Reference Manual
00809-0100-4811, Rev AA
October 2002

Rosemount 3300 Series

Guided Wave Radar Level and Interface Transmitters

ROSEMOUNT®

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EMERSON™
Process Management

Reference Manual
00809-0100-4811, Rev AA
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Guided Wave Radar Level and Interface Transmitters

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:

Equipment service needs.

1-800-654-7768 (*24 hours a day – Includes Canada*)

For equipment service or support needs outside the United States, contact your local Rosemount representative.

⚠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.

This product is designed to meet FCC and R&TTE requirements for a non-intentional radiator. It does not require any licensing whatsoever and has no tank restrictions associated with telecommunications issues.

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.

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Section 1 Introduction

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 saftey messages listed at the beginning of each section before performing an operation preceded by this symbol.

⚠WARNING

Failure to follow these installation 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.

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.

Electrical shock could cause death or serious injury.

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

⚠WARNING

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

MANUAL OVERVIEW

This manual provides installation, configuration and maintenance information for the Rosemount 3300 Series Radar Transmitter.

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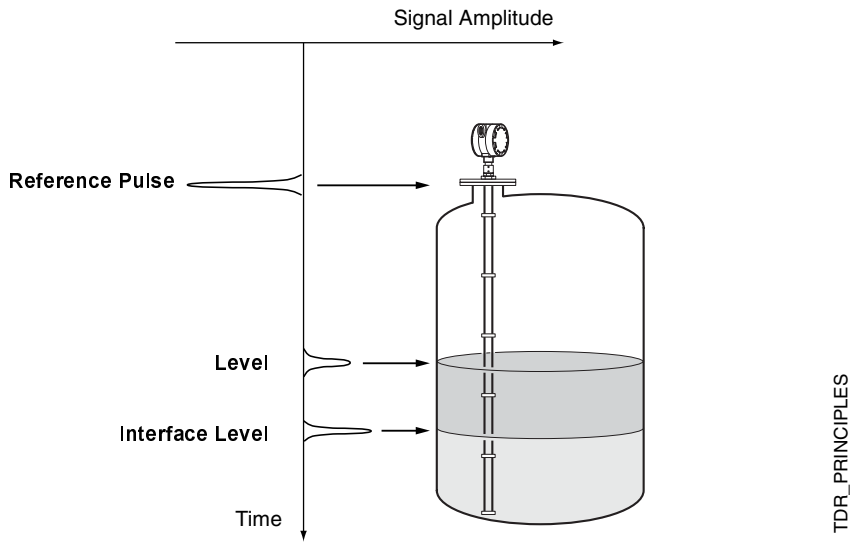
Section 2 Transmitter Overview

THEORY OF OPERATION

The Rosemount 3300 Series Radar Transmitter is a smart, two-wire continuous level transmitter that is based on Time Domain Reflectometry (TDR) principles. Low power nano-second-pulses are guided along a probe immersed in the process media. When a pulse reaches the surface of the material it is measuring, part of the energy is reflected back to the transmitter, and the time difference between the generated and reflected pulse is converted into a distance from which the total level or interface level is calculated (see below).

The reflectivity of the product is a key parameter for measurement performance. A high dielectric constant of the media gives better reflection and a longer measuring range. A calm surface gives better reflection than a turbulent surface.

Figure 2-1. Measurement Principle.



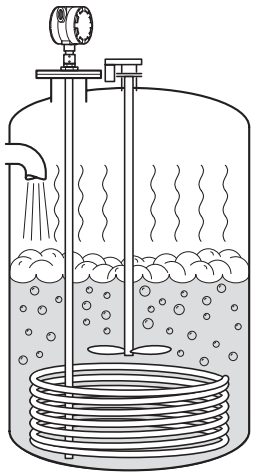
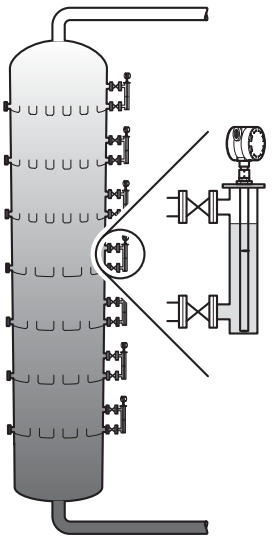
APPLICATIONS

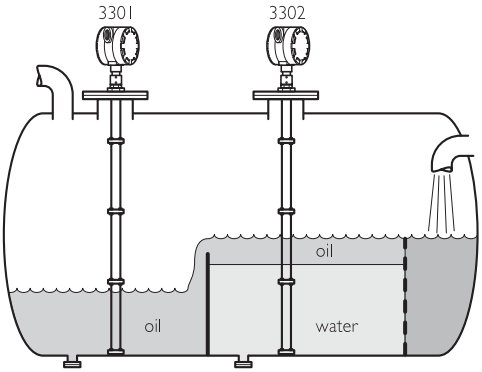
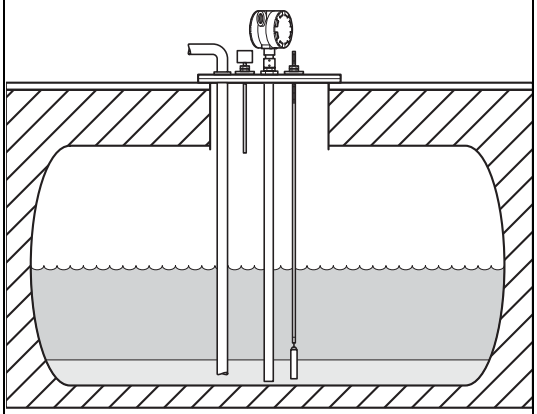
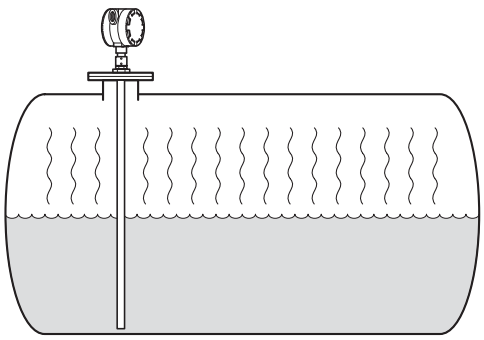
The Rosemount 3300 Series Radar Transmitter program is suited for aggregate (total) level measurements on most liquids, semi-liquids, and liquid/liquid interfaces.

Guided microwave technology offers highest reliability and precision which ensure measurements are virtually unaffected by temperature, pressure, vapor gas mixtures, density, turbulence, bubbling/boiling, low level, varying dielectric media, pH, and viscosity.

Guided wave radar technology in combination with advanced signal processing make the 3300 transmitters suitable for a wide range of applications:

Figure 2-2. Application examples

APPLIC TURBULENCE 	Boiling conditions with vapor and turbulence. For these applications the Coaxial probe is particularly suitable.
APPLIC BRIDLE 	The 3300 Series of transmitters is well suited for bridle applications such as distillation columns.

APPLIC SEPARATOR		Separator tank. The model 3302 measures both level and interface level.
APPLIC SEPARATOR		The Rosemount 3300 series is a good choice for underground tanks since it is installed on the tank top with the radar pulse concentrated near the probe. It can be equipped with probes that are unaffected by high and narrow openings or nearby objects.
APPLIC AMMONIA		Guided wave radar technology is a good choice for reliable measurements in small ammonia, NGL and LPG tanks.

