HART*

IG IECEx FISCO

Certificate	IECEx FMG15.0033X
Standards	IEC 60079-0:2017, IEC 60079-11:2011, IEC 60079-26:2014
Markings	Ex ia IIC T4...T2 Ga

Ex ib IIC T4…T2 Ga/Gb
Ex ia IIIC T85°C…T250°C Da
-55°C ≤ Ta ≤ +70°C

Safety parameter	FISCO
Voltage U_i	17.5 V
Current I_i	380 mA
Power P_i	5.32 W
Capacitance C_i	1.1 nF
Inductance L_i	0

Specific Conditions of Use (X):

1. The Model 5408 Level Transmitter will not pass the 500Vrms dielectric strength test between the circuits and the earth ground. This must be taken into account during installation.
2. Plastic wire-on tag, Plastic part of Process Seal Antenna and Non-standard paint options (paint options other than Rosemount Blue) may cause risk from Electrostatic discharge. Avoid installation that could cause electrostatic build-up, and only clean with a damp cloth.
3. Appropriate cable, glands, and plugs need to be suitable for a temperature of 5°C greater than the maximum specified ambient temperature for location where installed.
4. The Transmitter can be installed in the boundary wall between EPL Ga and EPL Gb location. In this configuration, the process connection is EPL Ga, while the transmitter housing is EPL Gb. Refer to Control Drawing D7000002-885.
5. Using the box provided on the nameplate, the User shall permanently mark the type of protection chosen for the specific installation. Once the type of protection has been marked it shall not be changed.
6. The applicable temperature class, ambient temperature range and process temperature range of the equipment is as follows:

Temperature class / Maximum surface temperature	Ambient temperature range	Process temperature range
Gas groups:		
T2	-55 °C ≤ Ta ≤ 70 °C	-55 °C to 250 °C
T3	-55 °C ≤ Ta ≤ 70 °C	-55 °C to 195 °C
T4	-55 °C ≤ Ta ≤ 70 °C	-55 °C to 130 °C
Dust groups:		
T250°C	-55 °C ≤ Ta ≤ 70 °C	-55 °C to 250 °C
T200°C	-55 °C ≤ Ta ≤ 70 °C	-55 °C to 195 °C
T135°C	-55 °C ≤ Ta ≤ 70 °C	-55 °C to 130 °C
T100°C	-55 °C ≤ Ta ≤ 70 °C	-55 °C to 95 °C
T85°C	-55 °C ≤ Ta ≤ 70 °C	-55 °C to 80 °C

N7 IECEx Type N: Non-Sparking

Certificate IECEx FMG15.0033X

Standards IEC 60079-0:2017, IEC 60079-15:2010, IEC 60529:2013

Markings Ex nA IIC T4...T2 Gc
(-34 °C ≤ Ta ≤ +70 °C), IP65
V ≤ 42.4V, I ≤ 23 mA (HART®)
V ≤ 32V, I ≤ 22 mA (Fieldbus)

Specific Conditions of Use (X):

1. The Model 5408 Level Transmitter will not pass the 500Vrms dielectric strength test between the circuits and the earth ground. This must be taken into account during installation.
2. Plastic wire-on tag, Plastic part of Process Seal Antenna and Non-standard paint options (paint options other than Rosemount Blue) may cause risk from Electrostatic discharge. Avoid installation that could cause electrostatic build-up, and only clean with a damp cloth.
3. Cable entries must be used which maintain the ingress protection of the enclosure to at least IP65. To maintain the ingress protection ratings, Covers and Sensor Module to be fully tightened and PTFE tape or pipe dope is required for cable entries and blanking plugs. See Instruction Manual on application requirements.
4. The applicable temperature class, ambient temperature range and process temperature range of the equipment is as follows:

Temperature class / Maximum surface temperature	Ambient temperature range	Process temperature range
T2	-34 °C ≤ Ta ≤ 70 °C	-34 °C to 250 °C
T3	-34 °C ≤ Ta ≤ 70 °C	-34 °C to 195 °C
T4	-34 °C ≤ Ta ≤ 70 °C	-34 °C to 130 °C

Brazil

E2 INMETRO Flameproof

Certificate UL-BR 17.0344X

Standards ABNT NBR IEC 60079-0:2013, ABNT NBR IEC 60079-1:2016, ABNT NBR IEC 60079-26:2016, ABNT NBR IEC 60079-31:2014

Markings Ex db IIC T6...T2 Ga/Gb
Ex tb III C T85°C...T250°C Db
Tamb = -60 °C to +70 °C; IP6X

Specific Conditions of Use (X):

1. See certificate.

I2 INMETRO Intrinsic Safety

Certificate UL-BR 17.0344X

Standards ABNT NBR IEC 60079-0:2013, ABNT NBR IEC 60079-11:2013, ABNT NBR IEC 60079-26:2016, ABNT NBR IEC 60079-31:2014

Markings Ex ia IIC T4...T2 Ga
Ex ib IIC T4...T2 Ga/Gb
Ex ia IIIC T85°C...T250°C Da
Tamb = -60 (-55) °C to +70 °C

Safety parameter	HART®	Fieldbus
Voltage U_i	30 V	30 V
Current I_i	133 mA	300 mA
Power P_i	1.0 W	1.5 W
Capacitance C_i	7.3 nF	1.1 nF
Inductance L_i	0	0

Specific Conditions of Use (X):

1. See certificate.

IB INMETRO FISCO

Certificate	UL-BR 17.0344X
Standards	ABNT NBR IEC 60079-0:2013, ABNT NBR IEC 60079-11:2013, ABNT NBR IEC 60079-26:2016
Markings	Ex ia IIC T4...T2 Ga Ex ib IIC T4...T2 Ga/Gb Ex ia IIIC T85°C...T250°C Da -55 °C ≤ Ta ≤ +70 °C

Safety parameter	FISCO
Voltage U_i	17.5 V
Current I_i	380 mA
Power P_i	5.32 W
Capacitance C_i	1.1 nF
Inductance L_i	0

Specific Conditions of Use (X):

1. See certificate.

N2 INMETRO Type N: Non-Sparking

Certificate	UL-BR 17.0344X
Standards	ABNT NBR IEC 60079-0:2013, ABNT NBR IEC 60079-15:2012
Markings	Ex nA IIC T4...T2 Gc Tamb = -34 °C to +70 °C; IP65 V ≤ 42.4V, I ≤ 23 mA (HART®) V ≤ 32V, I ≤ 22 mA (Fieldbus)

Specific Conditions of Use (X):

1. See certificate.

China

E3 Flameproof

Certificate	NEPSI GYJ17.1226X
Standards	GB3836.1/2/20-2010, GB12476.1/5-2013
Markings	Ex d IIC T6~T2 Ga/Gb Ex tD A21 IP6X T85°C~250°C Tamb = -60 °C to +70 °C; IP6X

Specific Conditions of Use (X):

1. See certificate.

I3 Intrinsic Safety

Certificate	NEPSI GYJ17.1226X
Standards	GB3836.1/4/20-2010, GB12476.4-2010
Markings	Ex ia IIC T4~T2 Ga Ex ib IIC T4~T2 Ga/Gb Ex iaD 20 T85~250 Da Tamb = -60 (-55) °C to +70 °C

Safety parameter	HART®	Fieldbus
Voltage U_i	30 V	30 V
Current I_i	133 mA	300 mA
Power P_i	1.0 W	1.5 W
Capacitance C_i	7.3 nF	1.1 nF
Inductance L_i	0	0

Specific Conditions of Use (X):

1. See certificate.

IC FISCO

Certificate	NEPSI GYJ17.1226X
Standards	GB3836.1/4/20-2010, GB12476.4-2010
Markings	Ex ia IIC T4...T2 Ga Ex ib IIC T4...T2 Ga/Gb Ex iaD 20 T85°C...T250°C Da -55 °C ≤ Ta ≤ +70 °C

Safety parameter	FISCO
Voltage U_i	17.5 V
Current I_i	380 mA
Power P_i	5.32 W
Capacitance C_i	1.1 nF
Inductance L_i	0

Specific Conditions of Use (X):

1. See certificate.

N3 Type N: Non-Sparking

Certificate NEPSI GYJ17.1226X

Standards GB3836.1-2010, GB3836.8-2014

Markings Ex nA IIC T4~T2 Gc
Tamb = -34 °C to +70 °C; IP65
V ≤ 42.4V, I ≤ 23 mA (HART®)
V ≤ 32V, I ≤ 22 mA (Fieldbus)

Specific Conditions of Use (X):

1. See certificate.

Technical Regulations Customs Union (EAC)

TR CU 020/2011 “Electromagnetic Compatibility of Technical Products”

TR CU 032/2013 “On safety of equipment and vessels under pressure”

Certificate ЕАЭС RU C-US.АД07.В.00770-19

TR CU 012/2011 “On safety of equipment intended for use in explosive atmospheres”

EM Technical Regulations Customs Union (EAC) Flameproof

Certificate ЕАЭС RU C-SE.АД07.В.01297/20

Standards GOST 31610.0-2014 (IEC 60079-0:2011), GOST IEC 60079-1-2011, GOST 31610.26-2012 (IEC 60079-26:2006), GOST R IEC 60079-31-2010

Markings Ga/Gb Ex d IIC T6….T2 X
Ex tb IIIC T85°C…T250°C Db X
Tamb = -60 °C to +70 °C

Specific Conditions of Use (X):

1. Flamepath joints are not for repair. Contact the manufacturer.

2. The Model 5408 Level Transmitter can accumulate electrostatic charge on the surface of the casing. It is necessary to clean the painted surfaces with a damp cloth.
3. Appropriate cable, glands, and plugs need to be suitable for a temperature of 5 °C greater than the maximum specified ambient temperature for location where installed.
4. Cable entries must be used which maintain the ingress protection of the enclosure to at least IP65.
5. It is necessary for display to avoid physical impact.
6. The applicable temperature class, ambient temperature range and process temperature range of the equipment is as follows;

Temperature class / Maximum surface temperature	Ambient temperature range	Process temperature range
IIC/ IIIC		
T2/T250	-60 °C ≤ Ta ≤ 70 °C	-60 °C to 250 °C
T3/T200	-60 °C ≤ Ta ≤ 70 °C	-60 °C to 195 °C
T4/T135	-60 °C ≤ Ta ≤ 70 °C	-60 °C to 130 °C
T5/T100	-60 °C ≤ Ta ≤ 70 °C	-60 °C to 100 °C
T6/T85	-60 °C ≤ Ta ≤ 70 °C	-60 °C to 85 °C

IM Technical Regulations Customs Union (EAC) Intrinsic Safety

Certificate ЕАЭС RU C-SE.АД07.B.01297/20

Standards GOST 31610.0-2014 (IEC 60079-0:2011), GOST 31610.11-2014 (IEC 60079-11:2011), GOST 31610.26-2012 (IEC 60079-26:2006)

Markings 0Ex ia IIC T4…T2 Ga X
Ga/Gb Ex ib IIC T4…T2 X
Ex ia IIIC T85°C …T250°C Da X
Tamb = -60 (-55) °C to +70 °C

Safety parameter	HART®	Fieldbus
Voltage U_i	30 V	30 V
Current I_i	133 mA	300 mA
Power P_i	1.0 W	1.5 W
Capacitance C_i	7.3 nF	1.1 nF
Inductance L_i	0	0

Specific Conditions of Use (X):

1. The Model 5408 Level Transmitter will not pass the 500Vrms dielectric strength test. This must be taken into account during installation.
2. The Model 5408 Level Transmitter can accumulate electrostatic charge on the surface of the casing. It is necessary to clean the painted surfaces with a damp cloth.
3. Appropriate cable, glands, and plugs need to be suitable for a temperature of 5 °C greater than the maximum specified ambient temperature for location where installed.
4. Cable entries must be used which maintain the ingress protection of the enclosure to at least IP6X.

5. The applicable temperature class, ambient temperature range and process temperature range of the equipment is as follows;

Temperature class / Maximum surface temperature	Ambient temperature range(1)	Process temperature range(1)
IIC/ IIIC		
T2/T250	-60 (-55) °C ≤ Ta ≤ 70 °C	-60 (-55) °C to 250 °C
T3/T200	-60 (-55) °C ≤ Ta ≤ 70 °C	-60 (-55) °C to 195 °C
T4/T135	-60 (-55) °C ≤ Ta ≤ 70 °C	-60 (-55) °C to 130 °C
T100	-60 (-55) °C ≤ Ta ≤ 70 °C	-60 (-55) °C to 100 °C
T85	-60 (-55) °C ≤ Ta ≤ 70 °C	-60 (-55) °C to 85 °C

(1) *-55 °C for Fieldbus; -60 °C for HART*

IN Technical Regulations Customs Union (EAC), FISCO

Certificate ЕАЭС RU C-SE.АД07.B.01297/20

Standards GOST 31610.0-2014 (IEC 60079-0:2011), GOST 31610.11-2014 (IEC 60079-11:2011), GOST 31610.26-2012 (IEC 60079-26:2006)

Markings Ex ia IIC T4…T2 Ga
Ex ib IIC T4…T2 Ga/Gb
Ex ia IIIC T85°C…T250°C Da
-55 °C ≤ Ta ≤ +70 °C

Safety parameter	FISCO
Voltage U_i	17.5 V
Current I_i	380 mA
Power P_i	5.32 W
Capacitance C_i	1.1 nF
Inductance L_i	0

Specific Conditions of Use (X):

1. The Model 5408 Level Transmitter will not pass the 500Vrms dielectric strength test. This must be taken into account during installation.
2. The Model 5408 Level Transmitter can accumulate electrostatic charge on the surface of the casing. It is necessary to clean the painted surfaces with a damp cloth.
3. Appropriate cable, glands, and plugs need to be suitable for a temperature of 5°C greater than the maximum specified ambient temperature for location where installed.
4. Cable entries must be used which maintain the ingress protection of the enclosure to at least IP6X.
5. The applicable temperature class, ambient temperature range and process temperature range of the equipment is as follows;

Temperature class / Maximum surface temperature	Ambient temperature range	Process temperature range
Gas groups:		
T2	-55 °C ≤ Ta ≤ 70 °C	-55 °C to 250 °C
T3	-55 °C ≤ Ta ≤ 70 °C	-55 °C to 195 °C
T4	-55 °C ≤ Ta ≤ 70 °C	-55 °C to 130 °C
Dust groups:		
T250°C	-55 °C ≤ Ta ≤ 70 °C	-55 °C to 250 °C
T200°C	-55 °C ≤ Ta ≤ 70 °C	-55 °C to 195 °C
T135°C	-55 °C ≤ Ta ≤ 70 °C	-55 °C to 130 °C
T100°C	-55 °C ≤ Ta ≤ 70 °C	-55 °C to 95 °C
T85°C	-55 °C ≤ Ta ≤ 70 °C	-55 °C to 80 °C

NM Technical Regulations Customs Union (EAC) Non-Sparking

Certificate ЕАЭС RU C-SE.АД07.B.01297/20

Standards GOST 31610.0-2014 (IEC 60079-0:2011), GOST 31610.15-2014/IEC 60079-15:2010

Markings 2Ex nA IIC T4…T2 Gc X
Tamb = -34 °C to +70 °C
V ≤ 42.4V, I ≤ 23 mA (HART®)
V ≤ 32V, I ≤ 22 mA (Fieldbus)

Specific Conditions of Use (X):

1. The Model 5408 Level Transmitter will not pass the 500Vrms dielectric strength test. This must be taken into account during installation.
2. Cable entries must be used which maintain the ingress protection of the enclosure to at least IP65.
3. The applicable temperature class, ambient temperature range and process temperature range of the equipment is as follows;

Temperature class / Maximum surface temperature	Ambient temperature range	Process temperature range
T2	-34 °C ≤ Ta ≤ 70 °C	-34 °C to 250 °C
T3	-34 °C ≤ Ta ≤ 70 °C	-34 °C to 195 °C
T4	-34 °C ≤ Ta ≤ 70 °C	-34 °C to 130 °C

Japan

E4 Flameproof

Certificate CML 17JPN1206X

Markings Ex d IIC T6…T2 Ga/Gb
Tamb = -40 °C to +70 °C

Specific Conditions of Use (X):

1. See certificate.

ID FISCO

Certificate	CML 17JPN1206X
Markings	Ex ia IIC T4…T2 Ga Ex ib IIC T4…T2 Ga/Gb Ex ia IIIC T85°C…T250°C Da -55 °C ≤ Ta ≤ +70 °C

Safety parameter	FISCO
Voltage U_i	17.5 V
Current I_i	380 mA
Power P_i	5.32 W
Capacitance C_i	1.1 nF
Inductance L_i	0

Specific Conditions of Use (X):

See certificate.

India

Intrinsic Safety

Certificate	PESO P403812
Markings	Ex ia IIC T4…T2 Ga

Flameproof Safety

Certificate	PESO P403810
Markings	Ex db IIC T6…T2 Ga/Gb

Intrinsic Safety and Flameproof

Certificate	PESO P402545, PESO P452909/2, PESO P452909/3
Markings	Ex ia IIC T4…T2 Ga Ex ib IIC T4…T2 Ga/Gb Ex db IIC T6…T2 Ga/Gb

Intrinsic Safety

Certificate	PESO P428401
Markings	Ex ia IIC T4…T2 Ga

Ex ib IIC T4…T2 Ga/Gb

Non-Sparking

Certificate	PESO P452909/1
Markings	Ex nA IIC T4…T2 Gc

Republic of Korea

EP Flameproof

Certificate	KTL 17- KAB4O-0652X, 18-KA4BO-0346X, 19-KA4BO-0169X, 19-KA4BO-0170X, 19-KA4BO-0726, 19-KA4BO-0727, 19-KA4BO-0728, 19-KA4BO-0732, 19-KA4BO-0733, 19-KA4BO-0734
Markings	Ex d IIC T6…T2 Ga/Gb Ex tb IIIC T85°C…T250°C Tamb = -60 °C to +70 °C

IP Intrinsic Safety

Certificate	KTL 17-KA4BO-0448X, 17-KA4BO-0654X, 18-KA4BO-0347X, 18-KA4BO-0345X, 19-KA4BO-0729, 19-KA4BO-0730, 19-KA4BO-0731, 19-KA4BO-0752, 19-KA4BO-0736, 19-KA4BO-0737
Markings	Ex ia IIC T4…T2 Ga Ex ib IIC T4…T2 Ga/Gb Tamb = -60 (-55) °C to +70 °C

Safety parameter	HART®	Fieldbus
Voltage U_i	30 V	30 V
Current I_i	133 mA	300 mA
Power P_i	1.0 W	1.5 W
Capacitance C_i	7.3 nF	1.1 nF
Inductance L_i	0	0

Specific Conditions of Use (X):

1. See certificate.

United Arab Emirates

Flame-proof

Certificate	20-11-28736/Q20-11-001012
Markings	Same as IECEx (E7)

Intrinsic Safety

Certificate	20-11-28736/Q20-11-001012
Markings	Same as IECEx (I7)

FISCO

Certificate	20-11-28736/Q20-11-001012
Markings	Same as IECEx (IG)

Type-N Non Sparking

Certificate	20-11-28736/Q20-11-001012
Markings	Same as IECEx (N7)

Additional certifications

SBS American Bureau of Shipping (ABS) Type Approval

Certificate	20-1981069-PDA
Intended Use	For use on ABS Classed Vessels and Offshore installations in accordance with ABS rules and International Standards.

Note
Housing material A, Aluminum, is not to be used on open decks.

SBV Bureau Veritas (BV) Type Approval

Certificate	52129/A1 BV
Requirements	Bureau Veritas Rules for the Classification of Steel Ships/Offshore Units. EC Code: 31/41SB for 5408 SST housing 31/41B for 5408 Aluminum housing
Application	Class Notations: AUT-UMS, AUT-CCS, AUT-PORT and AUT-IMS.

SDN Det Norske Veritas Germanischer Lloyd (DNV GL) Type Approval

Certificate	TAA0000230
Intended Use	DNV GL rules for classification – Ships, offshore units, and high speed and light craft.

Table 34: Application

Location classes	
Temperature	D
Humidity	B
Vibration	A
EMC	B
Enclosure	C(1)

(1) *Enclosure Class B for aluminum housing*

SLL Lloyd's Register (LR) Type Approval

Certificate LR2002529TA

Application Marine applications for use in environmental categories ENV1, ENV 2, ENV 3 and ENV 5(15) as defined in Lloyd's Register's Type Approval System, Test Specification Number 1, May 2018

SRS Russian Maritime Register of Shipping (RS) Type Approval

Certificate 21.10003.262

Rules Part XV of the Rules for the Classification and Construction of Sea-going Ships, 2020

Part XIV of the Rules for the Classification, Construction and Equipment of Mobile Offshore Drilling Units (MODU) and Fixed Offshore Platforms of (FOP), 2018

Part IV, section 12 of the Rules for Technical Supervision During Construction of ships and Manufacture of Materials and Products for Ships, 2020

Note
Housing material A, Aluminum, is not to be used on open decks.

QT Safety-certified to IEC 61508:2010 with certificate of FMEDA data

Certificate exida ROS 15-01-149 C001

Suitable for intended use

Compliant with NAMUR NE 95:2013, "Basic Principles of Homologation".

U1 Overfill prevention

Certificate Z-65.16-575

Application TÜV tested and approved by DIBt for overfill prevention according to the German WHG regulations.

(15) Only housing material "S" (stainless steel) is to be used on open decks.

Hygienic certificates and approvals

QA 3-A®

Certificate Authorization Number	3626

The following options are conforming to the 3-A Sanitary Standards, Number 74-07 (Sensors and Sensor Fittings and Connections):

Process connection type	C (Tri Clamp)
Process connection size	2, 3, 4
Antenna type	SAA (Process Seal antenna)
Antenna size	2, 3, 4

Other hygienic approvals

The process wetted components of the Process Seal Antenna (antenna type SAA) comply with:

- FDA 21 CFR 110, subpart C and FDA 21 CFR 177.1550
- EC 1935/2004 and EC 10/2011
- TSE/BSE Free
- USP<87>
- USP<88> Class VI

Instructions for hygienic installations

It is the responsibility of the user to ensure that:

1. The materials listed in Table 35 and Table 36 are suitable for the media and cleaning/sanitizing processes.
2. The installation of the transmitter is drainable and cleanable.
3. The joint/clamping between the transmitter and the nozzle is compatible with the tank pressure and media.
4. For the application suitable cable entry devices are used and with appropriate ingress protection.
5. Any unused cable entries are sealed with suitable plugs to maintain the ingress protection ratings.
6. The product contact surfaces are not scratched.
7. The 3-A specific nozzle height limits are kept to ensure cleanability.

Related information

Nozzle requirements

Materials of construction

The hygienic approvals and certificates of the transmitter rely upon the following materials used in its construction:

Table 35: Product Contact Surfaces

Item	Material
Microwave launcher	PTFE fluoropolymer

Table 36: Nonproduct Contact Surfaces

Item	Material
Metal housing	Stainless steel 300 series or aluminium 360, painted with epoxy-polyester or polyurethane
Fasteners and plugs	Stainless steel 300 series
Seals	Nitrile rubber NBR, Ethylene propylene peroxide and FKM fluoroelastomer
Labels	Stainless steel 300 series, metallized polyester, polyester/polycarbonate

Clean-In-Place (CIP)

Withstands cleaning routines up to 194 °F (90 °C)

Steam-In-Place (SIP)

Withstands cleaning routines up to 284 °F (140 °C)

Pattern approval

Belarus Pattern Approval

Certificate No. 12954

Kazakhstan Pattern Approval

Certificate KazInMetr No. 15466

Russia Pattern Approval

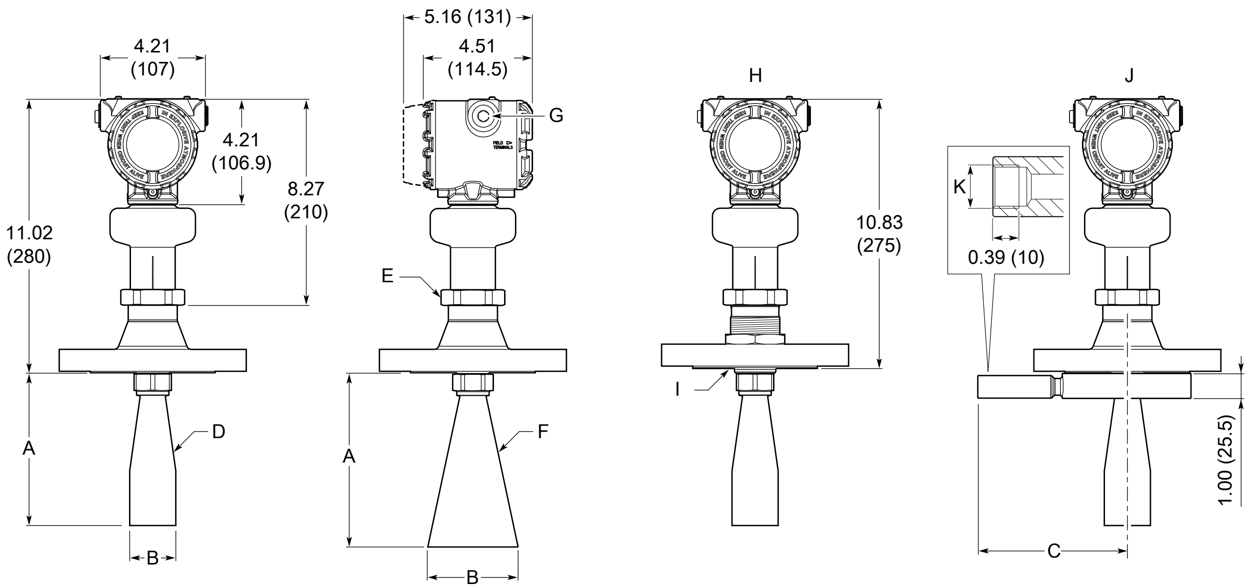
Certificate VNIIMS No. SE.C.29.004.A No 70968

Uzbekistan Pattern Approval

Certificate No. 02.7102

Dimensional drawings

Figure 26: Cone Antenna with Flanged Process Connection



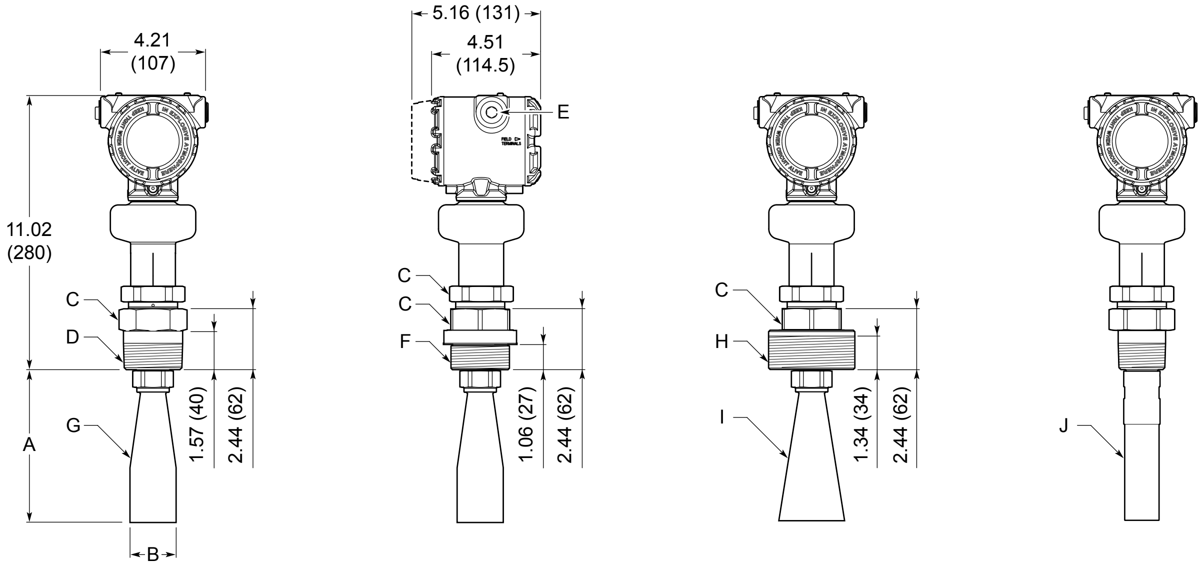
A. See Table 37 for dimensions.
B. See Table 37 for dimensions.
C. See Table 37 for dimensions.
D. 2-in. (DN50) cone style
E. s60
F. 3-in. (DN80) and 4-in. (DN100) cone style
G. ½-14 NPT, M20 x 1.5, or G½; optional adapters: eurofast® and minifast®
H. Protective plate design
I. Protective plate
J. Purging connector (option code PC1)
K. G⅜-in.

Dimensions are in inches (millimeters).

Table 37: Cone Antenna Dimensions

Cone size	A	B	C
1½-in. (DN40)	5.98 in. (152 mm)	1.38 in. (35 mm)	N/A
2-in. (DN50)	6.10 in. (155 mm)	1.85 in. (47 mm)	5.39 in. (137 mm)
3-in. (DN80)	6.02 in. (153 mm)	2.64 in. (67 mm)	6.77 in. (172 mm)
4-in. (DN100)	6.93 in. (176 mm)	3.62 in. (92 mm)	7.80 in. (198 mm)

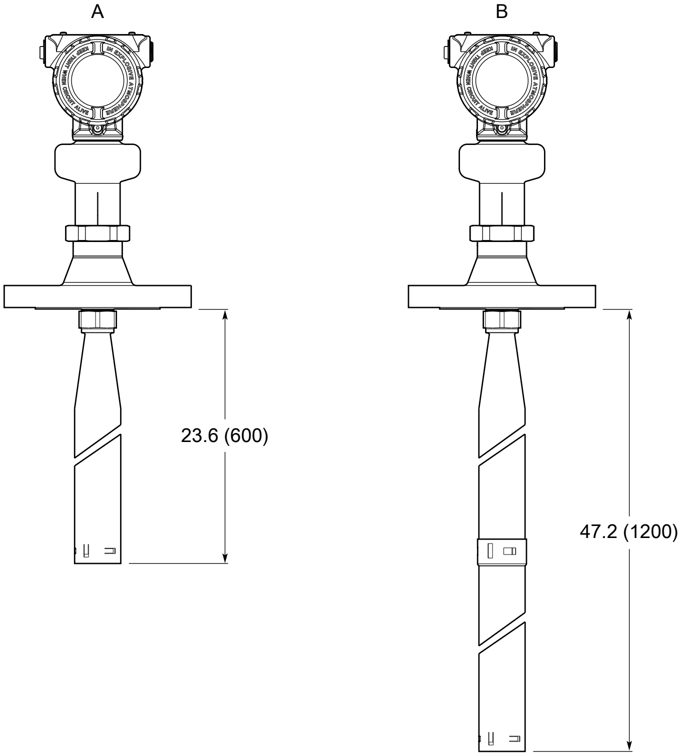
Figure 27: Cone Antenna with Threaded Process Connection



A. See Table 37 for dimensions.
B. See Table 37 for dimensions.
C. s60
D. NPT 1½-, 2-, 3-, 4-in.
E. ½-14 NPT, M20 x 1.5, or G½; optional adapters: eurofast and minifast
F. BSPP (G) 1½-, 2-in.
G. 2-in. (DN50) cone style
H. BSPP (G) 3-, 4-in.
I. 3-in. (DN80) and 4-in. (DN100) cone style
J. 1½-in. (DN40) cone style

Dimensions are in inches (millimeters).

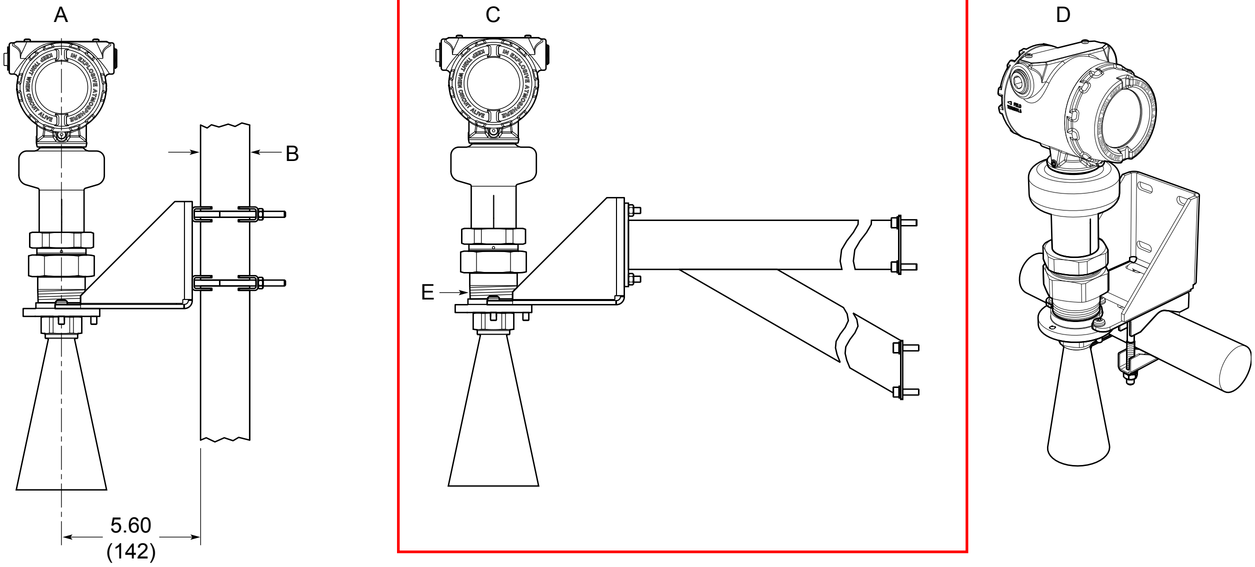
Figure 28: Extended Cone Antenna



A. Option code S1
B. Option code S2

Dimensions are in inches (millimeters).

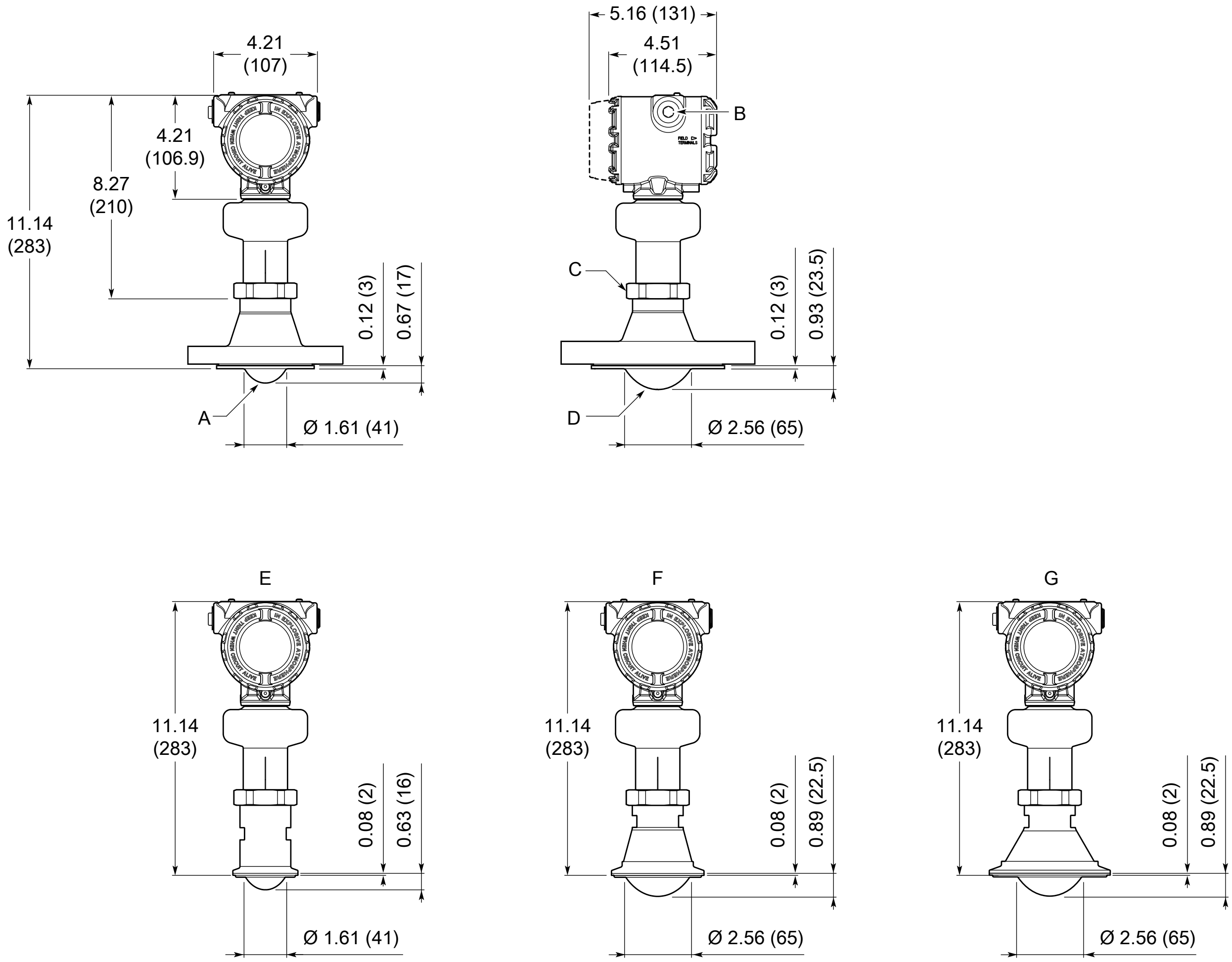
Figure 29: Cone Antenna with Bracket Mounting



A. *Pipe mounting (vertical pipe)*
B. *Pipe diameter, max 2.52 in. (64 mm)*
C. *Wall mounting (see Figure 34 for hole pattern)*
D. *Pipe mounting (horizontal pipe)*
E. *NPT 1½-in.*

Dimensions are in inches (millimeters).

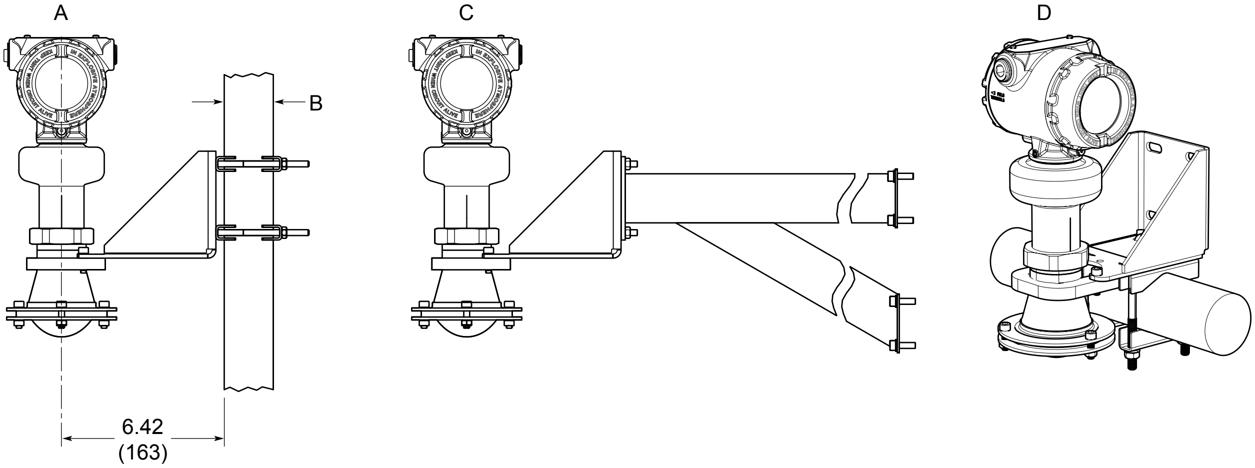
Figure 30: Process Seal Antenna



A. *2-in. (DN50) process seal style*
B. *½-14 NPT, M20 x 1.5, or G½; optional adapters: eurofast and minifast*
C. *s60*
D. *3-in. (DN80) and 4-in. (DN100) process seal style*
E. *2-in. Tri Clamp*
F. *3-in. Tri Clamp*
G. *4-in. Tri Clamp*

Dimensions are in inches (millimeters).

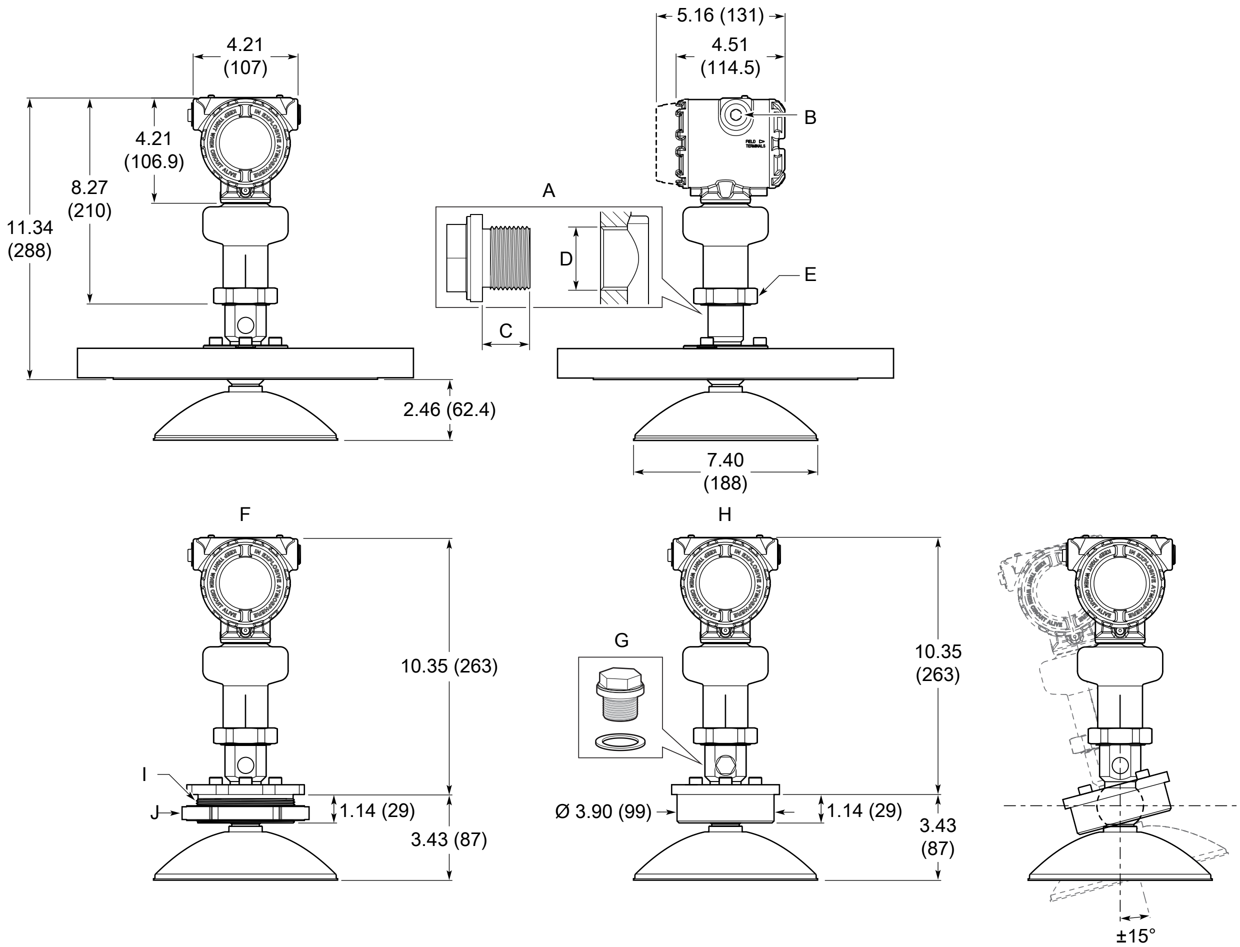
Figure 31: Process Seal Antenna with Bracket Mounting



A. *Pipe mounting (vertical pipe)*
B. *Pipe diameter, max 2.52 in. (64 mm)*
C. *Wall mounting (see Figure 34 for hole pattern)*
D. *Pipe mounting (horizontal pipe)*

Dimensions are in inches (millimeters).

Figure 32: Parabolic Antenna

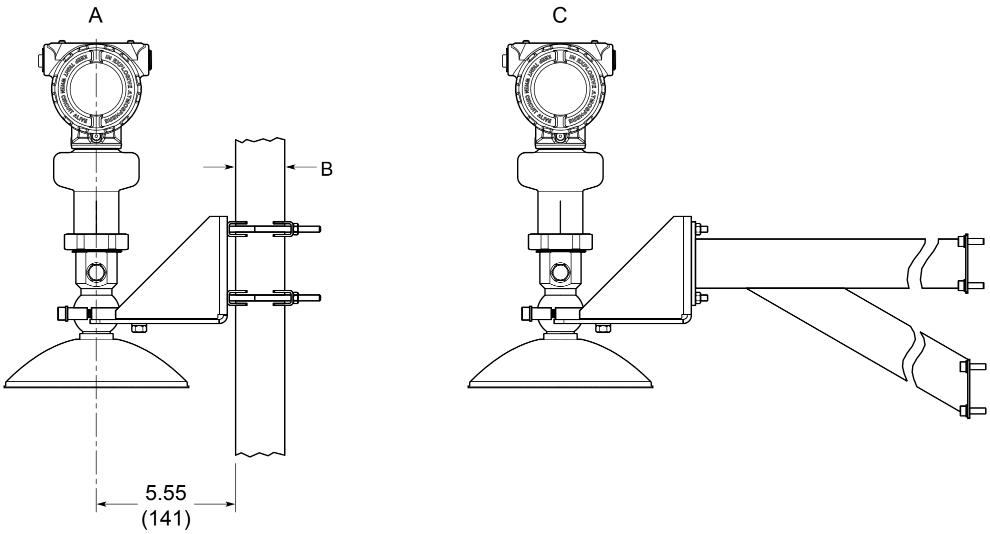


- A. *Purging connector*
- B. *½-14 NPT, M20 x 1.5, or G½; optional adapters: eurofast and minifast*
- C. *0.3-0.4 (8-10) (gasket excluded)*
- D. *G⅜-in.*
- E. *s60*
- F. *Threaded connection*
- G. *Purge plug kit (supplied)*
- H. *Welded connection*
- I. *BSPP (G) 3½-in.*
- J. *Lock nut (supplied)*(1)

1. Maximum flange thickness (with lock nut): 0.59 in. (15 mm)

Dimensions are in inches (millimeters).

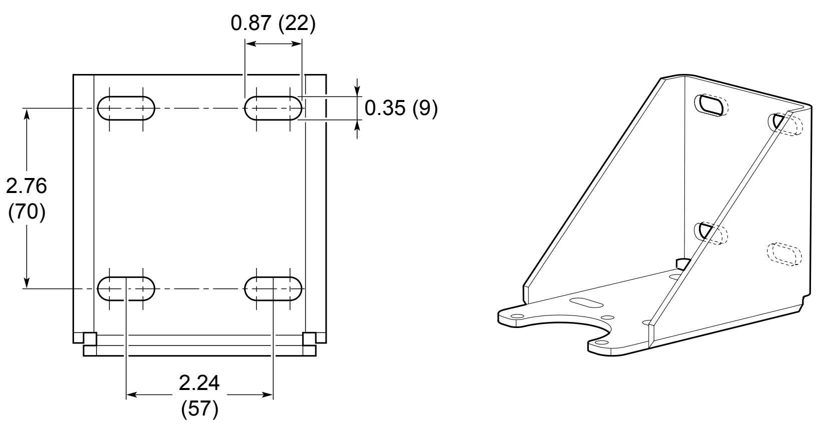
Figure 33: Parabolic Antenna with Bracket Mounting



A. *Pipe mounting (vertical pipe)*
B. *Pipe diameter, max 2.52 in. (64 mm)*
C. *Wall mounting (see Figure 34 for hole pattern)*

Dimensions are in inches (millimeters).

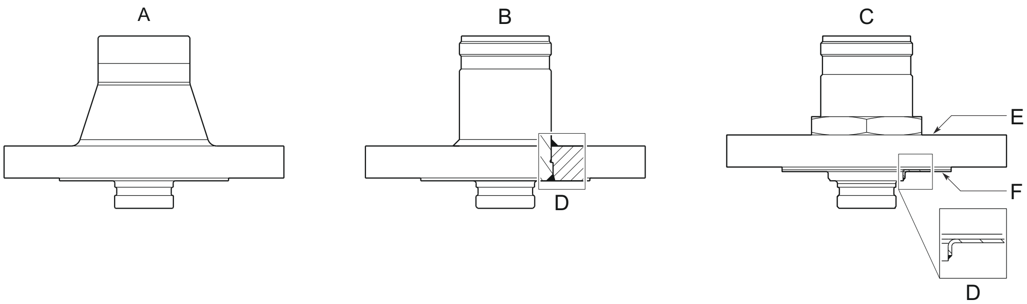
Figure 34: Hole Pattern for Wall Mounting



Dimensions are in inches (millimeters).

