

Rosemount™ 5600 Series Level Transmitter

Non-Contacting Radar with HART® Protocol



HART 
COMMUNICATION PROTOCOL **CE**


EMERSON™

Rosemount™ 5600 Series Radar Level Transmitter

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.

Within the United States, Rosemount Inc. has two toll-free assistance numbers.

Customer Central: 1-800-999-9307 (7:00 a.m. to 7:00 p.m. CST)

Technical support, quoting, and order-related questions.

North American Response Center: 1-800-654-7768 (24 hours a day – Includes Canada)
Equipment service needs.

⚠ CAUTION

The products described in this document are NOT designed for nuclear-qualified applications.

Using non-nuclear qualified products in applications that require nuclear-qualified hardware or products may cause inaccurate readings.

For information on Rosemount nuclear-qualified products, contact your local Rosemount Sales Representative.

Table of Contents

Section 1: Introduction

1.1 Safety messages	9
1.2 Overview	10
1.3 Specific FCC requirements (USA only)	12
1.3.1 Measuring range	12
1.4 Unpacking your Rosemount 5600 Transmitter	14
1.5 Service support	14
1.5.1 Within the USA	14
1.5.2 Outside the USA	14

Section 2: Mechanical Installation

2.1 Safety messages	17
2.2 Introduction	19
2.2.1 Tools	19
2.3 General installation requirements	19
2.3.1 Customer-supplied flanges	19
2.3.2 Nozzle requirements	19
2.3.3 Free space requirements	21
2.3.4 Beam width	22
2.3.5 Special antennas and space requirements reference	23
2.4 Wave guide tubes	24
2.5 Mounting the cone antenna - PTFE sealing	25
2.6 Mounting the cone antenna - quartz sealing	28
2.7 Mounting the process seal antenna	33
2.7.1 Preparations	33
2.8 Mounting the cone antenna in a still pipe/bridle	36
2.8.1 Installation requirements for cone antenna in a still pipe/bridle	36
2.8.2 For still pipes	36
2.8.3 For bridle pipes	37
2.8.4 Measurement in large pipes	38

2.8.5	Mounting the antenna	39
2.9	Mounting the parabolic antenna	40
2.9.1	Mounting the flange ball	40
2.9.2	Mounting the antenna	42
2.10	Mounting the extended cone antenna	45
2.10.1	Setting the tank connection length (TCL).....	46
2.10.2	Setting the Hold Off distance	47
2.10.3	Installation requirements for the extended cone antenna	48
2.11	Mounting the cone antenna with flushing connections	51

Section 3: Electrical Installation

3.1	Safety messages.....	55
3.2	System overview	56
3.3	Cables.....	57
3.4	Power supply	57
3.5	Grounding.....	58
3.6	HART electrical installation	58
3.6.1	External connections	58
3.6.2	Connecting HART devices	60

Section 4: Configuration

4.1	Safety messages.....	63
4.2	Overview	63
4.2.1	Basic configuration	64
4.2.2	Advanced configuration.....	64
4.3	Antenna.....	64
4.4	Tank geometry.....	66
4.4.1	Advanced tank geometry configuration.....	67
4.5	Analog output	68
4.6	Process conditions.....	70
4.7	Temperature measurement	70
4.8	Volume calculation	71
4.9	Advanced functions.....	71
4.9.1	Disturbance Echo Handling.....	71
4.9.2	Bottom Echo Handling.....	75
4.9.3	Full Tank Handling.....	75
4.9.4	Empty Tank Handling	76
4.9.5	Surface Tracking	76

4.9.6 Filtering..... 78

Section 5: HART Configuration

5.1 Safety messages..... 79

5.2 Overview..... 79

5.3 PC Configuration Software Radar Master..... 80

 5.3.1 Installation..... 80

 5.3.2 Main configuration icons..... 82

5.4 Handheld communicator..... 85

 5.4.1 HART fast keys..... 87

 5.4.2 Setting the loop to manual..... 87

 5.4.3 Connections and hardware..... 87

 5.4.4 Using a handheld communicator..... 87

 5.4.5 Level configuration example..... 87

Section 6: Maintenance and Troubleshooting

6.1 Overview..... 89

6.2 Safety messages..... 89

 6.2.1 Warnings..... 89

6.3 HART maintenance and troubleshooting..... 89

 6.3.1 Troubleshooting table..... 90

 6.3.2 Field upgrades..... 90

 6.3.3 Connection via Sensor Bus Port..... 91

Appendix A: Reference Data

A.1 Specifications..... 93

 A.1.1 General..... 93

 A.1.2 Measuring performance..... 93

 A.1.3 Configuration..... 93

 A.1.4 Electric..... 93

 A.1.5 Analog output characteristics..... 94

 A.1.6 Mechanical..... 94

 A.1.7 Environment..... 95

A.2 Dimensional drawings..... 97

A.3 Ordering information..... 102

 A.3.1 Accessories..... 107

Appendix B: Product Certifications

B.1 European Directive Information	109
B.2 Ordinary Location Certification.....	109
B.3 Telecommunication compliance	109
B.3.1 FCC.....	109
B.3.2 IC	109
B.3.3 Radio Equipment Directive (RED) 2014/53/EU	109
B.4 Installing equipment in North America	109
B.5 USA.....	110
B.6 Canada.....	110
B.7 Europe	111
B.8 International.....	112
B.9 Brazil.....	113
B.10China	114
B.11EAC.....	114
B.11.1 Ex	114
B.12Republic of Korea	114
B.13India	114
B.14Ukraine	115
B.15Additional certifications.....	115
B.15.1 Republic of Korea EMC.....	115
B.16Pattern approval	115
B.17ATEX approval drawings	116
B.18FM approval drawings	118
B.19CSA approval drawings.....	120

Section 1 Introduction

Safety messages	page 9
Overview	page 10
Specific FCC requirements (USA only)	page 12
Unpacking your Rosemount 5600 Transmitter	page 14
Service support	page 14

1.1 Safety messages

Procedures and instructions in this manual may require special precautions to ensure the safety of the personnel performing the operations. Information that raises potential safety issues is indicated by a warning symbol (⚠). Refer to the safety messages listed at the beginning of each section before performing an operation preceded by this symbol.

⚠ WARNING

Explosions could result in death or serious injury:

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

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

⚠ WARNING

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

Make sure only qualified personnel perform these procedures.

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

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

⚠ WARNING

This product is an electrical apparatus and must be installed in the hazardous area in accordance with the requirements of the EC Type Examination Certificate.

The installation and maintenance must be carried out in accordance with all appropriate international, national and local standard codes of practice and site regulations for intrinsically safe apparatus and in accordance with the instructions contained within this manual. Access to the circuitry must not be made during operation.

⚠ WARNING

Physical access

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

1.2 Overview

This manual provides information about mechanical and electrical installation of the Rosemount™ 5600 Series Radar Level Transmitter. It also describes how to start up and configure the transmitter. The main purpose of the book is to act as guide to installing and operating the Rosemount 5600 Series Radar Level Transmitter. It is not intended to cover service tasks such as changing circuit boards or internal software.

Section 2: Mechanical Installation

- Mechanical installation instructions

Section 3: Electrical Installation

- Electrical installation instructions

Section 4: Configuration

- Configuration

Section 5: HART Configuration

- Commissioning
- Software functions
- Configuration parameters
- Online variables

Section 6: Maintenance and Troubleshooting

- Troubleshooting techniques for the most common operating problems for HART protocol only.

Appendix A: Reference Data

- Specifications
- Dimensional Drawings
- Ordering information for HART protocols

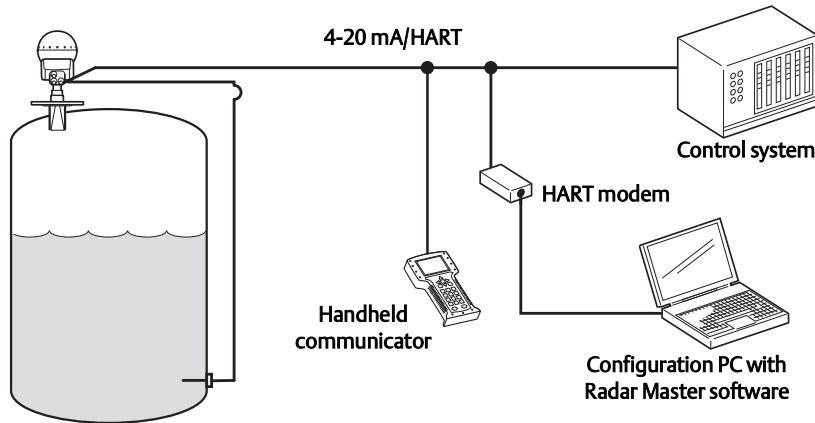
Appendix B: Product Certifications

- Intrinsic safety approval information
- European ATEX directive information
- Approval drawings for HART protocol

The Rosemount 5600 Series Radar Level Transmitter is a powerful radar level transmitter suitable for non-contact level measurements in process tanks, storage tanks, and other types of tanks. It is designed for easy installation and maintenance free operation.

Together with the Rosemount Radar Master Configuration Tool you are able, in an easy and user-friendly way, to configure the Rosemount 5600 transmitters. The Radar Master program is a Microsoft® Windows-based software package designed for the Rosemount 5600 transmitters, and offers great assistance, from startup and commissioning to advanced service. It includes waveform plots, offline configuration, logging, and an extensive online Help.

Figure 1-1. System Integration Using the Handheld Communicator

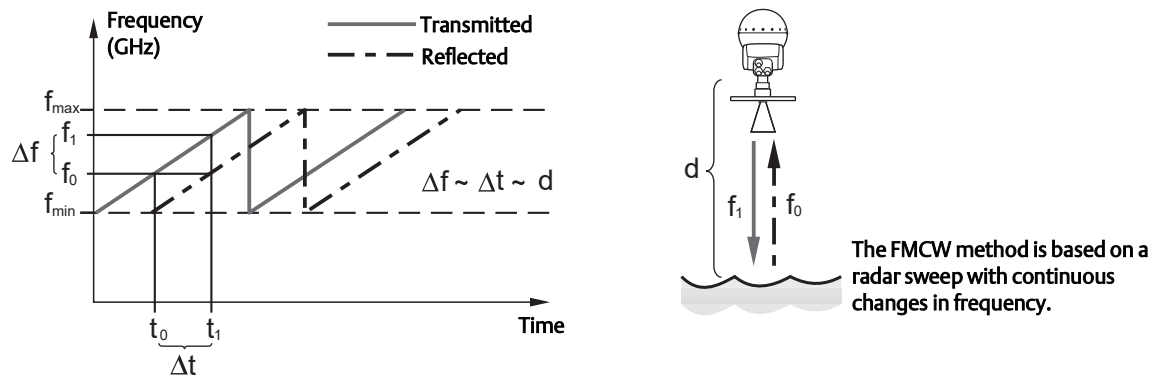


For stand-alone systems, or as a complement to a PC or a control system, you can monitor level data using one or two analog outputs depending on the particular hardware configuration.

Measurement principle

The level of the product in the tank is measured by radar signals transmitted from the antenna at the tank top. After the radar signal is reflected by the product surface the echo is picked up by the antenna. As the signal is varying in frequency the echo has a slightly different frequency compared to the signal transmitted at that moment. The difference in frequency is proportional to the distance to the product surface, and can be accurately calculated. This method is called FMCW (Frequency Modulated Continuous Wave) and is used in all high performance radar transmitters.

Figure 1-2. Frequency Modulated Continuous Wave



The Rosemount 5600 Series Radar Level Transmitter sends a microwave signal with a continuously varying frequency towards the product surface. When the reflected signal returns to the antenna, it is mixed with the outgoing signal.

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.

The transmitter mixes the two signals, resulting in a low frequency signal that is proportional to the distance to the product surface. This signal can be measured very accurately allowing fast, reliable, and accurate level measurements.

The Rosemount 5600 Series Radar Level Transmitter uses micro frequency to reduce sensitivity to vapor, foam, and contamination of the antenna, and keeps the radar beam narrow in order to minimize influence from walls and disturbing objects.

The Rosemount 5600 Series Radar Level Transmitter uses Fast Fourier Transformation (FFT), which is a well established signal processing technique, to obtain a frequency spectrum of all echoes in the tank. From this frequency spectrum the surface level is extracted. In combination with the echofixer, FFT allows measurements in tanks with agitators, mixers and other disturbing objects. The echofixer provides a technique to adapt measurements to various situations, by using information from previous measurements.

1.3 Specific FCC requirements (USA only)

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

The Rosemount 5600 generates and uses radio frequency energy. If it is not installed and used properly (in strict accordance with the manufacturer's instructions) it may violate FCC regulations on radio frequency emission.

Installation on non-metallic tanks, tanks with open manholes, external-floating-roof tanks without stillpipes etc. are not covered by this certificate, and require a Part 90 site-license. If you have an installation like this, contact your local Emerson Automation Solutions representative for help with the necessary license application.

1.3.1 Measuring range

The diagrams below show how the measuring range is influenced by the antenna type, dielectric constant of the liquid (ϵ_r) and the process conditions. For optimum performance the maximum measuring distance should be kept within the range indicated with darker color in the diagrams. Values are valid for free propagation measurement without still pipes (bridles).

For liquids with ϵ_r that are smaller than 1.9 such as liquefied gases, an 8 in. (203 mm) or bigger diameter antenna is recommended if measurement is done with free propagation. In this case the measuring range in calm surface tanks is in typical cases 50 ft. (15 m).

To increase the measuring range further in turbulent tanks, a still pipe can be used. For still pipe mounted Rosemount 5600 transmitters the typical measuring range is 115-160 ft. (35-50 m) in turbulent tanks with liquids having ϵ_r less than 1.9.

Table 1-1. Categories of Liquids

a	Oil, gasoline and other hydrocarbons, petrochemicals (dielectric constant, $\epsilon_r=1.9-4.0$)
b	Alcohols, concentrated acids, organic solvents, oil/water mixtures and acetone ($\epsilon_r=4.0-10$)
c	Conductive liquids, e.g. water based solutions, dilute acids, and alkalis ($\epsilon_r > 10$)

Figure 1-3. Applications with Calm Product Surface⁽¹⁾

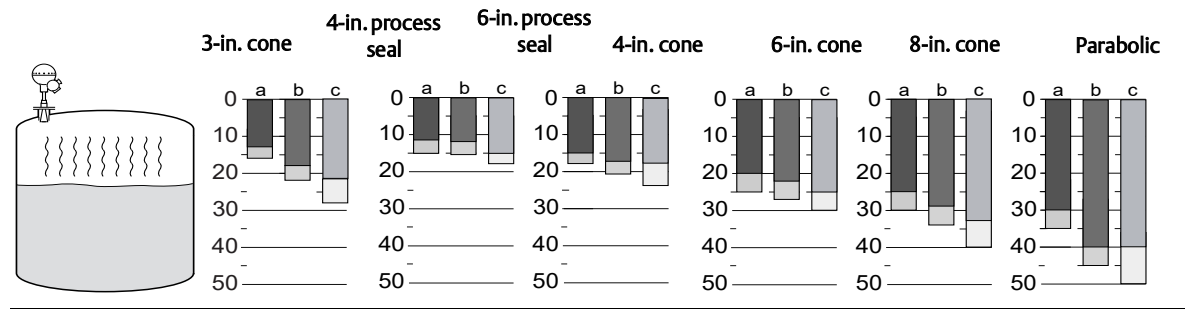


Figure 1-4. Applications Where the Product is Gently Stirred Causing Minor Turbulence⁽¹⁾

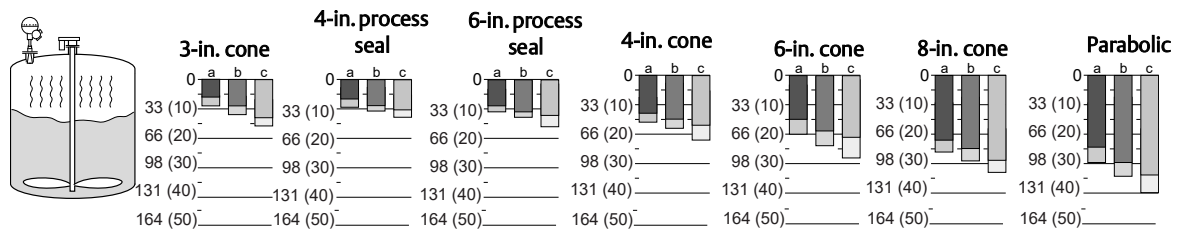
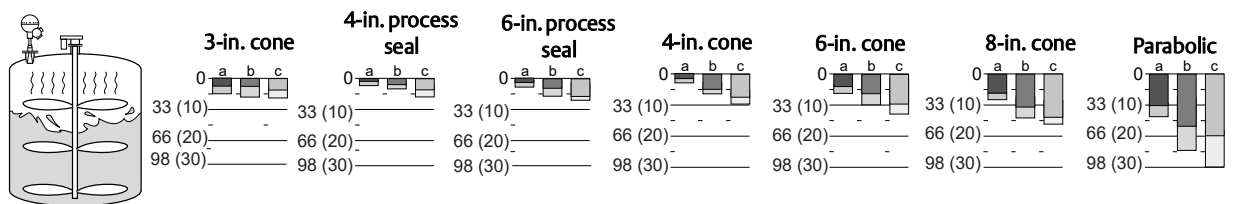


Figure 1-5. Applications with Turbulent Product Surface Conditions⁽¹⁾



Note: 4-in. and 6-in. process seal cones are not recommended for turbulent conditions.

Minimum measuring distance

The minimum distance the radar can measure depends on the antenna selected. Typically the level can come as close as 0.79 in. (20 mm) from the antenna tip, before the software disregards the signal. Being this close to the antenna may however reduce the measurement accuracy. [Table 2-1 on page 20](#) includes the value Hold Off Distance, which is the default setting for this minimum distance. It can not be decreased, only increased if needed.

1. Measuring range in ft. (m).

Measuring close to the tank bottom

When measuring products with low dielectric constants (i.e. DC range 1.4 - 2.5), some of the radar energy will go thru the product. This could lead to that the radar will see the Flat Tank Bottom, even though there is a small amount of product covering the bottom of the tank. This could reduce the accuracy of the measurement at these lower product levels. This could occur at product levels of 4 to 6 in. (100 to 150 mm) or lower, but depends on the product as well as the tank bottom type. There are special software settings that could improve this situation, or alternatively mechanical changes could be implemented to minimize the influence from the bottom of the tank.

1.4 Unpacking your Rosemount 5600 Transmitter

Verify that you have received:

- One box with the transmitter head. This box also includes a Hook spanner (used to open the terminal compartments), Reference manual (00809-0100-4024), Rosemount Radar Master CD-Rom (0822-0100-4757), and a Quick Installation Guide.
- One box with the antenna. This box contains the complete antenna assembly, including the wave guide tube (see “Wave guide tubes” on page 24) which is to be inserted in the transmitter head foot.

NOTE

If you ordered flanges, the flanges are typically stored at the bottom of the bigger wooden crate that the transmitter is delivered in. They are held in place with bolts and nuts.

1.5 Service support

If you have reason to believe that your Rosemount 5600 Radar Level Transmitter may need to be returned for service, contact the appropriate representative.

1.5.1 Within the USA

Please contact a Level Applications Support Specialist at Rosemount Customer Central (1-800-999-9307). They will help you determine the best course of action, and may transfer you to either an Order Administrator or to the Rosemount North American Response Center (NARC) to arrange for the return of your transmitter for service or repair.

1.5.2 Outside the USA

For Service Support outside the United States, please contact your nearest Rosemount Representative.

Note

Most radar problems encountered in the field are applications-related and can best be dealt with while the transmitter is installed.

The representative will assist you with any needed information or materials.

The representative will ask for the following information:

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

The representative will provide:

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

Spare parts

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

Section 2 Mechanical Installation

Safety messages	page 17
Introduction	page 19
General installation requirements	page 19
Wave guide tubes	page 24
Mounting the cone antenna - PTFE sealing	page 25
Mounting the cone antenna - quartz sealing	page 28
Mounting the process seal antenna	page 33
Mounting the parabolic antenna	page 40
Mounting the extended cone antenna	page 45
Mounting the cone antenna with flushing connections	page 51

2.1 Safety messages

Procedures and instructions in this manual may require special precautions to ensure the safety of the personnel performing the operations. Information that raises potential safety issues is indicated by a warning symbol (⚠). Refer to the safety messages listed at the beginning of each section before performing an operation preceded by this symbol.

⚠ WARNING

Explosions could result in death or serious injury:

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

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

⚠ WARNING

This product is an electrical apparatus and must be installed in the hazardous area in accordance with the requirements of the EC Type Examination Certificate.

The installation and maintenance must be carried out in accordance with all appropriate international, national and local standard codes of practice and site regulations for intrinsically safe apparatus and in accordance with the instructions contained within this manual. Access to the circuitry must not be made during operation.

1. The product has been designed such that the protection afforded will not resistance and the affects of temperature variation.
2. The product can not be repaired by the user and must be replaced by an equivalent certified product. Repairs should only be carried out by the manufacturer or approved repairer.
3. The product must be protected from excessive dust by an enclosure etc.
4. The product must not be subjected to mechanical and thermal stresses in excess of those permitted in the certification documentation and the instruction manual. If necessary the product must be protected by an enclosure to prevent mechanical damage.
5. There are no exposed parts of the apparatus which produce excessive surface temperature, infrared, electromagnetic, ionizing radiation or non electrical dangers.
6. The product must not be installed in a position where it may be attacked by aggressive substances.

All externally connected equipment must comply with, or have isolation from mains complying with, the relevant electrical safety standard. As a matter of routine, shut off the Model 5600 Radar Level Transmitter and all other equipment in the tank before you enter the tank.

⚠ WARNING

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

Make sure only qualified personnel perform these procedures.

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

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

The quartz seal is not suitable for use in environments where there is a risk for variations or other mechanical impacts.

For quartz seal, mechanical shocks may permanently damage the seal. A damaged tank seal must be replaced. Replacement must be done when the tank is unpressurized.

The customer must always make sure that exposed material of antenna and tank seal is compatible with the tank content (e.g. the quartz seal) is not suitable for use with Hydrofluoric acid (HF).

A damaged quartz tank seal will typically cause one or many disturbance echoes which will be seen in a tank spectrum plot during gauge configuration.

2.2 Introduction

This section describes the mechanical installation. Start by reading the General Installation Requirements for your antenna. This includes Nozzle and Free Space Requirements. The last part of this section includes mounting instructions for all antenna types, including special requirements for still pipe/bridle installations and applications.

2.2.1 Tools

The following set of tools are needed for installation of a Rosemount 5600 Series Radar Level Transmitter:

- Screw driver
- Adjustable wrench
- Allen key
- Circlip plier (snap ring plier)
- Hook spanner (comes delivered with the transmitter)

2.3 General installation requirements

Position the transmitter in a way that allows the microwaves to propagate without disturbance from the tank wall. In order to achieve optimum performance you should consider the following recommendations:

- Try to avoid obstacles in the radar beam.
- Mount the transmitter away from pipe inlets which cause turbulent conditions.
- Choose as large antenna as possible to ensure maximum antenna gain.
- For best measurement performance it is recommended that the antenna tip ends outside the nozzle, see [Figure 2-2](#).

2.3.1 Customer-supplied flanges

The simple design of cone antennas tank connection allows the use of customer supplied flanges. If a hole is drilled in a standard blind flange the pressure performance may be reduced. In such a case the flange should be marked with new rating for Maximum Allowed Working Pressure (MAWP).

2.3.2 Nozzle requirements

In order to allow the microwaves to propagate undisturbed, the nozzle dimensions should be kept within the specified limits for the different antennas.

Figure 2-1. Nozzle Requirements, See Table 2-1

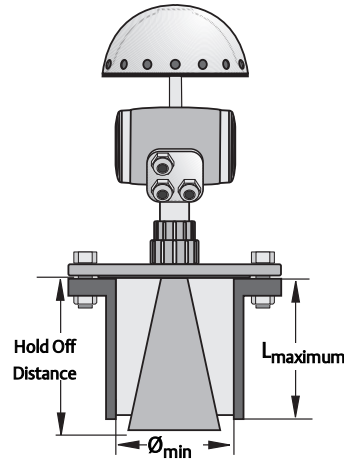


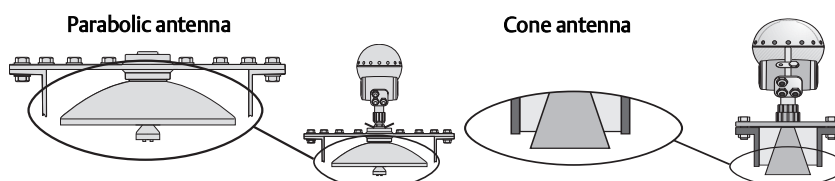
Table 2-1. Nozzle Requirements in Inches (Millimeters)

Antenna	L _{recommended}	Diam _{min}	L _{maximum}	Hold off distance
Cone 3 in.	3.7 (95) or less	2.9 (75)	9.6 (245)	4.7 (120)
Cone 4 in.	5.9 (150) or less	3.8 (98)	11.8 (300)	6.7 (170)
Cone 6 in.	10.2 (260) or less	5.7 (146)	16.1 (410)	11.0 (280)
Cone 8 in.	14.6 (370) or less	7.6 (194)	20.6 (525)	15.8 (400)
Parabolic	6.3 (160) or less	19.7 (500)	23.6 (600)	7.9 (200)
Process seal 4 in.	11.8 (300) or less	3.9 (100)	11.8 (300)	7.9 (200)
Process seal 6 in.	11.8 (300) or less	5.9 (150)	11.8 (300)	7.9 (200)
Extended cone 3 in.	19.5 (495) or less	3.0 (75)	19.5 (495)	20.5 (520)
Extended cone 4 in.	19.5 (495) or less	3.9 (98)	19.5 (495)	20.5 (520)
Extended cone 6 in.	19.5 (495) or less	5.8 (146)	19.5 (495)	20.5 (520)
Flushing cone 4 in.	5.9 (150) or less	3.9 (98)	11.8 (300)	6.7 (170)
Flushing cone 6 in.	10.2 (260) or less	5.8 (146)	16.1 (410)	11.0 (280)
Flushing cone 8 in.	14.6 (370) or less	7.6 (194)	20.7 (525)	15.8 (400)

Note

For parabolic antennas mounted in solid applications, minimize the L Distance to allow the parabolic antenna to reach into the tank.

Figure 2-2. Antenna Tip Outside Nozzle to Get the Best Measurement Performance



2.3.3 Free space requirements

Figure 2-3. Free Space Requirements, See Table 2-2

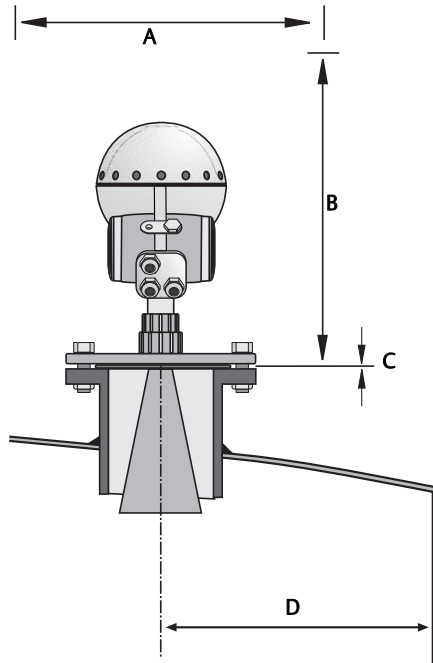


Table 2-2. Free Space Requirements

A. Service space width	
Antenna	Distance in. (mm)
All antennas	22 (550)
B. Service space height	
Antenna	Distance in. (mm)
Cone, Extended cone, Flushing cone	25 (650)
Process seal	31 (800)
Parabolic	27 (700)
C. Inclination	
Antenna	Maximum angle
Cone	1°
Process seal	3°
Parabolic	3°

Table 2-2. Free Space Requirements

D. Minimum distance to tank wall⁽¹⁾	
Antenna	Distance in. (mm)
Cone	24 (600)
Process seal	24 (600)
Parabolic	24 (600)

1. Mounting closer to the tank wall may be allowed if reduced accuracy is accepted.

2.3.4 Beam width

Figure 2-4. Beam Width Angle, See Table 2-3

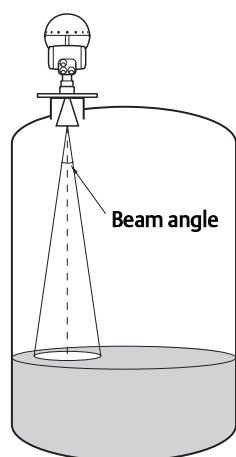


Table 2-3. Beam Width Angle

Antenna	Beam width
Cone 3 in.	25°
Cone 4 in./ Process seal 4 in.	21°
Cone 6 in./ Process seal 6 in.	18°
Cone 8 in.	15°
Parabolic	10°

Figure 2-5. Beam Width Distance, See Table 2-4

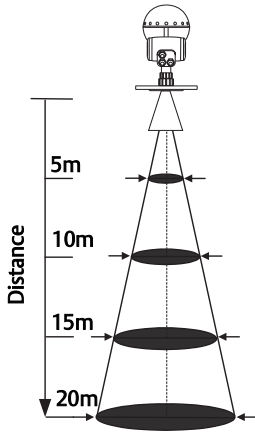


Table 2-4. Beam Width Distance

Antenna	Diameter of radiated area at different distances from flange, ft. (m)			
	16 ft (5 m)	33 ft (10 m)	49 ft (15 m)	66 ft (20 m)
Cone 3 in.	7.2 (2.2)	14 (4.4)	22 (6.7)	29 (8.9)
Cone 4 in./ Process seal 4 in.	6.2 (1.9)	12 (3.7)	18 (5.6)	24 (7.4)
Cone 6 in./ Process seal 6 in.	5.2 (1.6)	10 (3.1)	15 (4.7)	21 (6.3)
Cone 8 in.	3.3 (1.0)	7.9 (2.4)	13 (3.9)	17 (5.2)
Parabolic	3.0 (0.9)	5.6 (1.7)	8.5 (2.6)	11 (3.5)

2.3.5 Special antennas and space requirements reference

Pipe installation

See “Installation requirements for the extended cone antenna” on page 48 and “Installation requirements for cone antenna in a still pipe/bridle” on page 36.

Extended cone installation

See “Installation requirements for the extended cone antenna” on page 48 and “Mounting the extended cone antenna” on page 45.

2.4 Wave guide tubes

Note

The wave guide tubes are parts of the antenna kits.

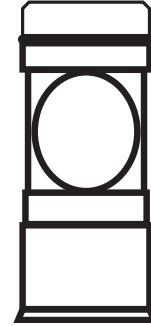
Cone antenna

- For model codes 1xx, 2xx, 7xx, and 9xx (with PTFE Seal for Cone)
- Distinguishing features:
- Length: 1.57-in. (40 mm)



Process seal

- For model codes 34S and 36S.
- Distinguishing features:
 - a. Length: 2.93-in. (74.5 mm)
 - b. O-ring on the inside



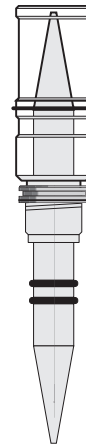
Parabolic

- For model codes 45S and 46S
- Distinguishing features:
 - a. Length: 2.93-in. (74.5 mm)
 - b. No O-ring on the inside



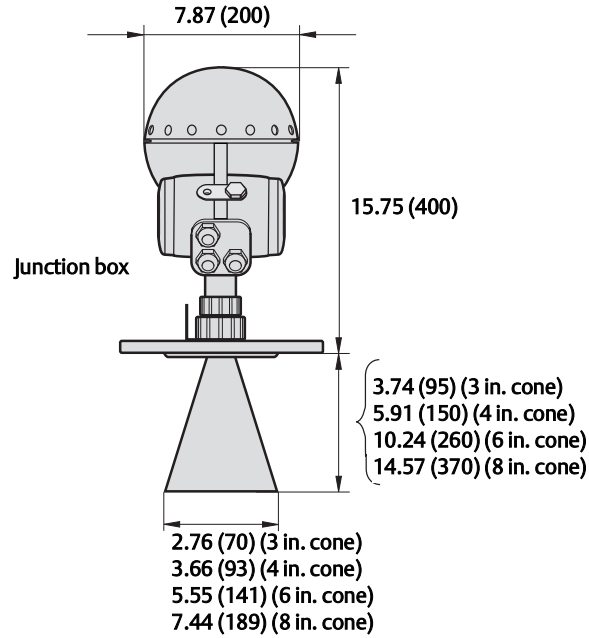
Cone antenna with quartz seal

- Model code option Q (with Quartz Seal)
- Distinguishing features:
 - a. Complete assembly
 - b. No loose wave guide tube
- Not available as spare part. If spare part is required, order complete antenna.



