Reference Manual
00809-0100-4024, Rev AB
November 2003

Rosemount 5600 Series
Radar Level Transmitter

CE

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Reference Manual
00809-0100-4024, Rev AB
November 2003

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.

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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.

OVERVIEW

This manual provides information about mechanical and electrical installation of the 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 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: Operation

- Operation and maintenance techniques for HART protocol only.
- For fieldbus protocol see the 5600 Series Radar Level Transmitter fieldbus manual (document number 00809-0100-4025).

Section 5: Configuration

- Commissioning and operation
- Software functions
- Configuration parameters
- Online variables

Section 6: Service and Troubleshooting

- Troubleshooting techniques for the most common operating problems for HART protocol only.
- For fieldbus protocol see the 5600 Series Radar Level Transmitter fieldbus manual (document number 00809-0100-4025).

Appendix A: Reference Information

- Specifications
- Dimensional Drawings
- Ordering information for HART and fieldbus protocols

Appendix B: Product Certifications

- Intrinsic safety approval information
- European ATEX directive information

Appendix C: Approval Drawings

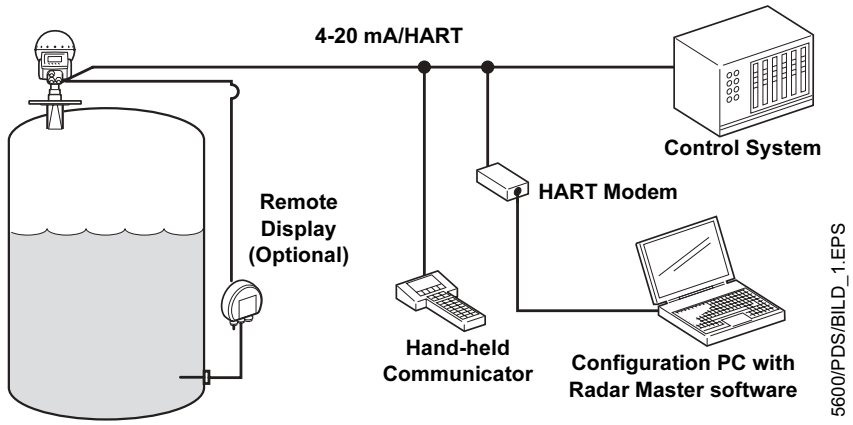
- Approval drawings for HART and fieldbus protocols

The 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.

A specially designed Radar Master software package offers configuration and service capabilities. It also includes functions for presentation of measurement data.

If HART technology is used you can configure and monitor measurement data via a hand held communicator or a PC.

Figure 1-1. System Integration using the Hand-held 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.

As an option, your Rosemount 5600 Radar Level Transmitter can be equipped with an easy-to-use Rosemount 2210 Display Panel. It offers basically the same functionality as the Radar Master package. Four sturdy softkeys give you access to configuration routines, service functions, and level monitoring.

Refer to Table 1-1 for the location of fieldbus protocol information. This manual (00809-0100-4024) covers HART protocol only.

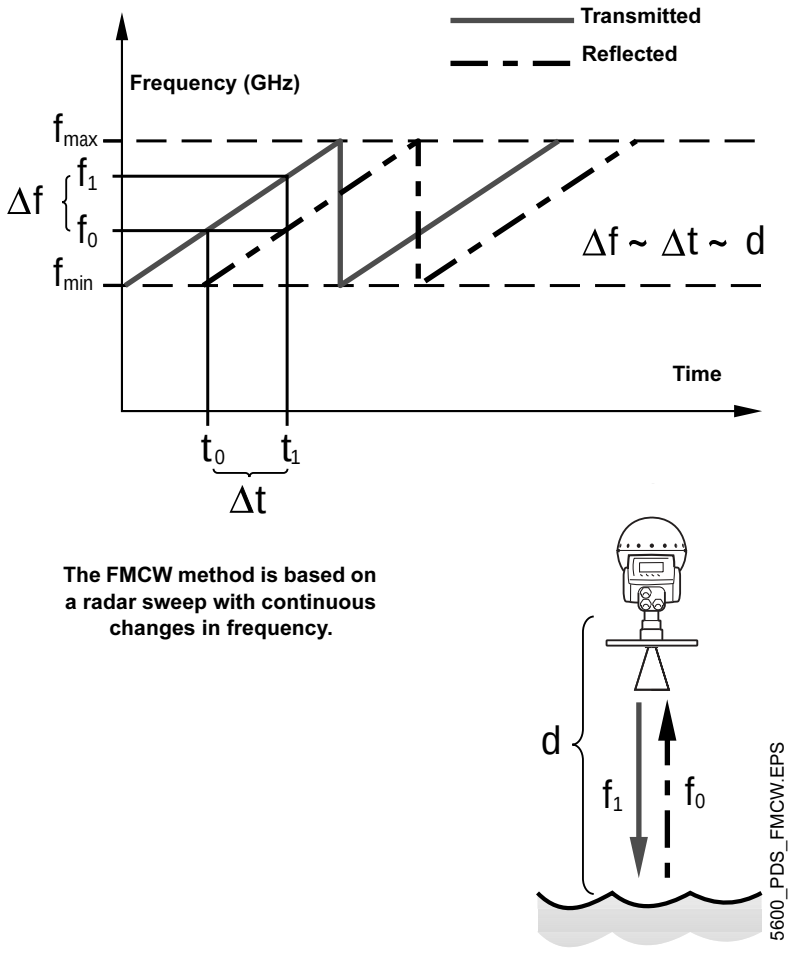
Table 1-1. Location of HART and FOUNDATION fieldbus Protocol Information

Section	HART	Fieldbus
Installation	00809-0100-4024	00809-0100-4025
Configuration	00809-0100-4024	00809-0100-4025
Operation and Maintenance	00809-0100-4024	00809-0100-4025
Troubleshooting	00809-0100-4024	00809-0100-4025
Reference data	00809-0100-4024	00809-0100-4024
Approvals	00809-0100-4024	00809-0100-4025

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 FMCW method is based on a radar sweep with continuous changes in frequency.

The 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 which is proportional to the distance to the product surface. This signal can be measured very accurately allowing fast, reliable, and accurate level measurements.

The 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 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.

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 Process Management representative for help with the necessary license application.

SERVICE SUPPORT

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

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

The representative arranging the return will ask for product model and serial numbers, and will provide a Return Material Authorization (RMA) number. The center will also ask for the name of the process material to which the product was last exposed. If the material to which the product was last exposed is a hazardous substance as defined by OSHA, a copy of the required Material Safety Data Sheet (MSDS) for each hazardous substance identified must be included with the returned products.

The representative arranging your return will detail the additional information and procedures necessary to return products 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

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Introduction

This section describes the mechanical installation. Start by reading the General Installation Requirements for your antenna. This includes Nozzle and Free Space Requirements. Also, if you are installing a cone antenna in a still-pipe/bridle or an extended cone antenna is used, there are special requirements for these applications. This section ends with the mounting instructions for all antenna types.

Tools

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

- Screw driver.
- Adjustable wrench.
- Allen key.
- Circlip plier (snap ring plier).
- Hook spanner.

Customer Supplied Flanges

The simple design of antenna 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).

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.

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

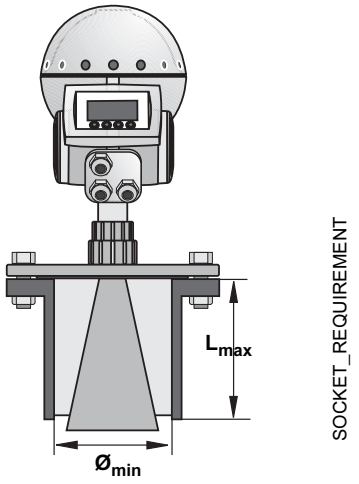
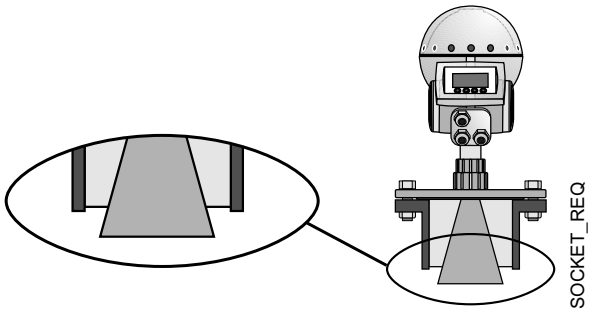


Table 2-1. Nozzle Requirements

Antenna	L_{max} in. (mm)	$Diam_{min}$ in. (mm)
Rod	11.8 (300)	1.65 (42)
Cone 3 in.	9.6 (245)	2.9 (75)
Cone 4 in.	11.8 (300)	3.8 (98)
Cone 6 in.	16.1 (410)	5.7 (146)
Cone 8 in.	20.6 (525)	7.6 (194)
Parabolic	23.6 (600)	19.7 (500)
Process Seal 4 in.	11.8 (300)	3.9 (100)
Process Seal 6 in.	11.8 (300)	5.9 (150)
Extended Cone 3 in.	19.5 (495)	3.0 (75)
Extended Cone 4 in.	19.5 (495)	3.9 (98)
Extended Cone 6 in.	19.5 (495)	5.8 (146)
Flushing Cone 4 in.	11.8 (300)	3.9 (98)
Flushing Cone 6 in.	16.1 (410)	5.8 (146)
Flushing Cone 8 in.	20.7 (525)	7.6 (194)

Figure 2-2. Antenna Tip Outside Nozzle



Free Space Requirements

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

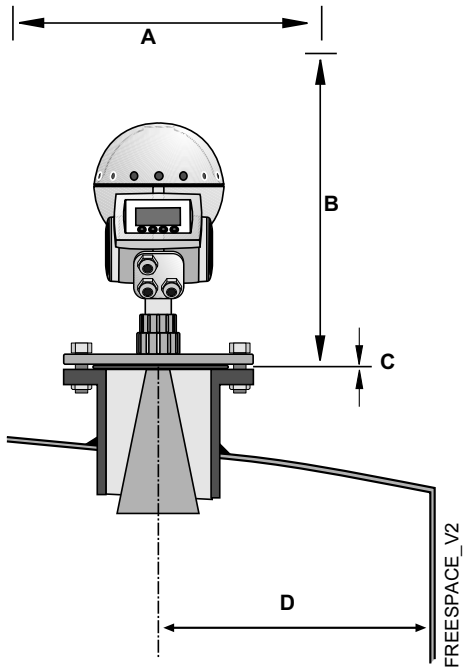


Table 2-2. Free Space Requirements

A. Service Space Width	**Distance in. (mm)**
All antennas	22 (550)
B. Service Space Height	
Antenna	**Distance in. (mm)**
Rod	27 (700)
Cone, Extended Cone, Flushing Cone	25 (650)
Process Seal	31 (800)
Parabolic	27 (700)
C. Inclination	
Antenna	**Maximum Angle**
Rod	3°
Cone	1°
Process Seal	3°
Parabolic	2°
D. Minimum distance to tank wall(1)	
Antenna	**Distance in. (mm)**
Rod	24 (600)
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.

Beam Width

Figure 2-4. Beam width angle, see Table 2-3

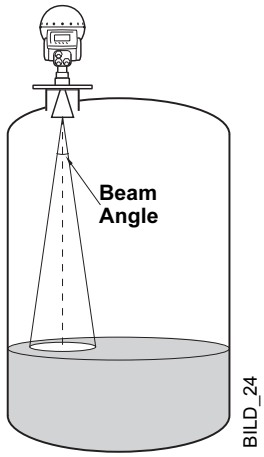


Table 2-3. Beam width angle

Antenna	Beam Width
Cone 3 in.	25°
Rod/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

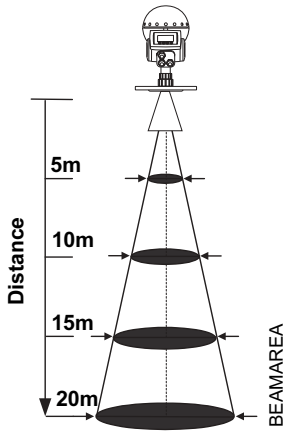


Table 2-4. Beam width distance

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)
Rod/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	0.9/(3.0)	1.7/(5.6)	2.6/(8.5)	3.5/(11)

Special antennas and space requirements reference

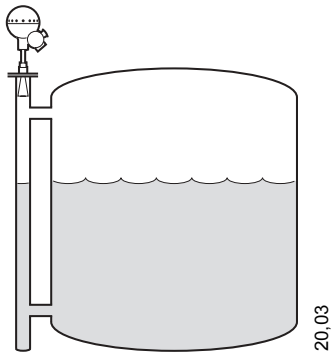
Pipe Installation
See page 2-6 and page 2-25.

Extended Cone Installation
See page 2-8 and page 2-33.

Installation Requirements Cone Antenna in a Still-pipe/Bridle

The 5600 Series Radar Level Transmitter is suitable for measurements in bridles. The high signal processing capacity allows measurements even when there are several pipe inlets.

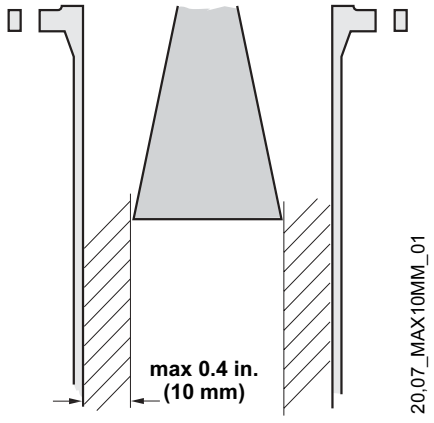
Figure 2-6. Example of a Bridle mount



Still-pipe or bridle 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.

1. The 3, 4, and 6 in. cone antennas are designed to fit into corresponding pipes. A gap between the antenna opening and the pipe of up to 0.4 in. (10 mm) may occur. In Still Pipes with small inlet pipes or no inlet pipes at all, the gap has no influence on the measuring performance.

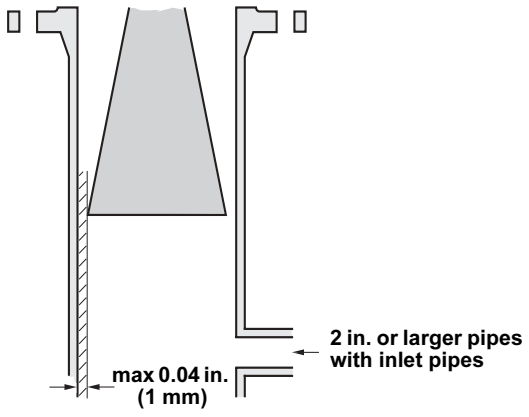
Figure 2-7. 3, 4, and 6 in. Cone Antenna - gap between pipe and antenna



2. In pipes with inlet pipes in the order of 3 in. or larger, or in pipes where severe contamination can be expected, the antenna should be customized in order to achieve optimum performance. In this case do the following:
   a. Measure the inner diameter of the pipe.
   b. Cut the cone antenna so that it fits inside the Still Pipe.
   c. Make sure that the gap between the pipe and the antenna is smaller than 0.4 inches (10 mm).

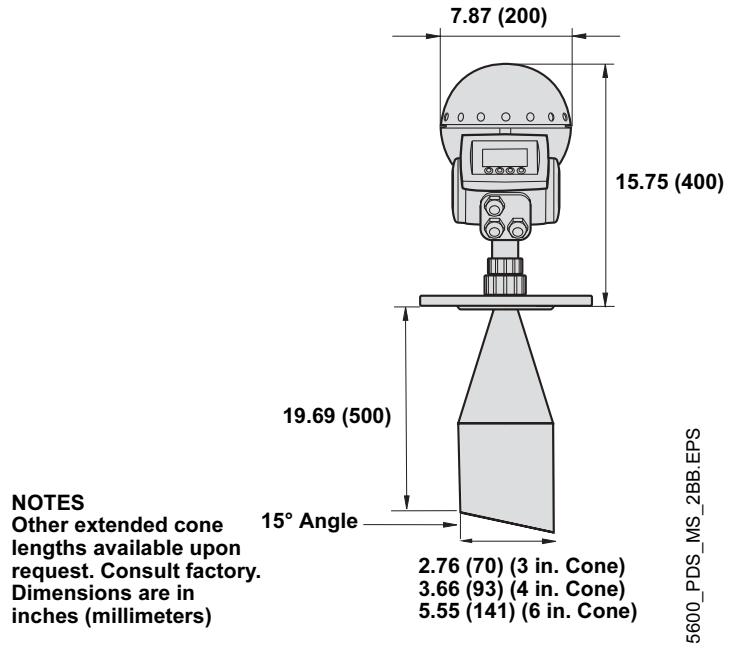
Please contact your local Emerson Process Management representative for details about a factory-cut antenna.

Figure 2-8. 2 in. or larger pipes with inlet pipes



Installation Requirements Extended Cone Antenna

Figure 2-9. Extended Cone Antenna Dimensions



NOTES
Other extended cone lengths available upon request. Consult factory.
Dimensions are in inches (millimeters)

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 2-10:
  ANSI 3” antenna for nozzles higher than 9.8 in. (250 mm),
  ANSI 4” antenna for nozzles higher than 11.8 in. (300 mm),
  ANSI 6” antenna for nozzles higher than 15.8 in. (400 mm),
- there are disturbing objects close to the tank opening, see Figure 2-11, or
- there is a rough surface at the inside of the nozzle or there is a height difference between nozzle sides, see Figure 2-12

Figure 2-10. Example of a high nozzle

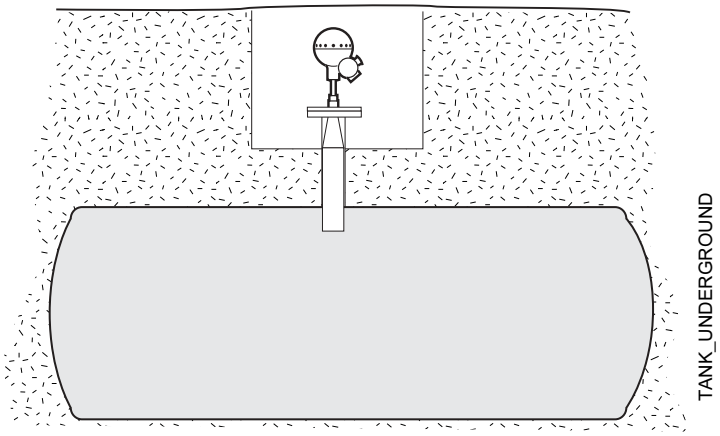


Figure 2-11. Example of disturbing objects close to the tank nozzle

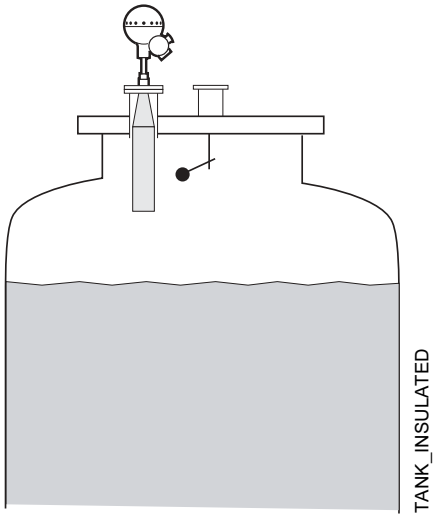


Figure 2-12. Examples of problem surfaces

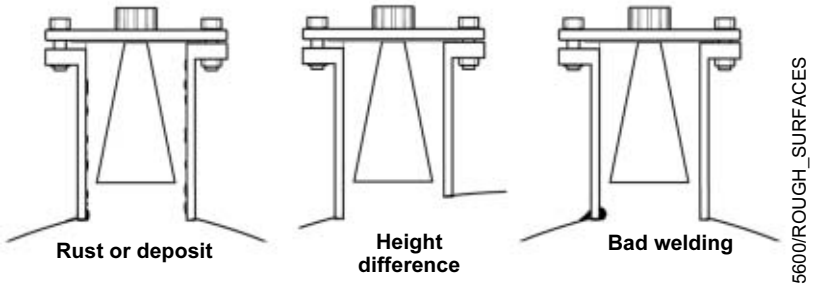
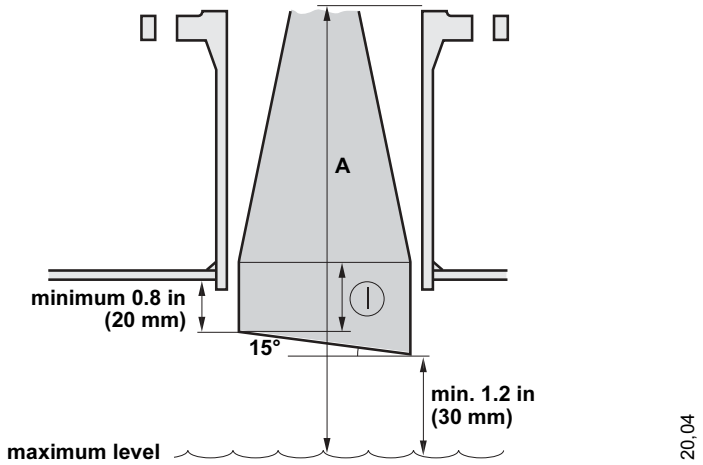


Figure 2-13. Total distance between flange and product level



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.

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 inch 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 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 2-5. Categories of liquids	
a	Oil, gasoline and other hydrocarbons, petrochemicals (dielectric constant, ε_r=1.9-4.0)
b	Alcohols, concentrated acids, organic solvents, oil/water mixtures and acetone (ε_r=4.0-10)
c	Conductive liquids, e.g. water based solutions, dilute acids and alkalis (ε_r > 10)

Figure 2-14. Applications with calm product surface(1)

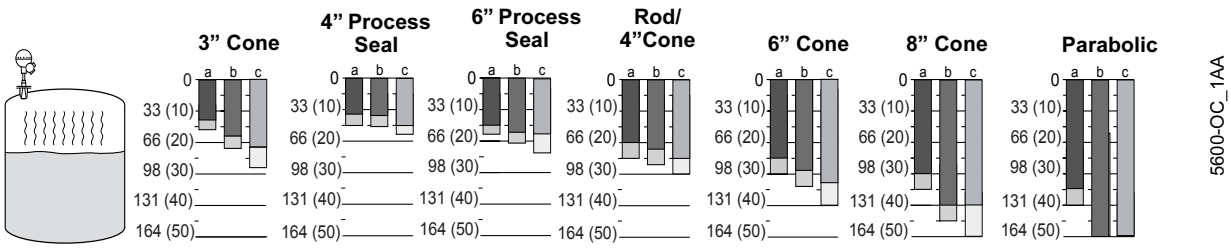


Figure 2-15. Applications where the product is gently stirred, causing minor turbulence(1)

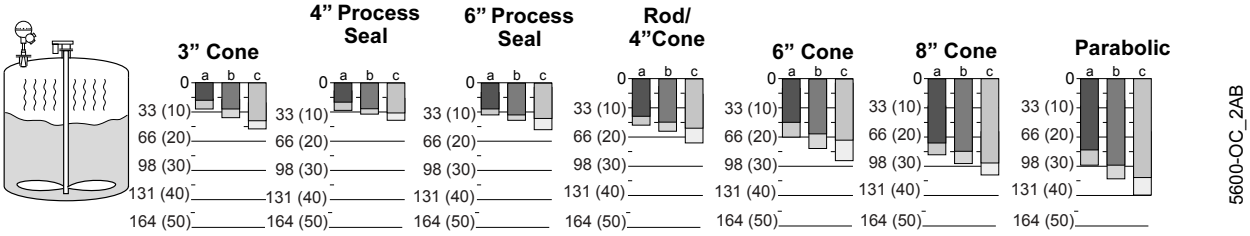
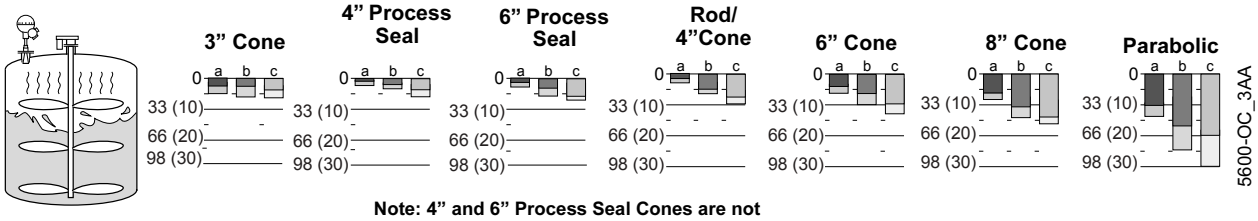


Figure 2-16. Applications with turbulent product surface conditions(1)

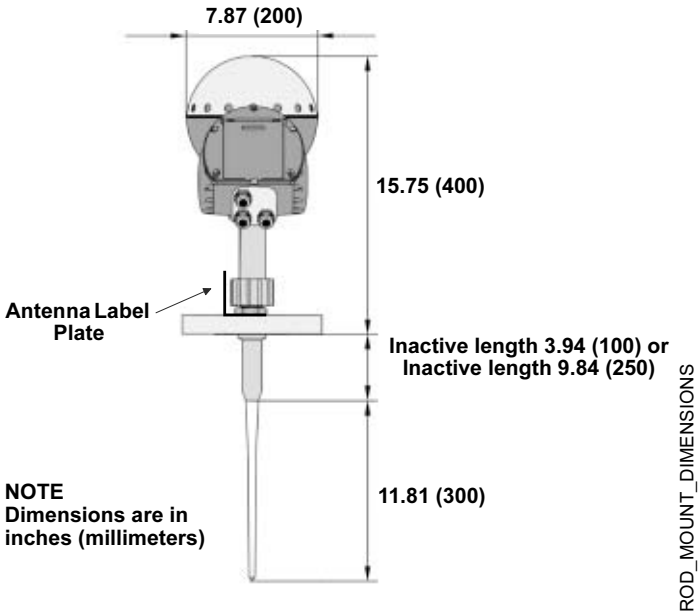


Note: 4" and 6" Process Seal Cones are not recommended for turbulent conditions

(1) Measuring range in ft (m).

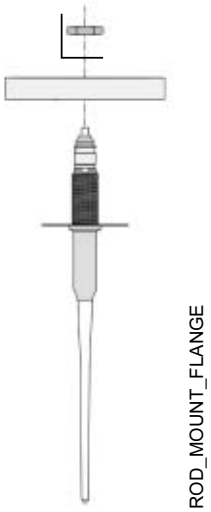
MOUNTING THE ROD ANTENNA, FLANGED VERSION

Figure 2-17. Rod Antenna Dimensions, Flanged Version



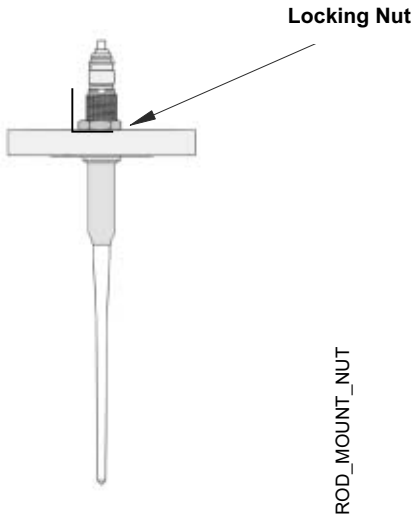
1. Mount the flange on top of the rod plate. Make sure the bottom side of the flange is flat and all parts are clean and dry.