Standard flanges

Figure 35: Cone Antenna Flange Connection



- *A. Forged one-piece*
- *B. Welded construction*
- *C. Protective plate design*
- *D. Weld*
- *E. Backing flange*
- *F. Protective plate*

Table 38: Standard Flanges for Cone Antenna

Standard	Face type (1)	Face surface finish, R_a
ASME B16.5	Raised face	125-250 µin
	Ring type joint	< 63 µin
EN 1092-1	Type B1 raised face	3.2-12.5 µm
	Type A flat face	3.2-12.5 µm
JIS B2220	Raised face	3.2-6.3 µm

(1) *Face gasket surface is serrated per mating standard.*

Table 39: Cone Antennas with Protective Plate

Standard	Face type including protective plate	Plate surface finish, R_a
ASME B16.5	Raised face	3.2-6.3 µm
EN 1092-1	Raised face	3.2-6.3 µm
JIS B2220	Raised face	3.2-6.3 µm

Figure 36: Parabolic Antenna Flange Connection

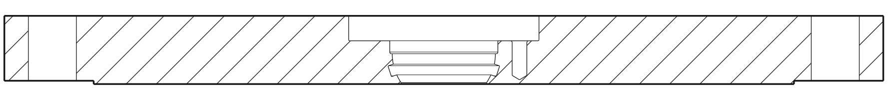


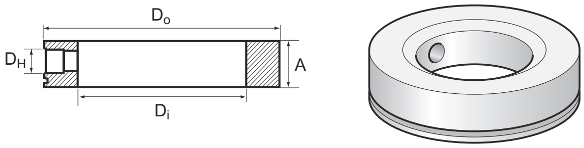
Table 40: Standard Flanges for Parabolic Antenna

Standard	Face type (1)	Face surface finish
ASME B16.5	Raised face	125-250 µin
EN 1092-1	Type A flat face	3.2-12.5 µm
JIS B2220	Raised face	3.2-12.5 µm

(1) *Face gasket surface is serrated per mating standard.*

Flushing connection rings

Figure 37: Flushing Connection Rings



A. Height: 0.97 in. (24.6 mm)

Table 41: Dimensions of Flushing Connection Rings

Flushing connection rings	D_i	D_o	D_H
2-in. ANSI	2.12 (53.8)	3.62 (91.9)	¼-in. NPT
3-in. ANSI	3.60 (91.4)	5.00 (127.0)	¼-in. NPT
4-in. ANSI/DN100	3.60 (91.4)	6.20 (157.5)	¼-in. NPT
DN50	2.40 (61.0)	4.00 (102.0)	¼-in. NPT
DN80	~~3.60 (91.4)~~	~~5.43 (1~~38.0)	¼-in. NPT

Reference Manual
00809-0100-4408, Rev BB
April 2018

Rosemount™ 5408 and 5408:SIS Level Transmitters

Non-Contacting Radar

HART COMMUNICATION PROTOCOL

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.

For technical assistance, contacts are listed below:

Customer Central

Technical support, quoting, and order-related questions.

- United States - 1-800-999-9307 (7:00 am to 7:00 pm CST)
- Asia Pacific- 65 777 8211

North American Response Center

Equipment service needs.

- 1-800-654-7768 (24 hours a day — includes Canada)
- Outside of these areas, contact your local Emerson representative.

⚠ WARNING!

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

- **Make sure the transmitter is installed by qualified personnel and in accordance with applicable code of practice.**
- **Use the equipment only as specified in this manual. 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 and 5408:SIS *Product Certifications* document and System Control Drawing (D7000002-885).**

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 Field 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 and Non-Incendive/Type n 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.

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

Process leaks could result in death or serious injury.

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

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

- **Unauthorized changes to the product are strictly prohibited as they may unintentionally and unpredictably alter performance and jeopardize safety. Unauthorized changes that interfere with the integrity of the welds or flanges, such as making additional perforations, compromise product integrity and safety. Equipment ratings and certifications are no longer valid on any products that have been damaged or modified without the prior written permission of Emerson. Any continued use of product that has been damaged or modified without the written authorization is at the customer's sole risk and expense.**

CAUTION!

Hot surfaces

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

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.

Contents

Appendices and reference

1 Introduction

1.1 Using this manual

The sections in this manual provide information on installing, operating, and maintaining the Rosemount™ 5408 and 5408:SIS Level Transmitters – Non-Contacting Radar.

The sections are organized as follows:

Chapter 2 provides an introduction to theory of operation, a description of the transmitter, information on typical applications, and process characteristics.

Chapter 3 contains mechanical installation instructions.

Chapter 4 contains electrical installation instructions.

Chapter 5 provides instructions on configuration of the transmitter.

Chapter 6 contains operation and maintenance techniques.

Chapter 7 provides troubleshooting techniques for the most common operating problems.

Chapter 8 contains identification, commissioning, maintenance, and operations information for safety-certified transmitter used in Safety Instrumented Systems (SIS) applications.

Appendix A supplies reference and specification data, as well as ordering information.

Appendix B contains safety approval information and approval drawings.

Appendix C provides extended information about the configuration parameters.

1.2 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 Transmitter Overview

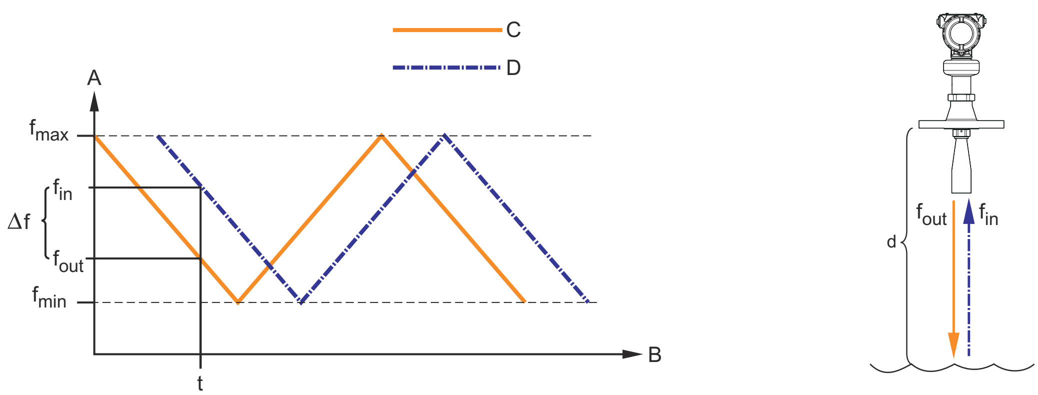
2.1 Measurement principle

The Rosemount™ 5408 and 5408:SIS are two-wire transmitters for continuous level measurements over a broad range of liquids, slurries, and solids. The measurement principle is fast-sweep Frequency Modulated Continuous Wave (FMCW).

The transmitter continuously emits signal sweeps with a constantly varying frequency towards the product surface. Since the transmitter continuously changes the frequency of the transmitted signal, there will be a difference in frequency between the transmitted and the reflected signals (see *Figure 2-1*).

The frequency of the reflected signal is subtracted from the frequency of the signal transmitted at that moment, resulting in a low frequency signal which is proportional to the distance to the product surface. This signal is further processed to obtain fast, reliable, and highly accurate level measurements. See *Figure 2-2* for a schematic overview of the signal processing.

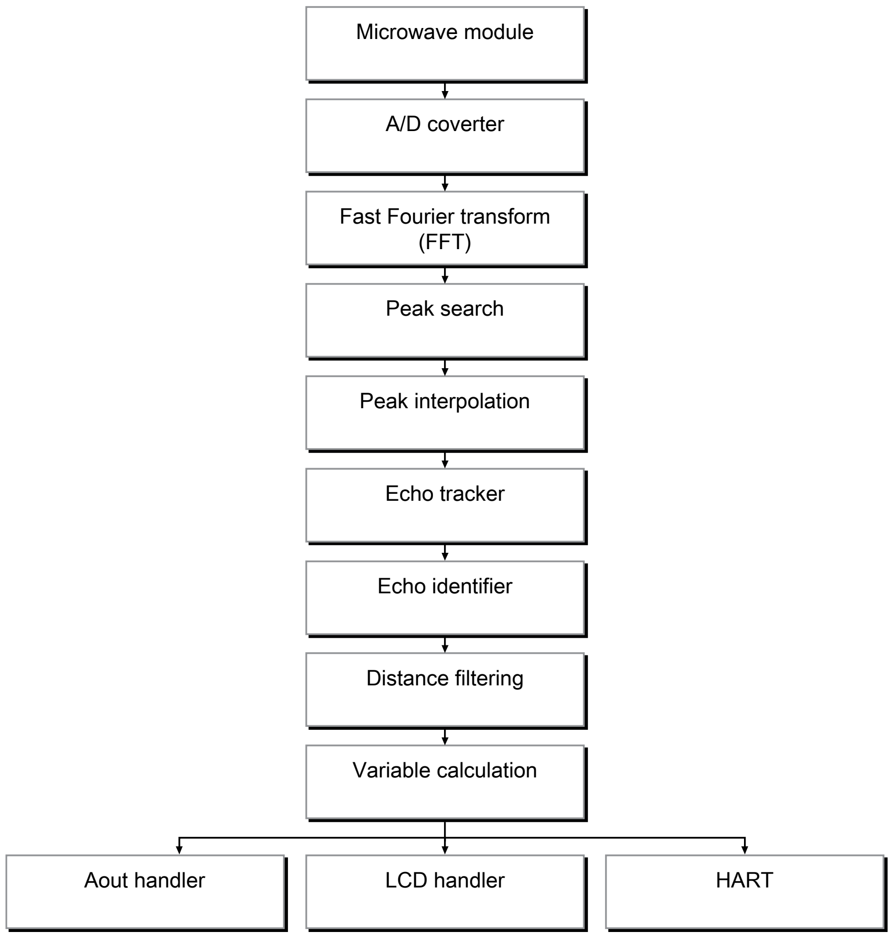
Figure 2-1: FMCW-method



Δf≈d=distance

A. *Frequency (GHz)*
B. *Time (s)*
C. *Transmitted signal*
D. *Reflected signal*

Figure 2-2: Flowchart of the Signal Processing



2.2 Process characteristics

2.2.1 Dielectric constant

A key parameter for measurement performance is reflectivity. A high dielectric constant of the media provides better reflection and enables a longer measuring range.

2.2.2 Foam and turbulence

Foaming liquids or turbulence may cause weak and varying surface echo amplitudes. The effects of turbulence are usually minor, but in the most challenging conditions, the transmitter may be mounted in a still pipe. In addition, measurement performance can be optimized by configuring the appropriate process conditions settings, see *Process conditions*.

Measurement in foamy applications depends largely on the foam properties. When the foam is light and airy, the actual product level is measured. For heavy and dense foam, the transmitter may measure the level of the foam's upper surface. The Double Surface Handling function allows the user to select if the foam layer or product surface should be used as output (see *Double surface handling*).

2.2.3 Dust

Dust is often present in solids applications, and even if the non-contacting radar is not affected by the dust in the vapor space, dust can be sticky and create a layer on the antenna. If this layer becomes too thick, it may affect the measurement. This is best managed by using air purging.

2.2.4 Solid surface

Solids have some common characteristics which may cause weak and varying surface reflections. The surface is rarely flat or horizontal, the angle of the sloping surface differs during filling and emptying, and the dielectric constant of many solids is fairly low.*Table 2-1* presents common characteristics of some solids applications.

The parabolic antenna is ideal for applications with weak surface reflections. A larger diameter concentrates the radar beam and ensures maximum antenna gain. The parabolic antenna comes with a swivel connection that adjusts for angled tank roofs.

Table 2-1: Common Characteristics of Solids Applications

	Common characteristics				
	Particle size			**Vapor space**	
Applications	**Dust or powder**	**Small (<1 in.)**	**Larger (>1 in.)**	**Dust**	**Steam or condensation**
Wood chip bins	Yes	Yes	Yes	Yes	Possible
Grain silo - small kernel grains	Yes	Yes	No	Yes	No
Grain silo - large kernel grains	No	Yes	No	No	No
Lime stone silo	No	Yes	Yes	Possible	No
Cement - raw mill silo	Yes	Yes	No	Yes	No
Cement - finished product silo	Yes	Yes	No	Yes	No
Coal bin	Yes	Yes	Yes	Yes	Yes
Saw dust	Yes	Yes	No	Yes	No
High consistency - pulp stock	No	No	No	No	Yes
Alumina	Yes	Yes	No	Yes	No
Salt	No	Yes	Yes	No	No

2.3 Vessel characteristics

2.3.1 In-tank obstructions

The transmitter should be mounted so that objects such as heating coils, ladders, and agitators are not in the radar signal path. These objects may cause false echoes resulting in reduced measurement performance. However, the transmitter has built-in functions designed to reduce the influence from disturbing objects where such objects cannot be totally avoided.

Vertical and inclined structures cause minimal effect since the radar signal is scattered rather than directed back to the antenna.

2.3.2 Tank shape

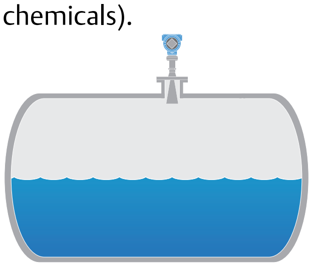
The shape of the tank bottom affects the measurement signal when the product surface is close to the tank bottom. The transmitter has built-in functions which optimize measurement performance for various bottom shapes.

2.4 Application examples

The Rosemount 5408 and 5408:SIS are ideal for level measurements over a broad range of liquid and solids applications. The transmitters are virtually unaffected by changing density, temperature, pressure, media dielectric, pH, and viscosity. Non-contacting radar level is ideal for harsh conditions such as corrosive and sticky media, or when internal tank obstructions are a limiting factor.

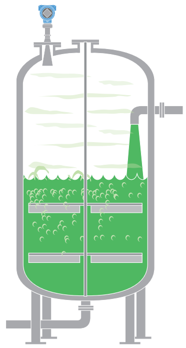
Storage and buffer tanks

The Rosemount 5408 provides accurate and reliable level measurement for both metallic or non-metallic vessels containing almost any liquid (e.g. oil, gas condensate, water, chemicals).



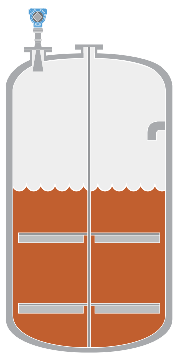
Reactors

The Rosemount 5408 is ideal for the most challenging applications, including reactors where there can be agitation, foaming, condensation as well as high temperatures and pressures.



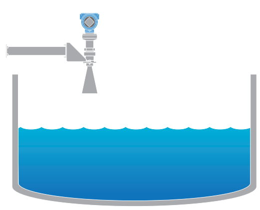
Blenders and mixers

The Rosemount 5408 can help you withstand the rigors of blenders and mixing tanks. Easy to install and commission, it is also unaffected by virtually any fluid property change.



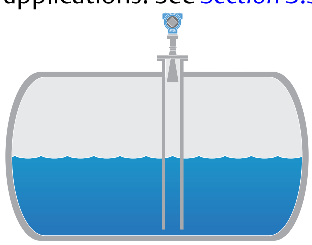
Open atmospheric applications

The Rosemount 5408 measures reliably in open applications, from short range sumps or ponds to long range dams.



Still pipe and chamber installations

The Rosemount 5408 is an excellent choice for level measurement in tanks with still pipes. It may also be used in chambers, but guided wave radar is generally the best fit for these applications. See *Section 3.3.8* for installation guidelines.

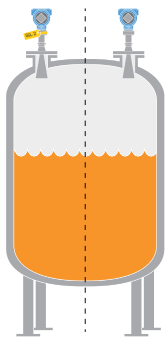


Bulk solids

The Rosemount 5408 is the ideal solution for small to medium sized silos with rapid level changes. The narrow beam avoids internal obstructions while still keeping good level measurement.

Safety applications

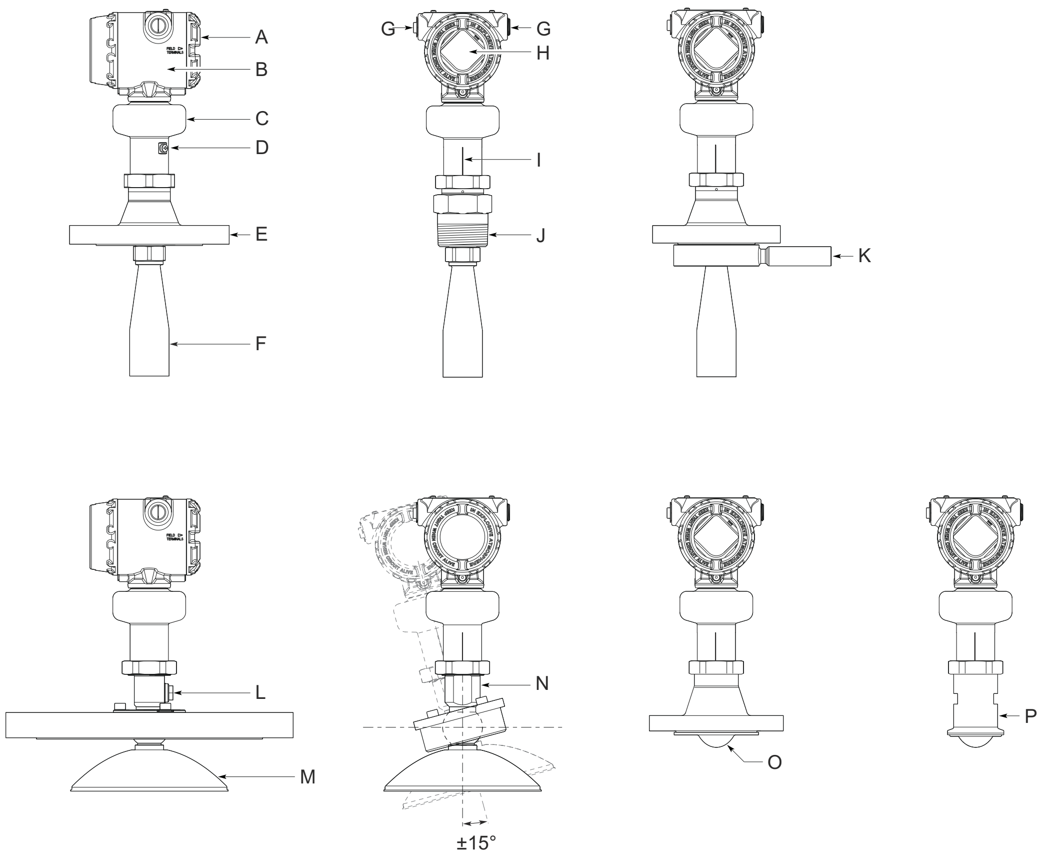
The Rosemount 5408:SIS is the ideal choice for safety functions such as overfill prevention, level deviation monitoring or dry-run prevention.



2.5 Components of the transmitter

Figure 2-3 shows the different components of the transmitter. There are different antenna types and sizes available for various applications.

Figure 2-3: Components



A.	*Terminal compartment*	I.	*Alignment marker (one per side)*
B.	*Transmitter housing (aluminum or stainless steel)*	J.	*Threaded process connection (NPT or BSPP (G))*
C.	*Sensor module with signal processing electronics*	K.	*Air purge ring (option code PC1 for cone antenna)*
D.	*External ground screw*	L.	*Integrated air purge connection*
E.	*Flanged process connection*	M.	*Parabolic antenna*
F.	*Cone antenna*	N.	*Parabolic antenna with swivel mount*
G.	*Two cable/conduit entries (½-14 NPT, M20 x 1.5, or G½)* *Optional adapters: eurofast™ and minifast™*	O.	*Process seal antenna*
H.	*LCD display (optional)*	P.	*Tri-Clamp process connection*

2.6 System integration

The transmitter is loop-powered, and uses the same two wires for power supply and output signal. The output is a 4-20 mA analog signal superimposed with a digital HART signal. The transmitter can be configured for either HART Revision 6 (default) or 7 (option code HR7). The HART Revision can be switched in field.

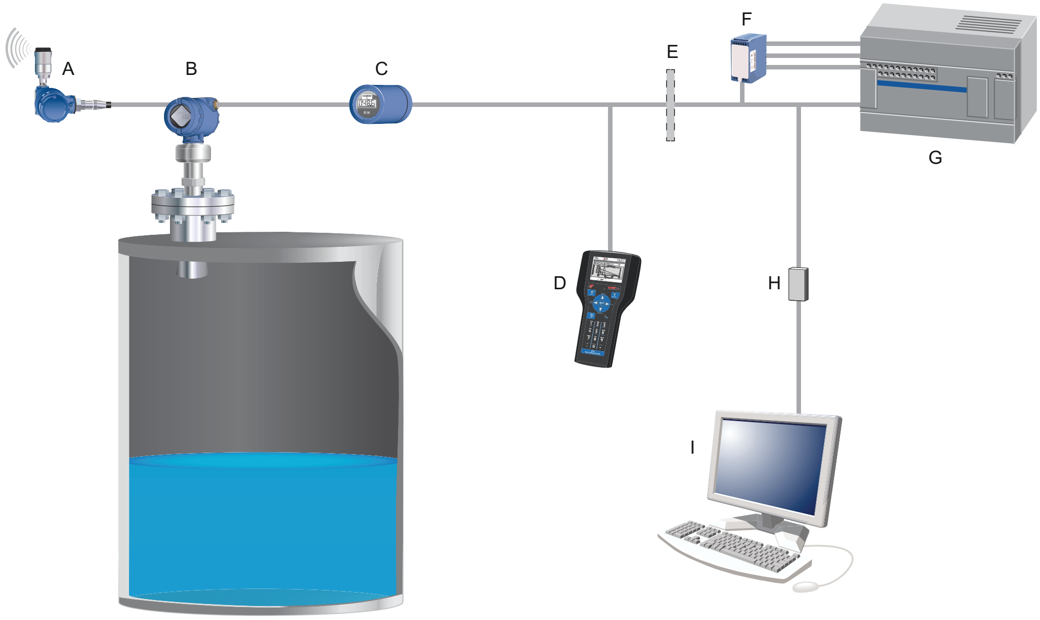
By using the optional Rosemount 333 HART Tri-Loop™, the digital HART signal can be converted into three additional 4-20 mA analog signals. With the HART protocol, multidrop configuration is possible. In this case, communication is restricted to digital, since current is fixed to the 4 mA minimum value.

The transmitter can be combined with the Emerson™ Wireless 775 THUM™ Adapter to wirelessly communicate HART data with IEC 62591 (*Wireless*HART®) technology. In addition, the transmitter can be connected to a Rosemount 751 Field Signal Indicator, or it can be equipped with an LCD display.

The transmitter can easily be configured by using a PC with the Rosemount Radar Master Plus software (running in the Instrument Inspector™ Application), a Field Communicator, the AMS Device Manager, or any other Device Descriptor (DD) or Field Device Integration (FDI) compatible host system.

The Rosemount 5408 and 5408:SIS are compliant with NAMUR NE 107 Field Diagnostics for standardized device diagnostic information.

Figure 2-4: System Architecture



A. *Emerson Wireless 775 THUM Adapter*
B. *Rosemount 5408*
C. *Rosemount 751*
D. *Field Communicator*
E. *Approved IS barrier (for Intrinsically Safe installations only)*
F. *Rosemount 333*
G. *Host/DCS system*
H. *HART modem*
I. *Rosemount Radar Master Plus or AMS Device Manager*

3 Mechanical 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 safe installation and servicing guidelines could result in death or serious injury.

- **Make sure the transmitter is installed by qualified personnel and in accordance with applicable code of practice.**
- **Use the equipment only as specified in this manual. 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 and 5408:SIS *Product Certifications* document and System Control Drawing (D7000002-885).**

Process leaks could result in death or serious injury.

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

Explosions could result in death or serious injury.

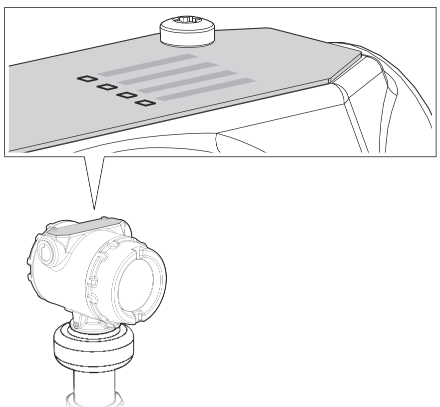
- **Verify that the operating atmosphere of the transmitter is consistent with the appropriate hazardous locations certifications.**

3.2 Confirm approval type

For hazardous locations transmitters labeled with multiple approval types:

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

Figure 3-1: Label with Multiple Approval Types



3.3 Installation considerations

Before installing the transmitter, follow recommendations for mounting position, sufficient free space, nozzle requirements, etc.

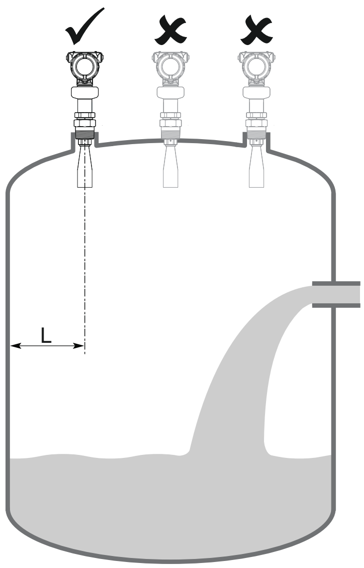
3.3.1 Mounting position

When finding an appropriate location on the tank for the transmitter, the conditions of the tank must be carefully considered.

Consider the following guidelines when mounting the transmitter:

- For optimal performance, the transmitter should be installed in locations with a clear and unobstructed view of the product surface.
- The transmitter should be mounted with as few internal structures as possible within the signal beam, see *Section 3.3.6*.
- Do not install the transmitter in the center of the tank.
- Do not mount close to or above the inlet stream.
- Multiple Rosemount 5408 and 5408:SIS Level Transmitters can be used in the same tank without interfering with each other.

Figure 3-2: Recommended Mounting Position



3.3.2 Free space requirements

If the transmitter is mounted close to a wall or other tank obstructions such as heating coils and ladders, noise might appear in the measurement signal. Therefore the following minimum clearance, according to *Table 3-1*, must be maintained.

For easy access to the transmitter, mount it with sufficient service space (see *Table 3-2*).

Figure 3-3: Free Space Requirements

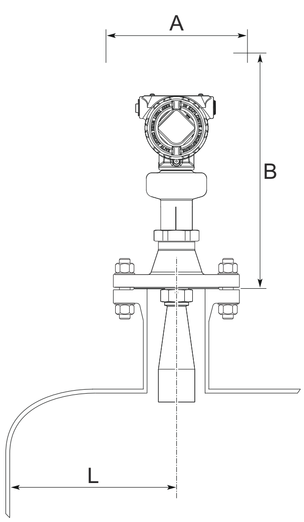


Table 3-1: Distance to Tank Wall (L)

Application	Minimum	Recommended
Liquids	8 in. (200 mm)	½ of tank radius
Solids	8 in. (200 mm)	⅔ of tank radius

Table 3-2: Free Space Requirements

Description	Distance
Service space width (A)	20 in. (500 mm)
Service space height (B)	24 in. (600 mm)

3.3.3 Antenna size

Choose as large antenna diameter as possible. A larger antenna diameter concentrates the radar beam and ensures maximum antenna gain. Increased antenna gain permits greater margin for weak surface echoes.

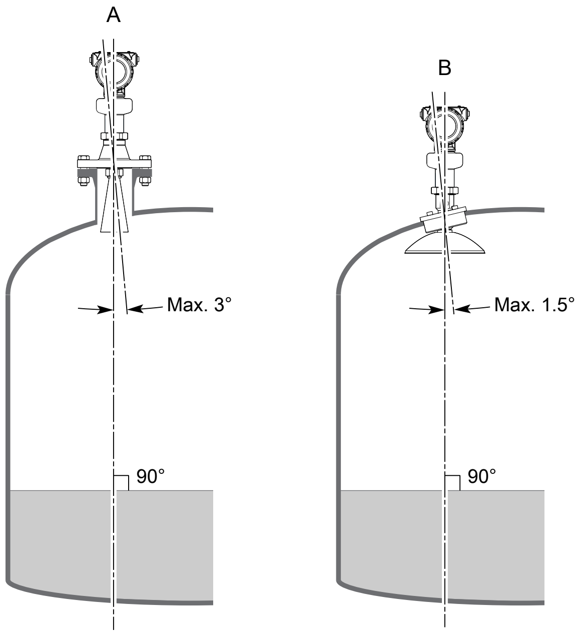
In addition, a larger antenna diameter results in a smaller beam angle and thereby, less interference from any internal structures in the tank.

3.3.4 Antenna inclination

Ensure the antenna is aligned perpendicular to the product surface (see *Figure 3-4*). The parabolic antenna comes with a swivel connection that adjusts for angled tank roofs.

Note that if the surface echo is weak in solids applications, then a small inclination of the parabolic antenna toward the surface slope may improve the performance.

Figure 3-4: Inclination



A. Cone antenna/process seal antenna
B. Parabolic antenna

3.3.5 Non-metallic tanks

The walls in non-metallic tanks can be invisible to the radar signal, so nearby objects outside the tank may cause disturbing radar echoes. Wherever possible, the transmitter should be positioned so that objects close to the tank are kept outside the signal beam.

3.3.6 Beam width and beam angle

The transmitter should be mounted with as few internal structures as possible within the signal beam. Refer to *Table 3-3* for beam angle and *Table 3-4* for beam width at different distances.

Figure 3-5: Beam Angle and Beam Width

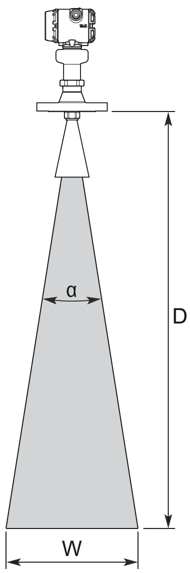


Table 3-3: Beam Angle

Antenna size	Beam angle (α)
2-in. (DN50) cone/process seal	18°
3-in. (DN80) cone/process seal	14°
4-in. (DN100) cone/process seal	10°
8-in. (DN200) parabolic	4.5°

Table 3-4: Beam Width, ft. (m)

	Beam width (W)			
Distance (D)	2-in. cone/ process seal	3-in. cone/ process seal	4-in. cone/ process seal	Parabolic
16 (5)	5.2 (1.6)	4.0 (1.2)	2.9 (0.9)	1.3 (0.4)
33 (10)	10.4 (3.2)	8.1 (2.5)	5.7 (1.8)	2.6 (0.8)
49 (15)	15.6 (4.8)	12.1 (3.7)	8.6 (2.6)	3.9 (1.2)
66 (20)	20.8 (6.3)	16.1 (4.9)	11.5 (3.5)	5.2 (1.6)
82 (25)	26.0 (7.9)	20.1 (6.1)	14.3 (4.4)	6.4 (2.0)
98 (30)	31.2 (9.5)	24.2 (7.4)	17.2 (5.3)	7.7 (2.4)
131 (40)	41.6 (12.7)	32.2 (9.8)	23.0 (7.0)	10.3 (3.1)

3.3.7 Nozzle requirements

In order to allow the microwaves to propagate undisturbed, the nozzle dimensions should be kept within the specified limits as given in *Table 3-5*, *Table 3-6*, and *Table 3-7*.

Nozzle requirements for cone antenna

For best performance, the cone antenna should extend at least 0.4 in. (10 mm) below the nozzle. If required, use the extended cone antenna versions (option code S1 or S2).

However, the antenna can be recessed in smooth nozzles up to 4 ft. (1.2 m). Note that if the inside of the nozzle has irregularities (e.g. due to bad welding, rust, or deposit), then use the extend cone antenna.

Figure 3-6: Mounting of the Cone Antenna

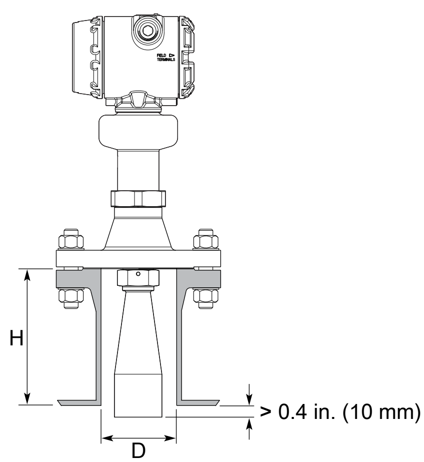


Table 3-5: Nozzle Requirements for Cone Antenna, in Inches (Millimeters)

Antenna size	Minimum nozzle diameter (D)(1)	Recommended maximum nozzle height (H)(2)(3)	
		Antenna	Antenna with air purge ring (code PC1)
2-in. (DN50)	1.94 (49.3)	5.71 (145)	4.69 (119)
3-in. (DN80)	2.80 (71.0)	5.63 (143)	4.61 (117)
4-in. (DN100)	3.78 (96.0)	6.54 (166)	5.51 (140)

(1) The antennas are sized to fit within schedule 80 or lower schedules.

(2) The values are valid for cone antennas without antenna extension.

(3) For liquid applications, the cone antenna can be recessed in smooth nozzles up to 4 ft. (1.2 m), but note that the accuracy may be reduced in the region close to the nozzle.

Nozzle requirements for process seal antenna

The antenna can be used on nozzles up to 4 ft. (1.2 m). Disturbing objects inside the nozzle may impact the measurement, and should therefore be avoided.

Figure 3-7: Mounting of the Process Seal Antenna

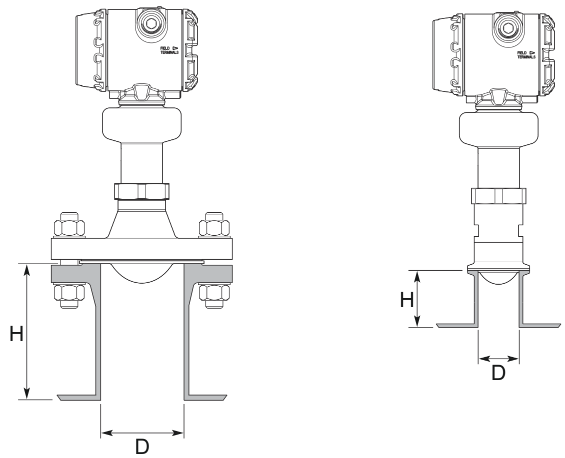


Table 3-6: Nozzle Requirements for Process Seal Antenna

Antenna size	Minimum nozzle diameter (D)(1)	Recommended maximum nozzle height (H)(2)
2-in. (DN50)	1.77 in. (45 mm)	4 ft. (1.2 m)
3-in. (DN80)	2.76 in. (70 mm)	4 ft. (1.2 m)
4-in. (DN100)	2.76 in. (70 mm)	4 ft. (1.2 m)

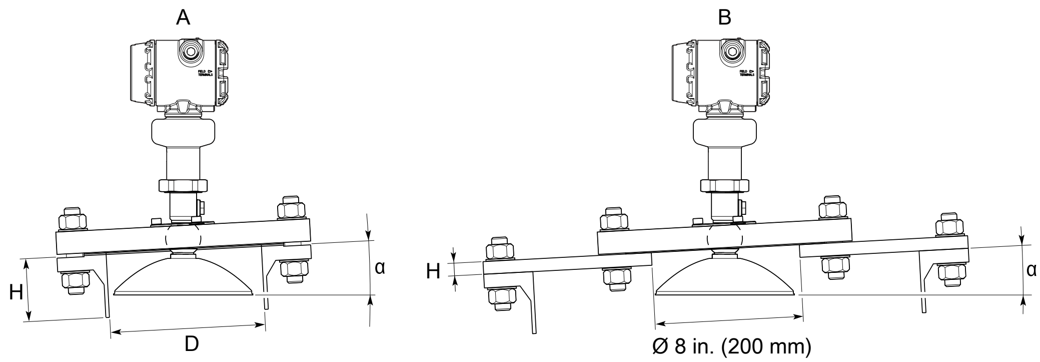
(1) The antennas are sized to fit within schedule 120 or lower schedules.

(2) For hygienic applications, the nozzle height (H) must not exceed 2 × nozzle diameter (D) to ensure cleanability. Maximum nozzle height is 5 in. (127 mm).

Nozzle requirements for parabolic antenna

See *Table 3-7* for nozzle height recommendations at different inclination angle.

Figure 3-8: Mounting of the Parabolic Antenna



A. Nozzle mounting
B. Flange mounting in manhole cover

Table 3-7: Nozzle Requirements for Parabolic Antenna, in Inches (Millimeters)

Nozzle size (D)	Inclination angle (α)	Maximum nozzle height (H)[1]
Pipe schedule std, Ø 8 in. (200 mm)	0°	5.9 (150)
	3°	5.5 (140)
	6°	1.6 (40)
	9°	1.2 (30)
	12°	1.0 (25)
	15°	0.6 (15)
Pipe schedule std, Ø10 in. (250 mm)	0°	8.0 (200)
	3°	8.0 (200)
	6°	8.0 (200)
	9°	8.0 (200)
	12°	5.9 (150)
	15°	4.3 (110)

(1) Note that the inside of the nozzle must be smooth (i.e. avoid bad welding, rust, or deposit).

3.3.8 Still pipe/chamber installations

Installation in still pipe/chamber is recommended for tanks where there are excessive foaming or turbulence. Still pipe/chamber may also be used to avoid disturbing objects in the tank.

Still pipe

Consider the following still pipe requirements:

Pipe

- Pipes should be an all-metal material.
- Pipe should have a constant inside diameter.
- The inner surface must be smooth and clear of any rough edges. (Smooth pipe joints are acceptable, but may reduce accuracy.)
- The end of the pipe must extend beyond the zero level.

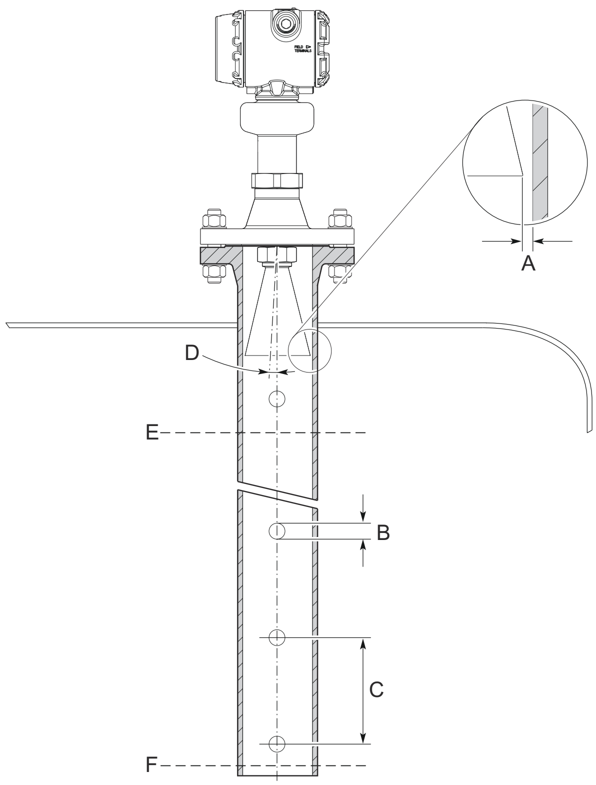
Holes

- Maximum hole diameter is 1 in. (25 mm).
- Minimum distance between holes is 6 in. (150 mm).
- Holes should be drilled on one side only and deburred.
- Drill one hole above maximum product surface.

Antenna

- All cone/process seal antenna sizes can be used for still pipe/chamber installations.
- The gap between the cone antenna and the still pipe should be maximum 0.2 in. (5 mm). If required, order a larger antenna and cut on location. See *Table A-19* for antenna dimensions.

Figure 3-9: Still Pipe Requirements



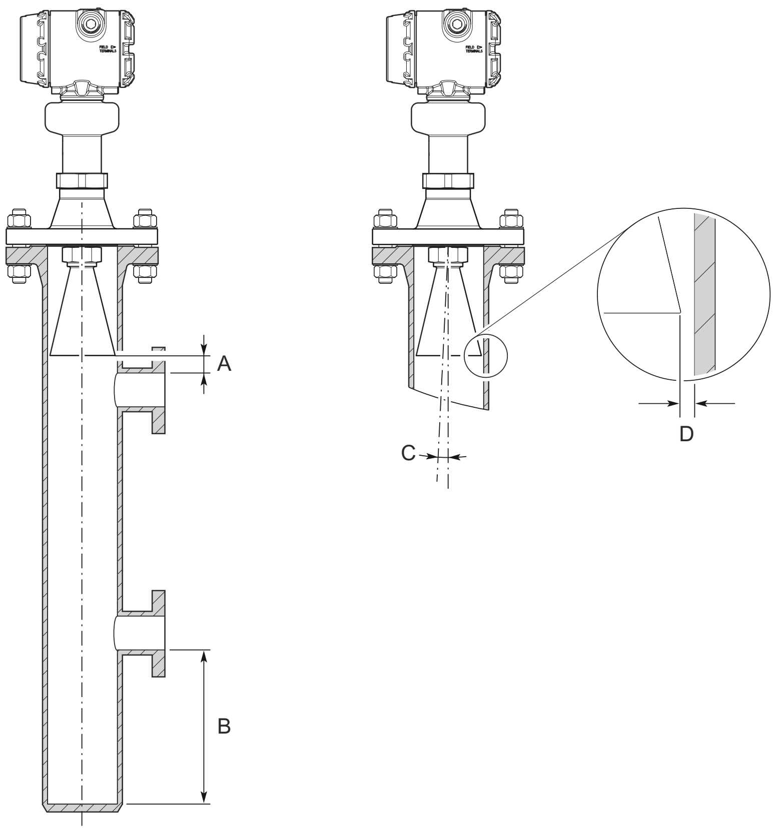
A. Max. 0.2 in. (5 mm)
B. Max. 1 in. (25 mm)
C. Min. 6 in. (150 mm)
D. Max. 1°
E. Level = 100%
F. Level = 0%

Chamber

Consider the following chamber requirements:

- Pipes should be an all-metal material.
- Pipe should have a constant inside diameter.
- Inlet pipes should not protrude into the inside of the stand pipe.
- The inner surface must be smooth and clear of any rough edges. (Smooth pipe joints are acceptable, but may reduce accuracy.)
- The gap between the cone antenna and the stand pipe should be maximum 0.2 in. (5 mm). If required, order a larger antenna and cut on location. See *Table A-19* for antenna dimensions.

Figure 3-10: Chamber Requirements



A. *Min. 0.4 in. (10 mm)*
B. *Min. 6 in. (150 mm)*
C. *Max. 1°*
D. *Max. 0.2 in. (5 mm)*

For more information and installation requirements, refer to the Guidelines for Choosing and Installing Radar in Stilling Wells and Bypass Chambers *Technical Note*.

3.3.9 Ball valve installation

The transmitter can be isolated from the process by using a valve:

- Use a full-port ball valve.
- Ensure there is no edge between the ball valve and the nozzle or still pipe, the inside should be smooth.
- Valves can be combined with still pipes.

3.4 Mounting preparations

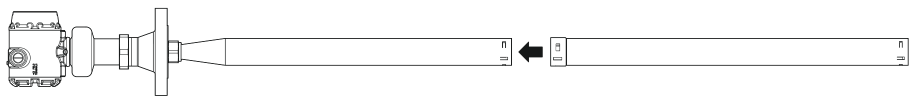
3.4.1 Assemble the segmented cone antenna

This section applies to the segmented cone antenna (option code S2). Use only one segment; the total antenna length should not exceed 47.2 in. (1200 mm).

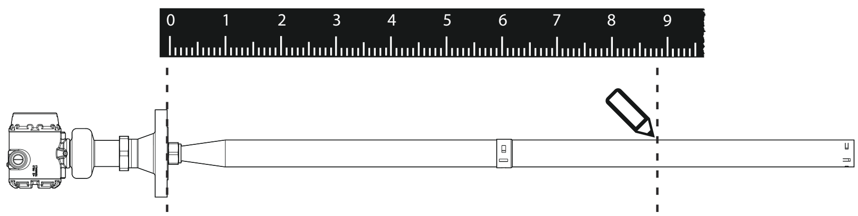
To determine the antenna length, follow the guidelines in section *Section 3.3.7*.

Procedure

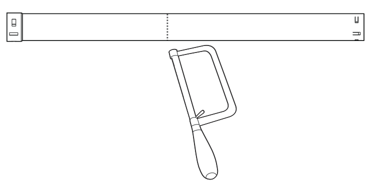
1. Insert the segment into the cone antenna until it bottoms.



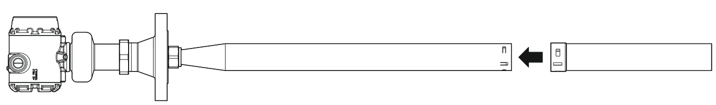
2. Mark where to cut the segment.



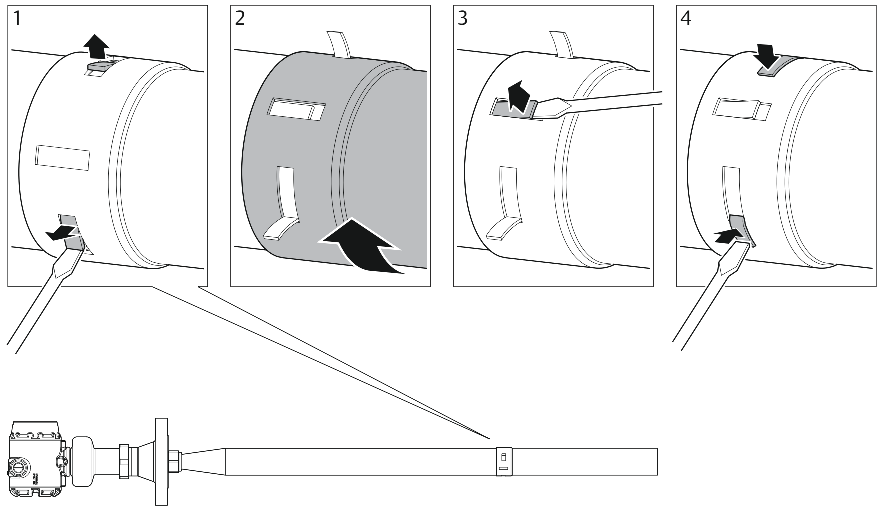
3. Remove and cut the segment at the marking.



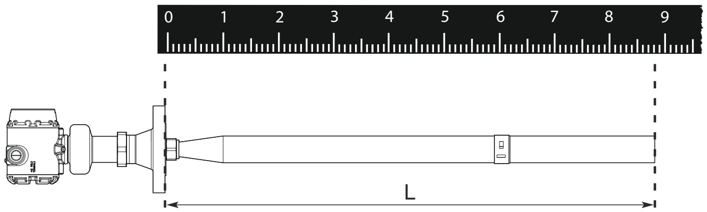
4. Remove any burrs.
5. Insert the segment into the cone antenna until it bottoms.



6. Secure the segment to the antenna.



7. Measure the Antenna Extension Length (L).



8. Update the transmitter configuration to the new Antenna Extension Length (L).
   - Rosemount Radar Master Plus:
     - Under *Configure*, select **Level Setup** > **Antenna**.
   - AMS Device Manager and Field Communicator:
     - Select **Configure** > **Manual Setup** > **Level Setup** > **Antenna**.

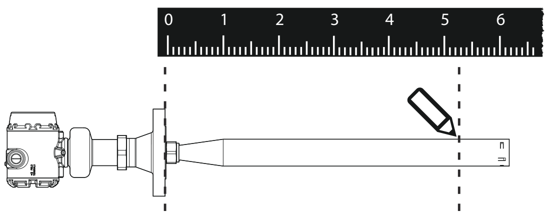
3.4.2 Shorten the extended cone antenna

This section only applies to the extended cone antenna (option code S1).