2.5 Mounting the cone antenna - PTFE sealing

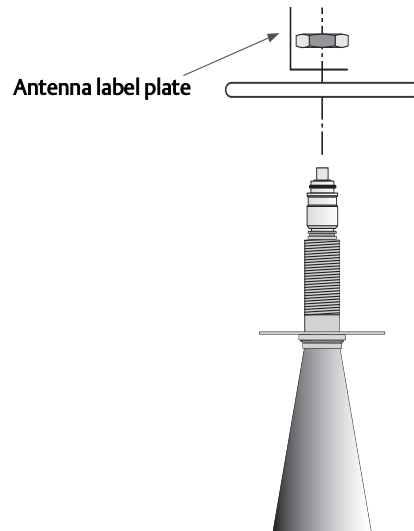
Figure 2-6. Cone Antenna Dimensions



Dimensions are in inches (millimeters)

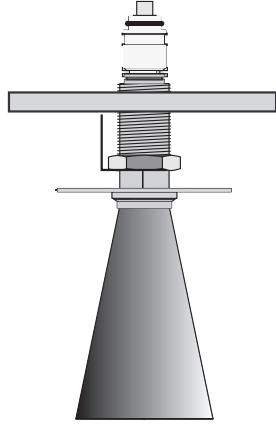
1. Remove locking ring and adapter from antenna.
2. Mount the flange on top of the cone plate. Make sure that the bottom side of the flange is flat and all parts are clean and dry.

Figure 2-7. Mount the Flange



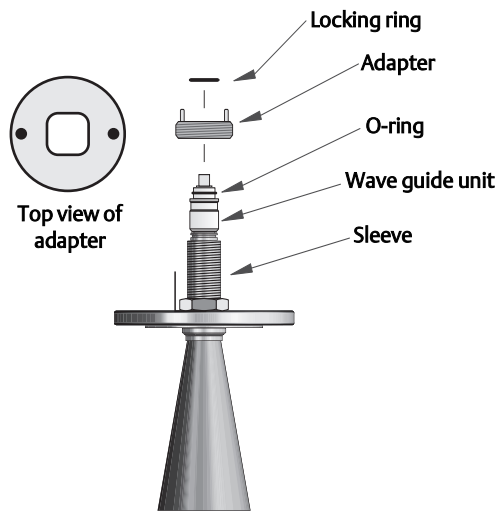
3. Secure the flange with the locking nut.
Make sure that the nut fits tightly to the flange.

Figure 2-8. Securing the Flange with the Locking Nut



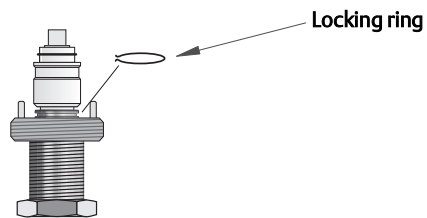
4. Mount the adapter on top of the sleeve.

Figure 2-9. Mounting the Adapter



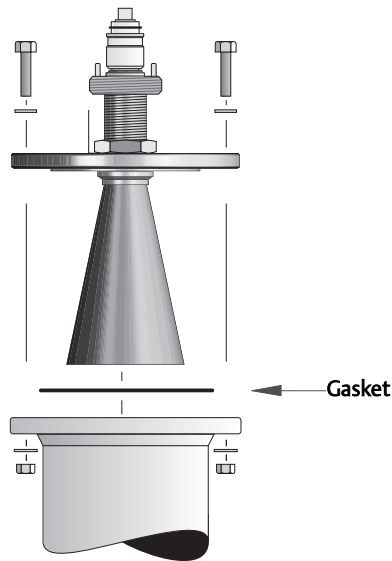
5. Secure the adapter with the locking ring.

Figure 2-10. Using the Locking Ring to Secure the Adapter



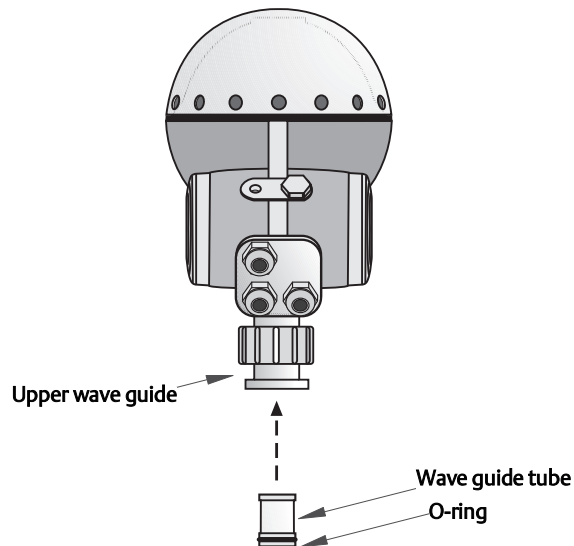
- Carefully fit the flange and the cone antenna on the tank nozzle.
- Tighten with screws and nuts.

Figure 2-11. Mounting the Flange and Cone Antenna on the Nozzle



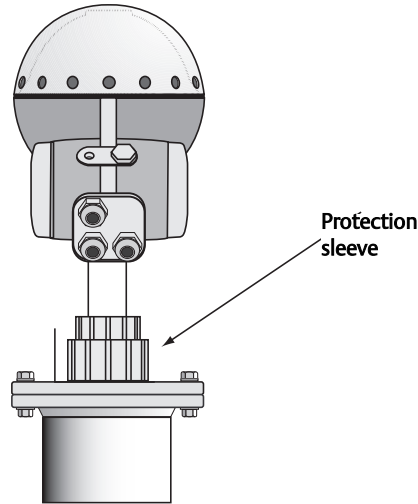
- Insert the wave guide tube into the upper wave guide.
Make sure the gasket at the lower end of the wave guide tube is in place.

Figure 2-12. Mount the Transmitter Head



- Place the protection sleeve on the flange.
Mount the transmitter head and tighten the nut. Check that the guide pins on the adapter enter the corresponding grooves on the upper wave guide.

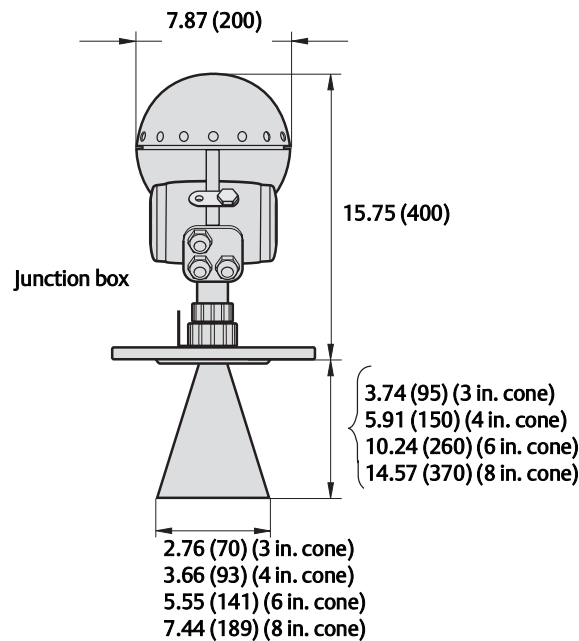
Figure 2-13. Completed Mechanical Installation



- Proceed with the electrical installation.

2.6 Mounting the cone antenna - quartz sealing

Figure 2-14. Cone Antenna Dimensions



Dimensions are in inches (millimeters)

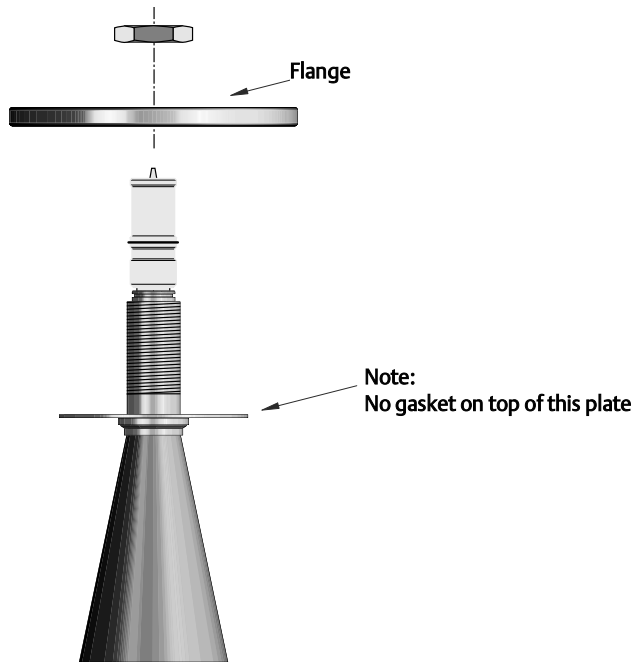
Antennas including tank seal of quartz material are suitable for high pressure applications.

Note

The quartz seal shall be protected against mechanical shocks or impacts. It is important to handle the antenna carefully in order to avoid any mechanical stresses such as bending or pressing the sealing.

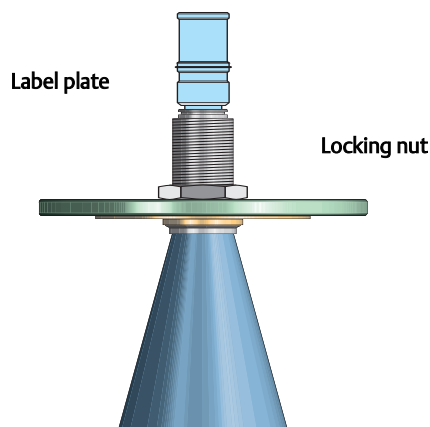
1. Remove locking ring and adapter from antenna.
2. Mount the range on top of the cone plate. Make sure the bottom side of the flange is flat and all parts are clean and dry.

Figure 2-15. Mount the Flange



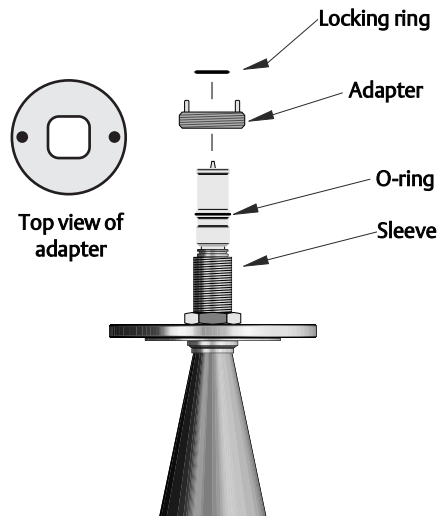
3. Secure the flange and label plate with the locking nut using a spanner with key width 1.6-in. (41 mm). Make sure the locking nut fits tightly to the flange without any visible gap between the plate and the flange.

Figure 2-16. Secure the Flange with the Locking Nut



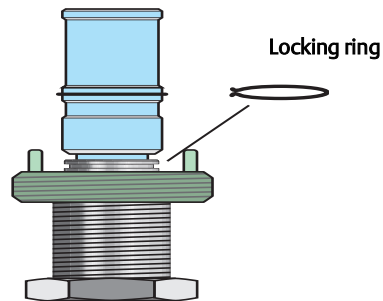
4. Mount the adapter on top of the sleeve.

Figure 2-17. Mounting the Adapter



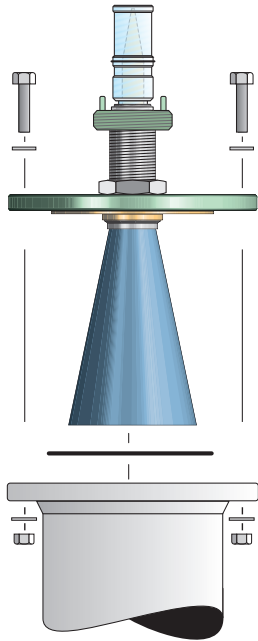
5. Secure the adapter with the locking ring.

Figure 2-18. Using the Locking Ring to Secure the Adapter



6. Fit the flange with the cone antenna on the horizontal tank flange. If the tank flange is not horizontal, the performance of the gauge may be negatively impacted.
7. Tighten with screws and nuts.

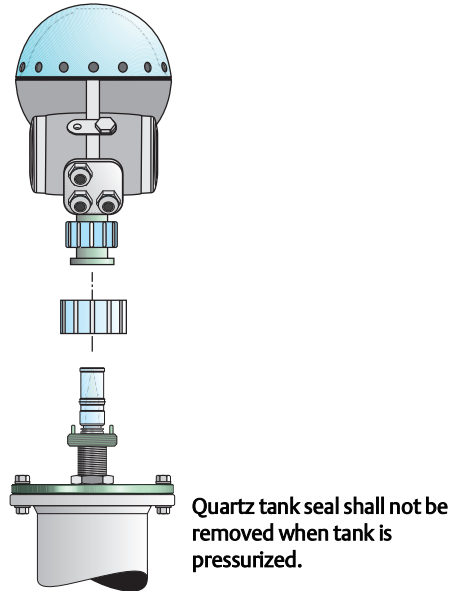
Figure 2-19. Mount the Flange and Cone Antenna on the Nozzle



8. Before mounting the transmitter head, visually verify that the quartz tank seal is undamaged and free from moisture and dirt.
9. Place the protection sleeve on the flange.

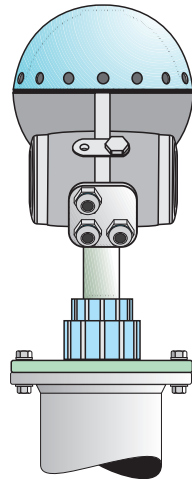
10. Mount the transmitter head on the adapter in one of the four possible positions.

Figure 2-20. Completed Mechanical Installation



11. Check the guide pins on the adapter enter the corresponding grooves on the upper wave guide. Maximum allowed spacing is 0.2-in. (5 mm). Tighten the nut manually or with a wrench using approximately 20-50 Nm torque until it stops on the adapter. It is normal that the transmitter head can be rotated a fraction corresponding to the play between the guide pins and the grooves. This will not have any negative impact on the performance of the gauge.

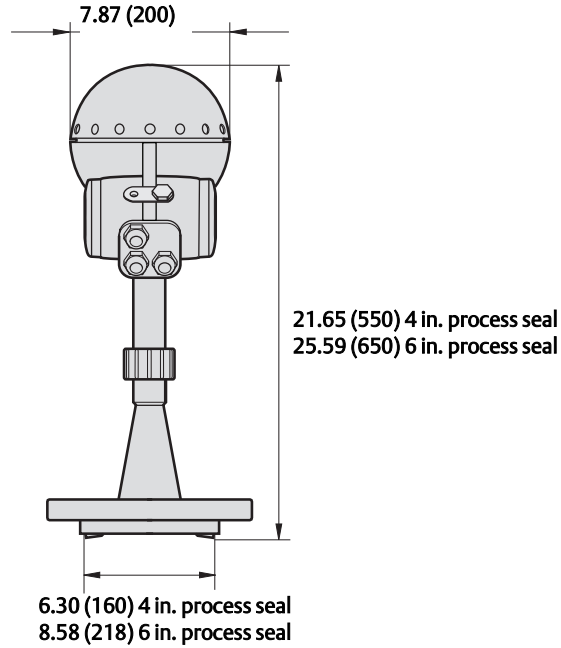
Figure 2-21. Completed Installation



12. Proceed with the electrical installation.

2.7 Mounting the process seal antenna

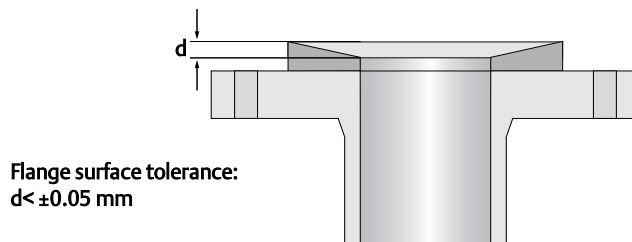
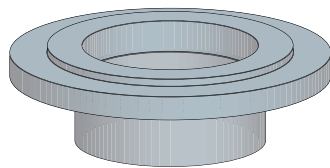
Figure 2-22. Process Seal Antenna Dimensions

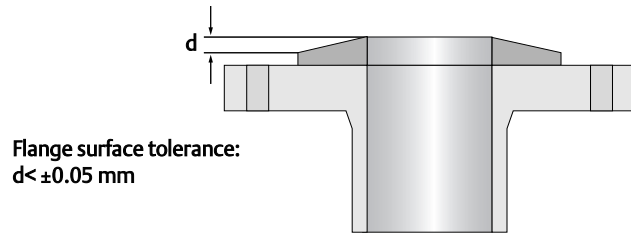


Dimensions are in inches (millimeters).

2.7.1 Preparations

It is important that the tank flange surface is flat. The maximum deviation must be within the following specifications as illustrated:





To mount the antenna do the following:

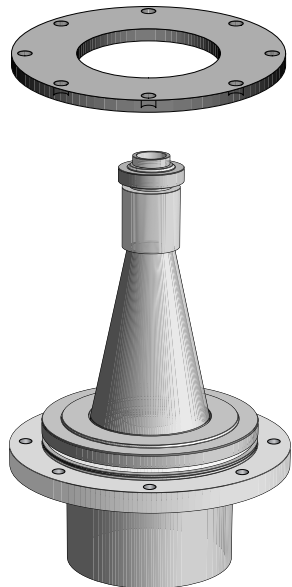
1. Place the gasket supplied by Emerson Automation Solutions on top of the nozzle and mount the antenna.

Note

The PTFE gaskets are optimized for use with microwave emitting equipment. No other gaskets than Rosemount original may be used for process seal antennas.

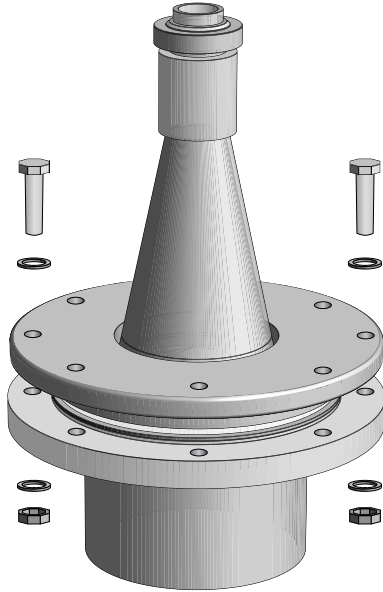
2. Put the loose flange on top of the antenna.

Figure 2-23. Placing the Flange on Top of the Antenna



3. Tighten the flange to the antenna by using screws and nuts. Use lubricating grease to minimize friction when the screws are tightened.

Figure 2-24. Tightening the Flange



Note

Tighten the screws carefully to the recommended torque according to [Table 2-5](#). Tighten opposite screws in pair.

4. Insert the wave guide tube into the upper wave guide.
(See [Figure 2-12 on page 27](#).)
5. Mount the transmitter head onto the adapter.
6. Tighten the nut and make sure that the transmitter head fits tightly to the antenna.

Torque

Tighten the flange screws to the following torque:

Table 2-5. Recommended Torque (Nm)

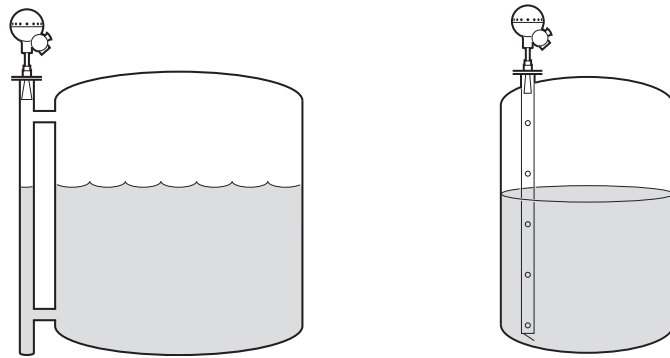
	PTFE	
DIN Flange	PN16	PN40
DN100	11	15
DN150	15	
ANSI Flange	150 Psi	300 Psi
4 in.	11	15
6 in.	15	10

2.8 Mounting the cone antenna in a still pipe/bridle

2.8.1 Installation requirements for cone antenna in a still pipe/bridle

The Rosemount 5600 Series Radar Level Transmitter is suitable for measurements in still pipes and bridles. The high signal processing capacity allows measurements even when there are several pipe inlets, provided that the mechanical installation is done per the guidelines in this manual or related technical note.

Figure 2-25. Example of a Bridle Mount (Left) and a Still Pipe Mount (Right)



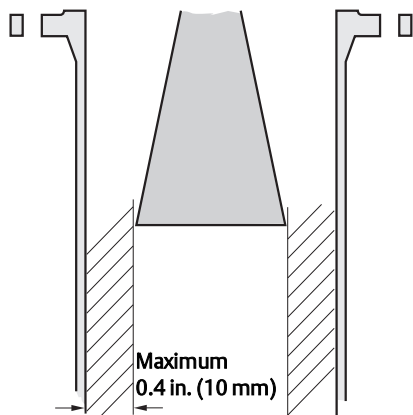
Still pipe or bridle pipe mounting is recommended for LPG tanks and other applications where surface conditions may be extremely turbulent. By using a pipe, foam and turbulence is reduced. Accuracy may, however, be reduced in bridle and still pipe applications.

2.8.2 For still pipes

The 3-, 4-, and 6-in. cone antennas are designed to fit into new or existing still pipes with the corresponding pipe size. A gap between the antenna opening and the pipe of up to 0.4 in. (10 mm) may occur. In most applications this gap has only a limited effect on the measuring performance.

It is always recommended to have the gap as small as possible, since larger gaps cause larger inaccuracies.

Figure 2-26. 3-, 4-, and 6-in. Cone Antenna in Still Pipe - Gap between Pipe and Antenna



2.8.3 For bridle pipes

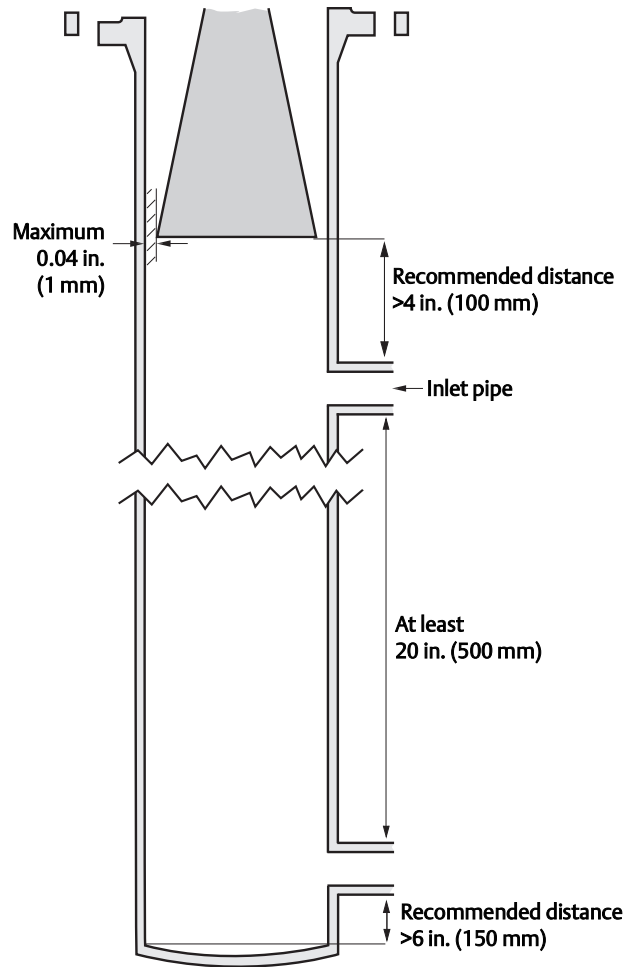
For bridle applications the basic guidelines are similar to the guidelines written above for still pipes i.e. that the 3-, 4-, and 6-in. cone antennas will fit the corresponding pipe sizes, and you should try to get the gap as small as possible. If possible, and if the application allows for it, another general guideline is to keep the pipe inlet as small as possible.

In more difficult bridle applications with inlet pipes larger than 2 in. or in pipes with severe contamination can be expected, the antenna size should be customized to better fit the pipe. In this case do the following:

- Measure the inner diameter of the pipe.
- Cut the cone antenna so that it fits inside the bridle pipe.
- Make sure that the gap between the pipe and the antenna is smaller than 0.04 in. (1 mm).

Please contact your local Emerson Automation Solutions representative for details about a factory-cut antenna.

Figure 2-27. Bridle Pipe Installation Guidelines



2.8.4 Measurement in large pipes

When using standard cones in larger (8-in. or larger) still pipe installations, there is a risk for measurement problems. When standard linear shaped cones are used in pipes, more than one microwave mode is generated and each mode has a unique propagation speed. This is a radar physics problem that is common to all radar gauges when linear shaped cones are used.

In larger pipes, the amplitude of echoes generated by the “unwanted” modes may become rather high, and may result in loss of the surface echo at certain locations in the pipe. In addition, there may be measurement errors associated with two closely spaced echoes where the gauge will not lock on a single target.

The relative amplitude of the unwanted modes in a straight cone is proportional to the product of the cone angle and the diameter in the cone opening. Therefore measurement error increases as pipe diameter increases since the cone angle is the same for all the cones.

Due to this issue, Emerson Automation Solutions does not recommend using the Rosemount 5600 Series 8-in. cone antennas for larger pipe measurements. Instead, a special pipe antenna should be used.

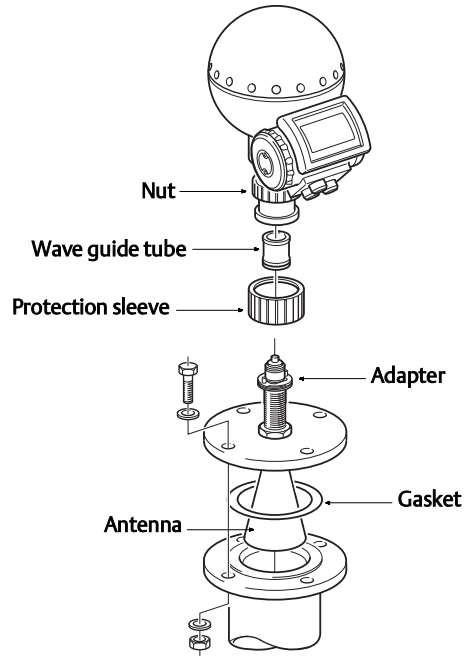
Table 2-6. Recommendations

	Pipe size		
	3-in. (76 mm)	4-in. (102 mm)	6-in. (152 mm)
Maximum measuring range	65 ft (20 m)	65 ft (20 m)	65 ft (20 m)
Maximum hole size (Ø)	0.24in. (6 mm)	0.28 in. (7 mm)	0.39 in. (10 mm)
Maximum number of holes per meter	2	2	2
Deflection plate required	Yes	Yes	Yes

2.8.5 Mounting the antenna

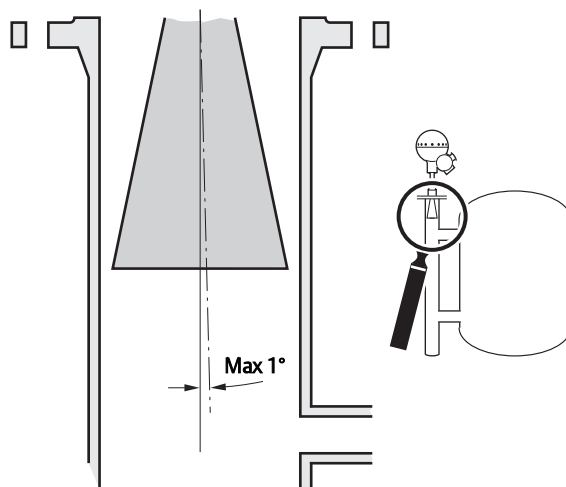
1. Mount the antenna and the transmitter head in the same way as a standard cone antenna (see “Mounting the cone antenna - PTFE sealing” on page 25).

Figure 2-28. Mounting the Antenna and Transmitter Head



2. Make sure that the inclination of the transmitter is less than one degree (1°).

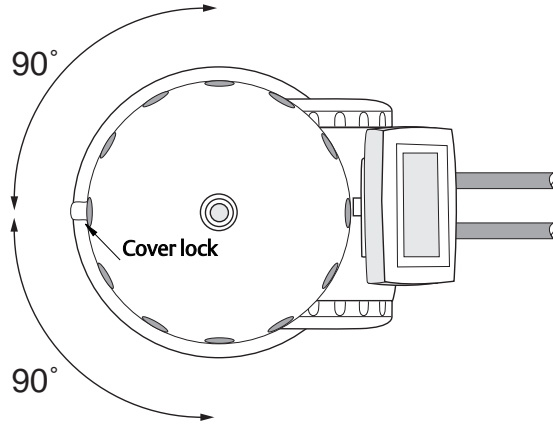
Figure 2-29. Inclination Less than One Degree°



Dimensions are in inches (millimeters).

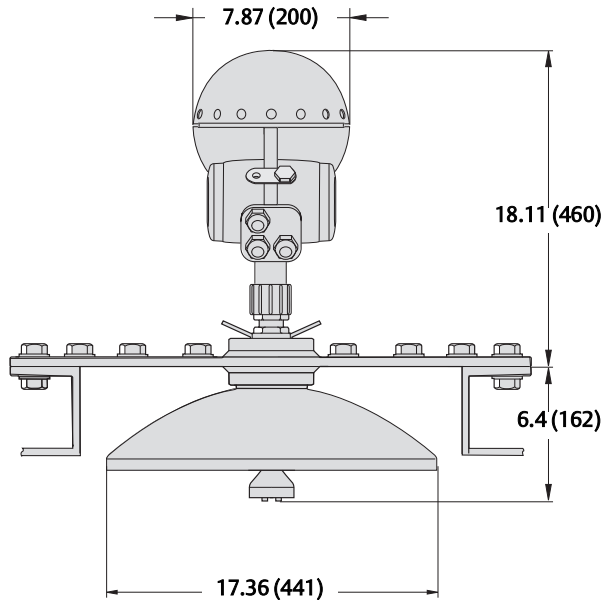
3. To minimize the influence of disturbing echoes from inlet and outlet pipes you may need to rotate the transmitter head 90°.

Figure 2-30. Example of Rotating the Transmitter Head to Minimize Disturbing Echoes



2.9 Mounting the parabolic antenna

Figure 2-31. Parabolic Antenna Dimensions



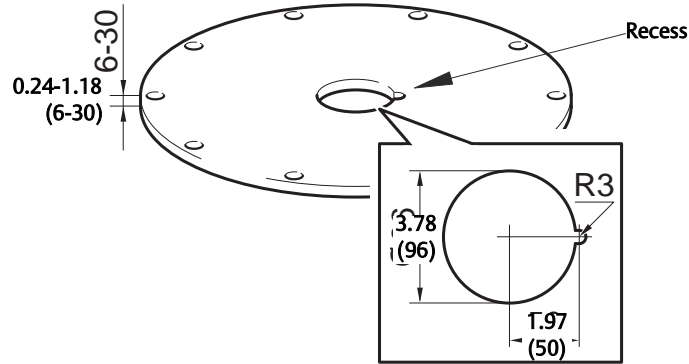
Dimensions are in inches (millimeters)

2.9.1 Mounting the flange ball

1. The flange should be between 0.24 and 1.18 in. (6 and 30 mm) thick. Make sure the diameter of the hole is 3.78 in. (96 mm).

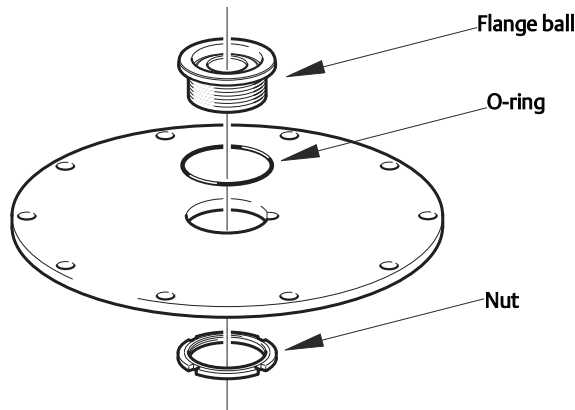
2. Make a small recess in the flange hole.