Figure 2-18. Mount the flange



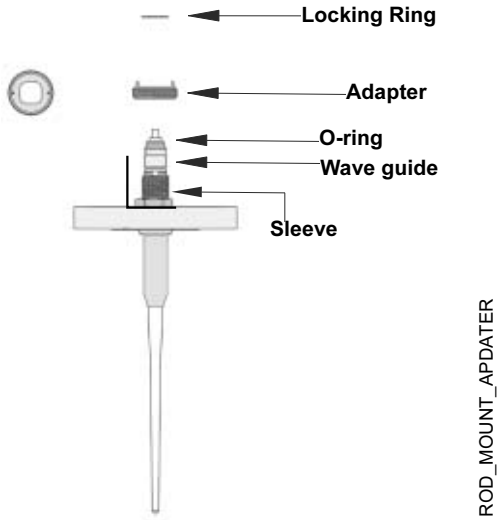
2. Secure the flange with the locking nut. Make sure the nut fits tightly to the flange.

Figure 2-19. Secure the flange with the locking nut



3. Mount the adapter on top of the sleeve.

Figure 2-20. Mounting the adapter

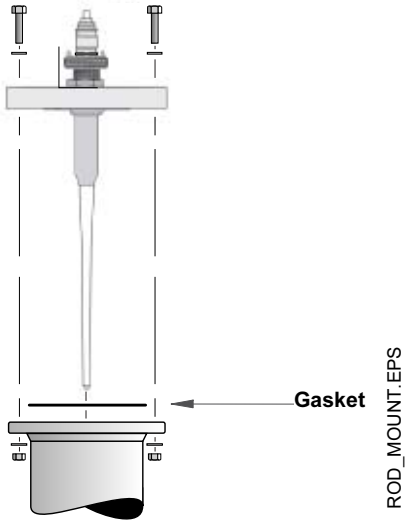


4. Secure the adapter with the locking ring.

Figure 2-21. Use the locking ring to secure the adapter

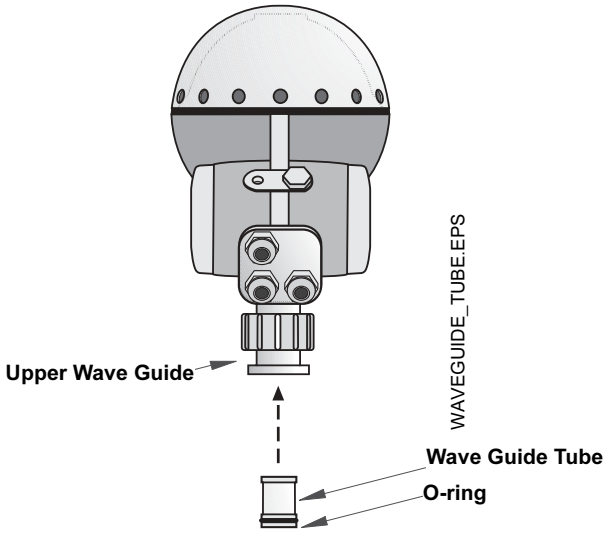
5. Carefully fit the flange and the rod antenna on the tank nozzle with an appropriate gasket in between. Tighten with screws and nuts.

Figure 2-22. Mount the flange and rod antenna on the nozzle



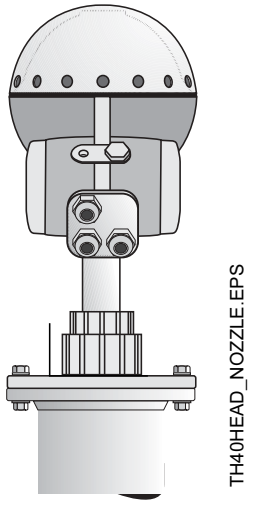
6. Insert the wave guide tube into the upper wave guide. Make sure the o-ring at the lower end of the wave guide tube is in place.

Figure 2-23. Mount the transmitter head



7. 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.

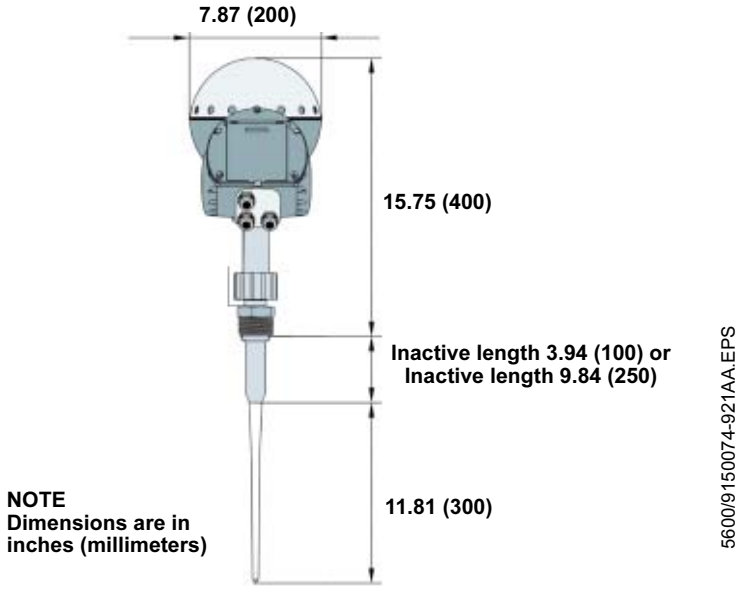
Figure 2-24. Completed mechanical installation



8. Proceed with the electrical installation.

MOUNTING THE ROD ANTENNA, THREADED VERSION

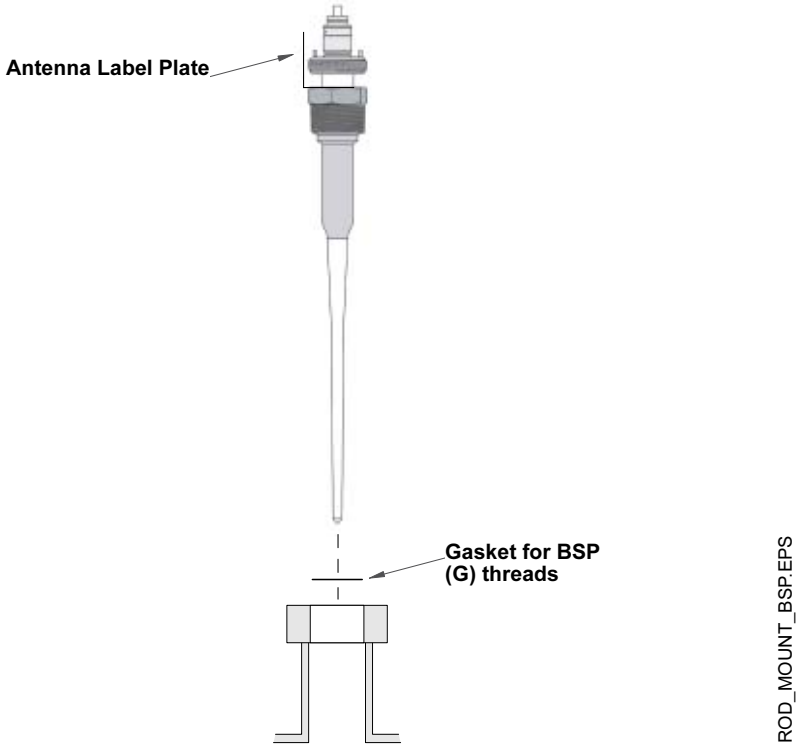
Figure 2-25. Rod Antenna Dimensions, Threaded Version



1. Carefully fit the rod antenna into the threaded nozzle and screw it in place.

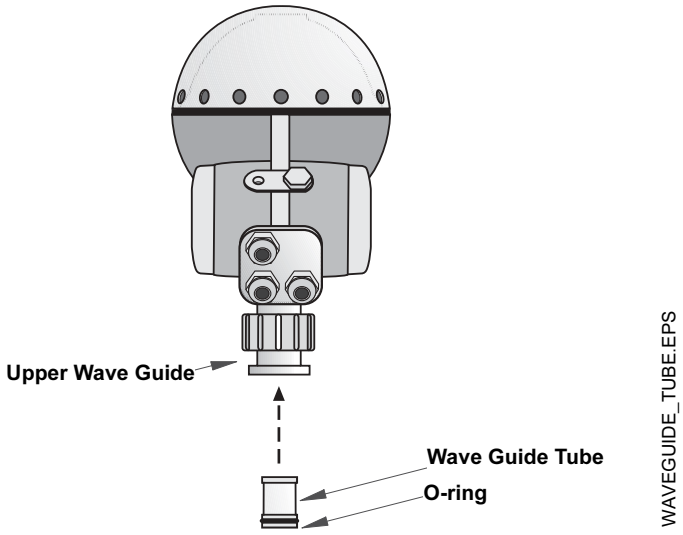
NOTE
For adapters with NPT threads, pressure-tight joints may require a sealant.

Figure 2-26. Mount the rod antenna



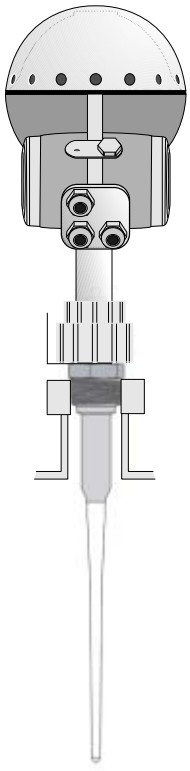
2. Insert the wave guide tube into the upper wave guide. Make sure the o-ring at the lower end of the wave guide tube is in place.

Figure 2-27. Mount the transmitter head



3. 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 2-28. Completed mechanical installation

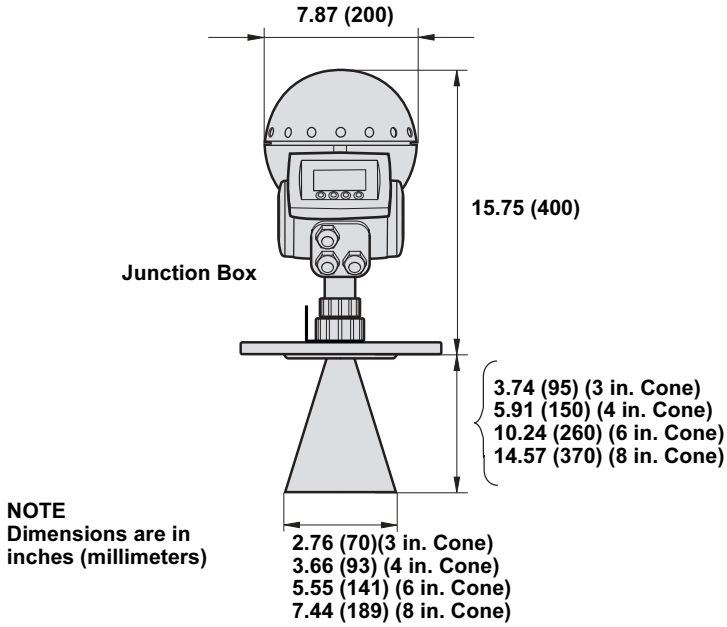


TH40HEAD_NOZZLE_BSP.EPS

4. Proceed with the electrical installation.

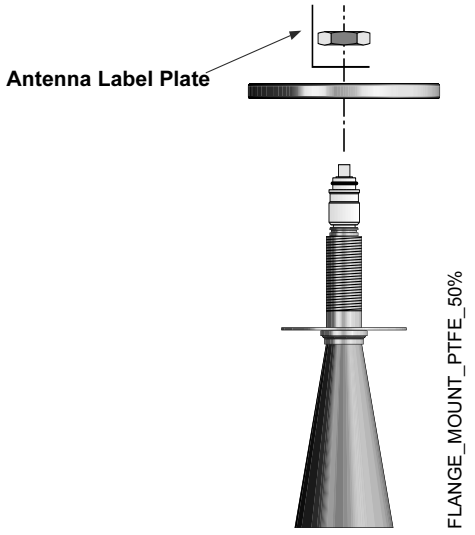
MOUNTING THE CONE ANTENNA - PTFE SEALING

Figure 2-29. Cone Antenna Dimensions



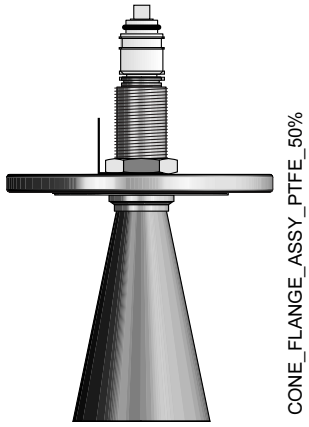
1. Mount the flange on top of the cone plate. Make sure that the bottom side of the flange is flat and all parts are clean and dry.

Figure 2-30. Mount the flange



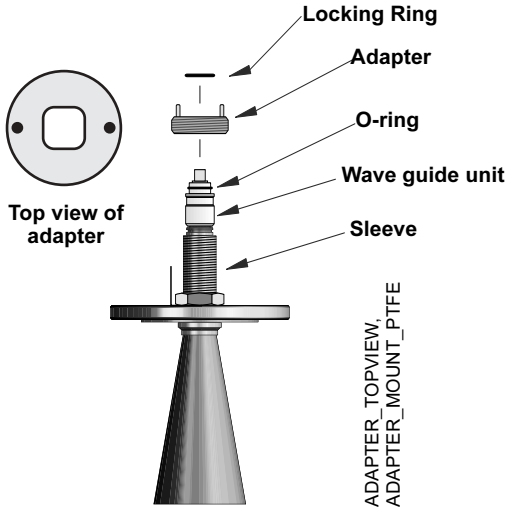
2. Secure the flange with the locking nut.
   Make sure that the nut fits tightly to the flange.

Figure 2-31. Secure the flange with the locking nut



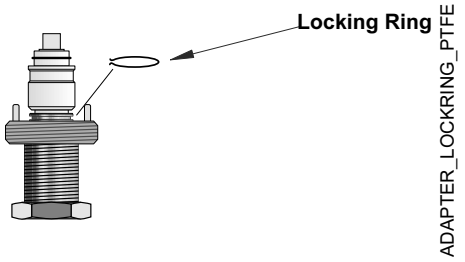
3. Mount the adapter on top of the sleeve.

Figure 2-32. Mounting the adapter



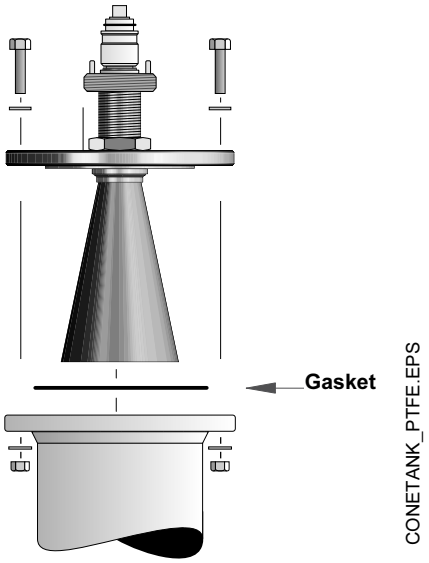
4. Secure the adapter with the locking ring.

Figure 2-33. Use the locking ring to secure the adapter



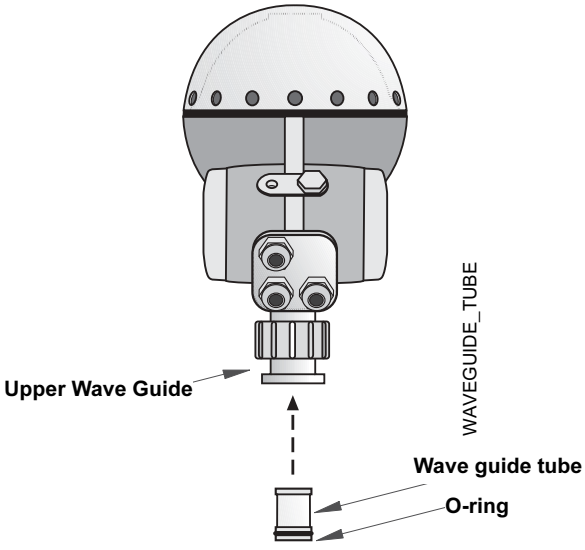
5. Carefully fit the flange and the cone antenna on the tank nozzle.
6. Tighten with screws and nuts.

Figure 2-34. Mount the flange and cone antenna on the nozzle



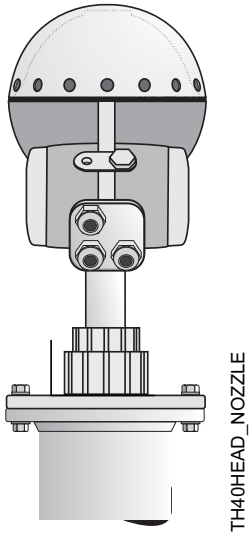
7. Insert the wave guide tube into the upper wave guide.
   Make sure the gasket at the lower end of the wave guide tube is in place.

Figure 2-35. Mount the transmitter head



8. 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.

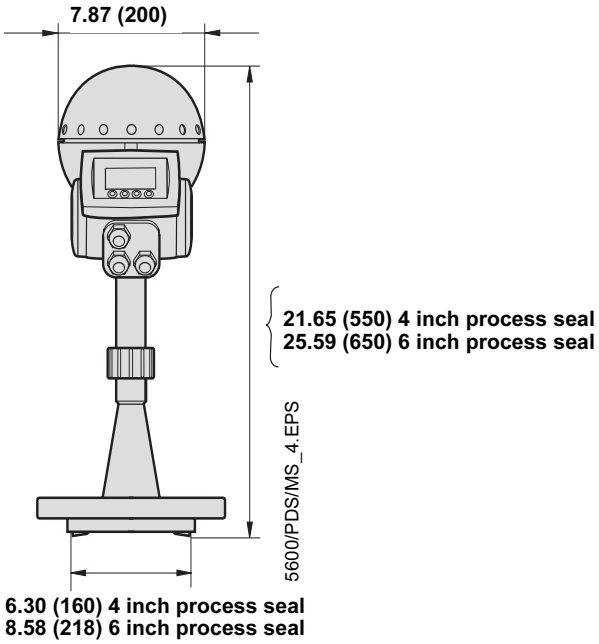
Figure 2-36. Completed mechanical installation



9. Proceed with the electrical installation.

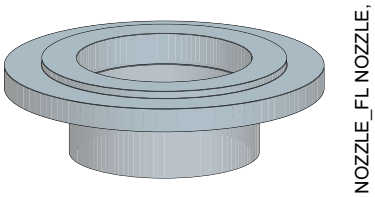
MOUNTING THE PROCESS SEAL ANTENNA

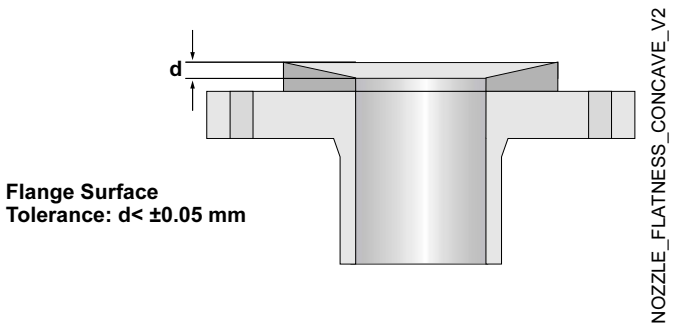
Figure 2-37. Process Seal Antenna Dimensions

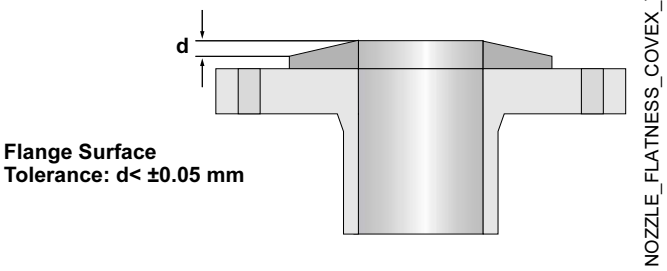


Preparations:

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







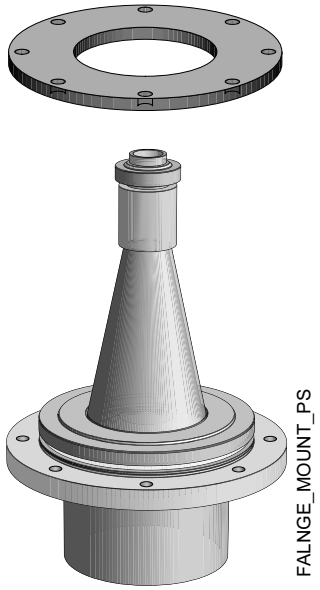
To mount the antenna do the following:

1. Place the teflon gasket supplied by Emerson Process Management on top of the nozzle and mount the antenna.

NOTE
The teflon gaskets are optimized for use with microwave emitting equipment. No other gaskets than Rosemount original may be used for Process Seal antennas.

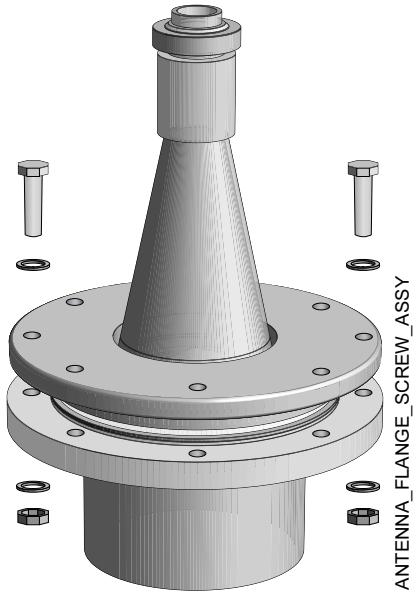
2. Put the loose flange on top of the antenna.

Figure 2-38. Put 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 2-39. Tighten the flange



NOTE
Tighten the screws carefully to the recommended torque according to Table 2-6. Tighten opposite screws in pair.

4. Insert the wave guide tube into the upper wave guide. (See Figure 2-35 on page 2-21.)
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:

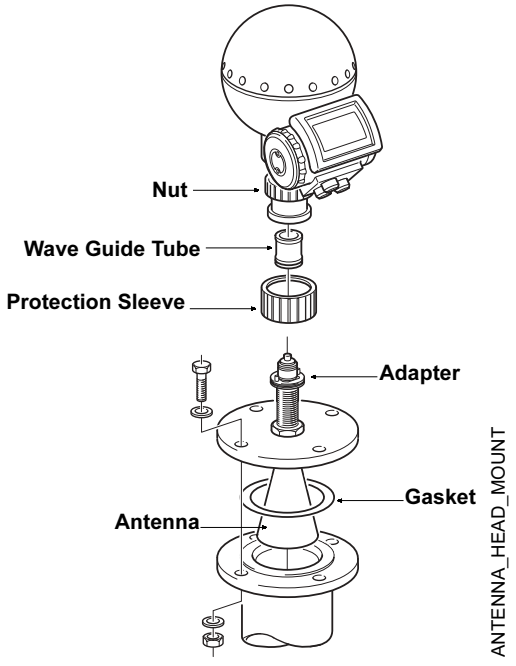
Table 2-6. Recommended Torque (Nm)

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

MOUNTING THE CONE ANTENNA IN A STILL-PIPE/BRIDLE

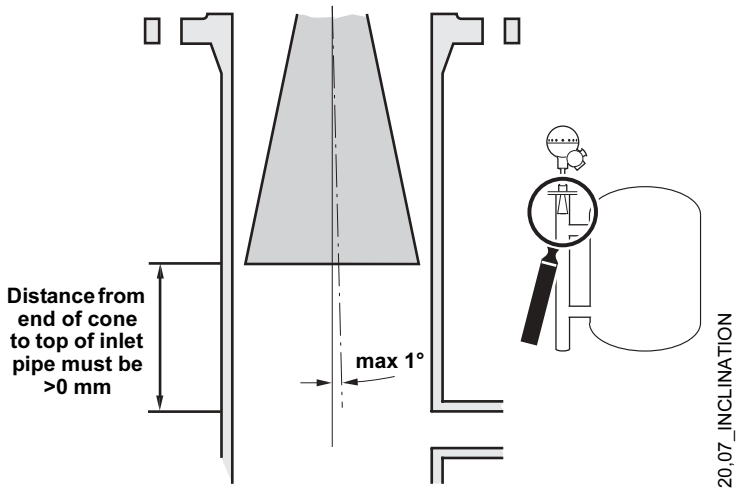
1. Mount the antenna and the transmitter head in the same way as a standard cone antenna (see “Mounting the Cone Antenna - PTFE sealing” on page 2-19).

Figure 2-40. Mounting the antenna and transmitter head



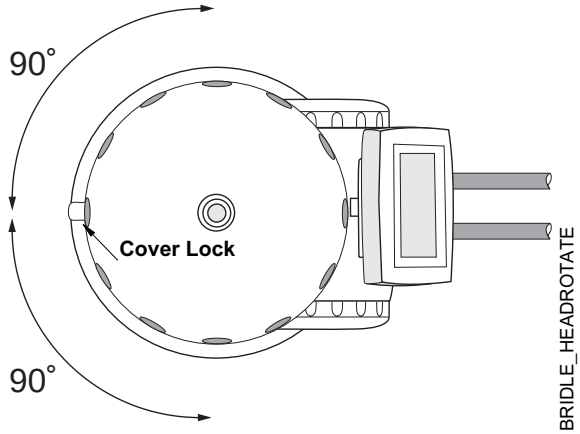
2. Make sure that the inclination of the transmitter is less than 1°.

Figure 2-41. Inclination less than 1°



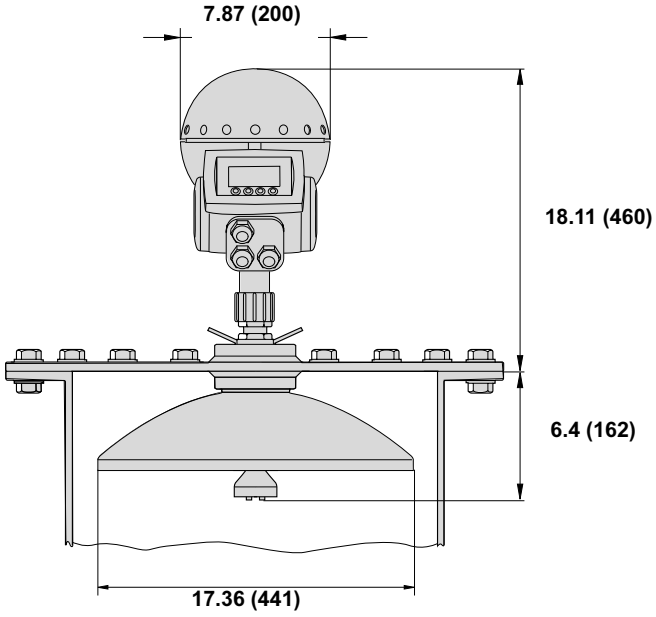
3. In order to minimize the influence of disturbing echoes from inlet and outlet pipes you may need to rotate the transmitter head 90°.