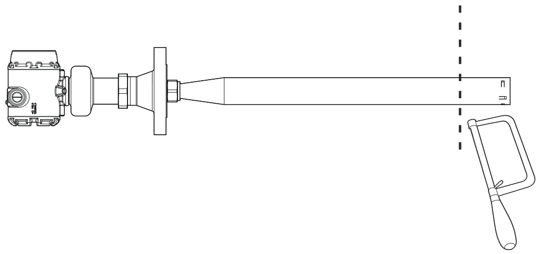
To determine the antenna length, follow the guidelines in section *Section 3.3.7*.

Procedure

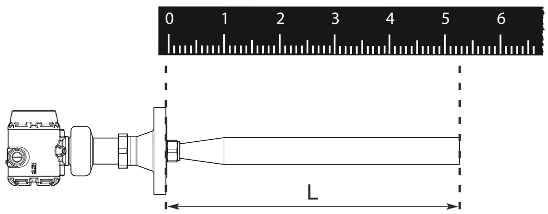
1. Mark where to cut the antenna.



2. Cut the antenna at the marking.



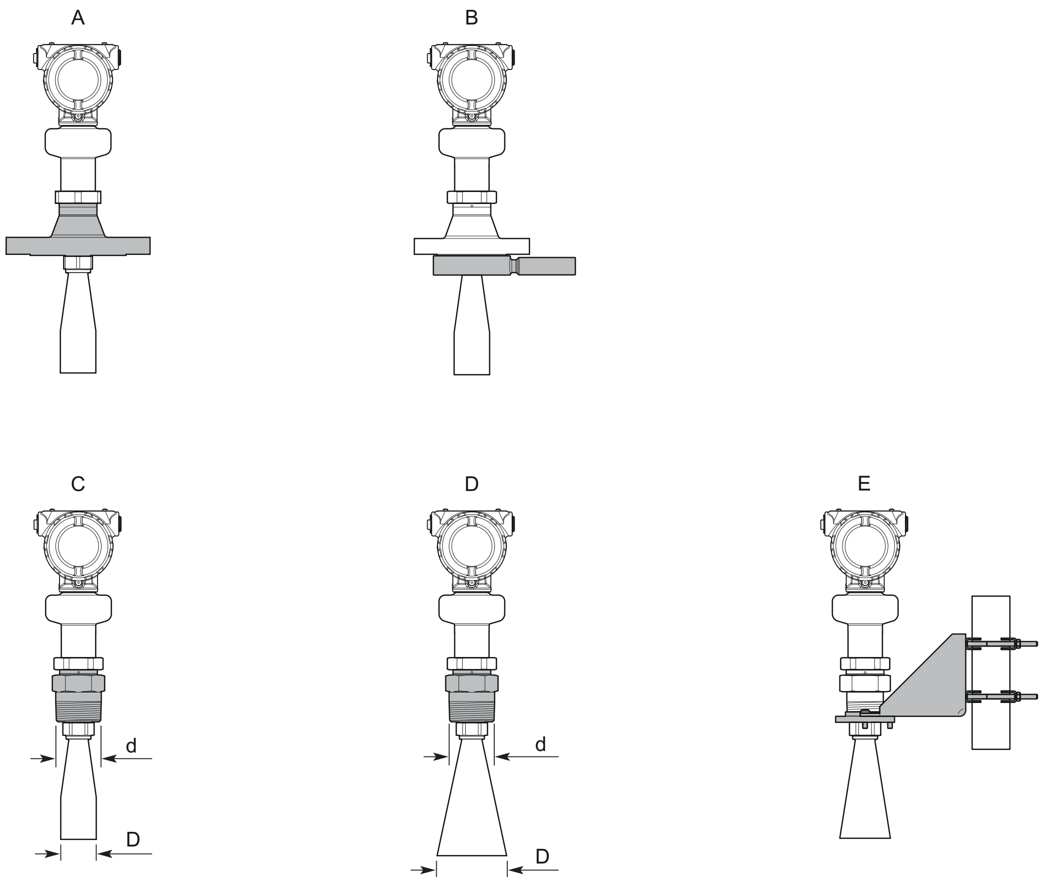
3. Remove any burrs.
4. Measure the Antenna Extension Length (L).



5. Update the transmitter configuration to the new Antenna Extension Length (L).
   - Rosemount Radar Master Plus:
     - Under *Configure*, select **Level Setup** > **Antenna**.
   - AMS Device Manager and Field Communicator:
     - Select **Configure** > **Manual Setup** > **Level Setup** > **Antenna**.

3.5 Mount the cone antenna

Figure 3-11: Overview

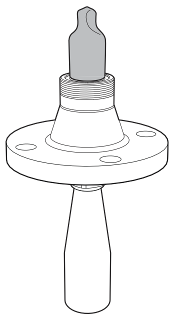


A. Flanged version (see page 29)
B. Flanged version with air purge ring (see page 30)
C. Threaded version, D < d (see page 31)
D. Threaded version, D > d (see page 34)
E. Bracket mounting (see page 36)

3.5.1 Protective cap

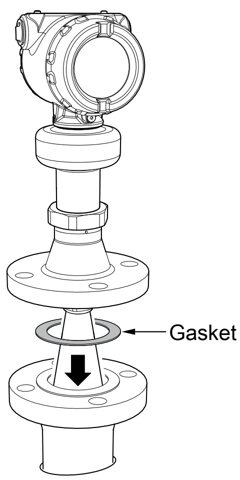
For spare antennas, keep the protective cap in place until installing the transmitter head. The cap protects the process seal from dust and water.

Figure 3-12: Protective Cap

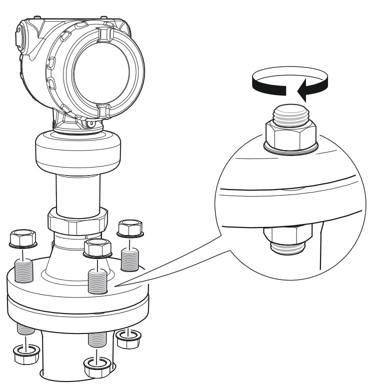


3.5.2 Flanged version

1. If applicable, assemble the segmented cone antenna (see *Section 3.4.1*).
2. Lower transmitter with antenna and flange into the nozzle.



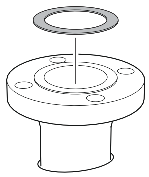
3. Tighten bolts and nuts with sufficient torque for the flange and gasket choice.



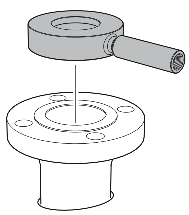
4. Align the transmitter head (see *Section 3.5.7*).

3.5.3 Flanged version with air purge ring (option code PC1)

1. If applicable, assemble the segmented cone antenna (see *Section 3.4.1*).
2. Place a suitable gasket on the tank flange.



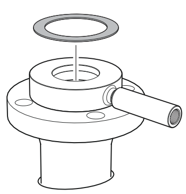
3. Place the purge ring over the gasket.



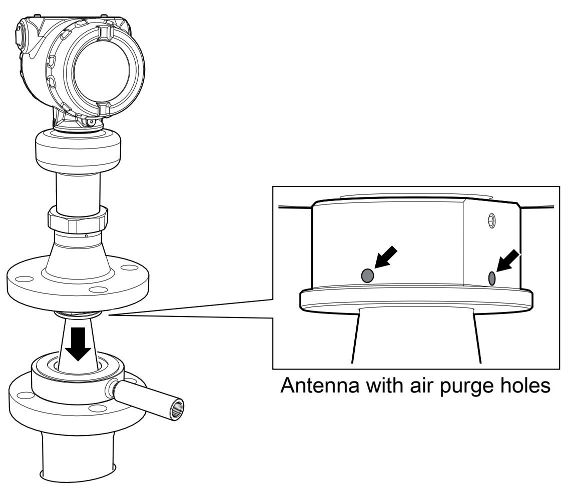
4. Place a suitable gasket over the purge ring.

Note

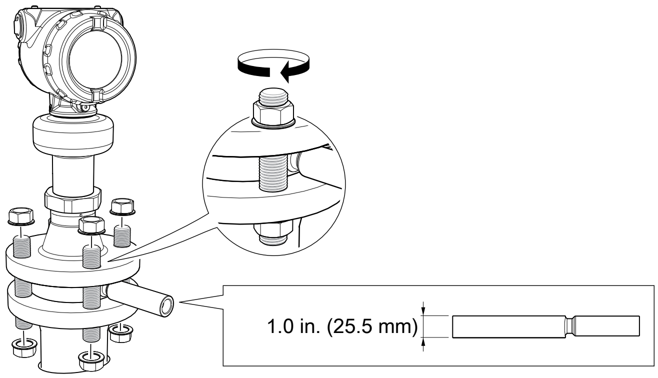
A minimum gasket thickness of 0.125 in. (3.2 mm) is required for flanges with protective plate design.



5. Lower transmitter with antenna and flange into the nozzle.



6. Tighten bolts and nuts with sufficient torque for the flange and gasket choice.



7. Connect the air purging system. Use thread sealant or suitable gasket according to your site procedures.

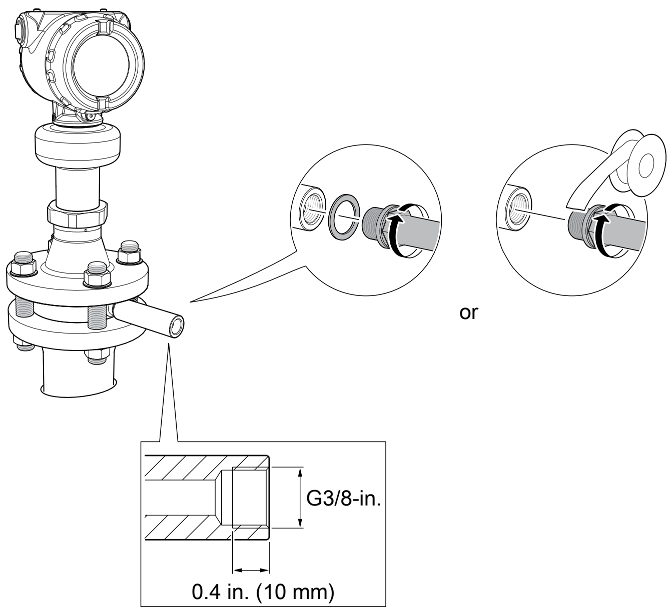


Table 3-8: Incoming Air Supply Specification

Maximum pressure	Recommended pressure
190 psi (13 bar)	100 to 115 psi (7 to 8 bar)

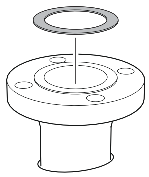
8. Align the transmitter head (see *Section 3.5.7*).

3.5.4 Threaded version, antenna diameter (D) < Thread diameter (d)

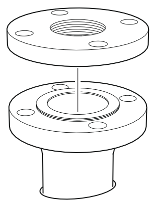
Flanged tank connection

1. If applicable, assemble the segmented cone antenna (see *Section 3.4.1*).

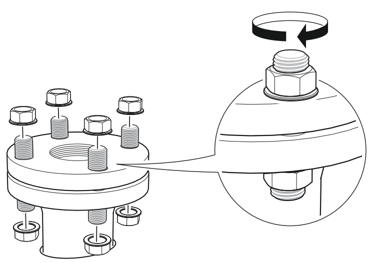
2. Place a suitable gasket on the tank flange.



3. Place the customer supplied flange over the gasket.

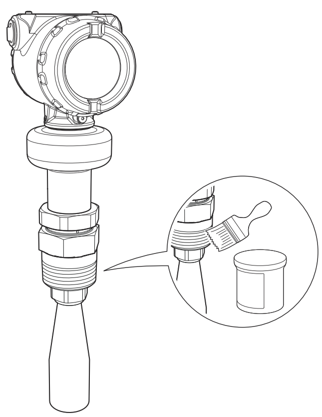


4. Tighten the bolts and nuts with sufficient torque for the flange and gasket choice.

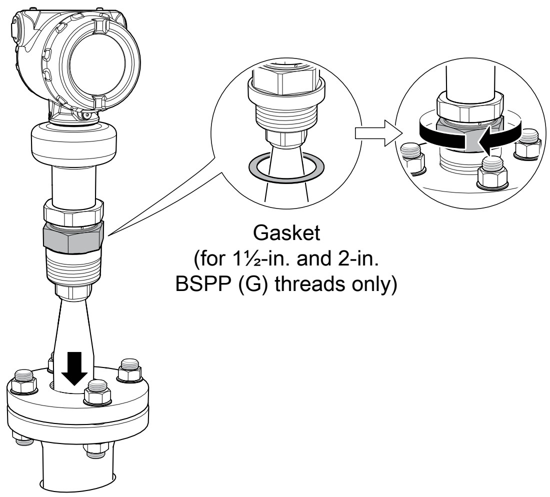


5. Apply anti-seize paste or PTFE tape on threads according to your site procedures.

   ⚠ Gasket may be used as a sealant for adapters with 1½- or 2-in. BSPP (G) threads.



6. Lower transmitter with antenna and flange into the nozzle.

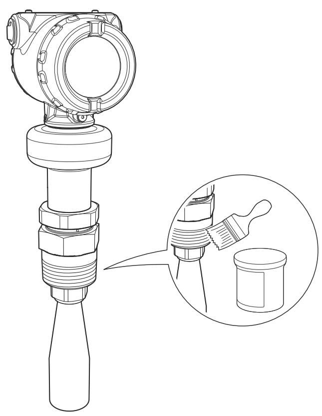


7. Align the transmitter head (see *Section 3.5.7*).

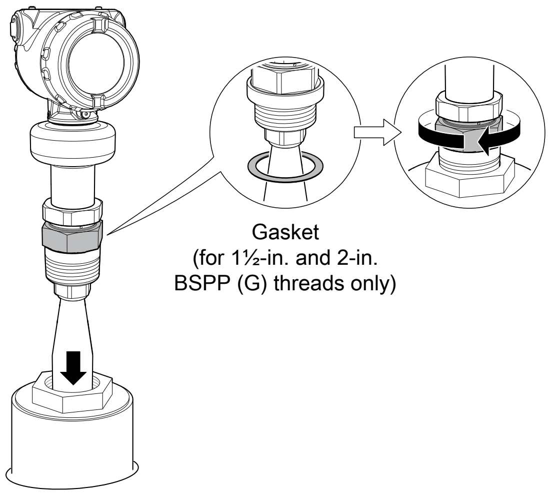
Threaded tank connection

1. If applicable, assemble the segmented cone antenna (see *Section 3.4.1*).
2. Apply anti-seize paste or PTFE tape on threads according to your site procedures.

   ⚠ Gasket may be used as a sealant for adapters with 1½- or 2-in. BSPP (G) threads.



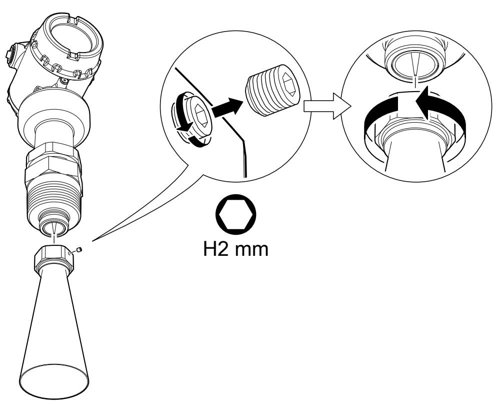
3. Mount the transmitter on the tank.



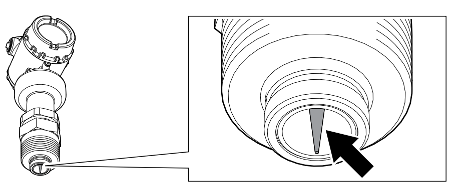
4. Align the transmitter head (see *Section 3.5.7*).

3.5.5 Threaded version, antenna diameter (D) > Thread diameter (d)

1. If applicable, assemble the segmented cone antenna (see *Section 3.4.1*).
2. Unscrew and remove the antenna.

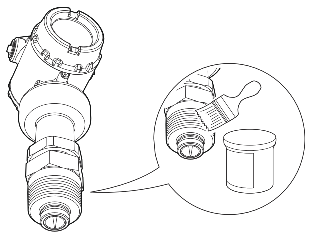


Note
Be careful not to scratch the microwave launcher. The microwave launcher is sensitive to mechanical impacts.

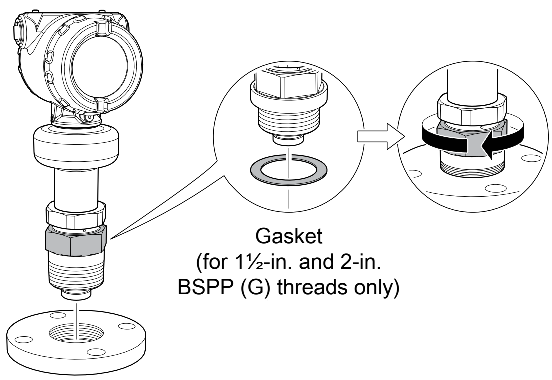


3. Apply anti-seize paste or PTFE tape on threads according to your site procedures.

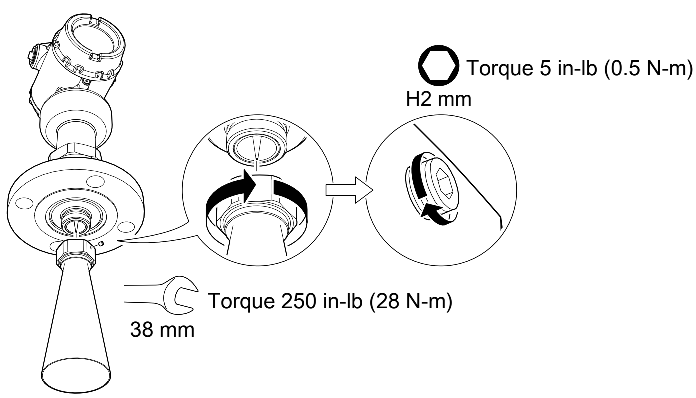
   ⚠ Gasket may be used as a sealant for adapters with 1½- or 2-in. BSPP (G) threads.



4. Mount the adapter on the customer supplied flange.

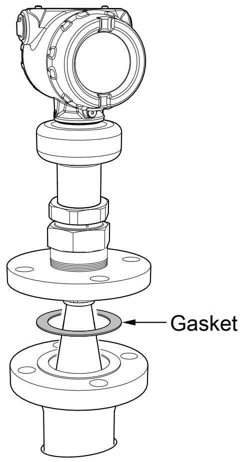


5. Mount the antenna.

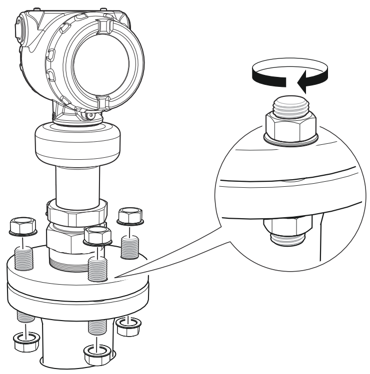


Note
Visually inspect the microwave launcher for damage and dirt.

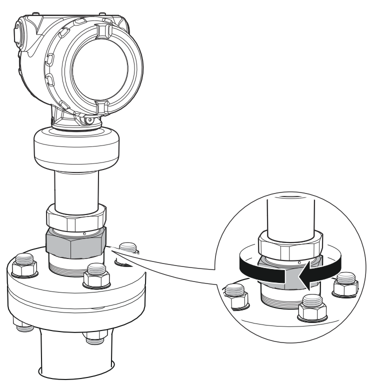
6. Lower transmitter with antenna and flange into the nozzle.



7. Tighten the bolts and nuts with sufficient torque for the flange and gasket choice.



8. Screw the adapter until it is properly tightened.

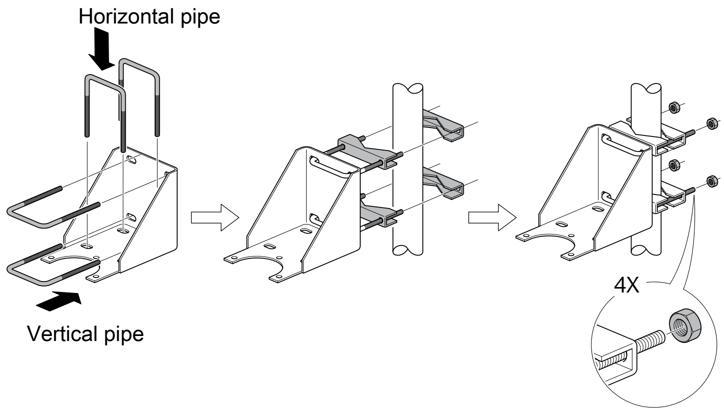


9. Align the transmitter head (see Section 3.5.7).

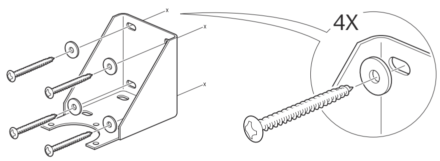
3.5.6 Bracket mounting

1. Mount the bracket to the pipe/wall.

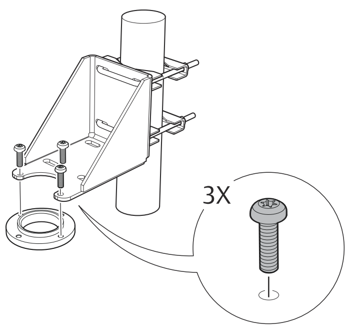
   On pipe:



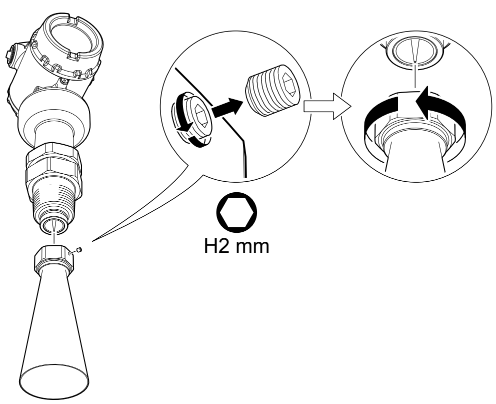
On wall:



2. Mount the holder to the bracket.

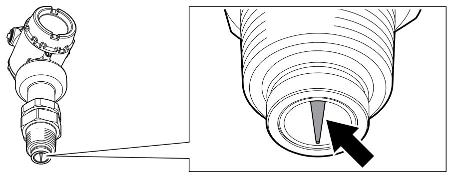


3. Unscrew and remove the antenna.



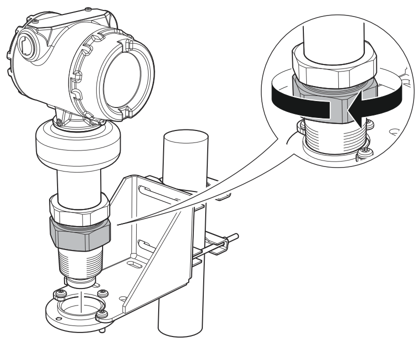
Note

Be careful not to scratch the microwave launcher. The microwave launcher is sensitive to mechanical impacts.

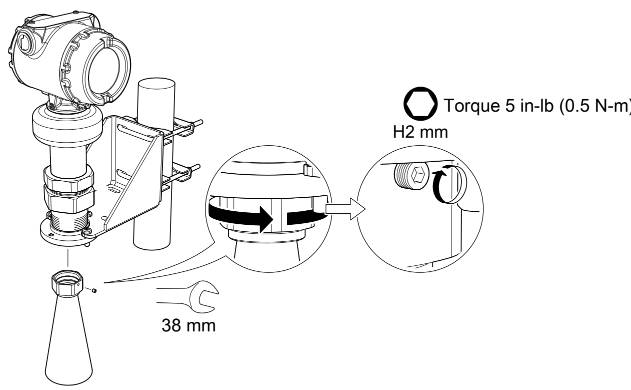


Microwave launcher

4. Screw the transmitter into the holder.



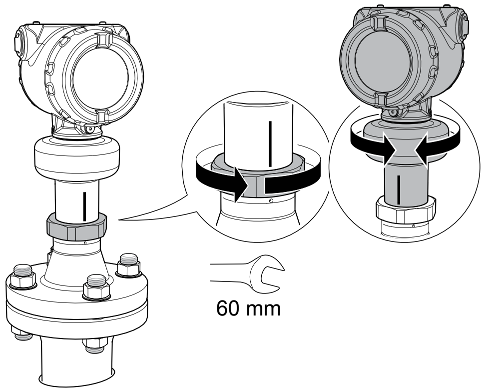
5. Mount the antenna.



6. Align the transmitter head (see Section 3.5.7).

3.5.7 Align transmitter head

1. Loosen the nut slightly and turn the transmitter.



2. Verify the transmitter head is properly aligned.

Option	Description
Open tank	Align the marking on the sensor module toward the tank wall (see *Figure 3-13*).
Still pipe	Align the external ground screw toward the holes of the still pipe (see *Figure 3-14*).
Chamber	Align the external ground screw toward the process connections (see *Figure 3-15*).

3. Tighten the nut.

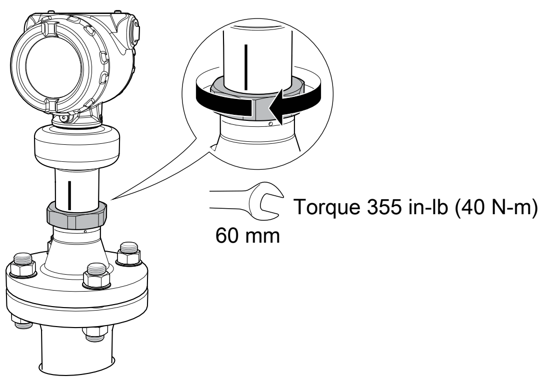


Figure 3-13: Open Tank

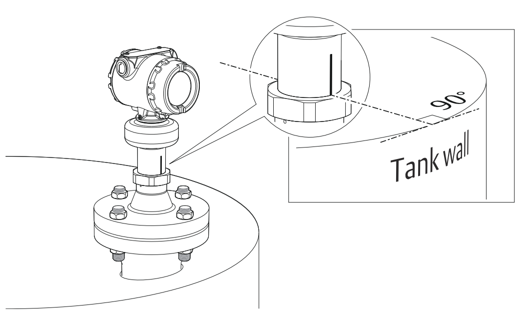


Figure 3-14: Still pipe

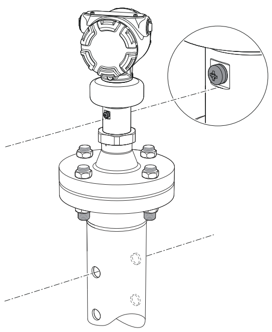
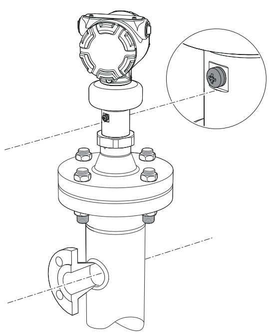


Figure 3-15: Chamber



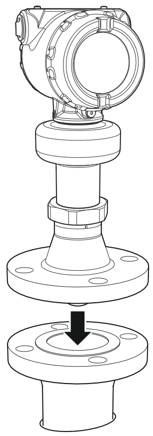
3.6 Mount the process seal antenna

Figure 3-16: Overview

A. *Flanged version (see page 40)*
B. *Tri-Clamp version (see page 42)*

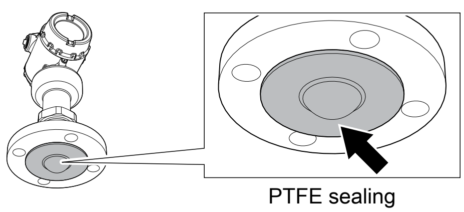
3.6.1 Flanged version

1. Lower the transmitter into the nozzle.



Note

Be careful not to scratch or otherwise damage the PTFE sealing.



2. Tighten the bolts and nuts (see *Table 3-9*).

Note

- Re-tighten after 24 hours and again after the first temperature cycle.
- Check at regular intervals and re-tighten if necessary.

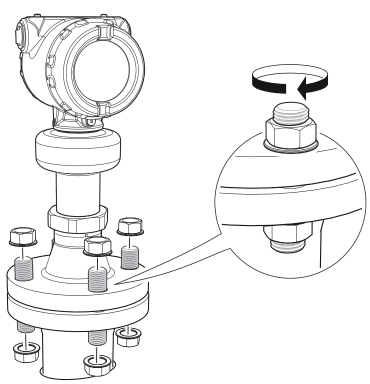


Table 3-9: Torque Value, lb-ft (N-m)

Process connection size (1) (2)	Process connection rating(1)(2)					
	ASME B16.5		EN1092-1			JIS B2220
	Class 150	Class 300	PN6	PN10/PN16	PN25/PN40	10K
2-in./DN50/50A	29 (40)	52 (70)	15 (20)	26 (35)	29 (40)	18 (25)
3-in./DN80/80A	33 (45)	48 (65)	37 (50)	37 (50)	41 (55)	22 (30)
4-in./DN100/100A	59 (80)	52 (70)	37 (50)	37 (50)	74 (100)	26 (35)

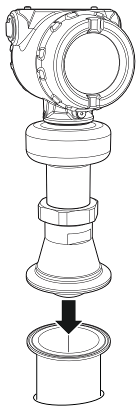
(1) The conditions used for the calculation are: Standard mating metal flange, A193 B8M Cl.2 / A4-70 bolt material, and a friction coefficient of μ=0.16.

(2) Low strength bolt and non-metallic mating flange may require lower tightening torque.

3. Align the transmitter head (see *Section 3.5.7*).

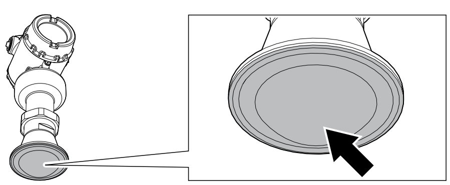
3.6.2 Tri-Clamp version

1. Lower the transmitter into the nozzle.

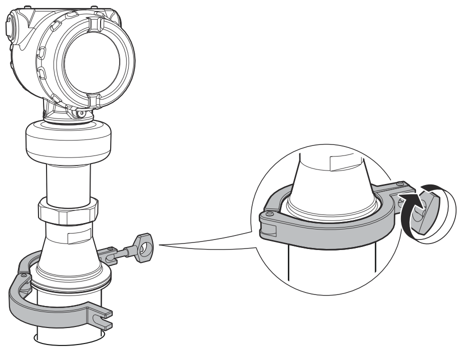


Note

Be careful not to scratch or otherwise damage the PTFE sealing.



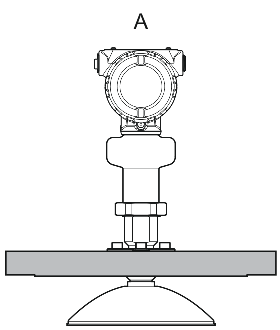
2. Tighten the clamp to the recommended torque (see the manufacturer's instruction manual).



3. Align the transmitter head (see *Section 3.5.7*).

3.7 Mount the parabolic antenna

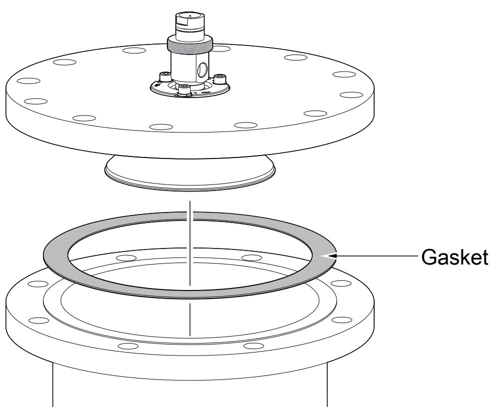
Figure 3-17: Overview



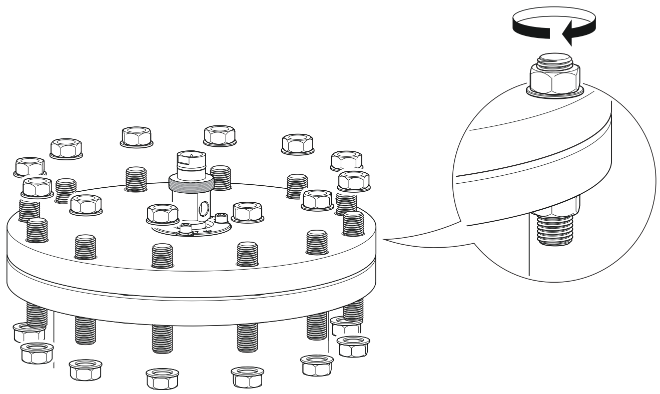
A. *Flanged version (see page 43)*
B. *Threaded version (see page 45)*
C. *Welded version (see page 49)*

3.7.1 Flanged version

1. Lower the flange and antenna assembly into the nozzle.



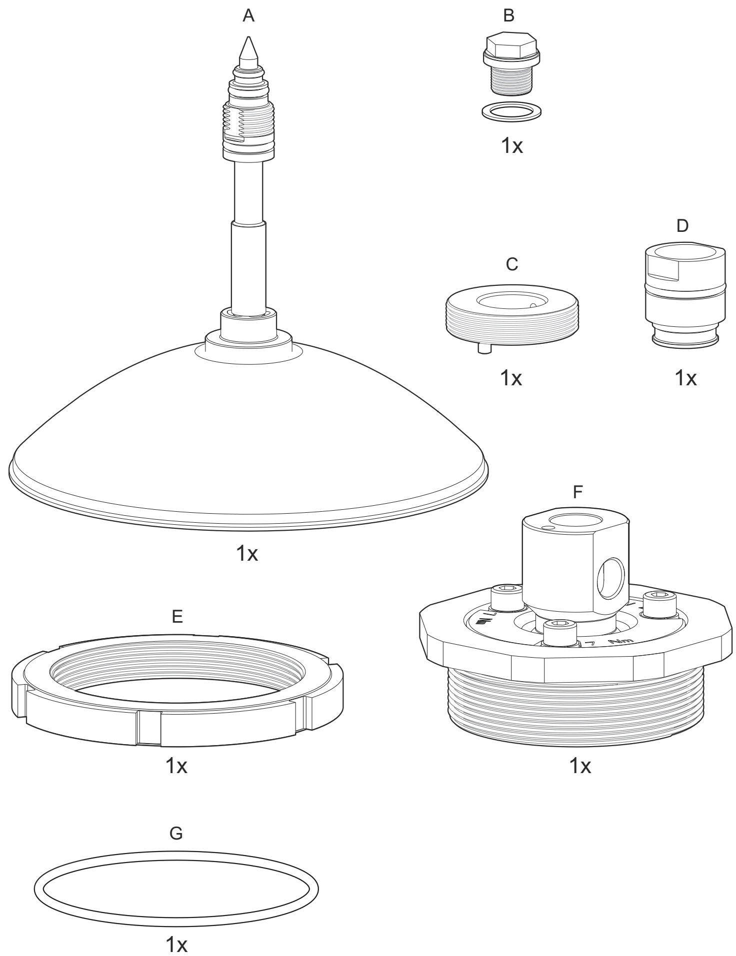
2. Tighten the bolts and nuts with sufficient torque for the flange and gasket choice.



3. Adjust the inclination of the antenna (see Section 3.7.4).
4. Connect the air purging system (see Section 3.7.5).

3.7.2 Threaded version

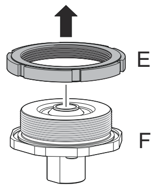
Figure 3-18: Components



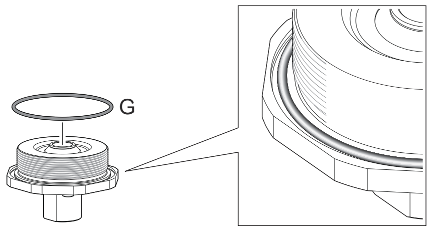
A.	*Antenna*	*E.*	*Lock nut BSPP (G) 3½"*
B.	*Purge plug kit*	*F.*	*Antenna adapter with ball joint*
C.	*Threaded sleeve*	*G.*	*O-ring*
D.	*M20 adapter*		

Procedure

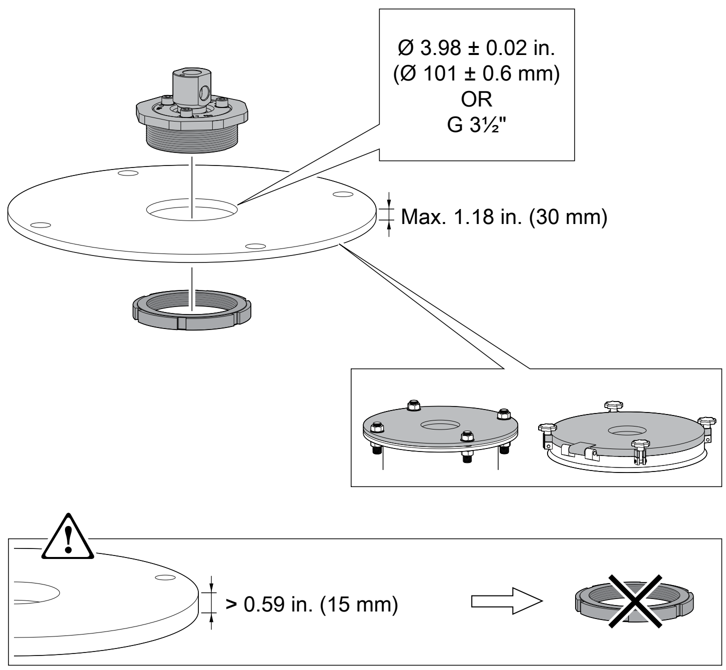
1. Remove the lock nut.



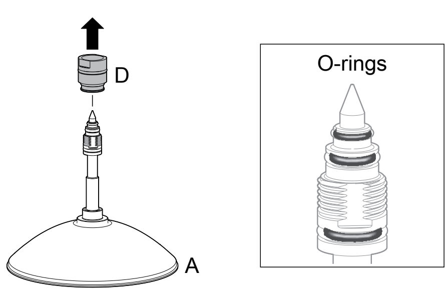
2. Mount the O-ring.



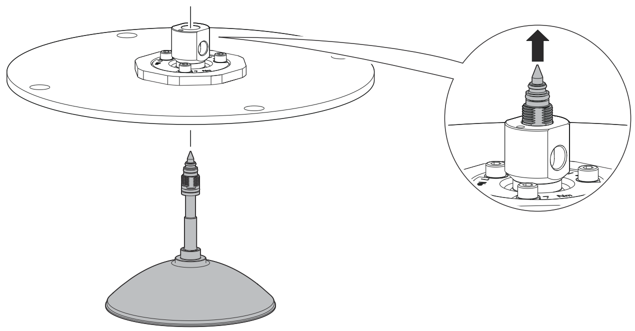
3. Mount the antenna adapter on flange/manhole cover. Ensure the antenna adapter fits tightly to the flange/manhole cover.



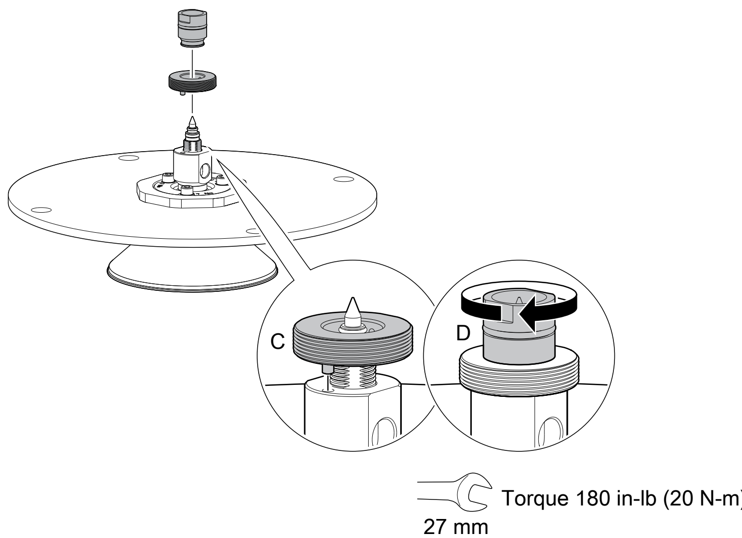
4. Remove the M20 adapter and visually inspect the O-rings for damage and dirt.



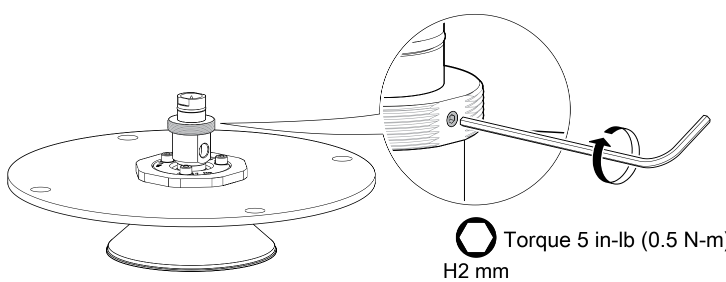
5. Carefully insert the antenna.



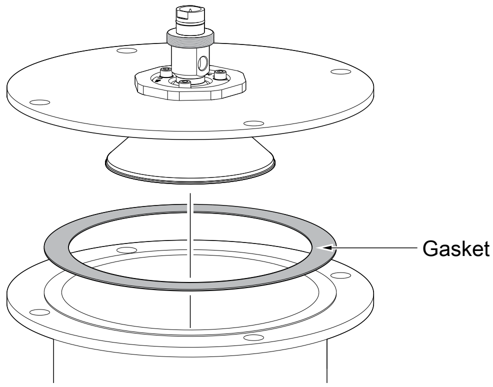
6. Secure the antenna.



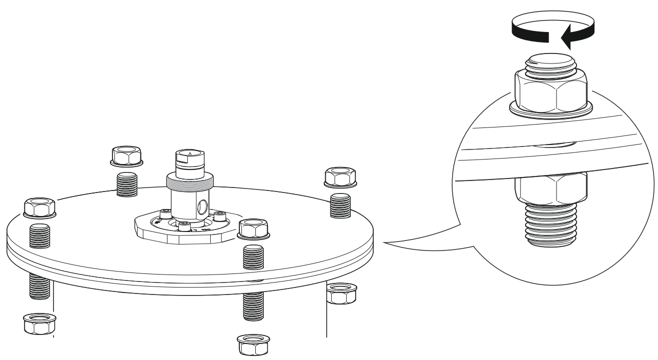
7. Tighten the set screw.



8. Lower the antenna assembly into the tank.



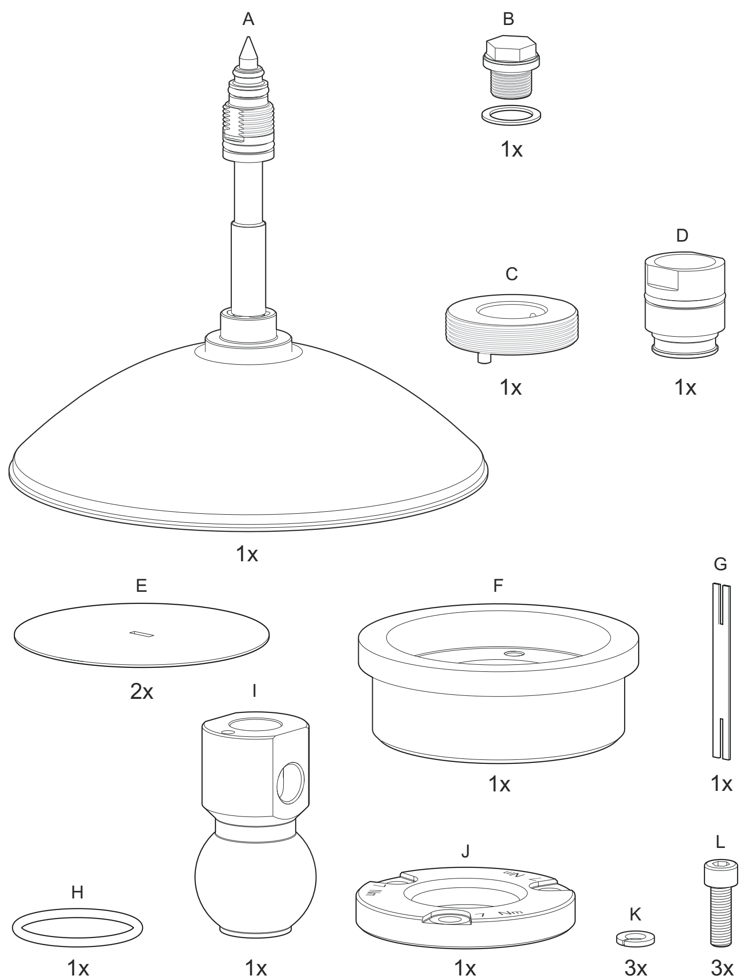
9. Tighten the bolts and nuts with sufficient torque for the flange and gasket choice.



10. Adjust the inclination of the antenna (see *Section 3.7.4*).
11. Connect the air purging system (see *Section 3.7.5*).

3.7.3 Welded version

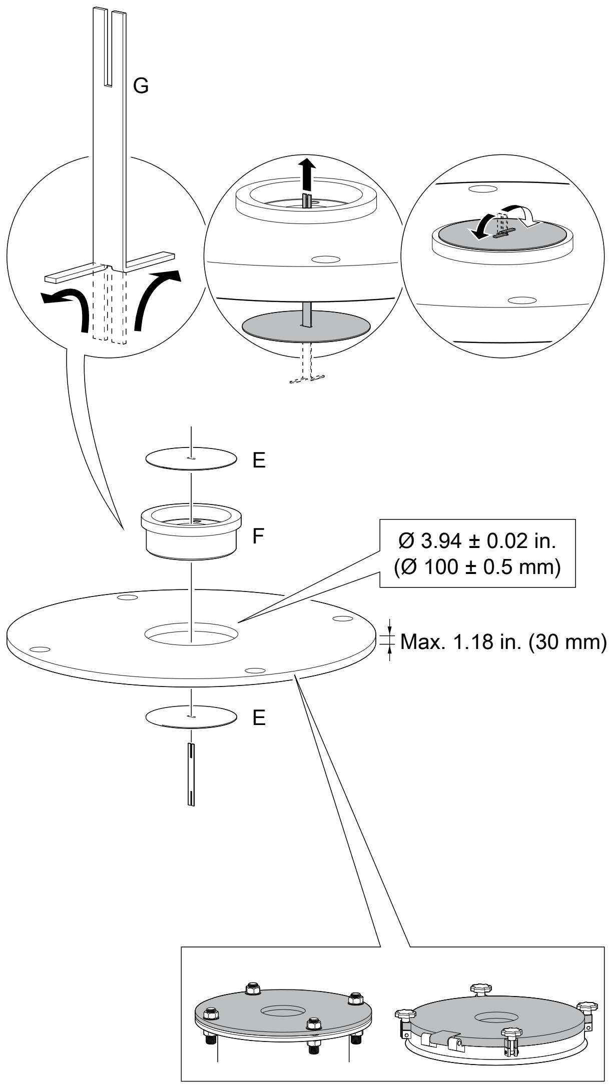
Figure 3-19: Components



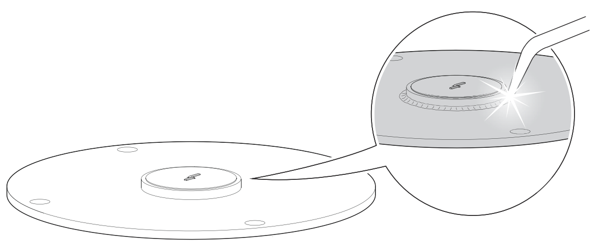
A.	*Antenna*	*G.*	*Weld protection bar*
B.	*Purge plug kit*	*H.*	*O-ring*
C.	*Threaded sleeve*	*I.*	*Ball joint*
D.	*M20 adapter*	*J.*	*Clamp flange*
E	*Weld protection plate*	*K.*	*Washer*
F	*Flange ball*	*L.*	*M8 screw*

Procedure

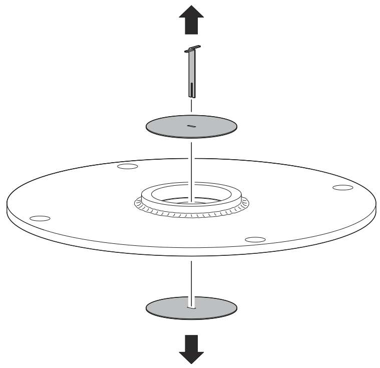
1. Mount the protection plates to flange/manhole cover. These plates protect the internal surfaces of the flange ball from dust and sparks during welding.



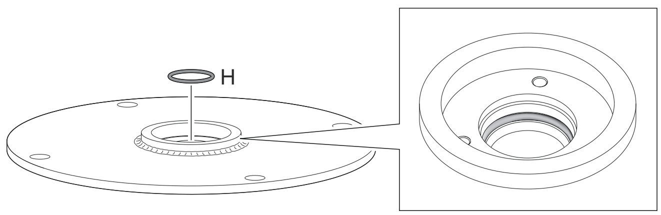
2. Weld the flange ball.