Figure 2-32. Recess Hole



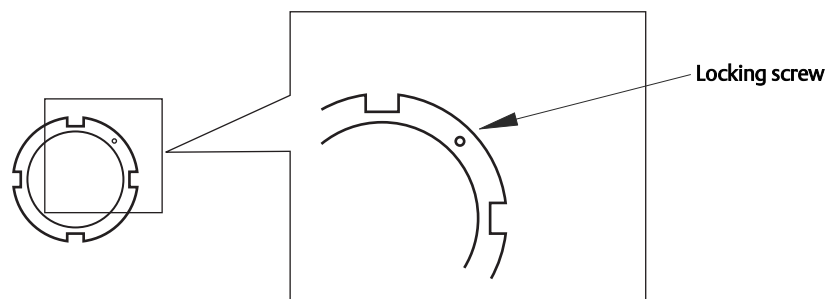
3. Put the O-ring on the flange and insert the flange ball into the hole. Make sure the pin on the side of the flange ball fits into the corresponding recess on the flange.

Figure 2-33. Put the O-ring on the Flange



4. Tighten the nut. Make sure the flange ball fits tightly to the flange.
5. Secure the nut by tightening the locking screw.

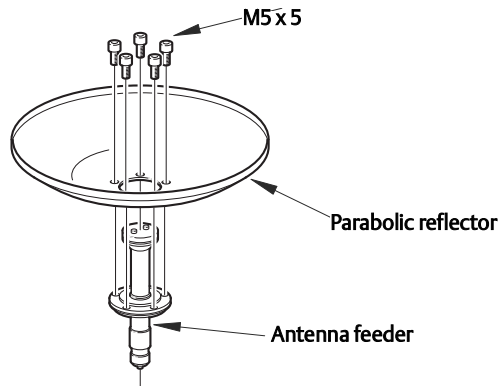
Figure 2-34. Secure the Nut



2.9.2 Mounting the antenna

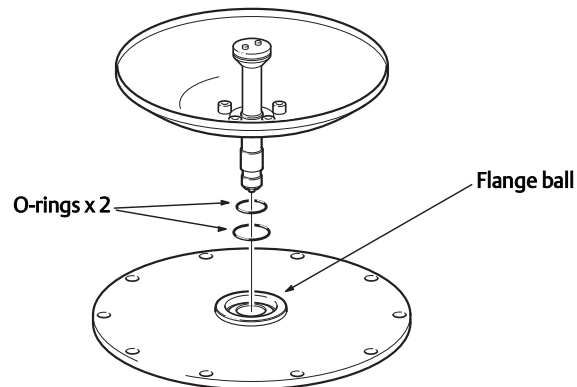
1. Fit the parabolic reflector to the antenna feeder and mount the five M5 screws that were delivered by Emerson Automation Solutions.

Figure 2-35. Mounting the Five M5 Screw



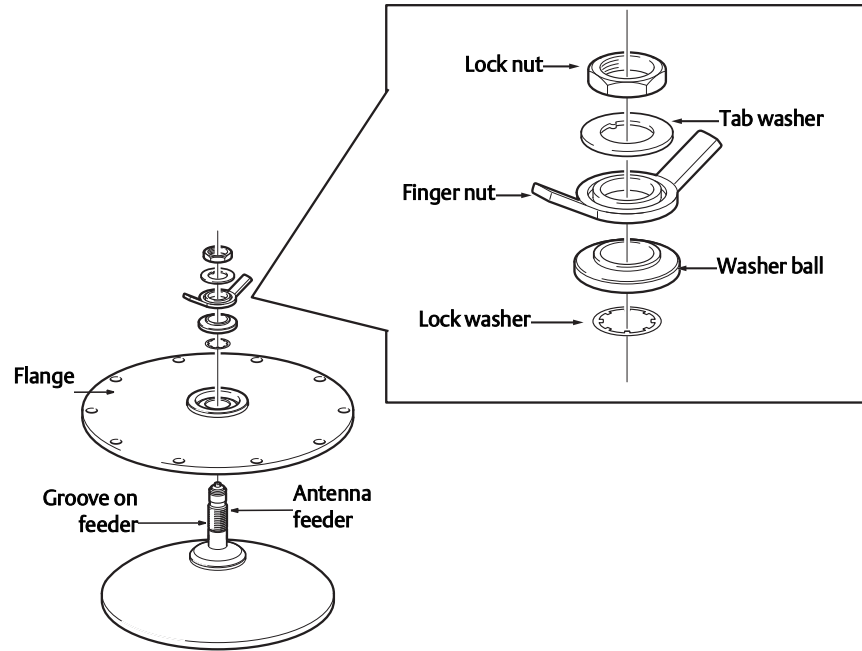
2. Tighten the screws.
3. Put the two O-rings in the grooves on the upper surface of the flange ball.

Figure 2-36. Placing the Two O-rings in the Grooves



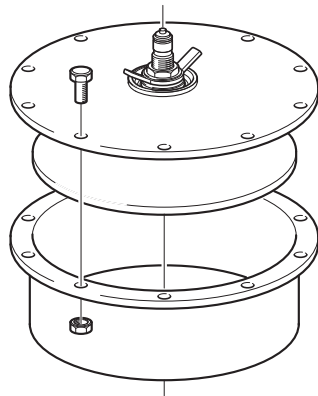
4. Turn the flange around and mount the antenna feeder on the flange. Mount the washers and nuts.

Figure 2-37. Mounting Washers and Nuts



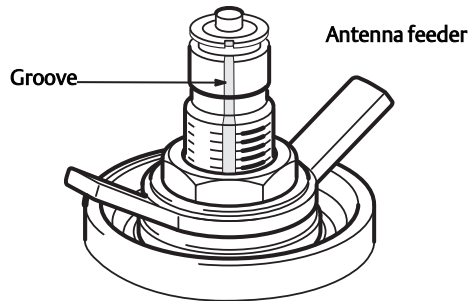
5. Tighten the finger nut and the lock nut loosely.
6. Place the antenna on the tank nozzle and tighten the flange screws.

Figure 2-38. Tightening the Flange Screws



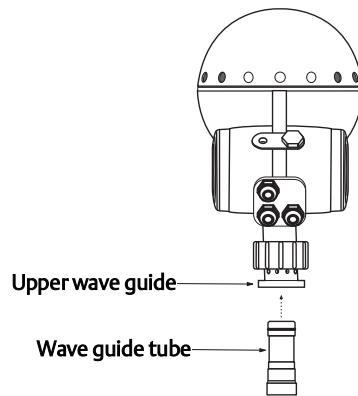
7. Rotate the antenna so the groove on the antenna feeder is directed 90° to the tank wall.

Figure 2-39. Groove on Antenna Feeder



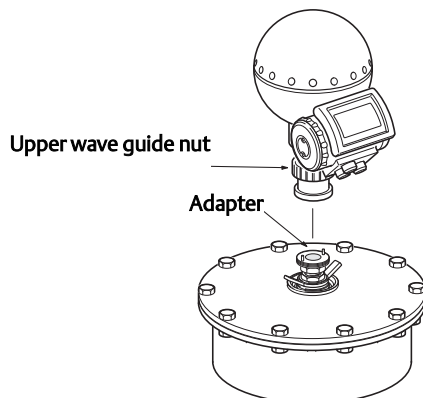
8. Tighten the finger nut and the lock nut.
9. Mount the adapter nut on top of the antenna feeder. Tighten the adapter nut firmly.
10. Insert the wave guide tube into the upper wave guide.

Figure 2-40. Inserting the Wave Guide Tube into the Upper Wave Guide



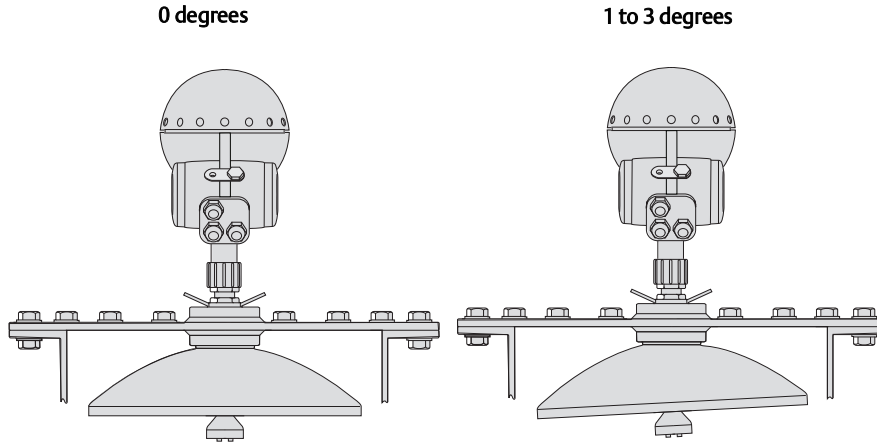
11. Carefully mount the Transmitter Head onto the adapter and tighten the upper wave guide nut by hand. Make sure that the guide pins on the adapter fits into the holes on the upper wave guide.

Figure 2-41. Mounting the Transmitter



- When the antenna inclination is adjusted to obtain optimum performance (Figure 2-42), tighten the finger nut and the lock nut firmly. Secure by folding the tab washer over the lock nut (Figure 2-43).

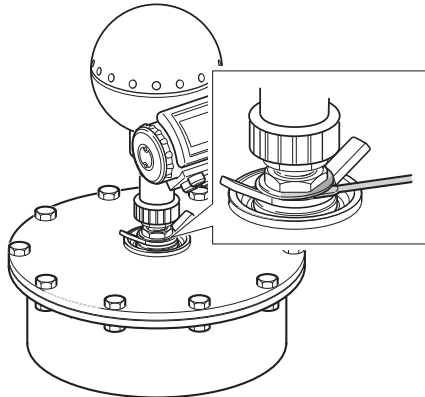
Figure 2-42. Inclination of the Parabolic Antenna



Note

Normally the antenna should be mounted with inclination 0°. However, in some applications, for example solid products, a small inclination of the antenna may improve the performance. This may also be the case if there are disturbing echoes from objects in the tank.

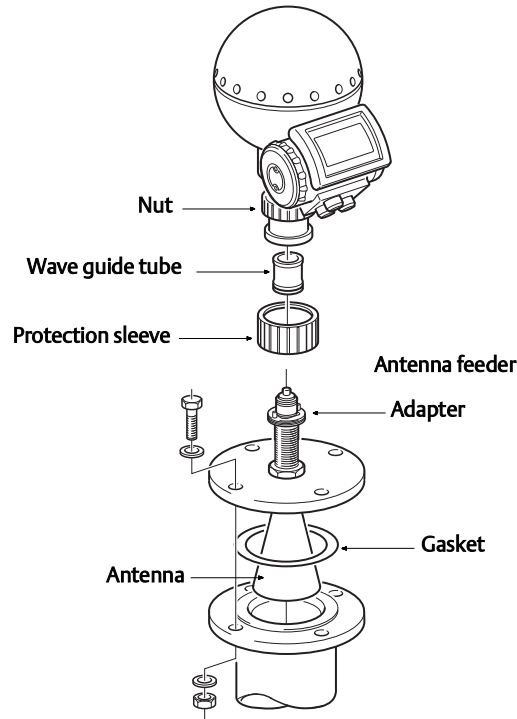
Figure 2-43. Folding the Tab Washer over the Lock Nut



2.10 Mounting the extended cone antenna

- Mount the antenna and transmitter head in the same way as a transmitter with a standard cone antenna (see “Mounting the cone antenna - PTFE sealing” on page 25).

Figure 2-44. Mounting the Antenna and Transmitter Head



2. When the transmitter is mounted, the following antenna parameters must be adjusted by using the configuration software:
 - Tank Connection Length (TCL),
 - Hold Off (H) distance.

See [page 46](#) and [page 47](#) for more information on how to set the hold off distance and the tank connection length for a cone extension antenna. See also [Section 4: Configuration](#) for more information about these parameters.

2.10.1 Setting the tank connection length (TCL)

To set the tank connection length, use one of the following procedures for standard and non-standard extended cone antenna.

Standard extended cone antenna

For the 20 in. (500 mm) extended cone the following TCL_{ext} values can be used:

Table 2-7. Standard Extended Cone Antenna

Antenna type	3-in. (68-mm) diameter	4-in. (90-mm) diameter	6-in. (138-mm) diameter
TCL_{ext} /PTFE	0.019 (0.489)	1.90 (0.482)	1.88 (0.477)
TCL_{ext} /Quartz	2.08 (0.529)	2.06 (0.522)	2.04 (0.517)

Non-standard extended cone antenna

To adjust the TCL value do the following:

1. Start the Radar Master configuration software.
2. From the Antenna Type drop down list choose User-Defined.
3. Enter the new TCL value.
Use the following formula to calculate the appropriate Tank Connection Length (TCL):

$$TCL_{ext} = TCL_{cone} + K * (L_{ext} - L_{antenna})$$

where:

- TCL_{ext} = the TCL adjusted to the extended cone antenna (See [Table 2-7](#)).
- TCL_{cone} = the default TCL for a standard cone antenna without extension. Note that there are different TCL values for tank sealing PTFE and Quartz, see [Table 2-8](#).
- L_{ext} = the measured length of the extended cone antenna.
- $L_{antenna}$ = the length of the standard cone antenna without extension.
- K = a constant related to the antenna inner diameter.

Table 2-8. Non-Standard Extended Cone Antenna

Antenna type	3-in. (68-mm) diameter	4-in. (90-mm) diameter	6-in. (138-mm) diameter
K	0.035	0.020	0.008
$L_{antenna}$	0.094	0.148	0.261
$TCL_{cone}/PTFE$	0.475	0.475	0.475
$TCL_{cone}/Quartz$	0.515	0.515	0.515

2.10.2 Setting the Hold Off distance

To set a new Hold Off distance do the following:

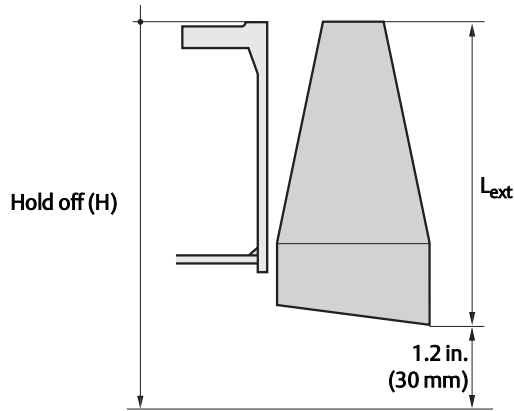
1. Start the configuration software.
2. In the Hold Off/New input field type the desired Hold Off distance.
Use the following formula in order to calculate the appropriate Hold Off (H) distance:

$$H = 1.2 \text{ inches} + L_{ext} \quad (H = 0.03 \text{ meters} + L_{ext})$$

where:

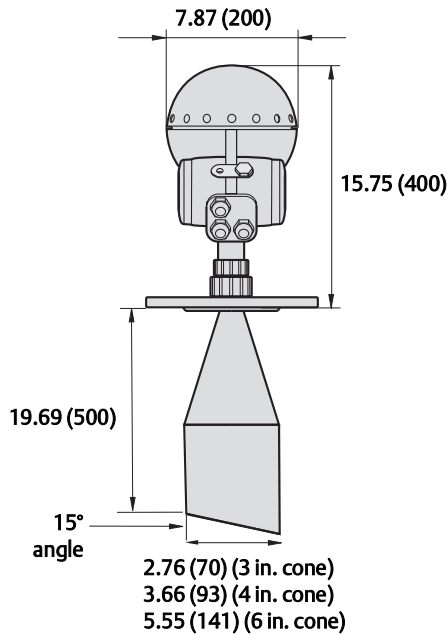
- L_{ext} is the length of the extended cone antenna

Figure 2-45. Extended Cone Antenna



2.10.3 Installation requirements for the extended cone antenna

Figure 2-46. Extended Cone Antenna Dimensions



Dimensions are in inches (millimeters).

Note

Other extended cone lengths available upon request. Consult factory.

The extended cone antenna is suitable for tanks with long nozzles or tanks where measurements should be avoided in the region close to the nozzle.

Use the extended cone antenna if:

- The nozzle is high, see [Figure 2-47](#):
ANSI 3-in. antenna for nozzles higher than 9.8 in. (250 mm),
ANSI 4-in. antenna for nozzles higher than 11.8 in. (300 mm),
ANSI 6-in. antenna for nozzles higher than 15.8 in. (400 mm),
- There are disturbing objects close to the tank opening, see [Figure 2-48](#), or
- There is a rough surface at the inside of the nozzle or there is a height difference between nozzle sides, see [Figure 2-49](#).

Figure 2-47. Example of a High Nozzle

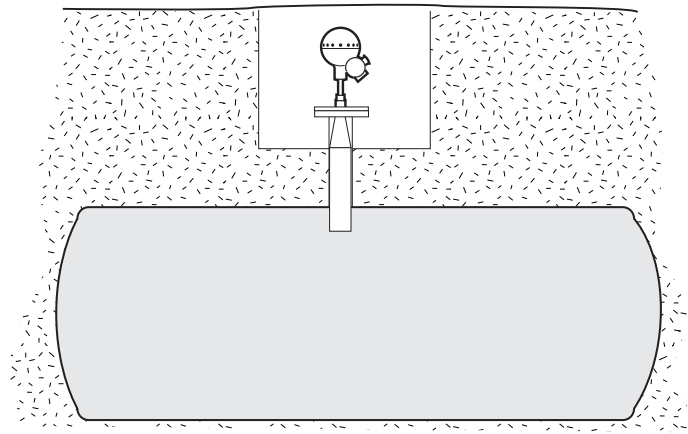


Figure 2-48. Example of Disturbing Objects Close to the Tank Nozzle

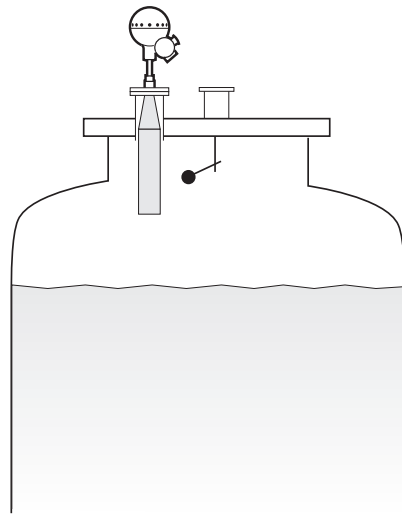


Figure 2-49. Examples of Problem Nozzles

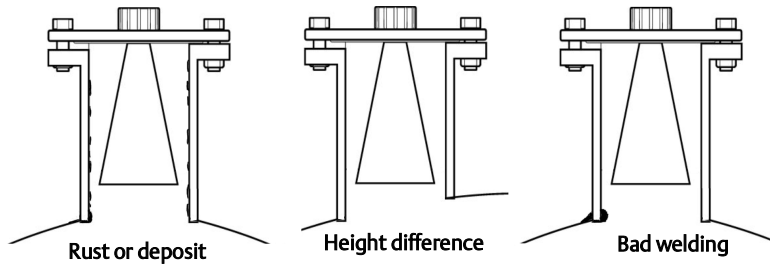
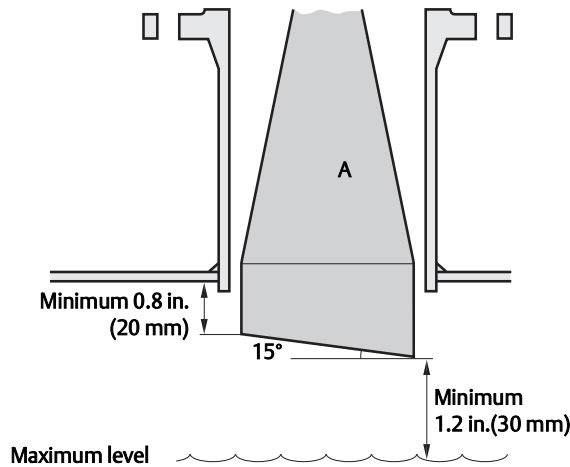


Figure 2-50. Total Distance between Flange and Product Level

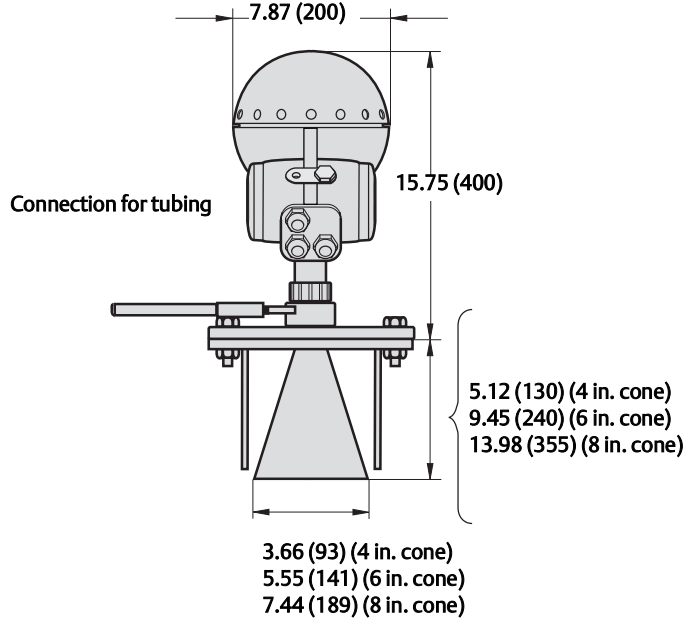


1. Measure the total distance **A** between the flange and the maximum product level.
2. The standard length of the extended cone antenna is 20 in. (500 mm). If **A** is less than 20 inches (500mm), then the cone may be cut so these minimum dimensions are met.

Due to the slanting opening of the antenna the direction of the radar beam is slightly changed towards the short end of the antenna opening. If objects are present which may cause disturbing radar echoes, the antenna should be oriented in such a way that the disturbing objects do not interfere with the radar signal. The short side should be turned away from disturbing objects on the most open part of the tank.

2.11 Mounting the cone antenna with flushing connections

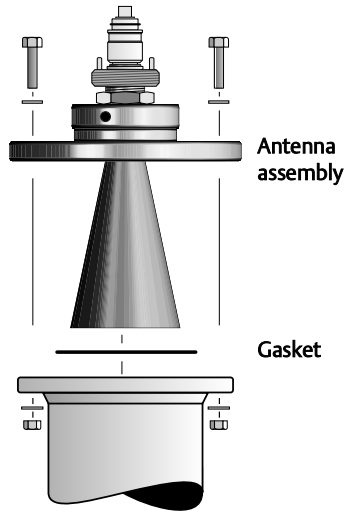
Figure 2-51. Cone Antenna with Integrated Flushing Connection Dimensions



Dimensions are in inches (millimeters)

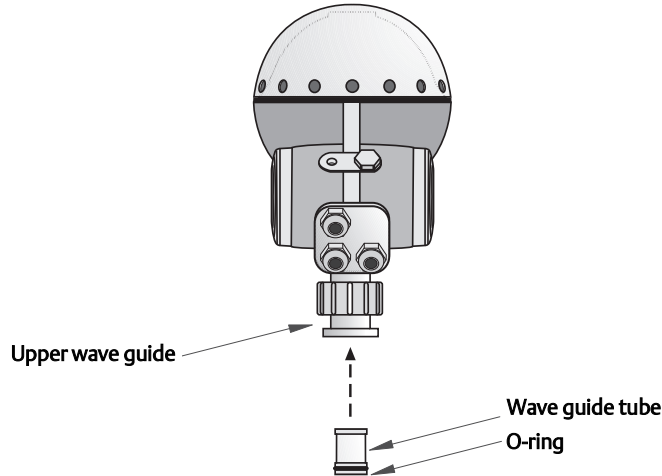
1. The flange is a part of the antenna assembly and welded to the cone antenna. Carefully fit the antenna assembly and appropriate gasket on the tank nozzle.

Figure 2-52. Mounting the Flushing Cone Antenna on the Nozzle



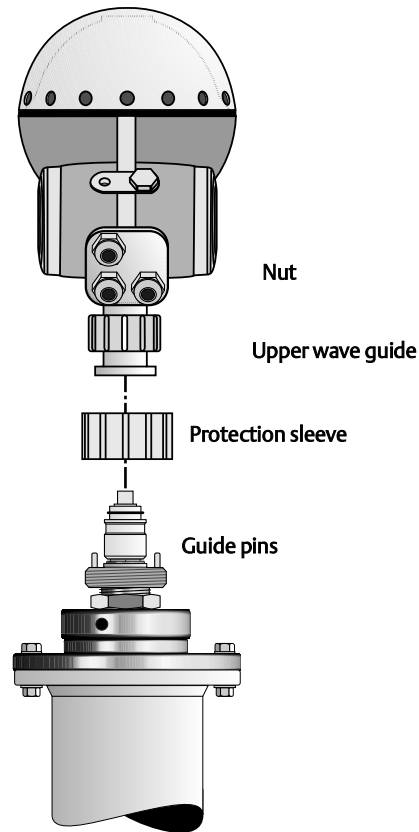
2. Insert the wave guide tube into the upper wave guide.
Make sure the O-ring at the lower end of the wave guide tube is in place.

Figure 2-53. Inserting the Wave Guide Tube



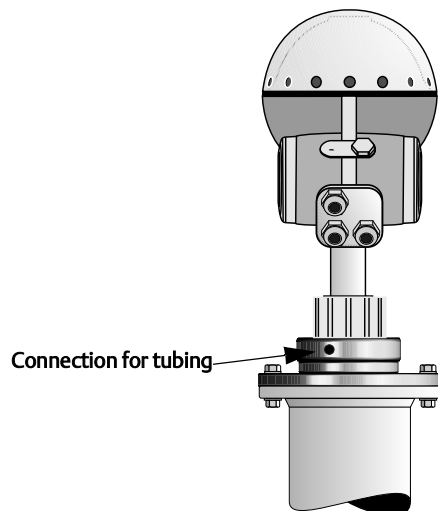
3. Mount the transmitter head and tighten the nut. Check that the guide pins on the adapter enter the corresponding grooves on the upper wave guide.

Figure 2-54. Mounting the Transmitter Head



4. Connect your tubing to the antenna for cleaning, purging, or cooling purposes. Use a minimum 0.4 in. (10 mm) tube or pipe. Typical media to use are:
 - Nitrogen
 - Air
 - Water
 - Steam

Figure 2-55. Connecting Tubing to Antenna



Section 3 Electrical Installation

Safety messages	page 55
System overview	page 56
Cables	page 57
Power supply	page 57
Grounding	page 58
HART electrical installation	page 58

3.1 Safety messages

Procedures and instructions in this section may require special precautions to ensure the safety of the personnel performing the operations. Information that raises potential safety issues is indicated by a warning symbol (⚠). Please 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 environment of the transmitter is consistent with the appropriate hazardous locations certifications.

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

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

⚠ WARNING

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

Make sure only qualified personnel perform the installation.

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

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

High voltage that may be present on leads could cause electrical shock:

Avoid contact with leads and terminals.

Make sure the main power to the Rosemount 5600 Series Radar Level Transmitter is off and the lines to any other external power source are disconnected or not powered while wiring the transmitter.

3.2 System overview

Power supply

Connect the power supply to terminals 3 and 4 in the non-intrinsically safe Junction Box (EEx e).

Analog outputs

There are two analog outputs which can be of passive or active type (external or internal loop supply). The primary output has a HART interface.

Connect the primary analog output to terminals 1 and 2.

Use the EExe junction box for non-intrinsically safe applications, and the EExi junction box for intrinsically safe applications.

Digital communication

The Rosemount 5600 Series Radar Level Transmitter can be equipped with HART interface, and can be either connected EExe or EExi.

Transmitter junction box

The standard version is equipped with two separate junction boxes, one non-intrinsically safe and one intrinsically safe part. There is also an optional version with two non-intrinsically safe compartments.

Figure 3-1. Junction Boxes X1 and X2

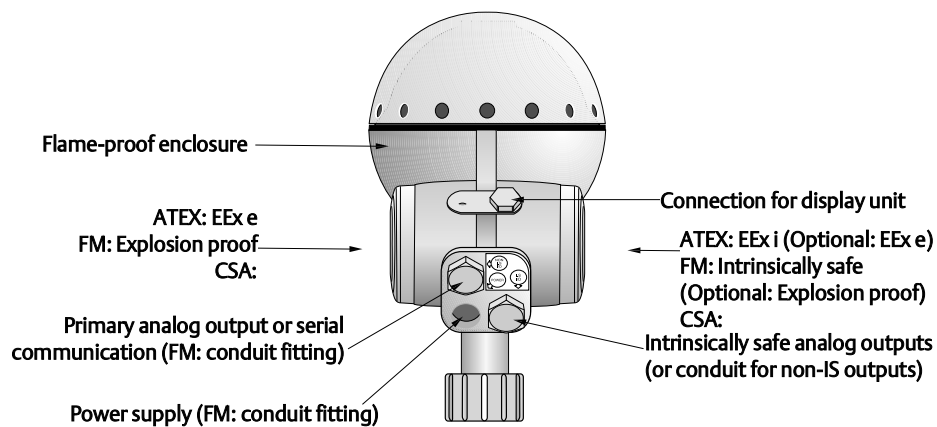
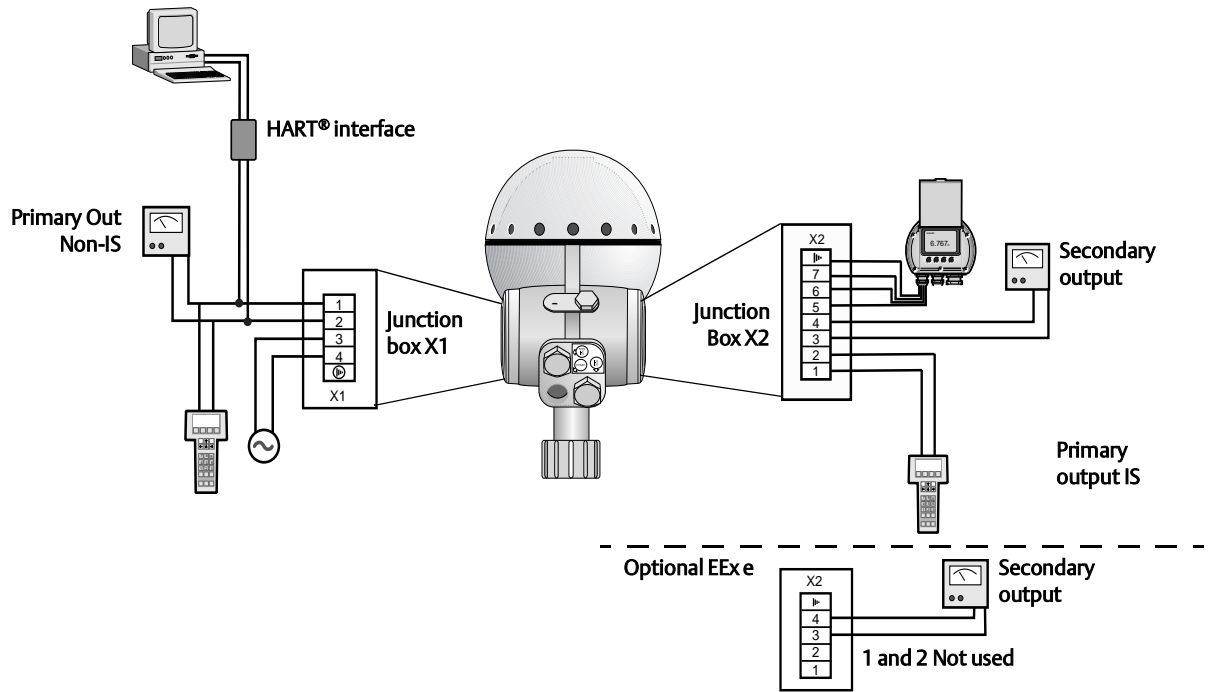


Figure 3-2. Schematic Illustration of the Rosemount 5600 Transmitter Connection



3.3 Cables

Depending on local requirements, cable glands, or explosion proof conduits must be used for connection to the non-intrinsically safe junction box (EEx e). For the connection to the intrinsically safe junction box (EEx i) use cable glands with integral shield connection for cable diameter 6-12 mm or conduit.

Use shielded instrument cable 0.5 mm² (AWG 20) for analog outputs and serial communication. Use min. 0.5 mm² cable for power supply.