Figure 2-42. Example of rotating the transmitter head to minimize disturbing echoes



MOUNTING THE PARABOLIC ANTENNA

Figure 2-43. Parabolic Antenna Dimensions



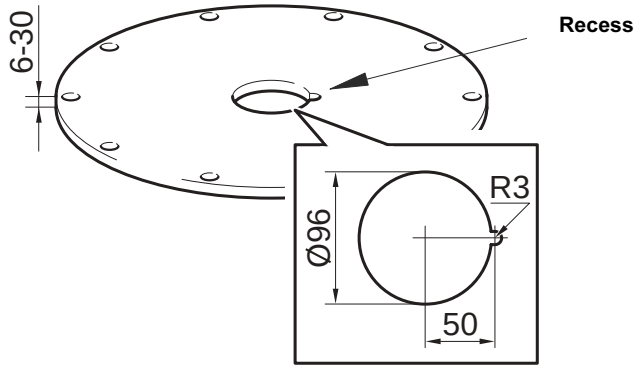
NOTE
Dimensions are in inches (millimeters)

.5600/9150074-920AA.EPS

Mounting the Flange Ball

1. The flange should be between 6 and 30 mm thick. Make sure the diameter of the hole is 96 mm.
2. Make a small recess in the flange hole.

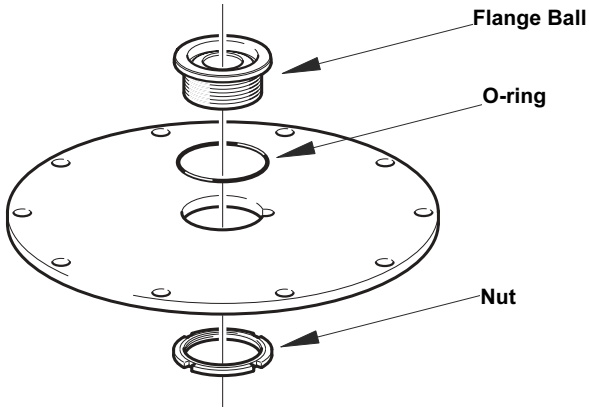
Figure 2-44. Recess Hole



PARANT_FLANGE

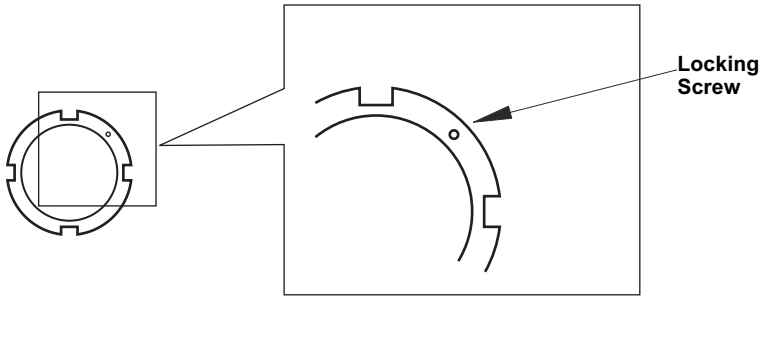
3. Put the O-ring on the flange and insert the Flange Ball into the hole. Make sure the pin on the side of the Flange Ball fits into the corresponding recess on the flange.

Figure 2-45. 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.

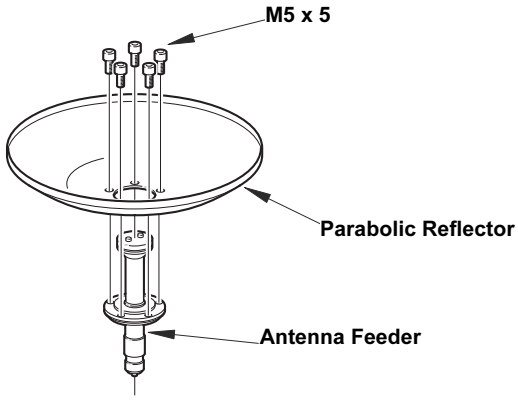
Figure 2-46. Secure the nut



Mounting the antenna

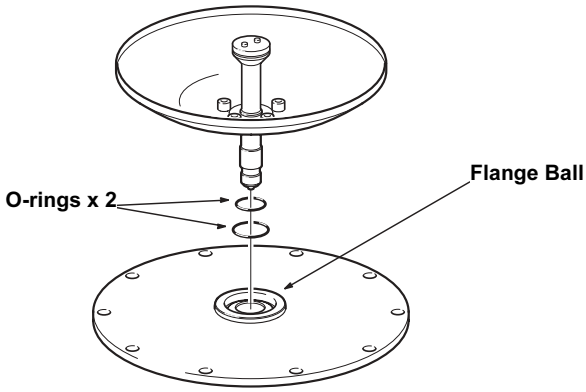
1. Fit the Parabolic Reflector to the Antenna Feeder and mount the five M5 screws that were delivered by Emerson Process Management.

Figure 2-47. Mount the five M5 screw



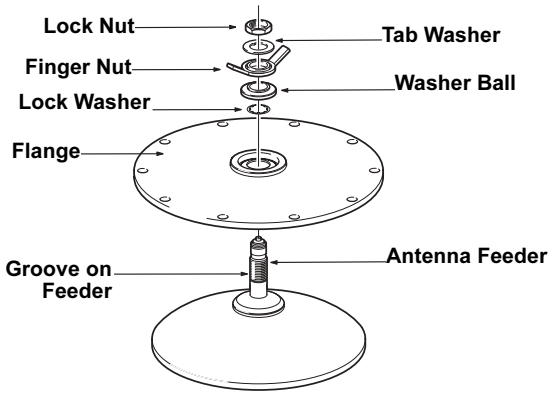
2. Tighten the screws.
3. Put the two O-rings in the grooves on the upper surface of the Flange Ball.

Figure 2-48. Put the two O-rings in the grooves



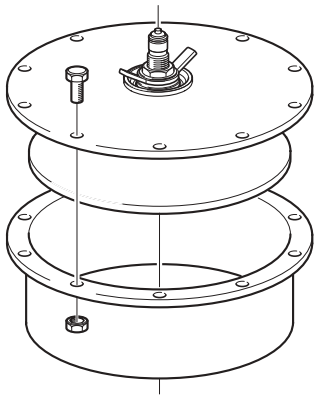
4. Turn the flange around and mount the antenna feeder on the flange. Mount the washers and nuts.

Figure 2-49. Mount washers and nuts



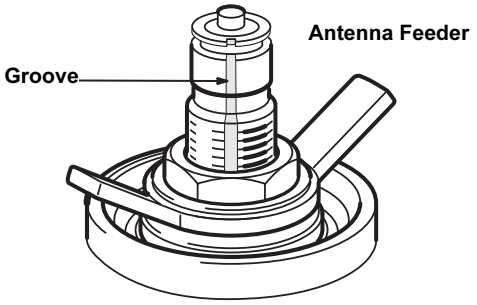
5. Tighten the Finger Nut and the Lock Nut loosely.
6. Place the antenna on the tank nozzle and tighten the flange screws.

Figure 2-50. Tighten the flange screws



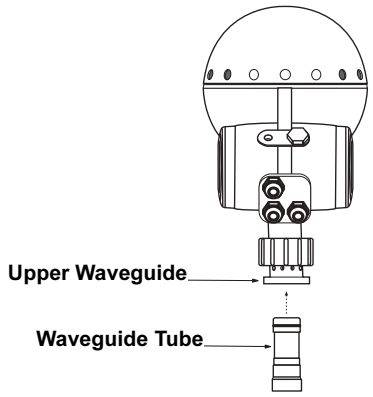
7. Rotate the antenna so the groove on the Antenna Feeder is directed 90° to the tank wall.

Figure 2-51. Groove on Antenna Feeder



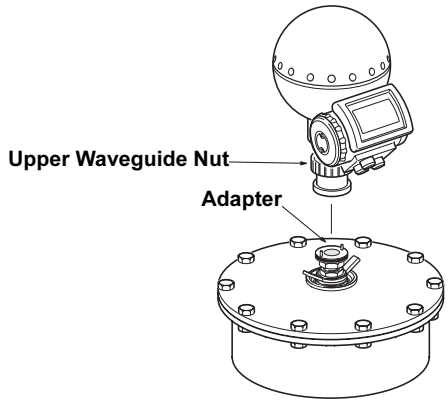
8. Tighten the Finger Nut and the Lock Nut.
9. Mount the adapter on top of the antenna feeder. Tighten the Adapter Nut loosely so the transmitter head can be properly aligned.
   Normally the antenna should be mounted with inclination 0°. However, in some applications, for example solid products, a small inclination of the antenna may improve the performance. This may also be the case if there are disturbing echoes from objects in the tank.
10. Insert the Waveguide Tube into the Upper Waveguide.

Figure 2-52. Insert the Waveguide Tube into the Upper Waveguide



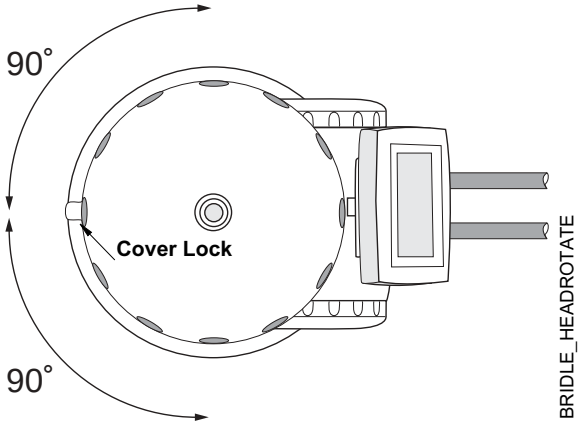
11. Carefully mount the Transmitter Head onto the adapter and tighten the Upper Waveguide Nut by hand. Make sure that the guide pins on the adapter fits into the holes on the Upper Waveguide.

Figure 2-53. Mount the Transmitter



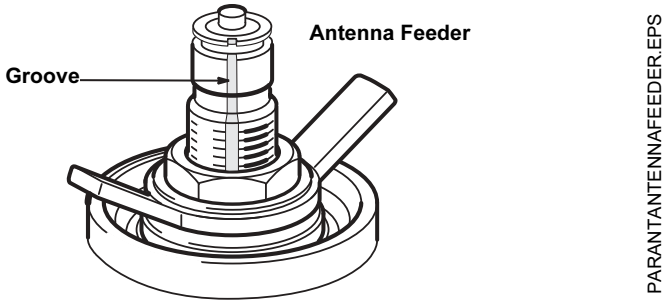
12. Rotate the transmitter head so the cover locking is directed 90° towards the groove along the Antenna Feeder.

Figure 2-54. Example of rotating the transmitter head to minimize disturbing echoes



13. Tighten the Adapter Nut firmly, as improper alignment may cause poor measurement performance.

Figure 2-55. Rotate the transmitter head

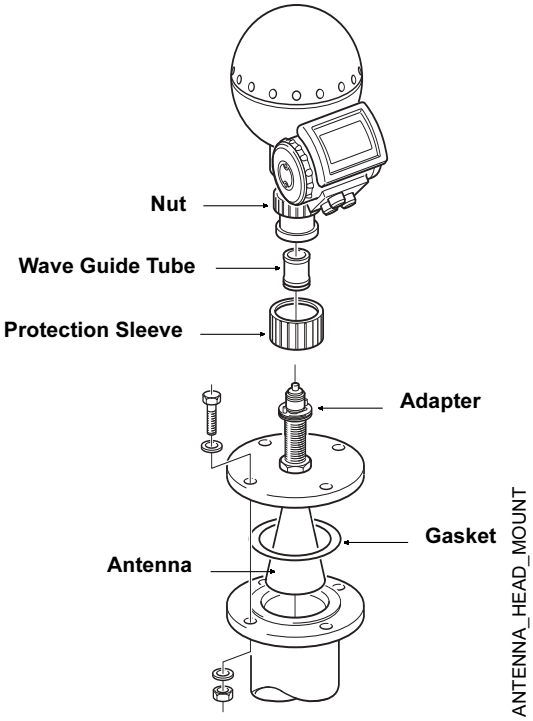


14. When the antenna inclination is adjusted to obtain optimum performance, tighten the finger nut and the lock nut firmly. Secure by folding the tab washer over the lock nut.

MOUNTING THE EXTENDED CONE ANTENNA

1. 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 2-19).

Figure 2-56. 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 2-34 and page 2-35 for more information on how to set the Hold Off distance and the Tank Connection Length for a Cone Extension antenna. See also Section 5: Configuration for more information about these parameters.

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.

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 the table below.
- 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.

Antenna Type	3 inch diameter = 68mm	4 inch diameter = 90mm	6 inch diameter = 138mm
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

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 inch diameter = 68mm	4 inch diameter = 90mm	6 inch diameter = 138mm
TCL_{ext}/PTFE	0.489	0.482	0.477
TCL_{ext}/Quartz	0.529	0.522	0.517

Setting the Hold Off Distance

To set a new Hold Off distance do the following:

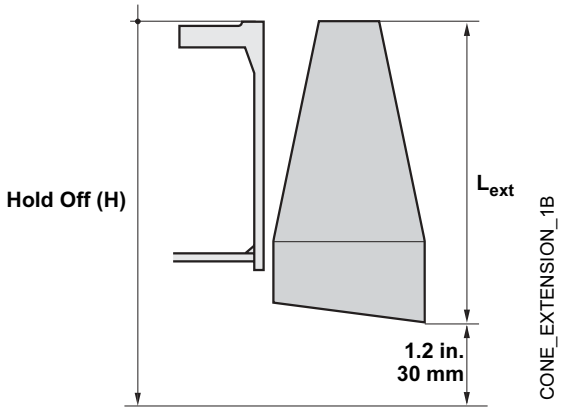
1. Start the configuration software.
2. In the Hold Off/New input field type the desired Hold Off distance. Use the following formula in order to calculate the appropriate Hold Off (H) distance:

   H=1.2 inches + L_{ext} or (H=0.03 meters + L_{ext})

where:

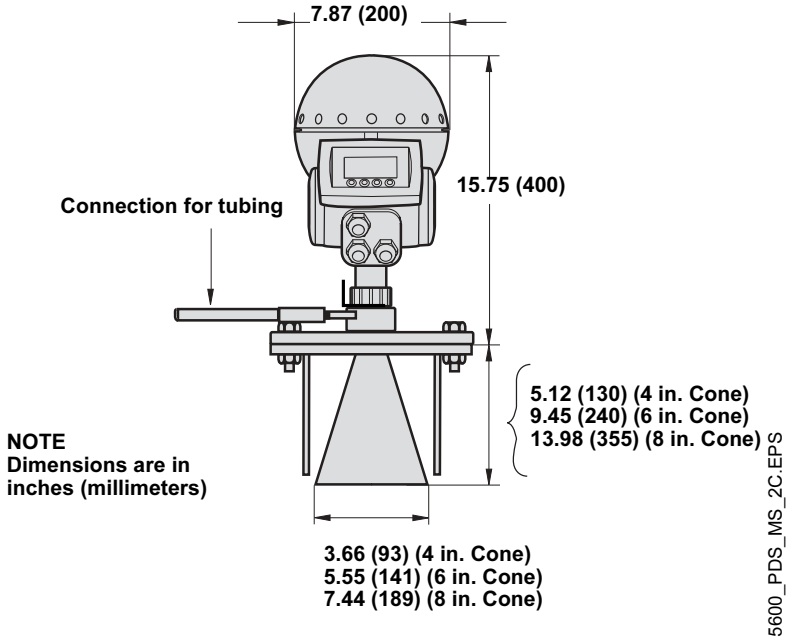
- L_{ext} is the length of the extended cone antenna

Figure 2-57. Extended cone antenna



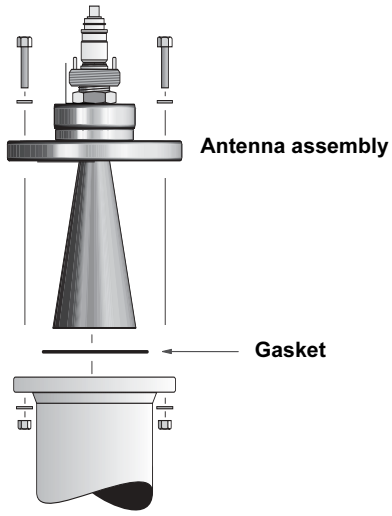
MOUNTING THE CONE ANTENNA WITH FLUSHING CONNECTIONS

Figure 2-58. Cone Antenna with Integrated Flushing Connection Dimensions



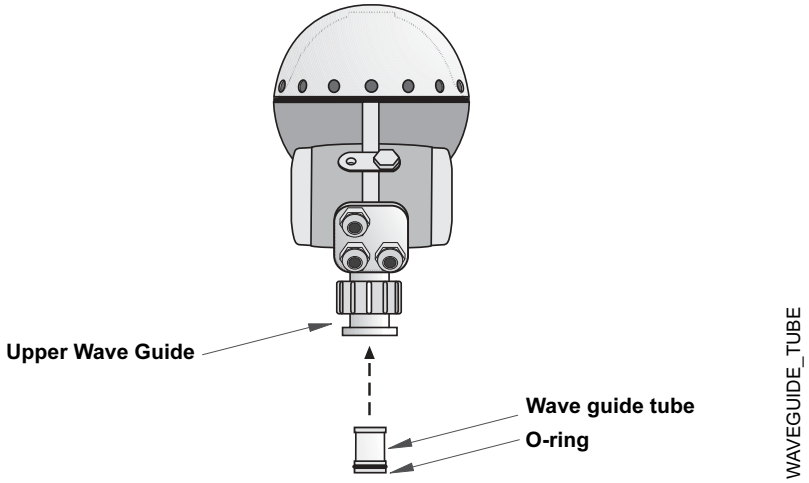
1. The flange is a part of the antenna assembly and welded to the cone antenna. Carefully fit the antenna assembly and appropriate gasket on the tank nozzle.

Figure 2-59. Mount the flushing cone antenna on the nozzle



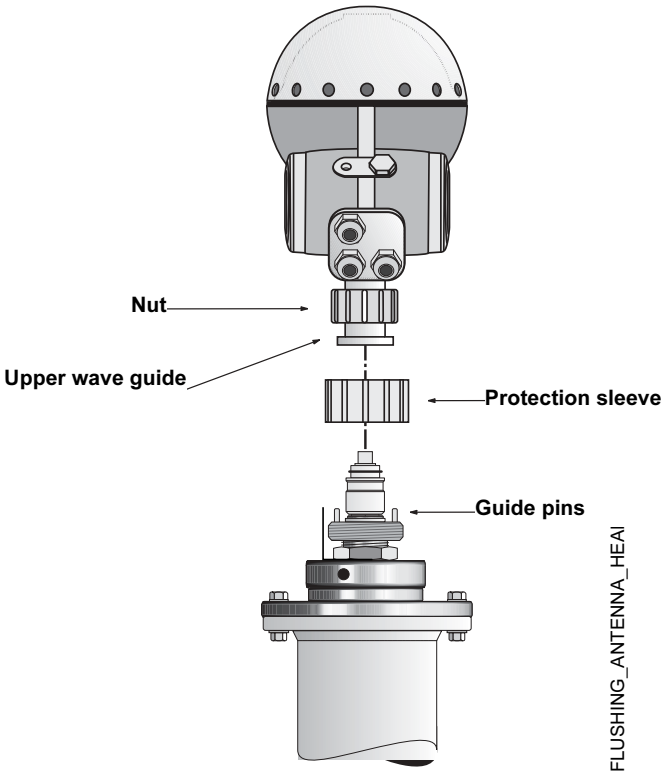
2. Insert the wave guide tube into the upper wave guide.
   Make sure the o-ring at the lower end of the wave guide tube is in place.

Figure 2-60. Insert wave guide tube



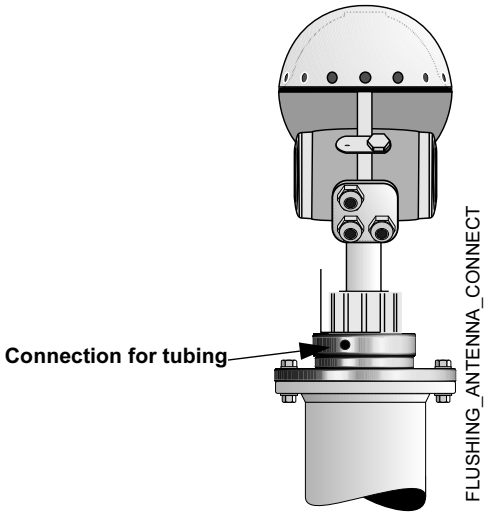
3. Mount the transmitter head and tighten the nut. Check that the guide pins on the adapter enter the corresponding grooves on the upper wave guide.

Figure 2-61. Mount 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, or
   - steam.

Figure 2-62. Connect tubing to antenna



Section 3 Electrical Installation

Safety Messages . . . . . page 3-1
System Overview . . . . . page 3-2
Cables . . . . . page 3-3
Power Supply . . . . . page 3-3
Grounding . . . . . page 3-4
External Connections . . . . . page 3-5

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 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.

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

The Foundation fieldbus can be connected to either the intrinsically safe (EExi) or the non-intrinsically safe (EExe) junction box.

Display Unit

Connect the intrinsically safe Rosemount 2210 Remote Display Unit to terminals 5, 6, 7 and ground in the intrinsically safe (EExi) junction box.

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

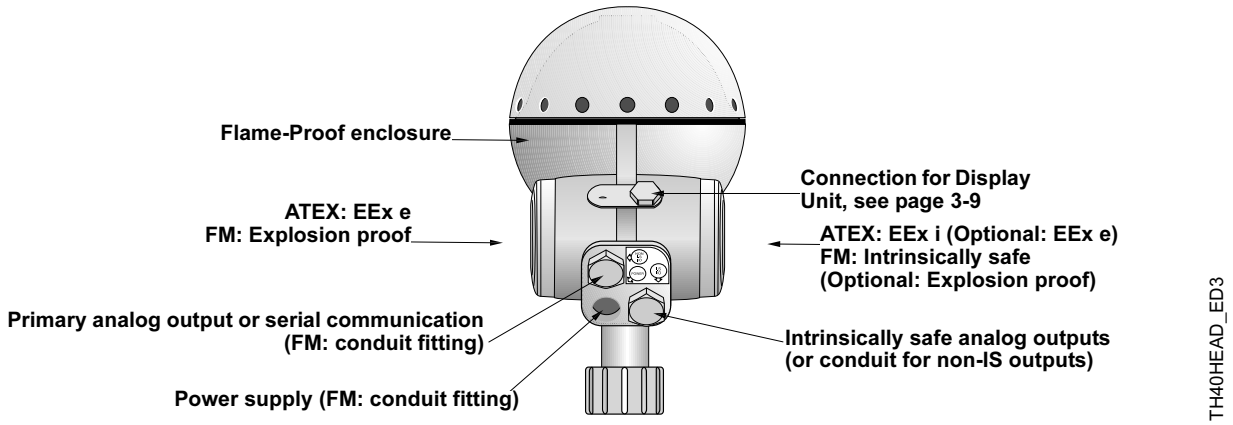
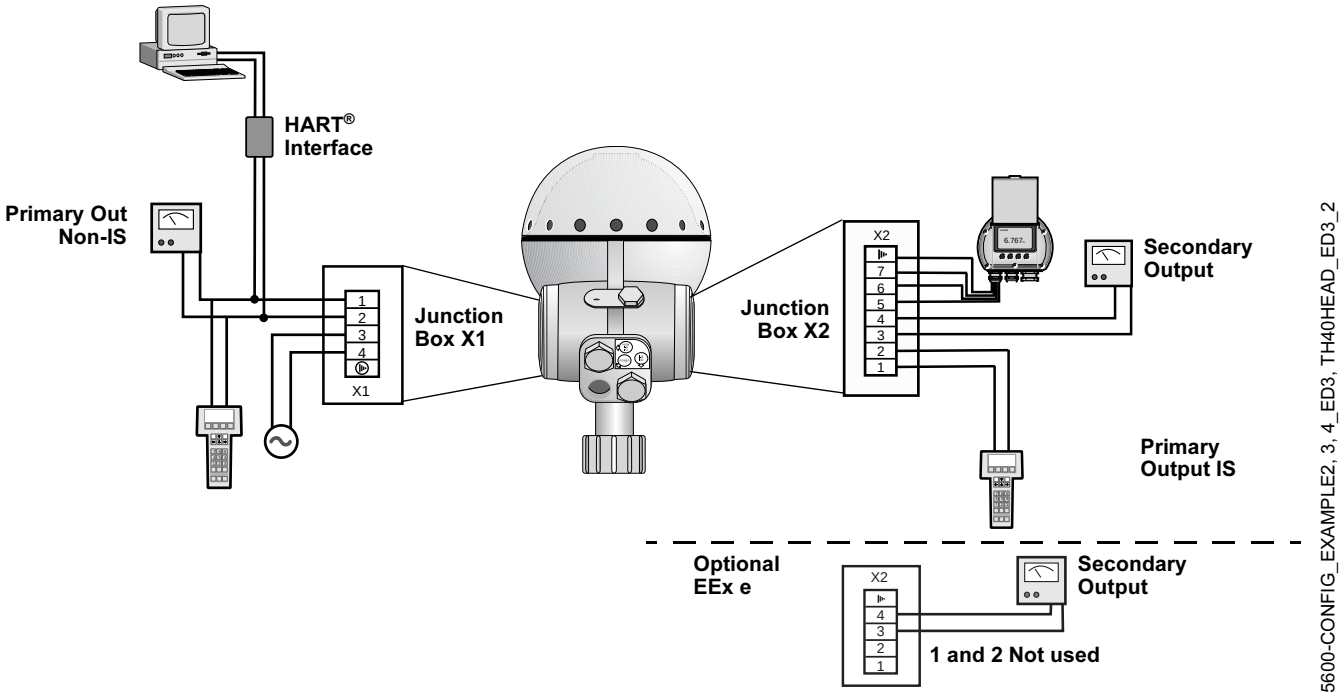


Figure 3-2. Schematic illustration of the Rosemount 5600 transmitter connection



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 instrinsically 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 mm^2 (AWG 20) for analog outputs and serial communication. Use min. 0.5 mm^2 cable for power supply.

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.

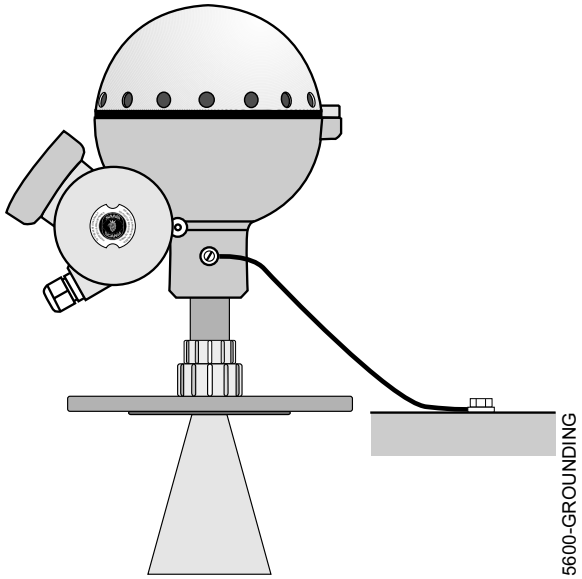
GROUNDING

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 also the Special Safety Instruction.

Figure 3-3. Grounding connection



FM

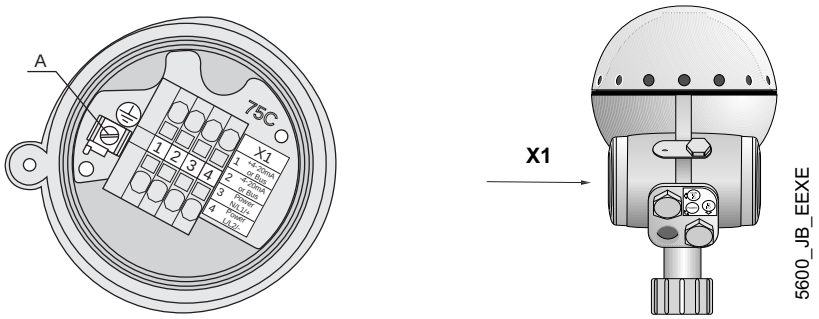
Grounding is accomplished through the conduit pipes.