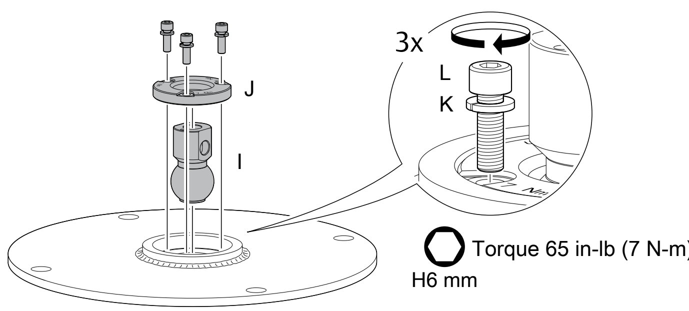
3. Remove the protection plates and visually inspect the internal surfaces of the flange ball for damage and dirt.

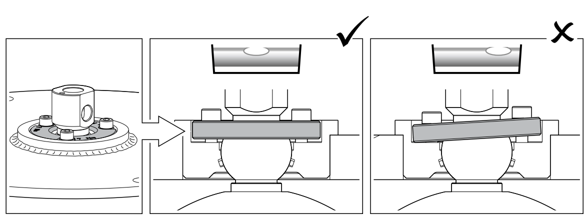


4. Mount the O-ring.

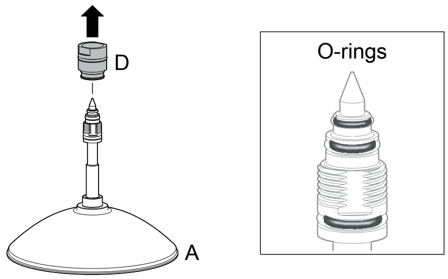


5. Mount the ball joint.
   a. Insert the ball joint and place the clamp flange with the “7 Nm” marking side up.
   b. Gradually tighten the M8 screws.

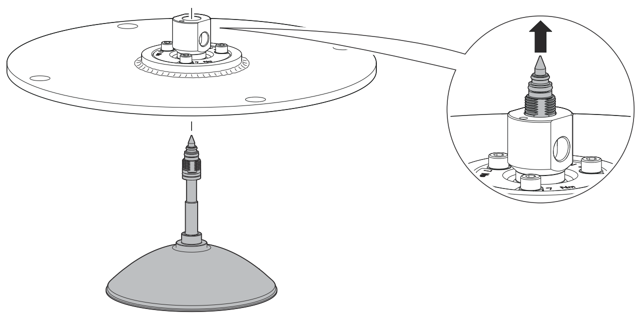




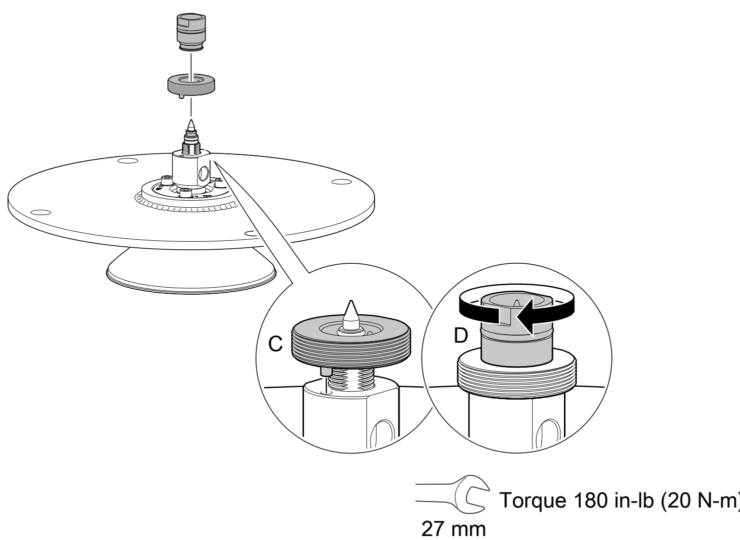
6. Remove the M20 adapter and visually inspect the O-rings for damage and dirt.



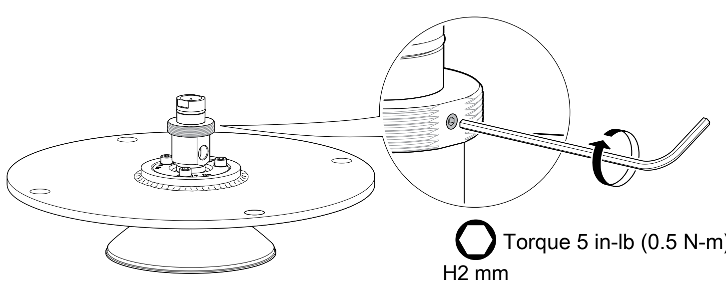
7. Carefully insert the antenna.



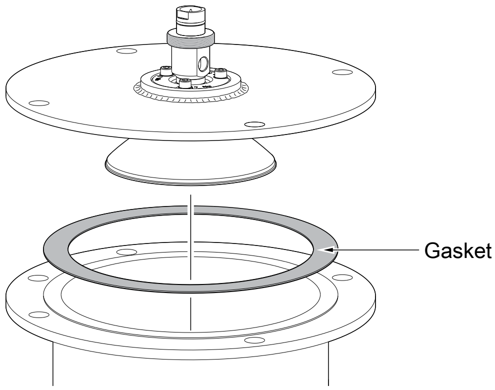
8. Secure the antenna.



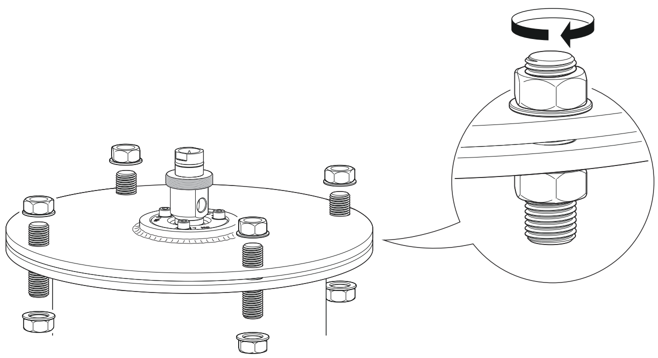
9. Tighten the set screw.



10. Lower the antenna assembly into the tank.



11. Tighten the bolts and nuts with sufficient torque for the flange and gasket choice.



12. Adjust the inclination of the antenna (see *Section 3.7.4*).
13. Connect the air purging system (see *Section 3.7.5*).

3.7.4 Adjust the inclination of the antenna

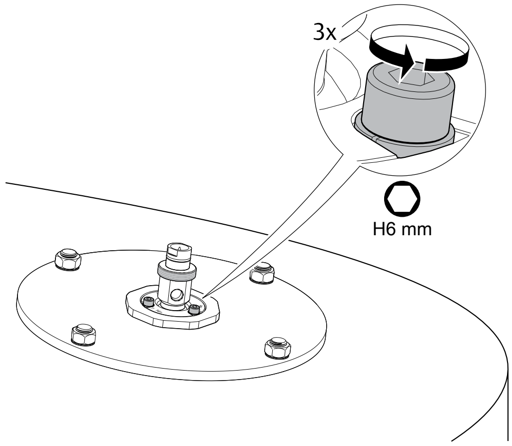
⚠ WARNING!

Contents may be under pressure.

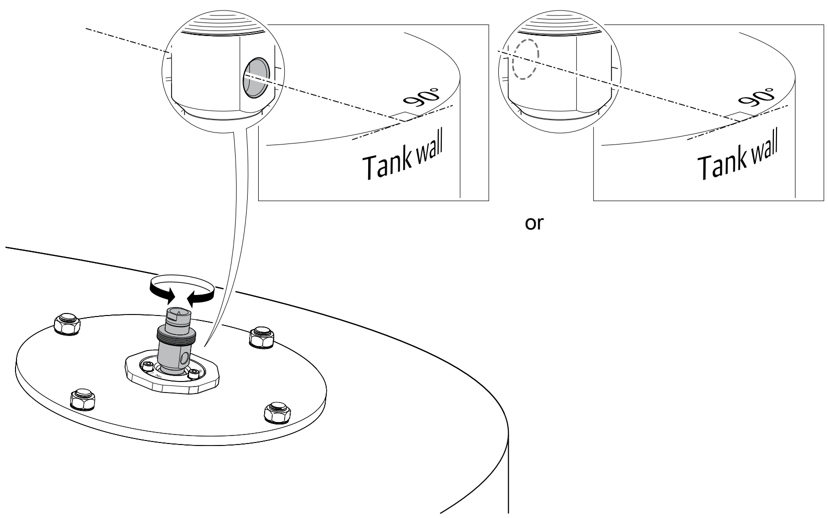
- **Do not loosen the M8 screws while in operation. Attempting to do so may release pressurized gases, resulting in serious injury or death.**

Procedure

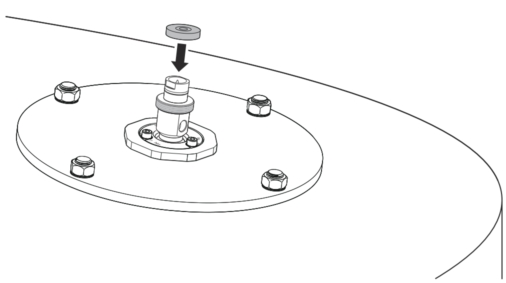
1. Loosen the M8 screws until the antenna can rotate smoothly.



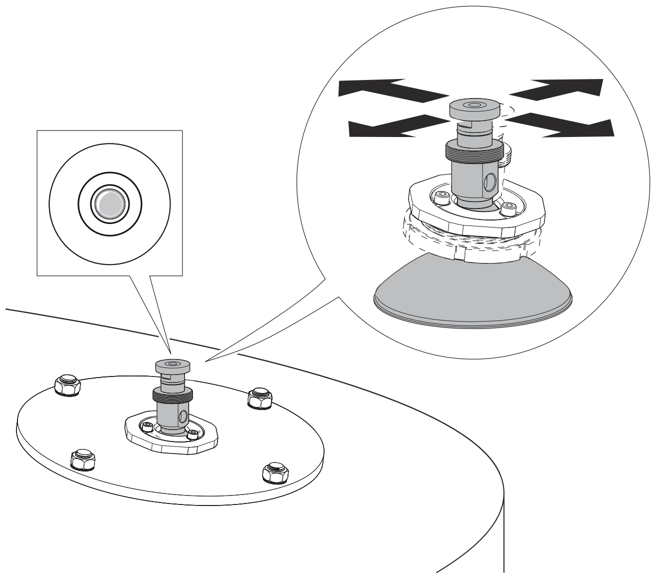
2. Rotate the antenna so the air purge connection is directed toward the tank wall.



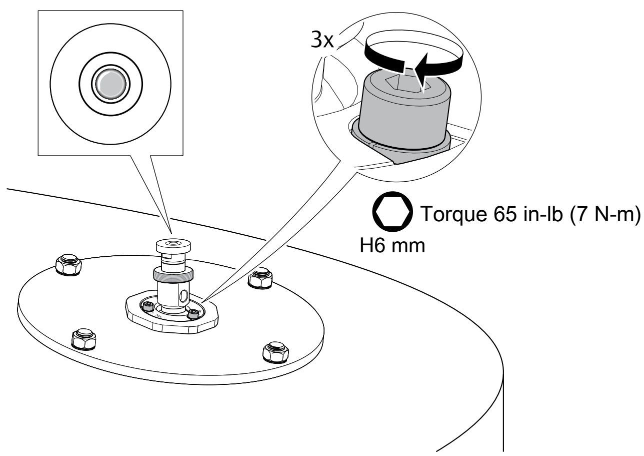
3. Place the circular level on top of the antenna assembly.



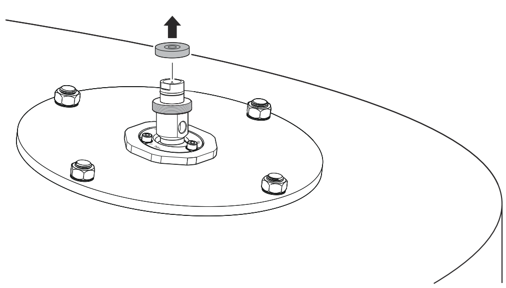
4. Adjust the inclination of the antenna.



5. Gradually tighten the M8 screws.

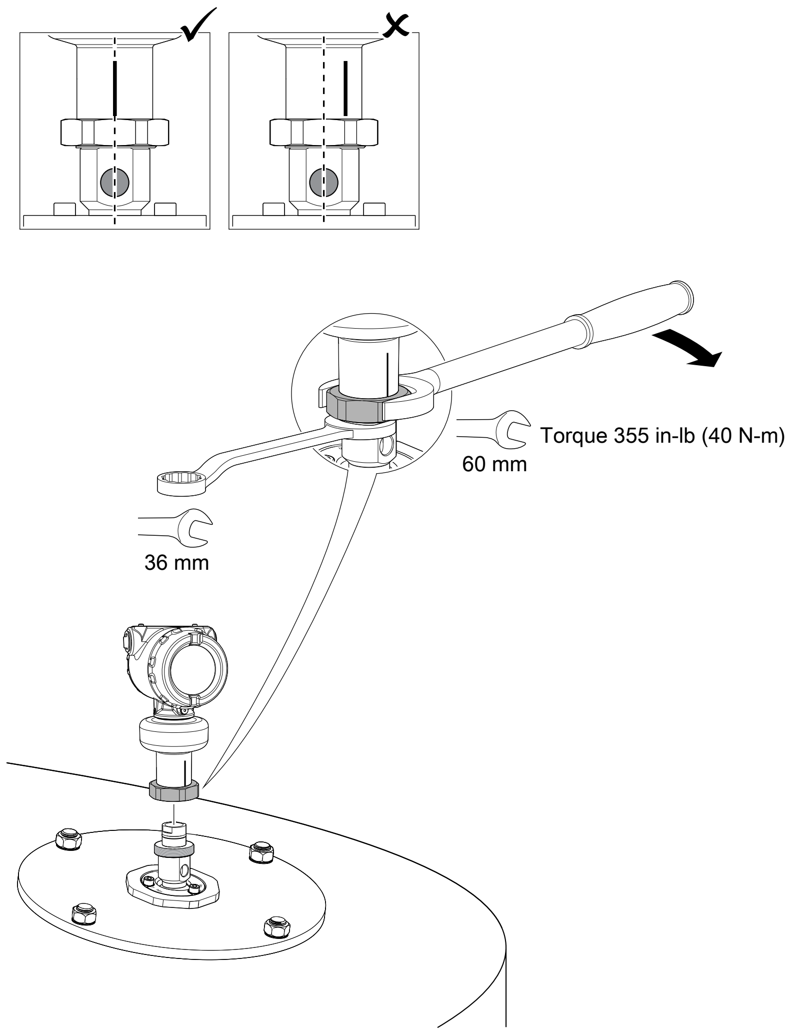


6. Remove the circular level.



7. Mount the transmitter head.

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



3.7.5 Connect the air purging

If air purging is not used, plug and seal the entry with the purge plug kit.

Figure 3-20: Air Purging

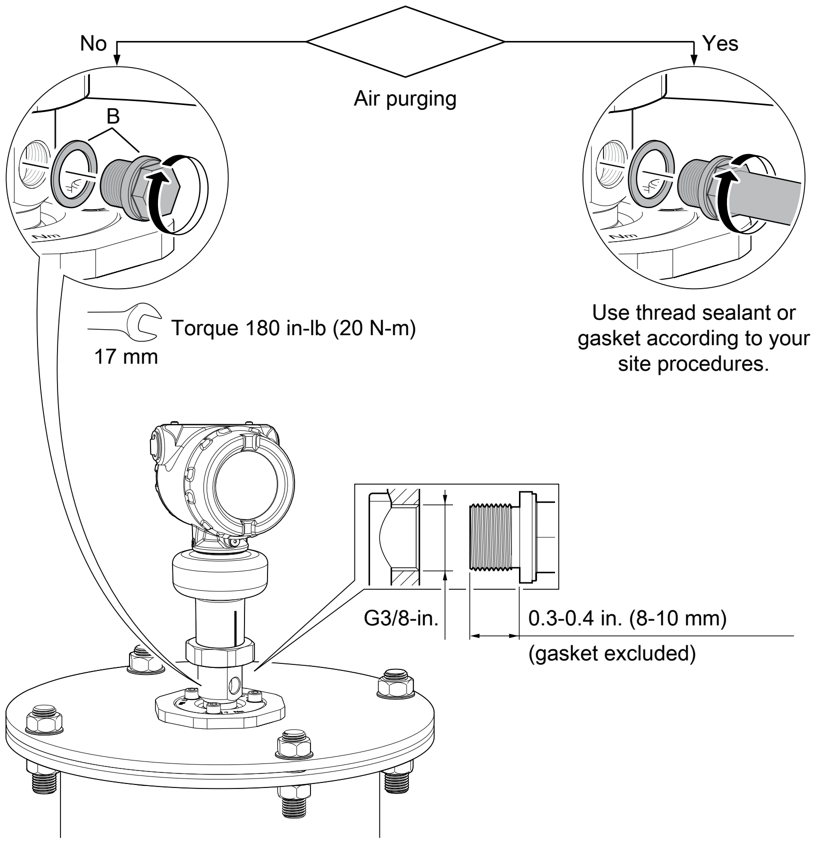


Table 3-10: Incoming Air Supply Specification

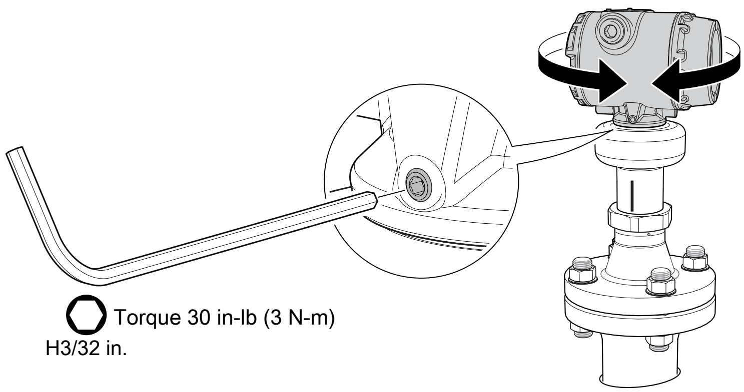
Maximum pressure	Recommended pressure
190 psi (13 bar)	100 to 115 psi (7 to 8 bar)

3.8 Adjust display orientation (optional)

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

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 3-21: Rotate the Transmitter Housing



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.

4 Electrical Installation

4.1 Safety messages

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

⚠ WARNING!

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

- **Make sure the transmitter is installed by qualified personnel and in accordance with applicable code of practice.**
- **Use the equipment only as specified in this manual. 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 and 5408:SIS *Product Certifications* document and System Control Drawing (D7000002-885).**

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 Field 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 and Non-Incendive/Type n 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.

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

4.2 Cable selection

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

Two wires can be safely connected to each terminal screw.

4.3 Cable gland/conduit

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

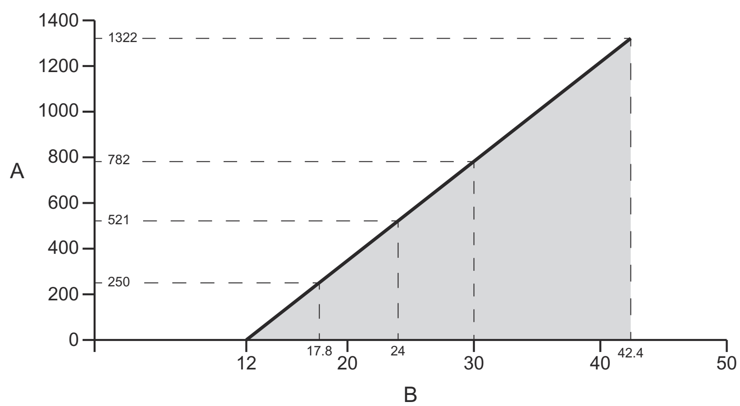
4.4 Power supply

The transmitter operates on 12-42.4 Vdc (12-30 Vdc in Intrinsically Safe installations) at the transmitter terminals.

4.5 Load limitations

For HART® communication, a minimum loop resistance of 250 Ω is required. Maximum loop resistance is determined by the voltage level of the external power supply.

Figure 4-1: Load Limits



*Maximum Loop Resistance = 43.5 * (External Power Supply Voltage - 12)*

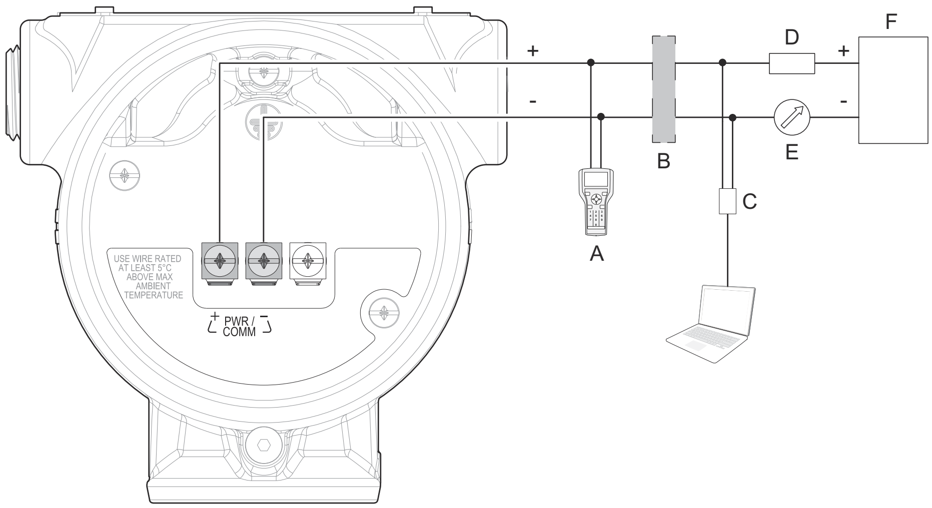
A. Loop Resistance (Ohms)
B. External Power Supply Voltage (Vdc)

4.6 Hazardous areas

When the transmitter is installed in hazardous areas, local regulations, and specifications in applicable certificates must be observed. See *Appendix B* for more information.

4.7 Wiring diagram

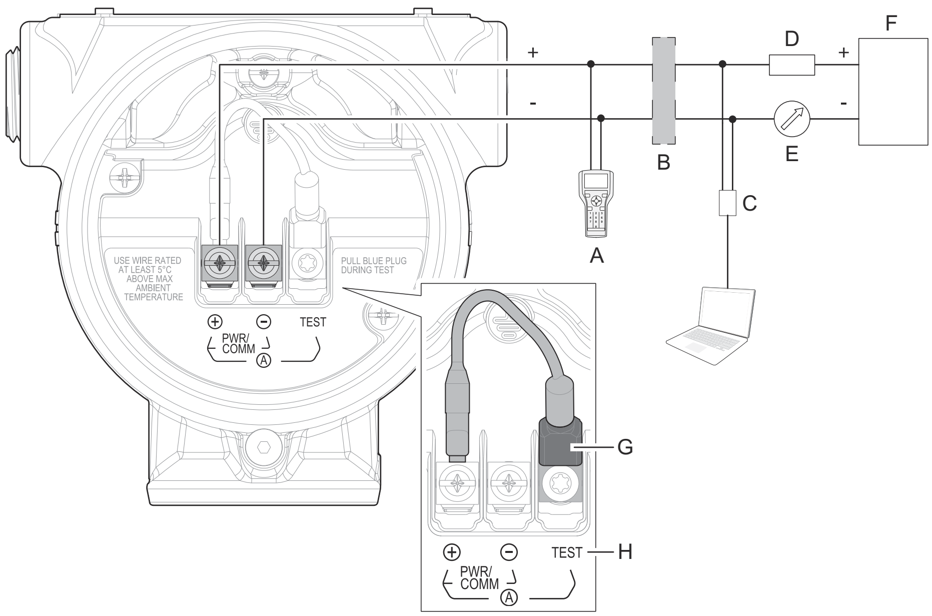
Figure 4-2: 4-20 mA/HART Communication



A. *Field Communicator*
B. *Approved IS barrier (for Intrinsically Safe installations only)*
C. *HART modem*
D. *Load resistance (≥250 Ω)*
E. *Current meter*
F. *Power supply*

For Rosemount 5408:SIS and Rosemount 5408 with option code EF1 (ready for upgrade to Rosemount 5408:SIS), connect the transmitter as shown in *Figure 4-3*.

Figure 4-3: 4-20 mA/HART Communication - Terminal Block with TEST Terminal



A. *Field Communicator*
B. *Approved IS barrier (for Intrinsically Safe installations only)*
C. *HART modem*
D. *Load resistance (≥250 Ω)*
E. *Current meter*
F. *Power supply*
G. *Blue plug*
H. *TEST terminal*

Note
Blue plug must only be disconnected during loop current measurement procedure.

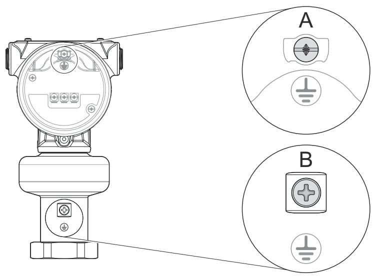
4.8 Grounding

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 4-4*).

Figure 4-4: Ground Screws



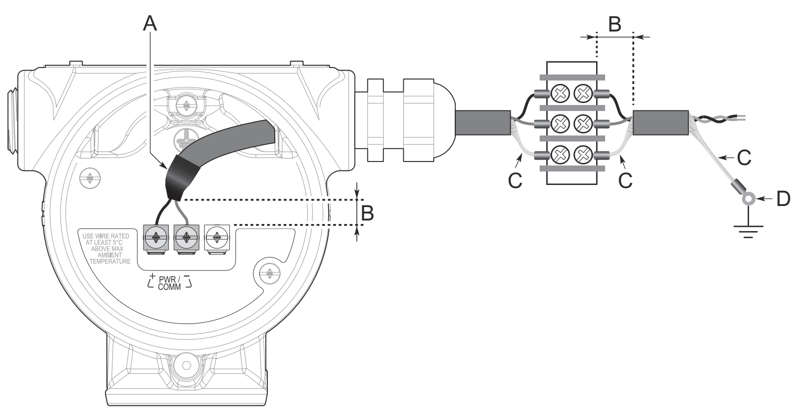
A. *Internal ground screw*
B. *External ground screw*

Signal cable shield grounding

Make sure the instrument cable shield is:

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

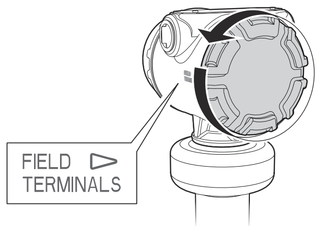
Figure 4-5: Cable Shield



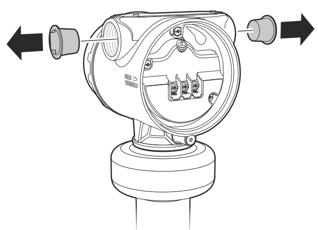
A. *Insulate shield*
B. *Minimize distance*
C. *Trim shield and insulate*
D. *Connect shield back to the power supply ground*

4.9 Connect wiring and power up

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

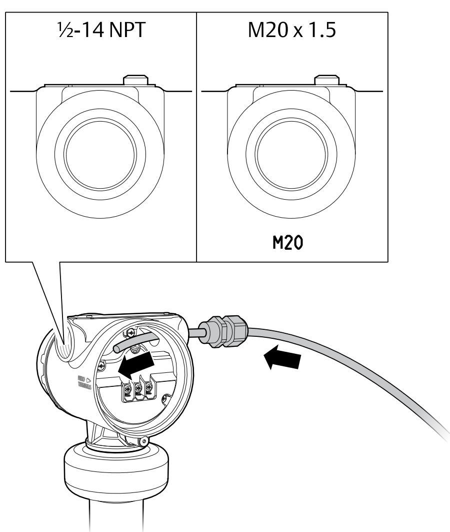


3. Remove the plastic plugs.

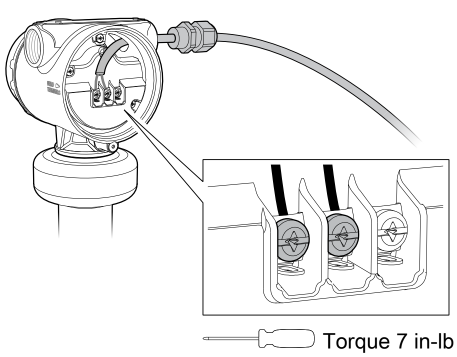


4. Pull the cable through the cable gland/conduit. (1)

Identification of thread size and type

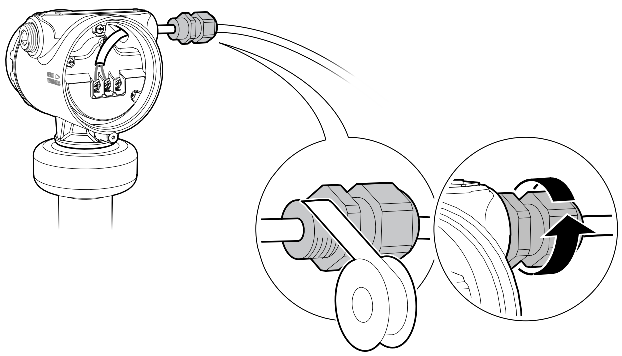


5. Connect the cable wires (see *Section 4.7*).

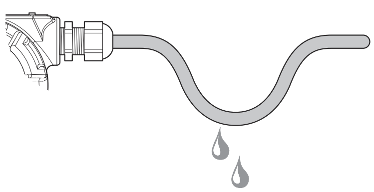


(1) Unless marked, the conduit/cable entries in the transmitter housing use a ½–14 NPT thread form.

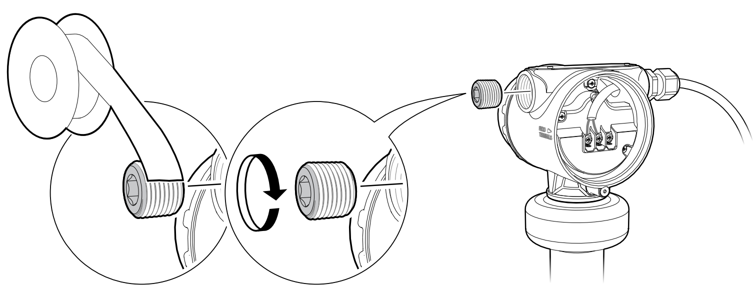
6. Ensure proper grounding (see *Section 4.8*).
7. Tighten the cable gland.



Note
Make sure to arrange the wiring with a drip loop.

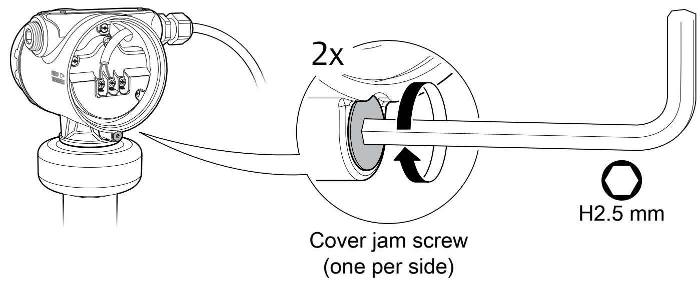


8. Seal any unused ports with the enclosed metal plug.

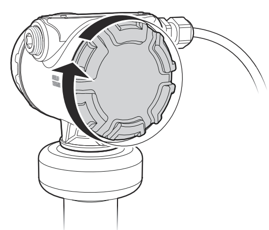


9. Attach and tighten the covers. Make sure the covers are fully engaged.

   a. Verify the cover jam screws are completely threaded into the housing.

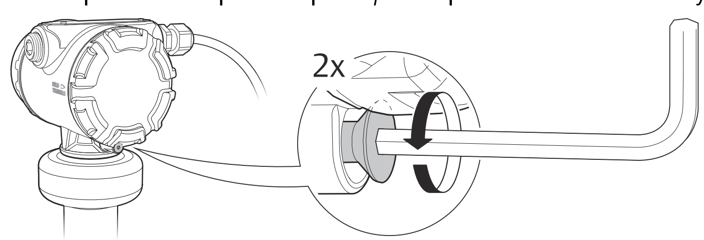


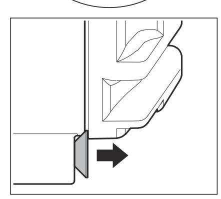
b. Attach and tighten the covers.



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 ½ turn counterclockwise to secure the cover.

10. Connect the power supply.

Note

It may take up to 15 seconds before the LCD display lights up.

4.10 Optional devices

4.10.1 Rosemount™ 333 HART Tri-Loop™

The Rosemount 5408 and 5408:SIS Level Transmitters output a HART signal with four process variables. By using the Rosemount 333 HART Tri-Loop, up to three additional analog 4-20 mA outputs are provided.

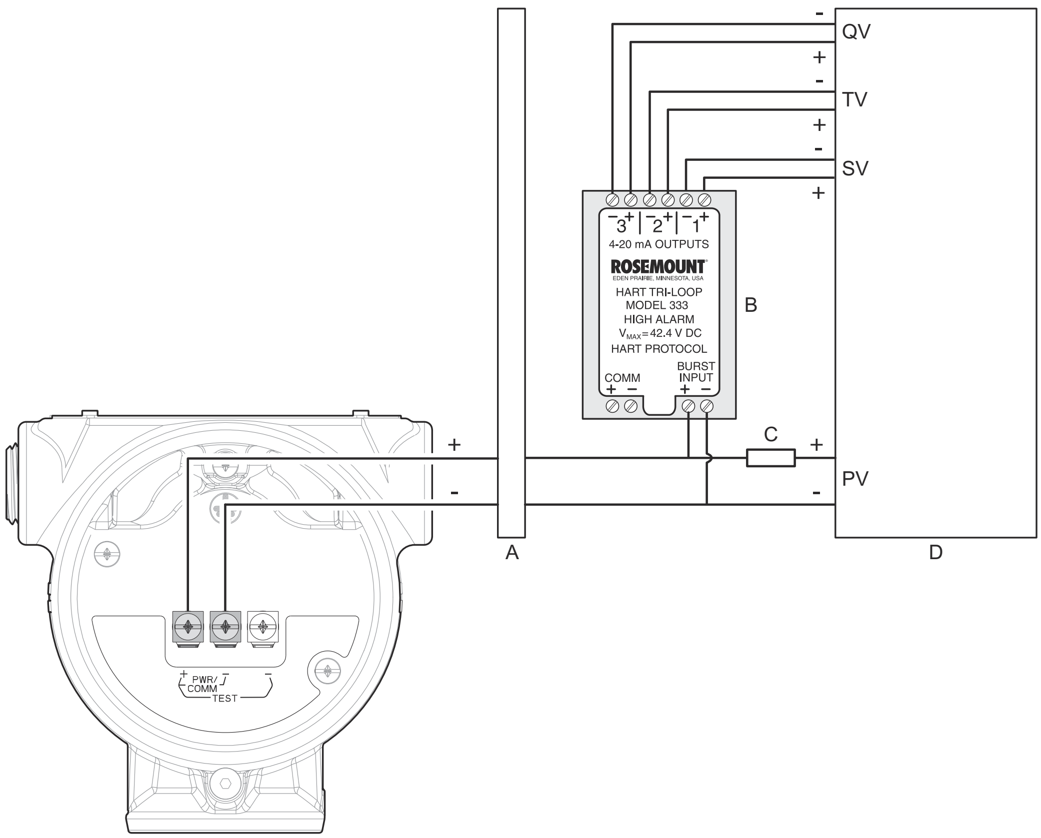
Each Tri-Loop channel receives power from control room. Channel 1 must be powered for the Tri-Loop to operate.

Rosemount 5408 or 5408:SIS receives power from control room.

Note

The operational mode on the Rosemount 5408:SIS must be set to Control/Monitoring when used with the Rosemount 333 HART Tri-Loop.

Figure 4-6: Example Installation of Rosemount 333 with Rosemount 5408



A. *Approved IS barrier*
B. *DIN rail mounted Rosemount 333*
C. *Load resistance (≥250 Ω)*
D. *Control room*

Refer to the Rosemount 333 HART Tri-Loop *Reference Manual* for further information on how to install and configure the Rosemount 333.

5 Configuration

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!

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 Field 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 and Non-Incendive/Type n 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.

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

5.2 Overview

This chapter provides information about configuration and configuration tools. *Appendix C* provides extended information about the configuration parameters. The menu trees can be found in *Section C.1*.

5.3 System readiness

5.3.1 Confirm correct device driver

The transmitter meets the NAMUR recommendation NE 53. Verify the latest Device Descriptor (DD) or FDI Package is loaded on your systems to ensure proper communication.

Procedure

1. Within *Table 5-1*, use the HART® Universal Revision and Device Revision numbers to find the correct DD or FDI Package.
2. Download the latest DD at *EmersonProcess.com/DeviceFiles*.
3. Download the latest FDI Package at *Emerson.com/RosemountRadarMasterPlus*.

Table 5-1: Identification and Compatibility According to NAMUR NE 53

Release date	Device identification			DD and FDI identification		Review instructions	Review functionality
	NAMUR hardware revision (1)	NAMUR software revision(1)	Device software revision (2)	HART® universal revision (3)	Device revision (4)	Manual document number	Change description
March-17	1.0.xx	1.0.xx	1.Axx	6	1	00809-0100-4408	N/A
				7	1		

(1) *NAMUR Revision is located on the transmitter label. Differences in level 3 changes, signified above by xx, represent minor product changes as defined per NE53. Compatibility and functionality are preserved and product can be used interchangeably.*

(2) *Device software revision is located on the transmitter label, e.g. 1.A3. It can also be found in Rosemount Radar Master Plus (under Overview, select **Device Information** > **Revisions**).*

(3) *HART Revision 6 and 7 can be switched in field. Default HART universal revision from factory is located on the transmitter head label, e.g. PROTOCOL 6.*

(4) *Device revision is located on the transmitter label, e.g. DEVICE REV 1.*

5.4 Get started with your preferred configuration tool

5.4.1 Configuration tools

The transmitter can easily be configured using:

- Rosemount Radar Master Plus (running in the Instrument Inspector™ Application)
- Device Descriptor (DD) based systems, e.g. AMS Device Manager, 475 Field Communicator, AMS Trex™ Device Communicator, and DeltaV™, or any other EDDL or enhanced-EDDL host
- Field Device Integration (FDI) based systems

Rosemount Radar Master Plus is the recommended tool for configuration.

5.4.2 Rosemount Radar Master Plus

The Rosemount Radar Master Plus is a user-friendly software package that includes basic configuration options, as well as advanced configuration and service functions. The Instrument Inspector Application or any FDI compliant host is needed to run Rosemount Radar Master Plus.

Instrument Inspector is shipped with every transmitter. See the CD installation guide for a list of supported HART modems and system requirements.

Instrument Inspector is also available at: *Emerson.com/InstrumentInspector*

Get the latest FDI Package

The Rosemount 5408 FDI Package is typically installed together with Instrument Inspector. If the FDI Package is not installed, it can be found on the enclosed CD. The latest FDI Package can also be downloaded from: *Emerson.com/RosemountRadarMasterPlus*

After downloading, add the FDI Package to Instrument Inspector.

Procedure

1. Start **Instrument Inspector**.
2. From the menu bar, select , and then select **Add Device Package**.
3. Browse to the downloaded FDI Package and select **Open**.
4. Select **Add**.
5. Select **Back**.

5.4.3 AMS Device Manager

Get the latest Device Descriptor (DD)

The Device Descriptor (DD) is a configuration tool that is developed to assist the user through the configuration. The Rosemount 5408 DD is typically installed together with AMS Device Manager.

To download the latest DD, visit the Emerson™ Device Install Kit site at: *EmersonProcess.com/devicefiles*

After downloading, add the DD to AMS Device Manager:

Procedure

1. Close AMS Device Manager.
2. Click the **Start** button, and then select **All Programs** > **AMS Device Manager** > **Add Device Type**.
3. Browse to the downloaded DD files and select **OK**.

In the *Add Device Type* application, select the **Help** button for more information on how to complete this operation.

Configure the HART modem interface

Before connecting to the device using a HART modem, the HART modem interface must be configured in AMS Device Manager:

Procedure

1. Close AMS Device Manager.
2. Click the Start button, and then select **All Programs** > **AMS Device Manager** > **Network Configuration**.
3. Select **Add**.
4. In the drop down list, select **HART modem** and select **Install**.
5. Follow the on-screen instructions.

   In the *Network Configuration* application, select the **Help** button for more information on how to complete this operation.

5.4.4 Field Communicator

Get the latest Device Descriptor (DD)

If the DD is not installed in your Field Communicator, see the appropriate Field Communicator User's Manual available at *Emerson.com/FieldCommunicator* for instructions on how to update the Field Communicator with the latest DD.

5.5 Confirm HART revision capability

If using HART based control or asset management systems, confirm the HART capability of those systems prior to transmitter installation. Not all systems are capable of communicating with HART Revision 7 protocol. This transmitter can be configured for either HART Revision 6 or Revision 7.

5.5.1 Switch HART revision mode

If the HART configuration tool is not capable of communicating with HART Revision 7, the device will load a generic menu with limited capability.

To switch the HART revision mode from the generic menu:

Procedure

1. Locate the "Message" field.
2. In the Message field, enter **HART6** or **HART7** and then 27 trailing spaces.

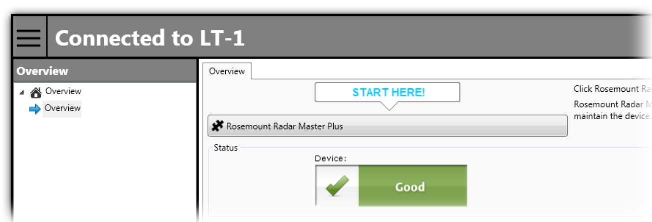
5.6 Configure device using Guided Setup

The options available in the Guided Setup wizard include all items required for basic operation. All basic configuration parameters are described in *Appendix C*.

5.6.1 Configure using Rosemount Radar Master Plus

1. Start Instrument Inspector Application.

2. Under *HART*, double-click the device icon.
3. From the *Overview* screen, select **Rosemount Radar Master Plus**.



4. Under *Configure*, select **Guided Setup** and follow the on-screen instructions.

5.6.2 Configure using AMS Device Manager

1. Start AMS Device Manager.
2. Select **View** > **Device Connection View**.
3. In the *Device Connection View*, double-click the HART modem icon.
4. Double-click the device icon.
5. Select **Configure** > **Guided Setup**.
6. Select **Basic Setup** and follow the on-screen instructions.

5.6.3 Configure using Field Communicator

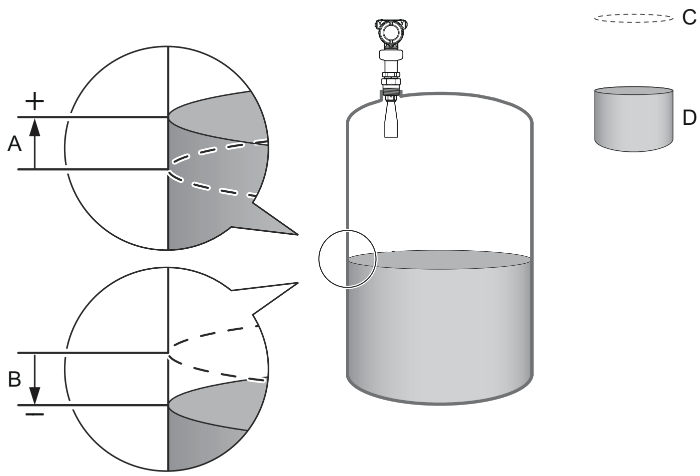
1. Turn on the Field Communicator and connect to the device.
2. Select **Configure** > **Guided Setup**.
3. Select **Basic Setup** and follow the on-screen instructions.

5.7 Verify level

The Verify Level tool matches the product level reported by the device to a reference measurement (measured by using for example handgauging).

If any difference, the Calibration Offset parameter will be adjusted. A minor adjustment using Calibration Offset is normal. There may, for example be a deviation between the actual tank height and the configured value.

Figure 5-1: Calibration Offset



A. Positive Calibration Offset value
B. Negative Calibration Offset value
C. Reported level
D. Actual level

Note

Before running Verify Level, make sure that: the product surface is calm, the tank is not being filled or emptied, and the actual level is well above the tank bottom.

5.7.1 Use Rosemount Radar Master Plus

Verify Level is included as part of the Guided Setup wizard. The tool is also available as follows:

Under *Configure*, select **Verify Level** to check your level measurement, and follow the on-screen instructions.

5.7.2 Use AMS Device Manager and Field Communicator

Verify Level is included as part of the Guided Setup wizard. The tool is also available as follows:

1. Select **Configure** > **Guided Setup**.
2. Select **Verify Level** to check your level measurement, and follow the on-screen instructions.

5.8 Establish multidrop communication

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

In multidrop communication, each transmitter in the loop must have a unique HART address.

5.8.1 Use Rosemount Radar Master Plus

1. Under *Configure*, select **Device Setup HART**.
2. Under *Communication Interface*, select **HART Multidrop**.
3. In the *HART Address box*, type or select the HART address you want to use.
4. Select **Save**.

5.8.2 Use AMS Device Manager

1. Select **Configure** > **Manual Setup** > **Device Setup** > **HART**.
2. Select **Change Address**, and then type the HART address you want to use.
3. Select **Next**.
4. Select **Finish** when the `Method Complete` message appears.
5. Ensure the `Multidrop` check box is selected.

5.8.3 Use Field Communicator

1. Select **Configure** > **Manual Setup** > **Device Setup** > **HART**.
2. Select **Change Address**.
3. Type the HART address you want to use, and then select **ENTER**.
4. Ensure **Multidrop** is set to `ON`.

5.9 Use with the Rosemount 333 HART Tri-Loop

To prepare the transmitter for use with a Rosemount 333 HART Tri-Loop, the transmitter must be configured to Burst Mode and the process variable output order must be set. This can be done using the AMS Device Manager or a Field Communicator.

Procedure

1. Make sure the transmitter is properly configured.
2. If desired, change the measurement units.

   a. Select **Configure** > **Manual Setup** > **Device Setup** > **Units**.

3. Set the desired transmitter variable to use for Primary Variable (PV), Secondary Variable (SV), Third Variable (TV), and Fourth Variable (QV).

    a. Select **Configure** > **Manual Setup** > **Device Setup** > **HART**.

    b. Under *Variable Mapping*, select variables for PV, SV, TV, and QV.

4. Set the Rosemount 5408 to Burst Mode.

    - HART Revision 6:

        a. Select **Configure Burst Mode**.

        b. Under *Burst Mode*, select **On**.

        c. Under *Burst Command*, select **PV, SV, TV, QV**.

        d. Select **Send**.

    - HART Revision 7:

        a. Select **Configure Burst Mode**.

        b. Select **View/Configure Message 1**.

        c. Under *Message 1 Broadcast*, select **Wired HART Enabled**.

        d. Under *Burst Command*, select **PV, SV, TV, QV**, and then select **Next**.

        e. Under *Burst Msg Trigger Mode*, select **Continuous**, and then select **Next**.

        f. Set the Update Period, and then select **Finish**.

5. Prior to exiting the configuration, note the selected variables for SV, TV, and QV, and the units set for each of the variables. The same configuration must be used for the Rosemount 333.

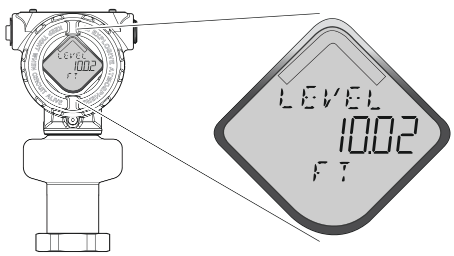
    Refer to the Rosemount 333 HART Tri-Loop *Reference Manual* for full information about installing and configuring the Rosemount 333.

6 Operation

6.1 LCD display screen messages

The optional LCD display shows output variables and abbreviated diagnostic messages.