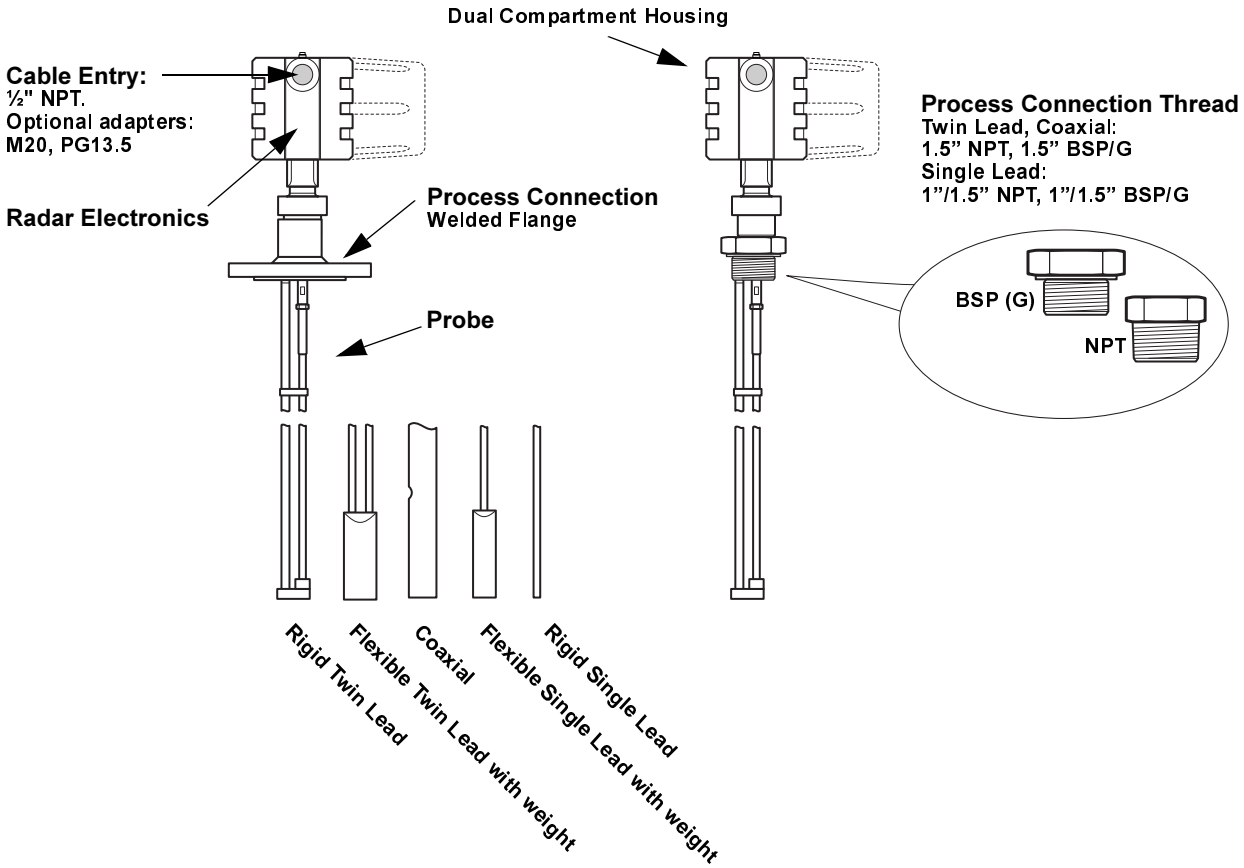
COMPONENTS OF THE TRANSMITTER

The Rosemount 3300 Series Radar Transmitter has an aluminum *transmitter housing* which contains advanced electronics for signal processing.

The *radar electronics* produces an electromagnetic pulse which is guided by the *probe*.

There are different probe types available for various applications: Rigid Twin Lead, Flexible Twin Lead, Rigid Single Lead, Flexible Single Lead, and Coaxial.

Figure 2-3. Transmitter components.



COMPONENTS TRANSMITTER

NOTE
Flexible and Rigid probes require different radar electronics and can not be used with the same transmitter head.

SYSTEM ARCHITECTURE

The Rosemount 3300 Series Radar Transmitter is loop-powered which means it uses the same two wires for both power supply and output signal. The output is a 4-20 mA analog signal superimposed with a digital HART signal.

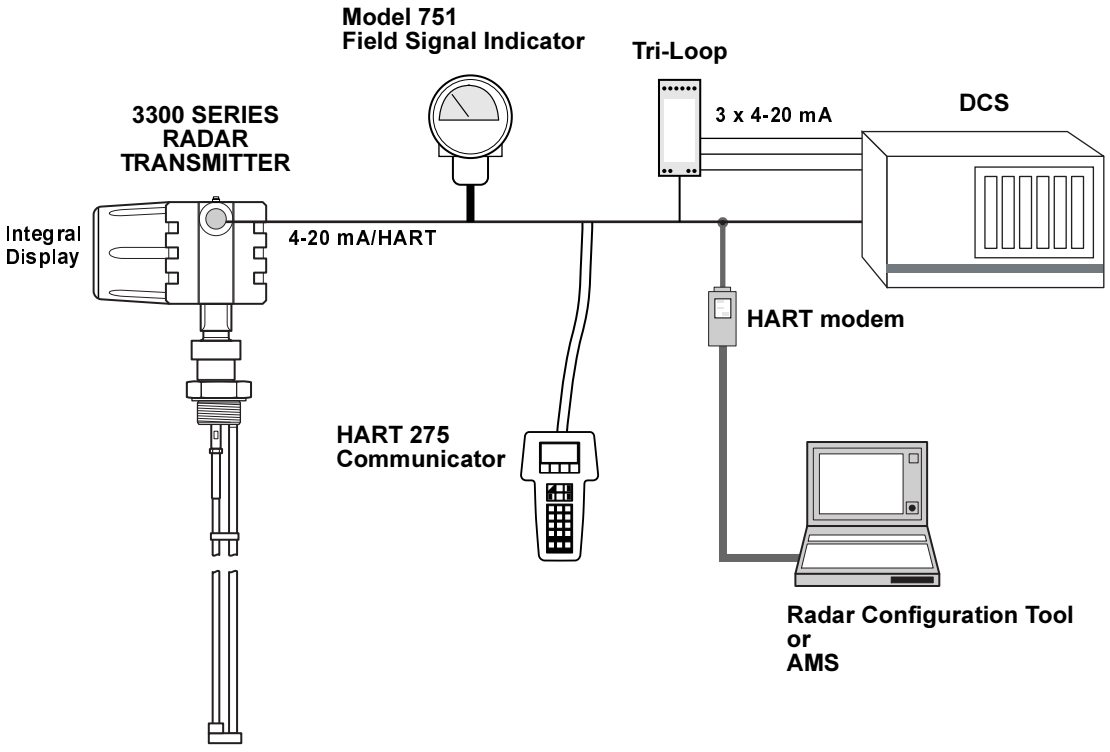
By using the optional HART Tri-loop, it is possible to convert the HART signal to up to three additional 4-20 mA analog signals.

With the HART protocol it is possible to use multidrop configuration. In this case communication is restricted to digital since current is fixed to the 4 mA minimum value.

The transmitter can be connected to display Model 751 Field Signal Indicator or it can be equipped with an integral display.

The transmitter can easily be configured by using a HART 275 Communicator or a PC with the Radar Configuration Tool software. Rosemount 3300 Series transmitters are also compatible with the AMS™ (Asset Management Solutions™) software which also can be used for configuration.

Figure 2-4. System architecture.



SYSTEM

PROBE SELECTION GUIDE

Use the following guidelines to choose appropriate probe for your 3300 transmitter:

Table 2-1. Probe selection guide. G=Good, NR=Not Recommended, AP=Application Dependent (consult factory)

	Coaxial	Rigid Twin Lead	Flexible Twin Lead	Rigid Single Lead	Flexible Single Lead
Measurements					
Level	G	G	G	G	G
Interface (liquid/liquid)	G	G	G	NR	NR
Process Medium Characteristics					
Changing density	G	G	G	G	G
Changing dielectric(1)	G	G	G	G	G
Wide pH variations	G	G	G	G	G
Pressure changes	G	G	G	G	G
Temperature changes	G	G	G	G	G
Condensing vapors	G	G	G	G	G
Bubbling/boiling surfaces	G	G	AP	G	AP
Foam (mechanical avoidance)	AP	NR	NR	NR	NR
Foam (top of foam measurement)	NR	AP	AP	AP	AP
Foam (foam and liquid measurement)	NR	AP	AP	NR	NR
Clean liquids	G	G	G	G	G
Liquid with dielectric<2.5	G	AP	AP	NR	AP
Coating liquids	NR	NR	NR	AP	AP
Viscous liquids	NR	AP	AP	AP	G
Crystallizing liquids	NR	NR	NR	AP	AP
Tank Environment Considerations					
Probe is close (<12 in./30 cm) to tank wall / disturbing objects	G	AP	AP	NR	NR
High turbulence	G	G	AP	G	AP
Turbulent conditions causing breaking forces	NR	NR	AP	NR	AP
Long and small mounting nozzles (diameter <6 in./15 cm, height>diameter + 4 in./10 cm)	G	AP	NR	NR	NR
Probe might touch nozzle / disturbing object	G	NR	NR	NR	NR
Liquid or vapor spray might touch probe	G	NR	NR	NR	NR
Disturbing EMC environment in tank	AP	NR	NR	NR	NR

(1) For overall level applications a changing dielectric has no effect on the measurement. For interface measurements a changing dielectric of the top fluid will degrade the accuracy of the interface measurement.

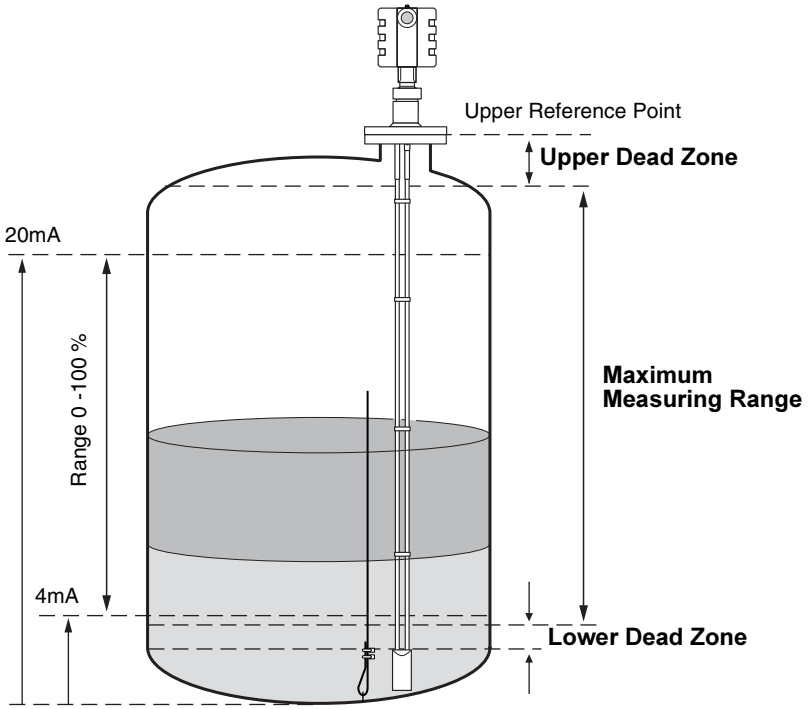
Dead Zones

The measuring range depends on probe type and properties of the product. The **Upper Dead Zone** is the minimum measurement distance between the upper reference point and the product surface. The Upper Dead Zone varies between 4 - 20 in. (0.1 and 0.5 m) depending on probe type and product.