3.4 Power supply

You can use either DC or AC as the built in power supply has a wide input range. The following specification is valid for the power supply:

- 24-240 V
- DC/AC 0-60 Hz
- 10 W
- 15 VA

There is no voltage selector in the electronics compartment since the transmitter power supply unit automatically adapts to the available voltage within specified limits.

Note

The minimum voltage required at the transmitter power terminals is 20V. Check that the voltage loss over the power cables is not large enough to make the voltage drop below 20V. The maximum voltage is 265V over the same power terminals.

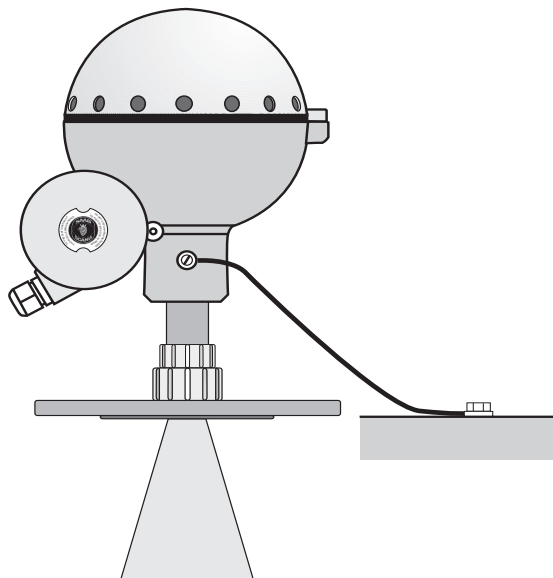
3.5 Grounding

ATEX

The flameproof enclosure must be connected to a potential equalizing network or the tank shell or according to national code of practice.

This grounding also serves as electrical safety ground. Additional connection to the protective ground terminal of terminal X1 in Junction Box EExe is not recommended except where required according to national code of practice. A ground loop with circulating current may occur. See [Appendix B: Product Certifications](#).

Figure 3-3. Grounding Connection



FM

Grounding is accomplished through the conduit pipes.

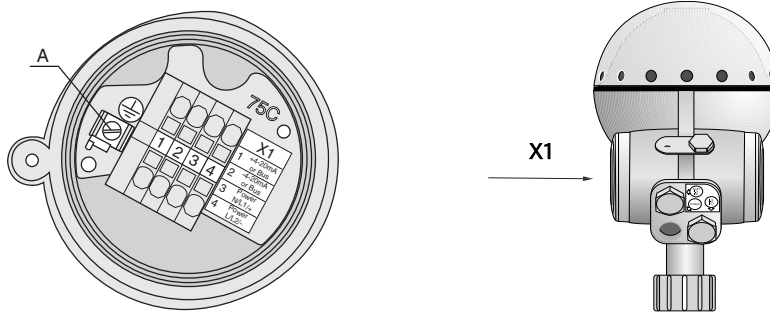
3.6 HART electrical installation

3.6.1 External connections

Non-intrinsically safe junction box - EEx e

This Junction Box is for non-intrinsically safe connections and power supply.

Figure 3-4. Transmitter Terminal Block (Non-IS Wiring)



- 1-2 Non-intrinsically safe HART/4-20 mA primary analog output
- 3-4 Power supply input
- A Electrical safety ground terminal

Note

Redundant when the transmitter is grounded according to ATEX.

Cable shield

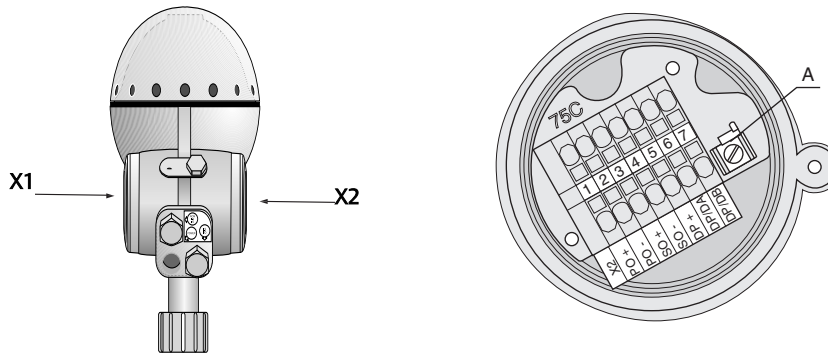
Connect the shield to the cable glands.

If conduit fittings are used no cable shield is used.

Intrinsically safe junction box - EEx i

This junction box is for intrinsically safe connections.

Figure 3-5. Transmitter Terminal Block (IS Wiring)



- 1-2 Intrinsically safe HART/4-20 mA primary analog output
- 3-4 Secondary analog output
- A Ground terminal for Display Unit

Cable shield

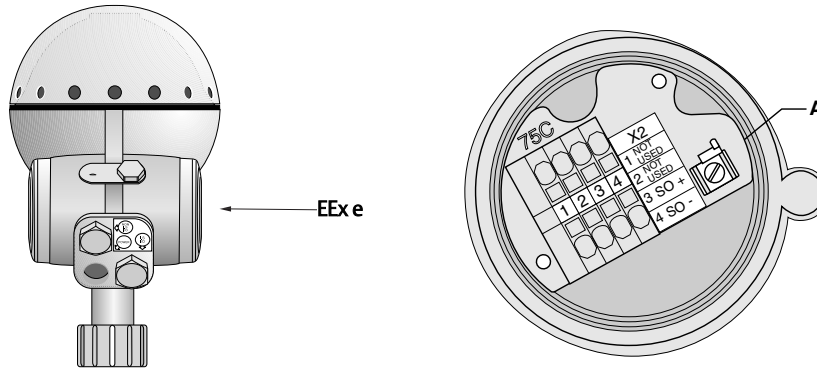
Connect the shield to the cable glands.

If conduit fittings are used no cable shield is used.

Optional non-intrinsically safe junction box

This is the standard intrinsically safe Junction Box (EExi) fitted with an alternative connector for connection of non-IS output if required.

Figure 3-6. Alternative Non-intrinsically Safe Junction Box



- 1-2 Not used
- 3-4 Non-intrinsically safe Secondary Analog Output
- A Ground terminal (not used)

Cable shield

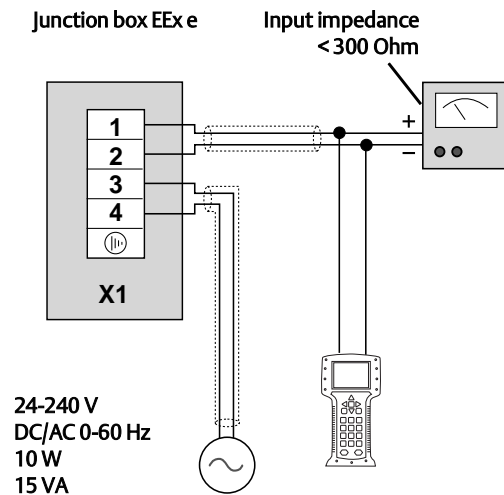
Connect the shield to the cable glands.
If conduit fittings are used no cable shield is used.

3.6.2 Connecting HART devices

Active output (internal loop supply)

For transmitters with active output a handheld terminal or a HART modem can be connected as follows:

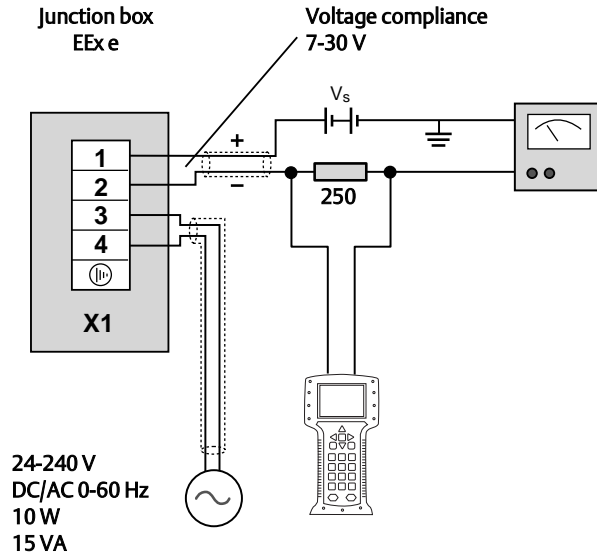
Figure 3-7. Typical Handheld Communicator Active Output (Primary)



Passive output (external loop supply)

A handheld terminal or a HART modem should not be connected directly across an external power supply. Instead, it should be connected across a load resistor of about 250 ohms.

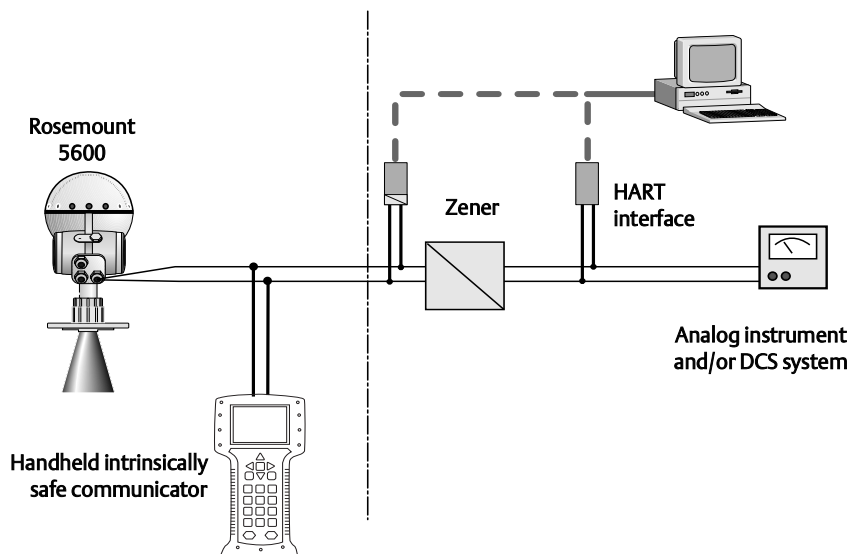
Figure 3-8. Typical Handheld Communicator (Passive Output)



Intrinsically safe conditions

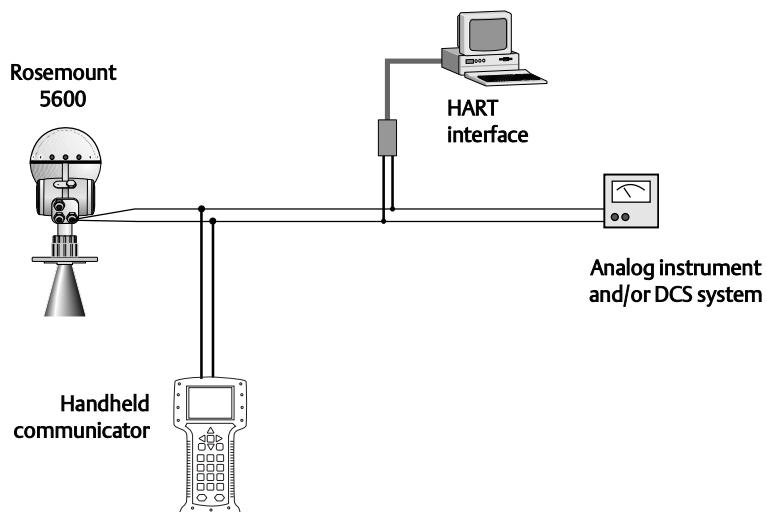
A handheld intrinsically safe communicator can be connected in the hazardous area. The HART interface must be connected via a zener barrier in the safe area. It is also possible to use an intrinsically safe Ex classed HART interface which has a built in Zener barrier.

Figure 3-9. Typical Handheld Communicator Connection In Intrinsically Safe Conditions



Non-intrinsically safe conditions

Figure 3-10. Typical Handheld Communicator Connection In Non-Intrinsically Safe Conditions



Section 4 Configuration

Antenna	page 64
Tank geometry	page 66
Analog output	page 68
Process conditions	page 70
Temperature measurement	page 70
Volume calculation	page 71
Advanced functions	page 71

4.1 Safety messages

Procedures and instructions in this section may require special precautions to ensure the safety of the personnel performing the operations. Information that raises potential safety issues is indicated by a warning symbol (⚠). Please 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 environment of the transmitter is consistent with the appropriate hazardous locations certifications.

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

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

4.2 Overview

To be able to fully utilize the Rosemount 5600 Radar Level transmitter it has to be properly configured. To configure the transmitter access the configuration parameters and assign them appropriate values. In this section you will find the parameters used and how they affect your application. The preferred user interface for the configuration is the Rosemount Radar Master software. See “[Safety messages](#)” on [page 9](#). Configuration can also be performed using the:

- AMS / 375 Field Communicator (see [Section 5: HART Configuration](#))
- DeltaV
- Or others

Limited support for various configuration parameters may apply when using certain configuration tools.

4.2.1 Basic configuration

The parameters are divided into several categories listed below. Configuration includes specification of parameters for:

- “Antenna” on page 64
- “Tank geometry” on page 66
- “Analog output” on page 68
- “Process conditions” on page 70
- “Temperature measurement” on page 70
- “Volume calculation” on page 71

4.2.2 Advanced configuration

When the basic configuration is done the transmitter will be optimized for your application. However, in some cases the transmitter must be further configured using the Advanced Functions (this may affect the previous basic configuration by updating some parameters already set). See the “Advanced functions” on page 71.

4.3 Antenna

For the antenna a few choices are available. The type of antenna must always be selected and, if applicable, corresponding type of tank sealing to be used. User-Defined is for non-standard antennas only.

The following parameters are used:

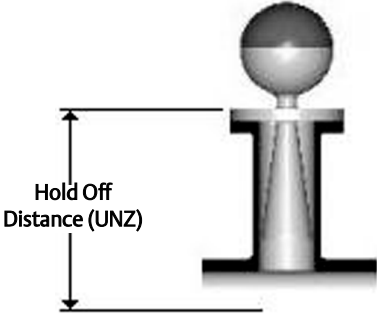
<p>Hold Off Distance</p>	<p>The (UNZ) defines how close to the transmitter’s reference point a level value is accepted. Normally, the Hold Off Distance is set automatically and does not need to be changed. However, if there are disturbing echoes in the upper part of the tank, for example from the tank nozzle, you can increase the Hold Off Distance in order to avoid measurements in the region close to the antenna. (See “Setting the Hold Off distance” on page 47).</p> 
<p>Pipe Inner Diameter</p>	<p>The figure is used to compensate for the lower microwave propagation speed inside the pipe. An incorrect value will give a scale factor error. Only valid for pipe antennas or cone antennas in existing still pipe. If locally supplied still pipes are used, make sure the inner diameter is noted before installation of the pipe.</p>
<p>Tank Connection Length</p>	<p>The (TCL) parameter is entered for antenna type User-Defined only. For standard antennas the TCL value is set automatically. For the 500 mm extended cone use the TCL_{ext} values in Table 4-2. (See “Setting the tank connection length (TCL)” on page 46).</p>

Table 4-1. Hold Off Distance Default Value in Inches (Millimeters)

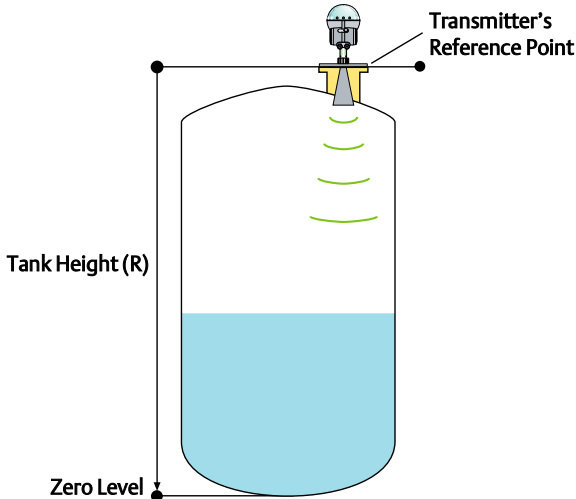
Antenna Type	TCL	Hold Off
User-defined	0.000 (0.000)	0.000 (0.000)
Cone 3-in. PTFE	18.70 (475)	4.72 (120)
Cone 4-in. PTFE	18.70 (475)	6.69 (170)
Cone 6-in. PTFE	18.70 (475)	11.02 (280)
Cone 8-in. PTFE	18.70 (475)	15.75 (400)
Cone 3-in. Quartz	20.28 (515)	4.72 (120)
Cone 4-in. Quartz	20.28 (515)	6.69 (170)
Cone 6-in. Quartz	20.28 (515)	11.02 (280)
Cone 8-in. Quartz	20.28 (515)	15.75 (400)
Pipe with cone PTFE	18.70 (475)	2.36 (60)
Pipe with cone Quartz	20.28 (515)	2.36 (60)
Parabolic	31.22 (793)	7.87 (200)
Process seal 4-in. PTFE	22.17 (563)	7.87 (200)
Process seal 6-in. PTFE	24.53 (623)	7.87 (200)

Table 4-2. TCL_{ext} for Standard Extended Lengths, 500 mm

Sealing	3-in. cone	4-in. cone	6-in. cone
PTFE	0.019 (0.489)	1.90 (0.482)	1.88 (0.477)
Quartz	2.08 (0.529)	2.06 (0.522)	2.04 (0.517)

4.4 Tank geometry

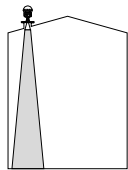
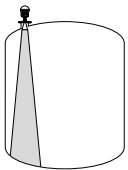
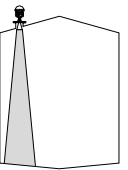
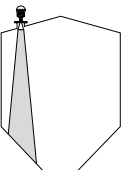
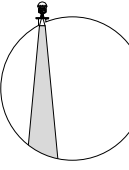
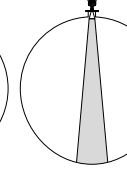
For Tank Geometry the following basic configuration must be performed:

<p>Tank Height (R)</p>	<p>The Tank Height is defined as the distance between the upper reference point (top-side of the tank nozzle) and the lower reference point (zero level).</p> 
<p>Tank Type Tank Bottom Type</p>	<p>By defining Tank Type and Tank Bottom Type default values for some parameters are set. Through this the transmitter is optimized for a specific combination of Tank type and Tank Bottom Type. For tank types vertical cylinder and cubical, all tank bottom types are valid. For tank types horizontal cylinder and spherical, the parameter Tank Bottom Type is not used. Select Tank Bottom Type flat inclined if the bottom inclination is between 10 and 30 degrees. If the inclination is less than 10 degrees but there are disturbing objects on the tank floor (like heating coils) right beneath the transmitter use this selection.</p>

The following combinations of Tank Type and Tank Bottom Type are valid:

Table 4-3. Tank Bottom

Tank Type	Tank Bottom Type
Vertical Cylinder	Flat, Dome, Cone, Flat inclined
Horizontal Cylinder	Not Applicable
Spherical	Not Applicable
Cubical	Flat, Dome, Cone, Flat inclined

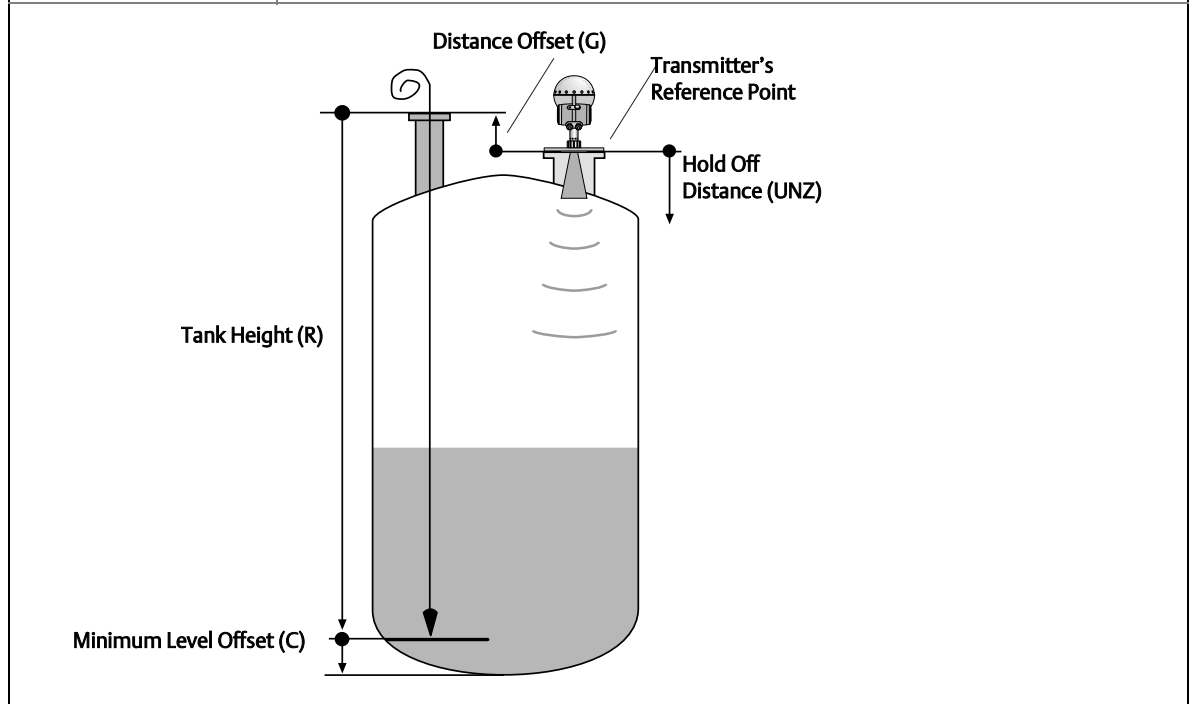







Flat
Dome
Flat Inclined
Cone
Spherical
Spherical

4.4.1 Advanced tank geometry configuration

Advanced configuration is done through the following parameters:

Distance Offset (G)	The Distance Offset (G) is defined as the distance between the upper reference point and the flange (the flange is referred to as the Transmitter's Reference Point). You can use the Distance Offset to specify your own reference point at the top of the tank. Set the Distance Offset to zero if you want the flange as upper reference point. The Distance Offset is defined as positive if you use an upper reference point above the Transmitter's Reference Point. The Distance Offset is used when the measured level by the transmitter should correspond with the level value obtained by hand-dipping.
Minimum Level Offset (C)	The Minimum Level Offset (C) defines a lower null zone which extends the measurement range beyond the Zero Level Reference Point down to the tank bottom. The Minimum Level Offset is defined as the distance between the zero level (Tank Level Reference Point) and the minimum accepted level and tank bottom. Set the Minimum Level Offset to zero if you use the tank bottom as zero level reference point. If the zero level is not defined as the tank bottom and instead is an elevated point as the datum plate, you need to define the Minimum Level Offset. Note: The Minimum Level Offset can not be negative.
Calibration Distance	The Calibration Distance is by default set to zero. It is used to adjust the transmitter so that measured levels match hand dipped product levels. Normally a minor adjustment is necessary. There may for example be a deviation between the actual tank height and the value stored in the transmitter database.
Show Negative Values as Zero	Set this parameter if you want levels below the reference point at the bottom of the tank to be displayed as zero. This parameter can be used if you have set a Minimum Level Offset distance in the tank geometry configuration.



4.5 Analog output

The Rosemount 5600 has the possibility to handle two analog outputs which can be separately configured.

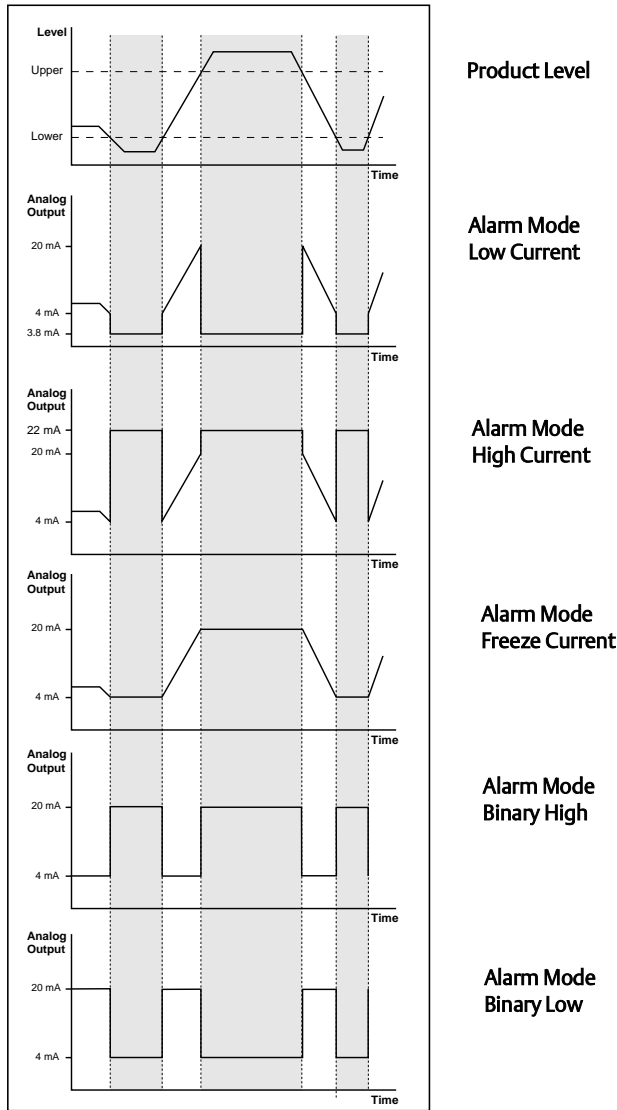
However, if your transmitter is equipped with a primary 4-20 mA HART output, you must use Analog Output 1. (Analog Output 1 is not available for primary output when using other bus communication protocols than HART).

Output Source	Select the source to control the analog output.
Upper Range Value Lower Range Value	Enter the range values that correspond to the analog output values 4 and 20 mA. You can specify any values as long as the Upper Range Value is above the Lower Range Value. If the measured value goes beyond the measurement range, the transmitter enters the alarm mode.
Alarm Mode	Choose the desired Alarm Mode. The Alarm Mode specifies the analog output state when a measurement error occurs or when the measured value is out of range. High: the output current is set to 22 mA. Low: the output current is set to 3.8 mA. Freeze Current: the output current is set to the present value at the time when the error occurs. Binary High: the output current is 4 mA under normal conditions. If there is a measurement error, or when the source signal is out of range, the output current is set to 20 mA. Binary Low: the output current is 20 mA under normal conditions. If there is a measurement error, or when the source signal is out of range, the output current is set to 4 mA.
Disable Limit Alarm if Out of Range	If the detected limit is out side the upper or lower limit, setting this parameter suppresses the analog output from going into alarm mode.

Figure 4-1 illustrates how the analog output signal is related to the actual measured product level and the specified upper and lower limits. As illustrated, if the source signal exceeds the Upper limit or falls below the Lower limit, the output current is set according to the specified Alarm Mode settings.

If your transmitter is equipped with an optional analog output (Analog Output 2), configure it as described above.

Figure 4-1. Alarm Mode Settings



Analog Output current as a function of product level for different alarm mode settings. The shaded area indicates analog output in Alarm mode. The graphs are valid when Disable Limit Alarm if Out of Range is not set.

4.6 Process conditions

Describe the conditions in your tank according to the Process Conditions listed below. For best performance choose only if applicable and not more than two options.

Rapid level changes	Optimize the transmitter for measurement conditions where the level changes quickly due to filling and emptying of the tank. A standard configured transmitter is able to track level changes of up to 4 inch/s (100 mm/s). When the Rapid Level Changes check box is marked, the transmitter can track level changes of up to 8 inch/s (200 mm/s).
Turbulent Surface	This parameter should be used if the tank shows a turbulent surface. The reason for the turbulence might be splash loading, agitators, mixers, or boiling product. Normally the waves in a tank are quite small and cause local rapid level changes. By setting this parameter the performance of the transmitter will be improved when there are small and quickly changing amplitudes and levels.
Foam	Setting this parameter optimizes the transmitter for conditions with weak and varying surface echo amplitudes, which are typical for foam.
Solid Products	Setting this parameter optimizes the transmitter for solid products, for example concrete or grains, which are not transparent for radar signals. For instance, this parameter can be used when the application is a silo with product buildup.

4.7 Temperature measurement

Up to six temperature sensors can be connected to an existing 2210 Display Unit⁽¹⁾. You can use 1-3 spot elements or 1-6 multiple spot elements. All temperature sensors must be of the same type, for example, the Pt100 or CU90.

Use one of the following temperature measurement conversion methods:

- PT100
- CU90
- User-defined linearization table. The sensor characteristics are specified in a table of corresponding resistance and temperature values.
- User-defined formula. The sensor characteristics are specified in a mathematical formula: $R=R_0 \cdot (1+A \cdot T+B \cdot T^2)$ where R is the resistance at temperature T, R_0 is the resistance at zero degrees Centigrade and A and B are constants.

Sensor Mounting Level 1-6	Enter the level (from the tank bottom) at which each sensor is mounted. The first sensor should be mounted in the lowest position in the tank, the second above the first and so on.
Number of Sensors	Enter the number of temperature sensors connected to the Display Unit. You can have up to six sensors connected. If you choose zero sensors temperature measurement is disabled.

1, The Rosemount 2210 Display Unit was discontinued Oct 2018, and is no longer available for ordering.

4.8 Volume calculation

The Volume Calculation is performed by using one of two methods: predefined tank shape or strapping table. The strapping table is an optional function. If this function is required, please contact your local Rosemount representative.

To configure the Rosemount 5600 transmitter for volume calculations you have to choose a Volume Calculation method.

Select one of the volume calculation methods. Choose one of the ideal tank shape options if approximation of your tank with an ideal tank shape provides sufficient accuracy. The strapping table option can be used for an arbitrary tank shape. You can enter levels and corresponding volumes to obtain a close match between the actual and the calculated volume. This option should be used in cases where the tank shape deviates significantly from an ideal sphere or cylinder, or when you require high accuracy.

Note

The transmitter is delivered with a code that enables the ordered software options including strapping table volume calculation. If you wish to change the set of available options, contact your local Rosemount representative.

Ideal tank

Use this option if approximation of your tank with an ideal tank shape (assuming no dished ends) provides sufficient accuracy. Enter the following parameters:

- Tank Diameter (and the length if it is a horizontal tank).
- Volume Offset: Use this parameter if you do not want zero volume and zero level to match (for example if you want to include volume below the zero level).

Strapping table

- Enter levels and corresponding volumes starting at the bottom of the tank. These figures can typically be obtained from tank drawings or from certificate from the tank manufacturer. If the level//volume table is based on a reference point that is different from your reference point, you can use Level Offset and Volume Offset. The Volume Offset is added to every value in the corresponding column.
- Select which interpolation method to use for calculating volumes between the strapping points. Normally, linear interpolation is the preferred method. For spherical tanks, quadratic interpolation may result in a smaller error. By using linear interpolation and a sufficient number of values in the strapping table, the interpolation error can normally be reduced to a minimum.

4.9 Advanced functions

In some cases the transmitter must be further configured using the Advanced Functions. Please note this may affect the previous basic configuration by updating some parameters already set.

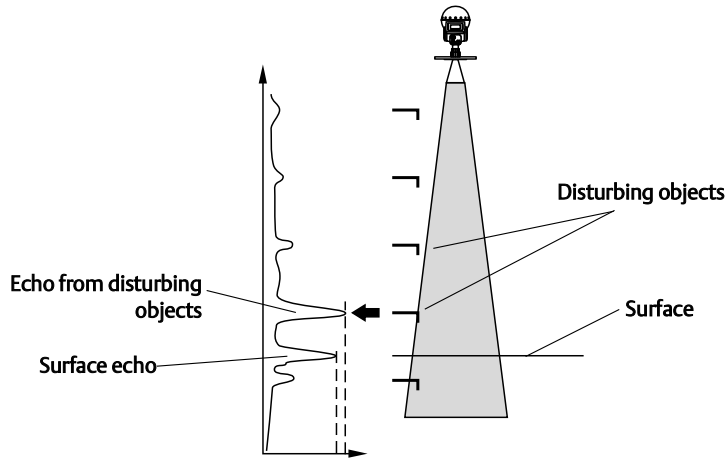
4.9.1 Disturbance Echo Handling

There are three methods available for Disturbance Echo Handling:

- General Amplitude Threshold
- Customized Noise Threshold Table (Amplitude Threshold Points [ATP] table)
- Registration of False Echoes

There are guidelines on when to register a false echo and what the Auto Configuration does.