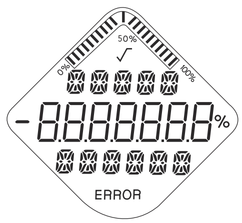
Figure 6-1: LCD Display (Option Code M5)



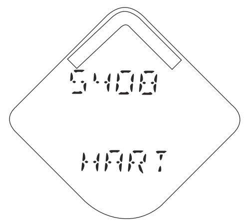
6.1.1 Startup screen sequence

The following screens are shown on the LCD display when the transmitter is switched on:

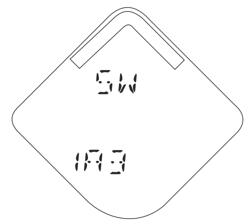
Figure 6-2: Startup Screen Sequence



1. All segments on

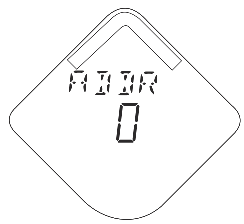


2. Device type and communication protocol



3. Software revision

4. Serial number



5. Device HART address

6.1.2 Variable screens

The Rosemount™ 5408 and 5408:SIS Level Transmitters can display the following variables:

Table 6-1: LCD Display Variables

Parameter	Presentation on display	Description
Level	LEVEL	The current level measurement value.
Distance	DIST	Distance from the upper reference point to the product surface.
Level Rate	LR	The current velocity at which the level is moving. A positive value indicates the surface is moving up.
Signal Strength	AMP	The signal amplitude of the surface echo.
Volume	VOLUM	Volume of the product at the current level.
Electronics Temperature	ITEMP	The current temperature at the electronics.
Signal Quality (1)	SIG QUALITY	The quality of product surface echo signal compared to surface threshold and noise.
Scaled Variable(1)	SCALE (2)	A variable calculated from a scaling table (as defined by pairs of input/scaled values).

Table 6-1: LCD Display Variables *(continued)*

Parameter	Presentation on display	Description
Percent of Range Primary Variable	PV %RANGE	A variable value expressed in percent within a range defined by a Lower Range Value (LRV) and an Upper Range Value (URV).
Auxiliary Percent of Range	AUX %RANGE	A variable value expressed in percent within a range defined by a Lower Range Value (LRV) and an Upper Range Value (URV).
User Defined Variable(1)	USER(2)	A variable associated with a selected register in the device. Refer to *Table C-5* for a list of suitable register variables.

(1) Only for transmitters ordered with Smart Diagnostics Suite (option code DA1).

(2) Default, user selectable display text (up to five characters).

6.2 Set up the LCD display

It is possible to specify the variables to be presented on the optional LCD display.

6.2.1 Use Rosemount Radar Master Plus

1. Under *Configure*, select **Device Setup**, and then select the **Display** tab.
2. Select the desired variables to be displayed on the LCD display.
3. Select **Save**.

6.2.2 Use AMS Device Manager and Field Communicator

1. Select **Configure** > **Manual Setup** > **Device Setup** > **Display**.
2. Select the desired variables to be displayed on the LCD display.
3. Select **Send**.

6.3 View measurement data

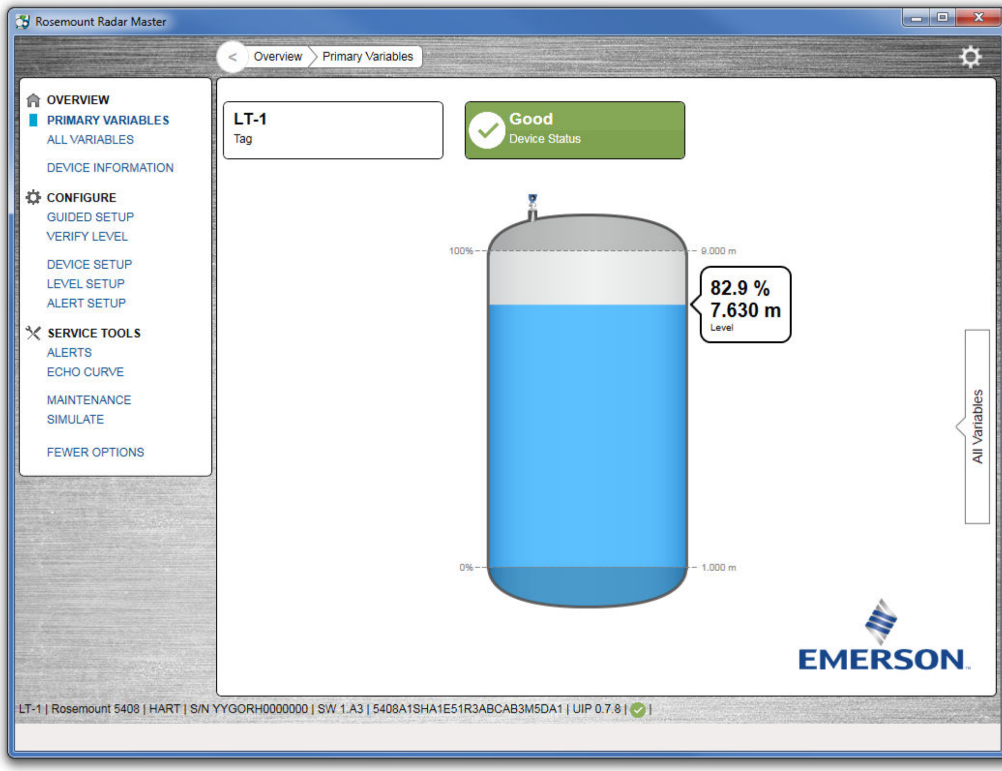
Measurement values can be viewed using Rosemount Radar Master Plus, AMS Device Manager, Field Communicator, or other communicator.

6.3.1 Use Rosemount Radar Master Plus

Current measurement data of the primary variables are presented on the Overview screen together with a graphical representation of the tank.

Select **All Variables** to view a complete list of all variables within the transmitter.

Figure 6-3: Rosemount Radar Master Plus - Overview Screen



6.3.2 Use AMS Device Manager and Field Communicator

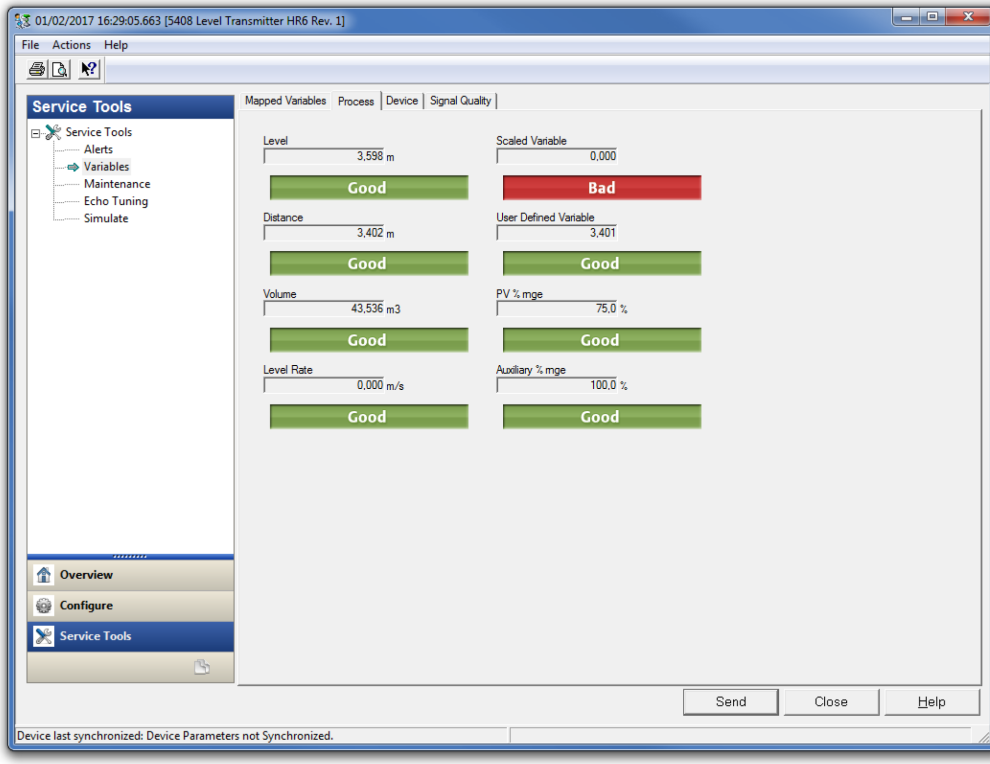
Current measurement data of the primary variables are presented on the Overview screen. To view all current measurement values, do the following:

1. Select **Service Tools Variables**.
2. Select **Mapped Variable**, **Process**, **Device**, or **Signal Quality**.

6.3.3 Interpret measurement status

A "Good" or "Bad" status next to a value is an indication of the reliability or integrity of the data being received, not an indication of whether or not the value is within the configured upper or lower ranges. A value that triggers an alert, such as a high or low temperature indication, will change the overall status of the device, but the measurement might still be indicated as "Good" if the reliability of the data is good.

Figure 6-4: AMS Device Manager - Status Indicators



6.4 Device status

The overall device status is presented under the Overview screen in Rosemount Radar Master Plus, AMS Device Manager, and Field Communicator. The transmitter reports diagnostic alerts when there is a device malfunction. For information on these alerts, see *Section 7.2*.

The device can also be configured to report user defined alerts based on the measured variables, see *Section C.4.3* for more information.

6.4.1 Check device status

Follow this procedure to check device status and see whether there are any active alerts reported.

1. Go to the **Overview** screen to view the overall device status.
2. If status is anything than Good, click the button in the device status image to open a window with active alerts. The different device status images are shown in *Table 6-2* and *Table 6-3*.

   Active Alerts can also be obtained via **Service Tools** > **Alerts**.

Table 6-2: Presentation of Device Status Images as per NAMUR NE 107 - AMS Device Manager

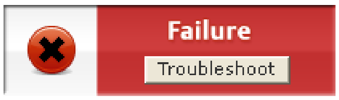
Device status image	Category	Description	Action
Device: 	Good	No active alert.	N/A
Device: 	Failure	At least one Failure alert is active.	Click the **Troubleshoot** button to open a window with active alerts together with recommended actions.
Device: 	Function Check	At least one Function Check alert is active (and no Failure alerts).	Click the **Investigate** button to open a window with active alerts together with recommended actions.
Device: 	Out of Specification	At least one Out of Specification alert is active (and no Failure or Function Check alerts).	
Device: 	Maintenance Required	At least one Maintenance Required alert is active (and no Failure, Function Check, or Out of Specification alerts).	

Table 6-3: Presentation of Device Status Images as per NAMUR NE 107 - Rosemount Radar Master Plus

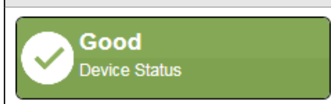
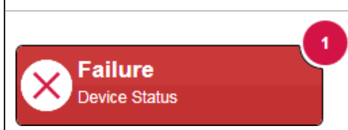
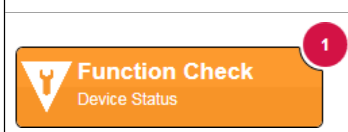
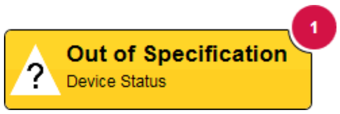
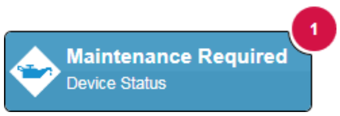
Device status image	Category	Description	Action
	Good	No active alert.	N/A
	Failure	At least one Failure alert is active.	Click the device status image to open a window with active alerts together with recommended actions.
	Function Check	At least one Function Check alert is active (and no Failure alerts).	

Table 6-3: Presentation of Device Status Images as per NAMUR NE 107 - Rosemount Radar Master Plus *(continued)*

Device status image	Category	Description	Action
	Out of Specification	At least one Out of Specification alert is active (and no Failure or Function Check alerts).	
	Maintenance Required	At least one Maintenance Required alert is active (and no Failure, Function Check, or Out of Specification alerts).	

7 Service and Troubleshooting

7.1 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 safe installation and servicing guidelines could result in death or serious injury.

- **Make sure the transmitter is installed by qualified personnel and in accordance with applicable code of practice.**
- **Use the equipment only as specified in this manual. Failure to do so may impair the protection provided by the equipment.**

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 Field 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 and Non-Incendive/Type n 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.**

Process leaks could result in death or serious injury.

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

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.**
- **Make sure 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.**

7.2 Diagnostic messages

Diagnostic messages per NAMUR NE 107 are listed in *Table 7-1* to *Table 7-5*.

Table 7-1: Status - Failed

LCD display message	Host diagnostic message	Description	Recommended actions
ELEC FAILUR	Electronics Failure, Transmitter	An electronics error has occurred. The device measurement reading is invalid.	1. Restart the device. 2. If the condition persists, replace the device.
ELEC FAILUR	Electronics Failure, Sensor Module	An electronics error has occurred. The device measurement reading is invalid.	1. Restart the device. 2. If the condition persists, replace the device.
MEMRY FAILUR	Device Memory Failure	A device memory error has occurred. The device measurement reading is invalid.	1. Restore default settings, restart device, and reconfigure the device. 2. If the condition persists, replace the device.
SIGNL FAILUR	Radar Signal Failure	The received radar signal is invalid resulting in an invalid device measurement reading.	1. Clean the antenna. 2. If the condition persists, replace the device.
START FAILUR	Startup Failure	Device repeatedly failed to start up with user configuration settings. The device measurement reading is invalid.	1. Check supply voltage is within range and restart device. 2. Restore default settings, restart device, and reconfigure the device. 3. If the condition persists, replace the device.
SW ERROR	Software Error	The software in the device encountered a problem and stopped running which may cause an invalid measurement reading. In some cases, problems may be caused by temporary environmental conditions (e.g. electromagnetic interferences) and not observed again.	1. Restart the device. 2. Restore default settings and reconfigure the device. 3. If the condition persists, replace the device.

Table 7-1: Status - Failed *(continued)*

LCD display message	Host diagnostic message	Description	Recommended actions
MEAS FAILUR	Level Measurement Lost	No valid level reading. Reasons may be multiple: • No valid surface echo peak in the measuring range. • Incorrect device configuration.	1. Analyze the Echo Curve at time of loss for reason and check device configuration, especially thresholds. 2. Check device physical installation (for instance antenna contamination). 3. Consider increasing Measurement Recovery Time parameter for intermittent conditions. 4. Restart the device. 5. Restore default settings and reconfigure the device. 6. If the condition persists, replace the device.
CONFG ERROR	Configuration Error	The device has detected a configuration error. Reasons may be multiple (see *Table 7-2* for details).	1. Click the Details button for more information. 2. Correct the parameter causing the error.

Table 7-2: Configuration Error Details

Host diagnostic message	Description	Recommended actions
Volume Configuration Error	The volume cannot be calculated correctly with the current configuration.	1. If strapping table is used, check that level-volume values are entered in increasing order. 2. If strapping table is used, check that number of strapping points to use is correct. 3. If tank dimensions are used for volume, check that geometry shape and size measures are correct. 4. If condition persists, restore default settings and reconfigure the device.
Scaled Variable Configuration Error	The Scaled Variable configuration is incorrect.	1. Check that the value pairs in the scaled variable table are entered in increasing order. 2. Check the number of table points to use is correct. 3. If condition persists, restore default settings, and reconfigure the device.
Geometry Configuration Error	The configured tank geometry results in a too large level measuring range for this device.	1. Check tank geometry configuration and reduce Reference Height. 2. If condition persists, restore default settings and reconfigure the device.

Table 7-2: Configuration Error Details *(continued)*

Host diagnostic message	Description	Recommended actions
Primary Variable Configuration Error	The Primary Variable selection is not supported. **Note** Rosemount 5408:SIS only supports level or distance as Primary Variable.	1. Change Primary Variable to variable supported by device. 2. Consider purchasing an upgrade of the device to access additional variables.
Measurement Correction Configuration Error	The factory measurement correction data is invalid.	1. Restore default settings and reconfigure the device. 2. If the condition persists, replace the device.
Threshold Configuration Error	The surface threshold configuration is incorrect.	1. In the threshold table, check that distance-threshold values are entered in increasing order. 2. Check that the number of threshold points to use is correct. 3. If condition persists, restore default settings and reconfigure the device.
Factory Approval Error	The Sensor Module factory approval is missing. The Transmitter factory approval is missing.	1. Restart the device. 2. Restore default settings and reconfigure device. 3. If the condition persists, replace the device.
SIS Configuration Error	It is currently not possible to enable Safety Mode due to other active alerts. **Note** Rosemount 5408:SIS only supports liquids level measurement when operating in Safety (SIS) mode.	1. Clear other active alerts by priority order until this alert is cleared. 2. Change Operational Mode to Control/ Monitoring if device is not intended to be used as safety device. 3. If the condition persists, restore default settings and reconfigure device.
Function Not Supported	Functionality in the device is enabled, but not supported by this device. Additional features may be enabled by purchasing an upgrade of the device.	1. Check that selections for variables (e.g. Primary Variable) are supported by this device. 2. Turn off functionality not supported by this device. 3. Consider purchasing an upgrade of the device to access additional variables and functionality. 4. If condition persists, restore default settings and reconfigure device.
Antenna Type Configuration Error	The configured Antenna Type is not supported by the device.	1. Check configuration of Antenna Type. 2. Make sure the configured antenna type matches the physical antenna for the device.

Table 7-2: Configuration Error Details *(continued)*

Host diagnostic message	Description	Recommended actions
Factory Calibration Error	The factory calibration in the device is missing.	• Replace the device.
Analog Out Span Configuration Error	The span for the configured analog out range is too small.	• Increase analog out span by adjusting Upper or Lower Range Value.
Analog Out Calibration Error	Analog output calibration failed.	1. Try calibrating the analog output again. 2. If the condition persists, replace the device.
SIS Multidrop Error	HART multidrop mode is not supported for safety (SIS) devices. Only 4-20 mA output is supported for safety devices.	1. Disable multidrop mode. 2. Change Operational Mode to Control/Monitoring if device is not intended to be used as safety device. 3. If the condition persists, restore default settings and reconfigure device.
Engineering Unit Configuration Error	One of the configured engineering units is not supported by the device.	1. Check unit configuration. 2. If condition persists, restore default settings and reconfigure device.
Burst Mode Configuration Error	The burst mode configuration is incorrect.	1. Check configuration of burst mode. 2. If condition persists, restore default settings and reconfigure device.
Start Code Configuration Error	The start code to enable options in the device is invalid. **Note** Start codes are unique for individual devices and cannot be copied from one device to another.	1. Enter a valid start code for this device using the Upgrade function. 2. If condition persists, contact your local Emerson representative to get a valid start code.

Table 7-3: Status - Function Check

LCD display message	Host diagnostic message	Description	Recommended actions
SAFE DISBLD	Safety Mode Not Activated	Safety Mode is disabled and device is in alarm mode. This device is configured for use in Safety Instrumented Systems (SIS) which requires Safety Mode to be enabled.	1. Change Safety Mode to Enabled for use in SIS application. 2. Change Operational Mode to Control/Monitoring if device is not intended to be used as safety device.

Table 7-3: Status - Function Check *(continued)*

LCD display message	Host diagnostic message	Description	Recommended actions
SIMUL ACTIVE	Simulation/Test Active	The device is in simulation or test mode and is not reporting actual information.	1. If this behavior is not desired, stop simulation or test mode. 2. If the condition persists, restart device.

Table 7-4: Status - Out of Specification

LCD display message	Host diagnostic message	Description	Recommended actions
TEMP LIMITS	Electronics Temperature Out of Limits	The temperature of the electronics board has exceeded the transmitter's operating range.	1. Verify ambient temperature is within the operating range. 2. Remote mount the transmitter away from the process and environmental conditions.

Table 7-5: Status - Maintenance Required

LCD display message	Host diagnostic message	Description	Recommended actions
SUPLY LOW	Supply Voltage Low	The supply voltage is low and may affect device operation.	• Check supply voltage is within range.
LOW SIG Q	Low Signal Quality	The Signal Quality is below the defined alert limit.	1. Take action based on your intended use of this alert. 2. Clean the antenna. 3. If no actions were necessary, consider to change the limit.
HIGH ALERT	High User Defined Alert	The user defined variable is above the defined limit.	1. Bring the system to a safe state. 2. Verify that the process variable is within specified limits. 3. Reconfirm the user defined alarm limit. 4. If not needed, disable this alert.
LOW ALERT	Low User Defined Alert	The user defined variable is below the defined limit.	1. Bring the system to a safe state. 2. Verify that the process variable is within specified limits. 3. Reconfirm the user defined alarm limit. 4. If not needed, disable this alert.

Table 7-5: Status - Maintenance Required *(continued)*

LCD display message	Host diagnostic message	Description	Recommended actions
VAR OUTRNG	Linearized Variable Out of Range	The level measurement is outside the configured range for volume or scaled variable, or both. Accuracy of volume/scaled variable measurement may be degraded.	1. If volume strapping table is used, make sure level values within operating range are included. 2. If scaled variable table is used, make sure input variable values within operating range are included.
DC DEGRAD	Dielectric Constant Estimation Degraded	The dielectric constant estimation is degraded. Accuracy of level measurement may be degraded.	1. Check configuration of Bottom Product Dielectric Constant. 2. Check configuration of Reference Height and Bottom Offset. 3. If not needed, disable Tank Bottom Projection.

7.3 Troubleshooting guide

If there is a malfunction despite the absence of alerts, *Table 7-6* see and *Table 7-7* for information on possible causes and recommended actions.

The troubleshooting guide contains the following symptoms:

- Incorrect level readings (see *Table 7-6*)
- Troubleshooting the 4-20 mA/HART output (see *Table 7-7*)

Table 7-6: Incorrect Level Readings

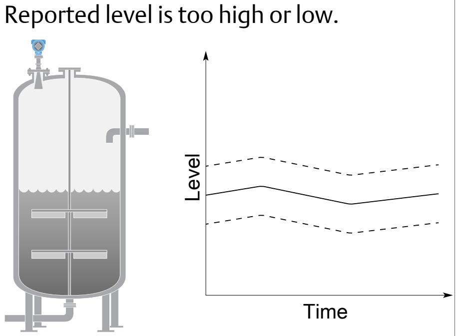
Symptom (1)	Possible causes	Recommended actions
Reported level is too high or low. 	Incorrect tank geometry configuration.	• Verify the tank geometry parameters are configured correctly (especially the Reference Height). • Run Verify Level to adjust level measurement, see *Section 5.7*. • Analyze the echo curve and check amplitude thresholds, see *Amplitude thresholds*. • Restore default settings and reconfigure the device.
Level is stuck in measuring range.	Incorrect alignment of the transmitter.	• Verify the transmitter head is correctly aligned, see *Section 3.5.7*.

Table 7-6: Incorrect Level Readings *(continued)*

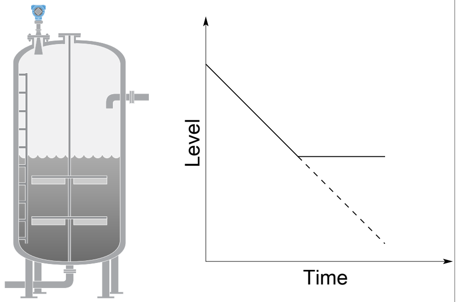
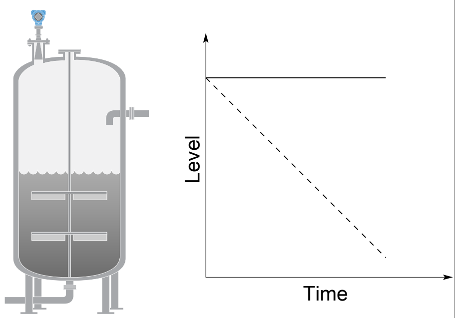
Symptom (1)	Possible causes	Recommended actions
	Disturbing objects in the tank.	• Use the suppress false echoes function to manage strong disturbance echoes, see *Suppressing false echoes*. • Analyze the echo curve and check amplitude thresholds, see *Amplitude thresholds*. • Remove the disturbing object. • Change alignment of transmitter head in steps of about 15 degrees, see *Section 3.5.7*. After each step, check if impact of disturbing echoes is decreased using the echo curve. • Put an inclined metal plate on top of the disturbing object. • Move the transmitter to another position. Refer to *Section 3.3* for installation considerations.
Level is stuck in full tank. 	Disturbing objects near the antenna.	• Use the suppress false echoes function to manage strong disturbance echoes, see *Suppressing false echoes*. • Analyze the echo curve and check amplitude thresholds, see *Amplitude thresholds*. • For process seal antenna installed in a nozzle taller than 10-in. (25 cm), adjust the pre-configured amplitude threshold, see *Section 7.5.1*. • Increase the Upper Null Zone, see *Section 7.5.1*. • Remove the disturbing object. • Move the transmitter to another position. Refer to *Section 3.3* for installation considerations.
	Product build-up on the antenna.	• Clean the antenna. • Use transmitter with air purging connection.
	Cone antenna does not extend below the nozzle.	Use the extended cone antenna.

Table 7-6: Incorrect Level Readings *(continued)*

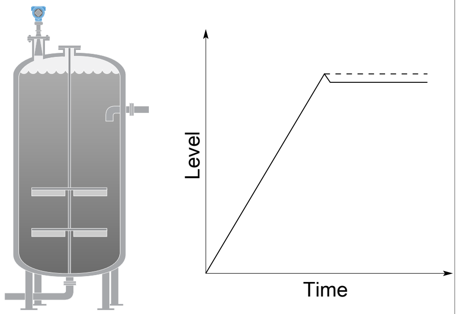
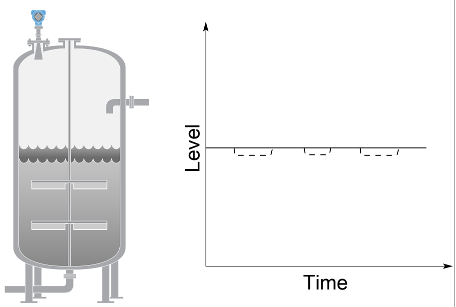
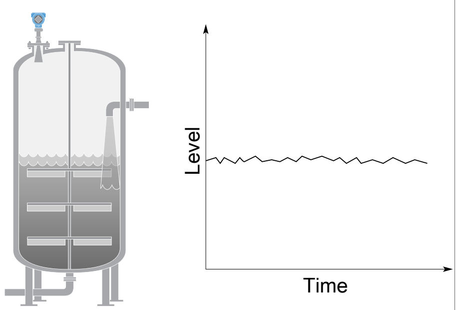
Symptom [1]	Possible causes	Recommended actions
Level value drops to a lower value when product surface is close to antenna.  	Product surface is within the Upper Null Zone and a disturbance echo is interpreted as the product surface.	Check the setting of the Upper Null Zone, see *Upper null zone*.
Measured value jumps to a lower value.  	Multiple products in the tank, e.g. thin oil layer on top of water that is sometimes detected, sometimes not.	Set Double Surface Handling to Track Upper Surface or Track Lower Surface, see *Double surface handling*.
Measured level fluctuates.  	Excessive foaming or turbulence.	• Under turbulent conditions with low level rates, consider increasing the Damping value, see *Damping value*. • Enable the Foam parameter or Turbulent Surface parameter, or both. See *Process conditions*. • If two surfaces are seen in foamy applications, set Double Surface Handling to Track Lower Surface. See *Double surface handling*.

Table 7-6: Incorrect Level Readings *(continued)*

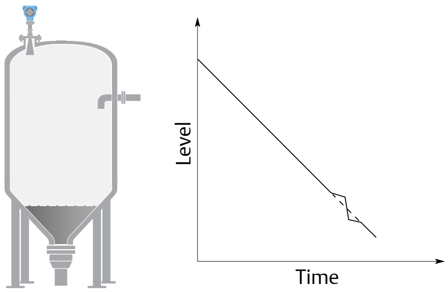
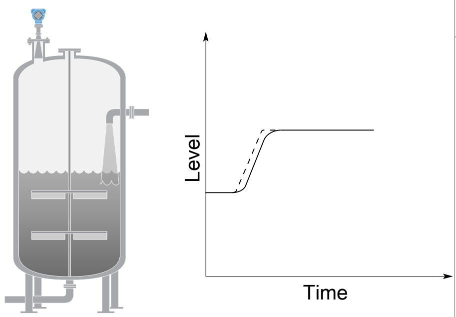
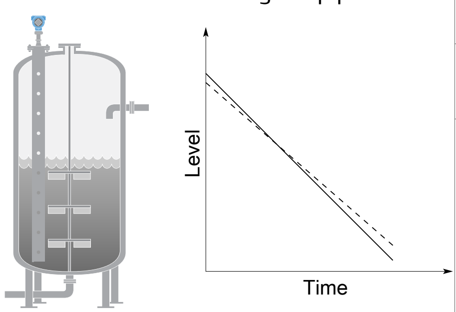
Symptom [1]	Possible causes	Recommended actions
Measured level is occasionally unstable. 	May be caused by an empty tank with the amplitude threshold set too low.	Analyze the echo curve and check amplitude thresholds, see *Amplitude thresholds*.
	The product surface is close to a suppressed false echo.	If possible, remove the disturbing object.
Measured level lags during rapid level changes. 	Damping value too high.	If there is a problem with lag during rapid level changes, consider decreasing the Damping value, see *Damping value*.
	Maximum Level Rate value too low.	Verify Maximum Level Rate configuration.
Incorrect level when using still pipe. 	Device is not configured for still pipe measurement.	Enable pipe measurement, see *Mounting type*.
	Incorrect Pipe Inner Diameter configuration.	Verify the configured Pipe Inner Diameter matches the physical inner diameter.
	Ghost echo problems below the product surface.	Enable the Track First Echo function, see *Section 7.5.3* .

Table 7-6: Incorrect Level Readings *(continued)*

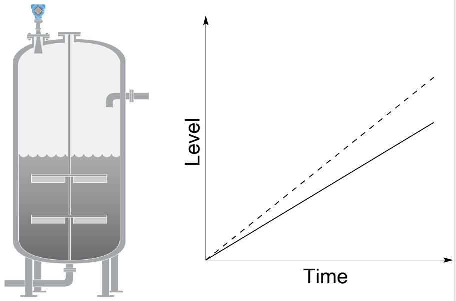
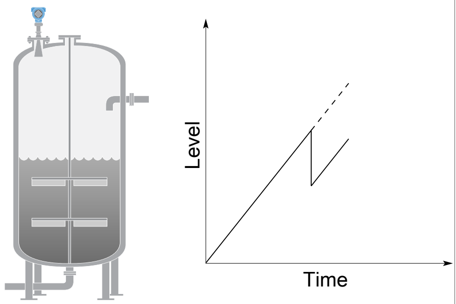
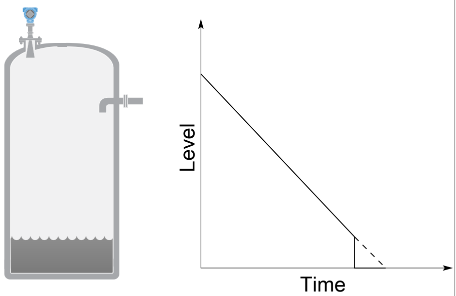
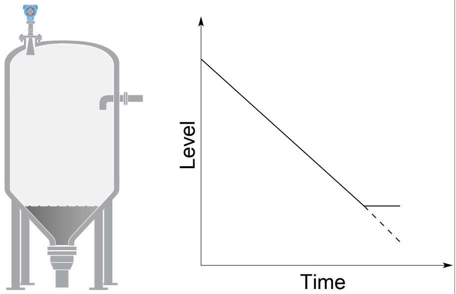
Symptom [1]	Possible causes	Recommended actions
Measured level is correct at 0% (4 mA) but incorrect at 100% (20 mA).  	Upper Range Value is not set correctly.	Check that the Upper Range Value matches the 100% (20 mA) level in the tank.
Incorrect level when the product surface is above the 50% level.  	Strong double bounce echo that is interpreted as the product surface.	Enable the Double Bounce Handling function, see *Section 7.5.4*.
Measured value drops to zero level.  	Transmitter has locked on a strong tank bottom echo.	• Verify the Reference Height is configured correctly. • Enable the Tank Bottom Projection function, see *Use tank bottom projection*. • Enable the Bottom echo visible when tank is empty parameter, see *Enable bottom echo visible when tank is empty*.

Table 7-6: Incorrect Level Readings *(continued)*

Symptom (1)	Possible causes	Recommended actions
When the product surface is near the sloped tank bottom, the transmitter enters alarm mode. 	Reduction of projected surface area close to sloping tank bottom.	• Verify the tank geometry parameters are configured correctly (especially the Reference Height and Bottom Offset). • If measurement in this region is not crucial, increase the Empty Tank Detection Area, see *Empty tank handling*. • Verify the Bottom echo visible when tank is empty parameter is disabled, see *Enable bottom echo visible when tank is empty*.

(1) - - - - - - - - = actual level ———————— = reported level

Table 7-7: Troubleshooting the 4-20 mA/HART Output

Symptom	Recommended actions
Transmitter milliamp reading is zero.	• Verify power is applied to signal terminals. • Verify power supply voltage is adequate at signal terminals, see *Section 4.4*. • Verify transmitter and power supply are properly grounded.
Transmitter milliamp reading is too low or high.	• Verify level. • Check the settings of the 4-20 mA range values, see *Upper/lower range value*. • Verify output is not in alarm condition. • Check that power wires are connected to the correct signal terminals. • Perform Calibrate Analog Out, see *Section 7.4.5*.
Milliamp reading is erratic.	• Verify power supply voltage is adequate at signal terminals, see *Section 4.4*. • Check for external electrical interference. • Verify transmitter is properly grounded. • Verify shield for twisted pair is only grounded at the power supply end. • Under turbulent conditions with low level rates, consider increasing the Damping value.
Transmitter will not respond to changes in level.	• Verify level is between the 4 and 20 mA set points. • Verify output is not in alarm condition. • Verify transmitter is not in loop test or simulation mode.

Table 7-7: Troubleshooting the 4-20 mA/HART Output *(continued)*

Symptom	Recommended actions
There is no HART communication (lost device communication).	• Verify power supply voltage is adequate at signal terminals, see *Section 4.4*. • Check load resistance (250 ohms minimum). • Check if transmitter is at an alternate HART address. • Check current analog output value to verify that transmitter hardware works. • Verify the blue plug is attached to the TEST terminal (if applicable). When unplugged, HART communication to configuration tool may be compromised.

7.4 Service and troubleshooting tools

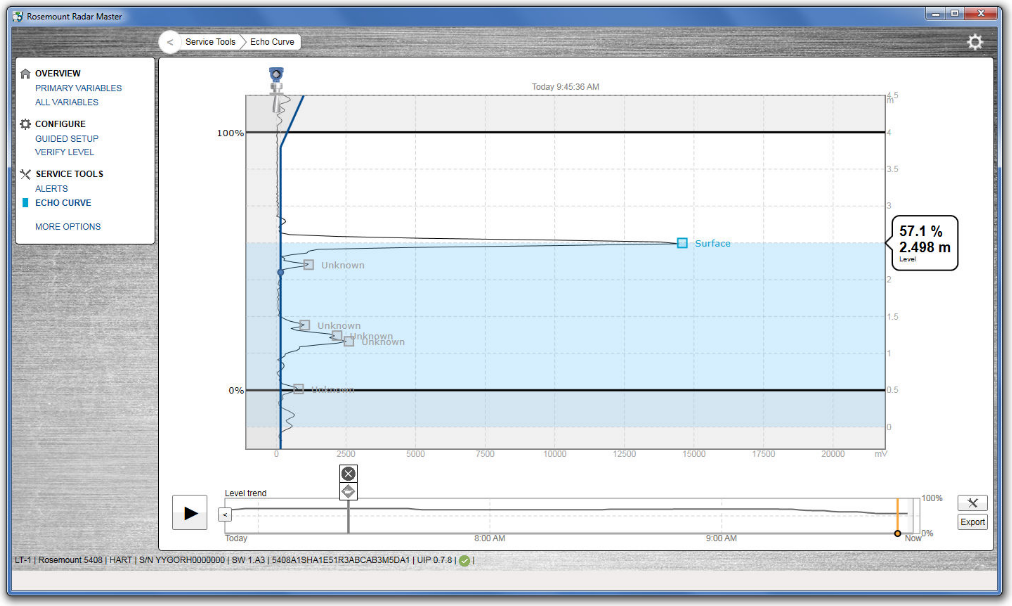
This section briefly describes tools and functions in the Rosemount Radar Master Plus, AMS Device Manager, and Field Communicator, which may be useful for service and troubleshooting of the Rosemount 5408 and 5408:SIS Level Transmitters.

7.4.1 Using the echo curve

The Rosemount Radar Master Plus software includes functions for viewing and recording single instances or movies of the echo curve. The echo curve represents the tank, as seen by the radar transmitter. Each peak corresponds to a strong reflection of the radar signal.

When connected to Rosemount Radar Master Plus, past measurement records and echo curves including the 10 highest peaks, as well as the 50 last alert events are automatically transferred from the transmitter's internal memory to the hard drive on your local computer. Past measurement records are then available the next time you connect to the transmitter using the level trend timeline.

Figure 7-1: Echo Curve



Measurement problems can be understood by studying the position and amplitude of the different peaks. Additionally, the recorded echo curves give insight into unexpected and intermittent measurement behaviors, for instance, at the time of the triggered alert.

Read the echo curve

To read the echo curve in Rosemount Radar Master Plus:

1. Under *Service Tools*, select **Echo Curve**. Rosemount Radar Master Plus reads one echo curve and then stops.
2. To continuously update the echo curve, select the **Play** icon.

Analyzing the echo curve

The following echo peaks may appear in the echo curve:

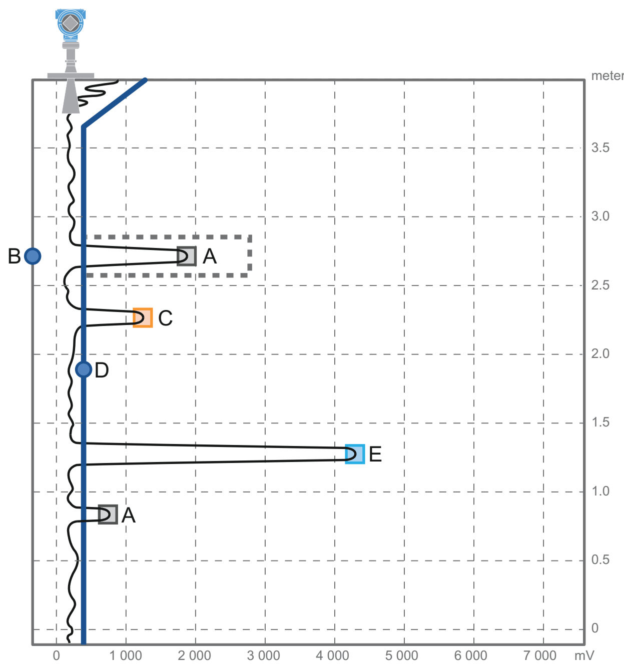
Table 7-8: Echo Peak Types

Type	Description
Surface	Echo tracked as the current surface echo
Unknown	Echo not recognized by the device, which might interfere with measurement
Suppressed	Echoes that are identified but suppressed by the device
Suppressed (double bounce)	Echo managed as a double bounce echo by the Double Bounce function

Table 7-8: Echo Peak Types *(continued)*

Type	Description
Secondary surface	Echo tracked as the current secondary surface (if Double Surface Handling function is enabled)
Tank bottom echo	Echo considered as an echo from the tank bottom

Figure 7-2: Echo Curve with Typical Echo Peaks



A. Suppressed (dashed line indicates use of false echo suppression)
B. False echo suppression
C. Unknown
D. Amplitude threshold
E. Surface

View level trends and historical echo curves

- To go to a desired point in the displayed part of the timeline, drag the slider, or click anywhere in the timeline.
- To move the timeline forward or backward, click the left or right arrow, or drag anywhere in the timeline.

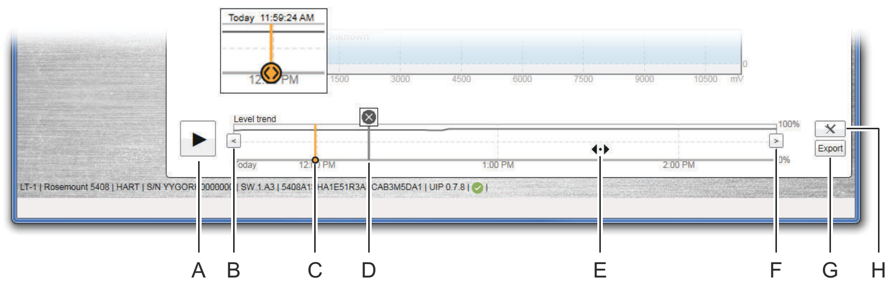
Tip

To speed up the upload time of historical data in a specific area, click or drag the slider to the desired start point on the timeline. Rosemount Radar Master Plus continues to load data from that point forward.

View active/historical alerts

In the timeline, click the left or right arrow to scroll to the alert, and then select the alert icon for details.

Figure 7-3: Level Trend Timeline



A. Play or pause
B. Left arrow
C. Timeline slider
D. History alert icon
E. Drag anywhere in the timeline to move the timeline forward or backward.
F. Right arrow
G. Export echo curves
H. Options

Play echo curve movies

1. Set the start point.
   a. Click the left or right arrow, or drag anywhere in the timeline.
   b. Click the start point in the timeline.
2. Select **Play**, or drag the timeline slider to move one frame at a time.

Export echo curve movies

1. Under *Service Tools*, select **Echo Curve**.
2. Select **Export**.

3. Type your desired file name.
4. Browse to the desired directory, and then select **Save**.
5. Under Time range, select **Last 1 hour**, **Last 3 hours**, **Last 24 hours**, or **User defined range**.
6. If **User defined range** is selected, specify the start and end times.
7. Select **Export**.
8. Select **Back**.

Set echo curve range

1. Under *Service Tools*, select **Echo Curve**.
2. Select **Options**.

3. Under *Echo Curve Range*, select **User Defined**.
4. Enter the desired values.
5. Select **Save**.
6. Select **Back**.

Set timeline resolution

To set the resolution of the level trend timeline:

1. Under *Service Tools*, select **Echo Curve**.
2. Select **Options**.

3. In the *Timeline Resolution* list, select the desired length (in hours) of the timeline.
4. Select **Save**.
5. Select **Back**.

7.4.2 Managing disturbance echoes

There are two general methods for managing disturbance echoes:

- Set amplitude thresholds to filter out weak disturbance echoes and noise.
- Use the suppress false echoes function to manage strong disturbance echoes.

Amplitude thresholds

The amplitude thresholds are used to filter out noise and disturbing echoes from the product surface echo. The transmitter uses certain criteria to decide which type of echo peak that is detected. Only echoes above the amplitude threshold might be considered the product surface. The amplitude threshold can either be set to a constant value, or split into sections as defined by up to 10 anchor points.

If necessary, a customized amplitude threshold section can for instance be used to remove the influence from the tank nozzle, or disturbances close to the tank bottom. Additionally, it might be needed in areas where there are occasionally strong echoes present, for instance due to wide mixer blades. Suppressing false echoes may not be sufficient in those areas.

Note

Do not create a customized amplitude threshold section around echoes which are already registered as false echoes.

General recommendations

Use the following best practices to apply custom threshold adjustments:

- Generally, set amplitude threshold to about 10% of surface echo amplitude.
- Do not set the amplitude threshold to less than 150 mV (50 mV for solids measurements) (1).

Adjust the threshold value

Prerequisites

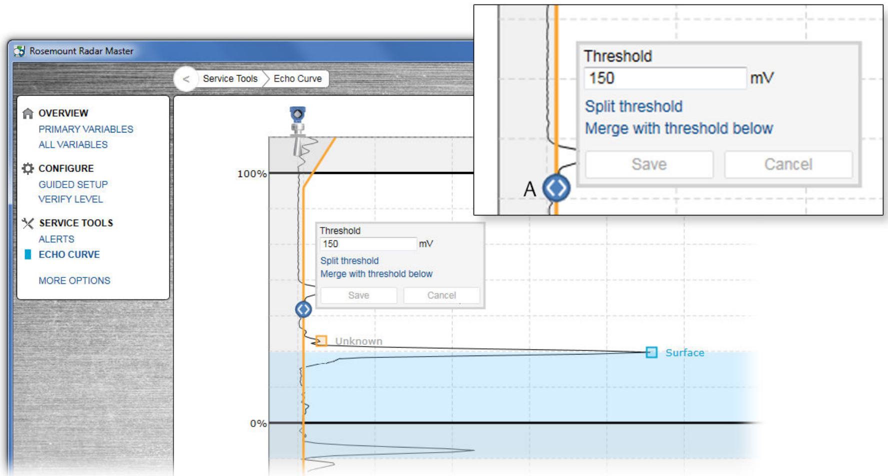
It is recommended to adjust thresholds using Rosemount Radar Master Plus.

Procedure

1. In Rosemount Radar Master Plus, under *Service Tools*, select **Echo Curve**.
2. In the echo curve, drag the amplitude threshold point left or right, or type the desired value (*Figure 7-4*).
3. Select **Save**.

(1) *If required in solids applications with weak surface echoes, the amplitude threshold can be set down to 50 mV, as long as it is greater than the disturbance echoes.*

Figure 7-4: Amplitude Threshold Point

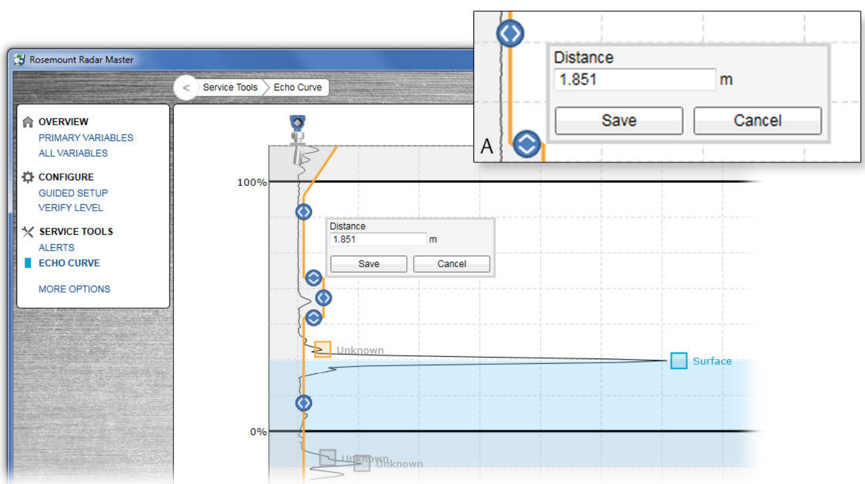


A. Amplitude threshold point

Set the endpoint of a threshold segment

1. In the echo curve, drag the endpoint up or down, or type the desired value (*Figure 7-5*).
2. Select **Save**.

Figure 7-5: Endpoint



A. Endpoint

Add or delete an amplitude threshold point

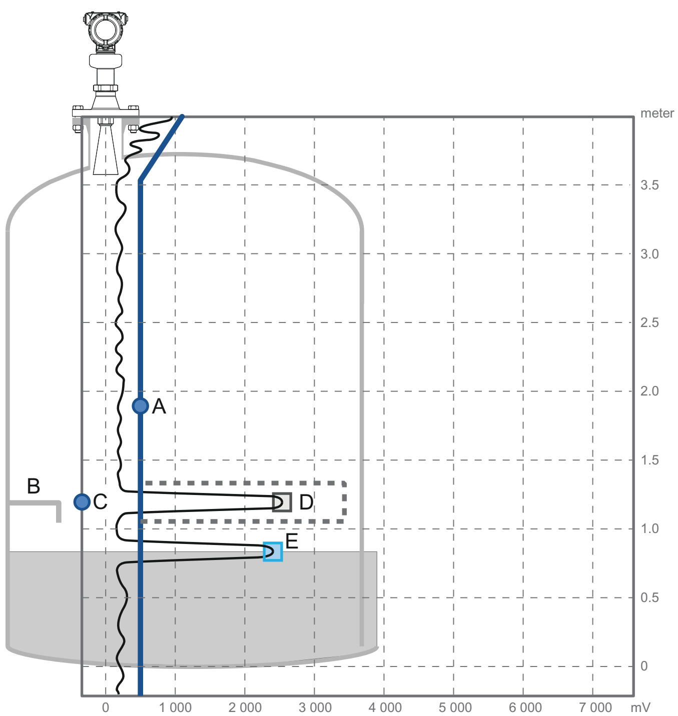
1. In the echo curve, select the desired amplitude threshold point, and select **Split threshold** or **Merge with threshold below**.
2. Click again on one of the amplitude threshold points and select **Save**.