At the end of the probe the measuring range is reduced by the **Lower Dead Zone**. The **Lower Dead Zone** also varies depending on probe type and product.

Figure 2-5 illustrates how the measuring range is related to the Dead Zones:

Figure 2-5. Dead Zones



DEAD ZONES

Table 2-2. Dead Zones for different probe types

	Dielectric Constant	Coaxial Probe	Rigid Twin Lead Probe	Flexible Twin Lead Probe	Single Lead Probe	Flexible Single Lead Probe
Upper Dead Zone	2	3.9 in. (10 cm)	7.9 in. (20 cm)	15.7 in. (40 cm)	13.8 in. (35 cm)	19.7 in. (50 cm)
	80	3.9 in. (10 cm)	7.9 in. (20 cm)	11.8 in. (30 cm)	7.9 in. (20 cm)	11.8 in. (30 cm)
Lower Dead Zone	2	2 in. (5 cm)	2.8 in. (7 cm)	5.9 in. (15 cm)	3.9 in. (10 cm)	4.7 in. (12 cm)
	80	1.2 in. (3 cm)	2 in. (5 cm)	2 in. (5 cm)	2 in. (5 cm)	2 in. (5 cm)

NOTE
The measurement accuracy is reduced in the Dead Zones. It may even be impossible to make any measurements at all in those regions. Therefore the 4-20 mA set points should be configured outside the Dead Zones.

PROCESS CHARACTERISTICS

The Rosemount 3300 Series has a high sensitivity due to its advanced signal processing and high signal to noise ratio, which makes it able to handle various disturbances. However, the following circumstances should be considered before mounting the transmitter.

Coating

Coating on the probe should be avoided since the sensitivity of the transmitter may be decreased leading to measurement errors. In viscous or sticky applications, periodic cleaning may be required.

Bridging

Heavy coating that results in product bridging across the two probes for twin lead versions, or between the pipe and the inner rod for coaxial probes, will cause erroneous level readings and must be prevented. Single lead probes are preferred in this case.

Foam

How well the Rosemount 3300 Series Radar Transmitter measures in foamy applications depends upon the properties of the foam; light and airy or dense and heavy, high or low dielectrics, etc. If the foam is conductive and creamy the transmitter will probably measure the surface of the foam. If the foam is less conductive the microwaves will probably penetrate the foam and measure the liquid surface.

Vapor

In some applications, as ammonia, there is heavy vapor above the product surface that will influence the level measurement. The Rosemount 3300 Series Radar Transmitter can be configured to compensate for the influence of vapor.

Measuring Range

The measuring range differs depending on probe type and characteristics of the application. The values given in *Table 2-3* can be used as a guideline for clean liquids.

Table 2-3. Measuring Range

Coaxial	Rigid Twin Lead	Flexible Twin Lead	Rigid Single Lead	Flexible Single Lead
Maximum Measuring Range				
19 ft 8 in. (6 m)	9 ft 10 in. (3 m)	65 ft 7 in. (20 m)	9 ft 10 in. (3 m)	65 ft 7 in. (20 m)
Minimum Dielectric Constant at Maximum Measuring Range				
1.6	1.9	2.0 (1.6 up to 10 m)	2.5 (2.0 if installed in a metallic bypass or stilling well)	2.8 (2.0 up to 10 m)

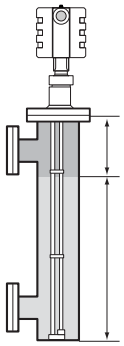
The maximum measuring range differs depending on application according to:

- Disturbing objects close to the probe.
- Media with higher dielectric constant (ε_r) gives better reflection and allows a longer measuring range.
- A calm surface gives better reflection than a turbulent surface. For a turbulent surface the measuring range might be reduced.
- Surface foam and particles in the tank atmosphere are also circumstances that might affect measuring performance.
- Coating/contamination can reduce the measuring range.

Interface

Model 3302 is the ideal choice for measuring the interface of oil and water or other liquids with significant dielectric differences. It is also possible to measure interface with the Model 3301 in bridle/tank applications when the probe is fully immersed in the liquid.

Figure 2-6. Fully immersed probe



BRIDLE_INTERFACE

Rigid twin lead, flexible twin lead and coaxial probes can be used to measure interfaces. However, the coaxial probe is the preferred choice. For measuring the interface level, the transmitter uses the residual wave of the first reflection. Part of the wave, which was not reflected at the upper product surface, continues until it is reflected at the lower product surface. The speed of this wave depends fully on the dielectric constant of the upper product.

If interface is to be measured, the following criteria have to be fulfilled:

- The dielectric constant of the upper product must be known. The Radar Configuration Tools software has a built-in dielectric constant calculator to assist user´s in determining the dielectric constant of the upper product (see “Dielectrics” on page 4-21).
- The dielectric constant of the upper product must have lower dielectric constant than the lower product in order to have a distinct reflection.
- The difference between the dielectric constants for the two products must be larger than 10.
- Maximum dielectric constant for the upper product is 10 for the coaxial probe and 5 for twin lead probes.
- The upper product thickness must be larger than 8 inch (0.2 m) for the flexible twin lead probe and 4 inch (0.1 m) for the rigid twin lead and coaxial probes in order to distinguish the echoes of the two liquids.

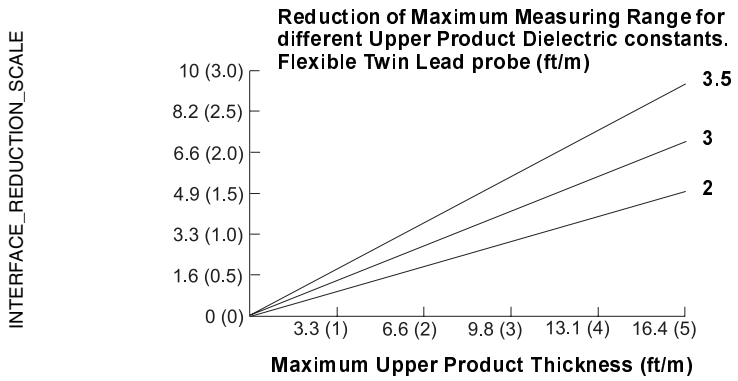
The maximum allowable upper product thickness/measuring range is primarily determined by the dielectric constants of the two liquids.

Target applications include interfaces between oil/oil-like and water/water-like liquids. For such applications the upper product dielectric constant is low (<3) and the lower product dielectric constant is high (>20), and the maximum measuring range is only limited by the length of the coaxial and rigid twin lead probes.

For the flexible twin lead probe, the reduction of maximum measuring range (65 ft/20 m), can be gained from Figure 2-7 on page 2-10..

However characteristics varies widely between different applications. For other product combinations, consult factory.

Figure 2-7. Reduction of maximum measuring range for Flexible Twin Lead probe



Emulsion Layers

Sometimes there is an emulsion layer (mix of the products) between the two products which, depending on its characteristics, will affect interface measurements.

For guidelines on emulsion situations, consult factory.

VESSEL CHARACTERISTICS

Heating Coils, Agitators

The Rosemount 3300 Series Radar Transmitter is relatively insensitive to objects in the tank since the radar signal is transmitted along a probe.

Avoid physical contact between probes and agitators as well as applications with strong fluid movement unless the probe is anchored. If the probe can move within 1 ft (30 cm) away from any object, such as an agitator, during operation then probe tie-down is recommended.

In order to stabilize the probe for side forces, it is possible to hang a weight at the probe end (flexible probes only) or fix/guide the probe to the tank bottom.

Tank Shape

The guided wave radar transmitter is insensitive to the tank shape. Since the radar signal travels along a probe, the shape of the tank bottom has virtually no effect on the measurement performance. The transmitter handles flat or dish-bottom tanks equally well.

Section 3 Installation

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 gauge 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.

⚠WARNING

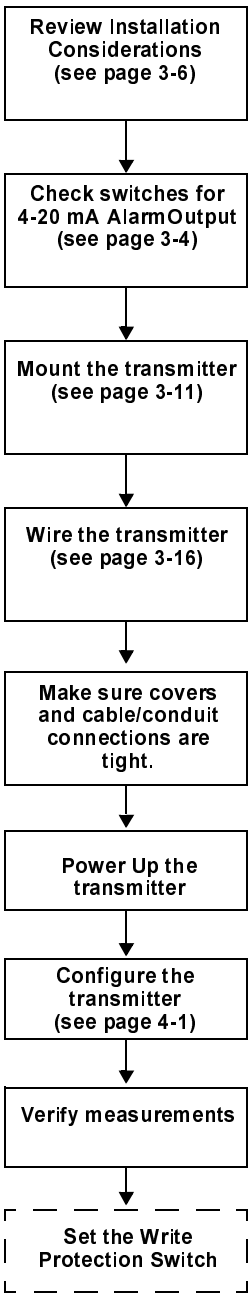
High voltage that may be present on leads could cause electrical shock:

Avoid contact with leads and terminals.