EXTERNAL CONNECTIONS

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

Non-Intrinsically Safe Junction Box - EEx e

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



1-2 Non-intrinsically safe HART/4-20 mA primary analog output or non-intrinsically safe FOUNDATION fieldbus.

3-4 Power supply input

A Electrical safety ground terminal

NOTE:
Redundant when the transmitter is grounded according to ATEX.

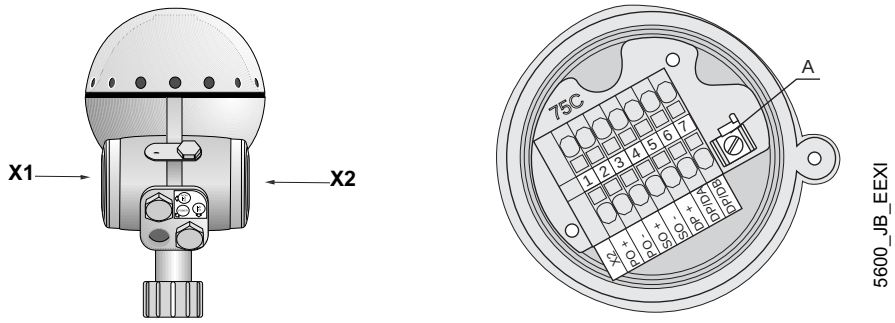
Cable shield
Connect the shield to the cable glands.

If conduit fittings are used no cable shield is used.

Intrinsically Safe Junction Box - EEx i

This Junction Box is for intrinsically safe connections and for connection of the Display Unit.

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



1-2 Intrinsically safe HART/4-20 mA primary analog output or intrinsically safe FOUNDATION fieldbus

3-4 Secondary analog output

5-7 Display Unit (6-7 also used for Sensor Bus see page 6-3)

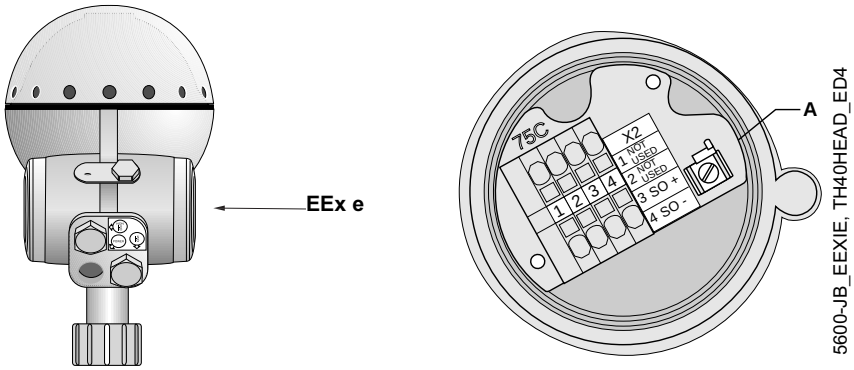
A Ground terminal for Display Unit

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)

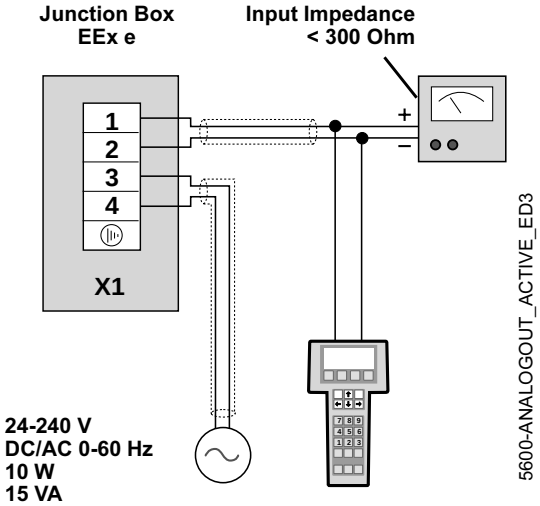
Cable shield
Connect the shield to the cable glands.
If conduit fittings are used no cable shield is used.

Connecting HART devices

Active output (internal loop supply)

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

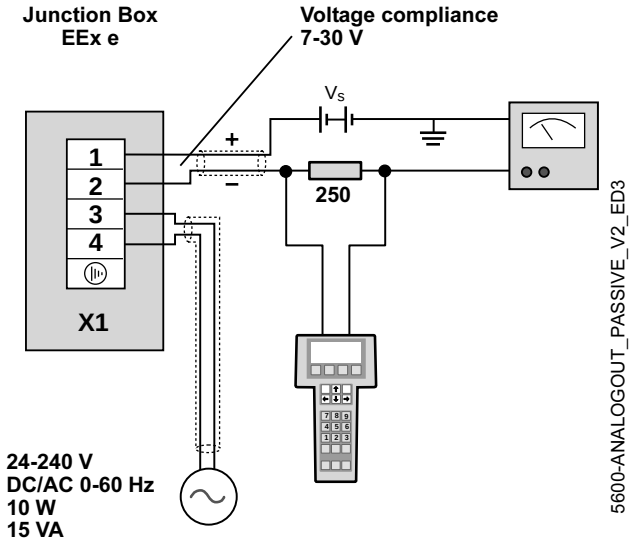
Figure 3-7. Typical hand-held communicator active output (primary)



Passive output (external loop supply)

A hand-held 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.

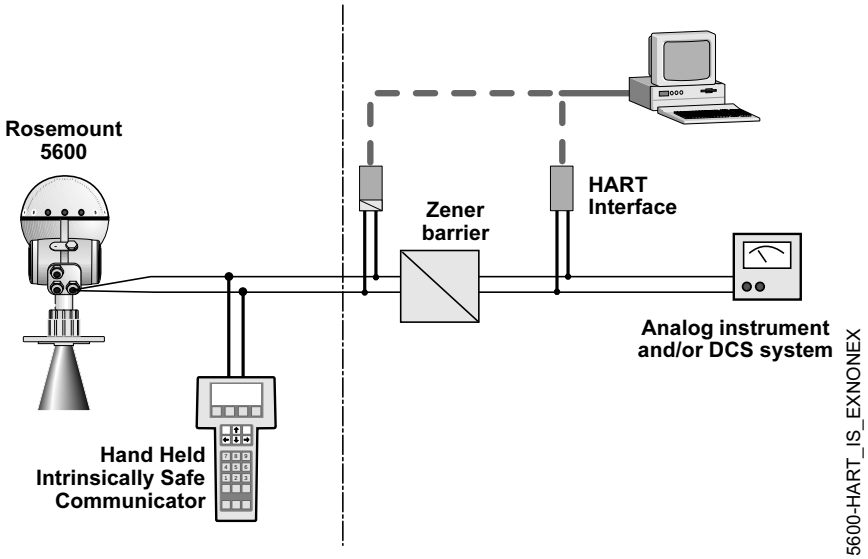
Figure 3-8. Typical hand-held Communicator (passive output)



Intrinsically safe conditions

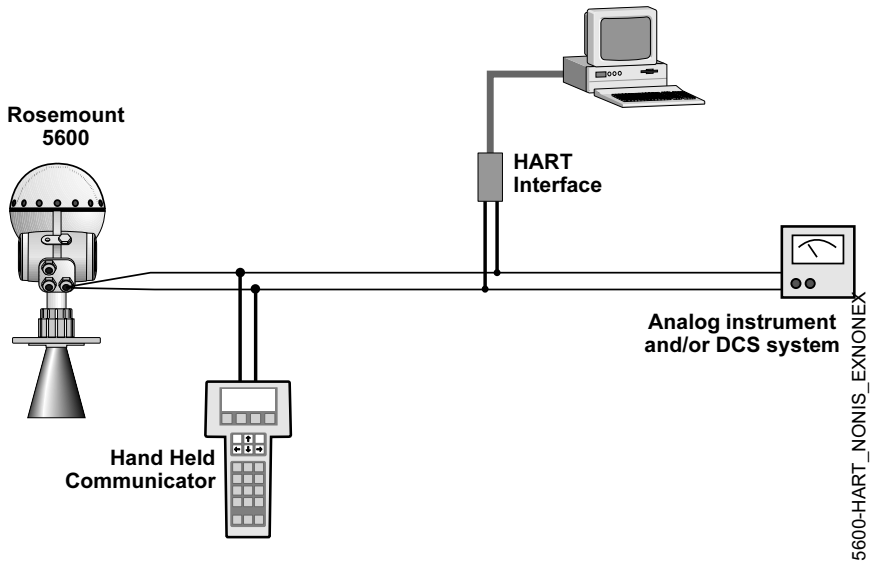
A hand-held intrinsically safe communicator can be connected in the hazardous area. The HART interface must be connected via a zener barrier in the safe area. It is also possible to use an intrinsically safe Ex classed HART interface which has a built in Zener barrier.

Figure 3-9. Typical hand-held Communicator connection in intrinsically safe conditions



Non-Intrinsically safe conditions

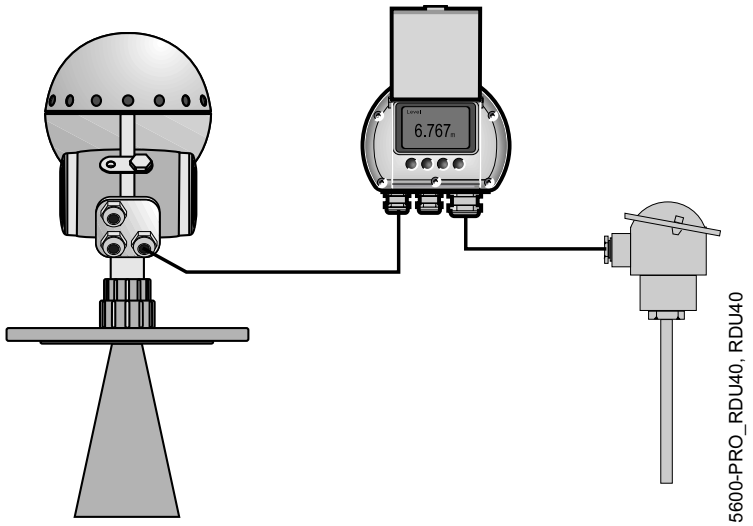
Figure 3-10. Typical Hand-held Communicator connection in Non-intrinsically safe conditions



Connecting the 2210 Display Unit

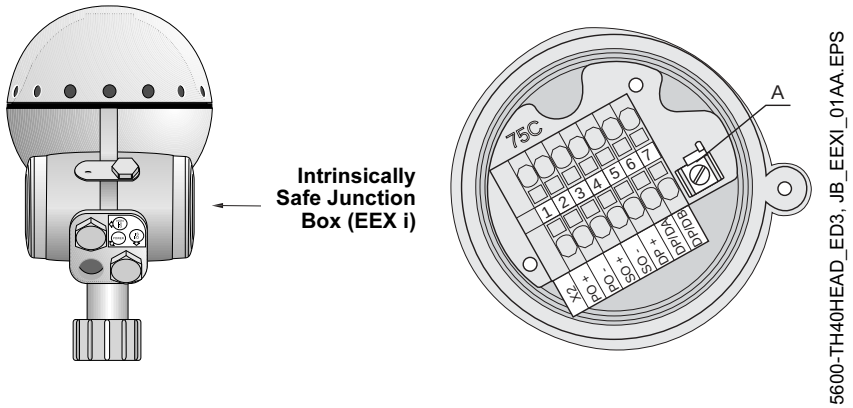
The Rosemount 2210 Display Unit can be factory mounted on the 5600 Series Radar Level Transmitter enclosure or remotely mounted. The Display Unit can be used for configuration of the transmitter as well as for displaying tank data (see Section 4: Operation for information on how to operate the transmitter by using the Display Unit).

Figure 3-11. Rosemount 2210 Display Unit Connection



The Display Unit is connected to the Intrinsically Safe Junction Box on the front of the transmitter head:

Figure 3-12. Intrinsically safe junction box



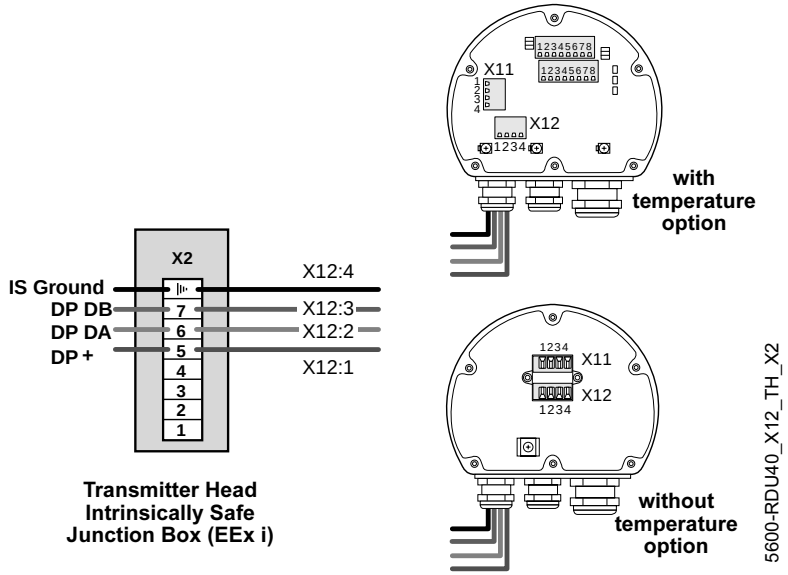
The Display Unit is offered in three versions:

- Mounted on the transmitter
- Remote mounted up to 330 ft (100m)
- Remote mounted with Temperature option card in it. This card allows for up to 6 temperature sensors to be hooked up. See “Temperature measurement” on page 3-11 for temperature connections.

Connect the Display Unit to the X2 terminal in the Intrinsically Safe Junction Box by the following four wires:

- Grounding wire to the ground terminal
- Signal wires to terminal 6 and 7
- Supply voltage to terminal 5

Figure 3-13. Connection of junction box with and without temperature option



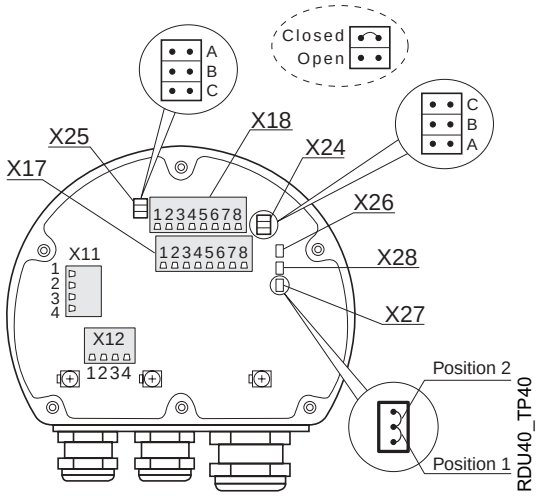
Connecting the Rosemount 2210 Display Unit

1. For power supply connect a wire between terminal block X2, position 5 and terminal block X12, position 1.
2. For communication connect a wire between terminal block X2, position 6 and terminal block X12, position 2, and a wire between terminal block X2 position 7 and terminal block X12 position 3.
3. Finally for grounding connect a wire from the IS Ground screw in the X2 terminal compartment to terminal block X12 position 4.

Temperature measurement

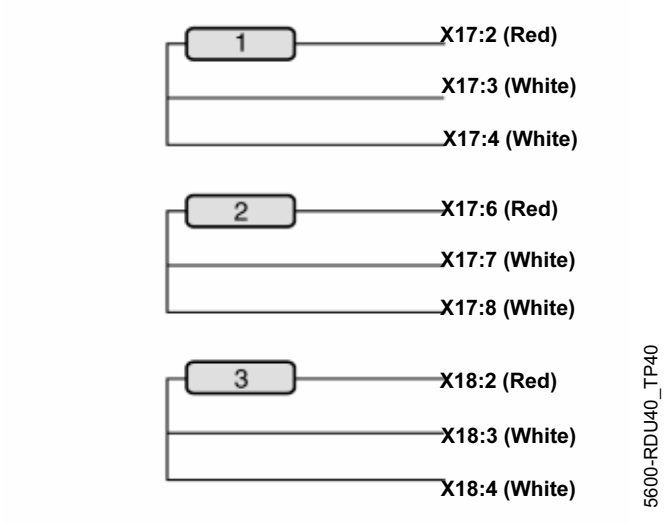
For temperature measurements you can use 1-3 3-wire RTD spot elements or 1-6 3-wire RTDs with common return. The sensors are connected to nozzle X17 and X18 on the optional TP40 board. Depending on the type of sensor that is used, different jumpers must be set on nozzles X24, X25, X26, X27 and X28, see Figure 3-14, Figure 3-15, and Figure 3-16.

Figure 3-14. Overview of the TP40 board



Spot elements 3-wire independent

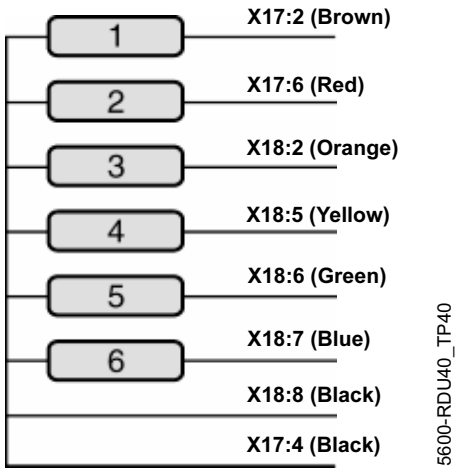
Figure 3-15. Connecting the sensors - Spot Elements



Jumper Settings	
X24	A, B, C open
X25	A, B, C closed
X26	position 1
X27	position 1
X28	position 1

Multiple spot elements 3-wire common return

Figure 3-16. Connecting the Sensors - Multiple Spot Elements



Jumper Settings	
X24	A, B, C closed
X25	A, B, C closed
X26	position 2
X27	position 2
X28	position 2

Section 4 Operation

Safety Messages . . . . . page 4-1
Overview . . . . . page 4-1
AMS . . . . . page 4-1
PC Configuration Software Radar Master . . . . . page 4-2
Hand-Held Communicator . . . . . page 4-4
Rosemount 2210 Display Unit . . . . . page 4-8

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.

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. The preferred user interface for the configuration is the Rosemount Radar Master software. Configuration can also be performed using the 2210 Display Unit, 275 HART Communicator, 375 Field Communicator, AMS, DeltaV, or others. Limited support for various configuration parameters may apply when using certain configuration tools.

AMS

The Rosemount 5600 Radar Level transmitter uses AMS as a configuration tool. Access http://www.emersonprocess.com/ams/ for literature related to configuring the Rosemount 5600 Radar Level transmitter.

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.

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.

Main Configuration Icons

Wizard

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

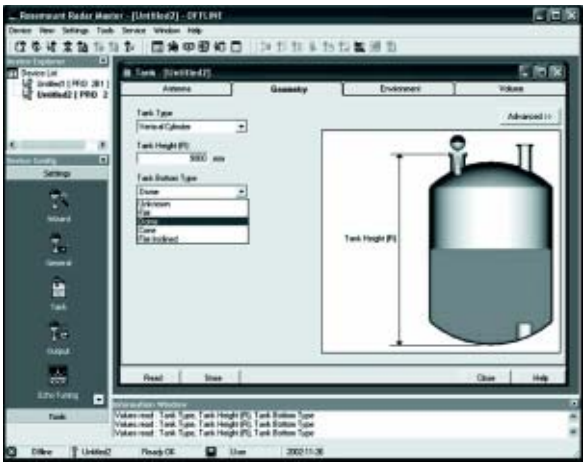
General

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

Tank

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

Figure 4-1. Radar Master Tank Configuration



5600/MAINWINDOWS WITH TANKGEOMETRY.TIF

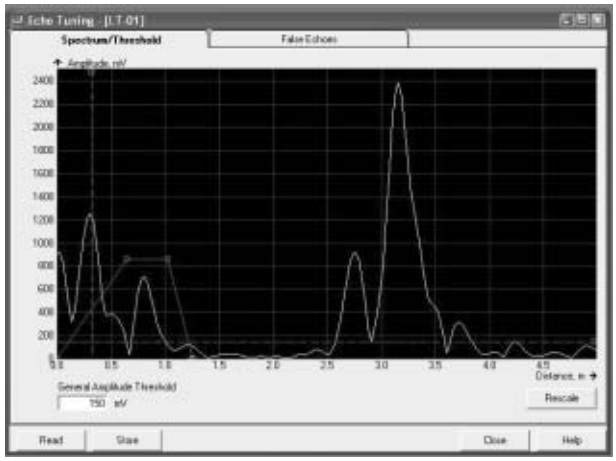
Output

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

Echo Tuning

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

Figure 4-2. Radar Master Echo Tuning



5600/ECHO TUNING.TIF

HAND-HELD COMMUNICATOR

275/0275J01A.EPS

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

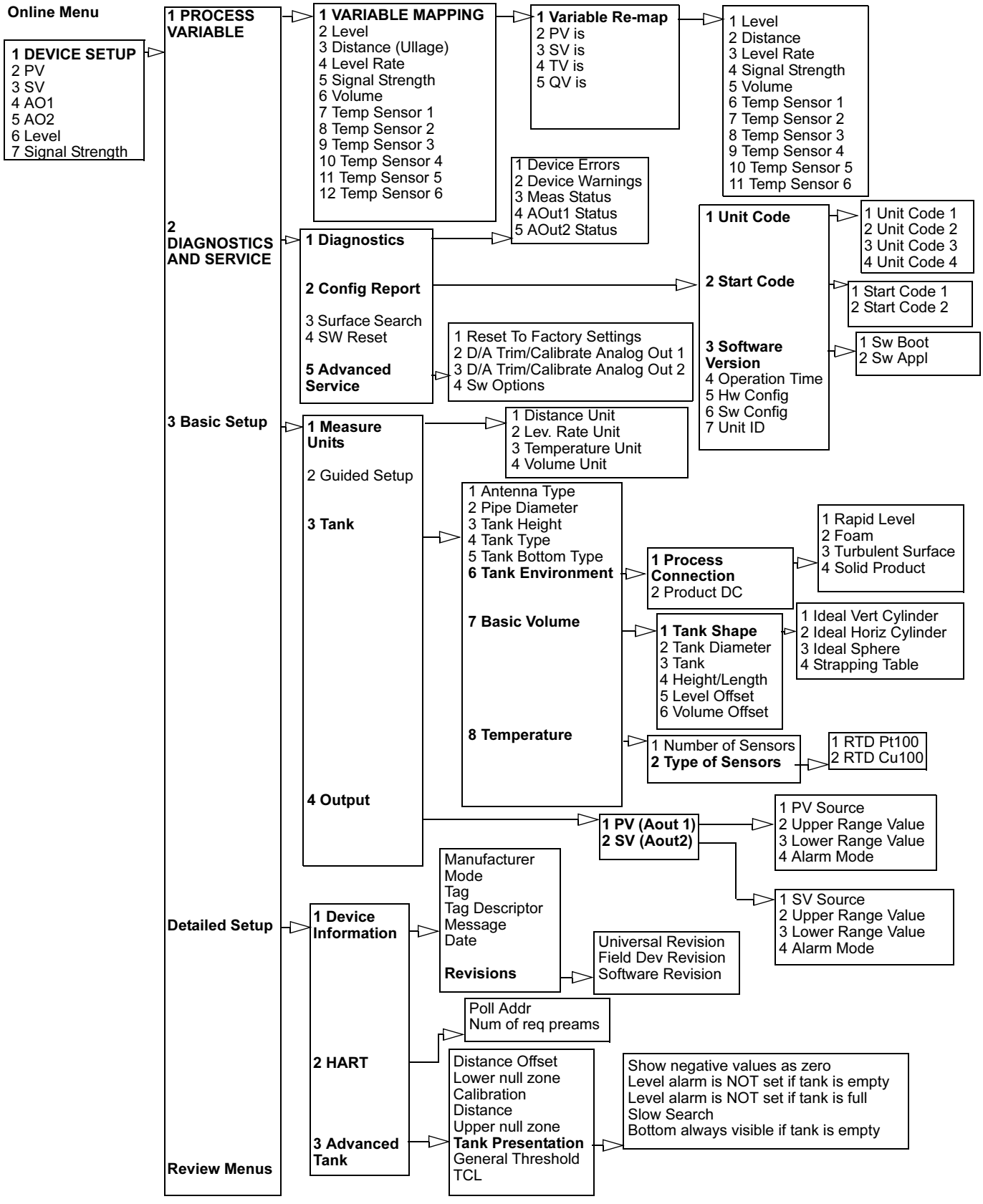
To commission, connect the transmitter and the Communicator. Make sure the instruments in the loop are installed according to intrinsically-safe or nonincendive field wiring practices before connecting a communication in an explosive atmosphere. Connect Communicator leads at any termination point in 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 5600 Series.

When using a hand-held 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 and Figure 3-10 on page 3-9 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 00809-0100-4276.

Figure 4-3. HART Communicator Menu Tree for the Rosemount 5600 Radar Level Transmitter



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

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.

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.

Using a HART Communicator

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

Level Configuration Example

To configure the Rosemount 5600 to report LEVEL (analog output is linear to level) with the transmitter wired as on page 3-7, connect the hand-held communicator as shown.