Suppressing false echoes

Stationary objects with horizontal surfaces may generate strong false echoes. When the surface is close to an obstruction in the tank (e.g. beams and agitators), the surface and false echoes might interfere and cause a decrease in performance.

However, false echoes can be suppressed to reduce the influence of such objects, in case they cannot be totally avoided. When the surface is passing by a disturbing object, the transmitter will then measure with higher reliability, even if the surface echo is weaker than the false echo, see *Figure 7-6*.

Figure 7-6: Suppression of False Echoes



A. Amplitude threshold
B. Disturbing object
C. False echo suppression
D. Suppressed echo
E. Surface

Add a new false echo suppression

Prerequisites

Follow these recommendations before suppressing new false echoes:

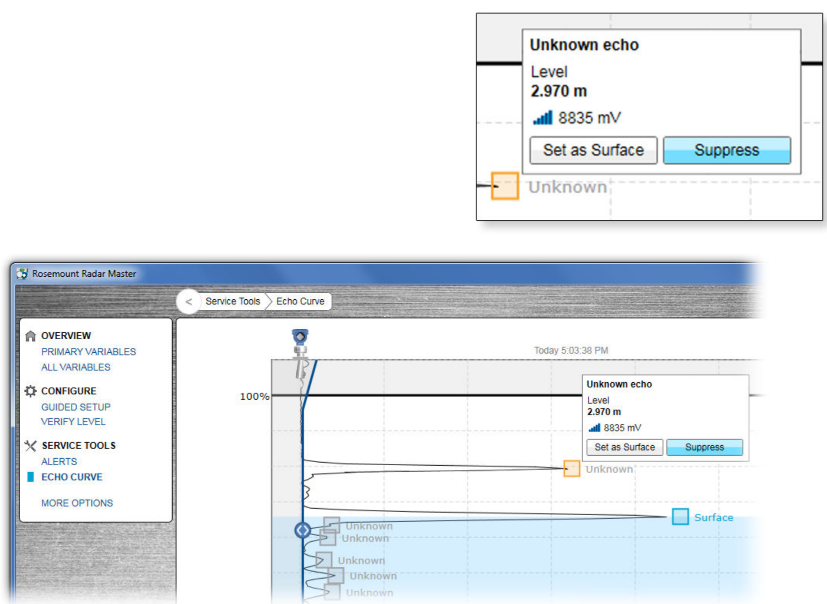
- Make sure a correct amplitude threshold is set (see *Amplitude thresholds*).
- Make sure the level is stable. A fluctuating level may indicate a temporary disturbance which is not due to an interfering object.
- Only suppress echoes which can be clearly identified as objects in the tank. Compare the list of interfering echoes with the tank drawing or visual inspection of the tank.
- Do not suppress false echoes located below the product surface.
- Keep the number of suppressed false echoes to a minimum.

It may be necessary to suppress new false echoes at a later stage when objects have become visible due to surface movement.

Procedure

1. In Rosemount Radar Master Plus, under *Service Tools*, select **Echo Curve**.
2. In the echo curve, click at the unknown echo peak, and then select **Suppress**.

Figure 7-7: Add False Echo Suppression

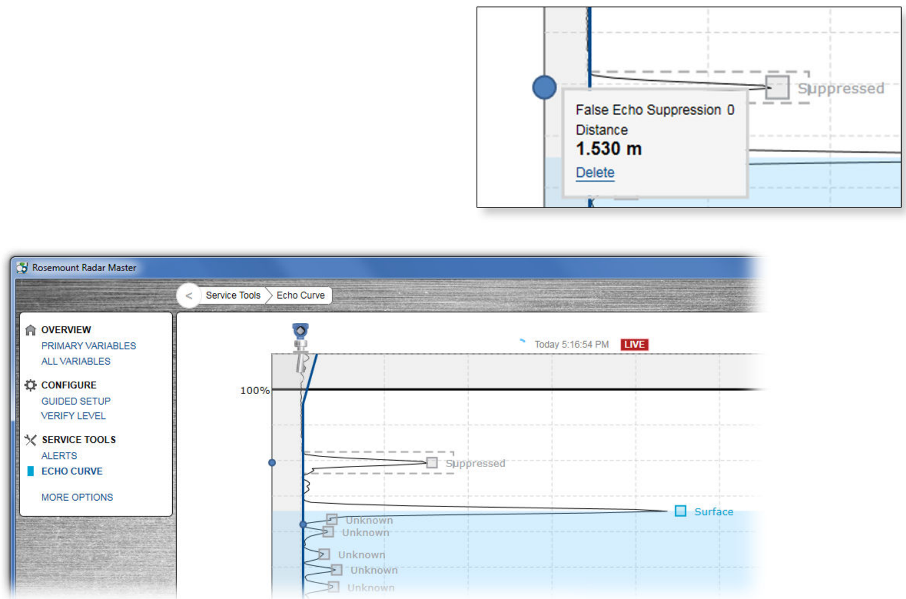


Delete a false echo suppression

1. In Rosemount Radar Master Plus, under *Service Tools*, select **Echo Curve**.

2. In the echo curve, click at the left end of the false echo suppression, and then select **Delete**.

Figure 7-8: Delete False Echo Suppression



Suppress a false echo manually

The false echo may also be suppressed manually if the position of the false echo is known.

Procedure

1. In Rosemount Radar Master Plus, under *Service Tools*, select **Echo Curve**.
2. Select **Options**.

3. Select **Suppress False Echo Manually**. Suppressed echoes are shown in the table.
   - To add a new suppression, select Add, and then type the distance to the false echo and the width of the false echo area.
   - To change a suppression, select the cell you want change and type the new value.
   - To delete a suppression, select the row you want to delete, and then select **Delete**.
4. Select **Save**.
5. Select **Back**.

Suppress false echoes using AMS Device Manager

1. Select **Service Tools Echo Tuning Suppress**. Suppressed echoes are shown in the table.
2. Select **Suppress** or **Remove Suppression**.
3. Type the distance to the echo that should be added to or removed from the list, and then select Next.
4. Select **Finish** when the `Method Complete` message appears.

Suppress false echoes using Field Communicator

1. Select **Service Tools** > **Echo Tuning** > **Suppress**.
2. To view the current suppressed echoes, select **Suppressed Echoes**.
3. Select **Suppress** or **Remove Suppression**.
4. Type the distance to the echo that should be added to or removed from the list, and then select **Enter**.

7.4.3 Perform an analog loop test

During a loop test, the transmitter outputs a fixed value (4 mA, 20 mA, or user-selected value). The loop test command verifies the output of the transmitter, the integrity of the loop, and the operations of any recorders or similar devices installed in the loop. A loop test can also be used to determine the need for an analog output calibration (see *Section 7.4.5*).

If the transmitter is equipped with a TEST terminal, current can be measured directly at the terminal block without disconnecting any signal wires. See *Section 7.4.4*.

Use Rosemount Radar Master Plus

1. Under *Service Tools*, select **Simulate**.
2. Select **Loop Test**.
3. Select **4 mA**, **20 mA**, or **Other**.
4. If **Other** is selected, enter the desired value.
5. Select **Start**.
6. Measure the loop current.
7. Select **Stop** to end loop test.

Use AMS Device Manager and Field Communicator

1. Select **Service Tools** > **Simulate**.
2. Under *Analog Out*, select **Loop test**.
3. Select **4mA**, **20mA**, or **Other**, and then select **Next** (**Enter** on Field Communicator).
4. If **Other** is selected, enter the desired value, and then select **Next** (**Enter** on Field Communicator).

5. Measure the loop current.
6. To end loop test, select **Cancel** (**ABORT** on Field Communicator).

7.4.4 Use the TEST terminal

⚠ WARNING!

Verify that the installation is consistent with the appropriate hazardous locations certifications when the instrument used for loop current measurement is connected.

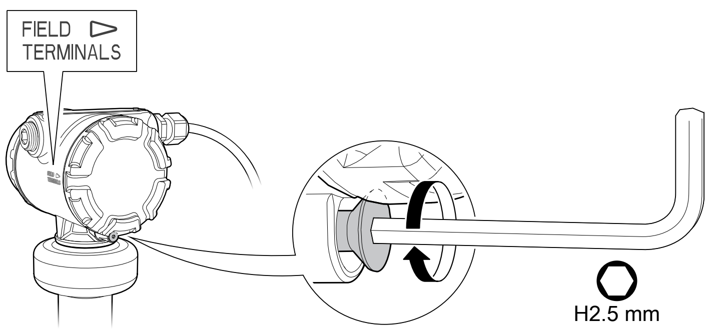
For Explosion-proof/Flameproof and Non-Incendive/Type n installations, the cover must not be opened in an explosive atmosphere.

Note

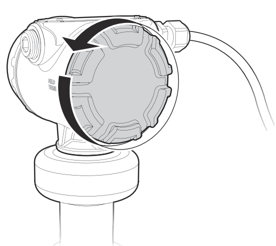
Blue plug must only be disconnected during loop current measurement procedure. To meet the stated EMC specification during normal operation, the blue plug must be plugged in.

Procedure

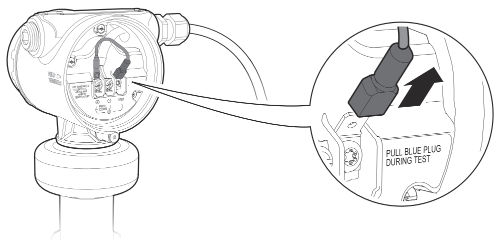
1. Turn the jam screw clockwise until it is completely threaded into the housing.



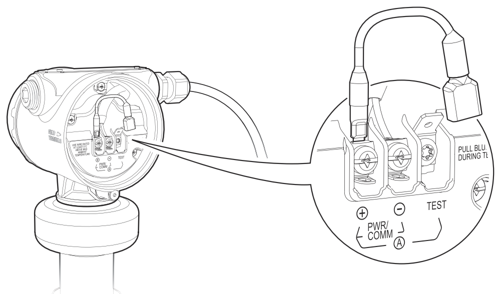
2. Remove the cover.



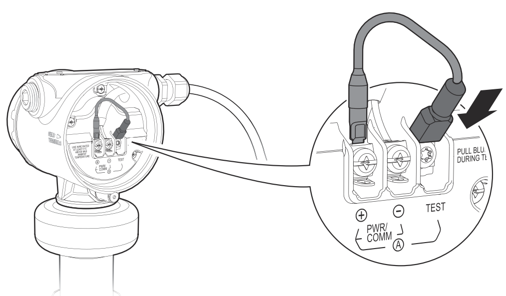
3. Remove the blue plug from the TEST terminal.



4. Connect the ampere meter leads to the terminals labeled “+” and “TEST”.

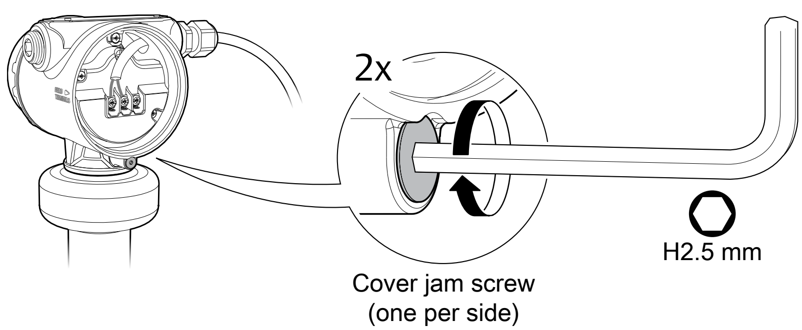


5. Measure the loop current.
6. Attach the blue plug to the TEST terminal.

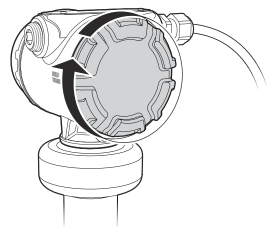


7. Attach and tighten the covers. Make sure the covers are fully engaged.

   a. Verify the cover jam screws are completely threaded into the housing.

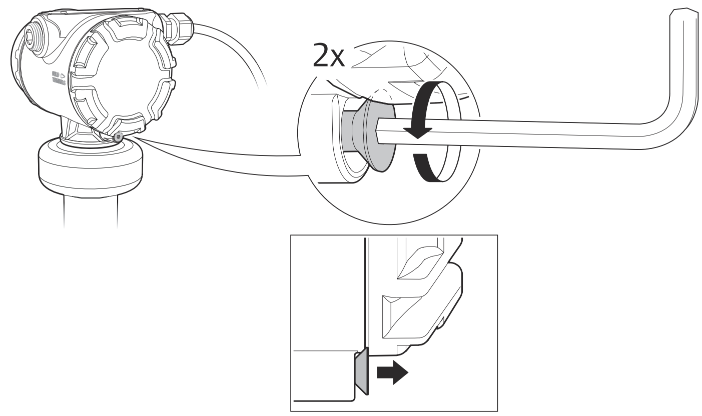


   b. Attach and tighten the covers.



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 ½ turn counterclockwise to secure the cover.

7.4.5 Calibrate analog out

Use this function to calibrate the analog output by comparing the actual output current with the nominal 4 mA and 20 mA currents. Calibration is done at factory and the analog output does not normally need to be recalibrated.

Use Rosemount Radar Master Plus

1. Under *Service Tools*, select **Maintenance** > **Routine Maintenance**.
2. Select **Calibrate Analog Out** and follow the on-screen instructions.

   AMS Device Manager and Field Communicator

Use AMS Device Manager and Field Communicator

1. Select **Service Tools** > **Maintenance** > **Routine Maintenance**.
2. Select **D/A trim** and follow the on-screen instructions.

7.4.6 Save a backup file of the device configuration

When configuration is finished, it is recommended to store the device configuration in a backup file for future reference using Rosemount Radar Master Plus. A backup of the device configuration will be saved to file as well as a configuration report (optional).

The backup file may be useful to:

- Restore the configuration of the transmitter.
- Install another transmitter in a similar tank.
- Troubleshoot the transmitter.

Procedure

1. In Rosemount Radar Master Plus, under *Service Tools*, select **Maintenance Backup**.
2. Select **Save Configuration**.
3. Type your desired file name.
4. Browse to the desired directory, and then select **Save**.
5. (Optional) Select the **Create and save report (.pdf)** check box.
6. Select **Save**.

7.4.7 Download configuration from file to device

1. In Rosemount Radar Master Plus, under *Service Tools*, select **Maintenance Backup**.
2. Select **Restore Configuration**.
3. Browse to the backup file and select **Open**.

7.4.8 Restore to default settings

This function restores the transmitter to default settings (user configuration is overwritten).

Prerequisites

Before restoring the transmitter to default settings, it is recommended to backup the device configuration, see *Section 7.4.6*. The backup file can be used to restore configuration at a later stage.

Use Rosemount Radar Master Plus

1. Under *Service Tools*, select **Maintenance** > **Reset/Restore**.
2. Select **Restore Default Settings**.

Use AMS Device Manager and Field Communicator

1. Select **Service Tools** > **Maintenance** > **Reset/Restore**.
2. Select **Restore Default Settings** and follow the on-screen instructions.

7.4.9 Use the simulation mode

This function can be used to simulate measurements.

Use Rosemount Radar Master Plus

1. Under *Service Tools*, select **Simulate**.
2. Select **Simulate** next to desired transmitter variable and follow the on-screen instructions.

Use AMS Device Manager and Field Communicator

1. Select **Service Tools** > **Simulate**.
2. Under *Simulate Measurement Values*, select desired transmitter variable and follow the on-screen instructions.

7.4.10 View input registers

Measured data is continuously stored in the input registers. By viewing the contents of the input registers, expert users can check that the transmitter works properly.

Use Rosemount Radar Master Plus

1. Under *Configure*, select **Level Setup** > **Advanced**.
2. Under *More Advanced Options*, select **Expert Options**.
3. Select the **Input Registers tab**.
4. Under Show registers by, do one of the following:
    - Select **Block**, and then in the list, select the desired register group.
    - Select **Number**, and then type the desired register number and the number of registers.

Use AMS Device Manager and Field Communicator

1. Select **Configure** > **Manual Setup** > **Level Setup** > **Advanced** > **Expert Options** > **Input Registers**.
2. Type the desired register number to start reading from.
3. Select **Read Input Registers**. 10 registers will be read, starting from the selected number.
4. (Field Communicator) Select **Input Registers**.

7.4.11 View/edit holding registers

The holding registers store various transmitter parameters, such as configuration data, used to control the measurement performance.

Note
Do not use holding registers to configure the transmitter unless you are qualified. This dialog is mainly used for service purposes and for advanced configuration.

Use Rosemount Radar Master Plus

1. Under *Configure*, select **Level Setup** > **Advanced**.
2. Under *More Advanced Options*, select **Expert Options**.
3. Select the **Holding Registers** tab.
4. Under *Show registers* by, do one of the following:
   - Select **Block**, and then in the list, select the desired register group.
   - Select **Number**, and then type the desired register number and the number of registers.
5. Select **Refresh**.
6. To change a holding register value, type a new value in the corresponding value field, or select a new value from the corresponding list.
7. Select **Save** to store the new value.

Use AMS Device Manager and Field Communicator

1. To view a holding register value:
   a. Select **Configure** > **Manual Setup** > **Level Setup** > **Advanced** > **Expert Options** > **Holding Registers**.
   b. Type the desired register number to start reading from.
   c. Select **Read Holding Registers**. 10 registers will be read, starting from the selected number.
   d. (Field Communicator) Select **Holding Registers**.
2. To edit a holding register value:
   a. Select **Configure** > **Manual Setup** > **Level Setup** > **Advanced** > **Expert Options** > **Holding Registers**.
   a. Select **Write Holding Register** and follow the on-screen instructions.

7.4.12 Write protect a transmitter

The transmitter can be write protected (with or without a password) to prevent unauthorized changes.

If the Rosemount 5408:SIS is configured for use in Safety (SIS) operational mode, then the Safety Mode must be enabled for the transmitter to become operational. When Safety Mode is enabled, the transmitter is write protected to prevent unauthorized changes.

Use Rosemount Radar Master Plus

1. Under *Overview*, select **Device Information** > **Security**.
2. Under *Write Protection*, select **Change** and follow the on-screen instructions.

Use AMS Device Manager and Field Communicator

1. Select **Configure > Manual Setup > Device Setup > Security**.
2. Under *Security*, select **Change Write Protection** and follow the on-screen instructions.

7.5 Application challenges

7.5.1 Handling disturbances at top of tank

There are two general methods for managing disturbance echoes at the top of the tank:

- Set amplitude threshold section
- Extend the Upper Null Zone

Set amplitude threshold section

If necessary, a customized amplitude threshold section can be used to block out disturbing echoes (e.g. from the tank nozzle or bypass well inlet). Refer to *Amplitude thresholds* for general guidelines.

Amplitude threshold sections are pre-configured at the factory for transmitters with process seal antenna. For nozzles taller than 10 in. (25 cm), it may be necessary to manually increase the distance value for the first endpoint (*Figure 7-9*).

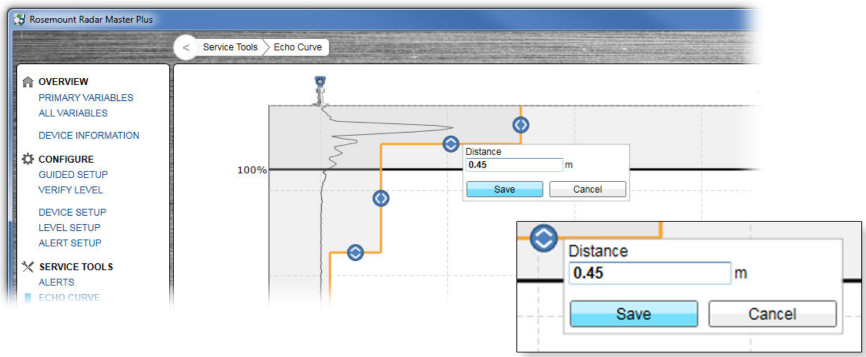
Procedure

1. In Rosemount Radar Master Plus, start the echo curve reading, see *Section 7.4.1*.
2. View the echo curve plot to find out if there are disturbing echoes close to the transmitter.
3. Calculate the required distance to the first endpoint.

Distance = Nozzle height + 2 in. (50 mm) =

4. In the echo curve, click the first endpoint and type the calculated value (*Figure 7-9*).
5. Select **Save**.

Figure 7-9: First Endpoint



A. *First endpoint*

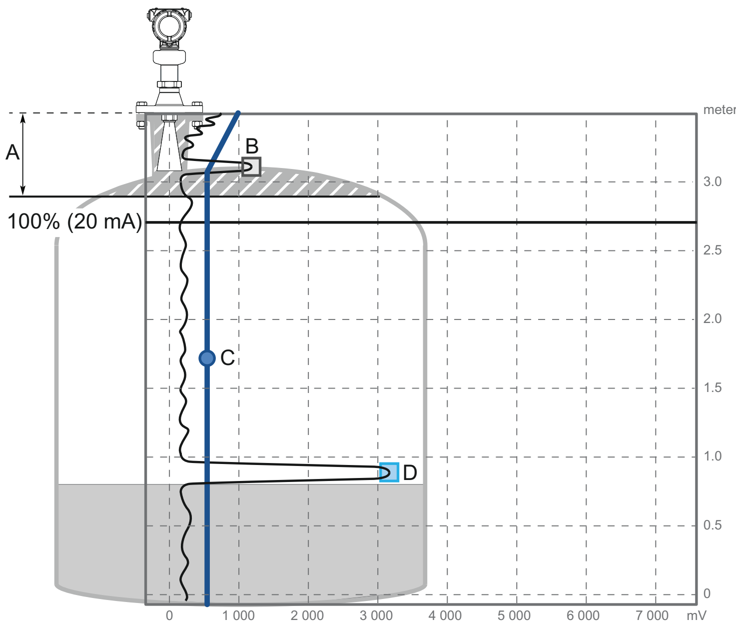
Change the upper null zone

The Upper Null Zone defines a zone close to the transmitter where echoes are ignored. This zone can be extended to block out disturbing echoes at the top of the tank.

Note

Make sure the Upper Range Value (100%/20 mA) value is below the Upper Null Zone. Measurements are not performed within the Upper Null Zone.

Figure 7-10: Upper Null Zone



A. *Upper Null Zone*
B. *Disturbance echo*
C. *Amplitude threshold*
D. *Product surface echo*

Procedure

1. Identify desired Upper Null Zone using the echo curve plot.
    a. In Rosemount Radar Master Plus, start the echo curve reading, see *Section 7.4.1*.
    b. View the echo curve plot to find out if there are disturbing echoes close to the transmitter.
2. Set the desired Upper Null Zone value.
    a. Under *Configure*, select **Level Setup** > **Antenna**.
    b. Under *Advanced*, type desired Upper Null Zone, and then select **Save**.

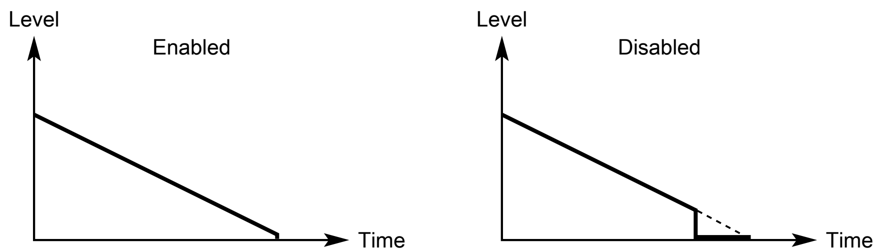
7.5.2 Tracking of weak surface echoes close to tank bottom

Use tank bottom projection

The Tank Bottom Projection function can be used to enhance measurement performance in the tank bottom region. If the product surface echo is weak in the tank bottom region and the bottom echo is strong (typical for flat tank bottoms), the transmitter may lock on the bottom echo and report a false level measurement (empty tank). If the application requires, the Tank Bottom Projection settings can be user-defined.

Figure 7-11 illustrates an example of the Tank Bottom Projection when the tank is being emptied.

Figure 7-11: Tank Bottom Projection



Procedure

1. In Rosemount Radar Master Plus, under *Configure*, select **Level Setup** > **Advanced**.
2. Under *More Advanced Options*, select **Empty Tank Handling**.
3. In the *Tank Bottom Projection* list, select **Enabled** or **Disabled**.
4. If you enabled Tank Bottom Projection, then:
   a. Set the Bottom Product Dielectric Constant.
   b. Enter Maximum Projection Distance.
   c. Enter Minimum Tank Bottom Echo Amplitude.
5. Select **Save**.

Bottom product dielectric constant

Enter the product dielectric constant for the product in the bottom of the tank.

Maximum projection distance

This defines the range in which the function operates. Enter the maximum distance from the zero level (tank bottom). It is recommended to use the default setting.

Minimum tank bottom echo amplitude

Enter the minimum allowed amplitude for the echo from the tank bottom before this function is activated. It is recommended to use the default setting.

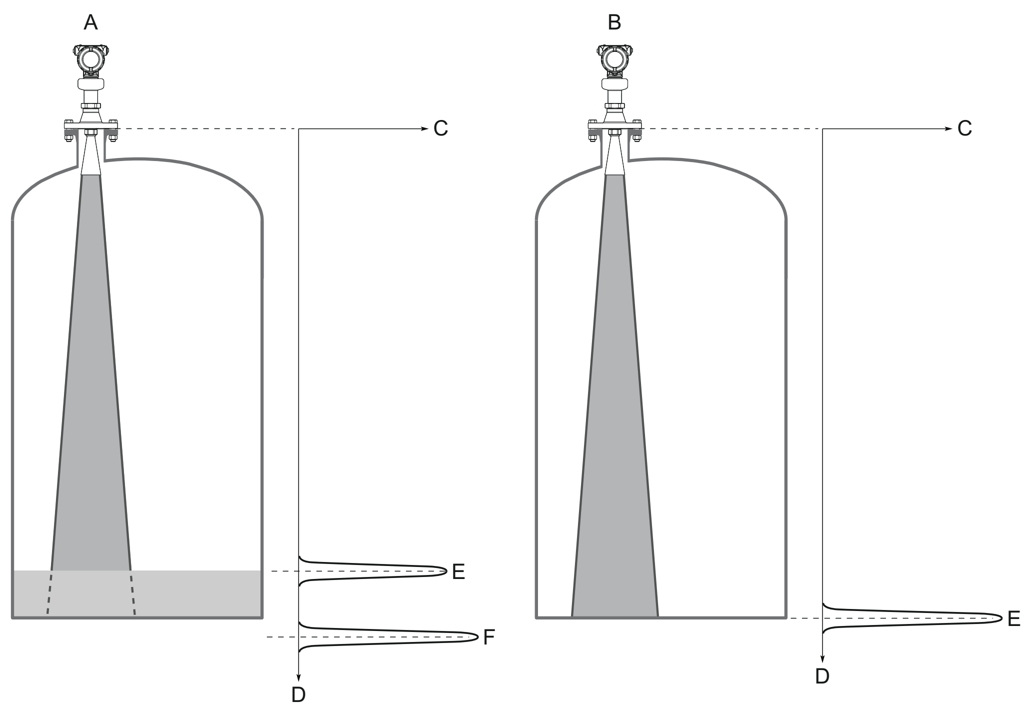
Enable bottom echo visible when tank is empty

Enable the Bottom echo visible when tank is empty parameter if a bottom echo is visible when tank is empty (i.e. for flat tank bottoms). The bottom echo will then be treated as a disturbance echo to facilitate tracking of weak surface echoes close to the tank bottom. This function may be useful for products which are relatively transparent for microwaves, such as oil.

Note

Only enable this parameter if a bottom echo is visible when tank is empty. To verify this, use the echo curve function.

Figure 7-12: Bottom Echo Visible



A. Product surface near bottom of tank
B. Empty tank
C. Signal amplitude
D. Distance
E. Surface echo
F. Echo peak from tank bottom (at the electrical distance when product in the tank)

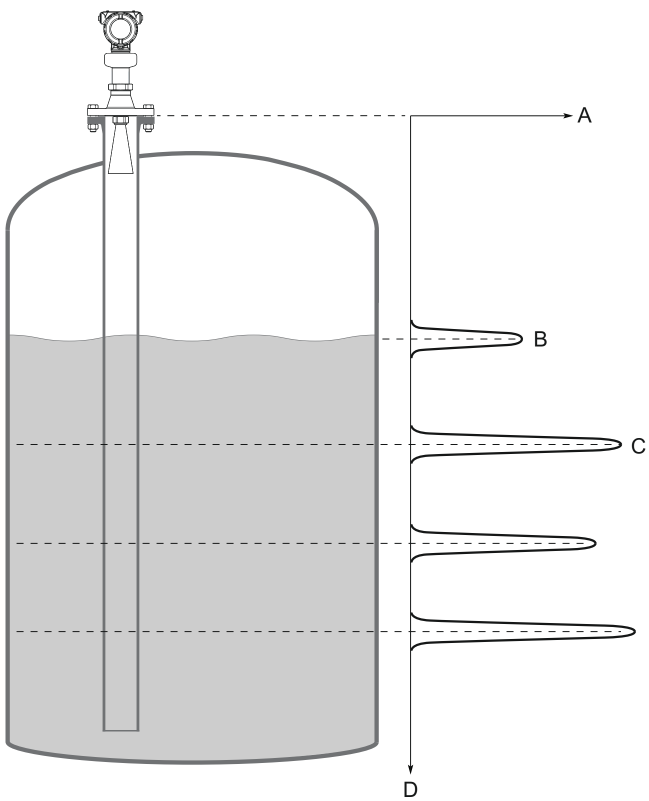
Procedure

1. In Rosemount Radar Master Plus, under *Configure*, select **Level Setup** > **Advanced.**
2. Under *More Advanced Options*, select **Empty Tank Handling**.
3. In the *Empty Tank Handling* list, select **User Defined**.
4. Select the **Bottom echo visible when tank is empty** check box.
5. Select **Save**.

7.5.3 Handling ghost echoes in still pipes

Ghost echoes may occur in still pipes because of multiple reflections between the pipe wall, flange, and antenna. In the echo curve, these echoes appear as amplitude peaks at various distances below the product surface, see *Figure 7-13*. The Track First Echo function can eliminate ghost echo problems below the product surface. When enabled, the first echo above threshold will always be considered as the surface echo.

Figure 7-13: Ghost Echoes in Still Pipes



A. Signal amplitude
B. Actual level
C. Virtual level
D. Distance

Enable the track first echo function

1. In Rosemount Radar Master Plus, read the echo curve. Make sure there are no disturbing echoes above the product surface. See *Section 7.4.1*.
2. Under *Configure*, select **Level Setup** > **Advanced**.
3. Under *More Advanced Options*, select **Echo Tracking**.
4. In the *Surface Echo Tracking* list, select **User defined**, and then select the **Track First Echo** check box.

5. Select **Save**.

7.5.4 Handling strong double bounce echoes

A double bounce echo occurs when a radar signal bounces back and forth between the product surface and tank roof (or other object within the tank) before it is detected by the transmitter. Normally, these signals have a low amplitude and are ignored by the transmitter.

Double bounces are most commonly present in spherical or horizontal cylinder tanks, and usually appear when the tank is about 60-70% filled. In these cases, the amplitude may be strong enough for the transmitter to interpret the double bounce as the surface echo. The Double Bounce Handling function is used for managing such problems.

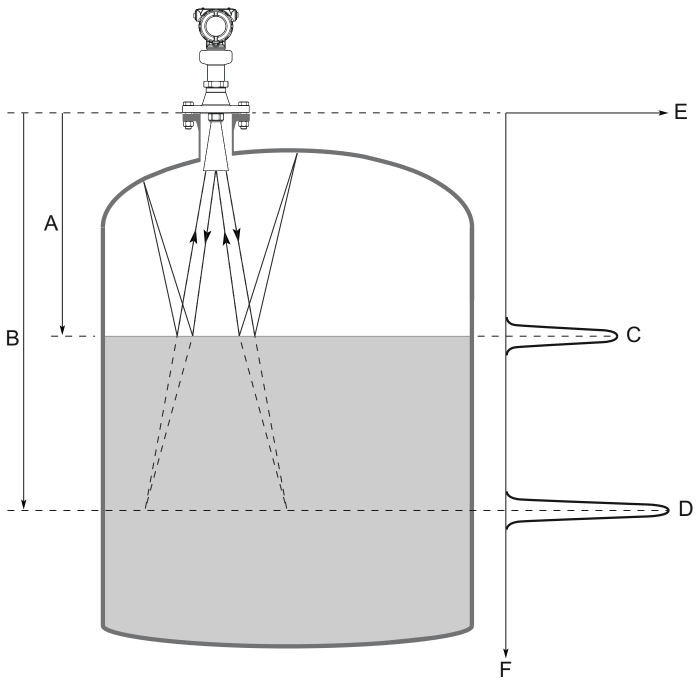
Note

The Double Bounce Handling function should only be used if the problem of double bounces cannot be solved by changing the mounting position.

Note

The surface echo is required to suppress the double bounce. If the surface echo enters the Upper Null Zone, there is no product surface reference and the double bounce might be interpreted as the surface echo.

Figure 7-14: Double Bounce Echoes



A. Distance to surface
B. Distance to first double bounce
C. Actual level
D. Virtual level (first double bounce)
E. Signal amplitude
F. Distance

Configure double bounce handling

1. In Rosemount Radar Master Plus, read the echo curve plot to determine if double bounce echoes are present, see *Section 7.4.1*.
2. Under *Configure*, select **Level Setup** > **Advanced**.
3. Under *More Advanced Options*, select **Echo Tracking**.
4. In the *Double Bounce Handling* list, select **Enabled** or **Disabled**.
5. If you enabled Double Bounce Handling, then enter desired Double Bounce Offset.
6. Select **Save**.

Double bounce offset

The distance between each double bounce echo is constant. The Double Bounce Offset is used to define the distance between detected double bounces, as given by the following formula (see *Figure 7-14*):

Double Bounce Offset = B - 2A

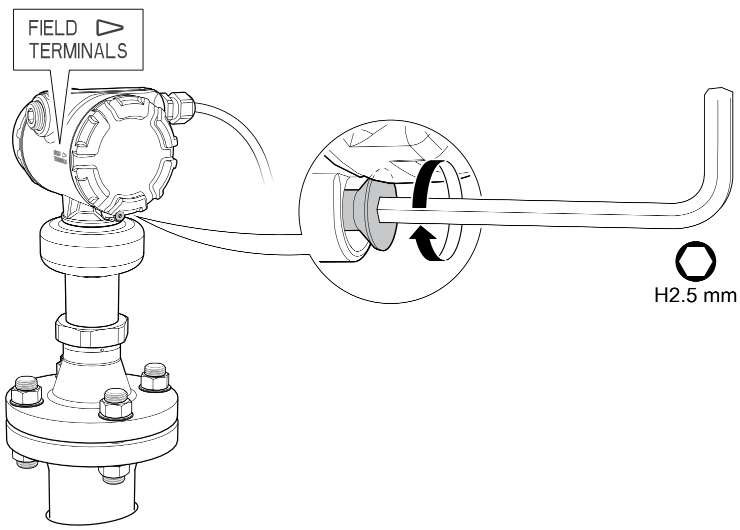
The Double Bounce Offset is negative if the reflection point (normally the tank roof) is below the Tank Reference Point.

7.6 Replace the transmitter head

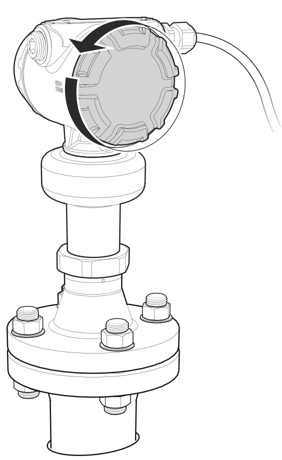
⚠ In Explosion Proof/Flameproof and Non-Incendive/Type n installations, do not remove the transmitter covers when power is applied to the unit.

Procedure

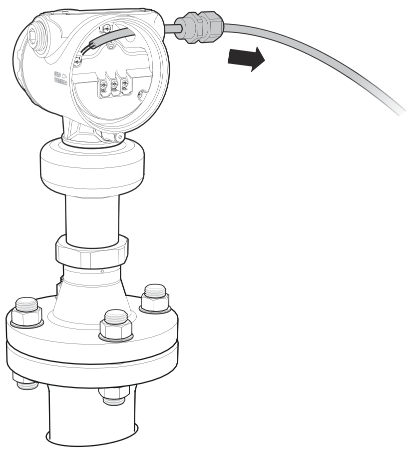
1. Disconnect the power supply.
2. If applicable, remove the external ground cable from the transmitter head.
3. Turn the jam screw clockwise until it is completely threaded into the housing.



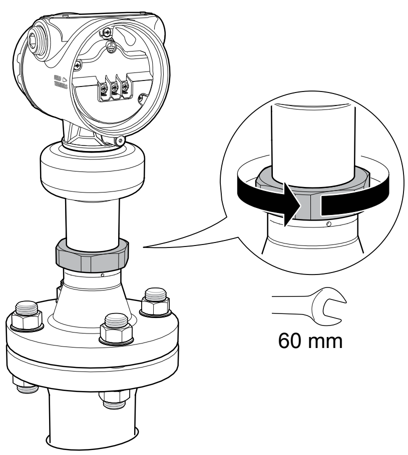
4. Remove the cover.



5. Remove all electrical leads and disconnect conduit.

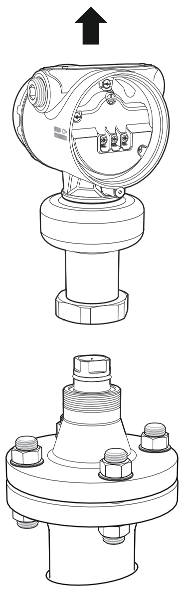


6. Loosen the nut that connects the transmitter head to the process seal.

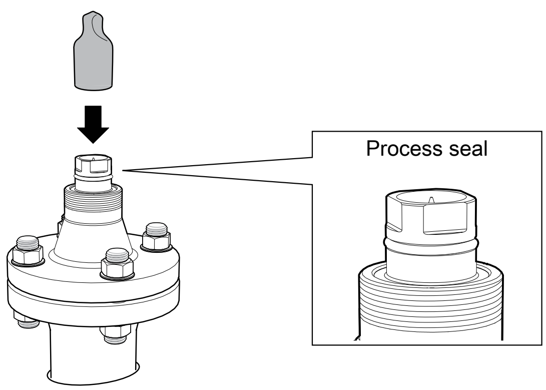


7. Carefully lift the transmitter head.

⚠ Do not attempt to loosen it by rotating the transmitter head. If it is stuck, then it may need to be replaced with a new process connection and transmitter head, by following all plant safety rules and procedures.



8. Attach a protection plug to the process seal to protect it from dust and water.



7.7 Cleaning or replacing the PTFE sealing

This section applies only to transmitters with a process seal antenna.

Replace the PTFE sealing if it shows any signs of damage. If it is not damaged, clean and reuse it.

Remove from service

⚠ Be aware of the following:

- Follow all plant safety rules and procedures.
- In Explosion Proof/Flameproof and Non-Incendive/Type n installations, do not remove the transmitter covers when power is applied to the unit.
- Do not remove the process connection while in operation. Removing while in operation may cause process gas leaks.

Cleaning

To avoid electrostatic charges, use only a damp cloth to clean the PTFE surfaces. Clean the PTFE sealing with care.

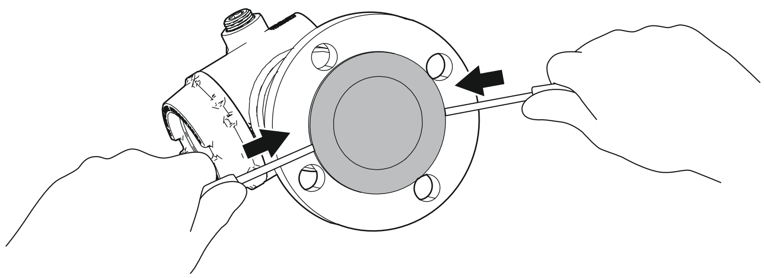
The transmitter is suitable for:

- Cleaning-Out-of-Place (COP)
- Cleaning-In-Place (CIP) up to 160 °F (71 °C)
- Steaming-In-Place (SIP) up to 275 °F (135 °C)

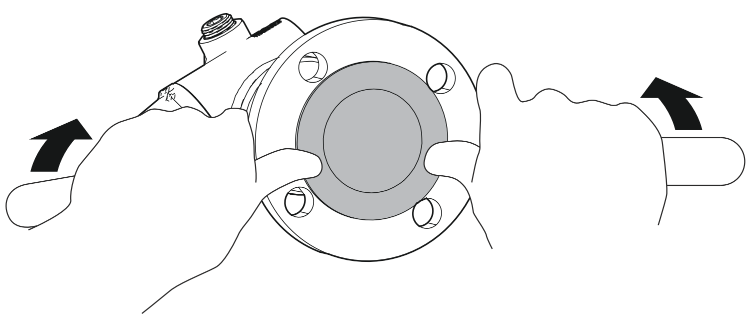
7.7.1 Flanged version

Disassembly procedures

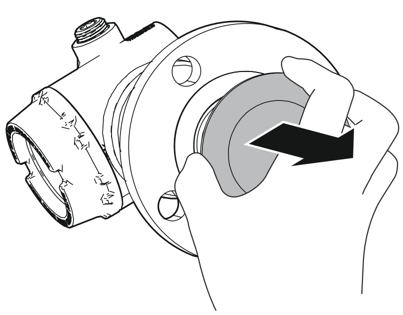
1. Insert two flathead screwdrivers between the PFTE sealing and flange.



2. Gently push the screwdriver handles forward until the PTFE sealing pops out.

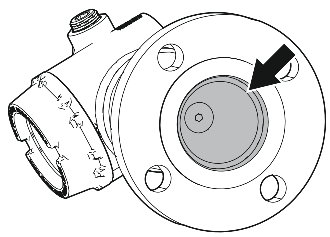


3. Carefully pull the PTFE sealing straight out.

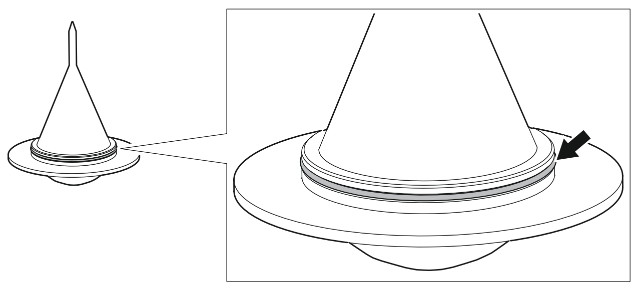


Reassembly procedures

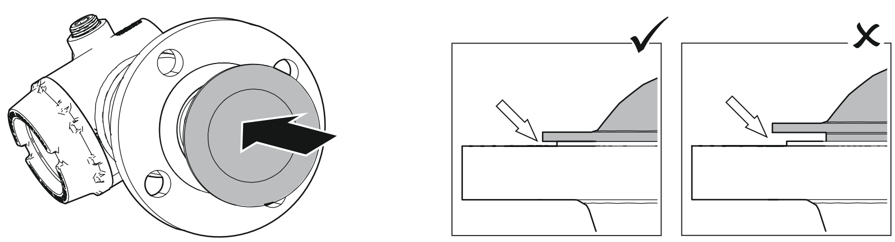
1. Clean the cavity with a lint-free cloth.



2. Verify the O-ring on the PTFE sealing is in place.



3. Gently insert the PTFE sealing until it stops, and then firmly push it all the way in.



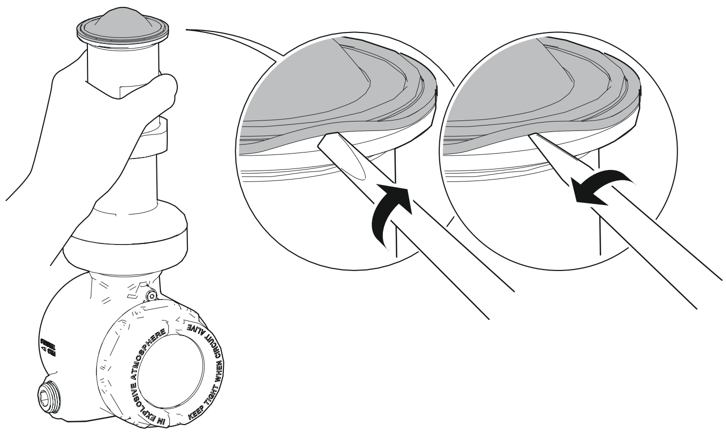
7.7.2 Tri Clamp version

Disassembly procedures

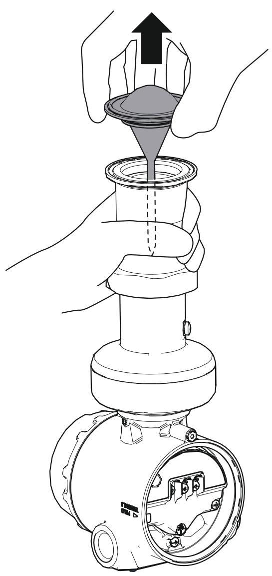
1. Insert a wide flathead screwdriver into the groove at the base of the PTFE sealing.
2. Gently wiggle the screwdriver back and forth.

Note

Be careful not to scratch or depress the PTFE surfaces (facing the process).

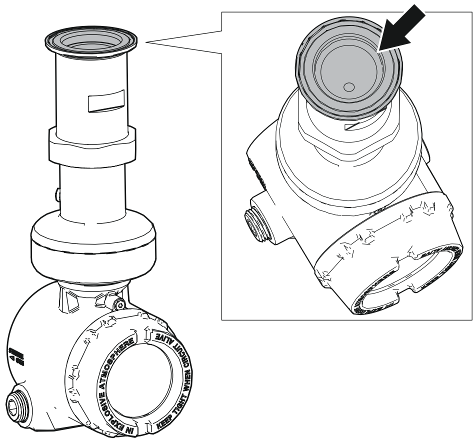


3. Repeat Step 1-Step 2 at different positions until the PTFE sealing is loose.
4. Carefully lift the PTFE sealing.

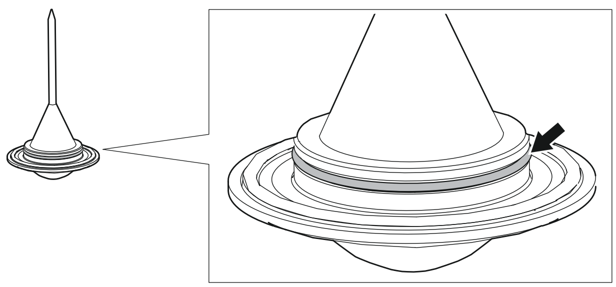


Reassembly procedures

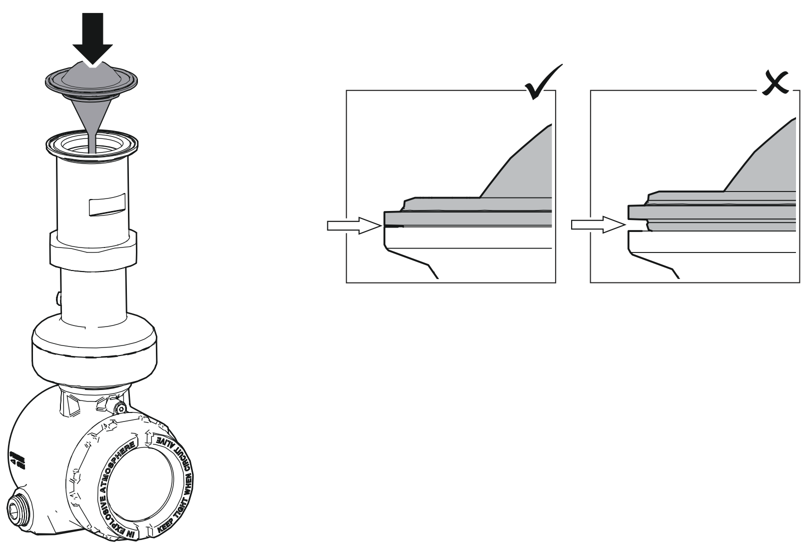
1. Clean the cavity with a lint-free cloth.



2. Verify the O-ring on the PTFE sealing is in place.



3. Gently insert the PTFE sealing until it stops, and then firmly push it all the way in.



7.8 Service support

To expedite the return process outside of the United States, contact the nearest Emerson representative.

Within the United States, call the Emerson Instrument and Valve Response Center using the 1-800-654-RSMT (7768) toll-free number. This center, available 24 hours a day, will assist you with any needed information or materials.

The center will ask for product model and serial numbers, and will provide a Return Material Authorization (RMA) number. The center will also ask for the process material to which the product was last exposed.