Make sure the main power to the 3300 transmitter is off and the lines to any other external power source are disconnected or not powered while wiring the gauge.

INSTALLATION PROCEDURE

Follow these steps for proper installation:



NOTE!
Disconnect power supply before setting the Write Protection.

BEFORE YOU INSTALL

Alarm and Write Protection Switches

Electronic boards are electrostatically sensitive. Failure to observe proper handling precautions for static-sensitive components can result in damage to the electronic components. Do not remove the electronic boards from the 3300 Radar Transmitter.

NOTE
To ensure long life for your radar transmitter, and to comply with hazardous location installation requirements, tighten covers on both sides of the electronics housing.

Table 3-1. 3300 Radar Transmitter Switch Settings

Switch Bank	Description	Default Setting	Position Settings
Alarm	4–20 mA Alarm Output	High	High, Low
Write Protect	Security Write Protection	Disabled (OFF)	ON = Enabled, OFF = Disabled

Table 3-2. Analog Output: Standard Alarm Values vs. Saturation Values

Level	4–20 mA Saturation Values	4–20 mA Alarm Value
Low	3.9 mA	3.75 mA
High	20.8 mA	21.75 mA

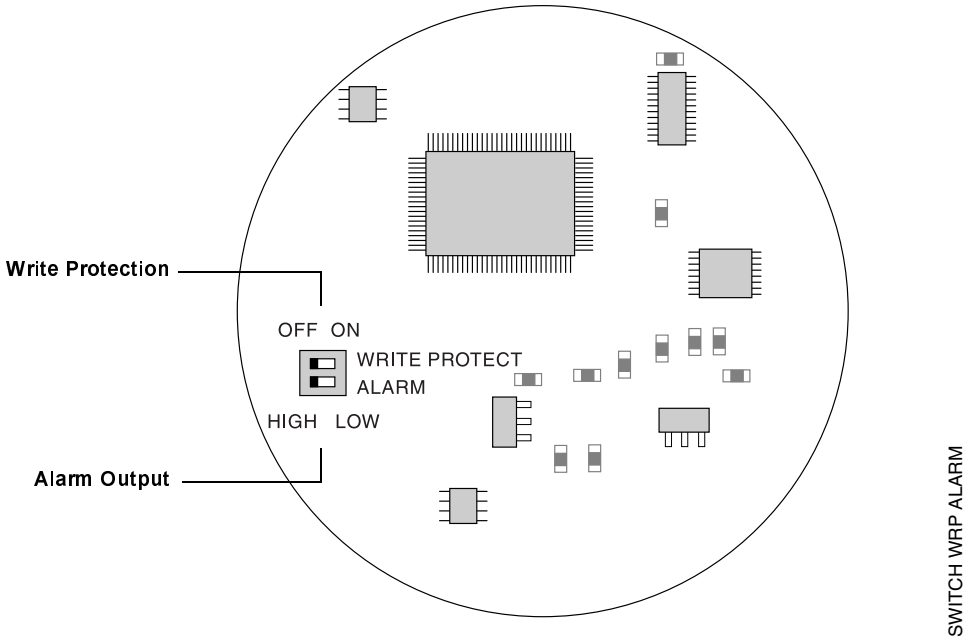
Table 3-3. Analog Output: NAMUR-Compliant Alarm Values vs. Saturation Values

Level	4–20 mA Saturation Values	4–20 mA Alarm Value
Low	3.8 mA	3.6 mA
High	20.5 mA	22.5 mA

The transmitter monitors its own operation. This automatic diagnostic routine is a timed series of checks repeated continuously. If the diagnostic routine detects a failure in the transmitter, the 4–20 mA output is driven upscale (high) or downscale (low) depending on the position of the Alarm switch.

Security write protection prevents unauthorized access to configuration data through the Rosemount Configuration Tool (RCT) software, a HART 275 Communicator or Asset Management Solutions (AMS) software.

Figure 3-1. Switches for Alarm and Write Protection



To set the Alarm and Write Protect switches do the following:

1. Remove the cover on the circuit side (see main label).
2. To set the 4-20 mA alarm output to Low, move the Alarm switch to the LOW position. HIGH is the factory default setting (see Figure 3-1).
3. To enable the security write protection feature, move the Write Protect switch to the ON position. The OFF position is the factory default setting (see Figure 3-1).
4. Replace and tighten the cover.

MOUNTING CONSIDERATIONS

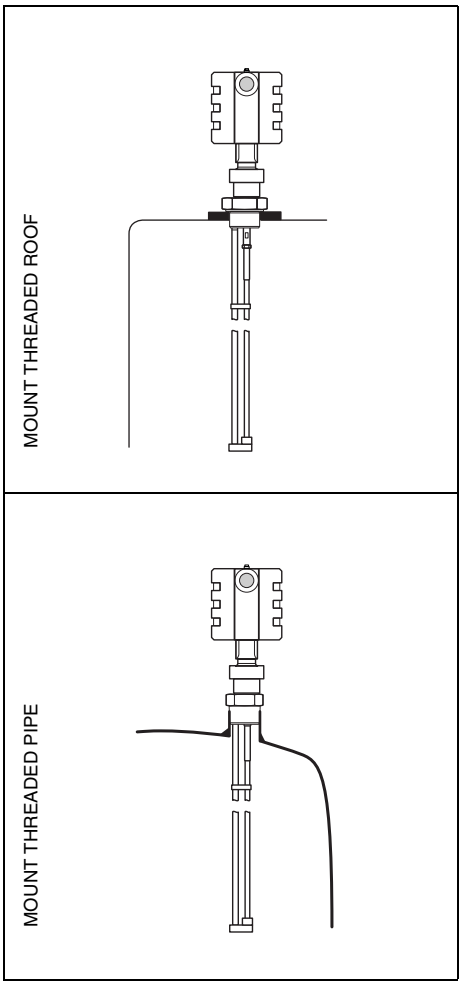
Before you install the Rosemount 3300 Series Radar Transmitter, be sure to consider specific mounting requirements, vessel characteristics and process characteristics.

Process connection

The 3300 Series has a threaded connection for easy mounting on the tank roof. It can also be mounted on a nozzle by using different flanges.

Threaded Connection

Figure 3-2. Mounting on tank roof using threaded connection

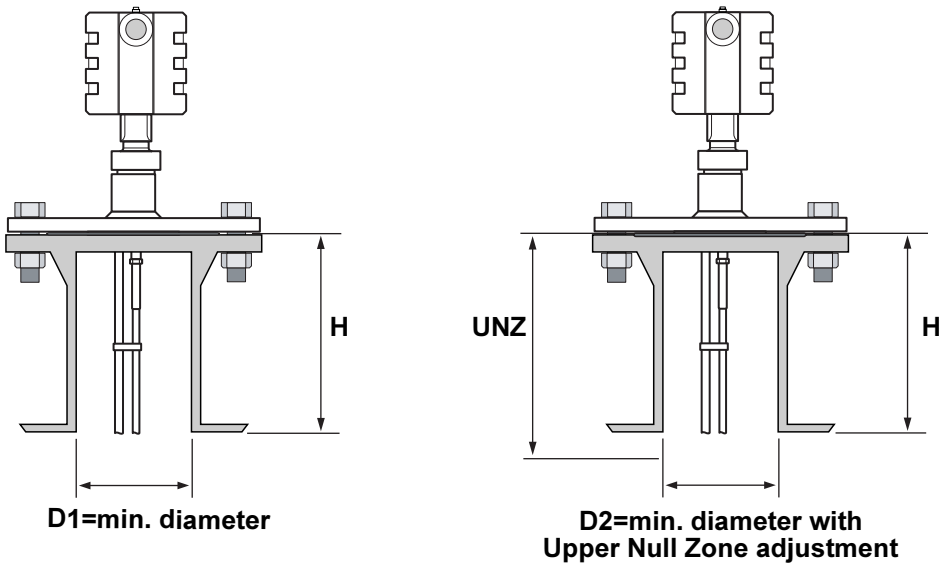


Mounting on tank roof.

Mounting in threaded pipe.

Flange Connection on Nozzles

Figure 3-3. Mounting in nozzles



NOZZLE MOUNT V3

The transmitter can be mounted in nozzles by using an appropriate flange. It is recommended that the nozzle size is within the dimensions given in *Table 3-4*. For small nozzles it may be necessary to increase the Upper Null Zone (UNZ) in order to reduce the measuring range in the upper part of the tank. By setting the UNZ equal to the nozzle height, the impact on the measurement due to interfering echoes from the nozzle will be reduced to a minimum. See also section *"Disturbances at the top of the tank" on page 6-12*. Amplitude Threshold adjustments may also be needed in this case.

NOTE
Except for the Coaxial Probe the probe must not be in contact with the nozzle.