Set Transmitter Units

HART Comm	1, 3, 2, 1

Set transmitter units:

- ft
- m
- in
- cm
- mm

Set Reference Transmitter Height

HART Comm	1, 3, 4

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

Set 4 and 20 mA Points

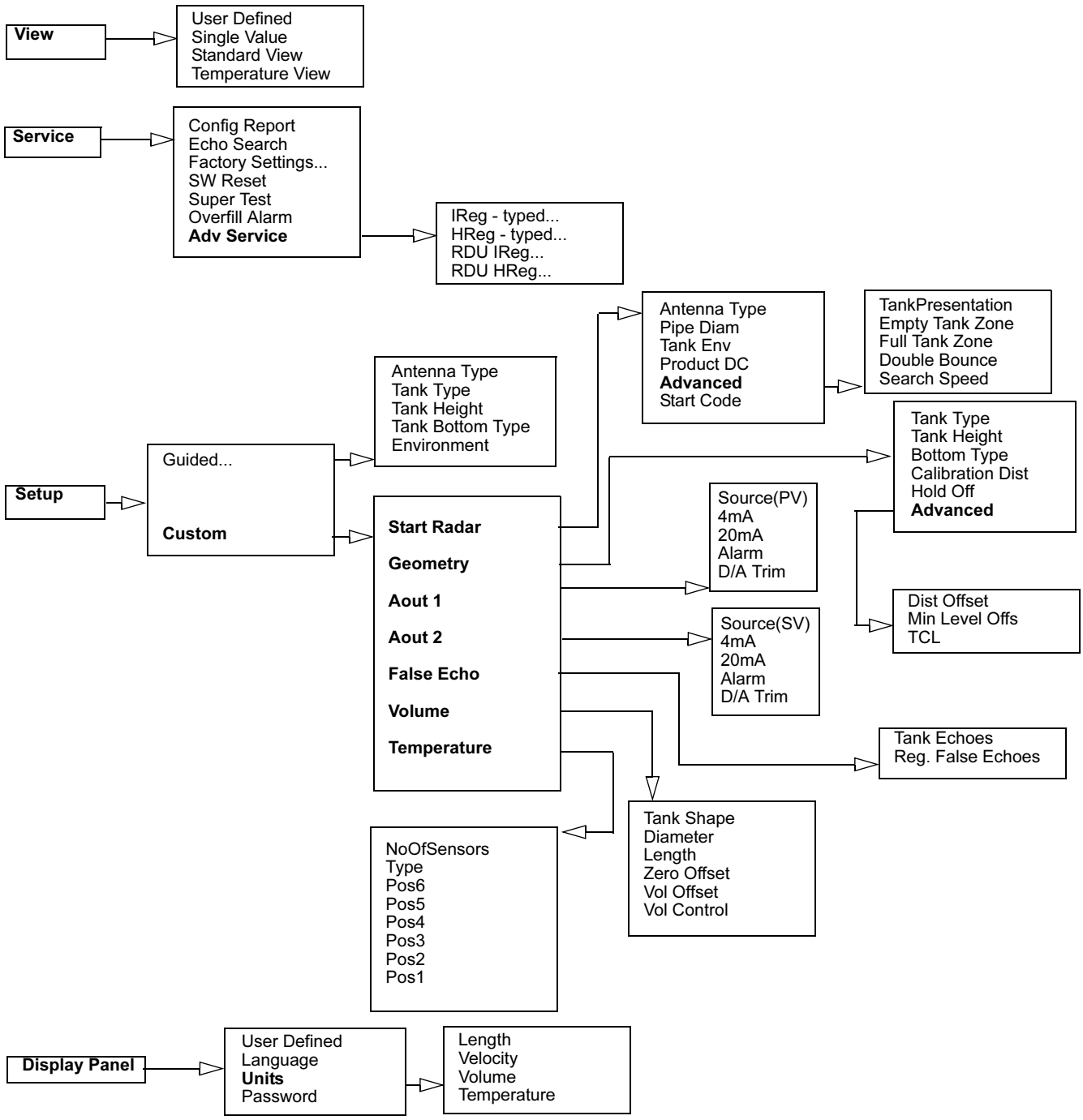
HART Comm	1, 3, 3

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).

ROSEMOUNT 2210 DISPLAY UNIT

Figure 4-4. Rosemount 2210 Display Unit Menu Tree



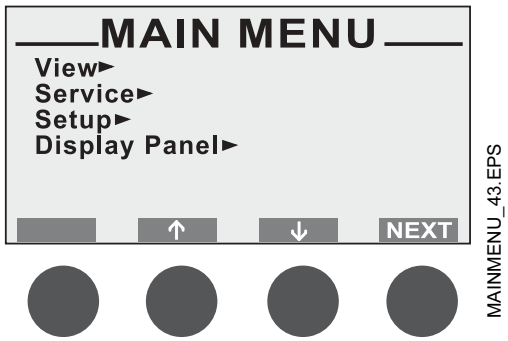
Operation

The Rosemount 2210 Display unit can be used for configuration as well as for viewing tank data. The four softkeys allow you to navigate through the different menus, and to select various functions for service and configuration. (See Section 2: Mechanical Installation for information on how to connect the 2210 Display Unit.)

If you leave the Display Unit in Service or Setup mode without pushing any button for 10 minutes (set in User Defined), it is automatically switched to View mode, presenting the same measurement variable that was displayed last time View mode was open.

The main menu contains the following options:

Figure 4-5. Main Menu



- The **View** option allows you to view level data and signal strength.
- The **Service** option allows you to view configuration status, edit holding registers, reset holding registers to factory values, do a software reset or to start a search for the surface echo.
- The **Setup** option allows you to configure a transmitter.
- The **Display Panel** option allows you to set units for measured values, to set language and to change the user password.

Adjusting the LCD contrast

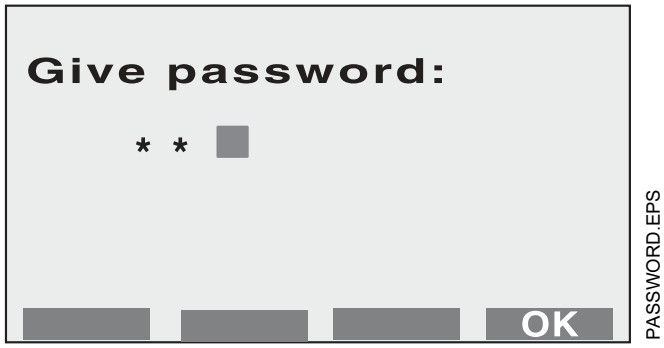
The LCD contrast can be increased by simultaneously pressing the two buttons on the right-hand side. Press the two left-hand buttons to decrease the contrast. It takes approximately 10 seconds to adjust from minimum to maximum display panel contrast.

Entering a Password

Some windows are protected by a password. The password is entered by pressing the three blank softkeys in a certain order (maximum 12 characters). Each figure refers to a particular softkey, as illustrated.

As default the password is blank, i.e. you can open a password protected window merely by pressing the **OK** button. In order to use the password protection you have to set the password as described in Display Setup and below.

Figure 4-6. Password screen

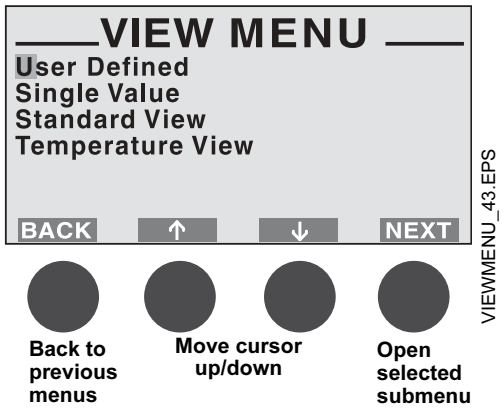


Example: If the password is “231”, you start by pressing the second key, then the third key and finally the first softkey. You can change the password at any time by opening the **Display Panel** menu.

Softkeys

The softkeys have different meanings depending on which window that is open. Use the arrow buttons to move the cursor up and down (or sideways in some windows). These buttons are also used for changing figures when you are asked to enter a value.

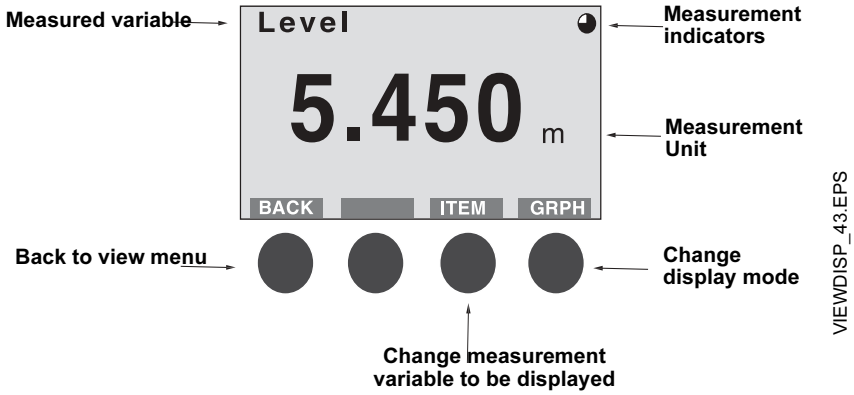
Figure 4-7. View Menu



Presentation of measured data

When viewing measurement data, you can use the softkeys to move between different views as illustrated below. There are also status indicators showing you that measurements are performed, and whether these measurements are valid or not.

Figure 4-8. View Display

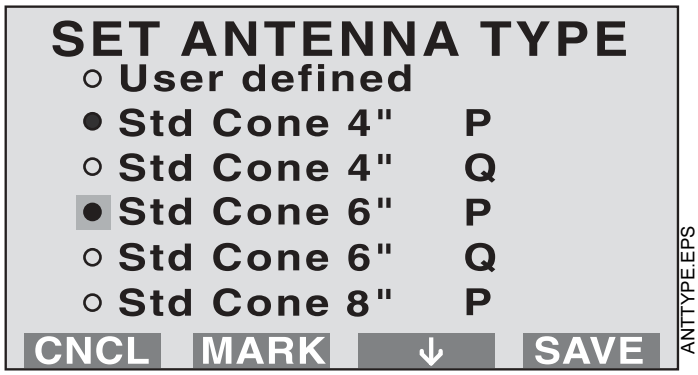


Selecting between different alternatives

When you configure the 5600, the softkeys will take on definitions which allow you to select specific items and to save the current settings.

When the cursor has reached the last item, it jumps back to the first item by pressing the down arrow button.

Figure 4-9. Set antenna type



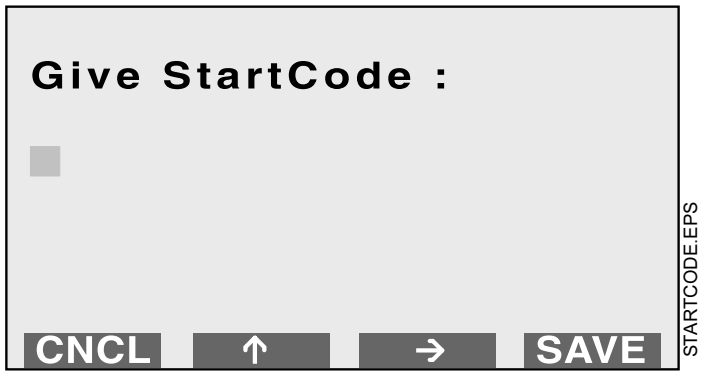
NOTE
When the word **MARK** appears, it must be used to save the selected value.

Entering numerical values

Use the up arrow button to enter the desired value. Each click increases the digital value one step from zero to nine and back to zero.

The **Next** button is to move the cursor to the next digit. When the cursor reaches the last digit, select **NEXT** to move back to the first digit again.

Figure 4-10. Give Startcode

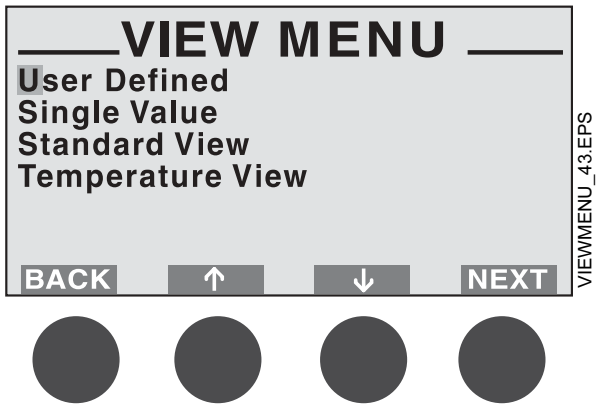


Viewing Level Data

The View Menu

the **View Menu** includes options for viewing tank and transmitter related data:

Figure 4-11. View Menu



- Press **Back** to return the main menu.
- Use the arrows to move the cursor up or down.
- Press **Next** to open the selected submenu.

User Defined

Select the **User Defined** submenu to view measured data according to defined settings. The fist time this submenu is accessed you will be asked to define your preferred settings.

Single Value

Select **Single Value** to view measured data.

Press **Item** to choose between the following:

- Level
- Ullage (distance)
- Level Rate
- Signal Strength
- Volume

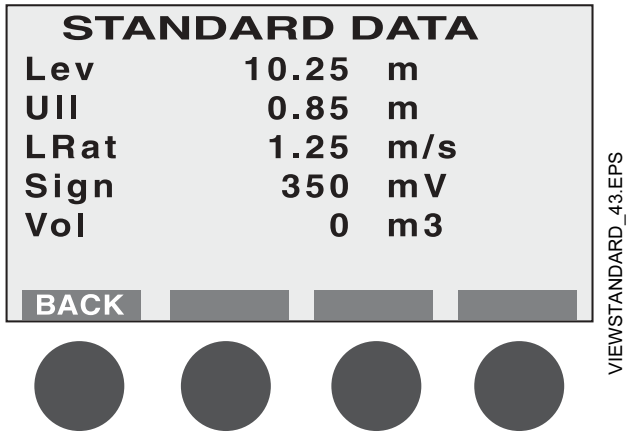
To switch between the following display modes, select **GRPH:**

- Numerical - measured data is presented as a value
- Bar graph - the measured value is presented in a bar graph showing the current value.

Standard View

Select **Standard View** from the **View** menu to view a list of measured variables.

Figure 4-12. Standard View menu



Temperature View

Select **Temperature View** from the **View** menu to view measured temperatures from the connected temperature sensors.

Display Setup

The Display Setup is used to set presentation units, language, and password in the 2210 Display only. If you do not want to change the default settings, skip this step and go to Custom Setup. To configure the display panel, access the Display Setup Window by selecting the Display Panel option from the Main Menu and pressing **Next**.

User Defined View

1. Select **User Defined** and press **Next**.
2. The number of selections above decides if the next choice is to select type or mode. If one item was selected, select type and press **Next**. If two or more items were selected, select mode and press **Next**. For the toggling mode also select how long each item will be shown and press **Next**.
3. Select units for the selected items and press **Next**.
4. Set time out in minutes for the display to return to default view and press **Save**.

Language

1. Select **Language** and press **Next**.
2. Move the cursor to the preferred language and press **Mark**.
3. Save your choice by pressing **Save**. The display will return to the view mode.

Units

1. Select the **Units** menu and press **Next**.
2. Select **Length**, **Velocity**, **Volume,** or **Temperature** and press **Next**. the measurement unit to be used for presentation of data and click **Save**.

Password

To change your display panel password select the **Password** option and press the button. This password must be entered in order to be able to change the transmitter configuration. Follow the procedure Entering a Password.

Installing a Rosemount 5600 Radar Level Transmitter

1. Select **Setup** from the Main Menu and choose one of the options to configure the transmitter.

NOTE
The Setup dialog is automatically opened when a transmitter is started for the first time.

Guided Setup
The Guided Setup option contains the basic steps for configuration of the 5600 Radar Level Transmitter.

Custom Setup
Use the Custom Setup option if you for example want to include options for volume calculations and disturbance echo handling.

Guided Setup

The **Guided Setup** includes the basic steps to start the transmitter. This option gives a guided step by step through a sequence of configuration windows. The windows are automatically opened in a predefined order. To configure a new radar transmitter using the Guided Setup option do the following:

1. Choose Setup from the Main Menu.
2. Enter your password and press the button. The password is defined by clicking the first three softkeys in a given order. An asterisk is shown for each key that is pressed.
3. Select “Guided...” from the Setup Menu and press **Next.**
4. Set the Antenna Type. Press **Save** to move the cursor to the desired antenna, and click **Mark** to select it (see Figure 4-9 on page 4-11).
   Std = standard;
   P = PTFE tank sealing;
   Q = quartz sealing;
   HP = factory use only;
   C = factory use only.

   Finish by pressing **Save**. Note that you have to scroll the list using the arrows to find all available antenna types.

NOTE
Dimensions must be entered in meters. Values may be displayed in metric or english units.

5. Set the **Tank Type**. Press the arrow button to move the cursor to the desired Tank Type, and click **Mark** to select it. See Section 5: Configuration for details about Tank Types.
6. Calibrate the **Tank Height** (R). The **Tank Height** (R) is defined as the distance between the upper reference point (specified by the Distance Offset G) and the lower reference point (zero level). Finish by pressing **Save**.
7. If the Tank Type is selected so that a Tank Bottom Type is necessary to define, press the arrow button to move the cursor to the desired Tank Bottom Type. Click **Mark** to select it.
8. Choose the **Tank Environment** option. Select appropriate surface conditions. Mark the options that describes the conditions in your tank by selecting **Mark**. See Section 5: Configuration for details about Environment settings.

NOTE
See **“Tank Geometry” on page 5-4** for further information on how to set the tank geometry parameters.

Custom Setup

To configure a radar transmitter using the **Custom Setup** option, do the following:

1. Choose **Setup** from the Main Menu.
2. Enter your password and press **OK**.
3. Select **Custom** from the Setup Menu and press **Next**.
4. Select the **Start Radar** option from the Custom Setup menu.
   a. Choose the **Antenna Type** option from the **Start Radar** menu. Examples of antennas available are Rod, Cone, Process Seal, and Parabolic.
   b. Select the type of antenna that is mounted on the transmitter and click **Save** to open the Start Radar menu.
   c. Choose the **Tank Environment** option. Select appropriate surface conditions. Mark the options that describes the conditions in your tank by selecting **Mark**.

NOTE
For best performance choose only if applicable and not more than two options, see page 5-8 for more information about the different settings.

   d. Press **Save** to store the current setting.
   e. Choose the **Product DC** option. The product dielectric constant defines how well the product will reflect microwaves. See the product data sheet (00813-0100-4024) for the correct value. Mark the appropriate range and press the button. When Unknown is used, the transmitter can not be optimized for the product.
   f. Choose the **Start Code** option. Confirm your **Start Code** by selecting **Save**. The transmitter is delivered with a start code that enables the ordered software options. If you wish to change the set of available options, contact your local representative for a new start code. Check the list of enabled options. Contact your local representative if you would like to add one or more software options. If the list is correct confirm by pressing **OK**.
   g. Press **Back** to return to the **Custom Setup** menu. The **Advanced** option allows you to make advanced setup of Tank Environment database registers (for trained personnel only).

5. Select the **Geometry** option from the Custom Setup menu.
   a. Select **Tank Type** and press **Next**. Select Tank Shape option and press **Save**.
   b. Select **Tank Height** and press **Next**.The **Tank Height** (R) is defined as the distance between the upper reference point and the lower reference point (zero level). Set the **Tank Height** and press **Save**.
   c. Select **Bottom Type** and press **Next**. Select Tank Bottom option and press **Save**.
   d. 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. Set the **Calibration Distance** and press **Save**.

NOTE
See **"Tank Geometry" on page 5-4** for further information on how to set the tank geometry parameters.

   e. Select the **Advanced** menu and press **Next**. Set the **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.
   f. Set the **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, i.e. the 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 that the Minimum Level Offset can not be negative.
   g. Set the **Tank Connection Length** (TCL). The **Tank Connection Length** (TCL) parameter is entered for antenna type User Defined only. For standard antennas the TCL value is set automatically.

6. Select the **Analog Out 1** option from the Custom Setup menu (Optional). If the transmitter is equipped with an analog output, the range of the output is automatically calibrated to match the tank calibration (Distance Offset and Tank Height). If you want to change this setting, do the following:
   a. Enter **Source**. Available options are: level, ullage, level rate, signal strength, and volume (T1-T6 and Average Liquid Temp. optional).
   b. Enter the analog output values that correspond to **4 mA** and **20 mA**, respectively.
   c. Select **Alarm mode**: Low Current, High Current, Freeze, BinLow, BinHIgh
   d. **D/A Trim**. Use this option to calibrate the Digital/Analog Converter to correspond to the nominal values 4 mA and 20 mA.

NOTE
The analog output is set to fixed current mode during the calibration procedure.

To calibrate the DAC do the following:

   a. Choose the **D/A Trim** option.
   b. Click the **OK** button if you want to continue, (or click **CNCL** to quit without calibrating the D/A converter).
   c. Enter the measured value that corresponds to the 4 mA setting.
   d. Click the **DONE** button.
   e. Enter the measured value that corresponds to the 20 mA setting.
   f. Click the **DONE** button. Now the D/A calibration is finished, and the analog output is no longer in fixed current mode.

7. Select the **Analog Out 2** option from the Custom Setup menu (optional). If the transmitter is equipped with an extra analog output, follow the same configuration procedure as for Analog Out 1. Configuration of the extra analog output is identical to configuration of analog output 1. See step 6 above.

8. Select the **False Echo** option from the Custom Setup menu (optional). In normal operation the transmitter compares detected echoes with a list of **registered** disturbance echoes, in order to decide which one is the actual product surface. To view a list of echoes that the transmitter has detected select the **Tank Echoes** option.
   Select echoes from this list and add to the list of registered echoes. Only register disturbing echoes which can be identified as caused by an object in the tank. To register a disturbance echo, do the following:
   a. Move the cursor to the echo you want to add to the list.
   b. Click **Edit**.
   c. Move the cursor to **Add to list**, and click **Mark**.
   d. Click **Save** to register the marked echo.
   e. Repeat steps **a** to **d** if you wish to register more disturbance echoes. The **Set as surface** option allows you to define an echo as the product surface. Mark the **Add new false** option if you want to manually add echoes. This may be a useful option if, for example, there are known disturbances below the product surface which can not be detected by the transmitter at the time of installation.
   f. Click **CNCL** to return to the False Echo menu. To view the current list of registered disturbing echoes select the **Reg. False Echoes**.

To remove a registered disturbance echo, do the following:
-Move the cursor to the echo you want to remove.
-Click **Edit**.
-Select the **Remove echo** option and click **MARK**.
-Click **Save** to remove the selected echo.

Mark the **Add new false** option if you want to manually add a false echo to the list of registered disturbance echoes. Mark the **Clear list** option if you want to remove the whole list of registered disturbance echoes. This option may be useful if you want to create a completely new list.

9. Select the **Volume** option from the Custom Setup menu. The **Volume** option allows you to setup the 5600 transmitter for volume calculations. You can choose between using either a predefined tank shape like a sphere or a horizontal or vertical cylinder, or entering level and volume values into a strapping table.
   a. Select **Shape** and press **Edit.** Choose the Tank Geometry to be used for volume calculation and press **Save**.
   b. Select **Diam** and press **Edit**. Set the tank diameter and press **Save**.
   c. Select ***Zero Level Offset*** and press **Edit**. Set the distance from zero level to tank bottom and press **Save**.
   d. Select ***Volume Offset*** and press **Edit**. Set the volume offset and press **Save**.
   e. Select ***Volume Control*** and press **Edit**. Mark the NegVolDisabled option and press **Save**.

Section 5 Configuration

Antenna . . . . . **page 5-3**
Tank Geometry . . . . . **page 5-4**
Analog Output . . . . . **page 5-6**
Process Conditions . . . . . **page 5-8**
Temperature Measurement . . . . . **page 5-8**
Volume Calculation . . . . . **page 5-9**
Advanced Functions . . . . . **page 5-10**

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.

OVERVIEW

To be able to fully utilize the 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. Configuration can also be performed using the 2210 Display Unit, 275 HART Communicator, 375 Field Communicator, AMS, DeltaV, or others. Limited support for various configuration parameters may apply when using certain configuration tools.

Basic Configuration

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

- “Antenna” on page 5-3
- “Tank Geometry” on page 5-4
- “Analog Output” on page 5-6
- “Process Conditions” on page 5-8
- “Temperature Measurement” on page 5-8
- “Volume Calculation” on page 5-9

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).

- “Advanced Functions” on page 5-10

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:

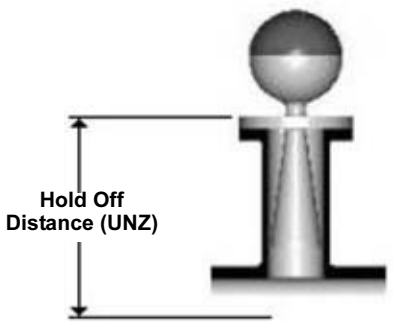
Hold Off Distance	The (UNZ) defines how close to the transmitter's reference point a level value is accepted. Normally, the Hold Off Distance is set automatically and does not need to be changed. However, if there are disturbing echoes in the upper part of the tank, for example from the tank nozzle, you can increase the Hold Off Distance in order to avoid measurements in the region close to the antenna.
	 5600/HOLDOFF DISTANCE.TIF
Pipe Inner Diameter	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.
Tank Connection Length	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 5-1.

Table 5-1. TCL_{ext}, for standard extended lengths, 500 mm

Sealing	3 inch Cone	4 inch Cone	6 inch Cone
PTFE	0.489	0.482	0.477
Quartz	0.529	0.522	0.517

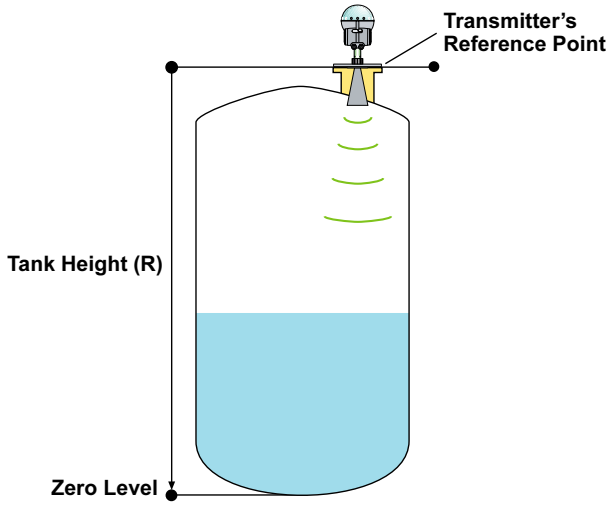
Table 5-2. Hold Off Distance Default Value (meters)

Antenna Type	Hold Off	TCL
User Defined	0.000	0.000
Rod 100	0.600	0.595
Rod 250	0.783	0.738
Cone 3" PTFE	0.475	0.120
Cone 4" PTFE	0.475	0.170
Cone 6" PTFE	0.475	0.280
Cone 8" PTFE	0.475	0.400
Pipe PTFE	0.475	0.060
Parabolic	0.793	0.200
Process Seal 4" PTFE	0.563	0.200
Process Seal 6" PTFE	0.623	0.200

TANK GEOMETRY

For Tank Geometry the following basic configuration must be performed:

Tank Height (R)	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).

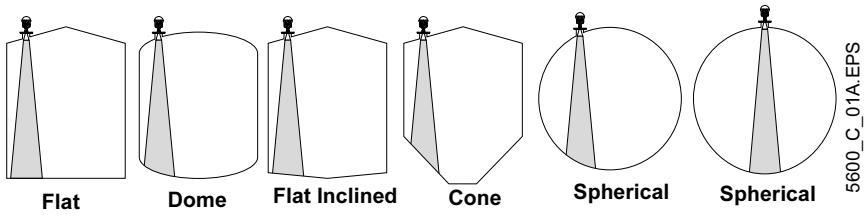


Tank Type Tank Bottom Type	By defining Tank Type and Tank Bottom Type default values for some parameters are set. Through this the transmitter is optimized for a specific combination of Tank type and Tank Bottom Type. For tank types vertical cylinder and cubical, all tank bottom types are valid. For 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.

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

Table 5-3. Tank Bottom

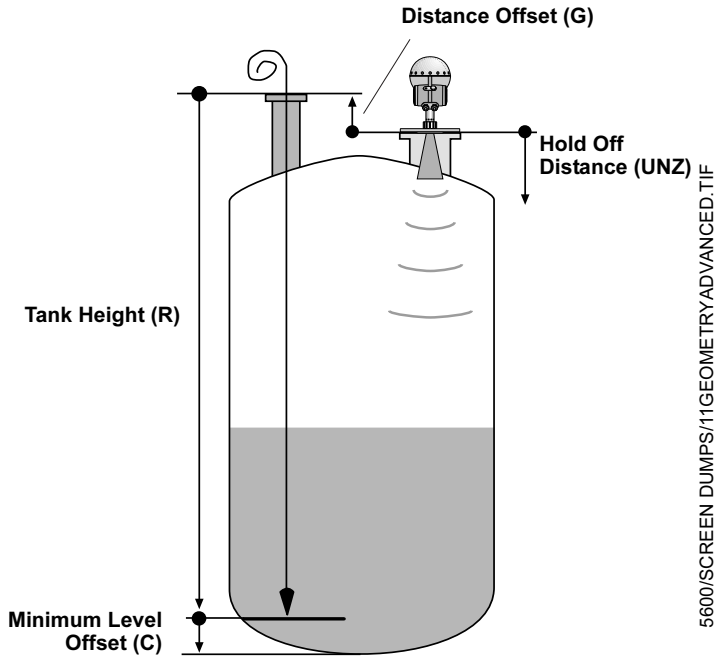
Tank Type	Tank Bottom Type
Vertical Cylinder	Flat, Dome, Cone, Flat inclined
Horizontal Cylinder	Not Applicable
Spherical	Not Applicable
Cubical	Flat, Dome, Cone, Flat inclined



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.