⚠ CAUTION!

Individuals who handle products exposed to a hazardous substance can avoid injury if they are informed of and understand the hazard. Returned products must include a copy of the required Safety Data Sheet (SDS) for each substance.

Emerson Instrument and Valve Response Center representatives will explain the additional information and procedures necessary to return goods exposed to hazardous substances.

8 Safety Instrumented Systems (4-20 mA only)

8.1 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 safe installation and servicing guidelines could result in death or serious injury.

- **Make sure only qualified personnel perform the installation.**

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 Field 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 and Non-Incendive/Type n 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.

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

8.2 Terms and definitions

Table 8-1: Terms and Definitions

Term	Definition
BPCS	Basic Process Control System
λ_{DU}	Dangerous Undetected

Table 8-1: Terms and Definitions *(continued)*

Term	Definition
λ_{DD}	Dangerous Detected
λ_{SU}	Safe Undetected
λ_{SD}	Safe Detected
Diagnostic coverage	Fraction of dangerous failures detected by automatic on-line diagnostic tests.
Diagnostic test interval	The time from when a dangerous failure/condition occurs until the device has set the safety related output in a safe state (total time required for fault detection and fault reaction).
FIT	Failure In Time per billion hours
FMEDA	Failure Modes, Effects and Diagnostic Analysis
HART®	Highway Addressable Remote Transducer
HFT	Hardware Fault Tolerance
High demand mode	The safety function is only performed on demand, in order to transfer the EUC (Equipment Under Control) into a specified safe state, and where the frequency of demands is greater than one per year (IEC 61508-4).
Low demand mode	The safety function is only performed on demand, in order to transfer the EUC into a specified safe state, and where the frequency of demands is no greater than one per year (IEC 61508-4).
Mission time	The time from an instrumented system's start-up until its replacement or refurbishment to as-new condition.
PFD_{AVG}	Average Probability of Failure on Demand
Proof-test coverage factor	The effectiveness of a proof-test is described using the coverage factor which specifies the share of detected dangerous undetected failures (λ_{DU}). The coverage factor is an indication of a proof-test's effectiveness to detect dangerous undetected faults.
Safety deviation	The maximum allowed deflection of the safety output due to a failure within the device (expressed as a percentage of span). Any failure causing the device output to change less than the Safety Deviation is considered as a "No Effect" failure. All failures causing the device output to change more than the Safety Deviation and with the device output still within the active range (non-alarm state) are considered dangerous failures. Note that the Safety Deviation is independent of the normal performance specification or any additional application specific measurement error.
SFF	Safe Failure Fraction
SIF	Safety Instrumented Function
SIL	Safety Integrity Level – a discrete level (one out of four) for specifying the safety integrity requirements of the safety instrumented functions to be allocated to the safety instrumented systems. SIL 4 has the highest level of safety integrity, and SIL 1 has the lowest level.
SIS	Safety Instrumented System – an instrumented system used to implement one or more safety instrumented functions. An SIS is composed of any combination of sensors, logic solvers, and final elements.

Table 8-1: Terms and Definitions *(continued)*

Term	Definition
Systematic Capability	Systematic Capability is a measure (expressed on a scale of SC 1 to SC 4) of the confidence that the systematic safety integrity of an element meets the requirements of the specified SIL, in respect of the specified element safety function, when the element is applied in accordance with the instructions specified in the compliant item safety manual for the element.
Transmitter response time	The time from a step change in the process until transmitter output reaches 90% of its final steady state value (step response time as per IEC 61298-2).
Type B device	Complex device using controllers or programmable logic, as defined by the standard IEC 61508.
Useful lifetime	Useful lifetime is a reliability engineering term that describes the operational time interval where the failure rate of a device is relatively constant. It is not a term which covers product obsolescence, warranty, or other commercial issues.

8.3 Safety Instrumented System (SIS) certification

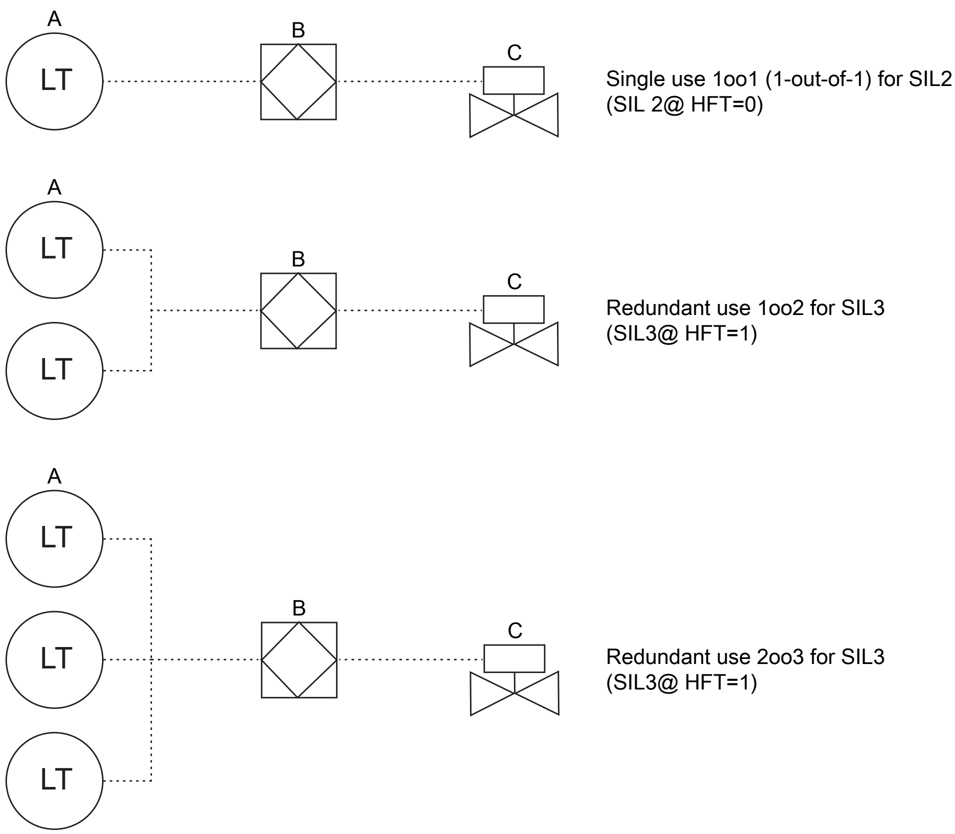
For safety instrumented systems usage, the 4-20 mA analog output is used as the primary safety variable. It is configured to activate the alarm function if an error occurs. If a measured value goes beyond the measurement range, the transmitter enters saturation mode.

The measurement signal used by the logic solver must be the analog 4-20 mA signal proportional to the level or distance (ullage) generated. The HART protocol can only be used for setup, calibration, and diagnostic purposes, not for safety critical operation.

The Rosemount™ 5408:SIS Level Transmitter is IEC 61508 certified accordingly:

- Low and high demand: Type B element
- SIL 2 for random integrity @ HFT=0
- SIL 3 for random integrity @ HFT=1
- SIL 3 for systematic capability

Figure 8-1: SIF Configuration Examples



A. *Rosemount 5408:SIS Level Transmitter (sensor)*
B. *Logic-solver*
C. *Actuator*

Application examples

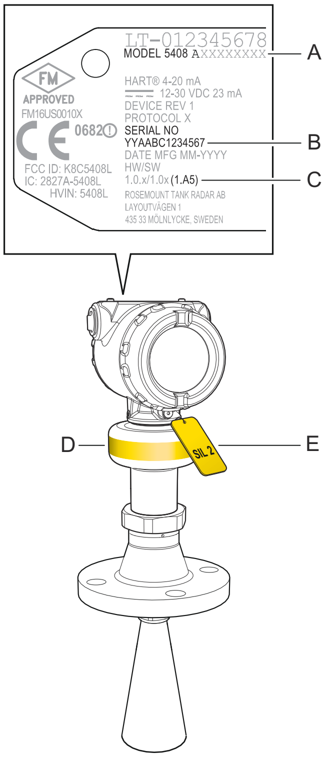
- Level range monitoring
- Dry-run prevention
- Overfill prevention

8.4 Safety certified identification

All Rosemount 5408:SIS Level Transmitters must be identified as safety certified before installing into SIS systems.

1. Verify the transmitter model code starts with “5408F”.
2. Verify the software (SW) is 1.A3 or later.

Figure 8-2: Identification



A. Model code
B. Serial number
C. SW version
D. Yellow stripe for locating device from distance
E. Yellow tag for locating device from distance

8.5 Installation

The Rosemount 5408:SIS must be installed and configured as described in *Chapter 3* and *Chapter 4*. No special installation is required in addition to the standard installation practices outlined in this manual.

The loop should be designed so the terminal voltage is within the limits specified in section *Section 4.4*.

Check that environmental conditions do not exceed the ratings in *Appendix A*.

Note

The Rosemount 5408:SIS Level Transmitter is not safety-rated during maintenance work, configuration changes, multidrop, loop test, proof-test, or other activity that affects the safety function. Alternative means should be used to ensure process safety during such activities.

8.5.1 Measuring range

The maximum measuring range is 82 ft. (25 m) for the Rosemount 5408:SIS Level Transmitter in Safety (SIS) mode. Refer to *Appendix A* for performance specification data.

8.6 Configuration

Use a HART-compliant master, such as Rosemount Radar Master Plus, AMS Device Manager, or a Field Communicator, to communicate with and verify configuration of the Rosemount 5408:SIS.

8.6.1 Prerequisites

Before doing any configuration, do the following:

1. Write down the serial number from the transmitter label (see *Figure 8-2*).
2. Make sure you are connected to the correct transmitter by verifying the same serial number in your configuration tool.
   - Rosemount Radar Master Plus:
     - Under *Overview*, select **Device Information** > **Identification**.
   - AMS Device Manager and Field Communicator:
     - Select **Overview** > **Device Information** > **Identification**.

8.6.2 Configure device using Guided Setup

Follow the Guided Setup wizard for transmitter configuration, refer to *Chapter 5*. When configuring parameters not included in the Guided Setup, it may be necessary to do additional verification.

8.6.3 Set operational mode

The Rosemount 5408:SIS can be used as the level sensor in a BPCS or as a safety device in a safety instrumented system.

If the Rosemount 5408:SIS is used as safety device in a Safety Instrumented System, then the operational mode must be set to Safety (SIS). The Safety (SIS) operational mode can be activated via the Guided Setup wizard, or as follows:

Use Rosemount Radar Master Plus

1. Under *Configure*, select **Device Setup Security**.
2. Under *Operational Mode*, select **Change** and follow the on-screen instructions.

Use AMS Device Manager and Field Communicator

1. Select **Configure** > **Manual Setup** > **Device Setup** > **Security**.

2. Under *Safety Instrumented Systems*, select **Change Operational Mode** and follow the on-screen instructions.

Note

When entering the Safety (SIS) operational mode, the analog output will be put into alarm mode until the Safety Mode is enabled.

8.6.4 Enable safety mode

If the transmitter is configured for use in Safety (SIS), then the Safety Mode must be enabled for the transmitter to become operational. When Safety Mode is enabled, the transmitter is write protected (with or without a password) to prevent unauthorized changes.

Use Rosemount Radar Master Plus

1. Under *Configure*, select **Device Setup** > **Security**.
2. Under *Safety Mode*, select **Change** and follow the on-screen instructions.

Use AMS Device Manager and Field Communicator

1. Select **Configure** > **Manual Setup** > **Device Setup** > **Security**.
2. Under *Safety Instrumented Systems*, select **Change Safety Mode** and follow the on-screen instructions.

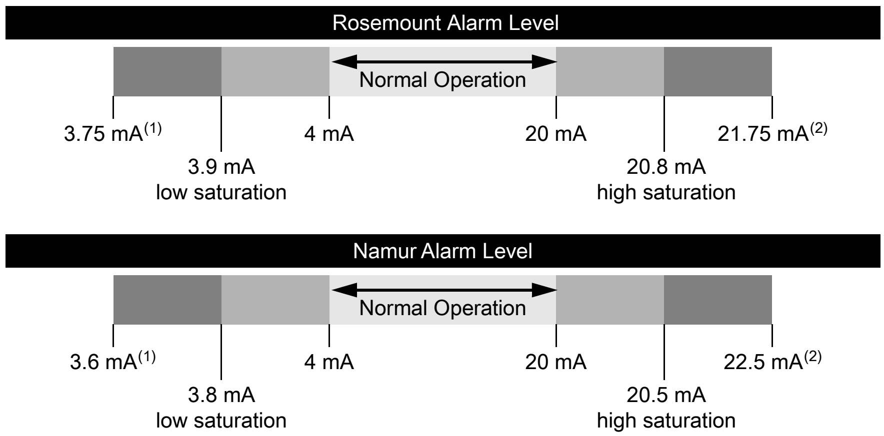
8.6.5 Alarm and saturation levels

DCS or safety logic solver should be configured to handle both High alarm and Low alarm. In addition, the transmitter must be configured for High or Low alarm (see *Alarm mode*).

Figure 8-3 identifies the alarm levels available and their operation values [1].

(1) *Note that during startup, the Rosemount 5408:SIS always outputs Low alarm current even if the transmitter is configured for High alarm mode.*

Figure 8-3: Alarm Levels and Operation Values



1. *Transmitter Failure, hardware or software alarm in Low position.*
2. *Transmitter Failure, hardware or software alarm in High position.*

8.7 Site acceptance

After installation and/or configuration, proper operation of the transmitter (including verification of all configuration changes) must be verified. A site acceptance test is therefore recommended. The proof-tests outlined in section *Section 8.8* can be used for this.

8.8 Proof-testing

8.8.1 Overview

The Rosemount 5408:SIS Level Transmitter must be tested at regular intervals to reveal faults which are undetected by automatic diagnostics. It is the user's responsibility to choose the type of testing and the frequency of these tests.

Results from periodic proof-tests shall be recorded and periodically reviewed. If an error is found in the safety functionality, the transmitter shall be put out of operation and the process shall be kept in a safe state by other measures.

Note

For a valid result, always perform the proof-test on the product that will be stored in the tank while the device is in operation.

The following proof-tests are suggested:

- (A) 1-point level and analog output verification (see *Section 8.8.2*)
- (B) 2-point level and analog output verification (see *Section 8.8.3*)
- (C) Analog output verification (see *Section 8.8.4*)
- (D) Level deviation monitoring (see *Section 8.8.5*)

Table 8-2 can be used as a guidance for selecting the appropriate proof-test.

Table 8-2: Suggested Proof-tests

Proof-test #	Type	Proof-test coverage (%) of DU	Remaining dangerous, undetected failures	Test coverage			Can be performed remotely
				Output circuitry	Measurement electronics	Antenna	
A	Comprehensive	73%	21 FIT	Y	Y	Y	Y (1)
B		84%	13 FIT	Y	Y	Y	Y
C	Partial	33%	53 FIT	Y	N	N	Y
D		61%	31 FIT	N	Y	N	Y

(1) With the assumption that the BPCS level sensor is used as independent measurement.

Proof-test interval

The time intervals for proof-testing are defined by the SIL verification calculation (subject to the PFD_{AVG}). The SIL verification calculation is an analytical method to calculate an appropriate proof-test interval for the specific safety function based on equipment's reliability and required risk reduction for the specific SIF.

The proof-tests must be performed more frequently than or as frequently as specified in the SIL verification calculation, in order to maintain the required safety integrity of the overall SIF.

Tools required

- HART host/communicator or Rosemount Radar Master Plus
- Current meter
- Safety logic solver
- Independent measuring device (e.g. BPCS level sensor, measuring tape)

8.8.2 Perform 1-point level and analog output verification

⚠ WARNING!

During the proof-test, the transmitter will not output measurement values corresponding to the product surface level. Make sure systems and people relying on measurement values from the transmitter are made aware of the changed conditions. Failure to do so could result in death, serious injury and/or property damage.

Use Rosemount Radar Master Plus

1. Prior to the test, ensure there are no alarms or warnings present in the transmitter.
   a. Under *Service Tools*, select **Alerts**.
2. Bypass the process safety function and take appropriate action to avoid a false trip.
3. Simulate 4.00 mA output and verify loop current.
   a. Under *Service Tools*, select **Simulate**.
   b. Select **Loop Test**.
   c. Select **4 mA** and then select **Start**.
   d. Measure loop current (e.g. reading the safety logic solver or using the TEST terminal, see *Section 7.4.4*).

   Note
   The inaccuracy of safety logic solver or current meter needs to be considered.

   e. Verify the current deviation is within the safety deviation of 2% (±0.32 mA).
   f. Select **Stop** to end loop test.
4. Simulate 20.00 mA output and verify loop current.
   a. Under *Service Tools*, select **Simulate**.
   b. Select **Loop Test**.
   c. Select **20 mA** and then select **Start**.
   d. Measure loop current (e.g. reading the safety logic solver or using the TEST terminal, see *Section 7.4.4*).
   e. Verify the current deviation is within the safety deviation of 2% (±0.32 mA).

   Note
   The inaccuracy of safety logic solver or current meter needs to be considered.

   f. Select **Stop** to end loop test.
5. Perform a one-point level measurement verification of the transmitter in the measuring range. Compare with independent measurement (e.g. the BPCS level sensor).
   a. Under *Overview*, select **All Variables**.
   b. Verify the current level or distance reading with an independent measurement is within the safety deviation of 2%.

   Note
   The inaccuracy of the independent measurement needs to be considered.

6. Remove the bypass and otherwise restore normal operation.

Use AMS Device Manager and Field Communicator

1. Prior to the test, ensure there are no alarms or warnings present in the transmitter.
    a. Select **Service Tools** > **Alerts**.
2. Bypass the process safety function and take appropriate action to avoid a false trip.
3. Simulate 4.00 mA output and verify loop current.
    a. Select **Service Tools** > **Simulate**.
    b. Under *Analog Out*, select **Loop test**.
    c. Select **4mA** and then select **Next** (**Enter** on Field Communicator).
    d. Measure loop current (e.g. reading the safety logic solver or using the TEST terminal, see *Section 7.4.4*).
    e. Verify the current deviation is within the safety deviation of 2% (±0.32 mA).

    Note
    The inaccuracy of safety logic solver or current meter needs to be considered.

    f. To end loop test, select **Cancel** (**ABORT** on Field Communicator).
4. Simulate 20.00 mA output and verify loop current.
    a. Select **Service Tools** > **Simulate**.
    b. Under *Analog Out*, select **Loop test**.
    c. Select **20mA** and then select **Next** (**Enter** on Field Communicator).
    d. Measure loop current (e.g. reading the safety logic solver or using the TEST terminal, see *Section 7.4.4*).
    e. Verify the current deviation is within the safety deviation of 2% (±0.32 mA).

    Note
    The inaccuracy of safety logic solver or current meter needs to be considered.

    f. To end loop test, select **Cancel** (**ABORT** on Field Communicator).
5. Perform a one-point level measurement verification of the transmitter in the measuring range. Compare with independent measurement (e.g. the BPCS level sensor).
    a. Select **Service Tools** > **Variables** > **Process**.
    b. Verify the current level or distance reading with an independent measurement is within the safety deviation of 2%.

    Note
    The inaccuracy of the independent measurement needs to be considered.

6. Remove the bypass and otherwise restore normal operation.

8.8.3 Perfom 2-point level and analog output verification

⚠ WARNING!

During the proof-test, the transmitter will not output measurement values corresponding to the product surface level. Make sure systems and people relying on measurement values from the transmitter are made aware of the changed conditions. Failure to do so could result in death, serious injury and/or property damage.

Use Rosemount Radar Master Plus

1. Prior to the test, ensure there are no alarms or warnings present in the transmitter.
   a. Under *Service Tools*, select **Alerts**.
2. Bypass the process safety function and take appropriate action to avoid a false trip.
3. Simulate 4.00 mA output and verify loop current.
   a. Under *Service Tools*, select **Simulate**.
   b. Select **Loop Test**.
   c. Select **4 mA** and then select **Start**.
   d. Measure loop current (e.g. reading the safety logic solver or using the TEST terminal, see *Section 7.4.4*).
   e. Verify the current deviation is within the safety deviation of 2% (±0.32 mA).

   Note
   The inaccuracy of safety logic solver or current meter needs to be considered.

4. Simulate 20.00 mA output and verify loop current.
   a. Under *Service Tools*, select **Simulate**.
   b. Select **Loop Test**.
   c. Select **20 mA** and then select **Start**.
   d. Measure loop current (e.g. reading the safety logic solver or using the TEST terminal, see *Section 7.4.4*).
   e. Verify the current deviation is within the safety deviation of 2% (±0.32 mA).

   Note
   The inaccuracy of safety logic solver or current meter needs to be considered.

   f. Select **Stop** to end loop test.
5. Perform a two-point level measurement verification of the transmitter in the measuring range. Compare with independent measurement (e.g. the BPCS level sensor).
   a. Under *Overview*, select **All Variables**.

b. Verify the current level or distance reading with an independent measurement is within the safety deviation of 2%.

Note
The inaccuracy of the independent measurement needs to be considered.

c. Move the surface in the tank at least 10% of the full measuring span (level 0-100%).

d. Repeat steps (a) to (b) for the second point.

6. Remove the bypass and otherwise restore normal operation.

Use AMS Device Manager and Field Communicator

1. Prior to the test, ensure there are no alarms or warnings present in the transmitter.

   a. Select **Service Tools** > **Alerts**.

2. Bypass the process safety function and take appropriate action to avoid a false trip.
3. Simulate 4.00 mA output and verify loop current.

   a. Select **Service Tools** > **Simulate**.
   b. Under *Analog Out*, select **Loop test**.
   c. Select **4mA** and then select **Next** (**Enter** on Field Communicator).
   d. Measure loop current (e.g. reading the safety logic solver or using the TEST terminal, see *Section 7.4.4*).
   e. Verify the current deviation is within the safety deviation of 2% (±0.32 mA).

Note
The inaccuracy of safety logic solver or current meter needs to be considered.

   f. To end loop test, select **Cancel** (**ABORT** on Field Communicator).

4. Simulate 20.00 mA output and verify loop current.

   a. Select **Service Tools** > **Simulate**.
   b. Under *Analog Out*, select **Loop test**.
   c. Select **20mA** and then select **Next** (**Enter** on Field Communicator).
   d. Measure loop current (e.g. reading the safety logic solver or using the TEST terminal, see *Section 7.4.4*).
   e. Verify the current deviation is within the safety deviation of 2% (±0.32 mA).

Note
The inaccuracy of safety logic solver or current meter needs to be considered.

   f. To end loop test, select **Cancel** (**ABORT** on Field Communicator).

5. Perform a two-point level measurement verification of the transmitter in the measuring range. Compare with independent measurement (e.g. the BPCS level sensor).

   a. Select **Service Tools > Variables > Process**.
   b. Verify the current level or distance reading with an independent measurement is within the safety deviation of 2%.

   Note
   The inaccuracy of the independent measurement needs to be considered.

   c. Move the surface in the tank at least 10% of the full measuring span (level 0-100%).
   d. Repeat steps (a) to (b) for the second point.

6. Remove the bypass and otherwise restore normal operation.

8.8.4 Perform analog output verification

Compare HART Primary Variable digital value with analog output reading. Verify that the deviation is within the pass limit.

Procedure

1. Obtain the loop current as a digital value, do one of the following:
   - In Rosemount Radar Master Plus, under *Overview*, select **All Variables** and read the current analog output value.
   - Read HART command 2 or 3 via the host system. (2)
2. Obtain the loop current as an analog value (e.g. by using the safety logic solver or using the TEST terminal, see *Section 7.4.4*).
3. Compare the current values.
4. Verify the current deviation is within the safety deviation of 2% (±0.32 mA).

Note
The inaccuracy of safety logic solver needs to be considered.

8.8.5 Perform level deviation monitoring

Use the analog output to obtain level (or distance) reading and compare with an independent level measurement. Verify that the deviation is within the pass limit.

Procedure

1. Obtain the level (or distance) measurement value derived from the analog output (e.g. by checking measurement value in safety logic solver).

(2) Command 2: Analog output current and Percent of range Command 3: Device variables (PV, SV, TV, and QV) and Analog output current

2. Obtain the level (or distance) measurement value from an independent level measurement (e.g. the BPCS level sensor).
3. Compare the measurements and verify that the deviation is within the safety deviation of 2%.

8.8.6 Product repair

The Rosemount 5408:SIS is repairable by major component replacement. All failures detected by the transmitter diagnostics or by the proof-test must be reported. Feedback can be submitted electronically at *EmersonProcess.com/Rosemount-safety* (Contact Us).

8.9 Specifications

The Rosemount 5408:SIS must be operated according to the functional and performance specifications provided in *Appendix A*.

8.9.1 Failure rate data

The *FMEDA report* includes failure rate data, assessment details, and assumptions regarding failure rate analysis.

8.9.2 Safety deviation

±2.0% of analog output span

8.9.3 Transmitter response time

- < 6 s at damping value 2 s (default)(3)
- < 2 s at damping value 0 s (minimum)(3)

The transmitter response time will be a function of the configured Damping value. Rosemount Radar Master Plus has a built-in function to calculate the transmitter's measurement response time (requires option code EF2).

8.9.4 Diagnostic test interval

< 90 min(4)

8.9.5 Turn-on time

< 40 s (5)

(3) *Step response time as per IEC 61298-2.*

(4) *A majority of the self-diagnostic tests is performed once every second and an action (if necessary) is taken in less than 30 seconds (default).*

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

Appendix A
Specifications and Reference Data

A.1 Performance specifications

A.1.1 General

Conformance to specification (±3σ [Sigma])

Technology leadership, advanced manufacturing techniques, and statistical process control ensure specification conformance to at least ±3σ.

Reference conditions

- Measurement target: Metal plate, no disturbing objects
- Temperature: 68 to 86 °F (20 to 30 °C)
- Ambient pressure: 14 to 15 psi (960 to1060 mbar)
- Relative humidity: 25-75%
- Damping: Default value, 2 s

Instrument accuracy (under reference conditions)

±0.08 in. (2 mm) (1)

Repeatability

±0.04 in. (±1 mm)

Ambient temperature effect

±0.04 in. (±1 mm)/10 K (2)

Sensor update rate

Minimum 1 update per second

(1) 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.

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

Maximum level rate

40 mm/s as default, adjustable up to 200 mm/s

A.1.2 Measuring range

Maximum measuring range

Rosemount 5408:	130 ft. (40 m)
Rosemount 5408:SIS:	130 ft. (40 m) in Control/Monitoring mode[(3)] 82 ft. (25 m) in Safety (SIS) mode[(3)]

Note that a combination of adverse process conditions, such as heavy turbulence, foam, and condensation, together with products with poor reflection may affect the measuring range.

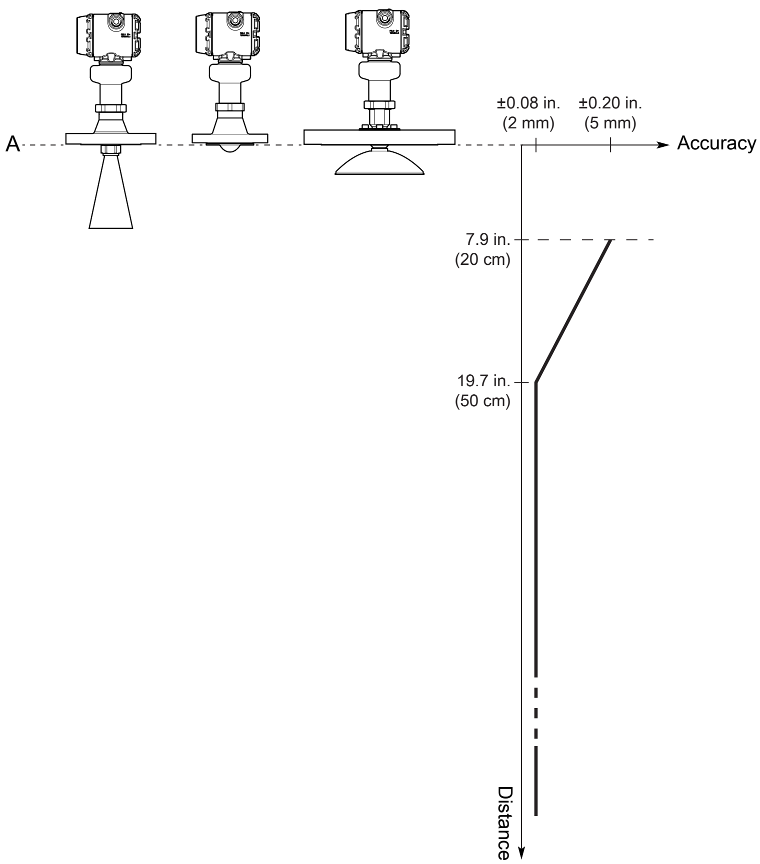
Accuracy over measuring range

The measuring range is limited by the blind zone at the very top of the tank. In the blind zone, the accuracy exceeds ±0.20 in. (±5 mm) and measurements may not be possible. Measurements close to the blind zone will have reduced accuracy (see *Figure A-1*).

For the extended cone antennas, the reduced accuracy zone ends 11.8 in. (30 cm) below the antenna end.

(3) The Rosemount 5408:SIS has two operational modes: Safety (SIS) and Control/Monitoring. Safety (SIS) mode must be set when used in Safety Instrumented Systems. Control/Monitoring mode is intended for use in a Basic Process Control System (BPCS).

Figure A-1: Accuracy Over Measuring Range



A. Device Reference Point

Table A-1: Recommended Measuring Range for Solids, ft. (m)

Antenna	Light powder (1)	Heavy powder (2)	Grain size products (3)	Larger particles (4)
2-in. (DN50) cone/process seal	N/A (5)	33 (10)	33 (10)	39 (12)
3-in. (DN80) cone/process seal 4-in. (DN100) process seal	10 (3)	49 (15)	49 (15)	59 (18)
4-in. (DN100) cone	23 (7)	66 (20)	130 (40)	130 (40)
8-in. (DN200) parabolic	46 (14)	115 (35)	130 (40)	130 (40)

(1) Plastic powder/granules/pellets (Dielectric constant: 1.2-2.0)
(2) Lime powder, cement, sand, etc. (Dielectric constant: 1.5-2.5)
(3) Grain, kernels, brans, etc. (Dielectric constant: 1.5-4.0)
(4) Wood chips, pellets, etc. (Dielectric constant: 1.7- 4.5)
(5) Consider using the Rosemount 5303.

The figures given in *Table A-1* should be considered as guidelines; the total measuring range may differ depending on other contributing application conditions such as product filling, how the product piles up, silo diameter vs. angle of repose, internal obstacles within the silo, etc.

A.1.3 Environment

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 (see *Section 3.8*).

Electromagnetic compatibility (EMC)

- EMC Directive (2014/30/EU): EN 61326-1
- EN 61326-2-3
- NAMUR recommendations NE21[(4)]

For Rosemount 5408:SIS and Rosemount 5408 with option code EF1, the blue plug on the terminal block must be connected.

Pressure Equipment Directive (PED)

Complies with 2014/68/EU article 4.3

Built-in lightning protection

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

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

(4) *In challenging applications where the dynamic of the Rosemount 5408 and 5408:SIS 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.*

A.2 Functional specifications

A.2.1 General

Field of application

Continuous level measurements for tank monitoring, process control, and overfill prevention on a broad range of liquids, slurries, and solids.

Ideal for applications with varying and harsh process conditions, such as heavy turbulence, foaming, product build-up, condensing vapors, sticky, viscous, corrosive, and crystallizing products.

Measurement principle

Frequency Modulated Continuous Wave (FMCW)

Frequency range

24.05 to 27.0 (26.5(5)) GHz

Maximum output power

-5 dBm (0.32 mW)

Internal power consumption

< 1 W in normal operation

Humidity

0 - 100% relative humidity, non-condensing

Turn-on time

< 40 s (6)

A.2.2 Display and configuration

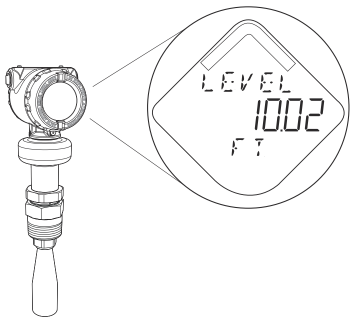
LCD display (option code M5)

- Toggles between selected output variables
- Shows diagnostic information (alerts)

(5) 26.5 GHz in Australia and New Zealand, and for LPR (Level Probing Radar), option code OA.

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

Figure A-2: LCD Display



Remote display

Data can be read remotely by using the Rosemount 751 Field Signal Indicator, see the corresponding *Product Data Sheet* for more information.

Configuration tools

- Rosemount Radar Master Plus for Rosemount 5408 Series (accessible through any Field Device Integration (FDI) based tool, e.g Instrument Inspector™ Application (7))
- Device Descriptor (DD) based systems, e.g. AMS Device Manager, 475 Field Communicator, AMS Trex™ Device Communicator, and DeltaV™, or any other EDDL or enhanced-EDDL host
- Field Device Integration (FDI) based systems

Damping

User selectable (default is 2 s, minimum is 0 s) (8)

Output units

- Level and distance: ft., in., m, cm, mm
- Level rate: ft/s, in./min, in./s, m/h, m/s
- Volume: ft^3, $in.^3$, yd^3, US gal, imperial gal, barrel (bbl), m^3, l
- Temperature: °F, °C
- Signal strength: mV

Table A-2: Output Variables

Variable	4-20 mA	Digital output	LCD display
Level	✓	✓	✓

(7) *Included in delivery of the transmitter. For additional information, visit Emerson.com/RosemountRadarMasterPlus.*

(8) *The Damping parameter defines how fast the device responds to level changes (step response). A high value makes the level steady but the device reacts slowly to level changes in the tank.*

Table A-2: Output Variables *(continued)*

Variable	4-20 mA	Digital output	LCD display
Distance (Ullage)	✓	✓	✓
Volume	✓	✓	✓
Scaled Variable [1]	✓	✓	✓
Electronics Temperature	N/A	✓	✓
Signal Quality[1]	N/A	✓	✓
Level Rate	N/A	✓	✓
Signal strength	N/A	✓	✓
Percent of Range	N/A	✓	✓
Percent of Range Auxiliary	N/A	✓	✓
User Defined[1]	✓	✓	✓

(1) Only for transmitters ordered with Smart Diagnostics Suite (option code DA1).

A.2.3 4-20 mA HART

Output

Two-wire, 4-20 mA. Digital process variable is superimposed on 4-20 mA signal, and available to any host that conforms to the HART protocol. The digital HART® signal can be used in multidrop mode.

HART Revision

- Revision 6 (default)
- Revision 7 (option code HR7)

The HART revision can be switched in field.

Power supply

Transmitter operates on 12-42.4 Vdc transmitter terminal voltage (12-30 Vdc in Intrinsically Safe installations).

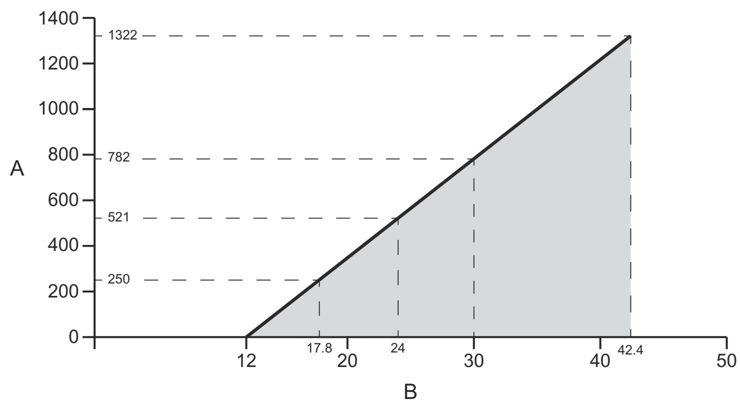
Power consumption

Max. 1 W, current max. 23 mA

Load limitations

For HART® communication, a minimum loop resistance of 250 Ω is required. Maximum loop resistance is determined by the voltage level of the external power supply.

Figure A-3: Load Limits



*Maximum Loop Resistance = 43.5 * (External Power Supply Voltage - 12)*

A. Loop Resistance (Ohms)
B. External Power Supply Voltage (Vdc)

Cable selection

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

Two wires can be safely connected to each terminal screw.

Analog signal on alarm

The transmitter automatically and continuously performs self-diagnostic routines. If a failure or a measurement error is detected, the analog signal will be driven offscale to alert the user. High or low failure mode is user-configurable.

Table A-3: Signal on Alarm

Standard	High	Low
Rosemount standard	≥ 21.75 mA (default)	≤ 3.75 mA (option code C8)
NAMUR NE43	≥ 22.50 mA (option code C4)	≤ 3.6 mA (option code C5)

Analog saturation levels

The transmitter will drive the output to high or low saturation values if measurement goes outside the 4-20 mA range values.

Table A-4: Saturation Levels

Standard	High	Low
Rosemount standard (default and option code C8)	20.8 mA	3.9 mA
NAMUR NE43 (option code C4 and C5)	20.5 mA	3.8 mA

A.2.4 Diagnostics

Alerts

The Rosemount 5408 and 5408:SIS are compliant with NAMUR NE 107 Field Diagnostics for standardized device diagnostic information.

Tools and logging in Rosemount Radar Master Plus

- Echo curve
- Measurement and alert log

Rosemount Radar Master Plus, embedded in Instrument Inspector, enables easy and powerful troubleshooting with the echo curve tool as well as the measurement and alert log.

The measurement and alert log holds records of the last seven days of level readings and echo curve profiles, as well as the 50 last alert events. The logs can be transferred from the transmitter's internal memory to a local computer and be presented in a graphical time line, enabling analysis of historical behaviors.

Smart Diagnostics Suite (option code DA1)

Signal Quality Metrics	Diagnostics package that monitors the relations between surface, noise, and threshold. The function can be used to detect abnormal conditions in the process such as antenna contamination or sudden loss of signal strength. Signal Quality is available as output variable and it comes with user configurable alerts.
Power Advisory	The transmitter automatically measures and monitors the input voltage. If the voltage is too low, operators will be provided with an early alert.
Scaled Variable	The scaled variable configuration allows the user to convert a transmitter variable into an alternative measurement, such as flow, mass, or calibrated level (e.g. 5 point verification).
User Defined Variable	Allows designating more than 200 variables in the device as output variable.

A.2.5 Process temperature and pressure rating

The following figures give the maximum process temperature (measured at the lower part of the flange, Tri-Clamp, or threaded connection) and pressure rating for different antenna types.

Final rating may be lower depending on flange selection.

For antenna type code CAB, at 100 °F (38 °C), the rating decreases with increasing temperature per ASME B16.5 Table 2-2.2, Class 300.

Figure A-4: Cone Antenna (PTFE Seal)

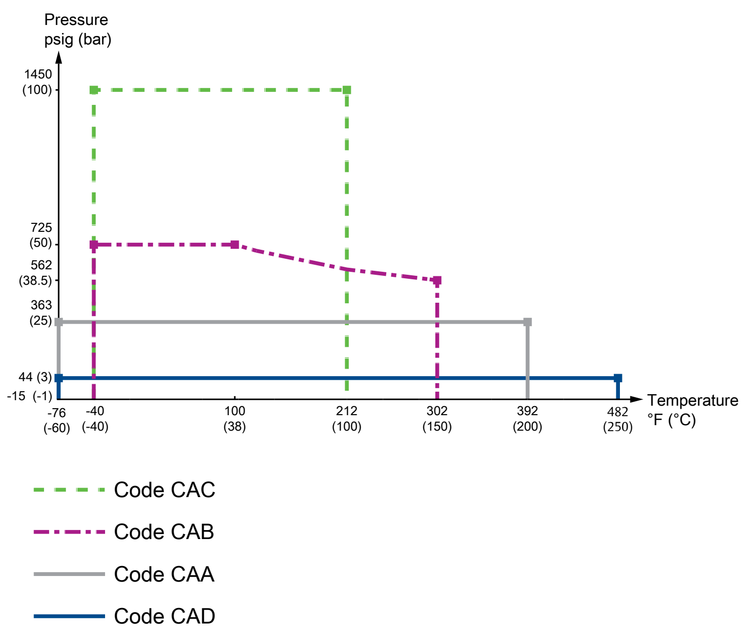


Figure A-5: Cone Antenna (PEEK Seal)

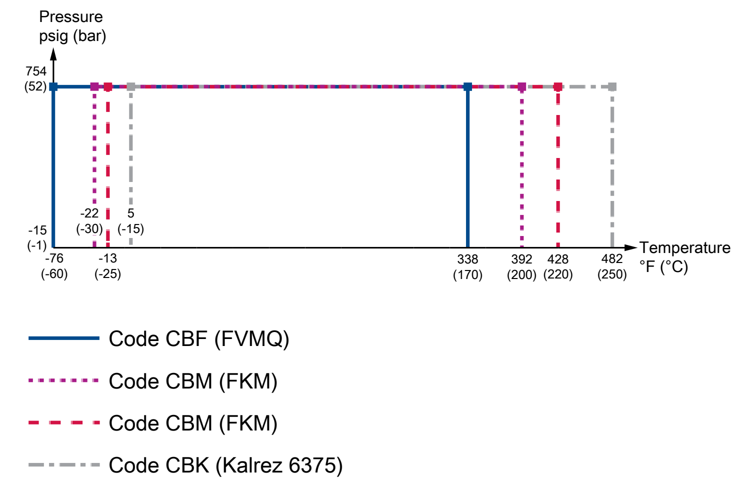


Figure A-6: Process Seal Antenna

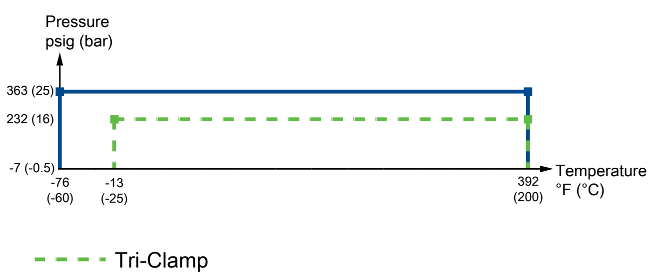


Figure A-7: Parabolic Antenna

A.2.6 Temperature limits

Verify that the operating atmosphere of the transmitter is consistent with the appropriate hazardous locations certifications, see *Appendix B*.

Table A-5: Ambient Temperature Limits

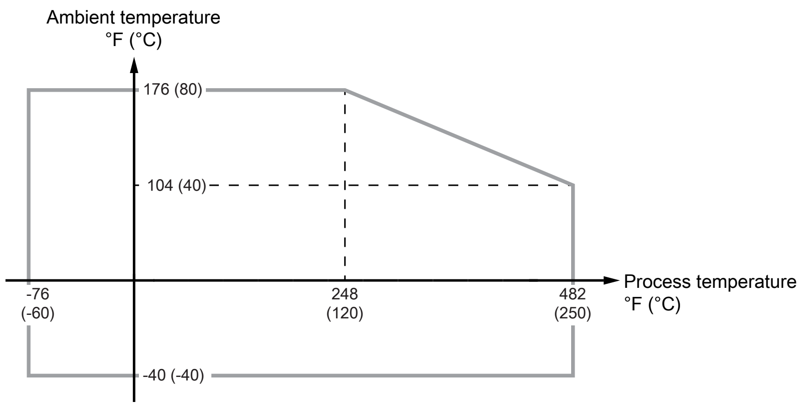
Description	Operating limit	Storage limit (1)
Without LCD display	-40 °F to 176 °F (-40 °C to 80 °C)	-58 °F to 176 °F (-50 °C to 80 °C)
With LCD display (2)		-40 °F to 176 °F (-40 °C to 80 °C)

(1) *The minimum storage temperature is -22 °F (-30 °C) for the cone antenna with Kalrez 6375 O-ring (antenna type code CBK).*

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

The ambient temperature limits may be further restricted by the process temperature as described by *Figure A-8*.

Figure A-8: Ambient Temperature vs. Process Temperature



A.2.7 Flange rating

ASME

- 316 SST according to ASME B16.5 Table 2-2.2
- 316L SST according to ASME B16.5 Table 2-2.3 (for protective plate design)(9)
- Alloy C-276 (UNS N10276) according to ASME B16.5 Table 2-3.8
- Alloy 400 (UNS N04400) according to ASME B16.5 Table 2-3.4

EN

- 1.4404 according to EN 1092-1 material group 13E0

JIS

- 316 SST according to JIS B2220 material group No. 2.2
- 316L SST according to JIS B2220 material group No. 2.3 (for protective plate design)(9)

(9) *Flange rating according to backing flange.*

A.2.8 Conditions used for flange strength calculations

Table A-6: 316/316L SST (EN 1.4404) Flanges

Item	ASME	EN, JIS
Bolting material	SA193 B8M CL.2, SA193 B7[(1)], or SA320 L7[(1)]	EN 1515-1/2, ISO 3506 A4-70, or Bumax® 88[(1)]
Gasket[(2)]	Soft (1a) with min. thickness 1.6 mm or Spiral wound gasket with nonmetallic filler (1b)	Soft (EN 1514-1) with min. thickness 1.6 mm or Spiral wound gasket with nonmetallic filler (EN 1514-2)
Flange material	Stainless steel A182 Gr. F316 and EN 10222-5-1.4404	
Hub material[(3)]	Stainless steel SA479 316 and EN 10272-1.4404	

(1) Only applicable to forged one-piece flanges.

(2) Not applicable to process seal antenna (features an integrated gasket).

(3) Only applicable to flanges with welded construction per Table A-12.

Table A-7: Flanges with Protective Plate Design

Item	ASME	EN, JIS
Bolting material	SA193 B8M Cl.2	EN 1515-1/2, ISO 3506 A4-70
Gasket[1]	Soft (1a) with min. thickness 1.6 mm or Spiral wound gasket with nonmetallic filler (1b)	Soft (EN 1514-1) with min. thickness 1.6 mm or Spiral wound gasket with nonmetallic filler (EN 1514-2)
Flange material	Stainless steel A182 Gr. F316L/F316 and EN 10222-5-1.4404	
Hub material	SB574 Gr. N10276 (solution annealed condition) or SB164 Gr. N04400 (solution annealed condition)	

(1) Note that a minimum gasket thickness of 0.125 in. (3.2 mm) is required when using an air purge ring (option code PC1).

Table A-8: Alloy C-276 (UNS N10276) Flanges

Item	ASME	EN, JIS
Bolting material	UNS N10276	UNS N10276
Gasket	Soft (1a) with min. thickness 1.6 mm or Spiral wound gasket with nonmetallic filler (1b)	Soft (EN 1514-1) with min. thickness 1.6 mm or Spiral wound gasket with nonmetallic filler (EN 1514-2)
Flange material	SB462 Gr. N10276 (solution annealed condition) or SB575 Gr. N10276 (solution annealed condition)	
Hub material	SB574 Gr. N10276 (solution annealed condition)	

Table A-9: Alloy 400 (UNS N04400) Flanges

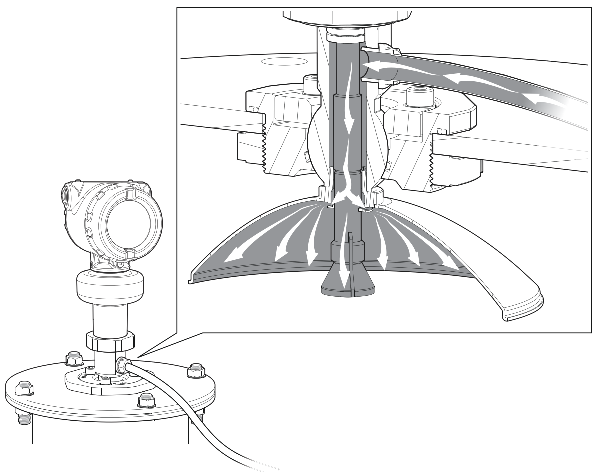
Item	ASME	EN, JIS
Bolting material	UNS N04400	UNS N04400
Gasket	Soft (1a) with min. thickness 1.6 mm or Spiral wound gasket with nonmetallic filler (1b)	Soft (EN 1514-1) with min. thickness 1.6 mm or Spiral wound gasket with nonmetallic filler (EN 1514-2)
Flange material	SB/B564 Gr. N04400 (solution annealed condition) or SB/B127 Gr. N04400 (solution annealed condition)	
Hub material	SB164 Gr. N04400 (solution annealed condition)	

A.2.9 Air purging

An air purge connection can prevent clogging of the antenna in extreme applications with dirt or heavy coating. The easiest way to determine if air purging is needed, is to inspect the tank internal conditions at the location intended for the transmitter. If there is normally a thick layer of product build-up there, air purging is most likely needed. Typical purging media to use is air.