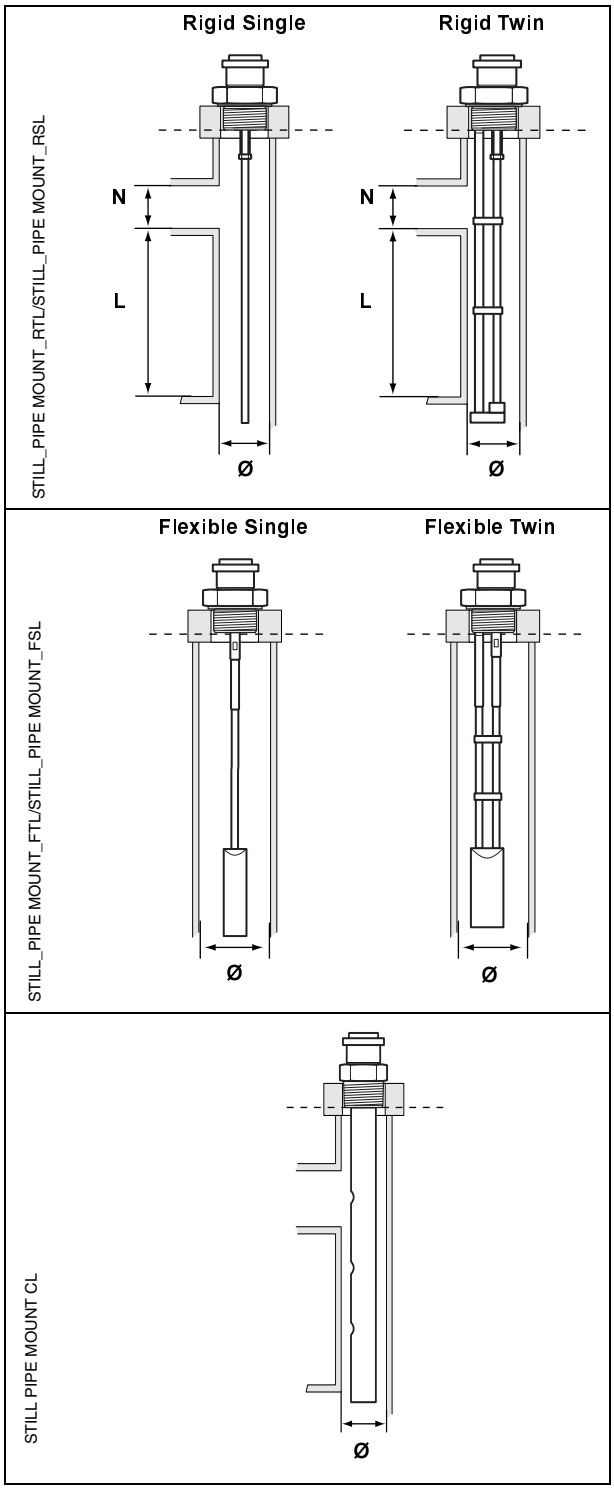
Table 3-4. Minimum nozzle diameter and maximum nozzle height (inch/mm)

	Rigid Twin Lead	Flexible Twin Lead	Coaxial	Single Lead	Flexible Single
D1(1)	4(100)	4(100)	> Probe diameter	6(150)	6(150)
D2(2)	2(50)	2(50)	> Probe diameter	2(50)(3) 1.5(38)(4)	2(50)
H(5)	4(100) + D(6)	4(100) + D(6)	-	4(100) + D(6)	4(100) + D(6)

(1) Upper Null Zone=0.
(2) Upper Null Zone>0.
(3) Process connection 1.5 inch
(4) Process connection 1 inch
(5) Recommended maximum nozzle height. For coaxial probes there is no limitation on nozzle height.
(6) Nozzle diameter

Mounting in Still pipes/by-pass pipes

Figure 3-4. Mounting in Still Pipes.



Rigid Twin Lead.
Pipe diameter Ø≥2 inch (50 mm).
Inlet pipe diameter N<Ø.
L≥12 inch (300 mm).

The center rod must be placed more than 0.6 inch/15 mm away from the pipe wall.

Rigid Single Lead.
Pipe diameter Ø≥1 inch (25 mm).
Inlet pipe diameter N<Ø.
L≥12 inch (300 mm).

Make sure that the probe is at the center of the Still pipe.

Note! It is not recommended that flexible probes are installed in by-pass pipes.

Flexible Twin Lead.
Pipe diameter Ø≥3 inch (75 mm).

The center rod must be placed more than 0.6 inch/15 mm away from the pipe wall. The probe may under no circumstances get into contact with the pipe wall.

Flexible Single Lead.
Pipe diameter Ø≥3 inch (75 mm).

Make sure that the probe is at the center of the Still pipe.

Coaxial Lead.
Pipe diameter Ø≥1.5 inch (38 mm).

Free Space

For easy access to the transmitter make sure that it is mounted with sufficient service space. For maximum measurement performance the transmitter should not be mounted too close to the tank wall or other objects in the tank.

If the probe is mounted close to a wall, nozzle or other tank obstruction noise might appear in the level signal. Therefore the following minimum clearance, according to the table below, must be maintained:

Figure 3-5. Free Space Requirement

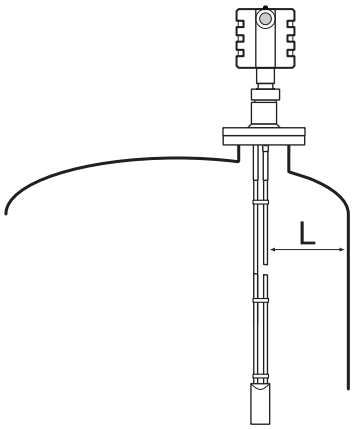


Table 3-5. Recommended free space to tank wall

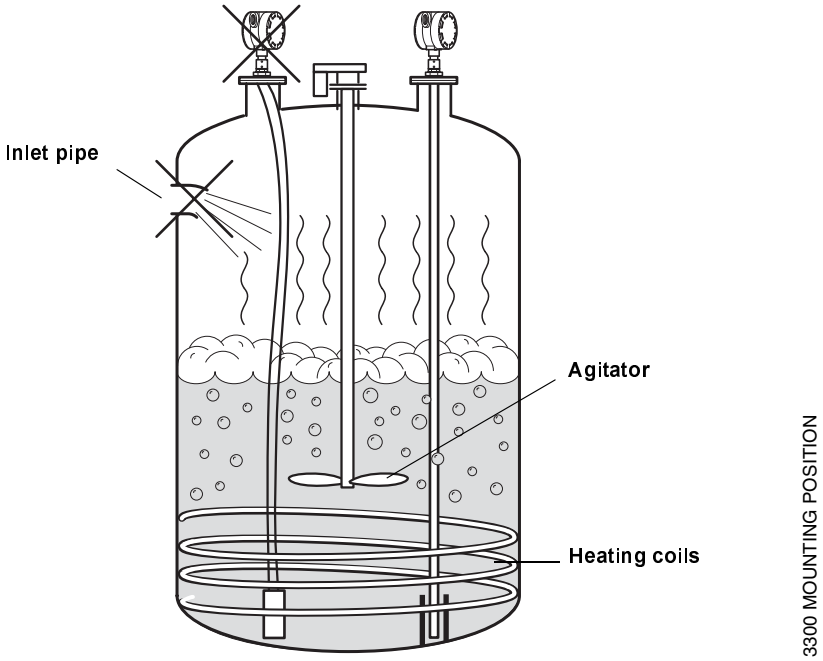
Coaxial	Rigid Twin	Flexible Twin	Rigid Single	Flexible Single
0 in. (0 mm)	4 in. (100 mm)	4 in. (100 mm)	12 in. (300 mm)	12 in. (300 mm)

Recommended Mounting Position

When finding an appropriate mounting position for the transmitter the conditions of the tank must be carefully considered. The transmitter should be mounted so that the influence of disturbing objects is reduced to a minimum.

In case of turbulence the probe may need to be anchored to the bottom, see “Mechanical Installation“ on page 3-11 for more information.

Figure 3-6. Mounting Position



The following guidelines should be considered when mounting the transmitter:

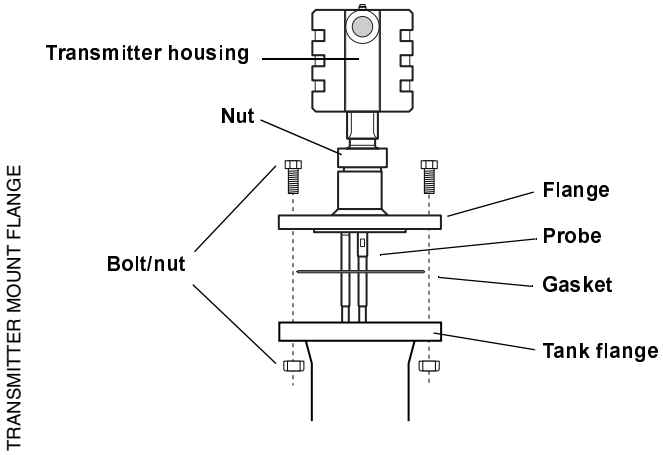
- Do not mount close to inlet pipes.
- Do not mount close to agitators. If the probe can move within 30 cm away from an agitator a probe tie-down is recommended.
- If the the probe tends to sway due to turbulent conditions in the tank, fasten the probe to the tank bottom.
- Avoid mounting close to heating coils.
- Make sure that the nozzle does not extend into the tank.
- Make sure that the probe does not come into contact with the nozzle or other objects in the tank.
- Position the probe such that it is subject to a minimum of lateral force.

MECHANICAL INSTALLATION

Mount the transmitter with flange on a nozzle on top of the tank. The transmitter can also be mounted on a threaded connection. Make sure only qualified personnel perform the installation.