Figure 4-2. Disturbance Echoes

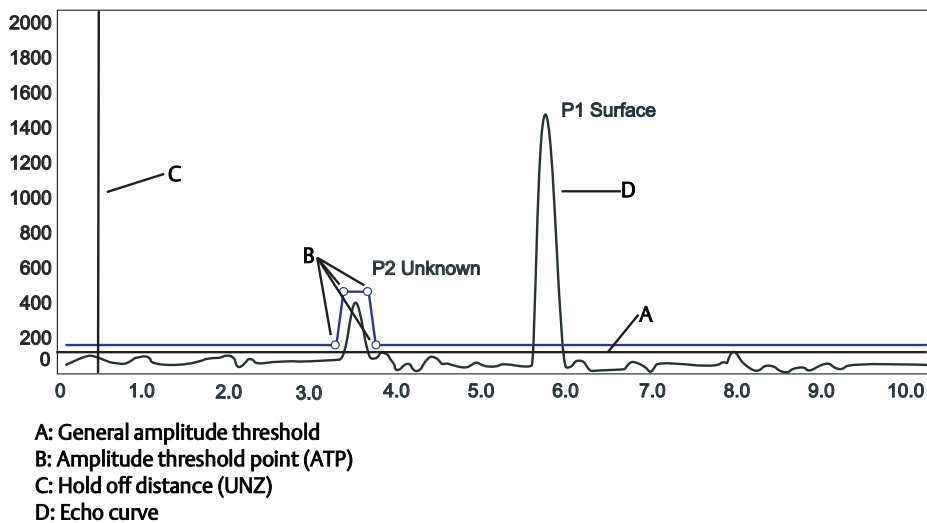


The False Echo function is used to improve the performance of the transmitter when the surface is close to a horizontal surface of a stationary object in the tank. The object causes an echo when it is above the surface. When the echoes from the surface and the object are close to each other, they might interfere and cause a decrease in performance.

It is possible to store the positions of the disturbing objects in the memory of the transmitter. When the surface is passing by a disturbing object, the transmitter can measure with a higher reliability, when the position of the object is registered.

Use a spectrum plot to find the disturbance echoes. Remember to update it several times to get the whole picture of disturbance echoes in the tank. Do not base the false echo registration on only one updated spectrum plot. (See Figure 4-3).

Figure 4-3. Spectrum Plot for Typical Calm Conditions



<p>General Amplitude Threshold</p>	<p>Echoes with amplitudes below the general amplitude threshold will be disregarded. Recommended threshold values are:</p> <ul style="list-style-type: none"> • Calm conditions: no turbulence, foam or condensation. Set amplitude threshold to approximately 20% of surface echo amplitude. • Foam, agitators, or low product DC: the surface echo signal may drop to 200-300 mV during processing in tank. A threshold value of about 150 mV is recommended. <p><i>Note:</i> <i>These figures are estimations. Significantly different figures may have to be used in many cases.</i></p> <p>Some further considerations are:</p> <ul style="list-style-type: none"> • If water test is performed before the product enters the tank, there is probably a difference in signal amplitude between the water and the product. Use the signal amplitude for the product to set the amplitude threshold. • A moving surface may cause a decrease in signal amplitude.
<p>Customized Noise Threshold Table (ATP-table)</p>	<p>You can filter out weak disturbing echoes by creating a noise threshold table. This technique should only be use in special situations, for example at the bottom of tanks with weak disturbing echoes. In such tanks the transmitter may lock at disturbances close to the bottom when the tank is empty. Setting up a noise threshold in the region will guarantee that the transmitter starts following the surface when the tank is filled again. Make sure the surface echo amplitude in the bottom region is always stronger than the noise threshold. (See Figure 4-4) Also, this function can be used in areas where occasionally there are strong echoes present. For those large areas registering a False Echo may not be sufficient. Furthermore, the ATP-table can be used to remove influence for the tank nozzle or a still pipe inlet at the top of the tank. The Hold Off Distance (UNZ) can also be used to manage such cases. Do not create noise thresholds around echoes which are already registered as interfering echoes. The general amplitude threshold is the lower limit of the noise threshold table. (See Figure 4-4).</p>
<p>Registration of False Echoes</p>	<p>The False Echo function allows you to let the transmitter register disturbing echoes caused by objects in the tank. This makes it possible to detect a product surface close to a disturbance echo even if the surface echo is weaker than the disturbing echo. (See Figure 4-5).</p> <p>When should I register?</p> <p>See the following recommendations before you register new interfering echoes:</p> <ul style="list-style-type: none"> • Make sure that a correct amplitude threshold is set before you register any disturbance echoes. See description of the SpectraThreshold window. • Keep the number of registered echoes to a minimum. • Compare the list of interfering echoes with the tank drawing or by visible inspection of the tank. Note if there are objects like beams, heating coils, agitators, etc. which correspond to the found echoes. Only register echoes which can be clearly identified as objects in the tank. • Make sure that the level is stable before you register a disturbance echo. A fluctuating level may indicate a temporary disturbance which is not due to an interfering object. • Do not register a disturbance echo if the amplitude is significantly smaller than the amplitude of the surface echo when the surface is at the same level as the disturbance. (In some cases weak disturbance echoes can be filtered out by creating a noise threshold table. • It may be necessary to register new disturbance echoes at a later stage when objects have become visible due to surface movement.

Figure 4-4. Noise Threshold

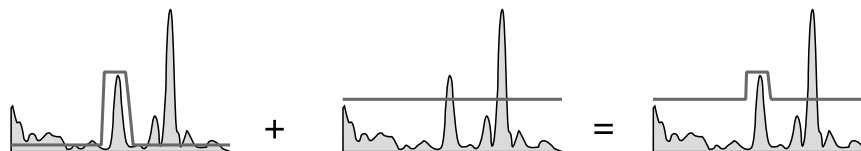
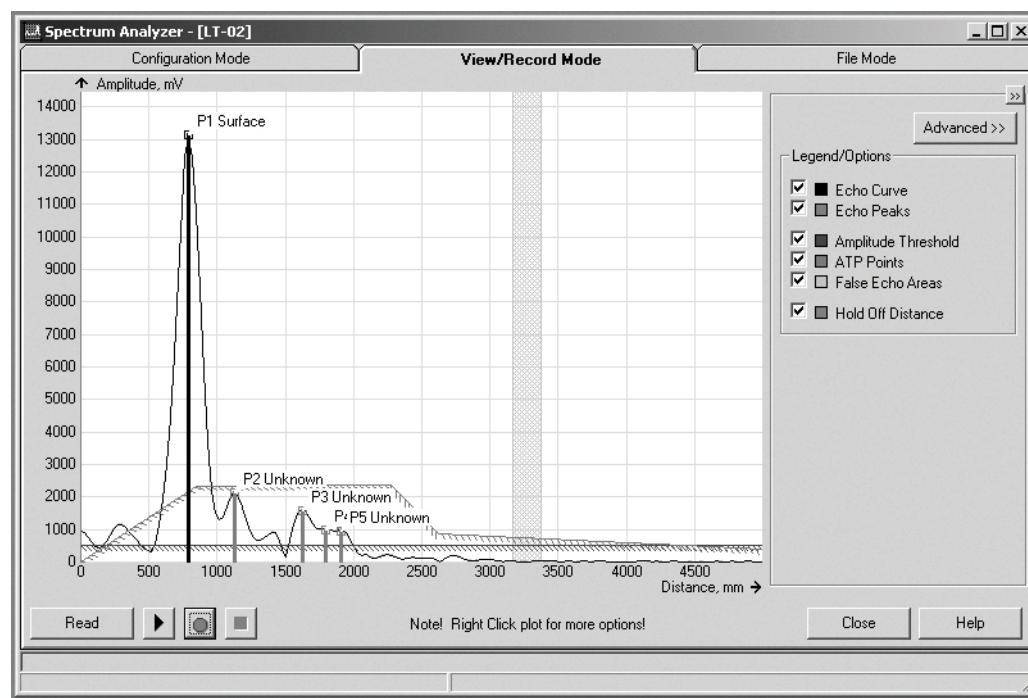
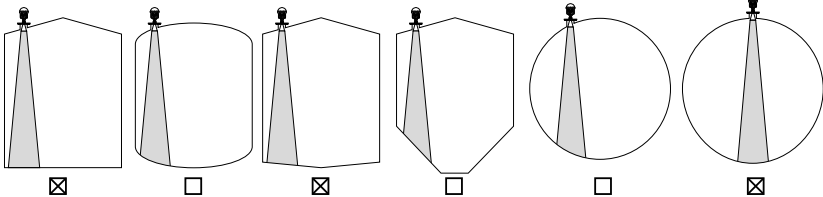


Figure 4-5. False Echoes



4.9.2 Bottom Echo Handling

<p>Bottom Echo Visible</p>	<p>This parameter is automatically set depending on tank type and tank bottom type. By setting this parameter the bottom echo will be treated as a disturbance echo to facilitate tracking of weak surface echoes close to the tank bottom. If this parameter is not set searching for a lost surface echo is restricted to a region close to the tank bottom. Only set this parameter if the bottom echo is visible. The figure shows scenarios (checked tanks) where the bottom echo is visible. Always check if the transmitter shows a value for the bottom at empty tank before marking the checkbox. Only flat bottom tanks have checkbox marked as default. Set this parameter in Advanced Service.</p> <p>If Empty Tank Handling is set to automatic, the choice of Tank Bottom Type controls the setting of Bottom Echo Visible. For Tank Bottom Type flat, the Bottom Echo Visible parameter is always set.</p> <p>If the Empty tank Handling function is not set to automatic, the Bottom Echo Visible parameter is set manually for all tank types. However, the Tank Bottom Type flat always has Bottom Echo Visible set.</p> 
<p>Invalid Level Alarm Is Not Set If Tank Is Empty</p>	<p>If the surface echo is lost close to the bottom of the tank, setting this parameter suppresses the “invalid” display.</p>

4.9.3 Full Tank Handling

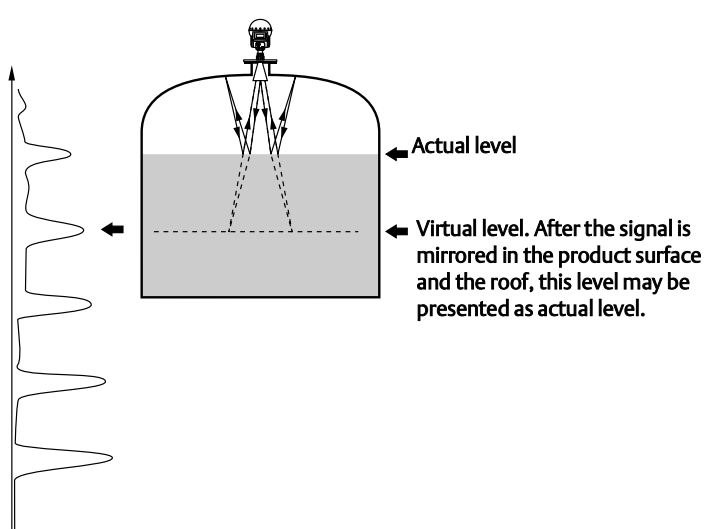
<p>Invalid Level Alarm Is Not Set If Tank Is Full</p>	<p>If the surface echo is lost close to the top of the tank, the level value will normally be displayed as “invalid”. Set this parameter to suppress the “invalid” display.</p> <p><i>Note</i></p> <p><i>By setting this parameter the analog output will not enter alarm mode for invalid levels close to the tank bottom or close to the antenna.</i></p>
---	---

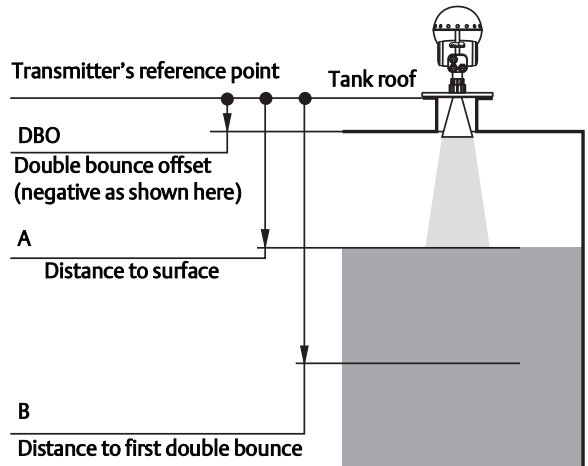
4.9.4 Empty Tank Handling

<p>Empty Tank Detection Area</p>	<p>The Empty Tank Handling is a function for handling situations when the surface echo is lost close to the bottom. If the surface echo is lost the function makes the transmitter present a zero-level measurement, and an alarm is created, unless this alarm has been blocked.</p> <p>This function is activated by default if you have selected one of the following Tank Bottom Types: Cone, Dome, Flat Inclined, or Unknown. This function also requires that the Bottom Echo Visible checkbox is not marked. If it is marked the function is disabled.</p> <p>The transmitter will search for the surface echo within the Empty Tank Detection Area. The Empty Tank Detection Area is calculated as a percentage of Tank Height (R) + Minimum Level Offset (C) - Distance Offset (G). It has a lower limit of 400 mm and a higher limit of 1000 mm. Used Empty Tank Detection Area is shown in Advanced Setup and can be adjusted manually if required.</p> <p>Since the transmitter will search for the surface echo in the Empty Tank Detection Area, it is important that there are no disturbances in this area. If there are disturbances it may need to be filtered out. (See “Disturbance Echo Handling” on page 71 and “Tank geometry” on page 66.</p>
----------------------------------	---

4.9.5 Surface Tracking

<p>Slow Search</p>	<p>This variable controls how to search for the surface if a surface echo is lost. With this parameter set the transmitter starts searching for the surface at the last known position, and gradually increases the width of the search region until the surface is found. If this variable is not set the transmitter searches through the whole tank. This parameter may typically be used for tanks with turbulent conditions.</p>
<p>Slow Search Speed</p>	<p>If the surface echo is lost, the transmitter starts to search around the last known level to find the surface echo again. This parameter indicates how fast it should expand the search window.</p>
<p>Double Surface</p>	<p>Indicates that there are two liquids or foam in the tank resulting in two reflecting surfaces. The upper liquid or foam layer must be partly transparent to the radar signal. If this function is activated, you can specify which surface to select by using the Select Lower Surface parameter.</p>
<p>Upper Product DC</p>	<p>This is the dielectric constant for the upper product. A more precise value results in better accuracy for the lower surface level.</p>
<p>Level above min distance possible</p>	<p>If the surface echo is lost in the vicinity of the antenna, full tank is indicated and searching for the surface echo is limited to a region close to the antenna.</p>
<p>Select Lower Surface</p>	<p>This function should only be used if Double Surface is set. If Select Lower Surface is set the lower surface will be presented as the product surface. If not set the upper surface is tracked.</p>
<p>Echo Timeout</p>	<p>Use Echo Timeout to define the time in seconds before the transmitter will start to search for a surface echo after it has been lost. After an echo has been lost, the transmitter will not start searching or set Invalid Level until this time has elapsed.</p>

Close Distance Window	<p>This parameter defines a window centered at the current surface position in which new surface echo candidates can be selected. The size of the window is \pmCloseDist. Echoes outside this window will not be considered as surface echoes. The transmitter will immediately jump to the strongest echo inside this window. If there are rapid level changes in the tank, the value of the Close Distance Window could be increased to prevent the transmitter from missing level changes. On the other hand, a value too large might cause the transmitter to select an invalid echo as the surface echo.</p>
Double Bounce Possible	<p>Some radar waves are reflected against the tank roof and back to the surface before they are detected by the transmitter. Normally, these signals have a low amplitude and are therefore neglected by the transmitter. For spherical and horizontal cylinder tanks, in some cases the amplitude may be strong enough to lead the transmitter to interpret the double bounce as the surface echo. By setting the Double Bounce parameter this type of measurement situation may be improved. This function should only be used if the problem of double bounces can not be solved by changing the mounting position.</p>  <p>The diagram illustrates a tank with a radar transmitter mounted on the roof. It shows the actual liquid level and a virtual level created by a double bounce (reflection off the roof and back to the surface). A radar waveform on the left shows two distinct peaks corresponding to these levels.</p> <p>Actual level</p> <p>Virtual level. After the signal is mirrored in the product surface and the roof, this level may be presented as actual level.</p>

<p>Double Bounce Offset</p>	<p>Use the Double Bounce Offset to define the distance between detected double bounces. In order to determine the Double Bounce Offset, you need to check the spectra of signal amplitude vs. distance to echo or read the detected echoes from the display. The distance between double bounces is constant. By subtracting two times the distance to the surface level (2A) from the distance to the first double bounce (B) you will get the Double Bounce Offset. The Double Bounce Offset is negative if the reflection point (normally the tank roof) is below the transmitter's reference point.</p> <p>$DBO = B - 2A$ DBO: Double Bounce Offset B: Distance to first double bounce A: Distance to surface</p> 
-----------------------------	---

4.9.6 Filtering

<p>Distance Filter Factor</p>	<p>The Distance Filter Factor defines how much the level value should be filtered. A low factor setting will give the new level value by adding a small portion (for instance 1%) of the level change to the previous level value. A high factor setting typically takes the latest measurement and presents it as the new level. This implies that a low factor setting makes the level value steady but the transmitter reacts slower to level changes in the tank. A high factor setting makes the transmitter react quickly to level changes but the level value can be somewhat jumpy.</p>
<p>Activate Jump Filter</p>	<p>If the surface echo is lost and a new surface echo is found, the Jump Filter tells the transmitter to wait for some time before it jumps to the new echo. During that time the new echo has to be a valid echo. The Jump Filter does not use the Distance Filter Factor and can be used in parallel to the Least Square Filter or the Adaptive Filter. The Jump Filter is typically used for applications with turbulent surface and makes the echo tracking work smoother as the level passes the agitator.</p>
<p>Activate Least Square Filter</p>	<p>This filter calculates the new level value according to the least square method and will give increased accuracy for slow filling or emptying of tanks. The level value will follow the surface with high accuracy and without delay as the level changes. When the level stabilizes at a certain level, the Least Square Filter makes the level move somewhat further before it aligns to the correct level value.</p>
<p>Activate Adaptive Filter</p>	<p>The Adaptive Filter is tracking the level fluctuations, and is continuously adjusting the filter grade accordingly. The filter can preferably be used in tanks where fast tracking of level changes are important, but where turbulence occasionally cause unstable level values.</p>

Section 5 HART Configuration

Safety messages	page 79
Overview	page 79
Safety messages	page 79
Handheld communicator	page 85

5.1 Safety messages

Procedures and instructions in this section may require special precautions to ensure the safety of the personnel performing the operations. Information that raises potential safety issues is indicated by a warning symbol (⚠). Please 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 environment of the transmitter is consistent with the appropriate hazardous locations certifications.

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

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

5.2 Overview

The Rosemount 5600 Radar Level Transmitter uses AMS Suite™ as a configuration tool. See www.emerson.com/ams/ for more information on configuring the Rosemount 5600 Radar Level transmitter.

5.3 PC Configuration Software Radar Master

The Rosemount Radar Master is an interactive and powerful configuration tool that assists you in properly setting up a Rosemount 5600 for the application it is mounted on. This tool is shipped with every order and offers assistance for users of all levels, from beginners to more experienced users. The Installation Wizard guides you through a basic setup including the necessary steps to get a straight-forward application up and running. Other sections in the software allows for a custom setup and includes features such as:

- An extensive online help, eliminating the need for a manual in paper. This online help is not only a description of the software itself but also includes guidelines of how to configure the transmitter.
- Offline installation, for configuration and setup of transmitters that have not been physically installed or powered up.
- A Spectrum Plot describes the situation and conditions in the tank the way the transmitter views them.
- Logging features is where you can log measured data and other relevant data.
- Use the Advanced setup support for your more difficult applications.

5.3.1 Installation

The program on the CD will automatically start and suggest an installation of the Radar Master software. You will need to restart your PC prior to running the Radar Master program.

Note

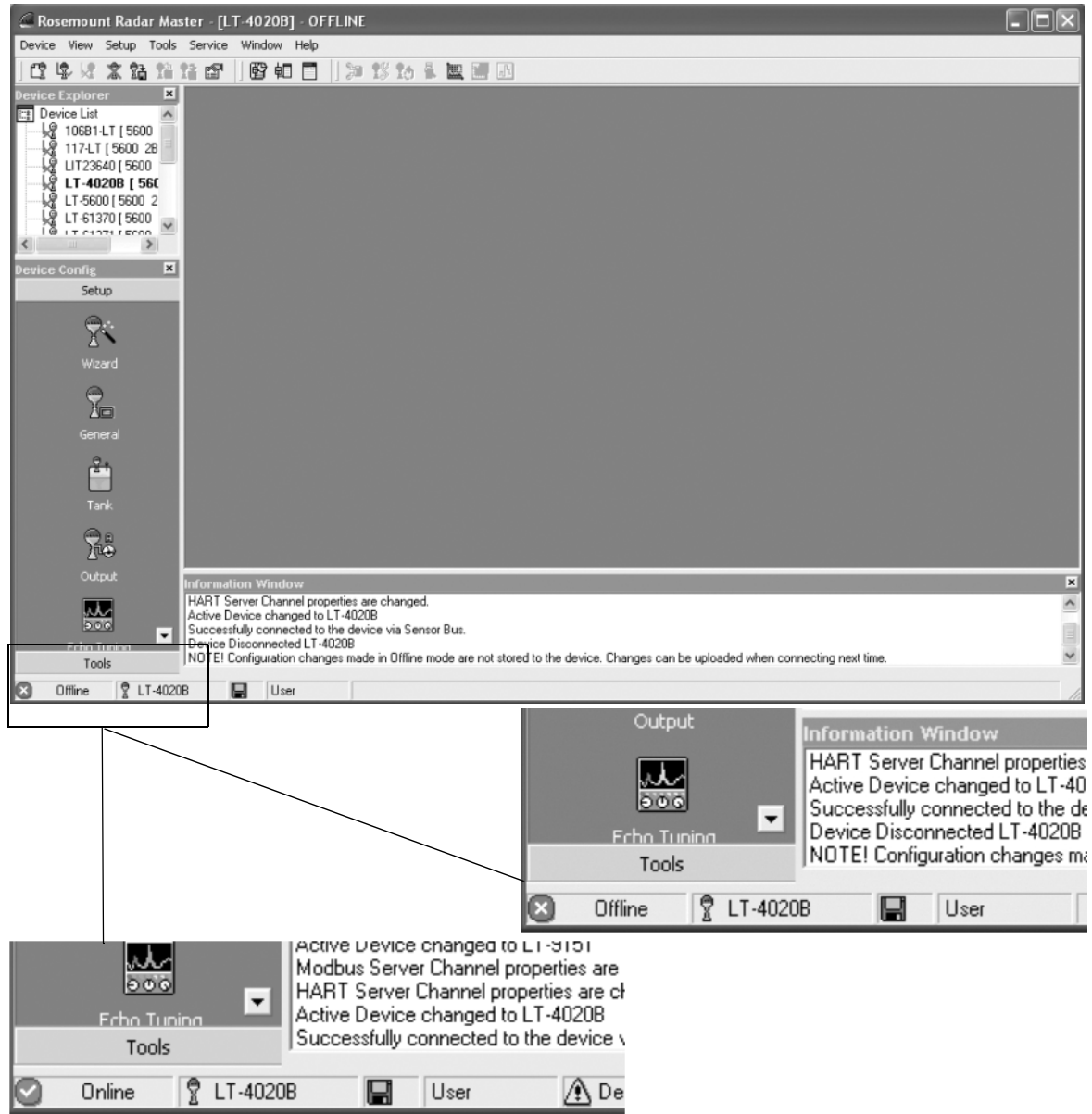
For Windows 2000 and Windows XP you need to set the Serial Port buffers to 1. Follow the instructions below.

1. Right click on My Computer and choose Properties.
2. Choose the tab Hardware.
3. Click on the button Device Manager.
4. Navigate to Ports in the list of hardware.
5. Right click on Serial Port COM 1 and choose Properties.
6. Choose the tab Port Settings.
7. Click Advanced.
8. Drag the slider for Receive Buffer and Transmit Buffer to 1.
9. Click OK.
10. Reboot the Computer.
11. Repeat for COM 2 if available.

Start the Radar Master

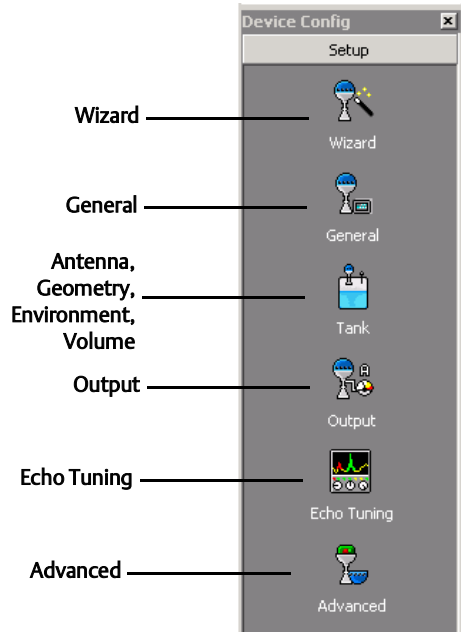
1. From the Start menu click Programs > Saab Rosemount > Rosemount Radar Master or click the RRM icon in the Windows workspace. Now RRM searches for the transmitter.
2. When the transmitter is found press Yes to connect. If communication does not work check that the correct COM port is connected on the computer and that the COM port is properly configured.
3. In the Radar Master Status Bar verify that RRM communicates with the transmitter (see [Figure 5-1](#)).

Figure 5-1. Online vs. Offline Connection to Device



5.3.2 Main configuration icons

Figure 5-2. Device Configuration Icons



Wizard

Guided setup including the basic configuration settings such as the HART Tag, Antenna Type, Tank Geometry, Variable assignments, Volume, etc.

General

Here you configure the Units settings to work with, HART Tag and descriptors, etc.

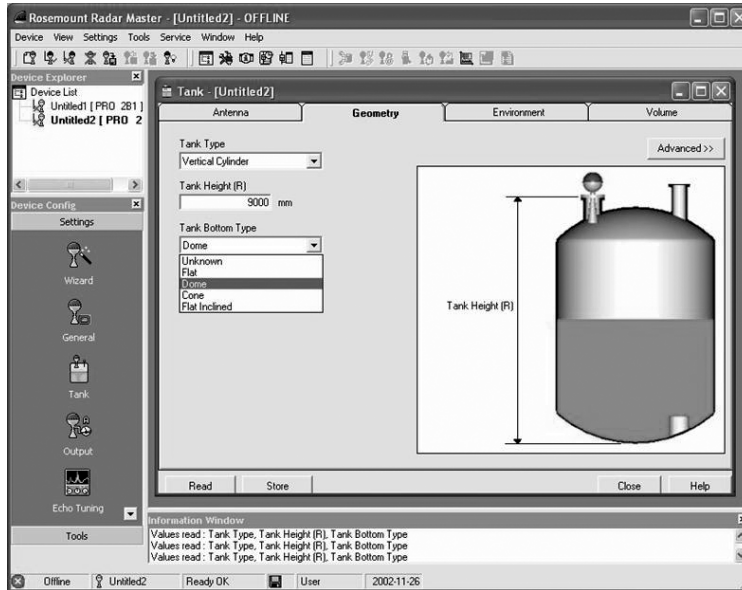
Figure 5-3. General Configuration

The image shows a screenshot of the 'General Configuration' window. The window has a title bar with 'Communication', 'Device Tag', and 'Units'. The main area of the window contains four fields, each with a label to its left and a value to its right. The labels and their corresponding values are: 'Tag' (LT-40208), 'Message' (0), 'Tag Descriptor' (0), and 'Date' (00:00:00). Each value is followed by an example in parentheses: (example "Device 123"), (example "Calibrated by John"), (example "Plant A"), and (for instance date of calibration).

Tank

This icon allows you to configure Antenna Type, set the Geometry settings for the tank, Environment settings, and Volume if applicable.

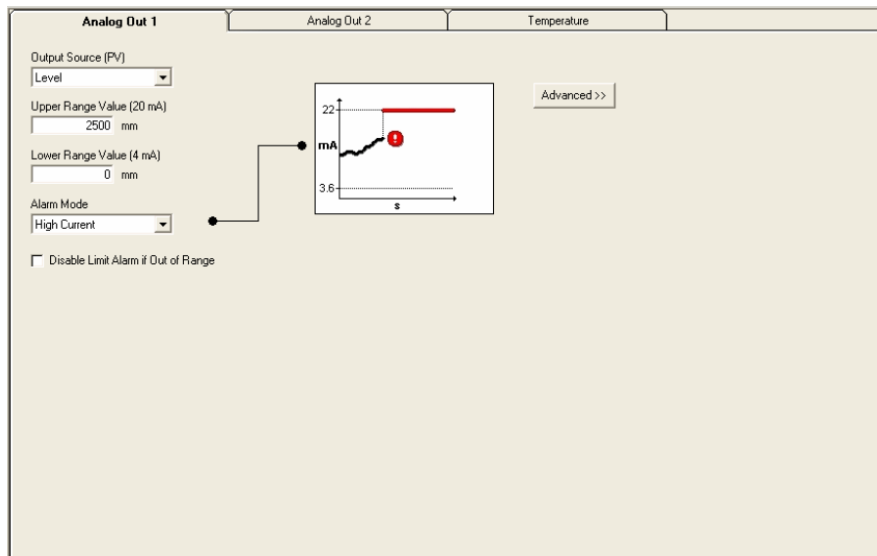
Figure 5-4. Radar Master Tank Configuration



Output

This is the Icon that handles the Analog Outputs and Variable assignments as well as Temperature sensor configuration.

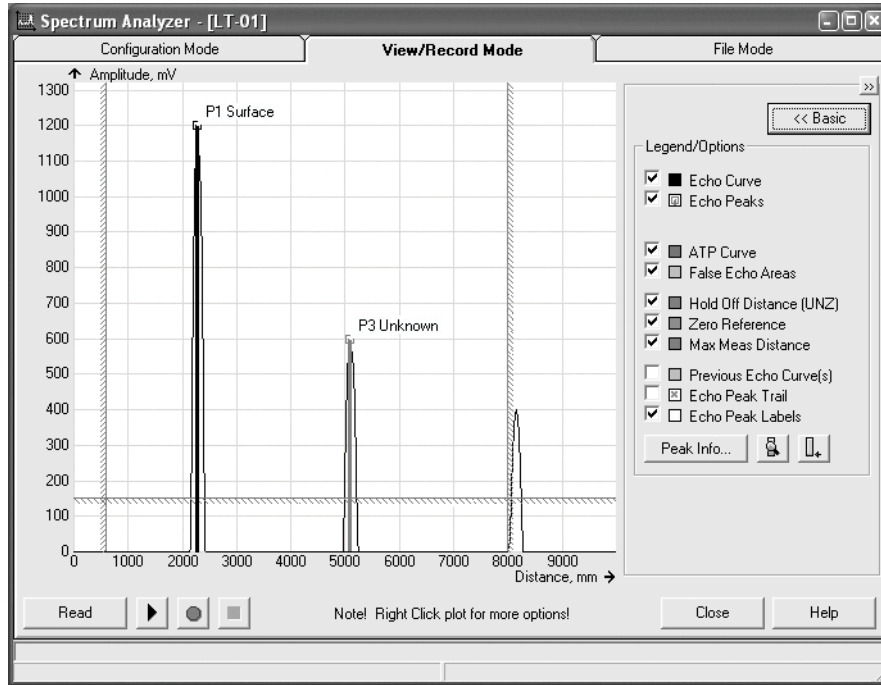
Figure 5-5. Output Configuration



Echo tuning

This window opens up the Tank Spectrum picture for echo tuning of Disturbance echoes, setting Noise Thresholds, etc.