ANALOG OUTPUT

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

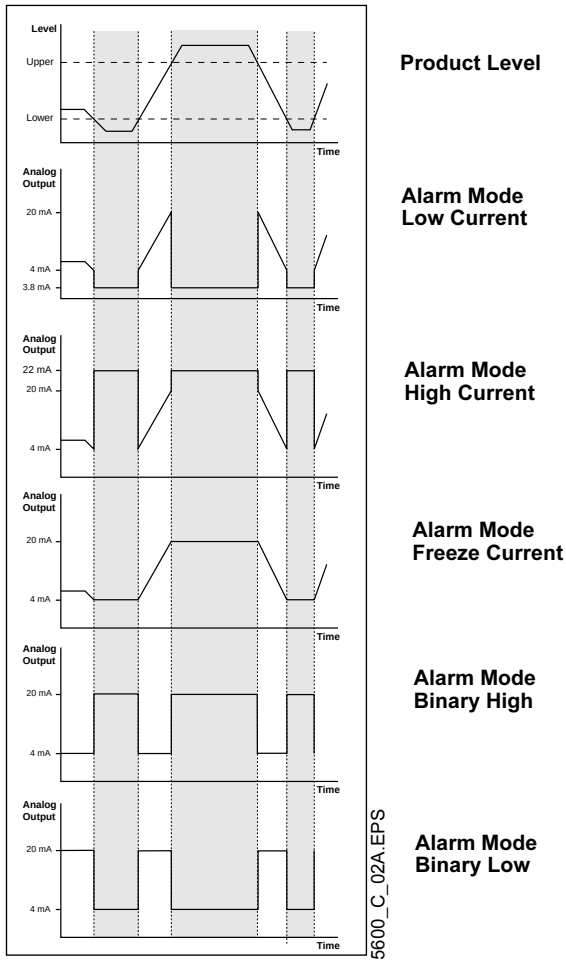
However, if your transmitter is equipped with a primary 4-20 mA HART output, you must use Analog Output 1. (Analog Output 1 is not available for primary output when using other bus communication protocols than HART).

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 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 5-1 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 Out 2), configure it as described above.

Figure 5-1. 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.

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.

TEMPERATURE MEASUREMENT

Up to six temperature sensors can be connected to the 2210 Display Unit. 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. See “Temperature measurement” on page 3-11 for information on how to connect the temperature sensors.

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: $R=R_0 *(1+A*T+B*T^2)$ 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.

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 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.

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.

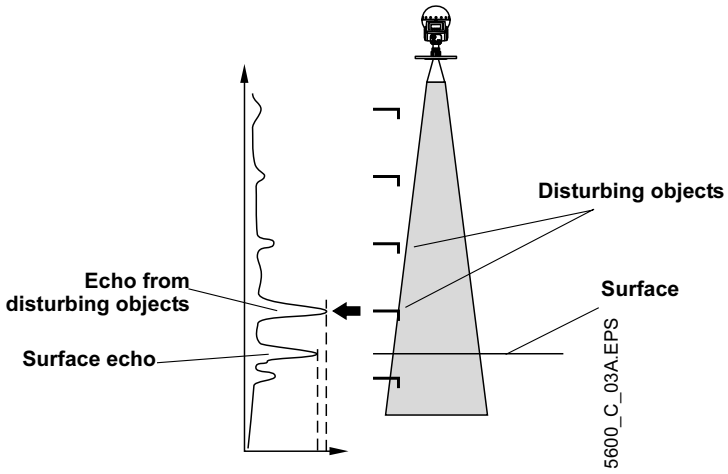
Disturbance Echo Handling

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 5-2. Disturbance Echoes

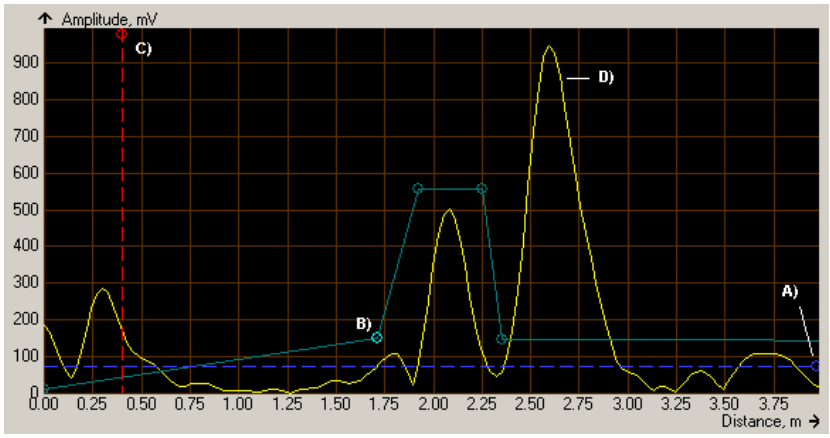


The False Echo function is used to improve the performance of the transmitter when the surface is close to a horizontal surface of a stationary object in the tank. The object causes an echo when it is above the surface. When the echoes from the surface and the object are close to each other, they might 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 5-3).

Figure 5-3. Spectrum plot for typical calm conditions

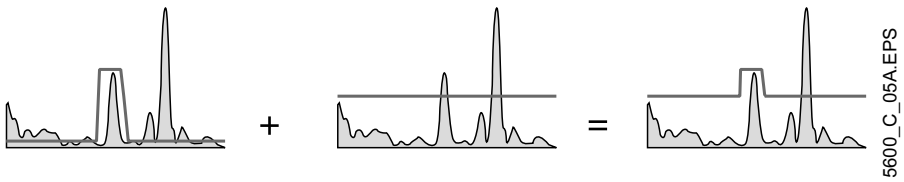


A: General amplitude threshold
B: Amplitude threshold point (ATP)
C: Hold off distance (UNZ)
D: Echo curve

General Amplitude Threshold	Echoes with amplitudes below the general amplitude threshold will be disregarded. Recommended threshold values are: • 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. *Note:* *These figures are estimations. Significantly different figures may have to be used in many cases.* Some further considerations are: • 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.

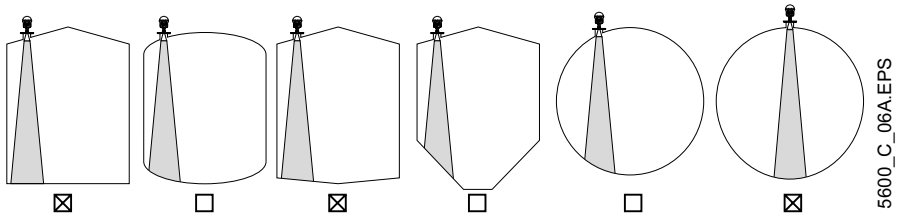
Customized Noise Threshold Table (ATP-table)	You can filter out weak disturbing echoes by creating a noise threshold table. This technique should only be use in special situations, for example at the bottom of tanks with weak disturbing echoes. In such tanks the transmitter may lock at disturbances close 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 5-4) 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 5-4).
Registration of False Echoes	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. **When should I register?** See the following recommendations before you register new interfering echoes: • 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 5-4. Noise threshold



Bottom Echo Handling

Bottom Echo Visible	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. 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. 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.



Invalid Level Alarm Is Not Set If Tank Is Empty	If the surface echo is lost close to the bottom of the tank, setting this parameter suppresses the “invalid” display.

Full Tank Handling

Invalid Level Alarm Is Not Set If Tank Is Empty	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. *Note* *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.*

Empty Tank Handling

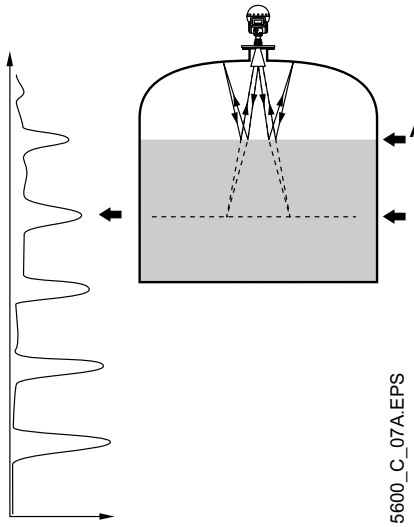
Empty Tank Detection Area	The Empty Tank Handling is a function for handling situations when the surface echo is lost close to the bottom. If the surface echo is lost the function makes the transmitter present a zero-level measurement, and an alarm is created, unless this alarm has been blocked. This 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. 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. 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 5-10 and “Tank Geometry” on page 5-4.

Surface Tracking

Slow Search	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.
Slow Search Speed	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.
Double Surface	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.
Upper Product DC	This is the dielectric constant for the upper product. A more precise value results in better accuracy for the lower surface level.
Level above min distance possible	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.
Select Lower Surface	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.

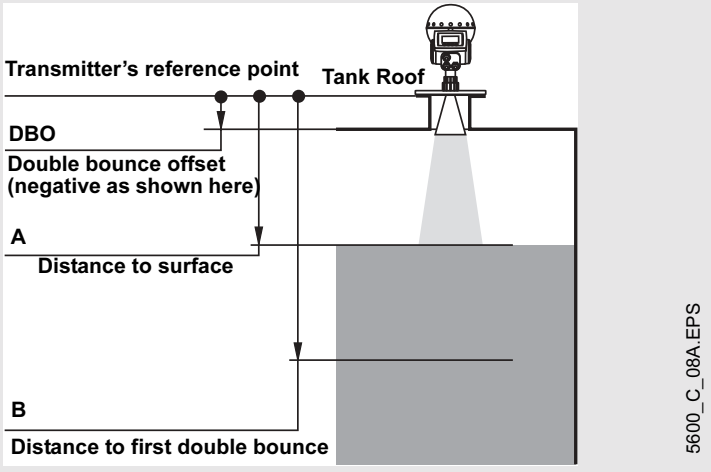
Double Bounce Possible

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.**



Double Bounce Offset

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.
DBO = B - 2A
DBO: Double Bounce Offset
B: Distance to first double bounce
A: Distance to surface



Filtering

Distance Filter Factor	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.
Activate Jump Filter	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.
Activate Least Square Filter	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.
Activate Adaptive Filter	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.
Echo Timeout	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.
Close Distance Window	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 ±CloseDist. 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.

Section 6 Service and Troubleshooting

Overview . . . . . **page 6-1**
Troubleshooting Table . . . . . **page 6-1**
Service Using the Rosemount 2210 Display Unit . . . . . **page 6-2**
Field Upgrades . . . . . **page 6-2**
Connection via Sensor Bus Port . . . . . **page 6-3**

OVERVIEW

This section contains Rosemount 5600 HART troubleshooting information only. 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.

TROUBLESHOOTING TABLE

Table 6-1 provides summarized troubleshooting suggestions for the most common operating problems. For Rosemount 5600 fieldbus information see the Rosemount 5600 FOUNDATION™ fieldbus manual (00809-0100-4025).

Table 6-1. Rosemount 5600 troubleshooting table

SYMPTOM	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 6-3)
	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.

SERVICE USING THE ROSEMOUNT 2210 DISPLAY UNIT

The Service Menu allows you to view the configuration status, edit holding registers, reset holding registers to factory values, do a software reset or to start a search for the surface echo. Information about antenna type, software versions, operation time, error status and unit code is available. You can also start a search for the surface echo and reset some of the holding registers to factory settings.

The service functions should only be used if you are familiar with the advanced functionality of the Rosemount 5600 Radar Level Transmitter.

Table 6-2. 5600 Advanced Functionality

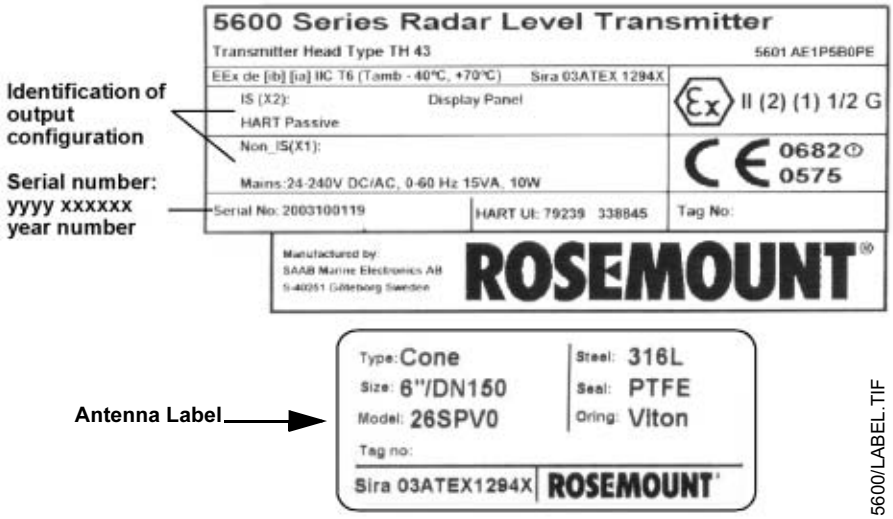
Advanced Functionality	Purpose
Config Report	Shows information on antenna type, software versions, software and hardware configuration, operation time, error status and unit code.
Echo Search	Starts a search for the surface echo.
Factory Settings	Resets selected holding registers to factory settings.
Software Reset	Use this option to trigger the software start up procedure
Super Test	Enables all software options for one week. Use this option if you want to test options not available in your transmitter.
Overfill Alarm	Use this menu to activate or deactivate the overfill alarm.
Advanced Service	Use this option to view input registers and to view an edit holding registers. The Advance Service window is protected by a special password which is valid for this window only. Contact your local representative for this password if you need to use the Advance Service option.

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



CONNECTION VIA SENSOR BUS PORT

In addition to the standard communication ports, where HART or FOUNDATION fieldbus are the main protocols used, there is an additional Port available (Sensor Bus Port).

This port is mainly used for upgrading Firmware, or for the use of the Radar Master software in combination with a transmitter equipped with a FOUNDATION fieldbus output. 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. since terminals 6 and 7 are used by the Rosemount 2210 Display Unit you have to disconnect it first. For more information about this Sensor Bus port, please see the on-line 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 Information

Specifications . . . . . page A-1
Dimensional Drawings . . . . . page A-7
Ordering Information . . . . . page A-11

SPECIFICATIONS

General

Product Designation
5600 Series Radar Level Transmitter

Operating principle
10GHz FMCW radar

Beam angle
See Figure 2-12 and Table 2-3 on page 2-9

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

Temperature measurement
1-3 spot elements, PT100 or CU100, or 6 spot elements with common return. Input accuracy ±0.9°F (±0.5°C)

Measuring Performance

Instrument accuracy (Under reference conditions)
±0.2 in (±5 mm)

Resolution
0.04 in (1 mm)

Repeatability
±0.04 in (±1 mm)

Measuring range
0-164 ft (0-50 m)

Update time
100 ms

Processors
32-bit Floating DSP

Display/ Configuration

Display (factory mounted on transmitter)
Protection class IP67
With weather/dirt protection cover; graphical LCD display 128 by 64 pixels with 4 control soft-keys and 7 text lines with 16 characters/line for display and configuration.

Display (remote mounted)
Same as above, mounted in separate enclosure, protection class IP67; max cable length, display - radar transmitter: 330 ft. (100 m); cable type: 4 wire shielded instrument cable, min. 0.5 mm^2, (AWG 20).

Display with Temperature Inputs (remote mounted)
Same as above, mounted in separate enclosure, protection class IP67; max cable length, display - radar transmitter: 330 ft (100 m); cable type: 4 wire shielded instrument cable, min. 0.5 mm^2, (AWG 20); temperature measurement 1-3 spot elements PT100 or CU100, or 6 spot elements with common return.

HART Device
Rosemount Hand-held communicator 275 or 375
Rosemount AMS software

PC/remote configuration (1)
(NOTE: HART Modem required, see page A-17)
Rosemount Radar Master, Powerful Windows based configuration software.

(1) Recommended PC hardware specification: ≥ 1 GHz processor, ≥ 128 MbRam, Operating system of Win NT or Win2000.

Electric

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

Power consumption
Maximum 10 W, Nominal 5 W

Outputs

Primary output:
Alternative 1: HART + 4-20 mA current loop (non-IS or IS option)
Alternative 2: FOUNDATION fieldbus (optional IS option)

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

Analog Output Characteristics

Type
Analog 4-20 mA Current Loop, active (with) or
passive (without loop supply)

Galvanic isolation
> 1500 V RMS or DC

Analog Output Characteristics
See “Hazardous Locations Certification” on page B-1

Range
4-20 mA

Alarm level
3.8 mA, 22 mA or freeze; NAMUR, Rosemount Alarm levels available

Resolution
0.5μA (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)

Fieldbus Output Characteristics
Fieldbus Voltage limits: 9 to 32 V
Current Draw: 12.5 mA
For I.S. Applications:
U_i < 30 V
I_i < 300 mA
P_i < 1.3 W
C_i = 0 μF
L_i = 0 mH

Output cabling
Twisted and shielded pair; min. 0.5 mm^2 (AWG 20)

Cable entries
3 × ½ inch NPT; for cable glands or conduit entries
Optional: cable gland kit, incl 3 × EEx e approved (ATEX) ½ inch NPT cable glands
Optional: 3 x EEx e approved (ATEX) adapters ½ inch NPT/M20

Display Output Characteristics

With Temperature Output
See “Hazardous Locations Certification” on page B-1

Without Temperature Output
See “Hazardous Locations Certification” on page B-1

Mechanical

Housing/Enclosure
Permanent moulded cast aluminium, chromed and powder painted

Flanges
ANSI, DIN standard,
Material: Stainless steel 316L and Stainless Steel EN 1.4404
Optional: Hot-galvanized carbon steel

Weight, excl, flange
18 lbs (8 kg)

Height above flange
15 in (400 mm)

Antenna Dimensions
Cone: See Figure A-2 on page 7
Rod: See Figure A-1 on page 7
Process Seal: See Figure A-3, and Table A-2 on page A-8
Extended Cone: See Figure A-4 on page A-9
Cone with Integrated Flushing Connection: See Figure A-5 on page A-9
Parabolic: See Figure A-6 on page 10

Table A-1. Antenna material and o-ring selection ● Applicable - Not applicable

	Rod Antenna	Cone Antenna	Process Seal Antenna	Extended Cone Antenna	Cone with Integrated Flushing Connection	Parabolic Antenna
Material:						
Stainless Steel 316L	●(1)	●	-	●	●	●
Hastelloy® C22	-	●	-	-	-	-
Tantalum	-	●	-	-	-	-
Monel® 400	-	●	-	-	-	-
PTFE	●(1)	-	●	-	-	-
Tank Sealing:						
PTFE	-	●	-	●	●	●
O-Rings:						
Viton	●	●	-	●	●	●
Kalrez	●	●	-	●	●	-
EPDM	●	●	-	●	●	-
Buna-N	●	●	-	●	●	-

(1) The Rod antenna is a combination of 316L SST and PTFE.

Environment

Ambient Temperature
-40 to 158°F (-40 to 70°C)

Tank Sealing Temperature Range with different O-rings (see Figure A-1, Figure A-2, Figure A-3, Figure A-4, and Figure A-5)

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)	392 (200)
Buna-N	-31 (-35)	230 (110)

Emission approvals
FCC: K8CPRO, K8CPROX
R&TTE: E813268O-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, NEMA 4

Vibration
IEC 721-3-4 class 4M4

UV protection
ISO 4892-2

Electromagnetic compatibility
EN61326, Immunity EN 50081-2, Emission EN50081-1

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

Power supply fluctuation
IEC 92 Part 504 sec. 3.5

DIMENSIONAL DRAWINGS

Figure A-1. Rod Dimensions

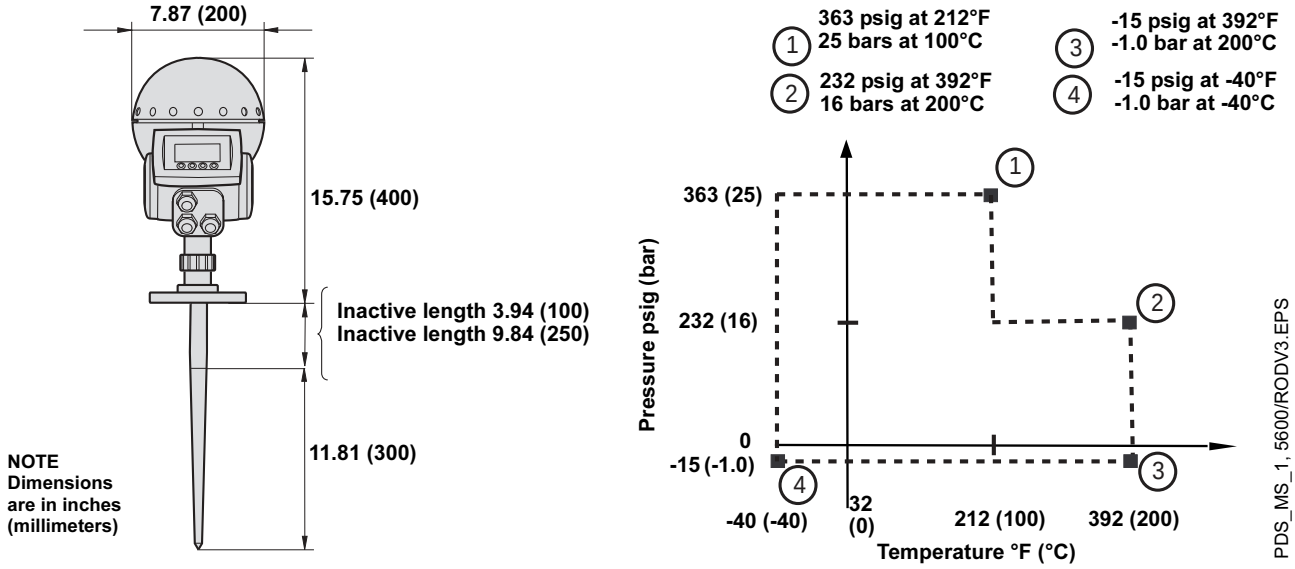


Figure A-2. Cone Dimensions

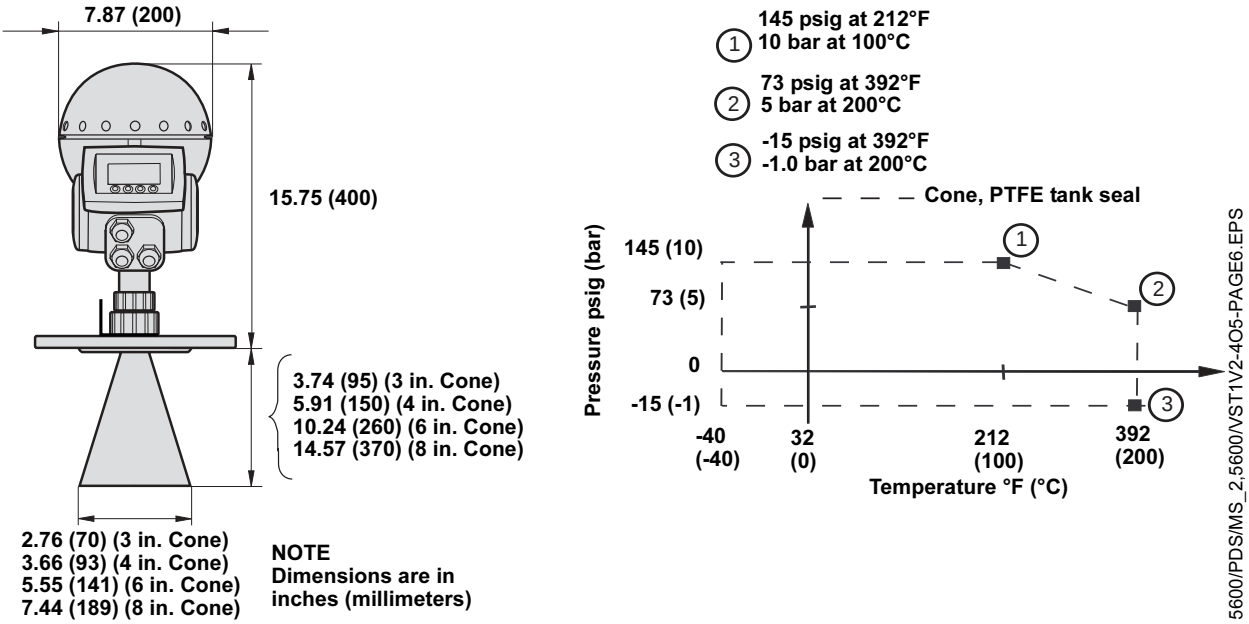


Figure A-3. Process Seal Dimensions

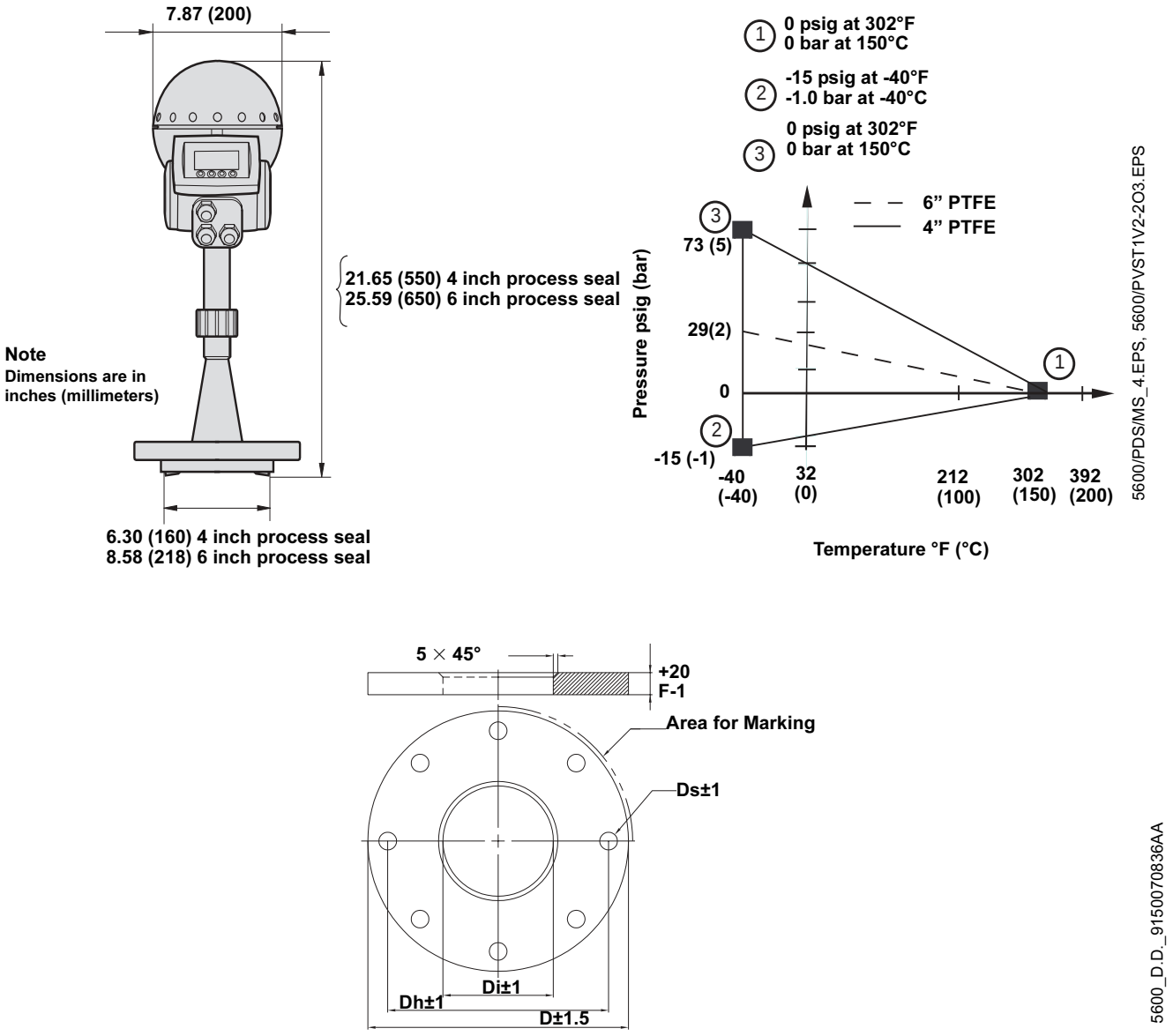


Table A-2. Process Seal Dimensions for Galvanized Carbon and Stainless Steel Flange
Dimensions are in inches (millimeters)