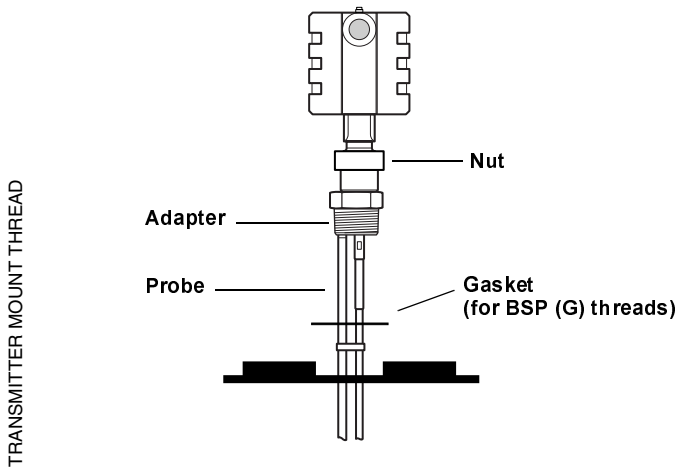
NOTE
If you need to remove the transmitter head from the probe, make sure that the Process Seal is carefully protected from dust and water. See *Section 6: Service* for further information.

Figure 3-7. Tank connection with flange.



1. Place a gasket on top of the tank flange.
2. Lower the transmitter and probe with flange into the tank.
3. Tighten the bolts.
4. Loosen the nut that connects the transmitter housing to the probe slightly.
5. Rotate the transmitter housing so the cable entries/display face the desired direction.
6. Tighten the nut.

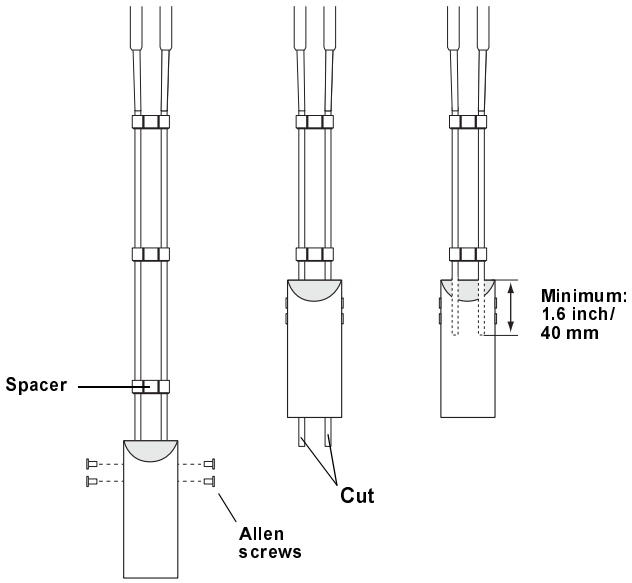
Figure 3-8. Threaded tank connection.



1. For adapters with BSP/G threads, place a gasket on top of the tank flange.
2. Lower the transmitter and probe into the tank.
3. Screw the adapter into the process connection.
4. Loosen the nut that connects the transmitter housing to the probe slightly.
5. Rotate the transmitter housing so the cable entries/display face the desired direction.
6. Tighten the nut.

Shortening the Probe

Flexible Twin Lead

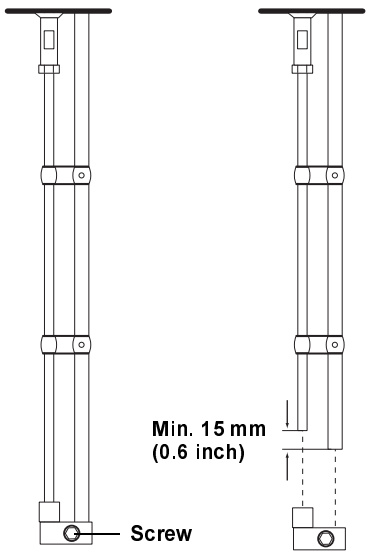


FLEX TWIN SHORT3

1. Mark off the required probe length. Add at least 1.6 inch /40 mm to the required probe length to be inserted into the weight.
2. Loosen the Allen screws.
3. Slide the weight upwards as much as needed in order to cut the probe.
4. Cut the probe. If necessary, remove a spacer to make room for the weight.
5. Slide the weight down to the required cable length.
6. Tighten the screws.
7. Update the transmitter configuration to the new probe length, see “Probe Length“ on page 4-9.

If the weight was removed from the cables when cutting, make sure that at least 1.6 inch/40 mm of the cable is inserted when the weight is replaced.

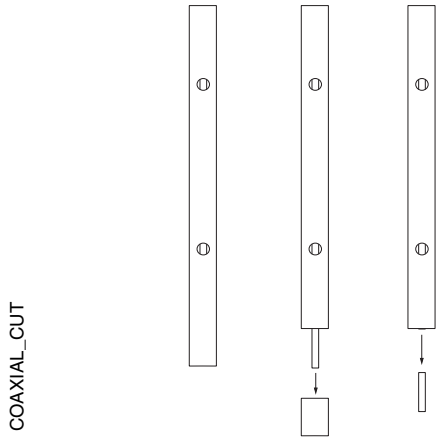
Rigid Twin Lead



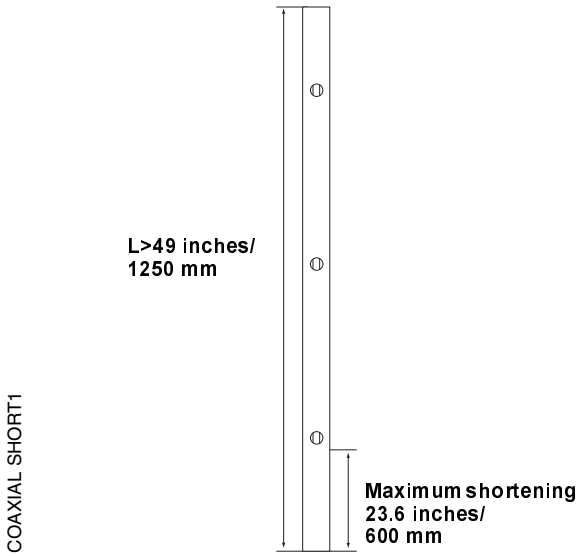
RIGID TWIN SHORT1

1. Loosen the screw and remove the end piece.
2. Cut the rods to the desired length. Make sure that the thin rod is 0.6 inch/15 mm shorter than the other probe to make sure that they fit into the end piece.
3. Replace the end piece and tighten the screw.
4. Update the transmitter configuration to the new probe length, see “Probe Length“ on page 4-9.

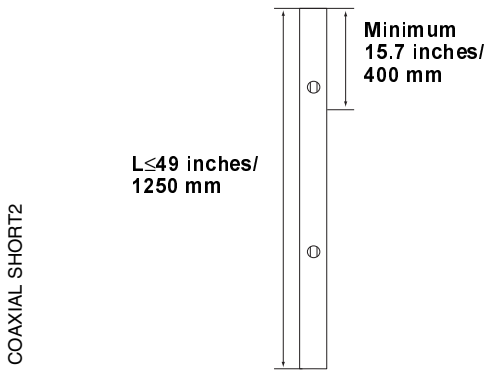
Coaxial



1. Cut the pipe to the desired length.
2. Cut the rod inside the pipe.



3. Update the transmitter configuration to the new probe length.
   - Pipes longer than 49 inches/1250 mm can be shortened by as much as 23.6 inches/600 mm.

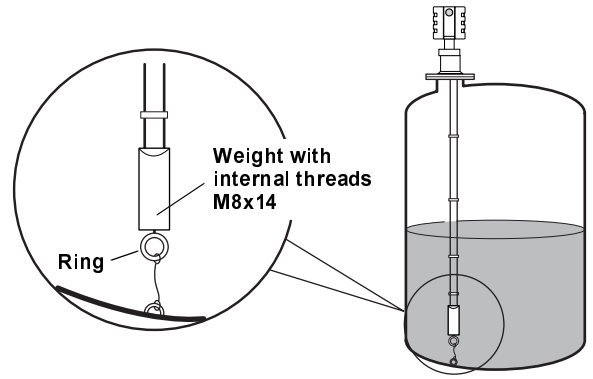


- Pipes shorter than 49 inches/1250 mm can be cut as long as the remaining length is not less than 15.7 inches/400 mm.

Anchoring

In turbulent tanks it may be necessary to fix the probe. Depending on the probe type different methods can be used to guide the probe to the tank bottom. This may be needed in order to prevent the probe from hitting the tank wall or other objects in the tank, as well as preventing a probe from breaking.

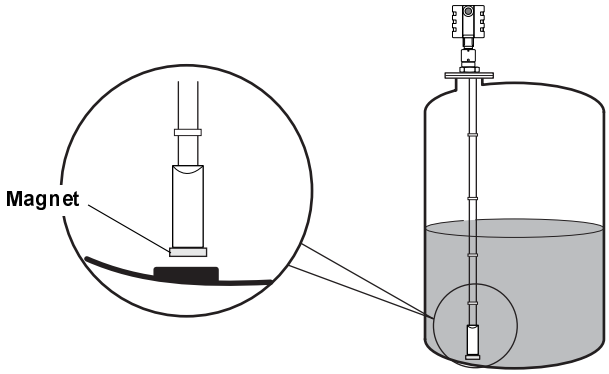
PROBEANCHOR RING FLEXIBLE TWIN



Flexible Twin/Single Lead probe with weight and ring.