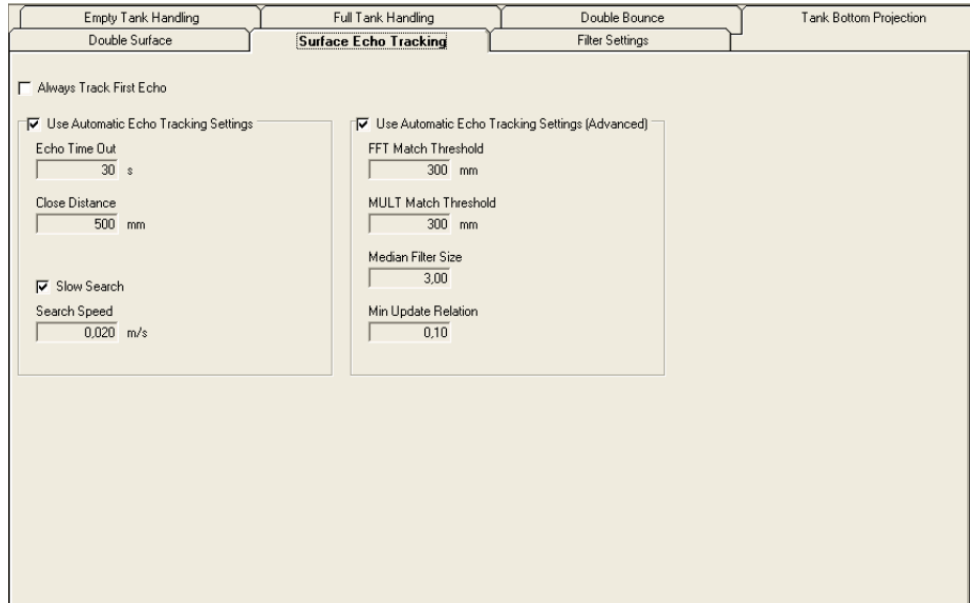
Figure 5-6. Radar Master Echo Tuning



Advanced

This icon gives you access to advanced configuration functions. Many are automatically set based on Tank Geometry and Environment settings, but for some tough applications the user can manually edit the settings if needed. Examples are Surface echo tracking functions, Empty tank handling, Filtering etc.

Figure 5-7. Advanced Configuration



5.4 Handheld communicator

Commissioning consists of testing the transmitter and verifying transmitter configuration data. The Rosemount 5600 Series can be commissioned either before or after installation.

To commission, connect the transmitter and the Communicator. Make sure the instruments in the loop are installed according to intrinsically-safe or nonincendive field wiring practices before connecting a communication in an explosive atmosphere. Connect Communicator leads at any termination point in the signal loop.

To enable communication, a resistance of at least 250 ohms must be present between the Communicator loop connection and the power supply. Do not use inductive-based transient protectors with the Rosemount 5600 Series.

When using a handheld Communicator, any configuration changes made must be sent to the transmitter by using the “Send” key (F2). AMS configuration changes are implemented when the “Apply” button is clicked. See [Figure 3-7](#), [Figure 3-8](#), [Figure 3-9](#), and [Figure 3-10](#) on page 62 to connect the Communicator and transmitter.

For more information on the 275 HART Communicator see document 00275-8026-0002 and for the 375 Field Communicator see document 00375-0047-0001.

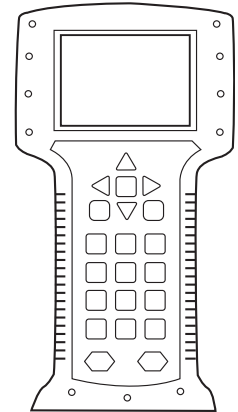
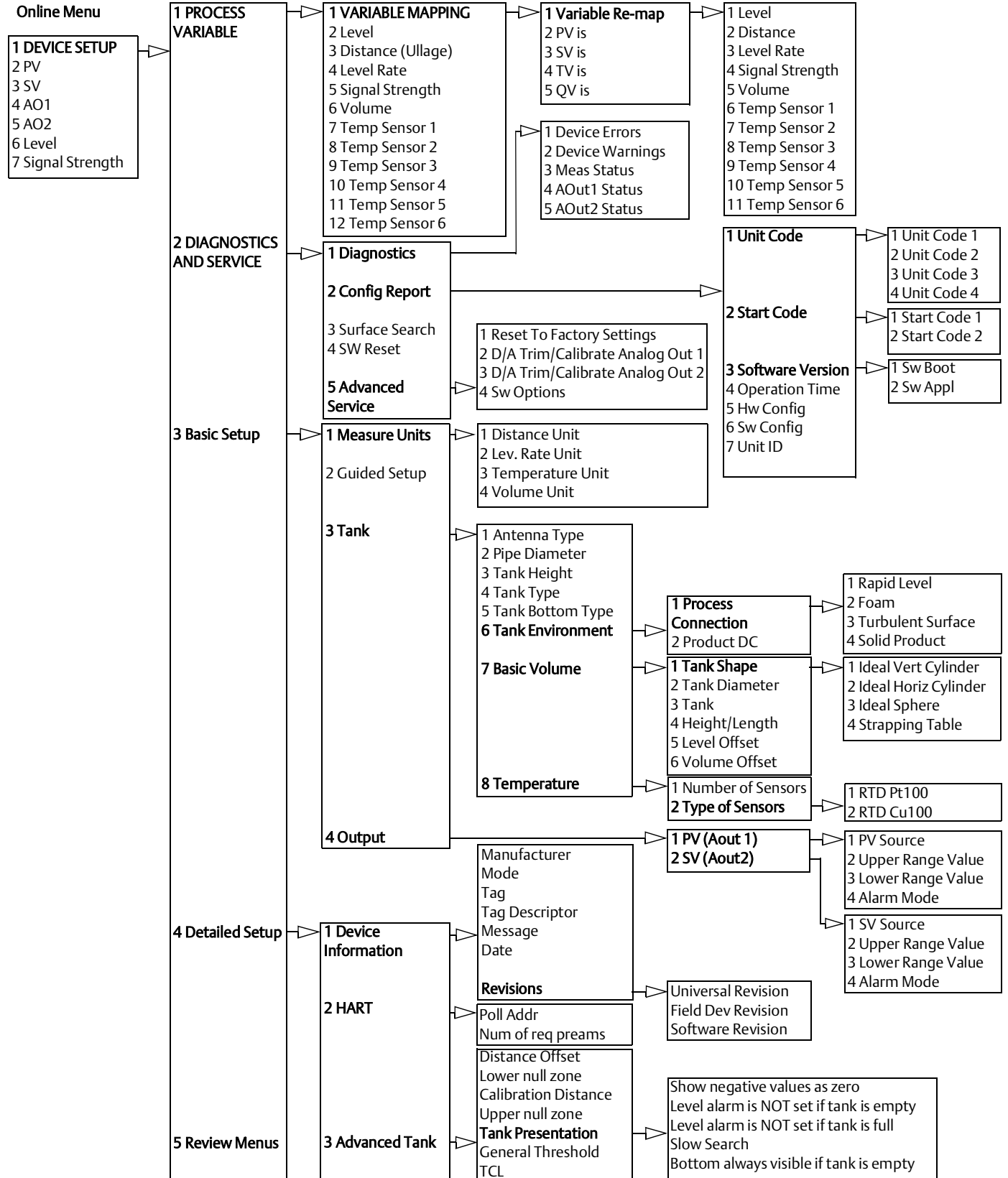


Figure 5-8. HART Communicator Menu Tree for the Rosemount 5600 Radar Level Transmitter



5.4.1 HART fast keys

Function	HART Fast Key
Antenna Type	1, 3, 3, 1
Basic Volume	1, 3, 3, 7
Device Information	1, 4, 1
Diagnostics	1, 2, 1
Distance Unit	1, 3, 1, 1
Poll Address	1, 4, 2, 1
Primary Variable	1, 1, 1, 1
PV Alarm Mode	1, 3, 4, 1, 4
PV Lower Range Value	1, 3, 4, 1, 3
PV Upper Range Value	1, 3, 4, 1, 2
PV Source (Assignment)	1, 3, 4, 1, 1
Software Version	1, 2, 2, 3
Surface Search	1, 2, 3
Tank Height	1, 3, 3, 3
Temperature	1, 3, 3, 8

5.4.2 Setting the loop to manual

Whenever sending or requesting data that would disrupt the loop or change the output of the transmitter, set the process application loop to manual. The HART Communicator will prompt you to set the loop to manual when necessary. Acknowledging this prompt does not set the loop to manual. The prompt is only a reminder; set the loop to manual as a separate operation.

5.4.3 Connections and hardware

The HART Communicator exchanges information with the Rosemount 5600 from the control room, the instrument site, or any wiring termination point in the loop. The HART Communicator should be connected in parallel with the transmitter. Use the loop connection ports on the rear panel of the HART Communicator. The connections are non-polarized.



Do not make connections to the serial port or NiCad recharger pack in an explosive atmosphere.

5.4.4 Using a handheld communicator

Note

Remember, when using a handheld communicator, you must **send** the data before configuration changes will take effect.

5.4.5 Level configuration example

To configure the Rosemount 5600 to report LEVEL (analog output is linear to level) with the transmitter wired as on [page 60](#), connect the handheld communicator as shown.

Setting transmitter units

HART Comm	1, 3, 1
-----------	---------

Set transmitter units:

- ft
- m
- in
- cm
- mm

Setting Reference Transmitter Height

HART Comm	1, 3, 3, 3
-----------	------------

When setting the Reference Transmitter Height, keep in mind that this value is used for all measurements performed by the Rosemount 5600.

Setting PV 4 and 20 mA Points

HART Comm	1, 3, 4, 1
-----------	------------

When setting the range values, it is possible to enter the values directly, or to use actual values.

Note

The primary variable must be set to *level* (factory default).

Section 6 Maintenance and Troubleshooting

Overview	page 89
Safety messages	page 89
HART maintenance and troubleshooting	page 89

6.1 Overview

This sections contains operating, maintenance, and troubleshooting information for the Rosemount 5600 HART.

6.2 Safety messages

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

Follow the procedures described here to verify that transmitter hardware and process connections are in good working order. Always deal with the most likely checkpoints first.

6.2.1 Warnings

⚠ WARNING

Explosions can result in death or serious injury.

- Do not remove the transmitter covers in explosive environments when the circuit is live.
- Transmitter covers must be fully engaged to meet explosion proof requirements.
- Before connecting a communicator in an explosive atmosphere, make sure that the instruments in the loop are installed according to intrinsically safe or nonincendive field wiring practices.

⚠ CAUTION

Static electricity can damage sensitive components.

- Observe safe handling precautions for static-sensitive components.
-

6.3 HART maintenance and troubleshooting

If you suspect malfunction despite the absence of any diagnostic messages on the HART Communicator display and other configuration tools, follow the procedures described here to verify that transmitter hardware and process connections are in good working order. Always deal with the most likely checkpoints first.

6.3.1 Troubleshooting table

Table 6-1 provides summarized troubleshooting suggestions for the most common operating problems.

Symptoms	Action
No level reading	Check the power supply.
	Check the cables for serial data communication.
Incorrect level reading	Check the transmitter calibration.
	Check that the transmitter has not locked on an interfering object.
	Check that the mechanical installation is correct.
Serial communication failure	Check the COM port setting in the Radar Master program (See page 91).
	Check the serial communication address.
	Check the cable connections and that the correct cables are used.
Display Panel window is blank	Check the power supply.
Poor Display Panel contrast	Press the two right-hand buttons to increase the LCD contrast.

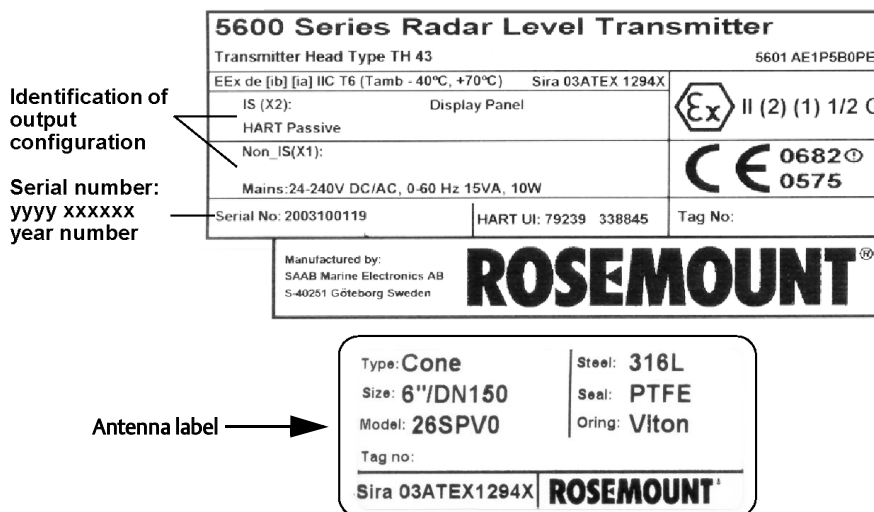
6.3.2 Field upgrades

Labeling



Each radar transmitter is labeled individually, so it is imperative that the approval codes on each label match exactly during upgrade. The label on the radar transmitter reflects the replacement model code for reordering an assembled unit. The housing labeling will only reflect the approvals and communication protocol of the housing.

Figure 6-1. Example of the Rosemount 5600 Transmitter Head Label and Antenna Label



6.3.3 Connection via Sensor Bus Port

In addition to the standard communication ports, where HART is the main protocol used, there is an additional port available (Sensor Bus Port).

This port is mainly used for upgrading Firmware. To utilize this port you need a RS485 modem hooked up on terminals 6 and 7 on the Intrinsically Safe side of the transmitter. The software used is the standard Rosemount Radar Master. For more information about this Sensor Bus port, please see the online help in the Radar Master software or contact your local Rosemount representative.

Note

For Windows 2000 and Windows XP you need to set the Serial Port buffer as instructed below.

1. Right click on My Computer and choose Properties.
2. Choose the tab Hardware.
3. Click on the button Device Manager.
4. Navigate to Ports in the list of hardware.
5. Right click on Serial Port COM 1 and choose Properties.
6. Choose the tab Port Settings.
7. Click Advanced.
8. Drag the slider for Receive Buffer and Transmit Buffer to 1.
9. Click OK.
10. Reboot the Computer.
11. Repeat for COM 2 or other communication port if available.

Appendix A Reference Data

Specifications	page 93
Dimensional drawings	page 97
Ordering information	page 102

A.1 Specifications

A.1.1 General

Product designation

Rosemount 5600 Series Radar Level Transmitter

Operating principle

10GHz FMCW radar

Beam angle

See [Figure 2-4](#) and [Table 2-3 on page 22](#)

Microwave output power

Max 1.0 mW

Internal calibration

Internal digital reference for automatic compensation of radar sweep

Signal processing

Powerful and advanced digital signal processing using FFT and advanced echo handling software

A.1.2 Measuring performance

Instrument accuracy (under reference conditions)

±0.2 in (±5 mm)

Resolution

0.04 in (1 mm)

Temperature stability

± 500 ppm of measured distance within the ambient temperature range\

Repeatability

±0.04 in (±1 mm)

Measuring range

0-164 ft (0-50 m)

Update time

100 ms

Processors

32-bit Floating DSP

A.1.3 Configuration

PC/remote configuration

Rosemount Radar Master, Powerful and Interactive Windows based configuration tool.

Recommended PC hardware specification:

≥ 1 GHz processor, ≥ 128 Mb Ram, Operating system of Win 2000, Win XP, or Win NT.

To communicate with the device using Radar Master either a HART or Modbus Modem (RS485 Sensor Bus Port) is required for the PC (see listed Modems on [page 107](#)).

See “[PC Configuration Software Radar Master](#)” on [page 80](#) for additional information.

HART device

375 Field Communicator

AMS software

See “[Handheld communicator](#)” on [page 85](#) for additional information.

A.1.4 Electric

Power supply

Ultra wide power supply 24-240 V AC or DC 0-60 Hz

Note

Minimum power required at the transmitter power terminals is 20 V.

Power consumption

Maximum 10 W, Nominal 5 W

Outputs

Primary output

HART + 4-20 mA current loop
(non-IS or IS option)

Secondary outputs

Analog 4-20 mA current loop, active or passive
(non-IS or IS option)

Output cabling

Twisted and shielded pair; min. 0.5 mm² (AWG 20)

Cable entries

3 3/4 inch NPT; for cable glands or conduit entries

Optional: 1/2 inch NPT Cable Gland Kit

Optional: 1/2 inch NPT/ M20 Adapters (Set of 3)

A.1.5 Analog output characteristics

Type

Analog 4-20 mA Current Loop, active (with power supplied by the Rosemount 5600) or passive (for external loop-supplied power)

Galvanic isolation

> 1500 V RMS or DC

Analog output electrical characteristics

See “Product Certifications” on page 109

Range

4-20 mA

Alarm level

Standard: Low=3.8 mA, High=22 mA or freeze,
NAMUR NE43: High=22.50 mA,
Rosemount: Low=3.75 mA

Accuracy

± 300 µA at 4 mA
± 600 µA at 20 mA

Resolution

0.5 µA (0.003%)

Linearity

±0.01%

Temperature drift

± 28 ppm/°F (±50 ppm/°C)

Output impedance

>10 MΩ

Voltage compliance

7-30 V (passive output)

External loop resistance

<700 Ω (passive output with 24 V external supply)

<300 Ω (active output)

A.1.6 Mechanical

Housing/enclosure

Permanent moulded cast aluminum, chromed, and powder painted

Flanges

ANSI, DIN standard,

Material: Stainless steel 316L and Stainless Steel EN 1.4404

Optional: Hot-galvanized carbon steel

Weight, excluding, flange

18 lbs (8 kg)

Height above flange

15 in (400 mm)

Antenna dimensions

Cone: See [Figure A-2 on page 97](#)

Process seal: See [Figure A-3 and Table A-3 on page 98](#)

Extended cone: See [Figure A-4 on page 99](#)

Cone with integrated flushing connection:

See [Figure A-5 on page 100](#)

Parabolic: See [Figure A-6 on page 101](#)

Table A-1. Antenna Material and O-ring Selection • Applicable - Not Applicable

	Cone antenna	Process seal antenna	Extended cone antenna	Cone with integrated flushing connection	Parabolic antenna
Material:					
Stainless steel 316L	•	-	•	•	•
Hastelloy® C22	•	-	-	-	-
Titanium Gr1/Gr2	•	-	-	-	-
Tantalum	•	-	-	-	-
Monel® 400	•	-	-	-	-
PTFE	-	•	-	-	-
Tank Seal:					
PTFE	•	-	•	•	•
Quartz	•	-	•	•	-
O-Rings:					
Viton	•	-	•	•	•
Kalrez	•	-	•	•	-
EPDM	•	-	•	•	-
Buna-N	•	-	•	•	-

A.1.7 Environment

Ambient temperature

-40 to 158°F (-40 to 70°C)

LCD Readable between: -4 to 158°F (-20 to 70°C)

Process temperature range ⁽¹⁾

-40 up to 752°F (-40 up to 400°C), depending on antenna style

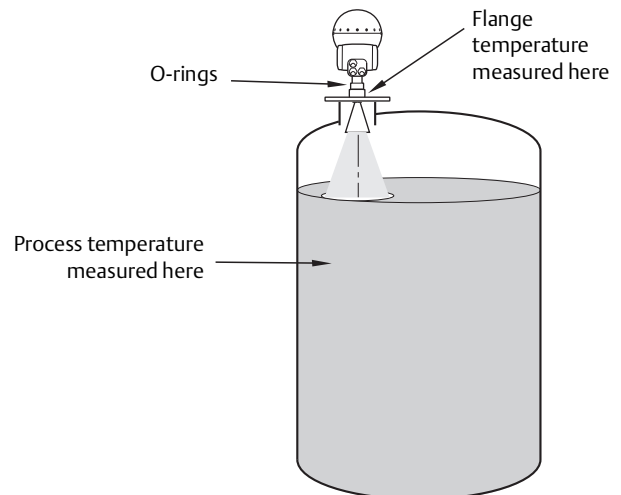
Flange temperature range ⁽¹⁾

Table A-2. Flange Temperature Range Depending on O-ring Selection

O-ring material	Minimum temperature °F (°C) in air	Maximum temperature °F (°C) in air
Viton	5 (-15)	392 (200)
Ethylene Propylene (EPDM)	-40 (-40)	266 (130)
Kalrez 6375	-4 (-20)	527 (275)
Buna-N	-31 (-35)	230 (110)

1. See Figure A-2, Figure A-3, Figure A-4, Figure A-5, and Figure A-6 for specification of each antenna.

Figure A-1. Temperature Rating Considerations



Note

Flange temperature depends on mounting conditions, such as nozzle position, distance to max product level, nozzle height, presence of insulation, etc.

Pressure range⁽¹⁾

Full vacuum up to +798 psig (+55 bar), depending on antenna style

Emission approvals

FCC: K8CPRO, K8CPROX
R&TTE: E8132680-CC

Humidity

IEC 60068-2-3

Climatic class/corrosion class

IEC 68-2-1, IEC 60068-2-52 test KB severity 2

Ingress protection

IP66, IP 67 and NEMA 4

Vibration

IEC 721-3-4 class 4M4

UV protection

ISO 4892-2

Electromagnetic compatibility

EN61326-1: 1997 incl A1:1998 and A2:2001, Immunity 50081-2,
Emission 50081-1

Lightning protection

EN61326, EN61000-4-5, IEC801-5, level 2 kV

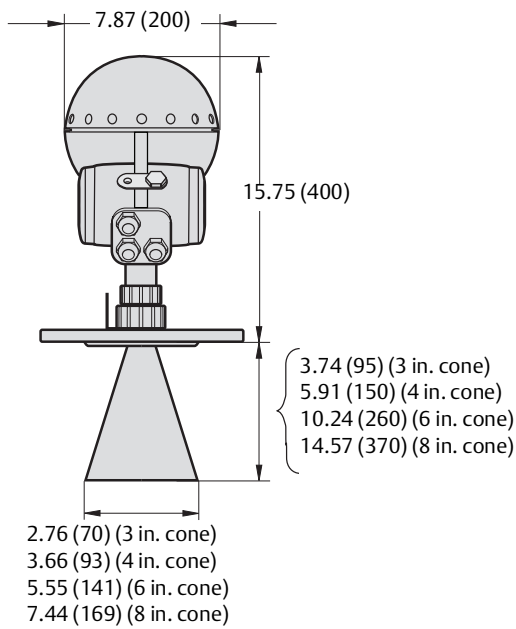
Power supply fluctuation

IEC 92 Part 504 sec. 3.5

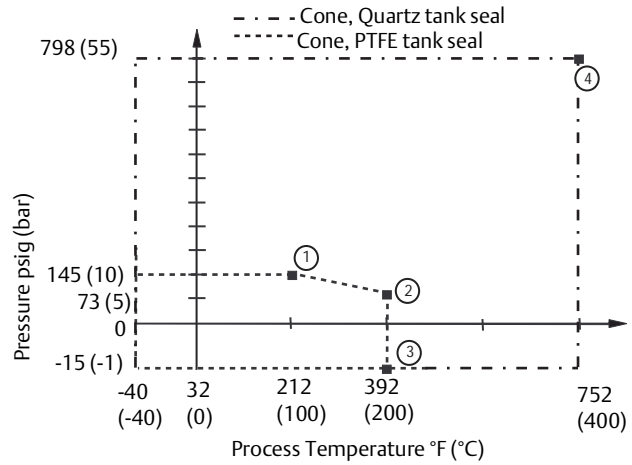
1. See Figure A-2, Figure A-3, Figure A-4, Figure A-5, and Figure A-6 for specification of each antenna.

A.2 Dimensional drawings

Figure A-2. Cone Dimensions



- ① 145 psig at 212°F / 10 bar at 100°C
- ② 73 psig at 392°F / 5 bar at 200°C
- ③ -15 psig at 392°F / -1.0 bar at 200°C
- ④ 798 psig at 752°F / 55 bar at 400°C

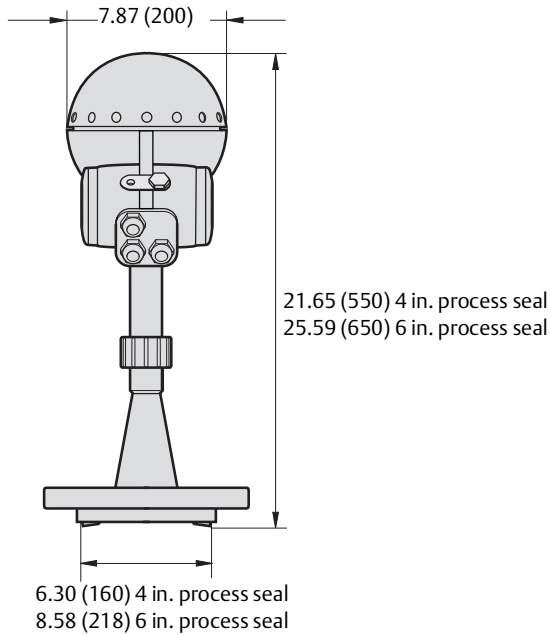


Dimensions are in inches (millimeters).

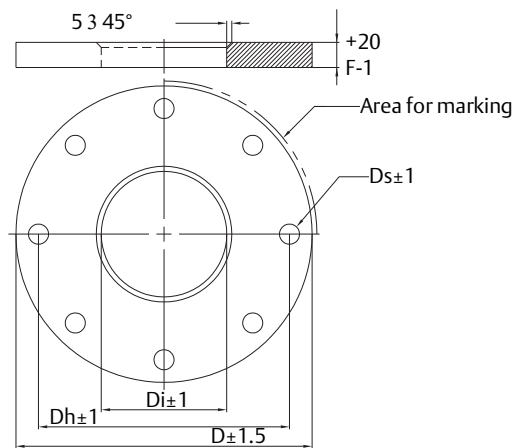
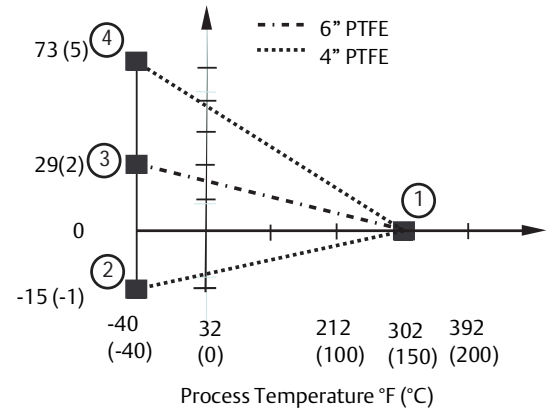
Note

Pressure rating may be lower depending on flange selection. Minimum/maximum flange temperature rating depends on O-ring selection (See Table A-2 and Figure A-1 on page 95).

Figure A-3. Process Seal Dimensions



- ① 0 psig at 302°F / 0 bar at 150°C
- ② -15 psig at -40°F / -1.0 bar at -40°C
- ③ 29 psig at -40°F / 2 bar at -40°C
- ④ 73 psig at -40°F / 5 bar at -40°C

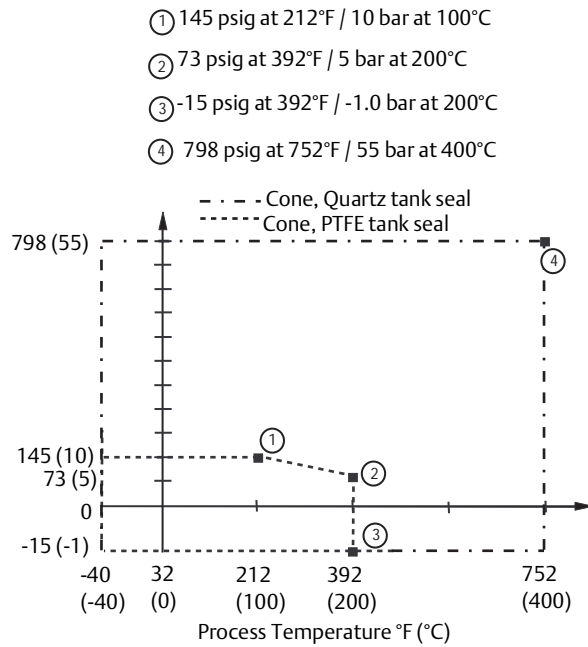
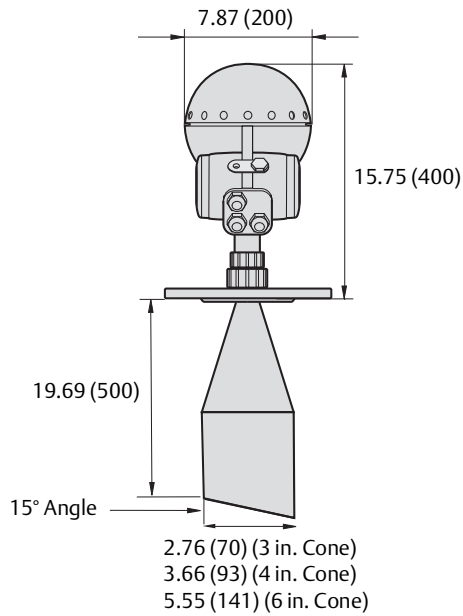


Dimensions are in inches (millimeters).

Table A-3. Dimensions for Stainless Steel Flange and Galvanized Carbon Steel
Dimensions are in inches (millimeters)

Flange	Di	D	Dh	Ds	F
ANSI 4 inch Class 150	3.78 (96)	9.02 (229)	7.52 (191)	0.87 (22)	0.87 (22)
ANSI 6 inch Class 150	4.94 (125.5)	10.98 (279)	9.49 (241)	0.87 (22)	0.87 (22)
DN100 PN16	3.78 (96)	8.66 (220)	7.09 (180)	0.71 (18)	0.87 (22)
DN150 PN16	4.94 (125.5)	11.22 (285)	9.45 (240)	0.87 (22)	0.87 (22)

Figure A-4. Extended Cone Dimensions for Stainless Steel Flange



Dimensions are in inches (millimeters).

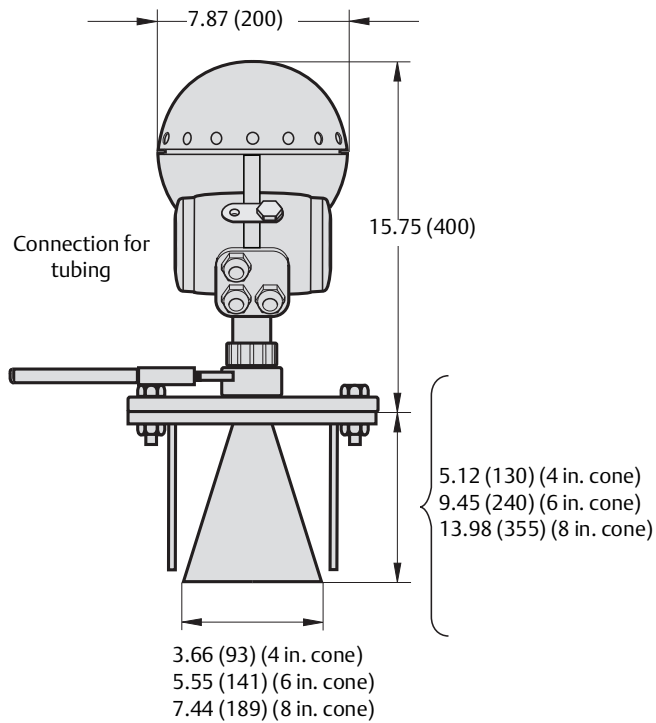
Note

Pressure rating may be lower depending on flange selection. Minimum/maximum flange temperature rating depends on O-ring selection (See Table A-2 and Figure A-1 on page 95).

Note

Other extended cone lengths available upon request. Consult factory.