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

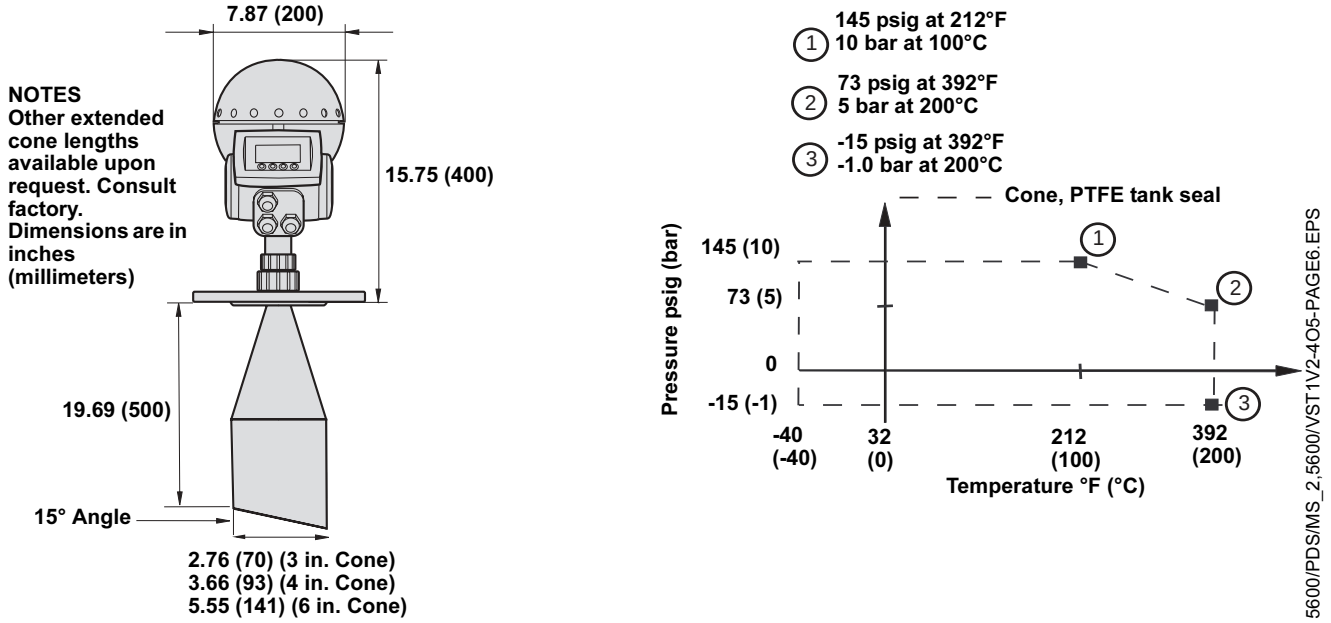


Figure A-5. Cone with Integrated Flushing Connection Dimensions for Stainless Steel Flange

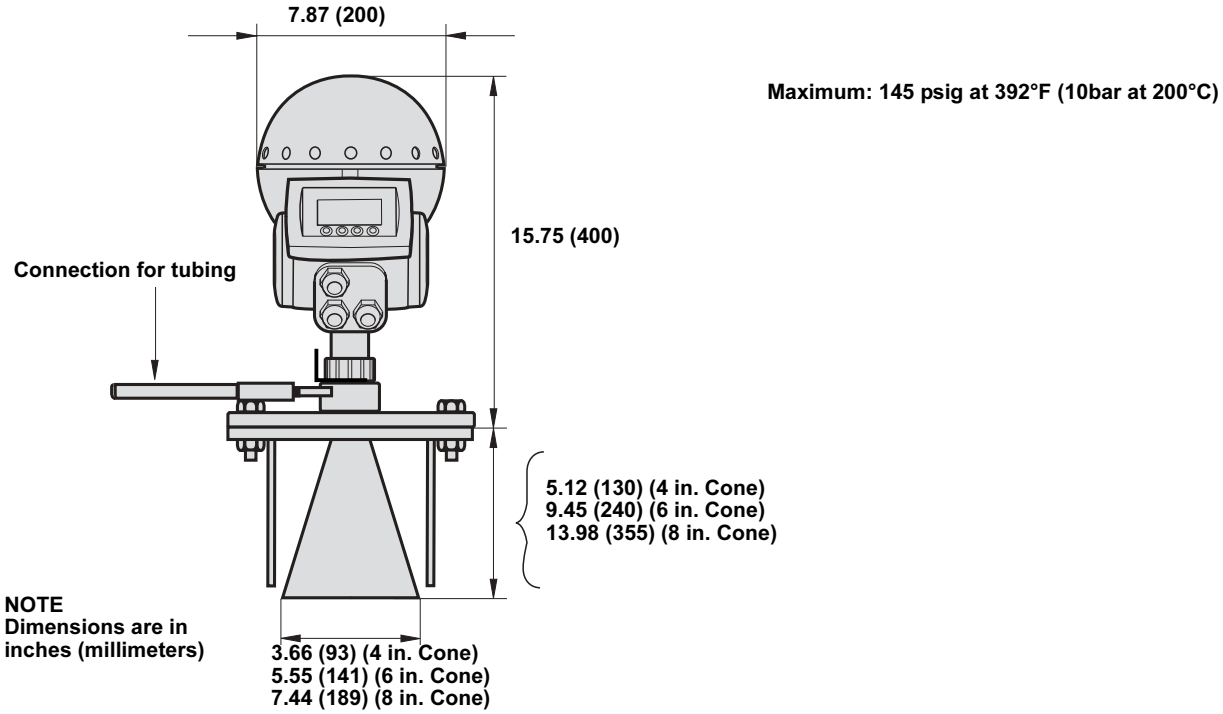
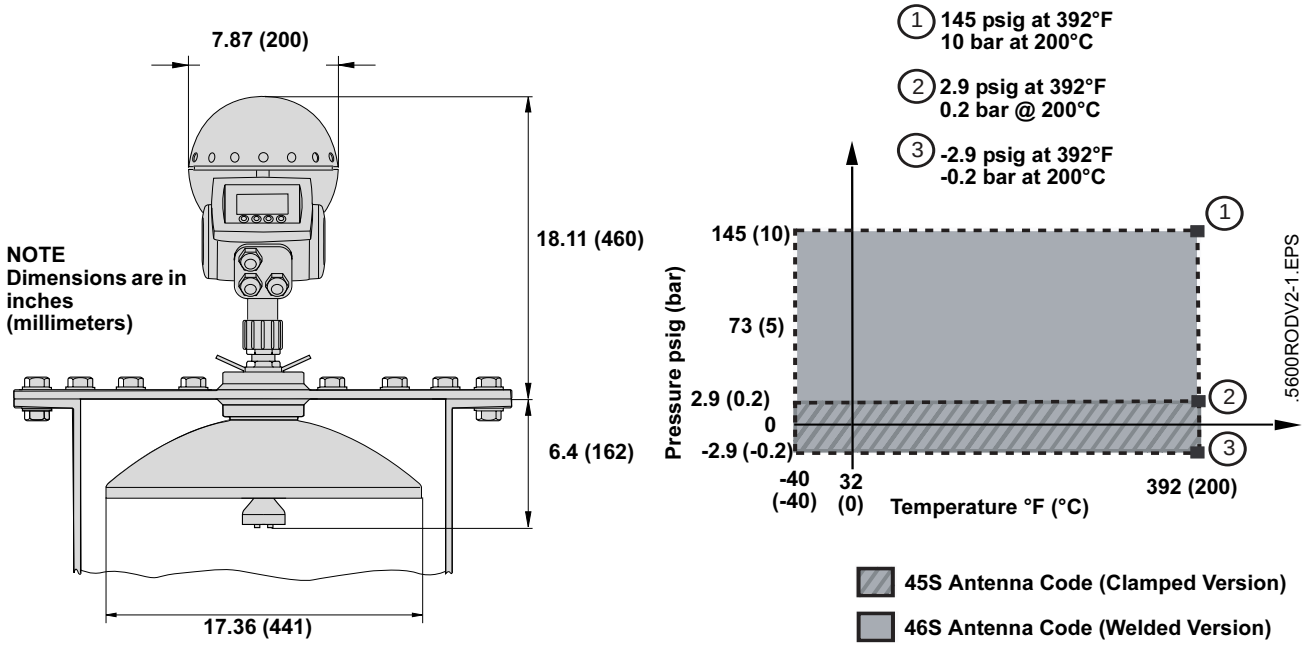


Figure A-6. Parabolic Dimensions for Stainless Steel Flange



ORDERING INFORMATION

Table A-3. Rosemount 5600 Radar Transmitter Selection

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 Certifications**
NA	None
E1	ATEX Flameproof
E5	FM 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	4-20 mA with HART communication, Passive Output, Intrinsically Safe Circuit
5C	4-20 mA with HART communication, Active Output
5D	4-20 mA with HART communication, Active Output, Intrinsically Safe Circuit
7A	Foundation Fieldbus
7B	Foundation Fieldbus, Intrinsically Safe Circuit
Code	**Secondary Output**
0	None
1	4-20 mA, Passive Output (1)
2	4-20 mA, Passive Output, Intrinsically Safe Circuit
3	4-20 mA, Active Output (1)
4	4-20 mA, Active Output, Intrinsically Safe Circuit
Code	**Display Unit**
N	None
P	LOI, Factory mounted on transmitter
R	LOI, Remote mounted
T	LOI, Remote mounted with temp inputs (1-6 spot elements with common returns)
Code	**Volume Calculation**
E	Basic Volume Equations (Standard)
V	Strapping Table, up to 100 points
Typical Model Number: 5601 S E1 P 5A 0 P E Antenna Selection (2)	

(1) Not allowed in combination with Display Unit codes P, R, or T.
(2) Select the antenna type and options using Table A-4, Table A-5, Table A-6, Table A-8, and Table A-9.

Table A-4. Rod Antenna

Code	Antenna Type	Antenna Size	Antenna Material	Note
	Rod			
11S		1.5 in. threaded version	SST 316L and PTFE	Inactive Length 4 inch (100 mm)
12S		2 in. (DN50) nozzles	SST 316L and PTFE	Inactive Length 4 inch (100 mm)
13S		3 in. (DN80) nozzles	SST 316L and PTFE	Inactive Length 4 inch (100 mm)
14S		4 in. (DN100) nozzles	SST 316L and PTFE	Inactive Length 4 inch (100 mm)
11L		1.5 in. threaded version	SST 316L and PTFE	Inactive Length 10 inch (250 mm)
12L		2 in. (DN50) nozzles	SST 316L and PTFE	Inactive Length 10 inch (250 mm)
13L		3 in. (DN80) nozzles	SST 316L and PTFE	Inactive Length 10 inch (250 mm)
14L		4 in. (DN100) nozzles	SST 316L and PTFE	Inactive Length 10 inch (250 mm)
1XX		Customer specific rod or material		Consult Factory
Code		**Tank Sealing**		
N		Not Applicable		
Code		**O-ring Material**		
V		Viton		
K		Kalrez 6375		
E		EPDM		
B		Buna-N		
Code		**Process Connection**		
NR		Antenna with Plate Design *NOTE: Customer supplied flange or see Table A-13 on page A-17 for flange options*		
XX		Special Process Connection		Consult Factory
		Threaded Version		
TN		Threaded 1.5 in. NPT		
TB		Threaded 1.5 in. G		
Code		**Options**		
Q8		Material Traceability Certification per EN 10204 3.1.B		
Typical Model Number: Selected code from Table A-3 on page A-11 11S N V TN				

Table A-5. Cone Antenna

Code	Antenna Type	Antenna Size	Antenna Material	Note
	Cone			
23S		3 in. (DN80) nozzles	SST 316L	Pipe Installation Only
24S		4 in. (DN100) nozzles	SST 316L	Free propagation or 4” pipe
26S		6 in. (DN150) nozzles	SST 316L	Free propagation or 6” 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
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 Sealing**		
P		PTFE		
Code		**O-ring Material**		
V		Viton		
K		Kalrez 6375		
E		EPDM		
B		Buna-N		
Code		**Process Connection**		
NR		Antenna with Plate Design *NOTE: Customer supplied flange or see Table A-13 on page A-17 for flange options*		
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-3 on page A-11 24S P V NR				

Table A-6. Process Seal Antenna

Code	Antenna Type	Antenna Size	Antenna Material	Note
	Process Seal			
34S		4 in. (DN100) nozzles	PTFE	
36S		6 in. (DN150) nozzles	PTFE	
Code		**Tank Sealing**		
P		PTFE		
Code		**O-ring Material**		
N		Not Applicable		
Code		**Process Connection**		
NF		None, Customer to supply flange per dimensions on Figure A-3		
XX		Special Process Connection		Consult Factory
		Stainless Steel Flange		
CA		4 in. ANSI Class 150		
DA		6 in. ANSI Class 150		
JA		DN100 PN16		
KA		DN150 PN16		
		Galvanized Carbon Steel Flange		
CC		4 in. ANSI Class 150		Longer Lead-Time, Consult Factory
DC		6 in. ANSI Class 150		Longer Lead-Time, Consult Factory
JC		DN100 PN16		Longer Lead-Time, Consult Factory
KC		DN150 PN16		Longer Lead-Time, Consult Factory
Code		**Options**		
Q8		Material Traceability Certification per EN 10204 3.1.B		
Typical Model Number: Selected code from Table A-3 on page A-11 34S P N JA				

Table A-7. Parabolic Antenna

Code	Antenna Type	Antenna Size	Antenna Material	Note
	Parabolic			
45S		ø18 in. (440mm)	SST with Integrated Inclination	Clamped, -2.9 to 2.9 psi (-0.2 to 0.2 bar)
46S		ø18 in. (440mm)	SST with Integrated Inclination	Welded, -2.9 to 145 psi (-0.2 to 10 bar)
4XX		Customer Specific	Customer Specific	Consult Factory
Code		**Tank Sealing**		
P		PTFE		
Code		**O-ring Material**		
V		Viton		
Code		**Process Connections**		
NF		None, Flange Ready		
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-3 on page A-11 45S P V NR				

Table A-8. Extended Cone Antenna

Code	Antenna Type	Antenna Size	Antenna Material	Note
	Extended			
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 Sealing**		
P		PTFE		
Code		**O-ring Material**		
V		Viton		
K		Kalrez 6375		
E		EPDM		
B		Buna-N		
Code		**Process Connections**		
NR		Antenna with Plate Design		
		NOTE: Customer supplied flange or see Table A-13 on page A-17 for flange options		
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-3 on page A-11 76S P V NR				

Table A-9. Cone Antenna with Integrated Flushing Connection

Code	Antenna Type	Antenna Size	Antenna Material	Note
	Cone with Integrated Flushing Connection			
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 Sealing**		
P		PTFE		
Code		**O-ring Material**		
V		Viton		
K		Kalrez 6375		
E		EPDM		
B		Buna-N		
Code		**Process Connection**		
XX		Special Process Connection		Consult Factory
		Stainless Steel Flange Welded to Antenna		
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-3 on page A-11 94S P K KL				

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

Code	Options
	Calibration Data Certification
Q4	Calibration Data Certificate
	Software Configuration
C1	Custom Software Configuration (CDS required with order)
	Alarm Limits
C4	NAMUR Alarm Level, High Alarm
C8	Low Alarm (Standard Rosemount Alarm)
	Conduit Adapters
G1	1/2 inch NPT Cable Gland Kit
	Special Procedures
P1	Hydrostatic Testing

Table A-11. Typical Model Code Examples

5601 A E5 P 5A 0 P E 24S P V NR
FM approval, passive HART primary output and display mounted on transmitter. Basic Volume calculation. Antenna is a 4 inch Cone, SST with PTFE Seal and Viton O-rings. No options.
5601 U NA P 7A 2 T V 94S P K CL C1
No Ex-approvals, FOUNDATION™ fieldbus output and remote mounted display with temp inputs 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.

Accessories

Table A-12. Accessories Part Numbers

Part Number	Description	Note
Modems		
03300-7004-0001	HART Modem and cables	Viator by MacTec
05600-5004-0001	K2 RS485 modem and cables	For Sensor Bus connection
Antenna Accessories		
05600-5001-0001	PTFE Protective Cover (PTFE Bag)	For Parabolic Antenna only

Flange

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	Acc. To ANSI B16.5	SST 316L (1)
05600-1811-0231	ANSI 2 inch Class 300	Acc. To ANSI B16.5	SST 316L (1)
05600-1811-0311	ANSI 3 inch Class 150	Acc. To ANSI B16.5	SST 316L
05600-1811-0331	ANSI 3 inch Class 300	Acc. To ANSI B16.5	SST 316L
05600-1811-0411	ANSI 4inch Class 150	Acc. To ANSI B16.5	SST 316L
05600-1811-0431	ANSI 4 inch Class 300	Acc. To ANSI B16.5	SST 316L
05600-1811-0611	ANSI 6 inch Class 150	Acc. To ANSI B16.5	SST 316L
05600-1811-0811	ANSI 8 inch Class 150	Acc. To ANSI B16.5	SST 316L
05600-1810-0231	DN50 PN40	Acc. To EN 1092-1	EN 1.4404 (2)
05600-1810-0311	DN80 PN16	Acc. To EN 1092-1	EN 1.4404 (2)
05600-1810-0331	DN80 PN40	Acc. To EN 1092-1	EN 1.4404 (2)
05600-1810-0411	DN100 PN16	Acc. To EN 1092-1	EN 1.4404 (2)
05600-1810-0431	DN100 PN40	Acc. To EN 1092-1	EN 1.4404 (2)
05600-1810-0611	DN150 PN16	Acc. To EN 1092-1	EN 1.4404 (2)
05600-1810-0811	DN200 PN16	Acc. To EN 1092-1	EN 1.4404 (2)
Galvanized Carbon Steel Flanges (Note: Longer Lead-time, Consult Factory)			
Part Number	**Flange Size**	**Dimensions**	**Material**
05600-1811-0210	ANSI 2 inch Class 150	Acc. To ANSI B16.5	CS (1)
05600-1811-0230	ANSI 2 inch Class 300	Acc. To ANSI B16.5	CS (1)
05600-1811-0310	ANSI 3 inch Class 150	Acc. To ANSI B16.5	CS
05600-1811-0330	ANSI 3 inch Class 300	Acc. To ANSI B16.5	CS
05600-1811-0410	ANSI 4 inch Class 150	Acc. To ANSI B16.5	CS
05600-1811-0430	ANSI 4 inch Class 300	Acc. To ANSI B16.5	CS
05600-1811-0610	ANSI 6 inch Class 150	Acc. To ANSI B16.5	CS
05600-1811-0810	ANSI 8 inch Class 150	Acc. To ANSI B16.5	CS
05600-1810-0230	DN50 PN40	Acc. To EN 1092-1	CS (2)
05600-1810-0310	DN80 PN16	Acc. To EN 1092-1	CS (2)
05600-1810-0330	DN80 PN40	Acc. To EN 1092-1	CS (2)
05600-1810-0410	DN100 PN16	Acc. To EN 1092-1	CS (2)
05600-1810-0430	DN100 PN40	Acc. To EN 1092-1	CS (2)
05600-1810-0610	DN150 PN16	Acc. To EN 1092-1	CS (2)
05600-1810-0810	DN200 PN16	Acc. To EN 1092-1	CS (2)

(1) Use gasket type Ia.
(2) Gasket type according to EN 1514-1 and bolting according to EN1515-2.

Appendix B Product Certifications

APPROVED MANUFACTURING LOCATIONS

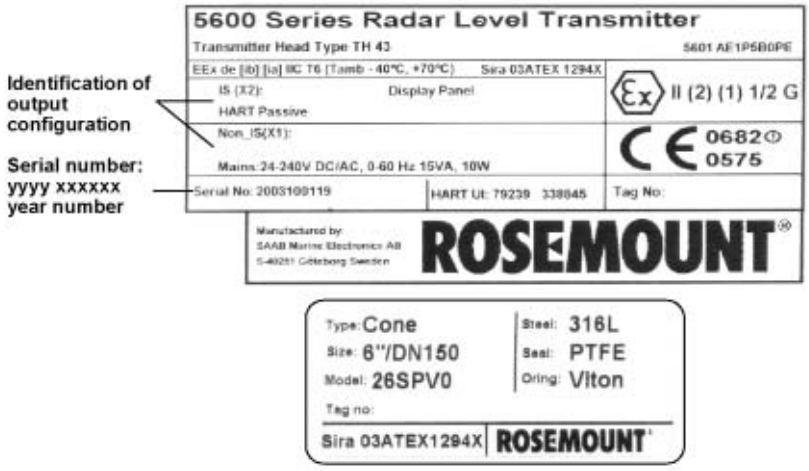
Saab - Rosemount – Gothenburg, Sweden

EUROPEAN UNION DIRECTIVE INFORMATION

5600 Series Radar Level Transmitter European ATEX Directive Information

This document lists specific requirements which have to be fulfilled to secure a safe installation and use of 5600 Series Radar Level Transmitter in a hazardous area. Omission may jeopardize safety, and Rosemount will not take any responsibility if requirements as listed below are not fulfilled.

Figure B-1. Approval labels for the 5600 Series Radar Level Transmitter and Antenna



ATEX Marking and EX Certification Code

ATEX Marking	Safety Coding	Outputs
II 1/2 G	EEx de IIC T6 (-40°C to +70°C)	Non-Intrinsically Safe (Non-IS) Primary and/or Secondary outputs
II (2) (1) 1/2 G	EEx de [ib] [ia] IIC T6 (-40°C to +70°C)	IS Display output. IS Primary output, and/or IS Secondary output
II (1) 1/2 G	EEx de [ia] IIC T6 (-40°C to +70°C)	IS Display output. Non-IS Primary output, and/or Non-IS Secondary output

Intrinsically Safe (IS) Entity Parameters

The unit can be equipped with various types of outputs, each type of IS configuration has specific entity parameters. The output configuration is shown on the main label of each unit.

- Passive analog output 4-20mA, Label identification = HART passive Voltage compliance 7-30V, Ui < 30V, Ii < 200mA, Pi < 1.3W, Ci = 0μF, Li = 0mH
- Active analog output 4-20mA, Label identification = HART active Max load 300Ω, U_o < 23.1 V, I_o < 125.7 mA, P_o < 0.726 W, C_{ext} <0.14 μF, L_{ext} < 2.2 mH
- Foundation Fieldbus, Label identification = Foundation Fieldbus U_i < 30 V, I_i < 300 mA, Pi < 1.3 W, C_i = 0 μF, L_i = 0 mH

Instructions specific to hazardous area installations

The 5600 Series Radar Level Transmitter has been certified to comply with Directive 94/9/EC of the European Parliament and the Council as published in the Official Journal of the European Communities No. L 100/1.

The following instructions apply to equipment covered by certificate numbers Sira03ATEX1294X:

1. The equipment may be used with flammable gases and vapors with apparatus Group IIC.
2. The Transmitter Head is certified for installation in a cat 1 area and for use in ambient temperatures in the range of -40°C to +70°C and should not be used outside this temperature range.
3. The antenna including tank seal is designed to be mounted across the boundary between a cat 1 and cat 2 area. There are various cat 1 areas within the range from -40°C to +400°C, -1 to 55 bar that can be considered. It is the responsibility of the user to select the appropriate antenna including tank seal to match the tank process conditions, see table below. Antenna type, size and tank seal material can be found on the antenna label.

Antenna Type	Size	Tank Seal Material	Temperature Range	Pressure Range (linear interpolation between breakpoints)
Cone Pipe	All	PTFE	-40 to +200°C	-1 to 10 bar @ -40°C -1 to 10 bar @ 100°C -1 to 5 bar @ 200°C
Cone Pipe	All	Quartz	-40 to +400°C	-1 to 55 bar
Cone/purging	All	PTFE	-40 to +200°C	-1 to 10 bar
Cone/purging	All	Quartz	-40 to +400°C	-1 to 10 bar
Process seal	4” / DN100	PTFE	-40 to +150°C	-1 to 5 bar @ -40°C 0 bar @ +150°C
Process seal	6” / DN150	PTFE	-40 to +150°C	-1 to 2 bar @ -40°C 0 bar @ +150°C
Rod100 Rod250	All	PTFE	-40 to +200°C	25 bar @ -40°C 25 bar @ 100°C 16 bar @ 200°C
Parabolic Parabolic	18” / Welded 18” / Clamped	PTFE	-40 to +230°C -40 to +230°C	-1 to 10 bar -0.5 to 0.5 bar

4. The product must be installed by suitably trained personnel and 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.
5. Repair of this equipment shall be carried out by the manufacturer or in accordance with the applicable code of practice.
6. All externally connected intrinsically safe apparatus must comply with the specified IS entity parameters.
7. The Flameproof/Explosionproof enclosure may not be opened while energized.
8. The certificate marking is detailed on drawing numbers 9150076-931 and 9150076-932.
9. The certificate has special conditions for safe use associated with it, denoted by the X on the end of the certificate no., which must be observed when the equipment is installed.
10. The certification of this equipment relies on the following materials used in its construction:

    If the equipment is likely to come into contact with aggressive substances, then it is the responsibility of the user to take suitable precautions that prevent it from being adversely affected, thus ensuring that the type of protection is not compromised.

    Aggressive substances - e.g. solvents that may affect polymeric materials.

    Suitable precautions - e.g. regular checks as part of routine inspections or establishing from the material's data sheet that it is resistant to specific chemicals.

Special Conditions for Safe Use (X)

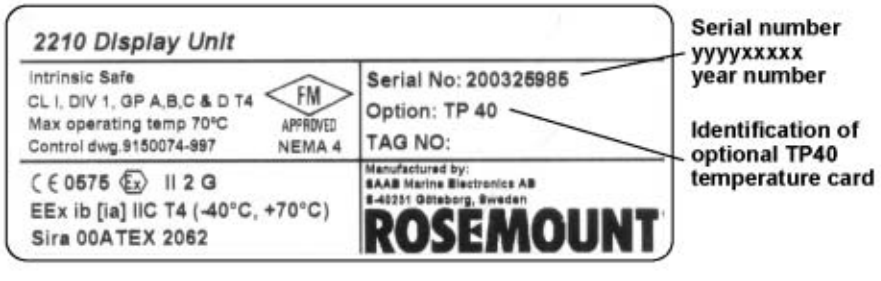
1. As alloys may be used as the enclosure (or other parts) material and be at the accessible surface of this equipment, in the event of rare incidents, ignition sources due to impact and friction sparks could occur. This shall be considered when the equipment is being installed in locations that specifically 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 of 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.