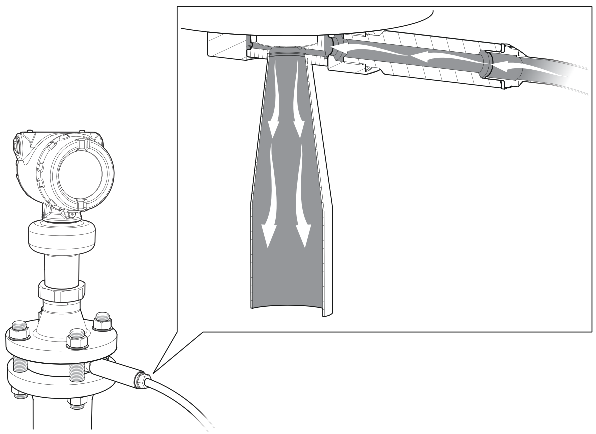
All parabolic antennas come with an integrated air purge connection (see *Figure A-9*).

Figure A-9: Air Purging for Parabolic Antenna



An air purge connection is also available for cone antennas with flanged connection by selecting option code PC1. This option consists of an antenna with purge holes and a separate air purge ring (see *Figure A-10*).

Figure A-10: Air Purging for Cone Antenna



Incoming air supply specification

- Maximum pressure: 190 psi (13 bar)
- Recommended pressure: 100 to 115 psi (7 to 8 bar)
- Inlet/outlet connection: BSPP (G) 3/8-in.
- Air consumption: 252 gal/min at 65 psi (955 l/min at 4.5 bar)

A.2.10 System integration

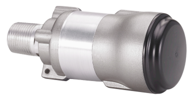
Rosemount 333 HART Tri-Loop™

By sending the digital HART signal to the optional HART Tri-Loop, it is possible to have up to three additional 4–20 mA analog signals.

See the Rosemount 333 HART Tri-Loop *Product Data Sheet* for additional information.

Emerson™ Wireless 775 THUM™ Adapter

The optional Emerson Wireless 775 THUM Adapter can be mounted directly on the transmitter or by using a remote mounting kit.



IEC 62591 (*Wireless*HART®) enables access to multivariable data and diagnostics, and adds wireless to almost any measurement point.

See the Emerson Wireless 775 THUM Adapter *Product Data Sheet* and *Technical Note* for additional information.

A.3 Physical specifications

A.3.1 Material selection

Emerson provides a variety of Rosemount products with various product options and configurations including materials of construction that can be expected to perform well in a wide range of applications. The Rosemount product information presented is intended as a guide for the purchaser to make an appropriate selection for the application. It is the purchaser's sole responsibility to make a careful analysis of all process parameters (such as all chemical components, temperature, pressure, flow rate, abrasives, contaminants, etc.), when specifying product, materials, options and components for the particular application. Emerson is not in a position to evaluate or guarantee the compatibility of the process fluid or other process parameters with the product, options, configuration or materials of construction selected.

A.3.2 Engineered solutions

When standard model codes are not sufficient to fulfill requirements, please consult the factory to explore possible Engineered Solutions. This is typically, but not exclusively, related to the choice of wetted materials or the design of a process connection. These Engineered Solutions are part of the expanded offerings and may be subject to additional delivery lead time. For ordering, factory will supply a special P-labeled numeric option code that should be added at the end of the standard model string.

A.3.3 Housing and enclosure

Electrical connections

Two cable/conduit entries (½-14 NPT, M20 x 1.5, or G½)

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

Materials

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

Weight

- Aluminum housing: 6.2 lb (2.8 kg) [10]
- Stainless steel housing: 10.0 lb (4.5 kg)[10]

Ingress protection

IP 66/67/68 [11] and NEMA® 4X

A.3.4 Tank connection

The tank connection consists of a tank seal, a flange, NPT or BSPP (G) threads, Tri Clamp, or a specific welded connection with swivel feature for parabolic antenna.

A.3.5 Flange dimensions

Follows ASME B16.5, JIS B2220, and EN 1092-1 standards. For more information, see *Section A.7.1*.

A.3.6 Antenna versions

Cone antenna

- Best choice for most applications, including closed vessels, still pipe/chamber installations, and open air applications
- Extended cone antennas are available for tall nozzles (option code S1 and S2). Depending on measurement conditions, a reduction of sensitivity close to antenna end might be present.

Process seal antenna

- All PTFE wetted parts ideal for use in corrosive and hygienic applications
- Suitable for applications with heavy condensation/build-up

Parabolic antenna

- Alternative for long measuring ranges in combination with conditions such as low reflective media
- Suitable for a broad range of solid materials (may need air purging in dusty environments)

A.3.7 Material exposed to tank atmosphere

Cone antenna, PTFE seal

- 316/316L SST (EN 1.4404), Alloy C-276 (UNS N10276), or Alloy 400 (UNS N04400)
- PTFE fluoropolymer

(10) Fully functional transmitter with sensor module, housing, terminal block, LCD display, and covers

(11) The transmitter meets IP 68 at 9.8 ft. (3 m) for 30 minutes.

Cone antenna, PEEK seal

- 316/316L SST (EN 1.4404), Alloy C-276 (UNS N10276), or Alloy 400 (UNS N04400)
- PEEK polyetheretherketone with PTFE fluoropolymer filler
- FVMQ fluorosilicone, Kalrez 6375 perfluoroelastomer, FKM fluoroelastomer, or Viton fluoroelastomer (O-ring)

Process seal antenna

- PTFE fluoropolymer

Parabolic antenna

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

A.4 Ordering Information

A.4.1 Rosemount 5408 Level Transmitter

The starred offerings (★) represent the most common options and should be selected for best delivery. The non-starred offerings are subject to additional delivery lead time.

Table A-10: Rosemount 5408 Level Transmitter Ordering Information

Model	Product Description	
5408	Radar Level Transmitter	★
Profile		
A	Standard Monitoring & Control Applications	★
Measurement type		
1	Liquid Level Measurement	★
3	Solids Level Measurement	★
4	Liquid & Solids Level Measurement	★
Performance class		
S	Standard	★
Signal output		
H	4–20 mA with digital signal based on HART® Revision 6 protocol (HART Revision 7 available as option)	★
Housing material		
A	Aluminum	★
S	Stainless Steel (SST)	★

Table A-10: Rosemount 5408 Level Transmitter Ordering Information *(continued)*

Conduit/cable threads			
1	½-14 NPT		★
2	M20 x 1.5		★
3(1)	G½		
Hazardous locations certifications			
NA	None		★
E1	ATEX Flameproof		★
I1	ATEX Intrinsic Safety		★
N1	ATEX Type n		★
E5	USA Explosion-proof, Dust Ignition-proof		★
I5	USA Intrinsically Safe; Nonincendive		★
E6	Canadian Explosion-proof, Dust Ignition-proof		★
I6	Canadian Intrinsically Safe; Nonincendive		★
E7	IECEx Flameproof, Dust Ignition-proof		★
I7	IECEx Intrinsic Safety		★
N7	IECEx Type n		★
E2	INMETRO Flameproof		★
I2	INMETRO Intrinsic Safety		★
N2	INMETRO Type n		★
E3	China Flameproof		★
I3	China Intrinsic Safety		★
N3	China Type n		★
IP	Republic of Korea Intrinsic Safety		★
Materials of construction		**Available antenna types**	
1	316/316L/EN 1.4404	Cone, Parabolic	★
7	All PTFE Wetted Parts	Process Seal	★
2	Alloy C-276 (UNS N10276) with Protective Plate	Cone	
3	Alloy 400 (UNS N04400) with Protective Plate	Cone	
H	Alloy C-276 (UNS N10276) Process Connection, Flange, and Antenna	Cone	
M	Alloy 400 (UNS N04400) Process Connection, Flange, and Antenna	Cone	
Process connection type (see *Table A-12*, *Table A-13*, *Table A-14*, and *Table A-15*)		**Available antenna types**	
F (2)	Flat Face Flange	Cone, Parabolic	★
R (3)	Raised Face Flange	All	★
N	NPT Thread	Cone	★
G	BSPP (G) Thread	Cone, Parabolic	★
B	Bracket Mounting	Cone	★

Table A-10: Rosemount 5408 Level Transmitter Ordering Information *(continued)*

C	Tri-Clamp®		Process Seal	★
W	Welded Connection		Parabolic	★
Process connection size (see *Table A-12*, *Table A-13*, *Table A-14*, and *Table A-15*)			**Available antenna types**	
A	1½-in.		Cone	★
2	2-in./DN50/50A		Cone, Process Seal	★
3	3-in./DN80/80A		Cone, Process Seal	★
B	3½-in.		Parabolic	★
4	4-in./DN100/100A		Cone, Process Seal	★
6	6-in./DN150/150A		Cone	★
8	8-in./DN200/200A		Cone, Parabolic	★
T	10-in./DN250/250A		Parabolic	★
Z	None (use when ordering bracket mounting)		Cone	★
Process connection rating (see *Table A-12*, *Table A-13*, *Table A-14*, and *Table A-15*)				
ZZ	For use with non-flange process connection type			★
ASME flanges				
AA	ASME B16.5 Class 150			★
AB	ASME B16.5 Class 300			★
AC	ASME B16.5 Class 600			★
EN flanges		Note		
DK	EN1092-1 PN6	N/A		★
DA	EN1092-1 PN16	PN10 and PN16 dimensions are identical for DN50 to DN150		★
DB	EN1092-1 PN40	PN25 and PN40 dimensions are identical for DN50 to DN150		★
DC	EN1092-1 PN63	N/A		★
DD	EN1092-1 PN100	N/A		★
JIS flanges				
JK	JIS 5K			★
JA	JIS 10K			★
JB	JIS 20K			★
Antenna type		**Operating pressure**	**Operating temperature**	
CAA	Cone Antenna (PTFE seal)	-15 to 363 psig (-1 to 25 bar)	-76 to 392 °F (-60 to 200 °C)	★
CAB	Cone Antenna (PTFE seal)	-15 to 725 psig (-1 to 50 bar) (4)	-40 to 302 °F (-40 to 150 °C)	★
CAC	Cone Antenna (PTFE seal)	-15 to 1450 psig (-1 to 100 bar)	-40 to 212 °F (-40 to 100 °C)	★
CAD	Cone Antenna (PTFE seal)	-15 to 44 psig (-1 to 3 bar)	-76 to 482 °F (-60 to 250 °C)	★
CBF	Cone Antenna (PEEK seal, FVMQ)	-15 to 754 psig (-1 to 52 bar)	-76 to 338 °F (-60 to 170 °C)	★
CBK	Cone Antenna (PEEK seal, Kalrez® 6375)	-15 to 754 psig (-1 to 52 bar)	5 to 482 °F (-15 to 250 °C)	★
CBM	Cone Antenna (PEEK seal, FKM)	-15 to 754 psig (-1 to 52 bar)	-13 to 428 °F (-25 to 220 °C)	★

Table A-10: Rosemount 5408 Level Transmitter Ordering Information *(continued)*

CBV	Cone Antenna (PEEK seal, Viton®)	-15 to 754 psig (-1 to 52 bar)	-22 to 392 °F (-30 to 200 °C)	★
SAA	Process Seal Antenna	-7 to 363 psig (-0.5 to 25 bar) (5)	-76 to 392 °F (-60 to 200 °C)(5)	★
PAS	Parabolic Antenna, Swivel Mount	-7 to 43 psig (-0.5 to 3 bar)	-67 to 392 °F (-55 to 200 °C)	★
Antenna size			**Available antenna types**	
2	2-in. (DN50)		Cone, Process Seal	★
3	3-in. (DN80)		Cone, Process Seal	★
4	4-in. (DN100)		Cone, Process Seal	★
8	8-in. (DN200)		Parabolic	★
Options (include with selected model number)				
Antenna extensions (see *Figure A-11*)			**Total length**	
S1	Extended Cone Antenna		24-in. (600 mm)	★
S2	Extended Cone Antenna, Segmented		48-in. (1200 mm)	★
Purging connection (see *Figure A-10*)(6)(7)				
PC1	Purging Connector (Purge Ring)			★
Display				
M5	LCD Display			★
Functional safety options				
EF1	Ready for upgrade to Rosemount 5408:SIS			★
Diagnostic functionality				
DA1	Smart Diagnostics Suite (see *Smart Diagnostics Suite (option code DA1)*)			★
HART revision configuration				
HR7	4-20 mA with digital signal based on HART Revision 7 protocol			★
Open air applications configuration (8)				
OA	Open Air Applications Configuration; LPR (Level Probing Radar)			★
Factory configuration				
C1	Factory Configuration per *Configuration Data Sheet*			★
Alarm limits				
C4	NAMUR Alarm and Saturation Levels, High Alarm			★
C5	NAMUR Alarm and Saturation Levels, Low Alarm			★
C8 (9)	Standard Rosemount Alarm and Saturation Levels, Low Alarm			★
Welding standard for flanges (10)				
AW	According to ASME IX			★
EW	According to EN-ISO			★

Table A-10: Rosemount 5408 Level Transmitter Ordering Information *(continued)*

Country certification[11]		
J1	Canadian Registration (CRN)	★
Special quality assurance		
Q4	Calibration Data Certificate	★
Hydrostatic testing [12]		
Q5	Hydrostatic Testing, including certificate	★
Material traceability certification [13]		
Q8	Material Traceability Certification per EN 10204 3.1 (2.1 for non-metallic)	★
Hygienic certification[14]		
QA	Certificate of compliance to 3-A®	★
Materials certification [15]		
Q15	NACE® Material Recommendation per NACE MR0175/ISO 15156	★
Q25	NACE Material Recommendation per ANSI/NACE MR0103/ISO 17495-1	★
Q35	NACE Material Recommendation per NACE MR0175/ISO 15156 and ANSI/NACE MR0103/ISO 17495-1	★
Welding procedure qualification record documentation[10]		
Q66	Welding Procedure Qualification Record (WPQR)	★
Q67	Welder Performance Qualification (WPQ)	★
Q68	Welding Procedure Specification (WPS)	★
Q79	WPQR/WPQ/WPS	★
Dye penetration test certificate[10]		
Q73	Certificate of Liquid Penetrant Inspection	★
Positive material identification certificate		
Q76	Positive Material Identification Certificate of Conformance	★
Overfill prevention		
U1	Overfill Prevention According to WHG/TUV	★
Extended product warranty		
WR3	3-year Limited Warranty	★
WR5	5-year Limited Warranty	★
Conduit electrical connector (shipped uninstalled) [16]		
EC	M 12, 4-pin, Male connector (eurofast®)	★
MC	A size Mini, 4-pin, Male connector (minifast®)	★
Specials (see *Section A.3.2*)		
PXXXX	Custom Engineered Solutions beyond standard model codes. Consult factory for details.	
Typical model number: 5408 A 1 S H A 1 E5 1 R 3 AB CAB 3 M5 DA1		

(1) G½ thread form is not available with hazardous locations approvals.
(2) Type A flat face for EN 1092-1 flanges.
(3) Type B1 raised face for EN 1092-1 flanges.
(4) Pressure limit is derated for process temperatures above 100 °F (38 °C), see Figure A-4 for details.
(5) Refer to Figure A-6 for pressure/temperature ratings of Tri-Clamp connection.
(6) Option code PC1 is for cone antennas only, and requires matching flange and antenna sizes. Note that all parabolic antennas come with an integrated air purge connection.
(7) A minimum gasket thickness of 0.125 in. (3.2 mm) is required for flanges with protective plate design.
(8) Only available with parabolic antenna and 4-in. (DN100) cone antenna.
(9) The standard alarm setting is high.
(10) Only applies to flanged process connections with welded construction or protective plate design; only applicable to cone antennas (see Table A-12 and Table A-13).
(11) Only available with ASME B16.5 flange connections, and materials of construction codes 1 and 7.
(12) Hydrostatic testing is only available for cone antennas and process seal antennas with flanged process connections.
(13) Certificate includes all pressure retaining and wetted parts.
(14) Only available for process seal antennas with Tri-Clamp connection.
(15) Not available with parabolic antenna.
(16) Requires ½-14 NPT conduit/cable threads (code 1). Available with Intrinsically Safe approvals only.

A.4.2 Rosemount 5408:SIS Level Transmitter

The starred offerings (★) represent the most common options and should be selected for best delivery. The non-starred offerings are subject to additional delivery lead time.

Table A-11: Rosemount 5408:SIS Level Transmitter Ordering Information

Model	Product Description	
5408	Radar Level Transmitter	★
Profile (1)		
F	Functional Safety / SIS Applications	★
Measurement type		
1	Liquid Level Measurement	★
4 (2)	Liquid & Solids Level Measurement	★
Performance class		
S	Standard	★
Signal output		
H	4–20 mA with digital signal based on HART Revision 6 protocol (HART Revision 7 available as option)	★
Housing material		
A	Aluminum	★
S	Stainless Steel (SST)	★
Conduit/cable threads		
1	½-14 NPT	★
2	M20 x 1.5	★

Table A-11: Rosemount 5408:SIS Level Transmitter Ordering Information *(continued)*

3[3]	G½		
Hazardous locations certifications			
NA	None		★
E1	ATEX Flameproof		★
I1	ATEX Intrinsic Safety		★
N1	ATEX Type n		★
E5	USA Explosion-proof, Dust Ignition-proof		★
I5	USA Intrinsically Safe; Nonincendive		★
E6	Canadian Explosion-proof, Dust Ignition-proof		★
I6	Canadian Intrinsically Safe; Nonincendive		★
E7	IECEx Flameproof, Dust Ignition-proof		★
I7	IECEx Intrinsic Safety		★
N7	IECEx Type n		★
E2	INMETRO Flameproof		★
I2	INMETRO Intrinsic Safety		★
N2	INMETRO Type n		★
E3	China Flameproof		★
I3	China Intrinsic Safety		★
N3	China Type n		★
IP	Republic of Korea Intrinsic Safety		★
Materials of construction		**Available antenna types**	
1	316/316L/EN 1.4404	Cone, Parabolic	★
7	All PTFE Wetted Parts	Process Seal	★
2	Alloy C-276 (UNS N10276) with Protective Plate	Cone	
3	Alloy 400 (UNS N04400) with Protective Plate	Cone	
H	Alloy C-276 (UNS N10276) Process Connection, Flange, and Antenna	Cone	
M	Alloy 400 (UNS N04400) Process Connection, Flange, and Antenna	Cone	
Process connection type (see *Table A-12*, *Table A-13*, *Table A-14*, and *Table A-15*)		**Available antenna types**	
F [4]	Flat Face Flange	Cone, Parabolic	★
R [5]	Raised Face Flange	All	★
N	NPT Thread	Cone	★
G	BSPP (G) Thread	Cone, Parabolic	★
B	Bracket Mounting	Cone	★
C	Tri-Clamp	Process Seal	★
W	Welded Connection	Parabolic	★

Table A-11: Rosemount 5408:SIS Level Transmitter Ordering Information *(continued)*

Process connection size (see *Table A-12*, *Table A-13*, *Table A-14*, and *Table A-15*)			Available antenna types	
A	1½-in.		Cone	★
2	2-in./DN50/50A		Cone, Process Seal	★
3	3-in./DN80/80A		Cone, Process Seal	★
B	3½-in.		Parabolic	★
4	4-in./DN100/100A		Cone, Process Seal	★
6	6-in./DN150/150A		Cone	★
8	8-in./DN200/200A		Cone, Parabolic	★
T	10-in./DN250/250A		Parabolic	★
Z	None (use when ordering bracket mounting)		Cone	★
Process connection rating (see *Table A-12*, *Table A-13*, *Table A-14*, and *Table A-15*)				
ZZ	For use with non-flange process connection type			★
ASME flanges				
AA	ASME B16.5 Class 150			★
AB	ASME B16.5 Class 300			★
AC	ASME B16.5 Class 600			★
EN flanges		Note		
DK	EN1092-1 PN6	N/A		★
DA	EN1092-1 PN16	PN10 and PN16 dimensions are identical for DN50 to DN150		★
DB	EN1092-1 PN40	PN25 and PN40 dimensions are identical for DN50 to DN150		★
DC	EN1092-1 PN63	N/A		★
DD	EN1092-1 PN100	N/A		★
JIS flanges				
JK	JIS 5K			★
JA	JIS 10K			★
JB	JIS 20K			★
Antenna type		**Operating pressure**	**Operating temperature**	
CAA	Cone Antenna (PTFE seal)	-15 to 363 psig (-1 to 25 bar)	-76 to 392 °F (-60 to 200 °C)	★
CAB	Cone Antenna (PTFE seal)	-15 to 725 psig (-1 to 50 bar) (6)	-40 to 302 °F (-40 to 150 °C)	★
CAC	Cone Antenna (PTFE seal)	-15 to 1450 psig (-1 to 100 bar)	-40 to 212 °F (-40 to 100 °C)	★
CAD	Cone Antenna (PTFE seal)	-15 to 44 psig (-1 to 3 bar)	-76 to 482 °F (-60 to 250 °C)	★
CBF	Cone Antenna (PEEK seal, FVMQ)	-15 to 754 psig (-1 to 52 bar)	-76 to 338 °F (-60 to 170 °C)	★
CBK	Cone Antenna (PEEK seal, Kalrez 6375)	-15 to 754 psig (-1 to 52 bar)	5 to 482 °F (-15 to 250 °C)	★
CBM	Cone Antenna (PEEK seal, FKM)	-15 to 754 psig (-1 to 52 bar)	-13 to 428 °F (-25 to 220 °C)	★
CBV	Cone Antenna (PEEK seal, Viton)	-15 to 754 psig (-1 to 52 bar)	-22 to 392 °F (-30 to 200 °C)	★
SAA	Process Seal Antenna	-7 to 363 psig (-0.5 to 25 bar) (7)	-76 to 392 °F (-60 to 200 °C)(7)	★

Table A-11: Rosemount 5408:SIS Level Transmitter Ordering Information *(continued)*

PAS	Parabolic Antenna, Swivel Mount	-7 to 43 psig (-0.5 to 3 bar)	-67 to 392 °F (-55 to 200 °C)	★
Antenna size			**Available antenna types**	
2	2-in. (DN50)		Cone, Process Seal	★
3	3-in. (DN80)		Cone, Process Seal	★
4	4-in. (DN100)		Cone, Process Seal	★
8	8-in. (DN200)		Parabolic	★
Options (include with selected model number)				
Antenna extensions (see *Figure A-11*)			**Total length**	
S1	Extended Cone Antenna		24-in. (600 mm)	★
S2	Extended Cone Antenna, Segmented		48-in. (1200 mm)	★
Purging connection (see *Figure A-10*) [8][9]				
PC1	Purging Connector (Purge Ring)			★
Display				
M5	LCD Display			★
Functional safety options				
EF2	Extended SIS Package			★
Diagnostic functionality				
DA1	Smart Diagnostics Suite (see *Smart Diagnostics Suite (option code DA1)*)			★
HART revision configuration				
HR7	4-20 mA with digital signal based on HART Revision 7 protocol			★
Factory configuration				
C1	Factory Configuration per *Configuration Data Sheet*			★
Alarm limits				
C4	NAMUR Alarm and Saturation Levels, High Alarm			★
C5	NAMUR Alarm and Saturation Levels, Low Alarm			★
C8 [10]	Standard Rosemount Alarm and Saturation Levels, Low Alarm			★
Welding standard for flanges [11]				
AW	According to ASME IX			★
EW	According to EN-ISO			★
Country certification[12]				
J1	Canadian Registration (CRN)			★
Special quality assurance				
Q4	Calibration Data Certificate			★

Table A-11: Rosemount 5408:SIS Level Transmitter Ordering Information *(continued)*

Hydrostatic testing (13)		
Q5	Hydrostatic Testing, including certificate	★
Material traceability certification (14)		
Q8	Material Traceability Certification per EN 10204 3.1 (2.1 for non-metallic)	★
Hygienic certification(15)		
QA	Certificate of compliance to 3-A	★
Quality certification for safety		
QS	Certificate of FMEDA Data	★
QT	Safety-certified to IEC 61508 with certificate of FMEDA data	★
Materials certification (16)		
Q15	NACE Material Recommendation per NACE MR0175/ISO 15156	★
Q25	NACE Material Recommendation per ANSI/NACE MR0103/ISO 17495-1	★
Q35	NACE Material Recommendation per NACE MR0175/ISO 15156 and ANSI/NACE MR0103/ISO 17495-1	★
Welding procedure qualification record documentation(11)		
Q66	Welding Procedure Qualification Record (WPQR)	★
Q67	Welder Performance Qualification (WPQ)	★
Q68	Welding Procedure Specification (WPS)	★
Q79	WPQR/WPQ/WPS	★
Dye penetration test certificate(11)		
Q73	Certificate of Liquid Penetrant Inspection	★
Positive material identification certificate		
Q76	Positive Material Identification Certificate of Conformance	★
Overfill prevention		
U1	Overfill Prevention According to WHG/TUV	★
Extended product warranty		
WR3	3-year Limited Warranty	★
WR5	5-year Limited Warranty	★
Paint option for aluminum housing		
PY1	Housing and Covers in Yellow per RAL 1003	★
PY2	Covers in Yellow per RAL 1003	★
PR1	Housing and Covers in Red per RAL 3002	★
PR2	Covers in Red per RAL 3002	★
PO1	Housing and Covers in Orange per Munsell 2.5 YR 6/14	★
PO2	Covers in Orange per Munsell 2.5 YR 6/14	★

Table A-11: Rosemount 5408:SIS Level Transmitter Ordering Information *(continued)*

Conduit electrical connector (shipped uninstalled) (17)		
EC	M 12, 4-pin, Male connector (eurofast)	★
MC	A size Mini, 4-pin, Male connector (minifast)	★
Specials (see *Section A.3.2*)		
PXXXX	Custom Engineered Solutions beyond standard model codes. Consult factory for details.	
Typical model number: 5408 F 1 S H A 1 E5 1 R 3 AB CAB 3 M5 DA1 EF2 QT		

(1) The Rosemount 5408:SIS has two operational modes: Safety (SIS) and Control/Monitoring. Safety (SIS) mode must be set when used in Safety Instrumented Systems. Control/Monitoring mode is intended for use in a Basic Process Control System (BPCS).

(2) Solids level measurement is only available when operating in Control/Monitoring mode.

(3) G½ thread form is not available with hazardous locations approvals.

(4) Type A flat face for EN 1092-1 flanges.

(5) Type B1 raised face for EN 1092-1 flanges.

(6) Pressure limit is derated for process temperatures above 100 °F (38 °C), see Figure A-4 for details.

(7) Refer to Figure A-6 for pressure/temperature ratings of Tri-Clamp connection.

(8) Option code PC1 is for cone antennas only, and requires matching flange and antenna sizes. Note that all parabolic antennas come with an integrated air purge connection.

(9) A minimum gasket thickness of 0.125 in. (3.2 mm) is required for flanges with protective plate design.

(10) The standard alarm setting is high.

(11) Only applies to flanged process connections with welded construction or protective plate design; only applicable to cone antennas (see Table A-12 and Table A-13).

(12) Only available with ASME B16.5 flange connections, and materials of construction codes 1 and 7.

(13) Hydrostatic testing is only available for cone antennas and process seal antennas with flanged process connections.

(14) Certificate includes all pressure retaining and wetted parts.

(15) Only available for process seal antennas with Tri-Clamp connection.

(16) Not available with parabolic antenna.

(17) Requires ½-14 NPT conduit/cable threads (code 1). Available with Intrinsically Safe approvals only.

A.5 Availability of process connections

Table A-12: Cone Antenna - 316/316L SST/EN 1.4404 (Type vs. Size and Rating)

Process connection size	Process connection rating									
		ASME B16.5 flanges(2)			EN1092-1 flanges(2)				JIS B2220 flanges(2)	
	Thread(1)	Class 150 (3)	Class 300(3)	Class 600 (4)	PN16 (5)	PN40(5)	PN63(4)	PN100(4)	10K(3)	20K(4)
1½-in.	G, N	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2-in./ DN50/50A	G, N	R	R	R	F	F, R	F, R	F	R	R
3-in./ DN80/80A	G, N	R	R	R	F, R	F, R	F, R	F, R	R	R
4-in./ DN100/ 100A	G, N	R	R	N/A	F, R	F, R	F	F	R	R
6-in./ DN150/ 150A	N/A	R	R	N/A	F, R	F, R	N/A	N/A	R	R
8-in./ DN200/ 200A	N/A	R	R	N/A	F, R	F, R	N/A	N/A	R	R

(1) BSPP (G) thread (process connection type code G). N = NPT thread (process connection type code N)

(2) F = Flat Face (process connection type code F). R = Raised Face (process connection type code R)

(3) Forged one-piece flange (see Figure A-15).

(4) Welded construction (see Figure A-15).

(5) Welded construction for type A flat face; forged one-piece flange for type B1 raised face.

Table A-13: Cone Antenna - Alloy C-276 and Alloy 400 (Type vs. Size and Rating)

Process connection size	Process connection rating								
	Thread(1)	ASME B16.5 flanges(2)(3)			EN1092-1 flanges(2)(4)(6)			JIS B2220 flanges(2)(6)	
		Class 150	Class 300	Class 600	PN16	PN40	PN63	10K	20K
1½-in.	N	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2-in./DN50/ 50A	N	R(5)	R(5)	R(5)	R	R	R	R	R
3-in./DN80/ 80A	N/A	R(5)	R(5)	R(5)	R	R	R	R	R
4-in./ DN100/ 100A	N/A	R(5)	R(5)	N/A	R	R	R	R	R
6-in./ DN150/ 150A	N/A	R(5)	R(6)	N/A	R	R	N/A	R	R
8-in./ DN200/ 200A	N/A	R(6)	N/A	N/A	R	R	N/A	R	R

(1) N = NPT thread (process connection type code N)
(2) R = Raised Face (process connection type code R)
(3) Welded construction for materials of construction codes H and M (see Figure A-15).
(4) Backing flange in flat face.
(5) Available with materials of construction codes 2, 3, H, and M.
(6) Only available with protective plate design (materials of construction codes 2 and 3).

Table A-14: Process Seal Antenna (Type vs. Size and Rating)

Process connection size	Process connection rating						
	Tri-Clamp(1)	ASME B16.5 flanges (2)(3)		EN1092-1 flanges(2)(3)			JIS B2220 flanges(2)(3)
		Class 150	Class 300	PN6	PN16	PN40	10K
2-in./DN50/ 50A	C	R	R	R	R	R	R
3-in./DN80/ 80A	C	R	R	R	R	R	R
4-in./ DN100/ 100A	N/A	R	R	R	R	R	R

(1) C = Tri-Clamp (process connection type code C)
(2) Forged one-piece flange (see Figure A-15).
(3) R = Raised Face (process connection type code R)

Table A-15: Parabolic Antenna (Type vs. Size and Rating)

Process connection size	Process connection rating				
	Thread(1)	Welded(2)	ASME B16.5 Class 150 flange(3)	EN1092-1 PN6 flange(4)	JIS B2220 5K flange(3)
3½-in.	G	W	N/A	N/A	N/A
8-in./DN200/200A	N/A	N/A	R	F	R
10-in./DN250/250A	N/A	N/A	R	F	R

(1) G = BSPP (G) thread (process connection type code G)
(2) W = Welded connection (process connection type code W)
(3) R = Raised Face face (process connection type code R)
(4) F = Flat Face face (process connection type code F)

A.6 Spare parts and accessories

Table A-16: Rosemount 5408 and 5408:SIS Spare Parts List - Transmitter Head

Model	Product Description
5408	Radar Level Transmitter
Profile	
A	Standard Monitoring & Control Applications
F (1)	Functional Safety / SIS Applications
Measurement type	
1	Liquid Level Measurement
3	Solids Level Measurement (profile code A only)
4 (2)	Liquid & Solids Level Measurement
Performance class	
S	Standard
Signal output	
H	4–20 mA with digital signal based on HART Revision 6 protocol (HART Revision 7 available as option)
Housing material	
A	Aluminum
S	Stainless Steel (SST)
Conduit/cable threads	
1	½-14 NPT
2	M20 x 1.5

Table A-16: Rosemount 5408 and 5408:SIS Spare Parts List - Transmitter Head *(continued)*

3[3]	G½
Hazardous locations certifications	
NA	None
E1	ATEX Flameproof
I1	ATEX Intrinsic Safety
N1	ATEX Type n
E5	USA Explosion-proof, Dust Ignition-proof
I5	USA Intrinsically Safe; Nonincendive
E6	Canadian Explosion-proof, Dust Ignition-proof
I6	Canadian Intrinsically Safe; Nonincendive
E7	IECEx Flameproof, Dust Ignition-proof
I7	IECEx Intrinsic Safety
N7	IECEx Type n
E2	INMETRO Flameproof
I2	INMETRO Intrinsic Safety
N2	INMETRO Type n
E3	China Flameproof
I3	China Intrinsic Safety
N3	China Type n
IP	Republic of Korea Intrinsic Safety
Materials of construction	
Z	None (Spare Transmitter Head)
Process connection type	
Z	None (Spare Transmitter Head)
Process connection size	
Z	None (Spare Transmitter Head)
Process connection rating	
ZZ	None (Spare Transmitter Head)
Antenna type	
ZZZ	None (Spare Transmitter Head)
Antenna size	
Z	None (Spare Transmitter Head)
Options (include with selected model number)	
Display	
M5	LCD Display

Table A-16: Rosemount 5408 and 5408:SIS Spare Parts List - Transmitter Head *(continued)*

Functional safety options	
EF1	Ready for upgrade to Rosemount 5408:SIS (profile code A only)
EF2	Extended SIS Package (profile code F only)
Diagnostic functionality	
DA1	Smart Diagnostics Suite (see *Smart Diagnostics Suite (option code DA1)*)
HART revision configuration	
HR7	4-20 mA with digital signal based on HART Revision 7 protocol
Open air applications configuration (4)	
OA	Open Air Applications Configuration; LPR (Level Probing Radar) (profile code A only)
Factory configuration	
C1	Factory Configuration per *Configuration Data Sheet*
Alarm limits	
C4	NAMUR Alarm and Saturation Levels, High Alarm
C5	NAMUR Alarm and Saturation Levels, Low Alarm
C8 (5)	Standard Rosemount Alarm and Saturation Levels, Low Alarm
Special quality assurance	
Q4	Calibration Data Certificate
Hygienic certification(6)	
QA	Certificate of compliance to 3-A
Quality certification for safety (profile code F only)	
QS	Certificate of FMEDA Data
QT	Safety-certified to IEC 61508 with certificate of FMEDA data
Overfill prevention	
U1	Overfill Prevention According to WHG/TUV
Extended product warranty	
WR3	3-year Limited Warranty
WR5	5-year Limited Warranty
Paint option for aluminum housing (profile code F only)	
PY1	Housing and Covers in Yellow per RAL 1003
PY2	Covers in Yellow per RAL 1003
PR1	Housing and Covers in Red per RAL 3002
PR2	Covers in Red per RAL 3002
PO1	Housing and Covers in Orange per Munsell 2.5 YR 6/14
PO2	Covers in Orange per Munsell 2.5 YR 6/14

Table A-16: Rosemount 5408 and 5408:SIS Spare Parts List - Transmitter Head *(continued)*

Conduit electrical connector (shipped uninstalled) (7)	
EC	M 12, 4-pin, Male connector (eurofast)
MC	A size Mini, 4-pin, Male connector (minifast)
Adapter wetted parts (8)	
A1	Adapter for Rosemount 5402 Antennas
Specials (see ***Section A.3.2*****)**	
PXXXX	Custom Engineered Solutions beyond standard model codes. Consult factory for details.
Typical model number: 5408 A 1 S H A 1 E5 Z Z Z ZZ ZZZ Z M5 DA1	

(1) *The Rosemount 5408:SIS (profile code F) has two operational modes: Safety (SIS) and Control/Monitoring. Safety (SIS) mode must be set when used in Safety Instrumented Systems. Control/Monitoring mode is intended for use in a Basic Process Control System (BPCS).*

(2) *Note that for the Rosemount 5408:SIS (profile code F), solids level measurement is only available when operating in Control/Monitoring mode.*

(3) *G½ thread form is not available with hazardous locations approvals.*

(4) *Only available with parabolic antenna and 4-in. (DN100) cone antenna.*

(5) *The standard alarm setting is high.*

(6) *Only available for process seal antennas with Tri-Clamp connection.*

(7) *Requires ½-14 NPT conduit/cable threads (code 1). Available with Intrinsically Safe approvals only.*

(8) *Rosemount 5408 is backward compatible with the full range of Rosemount 5402 antennas manufactured after September 2013, when ordered with the appropriate adapter (option code A1). The Rosemount 5408 transmitter head can also be ordered with a Rosemount 5402 antenna, or pre-configured to an existing Rosemount 5402 antenna. Contact your Emerson sales representative for more information.*

Table A-17: Rosemount 5408 and 5408:SIS Spare Parts List - Antenna

Model	**Product Description**
5408	Radar Level Transmitter
Profile	
Z	None (Spare Antenna)
Measurement type	
9	None (Spare Antenna)
Performance class	
Z	None (Spare Antenna)
Signal output	
Z	None (Spare Antenna)
Housing material	
Z	None (Spare Antenna)
Conduit/cable threads	
Z	None (Spare Antenna)

Table A-17: Rosemount 5408 and 5408:SIS Spare Parts List - Antenna *(continued)*

Hazardous locations certifications		
NA	None	
Materials of construction		**Available antenna types**
1	316/316L/ EN 1.4404	Cone, Parabolic
7	All PTFE Wetted Parts	Process Seal
2	Alloy C-276 (UNS N10276) with Protective Plate	Cone
3	Alloy 400 (UNS N04400) with Protective Plate	Cone
H	Alloy C-276 (UNS N10276) Process Connection, Flange, and Antenna	Cone
M	Alloy 400 (UNS N04400) Process Connection, Flange, and Antenna	Cone
Process connection type (see *Table A-12*, *Table A-13*, *Table A-14*, and *Table A-15*)		**Available antenna types**
F (1)	Flat Face Flange	Cone, Parabolic
R (2)	Raised Face Flange	All
N	NPT Thread	Cone
G	BSPP (G) Thread	Cone, Parabolic
B	Bracket Mounting	Cone
C	Tri-Clamp	Process Seal
W	Welded Connection	Parabolic
Process connection size (see *Table A-12*, *Table A-13*, *Table A-14*, and *Table A-15*)		**Available antenna types**
A	1½-in.	Cone
2	2-in./DN50/50A	Cone, Process Seal
3	3-in./DN80/80A	Cone, Process Seal
B	3½-in.	Parabolic
4	4-in./DN100/100A	Cone, Process Seal
6	6-in./DN150/150A	Cone
8	8-in./DN200/200A	Cone, Parabolic
T	10-in./DN250/250A	Parabolic
Z	None (use when ordering bracket mounting)	Cone
Process connection rating (see *Table A-12*, *Table A-13*, *Table A-14*, and *Table A-15*)		
ZZ	For use with non-flange process connection type	
ASME flanges		
AA	ASME B16.5 Class 150	
AB	ASME B16.5 Class 300	
AC	ASME B16.5 Class 600	
EN flanges		Note
DK	EN1092-1 PN6	N/A
DA	EN1092-1 PN16	PN10 and PN16 dimensions are identical for DN50 to DN150

Table A-17: Rosemount 5408 and 5408:SIS Spare Parts List - Antenna *(continued)*

DB	EN1092-1 PN40	PN25 and PN40 dimensions are identical for DN50 to DN150	
DC	EN1092-1 PN63	N/A	
DD	EN1092-1 PN100	N/A	
JIS flanges			
JK	JIS 5K		
JA	JIS 10K		
JB	JIS 20K		
Antenna type		**Operating pressure**	**Operating temperature**
CAA	Cone Antenna (PTFE seal)	-15 to 363 psig (-1 to 25 bar)	-76 to 392 °F (-60 to 200 °C)
CAB	Cone Antenna (PTFE seal)	-15 to 725 psig (-1 to 50 bar) (3)	-40 to 302 °F (-40 to 150 °C)
CAC	Cone Antenna (PTFE seal)	-15 to 1450 psig (-1 to 100 bar)	-40 to 212 °F (-40 to 100 °C)
CAD	Cone Antenna (PTFE seal)	-15 to 44 psig (-1 to 3 bar)	-76 to 482 °F (-60 to 250 °C)
CBF	Cone Antenna (PEEK seal, FVMQ)	-15 to 754 psig (-1 to 52 bar)	-76 to 338 °F (-60 to 170 °C)
CBK	Cone Antenna (PEEK seal, Kalrez 6375)	-15 to 754 psig (-1 to 52 bar)	5 to 482 °F (-15 to 250 °C)
CBM	Cone Antenna (PEEK seal, FKM)	-15 to 754 psig (-1 to 52 bar)	-13 to 428 °F (-25 to 220 °C)
CBV	Cone Antenna (PEEK seal, Viton)	-15 to 754 psig (-1 to 52 bar)	-22 to 392 °F (-30 to 200 °C)
SAA	Process Seal Antenna	-7 to 363 psig (-0.5 to 25 bar) (4)	-76 to 392 °F (-60 to 200 °C)(4)
PAS	Parabolic Antenna, Swivel Mount	-7 to 43 psig (-0.5 to 3 bar)	-67 to 392 °F (-55 to 200 °C)
Antenna size			**Available antenna types**
2	2-in. (DN50)		Cone, Process Seal
3	3-in. (DN80)		Cone, Process Seal
4	4-in. (DN100)		Cone, Process Seal
8	8-in. (DN200)		Parabolic
Options (include with selected model number)			
Antenna extensions (see *Figure A-11*)			**Total length**
S1	Extended Cone Antenna		24-in. (600 mm)
S2	Extended Cone Antenna, Segmented		48-in. (1200 mm)
Purging connection (5)(6)			
PC1	Purging Connector (Purge Ring)		
Welding standard for flanges (7)			
AW	According to ASME IX		
EW	According to EN-ISO		
Country certification(8)			
J1	Canadian Registration (CRN)		

Table A-17: Rosemount 5408 and 5408:SIS Spare Parts List - Antenna *(continued)*

Hydrostatic testing (9)	
Q5	Hydrostatic Testing, including certificate
Material traceability certification (10)	
Q8	Material Traceability Certification per EN 10204 3.1 (2.1 for non-metallic)
Hygienic certification(11)	
QA	Certificate of compliance to 3-A
Materials certification (12)	
Q15	NACE Material Recommendation per NACE MR0175/ISO 15156
Q25	NACE Material Recommendation per ANSI/NACE MR0103/ISO 17495-1
Q35	NACE Material Recommendation per NACE MR0175/ISO 15156 and ANSI/NACE MR0103/ISO 17495-1
Welding procedure qualification record documentation(7)	
Q66	Welding Procedure Qualification Record (WPQR)
Q67	Welder Performance Qualification (WPQ)
Q68	Welding Procedure Specification (WPS)
Q79	WPQR/WPQ/WPS
Dye penetration test certificate(7)	
Q73	Certificate of Liquid Penetrant Inspection
Positive material identification certificate	
Q76	Positive Material Identification Certificate of Conformance
Extended product warranty	
WR3	3-year Limited Warranty
WR5	5-year Limited Warranty
Specials (see *Section A.3.2*)	
PXXXX	Custom Engineered Solutions beyond standard model codes. Consult factory for details.
Typical model number: 5408 Z 9 Z Z Z Z NA 1 R 3 AB CAB 3	

(1) Type A flat face for EN 1092-1 flanges.

(2) Type B1 raised face for EN 1092-1 flanges.

(3) Pressure limit is derated for process temperatures above 100 °F (38 °C), see Figure A-4 for details.

(4) Refer to Figure A-6 for pressure/temperature ratings of Tri-Clamp connection.

(5) Option code PC1 is for cone antennas only, and requires matching flange and antenna sizes. Note that all parabolic antennas come with an integrated air purge connection.

(6) A minimum gasket thickness of 0.125 in. (3.2 mm) is required for flanges with protective plate design.

(7) Only applies to flanged process connections with welded construction or protective plate design; only applicable to cone antennas (see Table A-12 and Table A-13).

(8) Only available with ASME B16.5 flange connections, and materials of construction codes 1 and 7.

(9) Hydrostatic testing is only available for cone antennas and process seal antennas with flanged process connections.

(10) Certificate includes all pressure retaining and wetted parts.

(11) Only available for process seal antennas with Tri-Clamp connection.

(12) Not available with parabolic antenna.

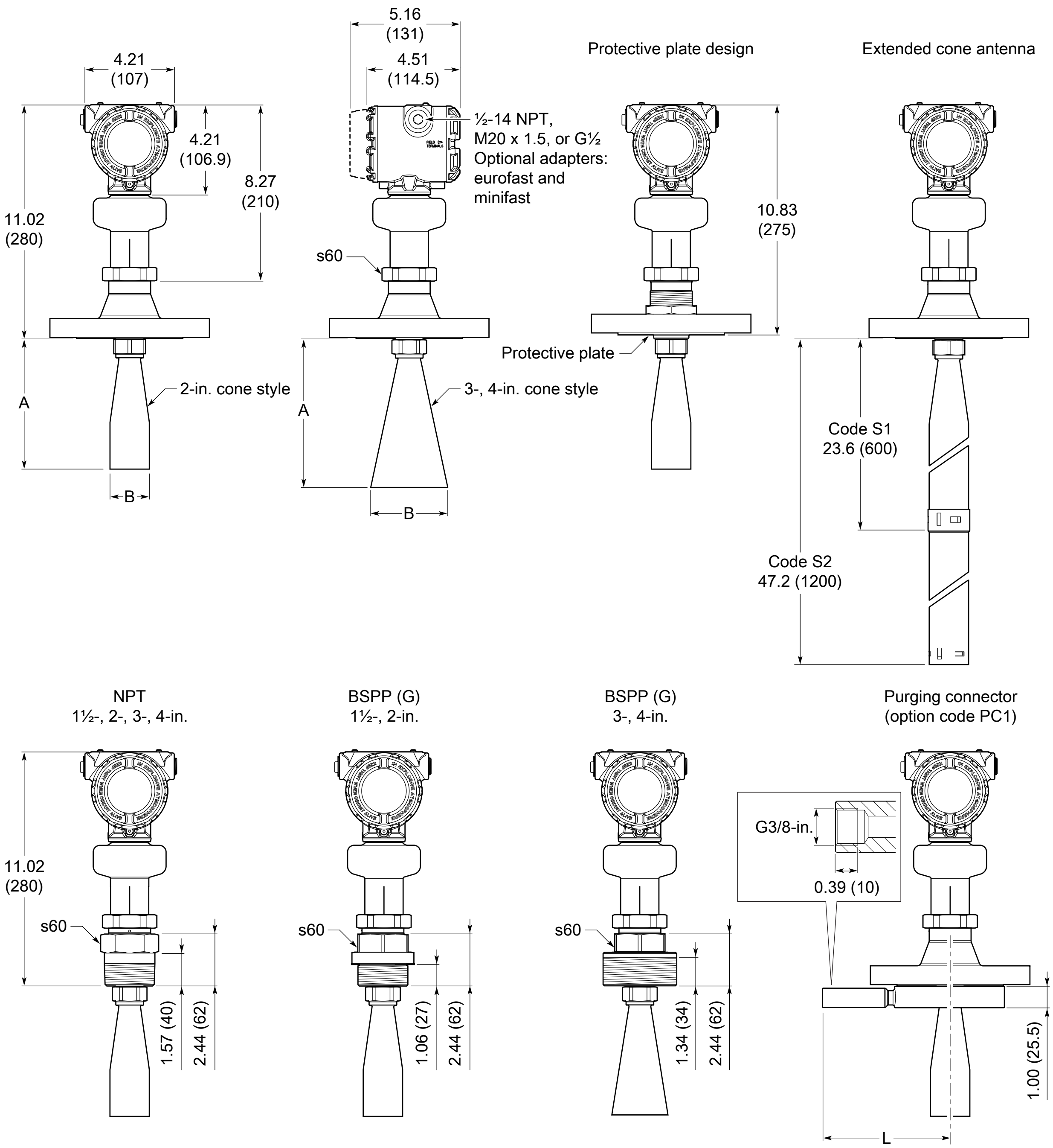
A.6.1 Accessories

Table A-18: Accessories

HART modem and cable	
03300-7004-0002	MACTek® VIATOR® HART modem and cables (USB connection)

A.7 Dimensional drawings

Figure A-11: Cone Antenna



Dimensions are in inches (millimeters).