Figure A-5. Cone with Integrated Flushing Connection Dimensions for Stainless Steel Flange



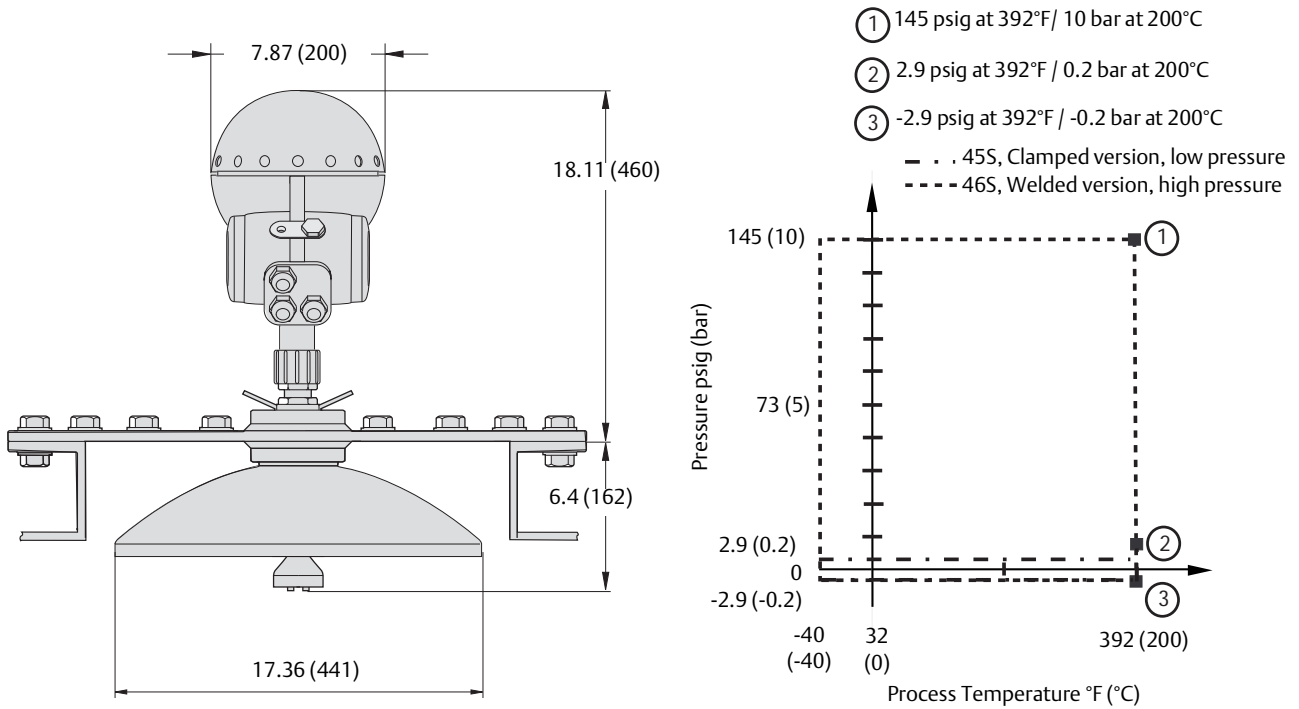
Maximum: 145 psig at 392°F (10bar at 200°C).
See Table A-9 on page 106 for additional information.

Dimensions are in inches (millimeters).

Note

Pressure rating may be lower depending on flange selection. Minimum/maximum flange temperature rating depends on O-ring selection (See Table A-2 and Figure A-1 on page 95).

Figure A-6. Parabolic Dimensions for Stainless Steel Flange



A.3 Ordering information

Table A-4. Rosemount 5600 Radar Transmitter Ordering Information

Model	Product description
5601	Radar Level Transmitter for Process Applications
Code	Frequency band
U	US Market Only (10 GHz)
S	Switzerland Market Only (10 GHz)
A	All Other Markets (10 GHz)
Code	Product certification
NA	None
E1	ATEX Flameproof
E5	FM Explosionproof
E6	CSA Explosionproof
Code	Power supply
P	24-240 V DC/AC 0-60 Hz
Code	Primary output
5A	4-20 mA with HART communication, Passive Output
5B ⁽¹⁾	4-20 mA with HART communication, Passive Output, Intrinsically Safe Circuit
5C	4-20 mA with HART communication, Active Output
5D ⁽¹⁾	4-20 mA with HART communication, Active Output, Intrinsically Safe Circuit
Code	Secondary output
0	None
1	4-20 mA, Passive Output
2 ⁽¹⁾	4-20 mA, Passive Output, Intrinsically Safe Circuit
3	4-20 mA, Active Output
4 ⁽¹⁾	4-20 mA, Active Output, Intrinsically Safe Circuit
Code	Display unit
N	None
Code	Volume calculation
E	Basic Volume Equations (Standard)
V	Strapping Table, up to 100 points
Typical model number: 5601 S E1 P 5A 0 N E Antenna Selection⁽²⁾	

1. Intrinsically safe circuit only applicable if product certificate codes E1, E5, or E6 is selected.
2. Select the antenna type and options using [Table A-5](#), [Table A-6](#), [Table A-7](#), [Table A-8](#), and [Table A-9](#).

Table A-5. Cone Antenna Ordering Information

Code	Antenna size	Antenna material	Note
23S	3 in. (DN80) nozzles	SST 316L	Pipe installation only
24S	4 in. (DN100) nozzles	SST 316L	Free propagation or 4-in. pipe
26S	6 in. (DN150) nozzles	SST 316L	Free propagation or 6-in. pipe
28S	8 in. (DN200) nozzles	SST 316L	Free propagation only
23H	3 in. (DN80) nozzles	Hastelloy C22	Longer lead-time, consult factory
24H	4 in. (DN100) nozzles	Hastelloy C22	Longer lead-time, consult factory
26H	6 in. (DN150) nozzles	Hastelloy C22	Longer lead-time, consult factory
28H	8 in. (DN200) nozzles	Hastelloy C22	Longer lead-time, consult factory
23T	3 in. (DN80) nozzles	Titanium Gr 1/2	Longer lead-time, consult factory
24T	4 in. (DN100) nozzles	Titanium Gr 1/2	Longer lead-time, consult factory
26T	6 in. (DN150) nozzles	Titanium Gr 1/2	Longer lead-time, consult factory
28T	8 in. (DN200) nozzles	Titanium Gr 1/2	Longer lead-time, consult factory
23M	3 in. (DN80) nozzles	Monel 400	Longer lead-time, consult factory
24M	4 in. (DN100) nozzles	Monel 400	Longer lead-time, consult factory
26M	6 in. (DN150) nozzles	Monel 400	Longer lead-time, consult factory
28M	8 in. (DN200) nozzles	Monel 400	Longer lead-time, consult factory
23Z	3 in. (DN80) nozzles	Tantalum	Longer lead-time, consult factory
24Z	4 in. (DN100) nozzles	Tantalum	Longer lead-time, consult factory
26Z	6 in. (DN150) nozzles	Tantalum	Longer lead-time, consult factory
28Z	8 in. (DN200) nozzles	Tantalum	Longer lead-time, consult factory
2XX	Customer specific cone or material		Consult factory
Code	Tank seal		
P	PTFE		
Q	Quartz		
Code	O-ring material		
V	Viton		
K	Kalrez 6375		
E	EPDM		
B	Buna-N		
Code	Process connection	Note	
NR	Antenna with Plate Design	NOTE: Customer supplied flange or see Table A-13 on page 108 for flange options	
XX	Special process connection	Consult factory	

Table A-5. Cone Antenna Ordering Information

Code	Options
Q8	Material Traceability Certification per EN 10204 3.1.B
Typical model number: Selected code from Table A-4 on page 102 24S NV NR	

Table A-6. Process Seal Antenna Ordering Information

Code	Antenna size	Antenna material	Note
34S	4 in. (DN100) nozzles	PTFE	
36S	6 in. (DN150) nozzles	PTFE	
Code	Tank seal		
P	PTFE		
Code	O-ring material		
N	Not Applicable		
Code	Process connection	Note	
NF	None, Customer to supply flange per dimensions on Figure A-3		
XX	Special process connection	Consult factory	
Code	Stainless steel flange		
CA	4 in. ANSI Class 150		
DA	6 in. ANSI Class 150		
JA	DN100 PN16		
KA	DN150 PN16		
Code	Options		
Q8	Material Traceability Certification per EN 10204 3.1.B		
Typical model number: Selected code from Table A-4 on page 102 34S P N JA			

Table A-7. Parabolic Antenna Ordering Information

Code	Antenna size	Antenna material	Note
45S	ø18 in. (440mm)	316 SST with Integrated Inclination	Clamped version (low pressure)
46S	ø18 in. (440mm)	316 SST with Integrated Inclination	Welded version (high pressure)
4XX	Customer specific	Customer specific	Consult factory
Code	Tank seal		
P	PTFE		

Table A-7. Parabolic Antenna Ordering Information

Code	O-ring material	
V	Viton	
Code	Process connections	Note
NF	None, flange ready	
XX	Special process connection	Consult factory
Code	Options	
Q8	Material Traceability Certification per EN 10204 3.1.B	
Protective cover		
PB	PTFE protective cover (PTFE Bag)	
Typical model number: Selected code from Table A-4 on page 102 45S P V NR		

Table A-8. Extended Cone Antenna Ordering Information

Code	Antenna size	Antenna material	Note
73S	3 in. (DN80) nozzles	SST 316L	Standard length 20 inch (500 mm)
74S	4 in. (DN100) nozzles	SST 316L	Standard length 20 inch (500 mm)
76S	6 in. (DN150) nozzles	SST 316L	Standard length 20 inch (500 mm)
7XX	Customer specific extended cone or material		Consult factory
Code	Tank seal		
P	PTFE		
Q	Quartz		
Code	O-ring material		
V	Viton		
K	Kalrez 6375		
E	EPDM		
B	Buna-N		
Code	Process connections	Note	
NR	Antenna with Plate Design	<i>NOTE: Customer supplied flange or see Table A-13 on page 108 for flange options</i>	
XX	Special process connection	Consult factory	
Code	Options		
Q8	Material Traceability Certification per EN 10204 3.1.B		
Typical model number: Selected code from Table A-4 on page 102 76S P V NR			

Table A-9. Cone Antenna with Integrated Flushing Connection Ordering Information

Code	Antenna size	Antenna material	Note
94S	4 in. (DN100) nozzles	SST 316L	Consult factory
96S	6 in. (DN150) nozzles	SST 316L	Consult factory
98S	8 in. (DN200) nozzles	SST 316L	Consult factory
Code	Tank seal		
P	PTFE		
Q	Quartz		
Code	O-ring material		
V	Viton		
K	Kalrez 6375		
E	EPDM		
B	Buna-N		
Code	Process connection	Note	
XX	Special process connection	Consult factory	
Code	Stainless steel flange welded to antenna	Note	
CL	4 in. ANSI Class 150	Max 101 psig at 392°F (7 bar at 200°C)	
DL	6 in. ANSI Class 150	Max 145 psig at 392°F (10 bar at 200°C)	
FL	8 in. ANSI Class 150	Max 145 psig at 392°F (10 bar at 200°C)	
JL	DN100 PN16	Max 72 psig at 392°F (5 bar at 200°C)	
KL	DN150 PN16	Max 87 psig at 392°F (6 bar at 200°C)	
LL	DN200 PN16	Max 87 psig at 392°F (6 bar at 200°C)	
Code	Options		
Q8	Material Traceability Certification per EN 10204 3.1.B		
Typical model number: Selected code from Table A-4 on page 102 94S P K KL			

Table A-10. Transmitter Options (multiple selections allowed)

Code	Options
	Material Traceability Certification
Q8	Material Traceability Certification per EN 10204 3.1B
	Calibration Data Certification
Q4	Calibration Data Certificate
	Software Configuration
C1	Custom Software Configuration (CDS required with order)

Table A-10. Transmitter Options (multiple selections allowed)

Alarm Limits	
C4	NAMUR Alarm Level, High Alarm
C8	Low Alarm (Standard Rosemount Alarm)
Conduit Adapters	
G	1/2 inch NPT Cable Gland Kit
G2	1/2 inch NPT/ M20 Adapters (Set of 3)
Conduit Electrical Connector	
GE	M12, 4-pin, Male Connector (eurofast)
GM	A size Mini, 4-pin, Male Connector (minifast)
Special Procedures	
P1	Hydrostatic Testing
Protective Cover	
PB ⁽¹⁾	Protective Cover (PTFE Bag)

1. Parabolic antenna only.

Table A-11. Typical Model Code Examples

5601 A E1 P 5A 0 N E 24S P V NR
ATEX approval, passive HART primary output and no display unit. Basic Volume calculation. Antenna is a 4 inch Cone, SST with PTFE Seal and Viton O-rings. No options.
5601 U E5 P 7A 2 N V 94S P K CL C1
FM approval, no display unit, and a secondary 4-20mA passive IS output. Volume table with up to 100 points. 4 inch cone antenna with integrated cleaning, PTFE seal and kalrez O-rings for high temperature and pressure. Flange is ANSI 4 inch Class 150 stainless steel. Custom configuration selected.

A.3.1 Accessories

Table A-12. Accessories Part Numbers

Part number	Description	Note
Modems		
03300-7004-0001	HART Modem and cables	Viator by MACTek
03300-7004-0002	HART USB Modem and cables	Viator by MACTek
05600-5004-0001	K2 RS485 Modbus Modem	For Sensor Bus Port connection
Antenna accessories		
05600-5001-0001	PTFE Protective Cover (PTFE Bag)	For Parabolic Antenna only

Cone antenna flanges

Table A-13. Non-Welded Flange Part Numbers

Stainless steel flanges			
Part number	Flange size	Dimensions	Material
05600-1811-0211	ANSI 2 inch Class 150	According to ANSI B16.5	SST 316L ⁽¹⁾
05600-1811-0231	ANSI 2 inch Class 300	According to ANSI B16.5	SST 316L ⁽¹⁾
05600-1811-0311	ANSI 3 inch Class 150	According to ANSI B16.5	SST 316L
05600-1811-0331	ANSI 3 inch Class 300	According to ANSI B16.5	SST 316L
05600-1811-0411	ANSI 4 inch Class 150	According to ANSI B16.5	SST 316L
05600-1811-0431	ANSI 4 inch Class 300	According to ANSI B16.5	SST 316L
05600-1811-0611	ANSI 6 inch Class 150	According to ANSI B16.5	SST 316L
05600-1811-0811	ANSI 8 inch Class 150	According to ANSI B16.5	SST 316L
05600-1810-0231	DN50 PN40	According to EN 1092-1	EN 1.4404 ⁽²⁾
05600-1810-0311	DN80 PN16	According to EN 1092-1	EN 1.4404 ⁽²⁾
05600-1810-0331	DN80 PN40	According to EN 1092-1	EN 1.4404 ⁽²⁾
05600-1810-0411	DN100 PN16	According to EN 1092-1	EN 1.4404 ⁽²⁾
05600-1810-0431	DN100 PN40	According to EN 1092-1	EN 1.4404 ⁽²⁾
05600-1810-0611	DN150 PN16	According to EN 1092-1	EN 1.4404 ⁽²⁾
05600-1810-0811	DN200 PN16	According to EN 1092-1	EN 1.4404 ⁽²⁾

1. Use gasket type la.
2. Gasket type according to EN 1514-1 and bolting according to EN1515-2.

Appendix B Product Certifications

European Directive Information	page 109
Ordinary Location Certification	page 109
Telecommunication compliance	page 109
Installing equipment in North America	page 109
USA	page 110
Canada	page 110
Europe	page 111
International	page 112
Brazil	page 113
China	page 114
EAC	page 114
Republic of Korea	page 114
India	page 114
Ukraine	page 115
Additional certifications	page 115
Pattern approval	page 115
ATEX approval drawings	page 116
FM approval drawings	page 118
CSA approval drawings	page 120

Rev. 1.18

B.1 European Directive Information

A copy of the EU Declaration of Conformity can be found at the end of the Quick Start Guide. The most recent revision of the EC Declaration of Conformity can be found at Emerson.com/Rosemount.

B.2 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).

B.3 Telecommunication compliance

B.3.1 FCC

This device complies with Part 15C and Part 90 of the FCC Rules.

Certificate: K8CPRO complies with Part 15C

K8CPROX complies with Part 90

B.3.2 IC

This device complies with RSS210 issue 6.

Certificate: 2827A-5600PRO

B.3.3 Radio Equipment Directive (RED) 2014/53/EU

This device complies with ETSI EN 302 372.

B.4 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.

B.5 USA

E5 Explosion-proof (XP), Dust-Ignitionproof (DIP)

5600 Series Transmitter

Certificate: FM 18US0053X

Standards: Class 3600 – 2011; Class 3610 – 2010;
Class 3615 – 2006; Class 3810 – 2005;
ANSI/NEMA 250 – 1991

Markings: Explosion-proof for use in Class I, Division 1, Groups A, B, C and D, T6; Dust-Ignition-proof for use in Class II, III, Division 1, Groups E, F and G, T5; Ta= +70 °C; Type 4X

Explosion-proof for use in Class I, Division 1, Groups A, B, C and D with Intrinsically Safe Connections to Class I, Division 1, Groups A, B, C and D, T6; Dust-Ignition-proof for use in Class II, III, Division 1, Groups E, F and G, T5, Ta=+70 °C; Type 4X; in accordance with Entity requirements and system control drawing 9150074-994

Specific Conditions for Safe Use (X):

1. Warning – Potential Electrostatic Charging Hazard – The enclosure is constructed from non-metallic material. To prevent the risk of electrostatic sparking the plastic surface should only be cleaned with a damp cloth.
2. Warning – The apparatus enclosure contains aluminum and is considered to constitute a potential risk of ignition by impact or friction. Care must be taken into account during installation and use to prevent impact or friction.

2210 Display Unit

Certificate: FM16US0222X

Standards: Class 3600 – 2018; Class 3610 – 2018;
Class 3810 – 2018 ; ANSI/ISA 60079-0:2009 ;
ANSI/ISA 60079-11:2011 ;
ANSI/ISA 61010-1:2012 ; NEMA 250:2008 ;
ANSI/IEC 60529:2004

Markings: IS / I / 1 / ABCD / T4 Ta = 70°C – 9150074-997;
Entity; Type 4X; IP66, IP67

Specific Conditions for Safe Use (X):

1. WARNING – Potential Electrostatic Charging Hazard – The enclosure is constructed from plastic. To prevent the risk of electrostatic sparking the plastic surface should only be cleaned with a damp cloth.
2. WARNING – The apparatus enclosure contains aluminum and is considered to constitute a potential risk of ignition by impact or friction. Care must be taken into account during installation and use to prevent impact or friction.
3. To maintain ingress protection ratings IP66, IP67, the Type 4X rating and Class II, III ratings, thread sealant is required for cable entries and blanking plugs.

	V _{max}	I _{max}	P _{max}	C _i	L _i
Input Entity Parameters Connector X12	12 V	400 mA	0.7 W	22 nF*	0 mH

* Ci = 22 nF with an associated apparatus V_{oc} of 6.5 V or greater
Ci = 15.7 μF with an associated apparatus V_{oc} of less than 6.5 V

	V _{oc}	I _{sc}	P _o	C _a	L _a	L _o /R _o
Output Entity Parameters Connector X17, X18	5.88 V	172.4 mA	0.253 W	43 μF	0.7 mH	140 μH/Ω

B.6 Canada

E6 Explosion-proof (XP)

5600 Series Transmitter

Certificate: 1346169

Standards: CSA C22.2 No 0-10 2010(R2015),
CAN/CSA C22.2 No 60079-0:2015,
CAN/CSA C22.2 No 60079-1:2016,
CAN/CSA C22.2 No 60079-7:2016 and
CAN/CSA C22.2 No 60079-11:2014,
CSA C22.2 No.142-M1987

Markings: Ex db eb IIC T6 Gb

TankRadar Pro Transmitter Head and 5600 Series Radar Level Transmitter, Type TH43, rated 24-240 Vac, 10W up to two inputs 7 - 30V, 4 - 20mA; up to two outputs 4 - 20mA, 300 Ohm max. or Digital outputs TRL2bus, Profibus DP; ambient temperature range [- 40C, + 70C]; for installation refer to drawing # 9150074-937

Ex db eb [ib/ia] IIC T6 Gb

TankRadar Pro Transmitter Head and 5600 Series Radar Level Transmitter, Type TH43, rated 24 - 240Vac, 10W; Intrinsically Safe Display Output(ia) with entity parameters U_o=7.84V, I_o=385.6mA, P_o=0.678W, L_o=0.17mH, C_o=8.8μF; up to two Intrinsically Safe Inputs(ib) with entity parameters U_i=30V, I_i=200mA, P_i=1.3W, L_i=0mH, C_i=0μF; up to two Intrinsically Safe outputs(ib) with entity parameters U_o=23.1V, I_o=125.7mA, P_o=0.726W, L_o=2.2mH, C_o=0.14. Or Digital outputs TRL2bus, Profibus DP; ambient temperature range [-40°C to +70°C]; for installation refer to drawing #9150074-939.

	U _o	I _o	P _o	C _o	L _o
Intrinsically Safe Display Output Entity parameters	7.84 V	385.6 mA	0.678 W	8.8 μF	0.17 mH
Up to two Intrinsically Safe Outputs Entity parameters	23.1 V	125.7 mA	0.726 W	0.14 μF	2.2 mH

	U _i	I _i	P _i	C _i	L _i
Up to two Intrinsically Safe Inputs Entity parameters	30 V	200 mA	1.3 W	0 μF	0 mH

Special conditions of safe use

Caution statement (on the cover of the “Ex d” compartment): “To prevent ignition of Hazardous Atmospheres, do not open when energized or when explosive gas is present”.

Caution statement (on the cover of each “Ex e” compartment): “To prevent ignition of Hazardous Atmospheres, do not open when energized”.

WARNING: SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY.

AVERTISSEMENT: LA SUBSTITUTION DE COMPOSANTS PUT COMPROMETTRE, LA SECURITE INTRINSIQUE.

2210 Display Unit

Certificate: 1346165

Standards: CSA C22.2 No.0-10 (reaffirmed 2015), CAN/CSA C22.2 60079-0:15, CAN/CSA 60079-11:14, CSA C22.2 No.142-M1987

Markings: Ex ib IIC T4 or Ex ib [ia] IIC T4, Ambient temperature range [-40°C, +70°C] For installation refer to drawing # 9150074-944.

WARNING: Substitution of components may impair intrinsic safety

WARNING: POTENTIAL ELECTROSTATIC CHARGING HAZARD.

	U _o	I _o	P _o	C _o	L _o
Intrinsically Safe Output Entity parameters	5.88 V	172.4 mA	0.253 W	43 μF	0.7 mH

	U _i	I _i	P _i	C _i	L _i
Intrinsically Safe Input Entity parameters	12 V	400 mA	0.72 W	22 nF*	0 mH

* Note: The associated apparatus shall be CSA certified with a maximum voltage rating U_o greater than 6.5 V or otherwise C_i shall be considered 15.7 μF.


B.7 Europe

E1 ATEX Flameproof

5600 Series Transmitter

Certificate: Sira 03ATEX1294X

Standards: EN 60079-0:2012/A11:2013, EN 60079-1:2014, EN 60079-7:2015, EN 60079-11:2012, EN 60079-26:2015 & EN 60079-31:2014

Markings:  Non-IS Outputs (Primary, Secondary) II ½ GD Ex db eb IIC T6 Ga/Gb (-40 °C to +70 °C) Ex tb IIIC T 85 °C Db IP65

IS Outputs (Primary, Secondary and Display) alt. with Non-IS Primary

Outputs

II (2) (1) ½ GD

Ex db eb [ib] [ia] IIC T6 Ga/Gb (-40 °C to +70 °C)

Ex tb IIIC T85 °C Db IP65

IS Outputs (Display) alt. with Non-IS Primary

Outputs

II (1) 1/2 GD

Ex db ib [ia] IIC T6 Ga/Gb (-40 °C to +70 °C)

Ex tb IIIC T85 °C Db IP65

Specific Conditions for Safe Use (X):


- As light alloys may be used as the enclosure (or other parts) they may be at the accessible surface of this equipment, in the event of rare incidents, ignitions sources due to impact and friction sparks could occur. This shall be considered when the equipment is being installed in locations that specifically require Group II, Category 1 G equipment.
- Under certain extreme circumstances, the non-metallic parts of the equipment may be capable of generating an ignition-capable level or electrostatic charge. Therefore, when used for applications that specifically require Group II, Category 1 equipment, the equipment shall not be installed in a location where the external conditions are conducive to the build-up of electrostatic charge on such surfaces. Additionally, the equipment non-metallic parts shall only be cleaned with a damp cloth.
- This equipment has flamepaths which differ from those in EN 60079-1 and are not intended for repair

	U _o	I _o	P _o	C _o	L _o
Output Entity parameters	7.84 V	385.6 mA	0.678 W	9.3 μF	239 μH

2210 Display Unit


Certificate: Sira 00ATEX2062X

Standards: EN 60079-0:2012/A11:2013 , EN 60079:11:2012

Markings:  II 2 G

Ex ib IIC T4 Gb
(Ta -40 °C to +70 °C)

Or

 II 2(1)G

Ex ib [ia Ga] IIC T4 Gb
(Ta -40 °C to +70 °C)

WARNING-POTENTIAL ELECTROSTATIC CHARGING
HAZARD-SEE INSTRUCTIONS

Specific Conditions for Safe Use (X):

1. At Connector X12, Ci is considered to be 22 nF with an associated apparatus U_o of 6.5 V or 15.7 μF with an associated apparatus U_o of less than 6.5 V.
2. Under certain extreme circumstances, exposed plastic and unearthened metal parts of the enclosure may store an ignition-capable level of electrostatic charge. Therefore, the user/installer shall implement precautions to prevent the build-up of electrostatic charge, e.g. locate the equipment where a charge-generating mechanism is unlikely to be present and clean with a damp cloth.

	U _i	I _i	P _i	C _i	L _i
Input Entity parameters, Connector X12	12 V	400 mA	0.7 W	22 nF*	0 μH

* Ci = 22 nF with an associated apparatus U_o of 6.5 V or greater
Ci = 15.7 μF with an associated apparatus U_o of less than 6.5 V

When the TP40 Temperature panel is fitted, the combined output parameters are:

	U _o	I _o	P _o	C _i	L _i
Output Entity parameters, Connectors X17, X18	5.88 V	172.4 mA	0.253 W	0 F	0 H

The capacitance and either the inductance or the inductance to resistance (L/R) ratio of the cable connected to the connectors X17 and X18 must not exceed the following values:

Group	Capacitance in mF	Inductance in mH	or L/R Ratio in mH/Ω
IIC	43	0.7	140
IIB	1000	5.2	560
IIA	1000	10.0	1120

B.8 International

E7 IECEx Flameproof

5600 Series Transmitter

Certificate: IECEx SIR 05.0024X

Standards: IEC 60079-0:2011, IEC 60079-1:2014, IEC 60079-7:2015, IEC 60079-11:2011, IEC 60079-26:2014 & IEC 60079-31:2013,

Markings: Non-IS Outputs (Primary, Secondary)

Ex db eb IIC T6 Ga/Gb (-40 °C to +70 °C)

Ex tb IIIC T85 °C Db IP65

IS Outputs (Primary, Secondary and Display) alt. with Non-IS Primary

Outputs

Ex db eb [ib] [ia] IIC T6 Ga/Gb (-40 °C to +70 °C)

Ex tb IIIC T85 °C Db IP65

IS Outputs (Display) alt. with Non-IS Primary

Outputs

Ex db eb [ia] IIC T6 Ga/Gb (-40 °C to +70 °C)

Ex tb IIIC T85 °C Db IP65

Specific Conditions for Safe Use (X):

1. As light alloys may be used as the enclosure (or other parts) they may be at the accessible surface of this equipment, in the event of rare incidents, ignitions sources due to impact and friction sparks could occur. This shall be considered when the equipment is being installed in locations that specifically require Group II, Category 1G equipment.
2. Under certain extreme circumstances, the non-metallic parts of the equipment may be capable of generating an ignition-capable level or electrostatic charge. Therefore, when used for applications that specifically require Group II, Category 1 equipment, the equipment shall not be installed in a location where the external conditions are conducive to the build-up of electrostatic charge on such surfaces. Additionally, the equipment non-metallic parts shall only be cleaned with a damp cloth.
3. This equipment has flamepaths which differ from those in IEC 60079-1 and are not intended for repair

	U _i	I _i	P _i	C _i	L _i
Passive Analog Circuit Entity parameters	30 V	200 mA	0 W	0 μF	0 μH

	U _o	I _o	P _o	C _o	L _o
Active Analog Circuit Entity parameters	23.1 V	125.7 mA	0.726 W	0.14 μF	2.2 mH

	U _o	I _o	P _o	C _o	L _o
Output Entity parameters	7.84 V	385.6 mA	0.678 W	9.3 μF	239 μH

2210 Display Unit

Certificate: IECEx SIR 05.0021X

Standards: IEC 60079-0:2011, IEC 60079-11:2011

Markings: Ex ib IIC T4 Gb (Ta = -40 °C to +70 °C) - Without TP40 Temperature Panel or Ex ib [ia Ga] IIC T4 Gb (Ta = 40 °C to +70 °C) - With TP40 Temperature Panel
 WARNING-POTENTIAL ELECTROSTATIC CHARGING
 HAZARD-SEE INSTRUCTIONS

Specific Conditions for Safe Use (X):

- At Connector X12, Ci is considered to be 22 nF with an associated apparatus U_o of 6.5 V or 15.7 μF with an associated apparatus U_o of less than 6.5 V.
- Under certain extreme circumstances, exposed plastic and unearthed metal parts of the enclosure may store an ignition-capable level of electrostatic charge. Therefore, the user/installer shall implement precautions to prevent the build-up of electrostatic charge, e.g. locate the equipment where a charge-generating mechanism is unlikely to be present and clean with a damp cloth.

	U _i	I _i	P _i	C _i	L _i
Input Entity parameters, Connector X12	12 V	400 mA	0.7 W	22 nF*	0 μH

* Ci = 22 nF with an associated apparatus U_o of 6.5 V or greater
 Ci = 15.7 μF with an associated apparatus U_o of less than 6.5 V

When the TP40 Temperature panel is fitted, the combined output parameters are:

	U _o	I _o	P _o	C _i	L _i
Output Entity parameters, Connectors X17, X18	5.88 V	172.4 mA	0.253 W	0 F	0 H

The capacitance and either the inductance or the inductance to resistance (L/R) ratio of the cable connected to the connectors X17 and X18 must not exceed the following values:

Group	Capacitance in mF	Inductance in mH	or L/R Ratio in mH/Ω
IIC	43	0.7	140
IIB	1000	5.2	560
IIA	1000	10.0	1120

B.9 Brazil

E2 INMETRO Flameproof

5600 Series Transmitter

Certificate: UL-BR 18.0034X

Standards: ABNT NBR IEC 60079-0:2013;
 ABNT IEC 60079-1:2016; ABNT IEC 60079-7:2008;
 ABNT IEC 60079-11:2013;
 ABNT IEC 60079-26:2016;
 ABNT NBR IEC 60079-31:2014

Markings: Ex db eb IIC T6 Ga/Gb (-40°C ≤ Tamb ≤ +70°C)
 Ex db eb [ib] [ia] IIC T6 Gb/Ga (-40°C ≤ Tamb ≤ +70°C)
 Ex db eb [ia] IIC T6 Gb/Ga (-40°C ≤ Tamb ≤ +70°C)
 Ex tb IIIC T85°C Db IP65

Specific Conditions for Safe Use (X):

- See certificate for Specific Conditions.

	U _i	I _i	P _i	C _i	L _i
Entity parameters HART	30 V	200 mA	0 W	0 μF	0 μH

2210 Display Unit

Certificate: UL-BR 18.0026X

Standards: ABNT NBR IEC 60079-0:2013 e ABNT NBR IEC 60079-11:2013

Markings: Ex ib IIC T4 Gb (Ta = -40 °C à +70 °C) (sem painel TP40), Ex ib [ia Ga] IIC T4 Gb (Ta = -40 °C à +70 °C) (com painel TP40)

Specific Conditions for Safe Use (X):

- See certificate for Specific Conditions.

See certificate for entity parameters

B.10 China

Flameproof

5600 Series Transmitter

Certificate: GYJ18.1481X

Standards: GB3836.1-2010, GB 3836.2-2010,
GB 3836.4-2010, GB 3836.20-2010,
GB 12476.1-2013, GB12476.5-2013

Markings: Ex de IIC T6 Ga/Gb, Ex de [ib] [ia] IIC T6 Ga/Gb,
Ex de [ia] IIC T6 Ga/Gb, Ex tD A21 IP65 T_A 85 °C

Specific Conditions for Safe Use (X):

1. See certificate for specific conditions.

2210 Display Unit

Certificate: GYJ15.1497X

Standards: GB3836.1-2010, GB 3836.4-2010,
GB 3836.20-2010

Markings: Ex ib IIC T4 Gb, Ex ib [ia Ga] IIC T4 Gb

Specific Conditions for Safe Use (X):

1. See certificate for Specific Conditions.
- See certificate for entity parameters

Flameproof

TH43 (valid for 5600/PRO Series Transmitter)

Certificate: GYJ19.1370X

Standards: GB3836.1-2010, GB 3836.2-2010,
GB 3836.3-2010, GB 3836.4-2010,
GB 3836.20-2010, GB 12476.1-2013,
GB12476.5-2013

Markings: Ex de IIC T6 Ga/Gb, Ex de [ib] [ia] IIC T6 Ga/Gb,
Ex de [ia] IIC T6 Ga/Gb,
Ex tD A2 IP65 T_A 85 °C

Specific Conditions for Safe Use (X):

1. See certificate for specific conditions.
- See certificate for entity parameters

B.11 EAC

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

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

Certificate: RU C-US.AQ07.B.00770-19

B.11.1 Ex

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

EM Technical Regulations Customs Union (EAC) Flameproof

Certificate: RU C-SE. AA87.B.00143

Markings: 5600 Series Transmitter
Ga/Gb Ex d e IIC T6 X
Ga/Gb Ex d e [ib Gb] [ia Ga] IIC T6 X
Ga/Gb Ex d e [ia Ga] IIC T6 X
2210 Display Unit
1Ex ib IIC T4 Gb
1Ex ib [ia Ga] IIC T4 Gb

Specific Conditions for Safe Use (X):

1. See certificate for Specific Conditions.
- See certificate for entity parameters

B.12 Republic of Korea

Flameproof

Certificate: 10-KB4BO-0009X

Markings: Ex d e IIC T6 Ga/Gb, Ex tb IIIC T85 °C IP65
Ex de [ib] [ia] IIC T6 Ga/Gb, Ex tb IIIC T85 °C IP65
Ex d e [ia] IIC T6 Ga/Gb, Ex tb IIIC T85 °C IP65

Specific Conditions for Safe Use (X):

1. See certificate for Specific Conditions.

B.13 India

Flameproof

Certificate: P454621/2/3

Markings: Ex db eb IIC T6 Ga/Gb or Ex db eb [ia] [ib] IIC T6
Ga/Gb or
Ex db eb [ia] IIC T6 Ga/Gb

Specific Conditions for Safe Use (X):

1. See certificate for Specific Conditions.

2210 Display Unit

Certificate: P428406/1

Markings: Ex ib IIC T4 Gb

Certificate: P428403/1

Markings: Ex ib IIC T4 Gb

Specific Conditions for Safe Use (X):

See certificate for Specific Conditions.