2210 Display Unit European ATEX Directive Information

The 2210 Display Unit can be installed as a remote mounted local readout unit for a 5600 Series Radar Level Transmitter or be factory mounted attached directly tot he Radar Level Transmitter head enclosure. The remote version has an optional I/O terminal card TP40 for temperature measurement.

The 2210 Display Unit is certified to comply with Directive 94/9/EC of the European Parliament and the Council as published in the Official Journal of the European Communities No. LO 100/1.

Figure B-2. Approval Label for the 2210 Display Unit.



ATEX marking and Ex Certification code

2210 DU without TP40:	Ex II 2 G	EEx ib IIC T4 (Ta = -40°C to +70°C)
2210 DU including TP40:	Ex II 2 (1) G	EEx ib ia IIC T4 (Ta = -40°C to +70°C)

Intrinsically safe (IS) entity parameters

- Connector X2: U_i = 12V, I_i = 400 mA, Pi = 0.7 W
- Optional TP40, connector X17 and X18: U_o = 5.88 V, I_o = 172.4 mA, P_o = 0.253 W
  The capacitance or 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:

Gas Group	Capacitance μF	Inductance μH	or	L/R ratio μH/Ohm
IIC	43	0.7		140
IIB	1000	5.2		560
IIA	1000	10		1120

Hazardous Locations Installations

Instructions specific to hazardous area installations

The following instructions apply to equipment covered by certificate number Sira 00ATEX2062:

1. The equipment may be used with flammable gases and vapors with apparatus groups IIC, IIB, and IIA and with temperature classes T1, T2, T3, and T4.
2. The equipment is only certified for use in ambient temperatures in the range -40°C to +70°C and should not be used outside this range.
3. Installation shall be carried out in accordance with the applicable code of practice.
4. Certification marking as detailed in drawing numbers 9150 074-980 and 9150 074-981.

5600 Series Level Transmitter

E1 Certificate Number: Sira 03ATEX 1294X
With Non-IS Primary output and IS Display Output:
ATEX Category Marking ⟨Ex⟩ II (1) 1/2 G
EEx de [ia] IIC T6, (T_{amb} -40°C, +70°C)
With IS Primary and Secondary Outputs and IS Display Output:
ATEX Category Marking ⟨Ex⟩ II (2) (1) 1/2 G
EEx de [ib] [ia] IIC T6 (T_{amb} -40°C, +70°C)
With Non-IS Outputs (Display Output not available):
ATEX Category Marking ⟨Ex⟩ II 1/2 G
EEx de IIC T6, (T_{amb} -40°C, +70°C)

Passive analog output 4-20mA,
Label identification = HART passive.
Voltage compliance 7-30V:
U_i < 30 V
I_i < 200 mA
Pi < 1.3 W
C_i = 0 μF
L_i = 0 mH

Active analog output 4-20mA,
Label identification = HART active.
Max load 300Ω:
U_o < 23.1 V
I_o < 125.7 mA
P_o < 0.726 W
C_{ext} <0.14 μF
L_{ext} < 2.2 mH

FOUNDATION Fieldbus,
Label identification = FOUNDATION fieldbus.
U_i < 30 V
I_i < 300 mA
Pi < 1.3 W
C_i = 0 μF
L_i = 0 mH

Factory Mutual (FM) approval.
Certificate: J.I. 4D5A9.AX

E5 With Intrinsically safe outputs:
(All versions except those listed below)

Explosionproof with IS outputs for HAZLOC

Class I, Division 1, Group A, B, C and D,
Max operating temperature +70°C

Use conductors rated at least 85°C

Shall be installed in accordance with System control drawing 9150074-994.

E5 With Secondary output code 1 or 3:

Explosionproof

Class I, Division 1, Group A, B, C and D,
Max operating temperature +70°C

Use conductors rated at least 85°C

2210 Display Unit

SIRA / ATEX Intrinsically safe certification.
Equipment group II, Category 2 (1) G
Certificate: SIRA 00ATEX2062

E1 With Display Panel Code P or R:

ATEX Category Marking ⟨Ex⟩ II 2 G

EEx ib IIC T4, (T_{amb} -40°C, +70°C)

E1 With Display Panel Code T:

ATEX Category Marking ⟨Ex⟩ II 2 (1) G

EEx ib [ia] IIC T4, (T_{amb} -40°C, +70°C)

Connector X2:
U_i < 12 V
I_i < 400 mA
Pi < 0.7 W
Optional TP 40, connector X17 and X18:
U_o=5.88V
I_o=172.4mA
P_o=0.253W

North American Certifications

Factory Mutual (FM) Approvals

Certificate: J.I. 4D5A9.AX

E5 With Display panel code P or R or T:

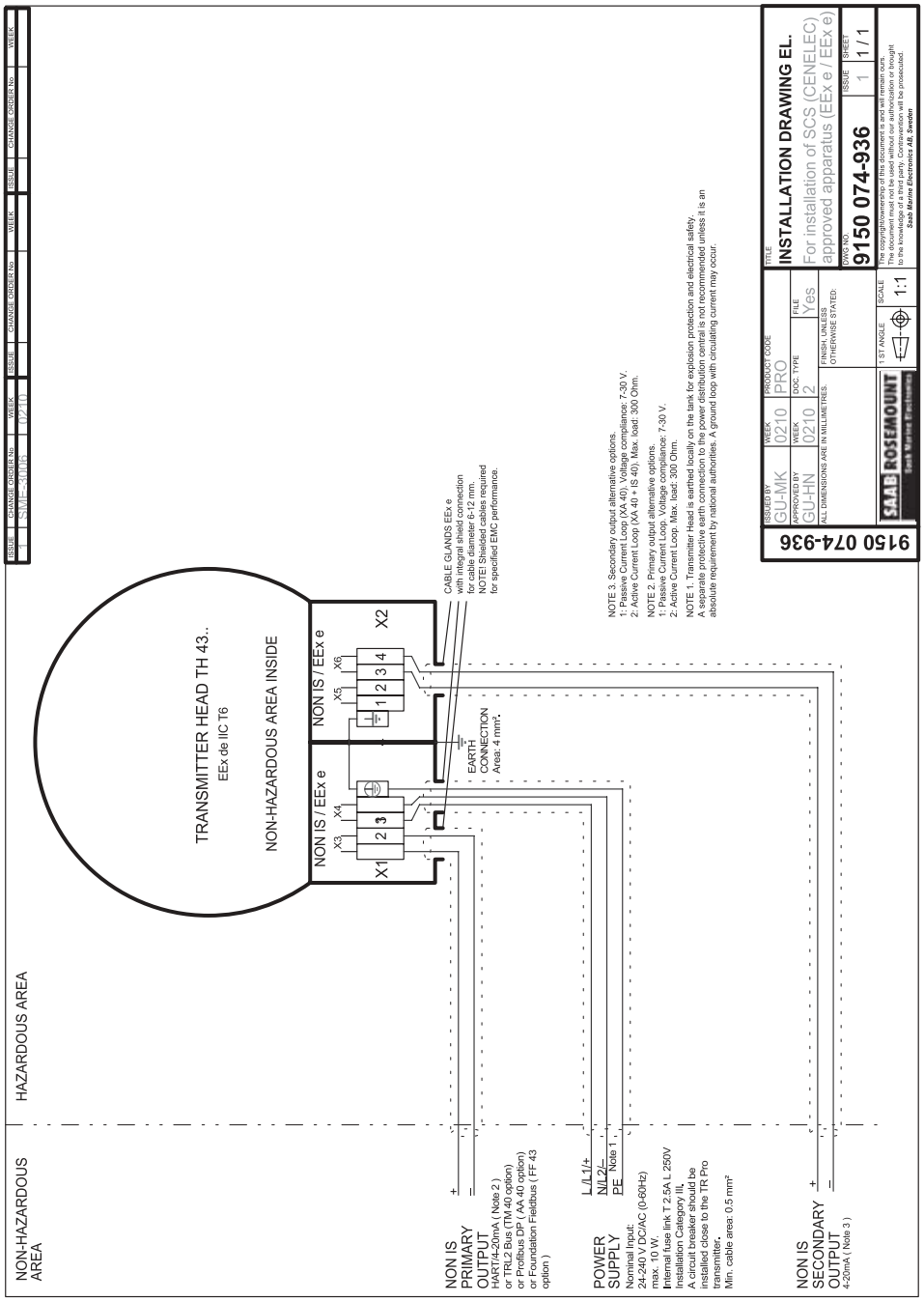
Intrinsic Safe for HAZLOC

Class I, Division 1, Group A, B, C and D T4

Max operating temperature +70°C

Shall be installed in accordance with System control drawing 9150074-997.

Appendix C Approval Drawings



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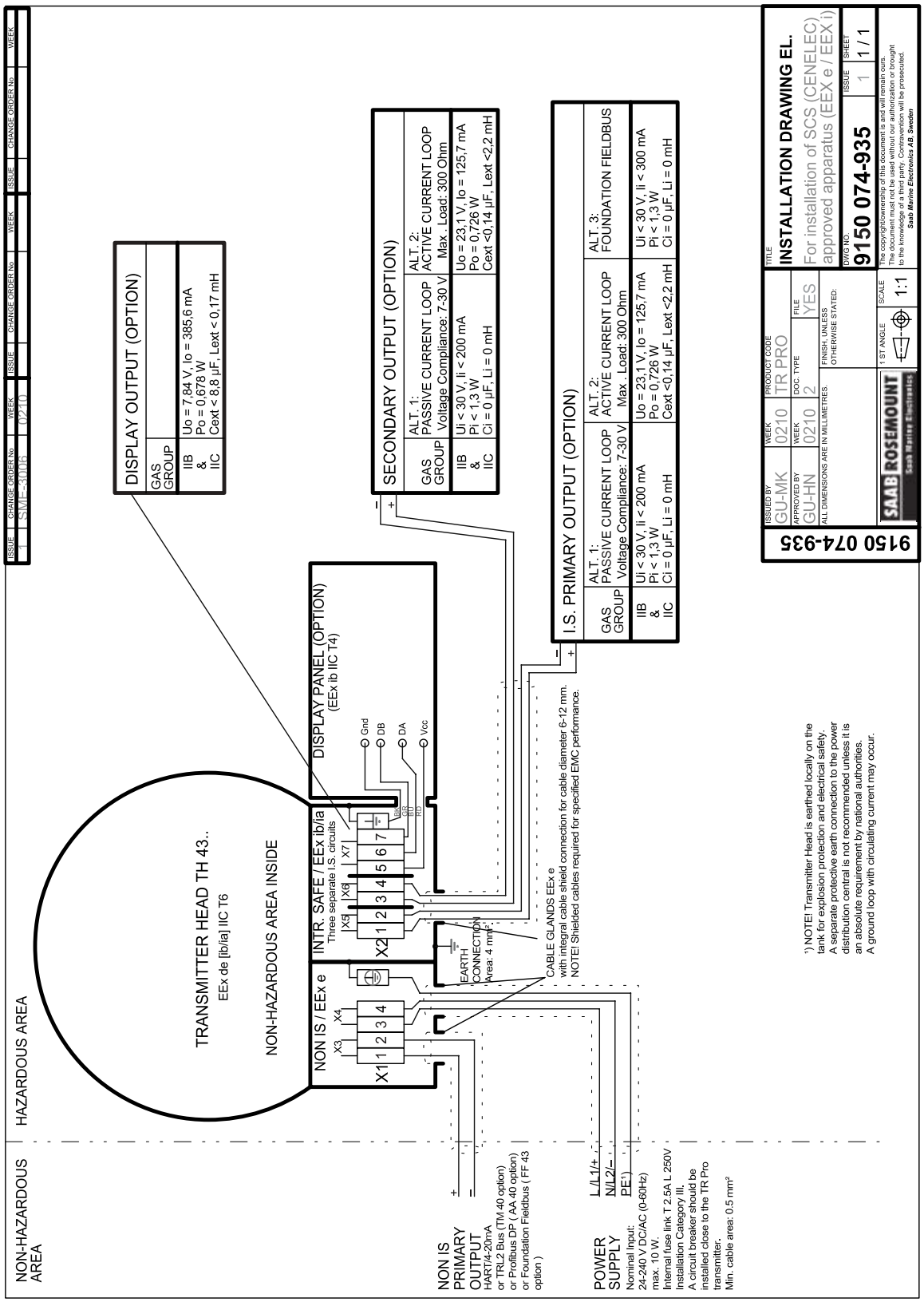
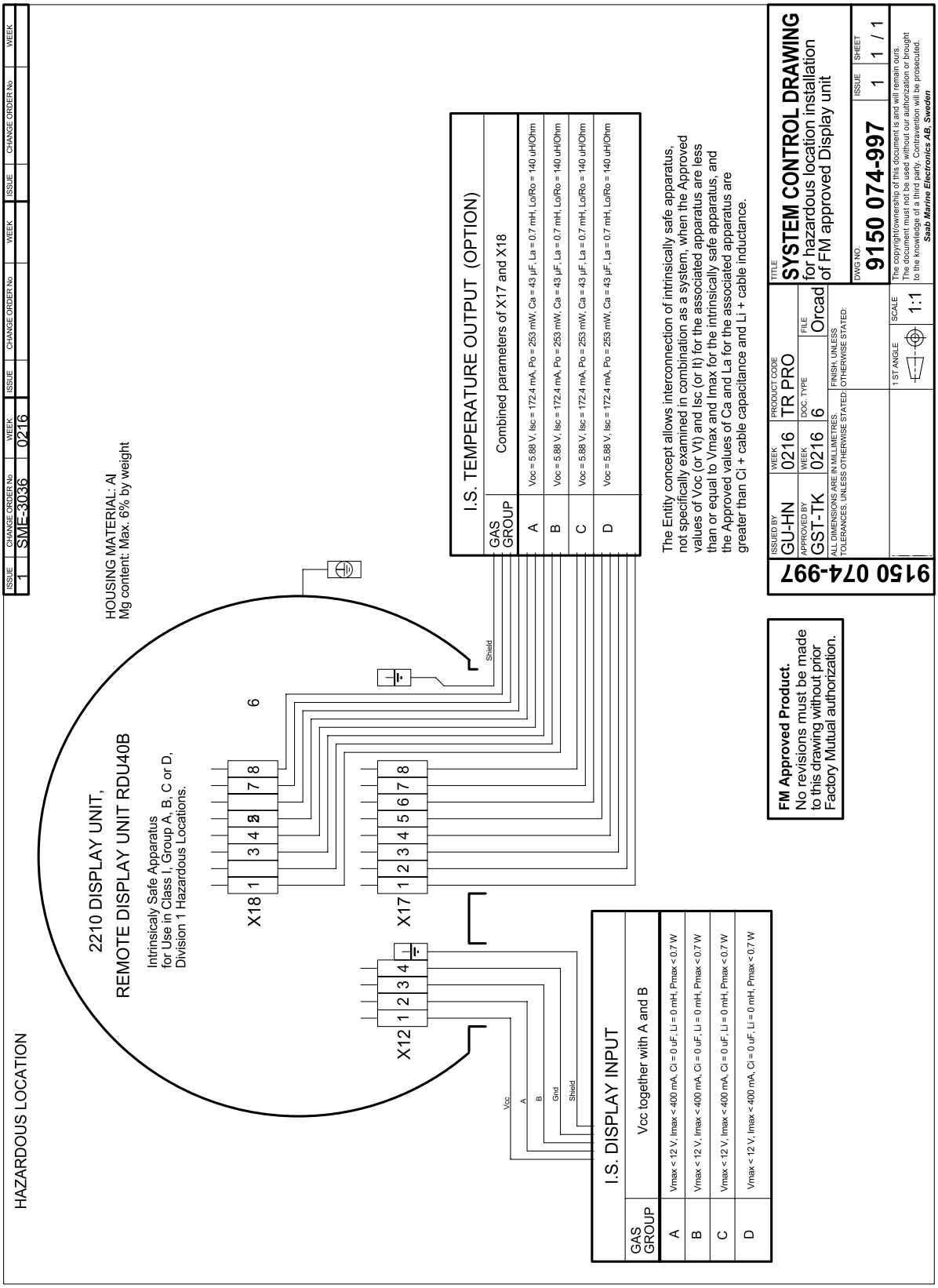


5600APPROVAL02.EPS


ISSUE | CHANGE ORDER No | WEEK | ISSUE | CHANGE ORDER No | WEEK | ISSUE | CHANGE ORDER No | WEEK
1 | SME-3036 | 0216
HAZARDOUS LOCATION
2210 DISPLAY UNIT,
REMOTE DISPLAY UNIT RDU40B
Intrinsicaly Safe Apparatus
for Use in Class I, Group A, B, C or D,
Division 1 Hazardous Locations.
HOUSING MATERIAL: Al
Mg content: Max. 6% by weight
X12 1 2 3 4
X18 1 3 4 5 6 7 8
X17 1 2 3 4 5 6 7 8
Vcc
A
B
Gnd
Shield
I.S. DISPLAY INPUT
GAS GROUP
Vcc together with A and B
A Vmax < 12 V, Imax < 400 mA, Ci = 0 uF, Li = 0 mH, Pmax < 0.7 W
B Vmax < 12 V, Imax < 400 mA, Ci = 0 uF, Li = 0 mH, Pmax < 0.7 W
C Vmax < 12 V, Imax < 400 mA, Ci = 0 uF, Li = 0 mH, Pmax < 0.7 W
D Vmax < 12 V, Imax < 400 mA, Ci = 0 uF, Li = 0 mH, Pmax < 0.7 W
Shield
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, Lo/Ro = 140 uH/Ohm
B Voc = 5.88 V, Isc = 172.4 mA, Po = 253 mW, Ca = 43 µF, La = 0.7 mH, Lo/Ro = 140 uH/Ohm
C Voc = 5.88 V, Isc = 172.4 mA, Po = 253 mW, Ca = 43 µF, La = 0.7 mH, Lo/Ro = 140 uH/Ohm
D Voc = 5.88 V, Isc = 172.4 mA, Po = 253 mW, Ca = 43 µF, La = 0.7 mH, Lo/Ro = 140 uH/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.
FM Approved Product.
No revisions must be made to this drawing without prior Factory Mutual authorization.
9150 074-997
ISSUED BY GU-HN WEEK 0216
APPROVED BY GST-TK WEEK 0216
PRODUCT CODE TR PRO
DOC. TYPE 6
FILE Orcad
ALL DIMENSIONS ARE IN MILLIMETRES. TOLERANCES, UNLESS OTHERWISE STATED:
FINISH, UNLESS OTHERWISE STATED:
1 ST ANGLE
SCALE 1:1
TITLE
SYSTEM CONTROL DRAWING
for hazardous location installation
of FM approved Display unit
DWG NO. 9150 074-997
ISSUE 1
SHEET 1 / 1
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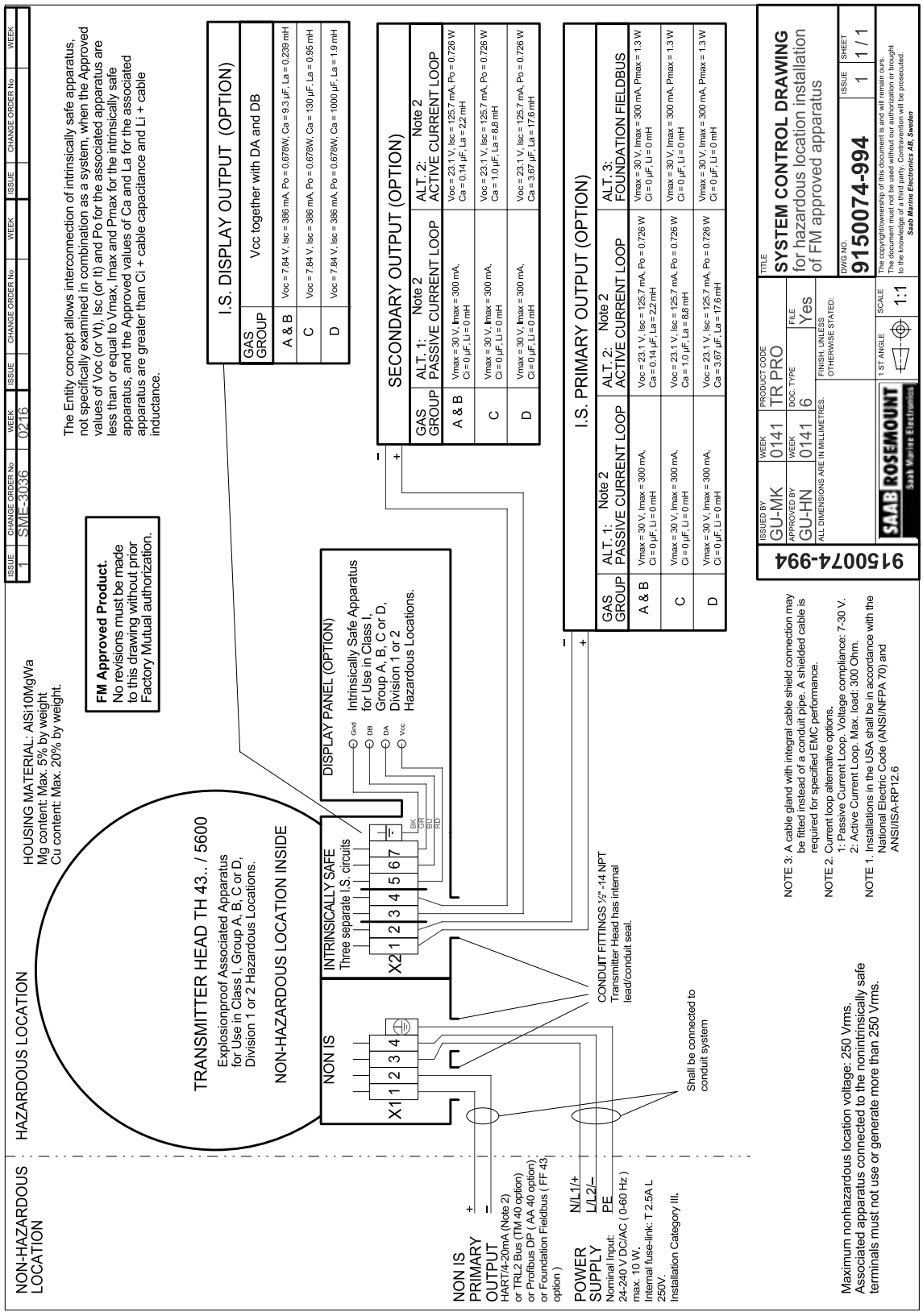
NON-HAZARDOUS LOCATION
HAZARDOUS LOCATION
HOUSING MATERIAL: AlSi10MgWa
Mg content: Max. 5% by weight
Cu content: Max. 20% by weight.
TRANSMITTER HEAD TH 43.. / 5600
Explosionproof Associated Apparatus for Use in Class I, Group A, B, C or D, Division 1 or 2 Hazardous Locations.
NON-HAZARDOUS LOCATION INSIDE
NON IS
INTRINSICALLY SAFE
Three separate I.S. circuits
X1 1 2 3 4
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
BK
GR
BU
RD
NON IS PRIMARY OUTPUT
HART/4-20mA (Note 2) or TRL2 Bus (TM 40 option) or Profibus DP (AA 40 option) or Foundation Fieldbus (FF 43 option)
POWER SUPPLY
Nominal Input: 24-240 V DC/AC (0-60 Hz) max. 10 W.
Internal fuse-link: T 2.5A L 250V.
Installation Category III.
N/L1/+
L/L2/–
PE
CONDUIT FITTINGS ½" -14 NPT
Transmitter Head has internal lead/conduit seal.
Shall be connected to conduit system
Maximum nonhazardous location voltage: 250 Vrms.
Associated apparatus connected to the nonintrinsically safe terminals must not use or generate more than 250 Vrms.
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. Voltage compliance: 7-30 V.
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
FM Approved Product.
No revisions must be made to this drawing without prior Factory Mutual authorization.
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), Isc (or It) and Po for the associated apparatus are less than or equal to Vmax, Imax and Pmax 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 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 PASSIVE CURRENT LOOP | ALT. 2: Note 2 ACTIVE CURRENT LOOP
A & B | Vmax = 30 V, Imax = 300 mA, Ci = 0 µF, Li = 0 mH | Voc = 23.1 V, Isc = 125.7 mA, Po = 0.726 W, Ca = 0.14 µF, La = 2.2 mH
C | Vmax = 30 V, Imax = 300 mA, Ci = 0 µF, Li = 0 mH | Voc = 23.1 V, Isc = 125.7 mA, Po = 0.726 W, Ca = 1.0 µF, La = 8,8 mH
D | Vmax = 30 V, Imax = 300 mA, Ci = 0 µF, Li = 0 mH | Voc = 23.1 V, Isc = 125.7 mA, Po = 0.726 W, Ca = 3.67 µF, La = 17.6 mH
I.S. PRIMARY OUTPUT (OPTION)
GAS GROUP | ALT. 1: Note 2 PASSIVE CURRENT LOOP | ALT. 2: Note 2 ACTIVE CURRENT LOOP | ALT. 3: FOUNDATION FIELDBUS
A & B | Vmax = 30 V, Imax = 300 mA, Ci = 0 µF, Li = 0 mH | Voc = 23.1 V, Isc = 125.7 mA, Po = 0.726 W, Ca = 0.14 µF, La = 2.2 mH | Vmax = 30 V, Imax = 300 mA, Pmax = 1.3 W, Ci = 0 µF, Li = 0 mH
C | Vmax = 30 V, Imax = 300 mA, Ci = 0 µF, Li = 0 mH | Voc = 23.1 V, Isc = 125.7 mA, Po = 0.726 W, Ca = 1.0 µF, La = 8,8 mH | Vmax = 30 V, Imax = 300 mA, Pmax = 1.3 W, Ci = 0 µF, Li = 0 mH
D | Vmax = 30 V, Imax = 300 mA, Ci = 0 µF, Li = 0 mH | Voc = 23.1 V, Isc = 125.7 mA, Po = 0.726 W, Ca = 3.67 µF, La = 17.6 mH | Vmax = 30 V, Imax = 300 mA, Pmax = 1.3 W, Ci = 0 µF, Li = 0 mH
ISSUE | CHANGE ORDER No | WEEK
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ISSUE | CHANGE ORDER No | WEEK
9150074-994
ISSUED BY GU-MK | WEEK 0141 | PRODUCT CODE TR PRO
APPROVED BY GU-HN | WEEK 0141 | DOC. TYPE 6 | FILE Yes
ALL DIMENSIONS ARE IN MILLIMETRES. | FINISH, UNLESS OTHERWISE STATED:
SAAB ROSEMOUNT Saab Marine Electronics
1 ST ANGLE | SCALE 1:1
TITLE
SYSTEM CONTROL DRAWING
for hazardous location installation of FM approved apparatus
DWG NO. 9150074-994 | ISSUE 1 | SHEET 1 / 1
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Rosemount 5600 Series

Reference Manual
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November 2003

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