A ring (customer supplied) can be attached to the weight in a threaded (M8x14) hole at the end of the weight. Attach the ring to a suitable anchoring point.

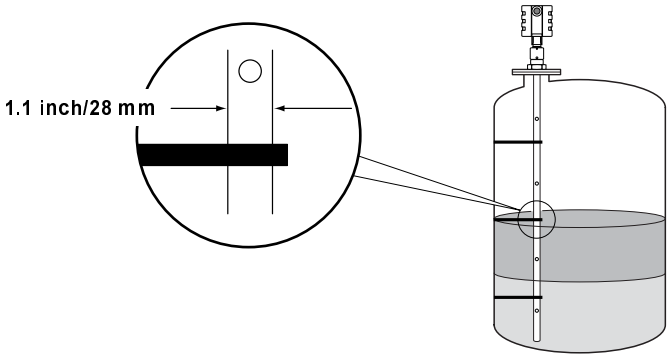
PROBEANCHOR MAGNET FLEXIBLE TWIN



Flexible Twin/Single Lead probe with weight and magnet.

A magnet (customer supplied) can be fastened in a threaded (M8x14) hole at the end of the weight. The probe can then be guided by placing a suitable metal plate beneath the magnet.

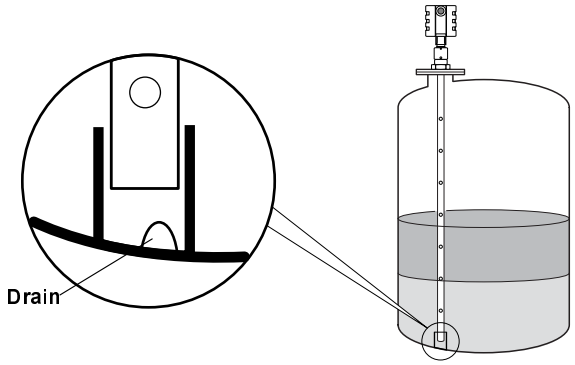
PROBE SUPPORT COAX



Coaxial probe fixed to the tank wall.

The coaxial probe can be guided to the tank wall by fixtures fastened to the tank wall. Fixtures are customer supplied. Make sure the probe can move freely due to thermal expansion without getting stuck in the fixture.

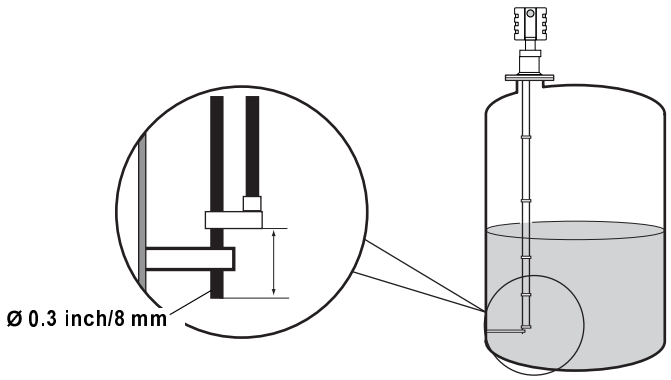
PROBE SUPPORT2 COAX



Coaxial probe.

The coaxial probe can be guided by a tube welded on the tank bottom. Tubes are customer supplied. Make sure that the probe can move freely in order to handle thermal expansion.

PROBEANCHOR RIGID TWIN

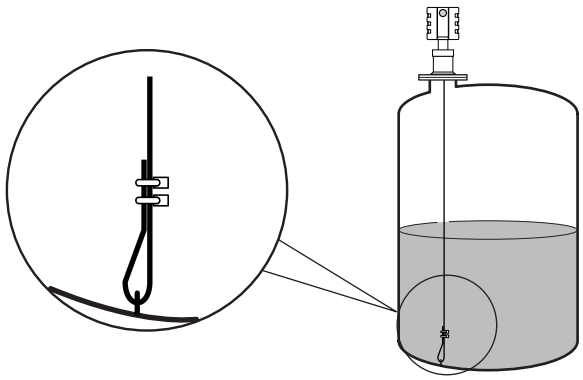


Rigid Twin Lead probe.

The rigid twin lead probe can be guided to the tank wall by a fixture at the lower end of the outer rod. The end piece needs to be moved accordingly by cutting the center rod. The length of the rod outside the end piece will add to the dead zone.

The fixture is customer supplied. Make sure the probe is only guided and not fastened in the fixture to be able to move freely for thermal expansion.

PROBEANCHOR FLEXIBLE SINGLE



Flexible Single Lead probe.

The probe rope itself can be used for anchoring. Pull the probe rope through a suitable anchoring point, e.g. a welded eye and fasten it with two clamps.

The length of the loop will add to the dead zone.The location of the clamps will determine the beginning of the dead zone. See section “Dead Zones“ on page 2-7 for further information on Dead Zones.

ELECTRICAL INSTALLATION

Cable/conduit entries

The electronics housing has two entries for ½ - 14 NPT. Optional M20×1.5 and PG 13.5 adapters are also available. The connections are made in accordance with local or plant electrical codes.

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

NOTE!
Use the enclosed metal plug to seal the unused port.

Grounding

The housing should always be grounded in accordance with national and local electrical codes. Failure to do so may impair the protection provided by the equipment. The most effective grounding method is direct connection to earth ground with minimal impedance. There are two grounding screw connections provided. One is inside the Field Terminal side of the housing and the other is located on top of the housing. The internal ground screw is identified by a ground symbol: ⏚.

NOTE!
Grounding the transmitter via threaded conduit connection may not provide sufficient ground.

Cable Selection

Use shielded twisted pair wiring for the Rosemount 3300 Series in order to comply with EMC regulations. The cables must be suitable for the supply voltage and approved for use in hazardous areas, where applicable. For instance, in the U.S., explosion-proof conduits must be used in the vicinity of the vessel. For the ATEX flame proof approval version of the 3300 Series, suitable conduits with sealing device or flame proof (EEx d) cable glands must be used depending on local requirements.

Use 18 AWG to 12 AWG in order to minimize the voltage drop to the transmitter.

Hazardous Areas

When the 3300 transmitter is installed in hazardous area, local regulations and specifications in applicable certificates must be observed.

Power Requirements

Terminals in the transmitter housing provide connections for signal cables.

The 3300 transmitter is loop-powered and operates with power supplies ranging from 11 to 42 VDC. For Intrinsically Safe output the supply voltage must be within 11 to 30 VDC. For Explosion Proof/Flame Proof the supply voltage must be within 16 to 42 VDC.

Maximum Loop Resistance

The maximum current loop resistance can be gained from the following diagrams:

Figure 3-9. Explosion/Flame Proof installations

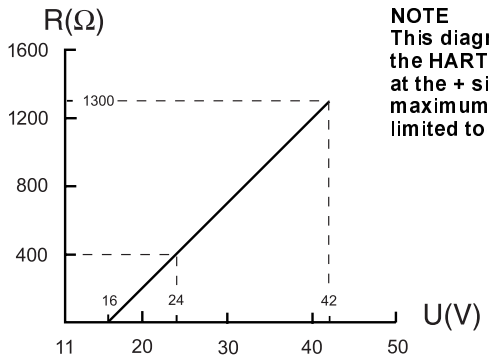


Figure 3-10. Non-hazardous installations

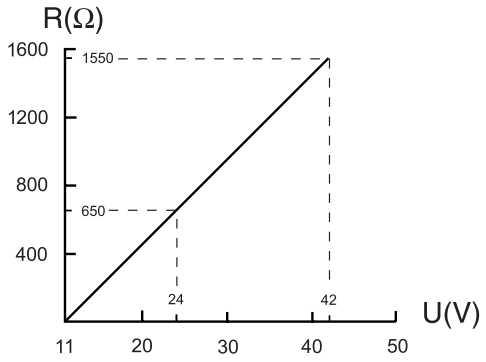
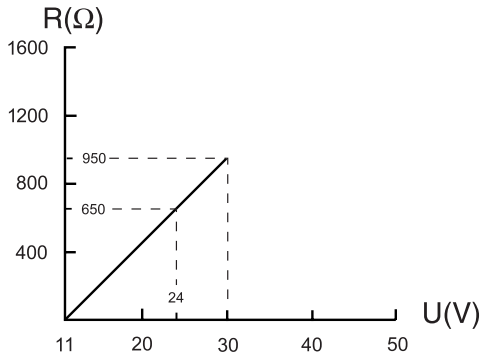


Figure 3-11. Intrinsically Safe installations



Connecting the Transmitter

The 3300 Series is a two-wire loop powered transmitter. It accepts power supplies ranging from 11 VDC to 42 VDC. It uses 4-20 mA power superimposed with a HART signal.