B.14 Ukraine

Flameproof, Intrinsically Safe

Certificate: UA.TR.047.C.0352-13

Markings: 0 Ex ia IIC T4X

1 Ex d ia IIC T4X

Specific Conditions for Safe Use (X):

1. See certificate for Specific Conditions.

B.15 Additional certifications

Certificate: Z 65.16-417

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

B.15.1 Republic of Korea EMC

Certificate: KCC-REM-ERN-RTGDISP2210DUX

2210 Display Unit

Certificate: KCC-REM-ERN-RTGDISP2210DUX

B.16 Pattern approval

GOST Belarus

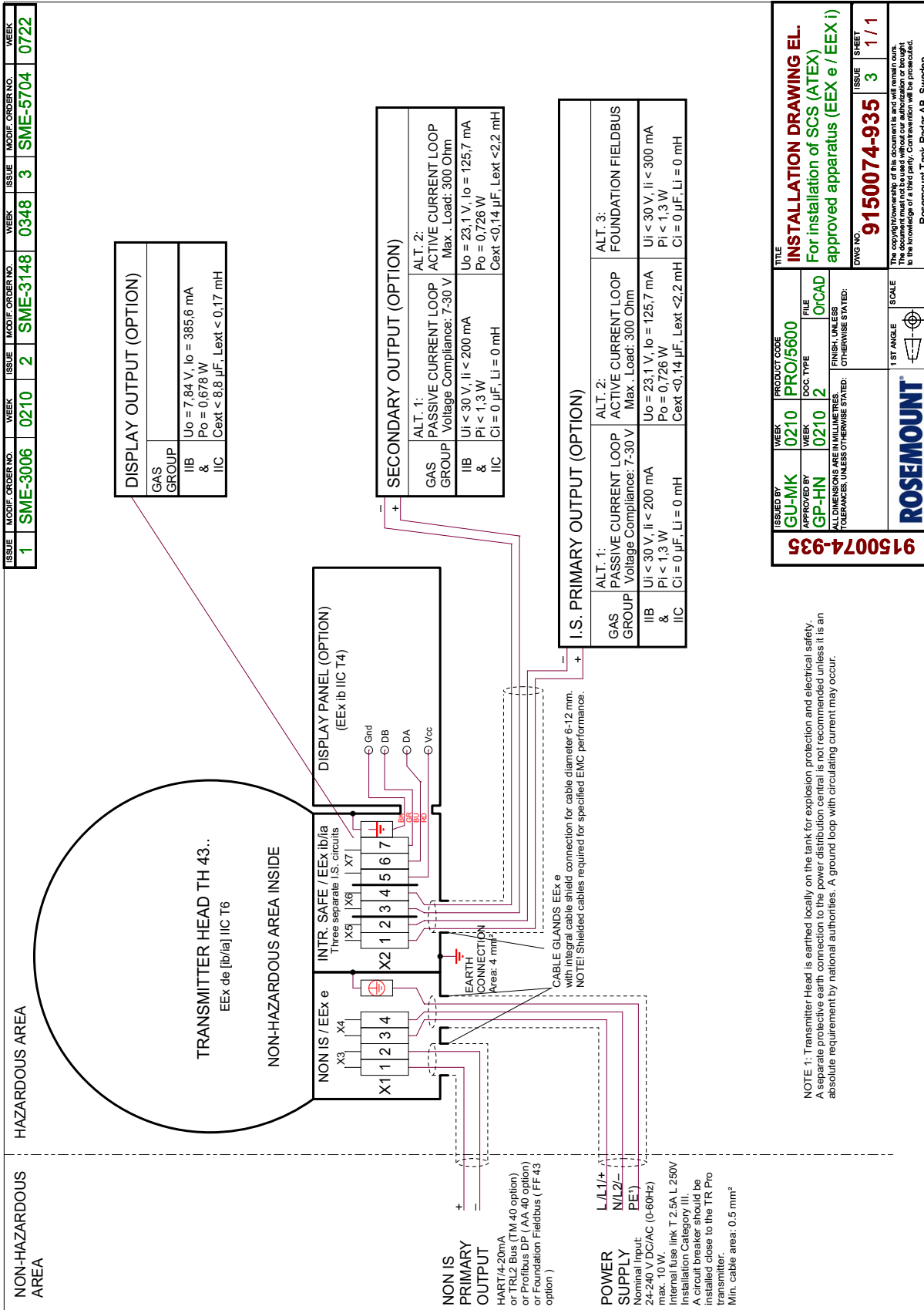
Certificate: RB 03 07 2765 16

GOST Kazakhstan

Certificate: KZ.02.02.06457-2018

GOST Russia

Certificate: SE.C.29.004.A



ISSUE	MODIF. ORDER NO.	WEEK	ISSUE	MODIF. ORDER NO.	WEEK	ISSUE	MODIF. ORDER NO.	WEEK
1	SME-3006	02/10	2	SME-3148	03/48	3	SME-5704	07/22

ISSUED BY		WEEK	PRODUCT CODE	TITLE	
GU-MK	0210	PRO/5600	INSTALLATION DRAWING EL.		
APPROVED BY	FILE	DOC. TYPE	For installation of SCS (ATEX)		
GP-HN	0210	2	OrCAD	approved apparatus (EEx e / EEx i)	
ALL DIMENSIONS ARE IN MILLIMETRES, UNLESS OTHERWISE STATED.				DWG NO.	9150074-935
TOLERANCES, UNLESS OTHERWISE STATED:				ISSUE	3
				SHEET	1 / 1
				The copyright/ownership of this document is and will remain ours. The document must not be used without our authorization or brought to the knowledge of a third party. Our permission is not to be granted.	
				Rosemount Tank Radar AB, Sweden	
ROSEMOUNT		1 ST ANGLE	SCALE		

B.18 FM approval drawings

ISSUE	CHANGE ORDER NO.	WEEK	ISSUE	CHANGE ORDER NO.	WEEK	ISSUE	CHANGE ORDER NO.	WEEK
1	SME-3036	0216	2	SME-5617	0707	3	SME-7118	1143

HAZARDOUS LOCATION

**2210 DISPLAY UNIT,
REMOTE DISPLAY UNIT RDU40B**

Intrinsically Safe Apparatus
for Use in Class I, Group A, B, C or D,
Division 1 Hazardous Locations.

HOUSING MATERIAL: AI
Mg content: Max. 6% by weight

I.S. TEMPERATURE OUTPUT (OPTION)	
GAS GROUP	Combined parameters of X17 and X18
A	Voc = 5.88 V, Isc = 172.4 mA, Po = 253 mW, Ca = 43 µF, La = 0.7 mH, LoRo = 140 µH/Ohm
B	Voc = 5.88 V, Isc = 172.4 mA, Po = 253 mW, Ca = 43 µF, La = 0.7 mH, LoRo = 140 µH/Ohm
C	Voc = 5.88 V, Isc = 172.4 mA, Po = 253 mW, Ca = 43 µF, La = 0.7 mH, LoRo = 140 µH/Ohm
D	Voc = 5.88 V, Isc = 172.4 mA, Po = 253 mW, Ca = 43 µF, La = 0.7 mH, LoRo = 140 µH/Ohm

The Entity concept allows interconnection of intrinsically safe apparatus, not specifically examined in combination as a system, when the Approved values of Voc (or Vt) and Isc (or It) for the associated apparatus are less than or equal to Vmax and Imax for the intrinsically safe apparatus, and the Approved values of Ca and La for the associated apparatus are greater than Ci + cable capacitance and Li + cable inductance.

I.S. DISPLAY INPUT	
GAS GROUP	Vcc together with A and B
A	Vmax < 12 V, Imax < 400 mA, Ci = 0 µF, Li = 0 mH, Pmax < 0.7 W
B	Vmax < 12 V, Imax < 400 mA, Ci = 0 µF, Li = 0 mH, Pmax < 0.7 W
C	Vmax < 12 V, Imax < 400 mA, Ci = 0 µF, Li = 0 mH, Pmax < 0.7 W
D	Vmax < 12 V, Imax < 400 mA, Ci = 0 µF, Li = 0 mH, Pmax < 0.7 W

WARNING – Potential Electrostatic Charging Hazard – The enclosure is constructed from plastic. To prevent the risk of electrostatic sparking the plastic surfaces should only be cleaned with a damp cloth.

WARNING – The apparatus enclosure contains aluminum and is considered to constitute a potential risk of ignition by impact or friction. Care must be taken into account during installation and use to prevent impact or friction.

FM Approved Product.
No revisions must be made to this drawing without prior Factory Mutual authorization.

ISSUED BY	WEEK	PRODUCT CODE	TITLE
GU-HN	0216	TR PRO	SYSTEM CONTROL DRAWING for hazardous location installation of FM approved Display unit
APPROVED BY	WEEK	DOC. TYPE	
GST-TK	0216	6	ORoad
ALL DIMENSIONS IN MILLIMETERS		FORMER LINE/ISSUE CONTINUOUSLY 6/17/15	ORoad VCS
			9150 074-997
			9150 074-997
			3
			1 / 1

ROSEMOUNT

1" ET ANGLE SCALE 1:1

Approved Date: 06/18/15
Approved By: Mike All

2012-01-03 Electronic Market - PRINTED COPIES ARE UNCONTROLLED - Rosemount Property

NON-HAZARDOUS LOCATION

HAZARDOUS LOCATION

HOUSING MATERIAL: AISI10MgWa
Mg content: Max. 5% by weight
Cu content: Max. 20% by weight.

FM Approved Product.
No revisions must be made to this drawing without prior Factory Mutual authorization.

ISSUE	MODIF.	ORDER NO.	WEEK	ISSUE	MODIF.	ORDER NO.	WEEK	ISSUE	MODIF.	ORDER NO.	WEEK
1	SME-3036	0216	2	SME-5617	0707	3	SME-7118	1143			

HAZARDOUS LOCATION

TRANSMITTER HEAD TH 43.. / 5600
Explosionproof Associated Apparatus for Use in Class I, Group A, B, C or D, Division 1 or 2 Hazardous Locations.

NON-HAZARDOUS LOCATION INSIDE

NON IS
X1 1 2 3 4

INTRINSICALLY SAFE
Three separate I.S. circuits
X2 1 2 3 4 5 6 7

DISPLAY PANEL (OPTION)
Intrinsically Safe Apparatus for Use in Class I, Group A, B, C or D, Division 1 or 2 Hazardous Locations.
GND DB DA VCC

CONDUIT FITTINGS 1/2" -14 NPT
Transmitter Head has internal lead/conduit seal.

POWER SUPPLY
L1/L1+
N1/L2-
PE
Nominal Input: 24-240 V DC/AC (0-60 Hz)
Max. 10 W.
Internal fuse-link: T 2.5A L 350V.
Installation Category III.

Should be connected to conduit system

NON-HAZARDOUS LOCATION
Maximum nonhazardous location voltage: 250 Vrms.
Associated apparatus connected to the nonintrinsically safe terminals must not use or generate more than 250 Vrms.

WARNING - Potential Electrostatic Charging Hazard - The enclosure is constructed from plastic. To prevent the risk of electrostatic sparking the plastic surface should only be cleaned with a damp cloth.

WARNING - The apparatus enclosure contains aluminum and is considered to constitute a potential risk of ignition by impact or friction. Care must be taken into account during installation and use to prevent impact or friction.

I.S. DISPLAY OUTPUT (OPTION)			
GAS GROUP	Vcc together with DA and DB		
A & B	Voc = 7,84 V, Isc = 386 mA, Po = 0,678W, Ca = 9,3 μF, La = 0,239 mH		
C	Voc = 7,84 V, Isc = 386 mA, Po = 0,678W, Ca = 130 μF, La = 0,95 mH		
D	Voc = 7,84 V, Isc = 386 mA, Po = 0,678W, Ca = 1000 μF, La = 1,9 mH		

SECONDARY OUTPUT (OPTION)			
GAS GROUP	ALT. 1: Note 2	ALT. 2: Note 2	ALT. 2: ACTIVE CURRENT LOOP
A & B	Voc = 30 V, Imax = 300 mA, Ci = 0 μF, Li = 0 mH	Voc = 23,1 V, Isc = 125,7 mA, Po = 0,726 W	Voc = 23,1 V, Isc = 125,7 mA, Po = 0,726 W
C	Voc = 30 V, Imax = 300 mA, Ci = 0 μF, Li = 0 mH	Voc = 23,1 V, Isc = 125,7 mA, Po = 0,726 W	Voc = 23,1 V, Isc = 125,7 mA, Po = 0,726 W
D	Voc = 30 V, Imax = 300 mA, Ci = 0 μF, Li = 0 mH	Voc = 23,1 V, Isc = 125,7 mA, Po = 0,726 W	Voc = 23,1 V, Isc = 125,7 mA, Po = 0,726 W

I.S. PRIMARY OUTPUT (OPTION)			
GAS GROUP	ALT. 1: Note 2	ALT. 2: Note 2	ALT. 3: FOUNDATION FIELDBUS
A & B	Voc = 30 V, Imax = 300 mA, Ci = 0 μF, Li = 0 mH	Voc = 23,1 V, Isc = 125,7 mA, Po = 0,726 W	Voc = 30 V, Imax = 300 mA, Pmax = 1,3 W Ci = 0 μF, Li = 0 mH
C	Voc = 30 V, Imax = 300 mA, Ci = 0 μF, Li = 0 mH	Voc = 23,1 V, Isc = 125,7 mA, Po = 0,726 W	Voc = 30 V, Imax = 300 mA, Pmax = 1,3 W Ci = 0 μF, Li = 0 mH
D	Voc = 30 V, Imax = 300 mA, Ci = 0 μF, Li = 0 mH	Voc = 23,1 V, Isc = 125,7 mA, Po = 0,726 W	Voc = 30 V, Imax = 300 mA, Pmax = 1,3 W Ci = 0 μF, Li = 0 mH

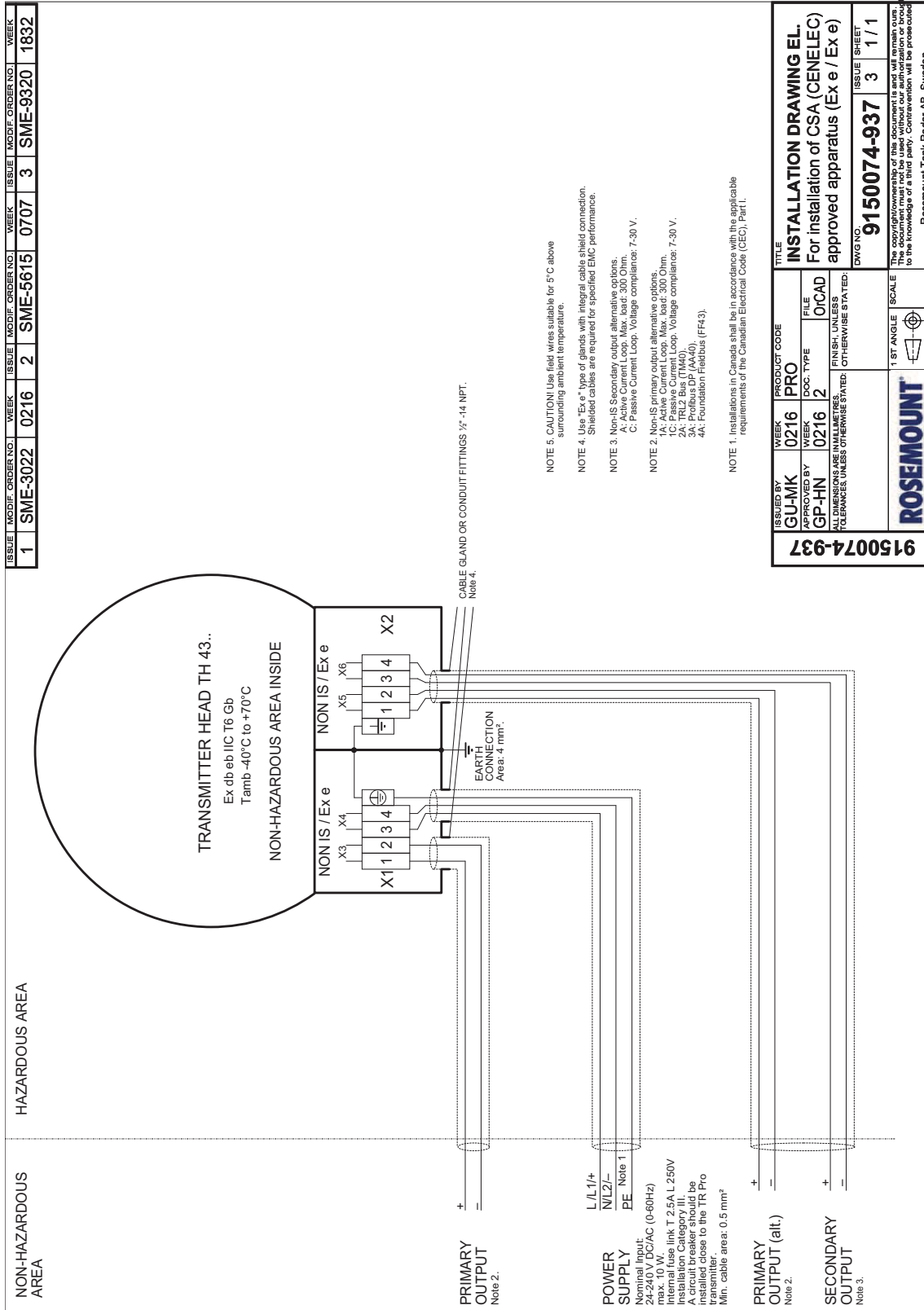
NOTE 3: A cable gland with integral cable shield connection may be fitted instead of a conduit pipe. A shielded cable is required for specified EMC performance.

NOTE 2: Current loop alternative options:
1: Passive Current Loop, Max. load: 300 Ohm.
2: Active Current Loop, Max. load: 300 Ohm.

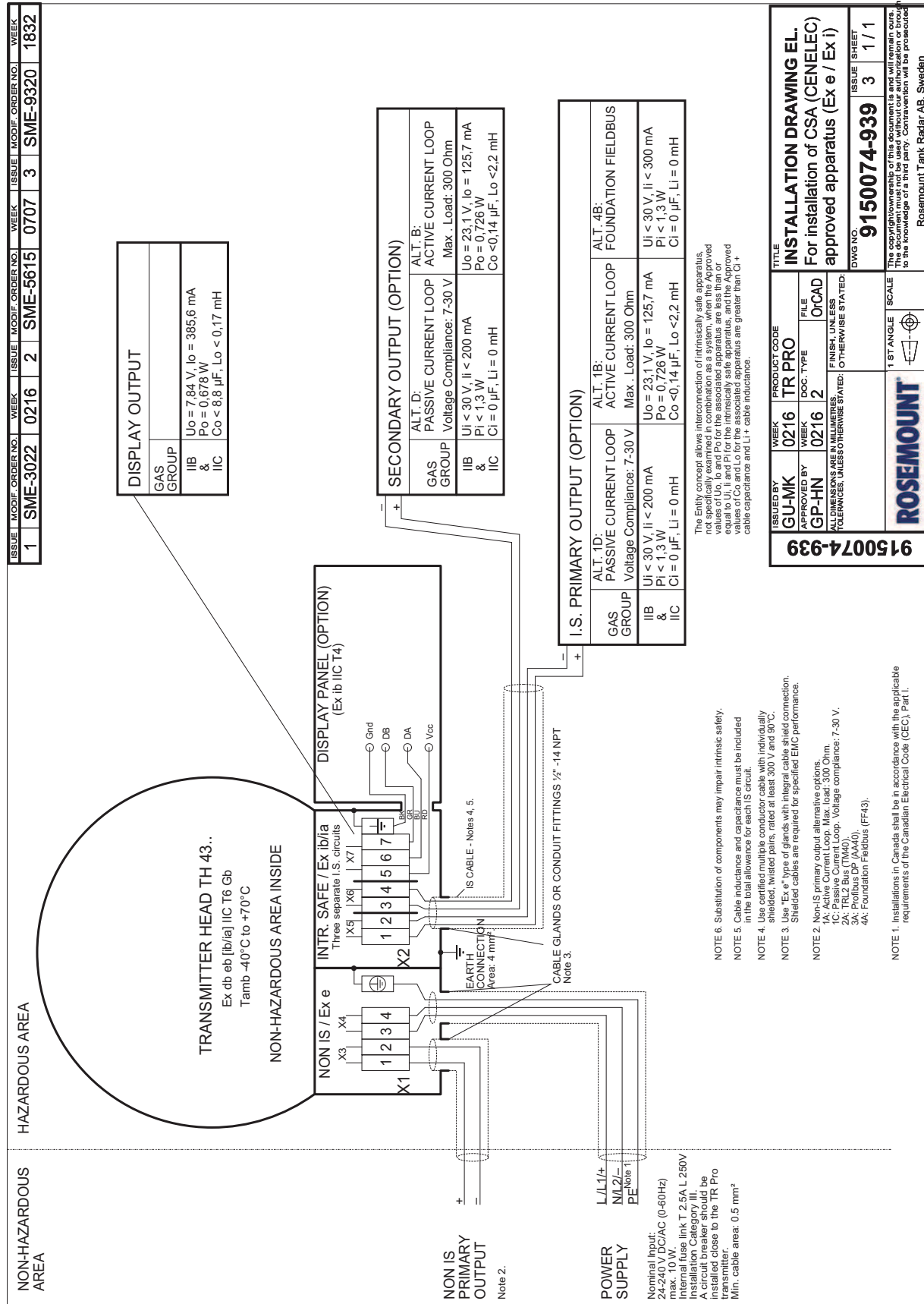
NOTE 1: Installations in the USA shall be in accordance with the National Electric Code (ANSI/NFPA 70) and ANSI/ISA-RP12.6

ISSUED BY	WEEK	PRODUCT CODE	TITLE
GU-MK	0141	TR PRO	SYSTEM CONTROL DRAWING
GP-HN	0141	6	for hazardous location installation of FM approved apparatus
APPROVED BY			FILE
ORCAD			FINISH, UNLESS OTHERWISE STATED.
ALL DIMENSIONS ARE IN MILLIMETRES, UNLESS OTHERWISE STATED.			SCALE
ROSEMOUNT			1:1 SINGLE
DWG NO. 9150074-994			ISSUE SHEET
			3 / 1 / 1
Rosemount Tank Radar AB, Sweden			

B.19 CSA approval drawings



2019-06-05 Electronic Master - Printed Copies Uncontrolled - Emerson Proprietary



1	SME-3022	0216	2	SME-5615	0707	3	SME-9320	1832
---	----------	------	---	----------	------	---	----------	------

ISSUED BY		WEEK	TR PRO	TITLE	
GU-MK		0216	TR PRO	INSTALLATION DRAWING EL.	
APPROVED BY		WEEK	DOC. TYPE	For installation of CSA (CENELEC)	
GP-HN		0216	2	approved apparatus (Ex e / Ex i)	
FINISH UNLESS OTHERWISE STATED:		OTHERWISE STATED:		DWG NO	
TOLERANCES UNLESS OTHERWISE STATED:		OTHERWISE STATED:		9150074-939	
SCALE		1 ST ANGLE		ISSUE / SHEET	
ROSEMOUNT		1:1		3 / 1	
The copyright ownership of this document is and will remain with Rosemount. This document must not be used without our authorization or brought to the knowledge of a third party. Contravention will be prosecuted.					
Rosemount Tank Radar AB, Sweden					

Index

A

Activate Least Square Filter	78
Active Adaptive Filter	78
Active Jump Filter	78
Advanced Configuration	67
Analog Output	68
Bottom Echo Handling	75
Calibration Distance	67
Distance Offset	67
Disturbance Echo Handling	71
Empty Tank Handling	76
Filtering	78
Full Tank Handling	75
Minimum Level Offset	67
Process Conditions	70
Foam	70
Rapid Level Changes	70
Solid Products	70
Turbulent Surface	70
Show Negative Values as Zero	67
Surface Tracking	76
Temperature Measurement	70
Number of Sensors	70
Sensor Mounting Level 1-6	70
Volume Calculation	71
Analog Output	68
Antenna	64
Hold Off Distance	64
Pipe Inner Diameter	64
Tank Connection Length	64

B

Bottom Echo Handling	75
Bottom Echo Visible	75
Invalid Level Alarm is not Set if Tank is Empty	75
Bottom Echo Visible	75

C

Calibration Distance	67
Close Distance Window	77
Commission	
HART Communicator	85
Cone Antenna	
Extended	
Mounting	45
PTFE Sealing	
Mounting	25, 28
Configuration	63
Advanced	67
Basic	
Tank Geometry	66
Connections and Hardware	
HART Communicator	87

Customized Noise Threshold Table	73
----------------------------------	----

D

Distance Filter Factor	78
Distance Offset	67
Disturbance Echo Handling	71
Customized Noise Threshold table	73
General Amplitude Threshold	73
Registration of False Echoes	73
Double Bounce Offset	78
Double Bounce Possible	77
Double Surface	76

E

Echo Timeout	76
Empty Tank Detection Area	76
Empty Tank Handling	76
Empty Tank Detection Area	76
Extended	
Cone Antenna	
Mounting	45

F

FCC Requirements	12
Field Upgrades	90
Labeling	90
Filtering	78
Activate Jump Filter	78
Activate Least Square Filter	78
Active Adaptive Filter	78
Close Distance Window	77
Distance Filter Factor	78
Echo Timeout	76
Foam	70
Free Space	
Requirements	21
Full Tank Handling	75
Invalid Level Alarm is Not Set if Tank is Empty	75

G

General Amplitude Threshold	73
-----------------------------	----

H




HART Communicator	
Commission	85
Connections and Hardware	87
Level Configuration Example	87
Setting the Loop to Manual	87
HART Communicator Menu Tree	86
HART Fast Keys	87
Hold Off Distance	64

I			
Ideal Tank			
Volume Calculation	.....	71	
Installation			
Requirements			
Free Space	.....	21	
Nozzle	.....	19	
Tools	.....	19	
Invalid Level Alarm is Not Set if Tank is Empty	.....	75	
Invalid Level Alarm is not Set if Tank is Empty	.....	75	
K			
Keys			
HART	.....	87	
L			
Label	.....	90	
Level above Min. Distance Possible	.....	76	
Level Configuration Example			
HART Communicator	.....	87	
M			
Measurement Principle	.....	11	
Menu Tree			
HART Communicator	.....	86	
Minimum Level Offset	.....	67	
Mounting			
Cone Antenna			
Extended	.....	45	
PTFE Sealing	.....	25, 28	
Still-pipe/Bridle	.....	36	
Parabolic Antenna	.....	40	
Process Seal Antenna	.....	33	
N			
Number of Sensors	.....	70	
O			
Output			
Analog	.....	68	
P			
Parabolic Antenna			
Mounting	.....	40	
PC Configuration Software Radar Master	.....	80	
Pipe Inner Diameter	.....	64	
Process Conditions	.....	70	
Foam	.....	70	
Number of Sensors	.....	70	
Rapid Level Changes	.....	70	
Sensor Mounting Level 1-6	.....	70	
Solid Products	.....	70	
Turbulent Surface	.....	70	
Process Seal Antenna			
Mounting	.....	33	
PTFE Sealing			
Mounting	.....	25, 28	
R			
Radar Master	.....	80	
Rapid Level Changes	.....	70	
Registration of False Echoes	.....	73	
S			
Safety Messages	.....	9, 17	
Sensor Mounting Level 1-6	.....	70	
Service			
Spare Parts	.....	15	
Support	.....	14	
Setting the Loop to Manual			
HART Communicator	.....	87	
Show Negative Values as Zero	.....	67	
Slow Search	.....	76	
Speed	.....	76	
Solid Products	.....	70	
Specific FCC Requirements	.....	12	
Still-pipe/Bridle			
Mounting	.....	36	
Strapping Table			
Volume Calculation	.....	71	
Surface Tracking	.....	76	
Double Bounce Offset	.....	78	
Double Bounce Possible	.....	77	
Double Surface	.....	76	
Level above Min. Distance Possible	.....	76	
Slow Search	.....	76	
Slow Search Speed	.....	76	
Upper Product DC	.....	76	
Symptom			
Troubleshooting Table	.....	90	
T			
Tank Bottom Type	.....	66	
Tank Connection Length	.....	64	
Tank Geometry	.....	66	
Tank Bottom Type	.....	66	
Tank Height	.....	66	
Tank Type	.....	66	
Tank Height	.....	66	
Tank Type	.....	66	
Temperature Measurement	.....	70	
Troubleshooting			
Reference Table	.....	89	
Table	.....	90	
Turbulent Surface	.....	70	
U			
Upper Product DC	.....	76	
V			
Volume Calculation	.....	71	
Ideal Tank	.....	71	

Strapping Table71




Global Headquarters

Emerson Automation Solutions

6021 Innovation Blvd.
Shakopee, MN 55379, USA
 +1 800 999 9307 or +1 952 906 8888
 +1 952 949 7001
 RFQ.RMD-RCC@Emerson.com

North America Regional Office

Emerson Automation Solutions

8200 Market Blvd.
Chanhassen, MN 55317, USA
 +1 800 999 9307 or +1 952 906 8888
 +1 952 949 7001
 RMT-NA.RCCRFQ@Emerson.com




Latin America Regional Office

Emerson Automation Solutions

1300 Concord Terrace, Suite 400
Sunrise, FL 33323, USA
 +1 954 846 5030
 +1 954 846 5121
 RFQ.RMD-RCC@Emerson.com




Europe Regional Office

Emerson Automation Solutions Europe GmbH

Neuhofstrasse 19a P.O. Box 1046
CH 6340 Baar
Switzerland
 +41 (0) 41 768 6111
 +41 (0) 41 768 6300
 RFQ.RMD-RCC@Emerson.com

Asia Pacific Regional Office

Emerson Automation Solutions

1 Pandan Crescent
Singapore 128461
 +65 6777 8211
 +65 6777 0947
 Enquiries@AP.Emerson.com

Middle East and Africa Regional Office

Emerson Automation Solutions

Emerson FZE P.O. Box 17033
Jebel Ali Free Zone - South 2
Dubai, United Arab Emirates
 +971 4 8118100
 +971 4 8865465
 RFQ.RMTMEA@Emerson.com



[Linkedin.com/company/Emerson-Automation-Solutions](https://www.linkedin.com/company/Emerson-Automation-Solutions)



[Twitter.com/Rosemount_News](https://twitter.com/Rosemount_News)



[Facebook.com/Rosemount](https://www.facebook.com/Rosemount)



[Youtube.com/user/RosemountMeasurement](https://www.youtube.com/user/RosemountMeasurement)

Standard Terms and Conditions of Sale can be found on the [Terms and Conditions of Sale page](#).

The Emerson logo is a trademark and service mark of Emerson Electric Co. Rosemount is a mark of one of the Emerson family of companies. All other marks are the property of their respective owners.

© 2020 Emerson. All rights reserved.