To connect the transmitter:

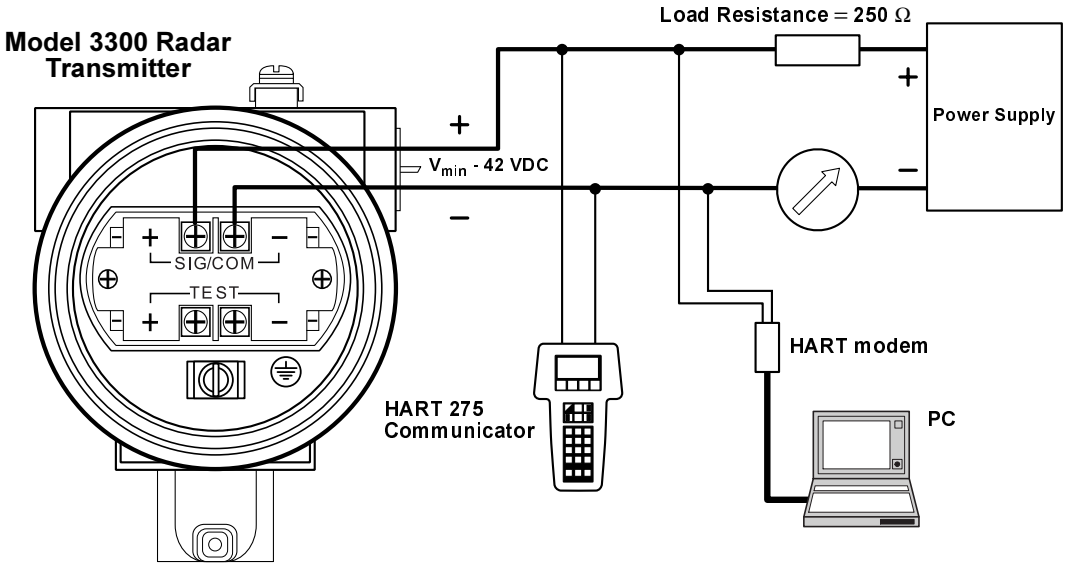
1. Make sure that power supply is disconnected.
2. Remove the cover on the transmitter housing terminal side (see label).
3. Pull the cable through the cable gland/conduit.
4. Connect wires according to Figure 3-12 for non-intrinsically safe output and according to Figure 3-13 for Intrinsically safe output.
5. Replace the cover, tighten the cable gland and connect the power supply.

Non-Intrinsically Safe Output

For non-intrinsically safe installations wire the transmitter as shown in Figure 3-12.

NOTE!
Make sure that the power supply is off when connecting the transmitter.

Figure 3-12. Wiring diagram for non-intrinsically safe installations.



WIRING NON IS

The HART 275 Communicator requires a minimum load resistance of 250 Ohm within the loop in order to function properly. For maximum load resistance see Figure 3-9 (Explosion/Flame Proof) and Figure 3-10 (Non-hazardous installations).

The power supply voltage ranges from V_{min} VDC to 42 VDC where V_{min} is the minimum voltage given by:

11 V	Non-hazardous locations certification
16 V	Explosion proof/flameproof certification

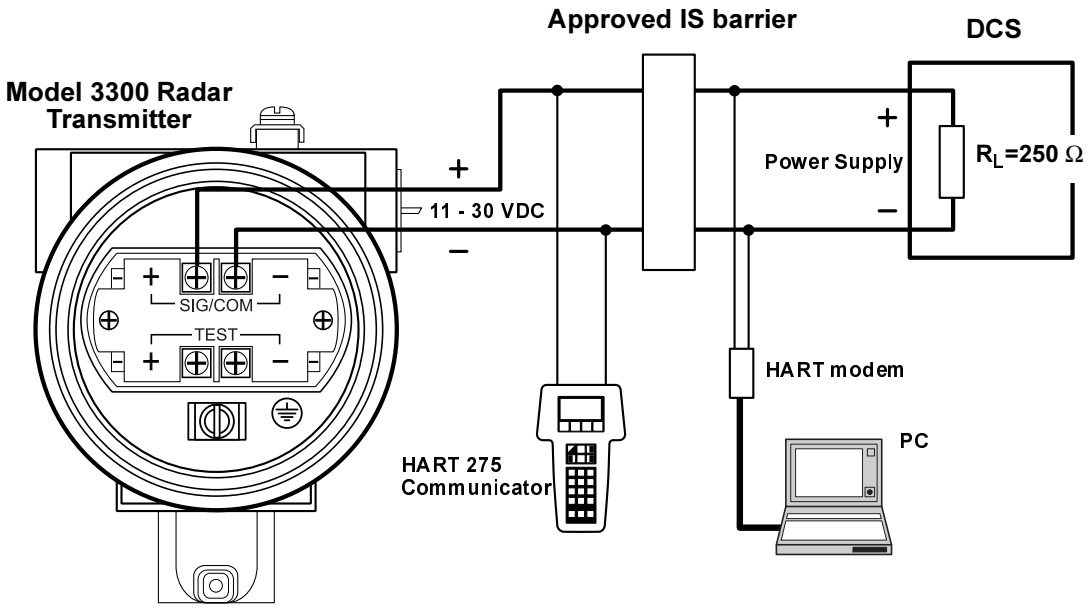
For Explosion Proof/Flame Proof applications the resistance between the negative terminal on the transmitter and the power supply must not exceed 300 Ohm.

Intrinsically Safe Output

For intrinsically safe installations wire the transmitter as shown in Figure 3-13.

NOTE!
Make sure that the instruments in the loop are installed in accordance with intrinsically safe field wiring practices.

Figure 3-13. Wiring diagram for intrinsically safe installations



WIRING IS

The HART 275 Communicator requires a minimum load resistance within the loop of 250 Ohm in order to function properly. For maximum load resistance see Figure 3-11.

The power supply voltage ranges from 11 V to 30 V.

IS parameters

Ui=30 V.

Ii=130 mA.

Pi=1 W.

Ci=0.

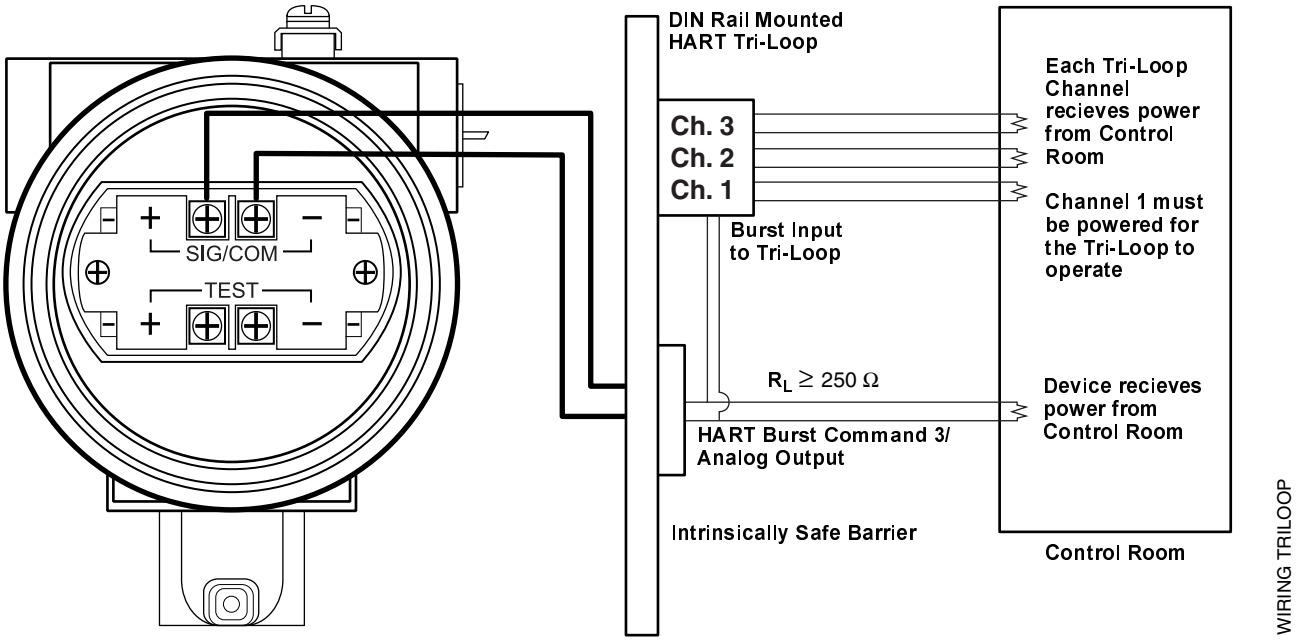
Li=0.

OPTIONAL DEVICES

Tri-Loop

The Model 3300 transmitter outputs a HART signal with four process variables. By using the Model 333 HART Tri-Loop up to three additional analog 4-20 mA outputs are provided.

Figure 3-14. Wiring diagram for HART Tri-Loop

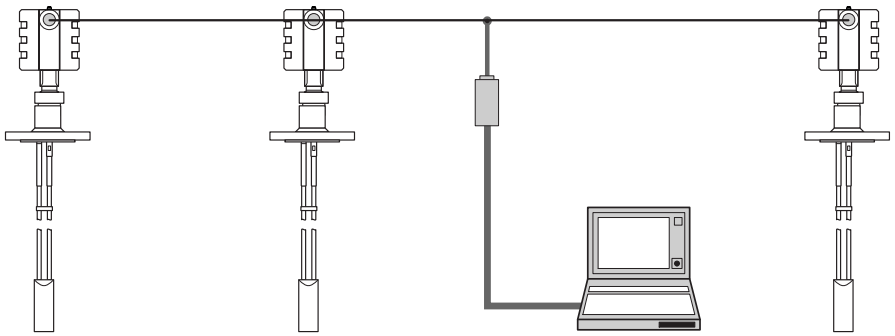


Configure Channels 1, 2, and 3 to reflect the units as well as Upper Range Values and Lower Range Values for your secondary, tertiary and fourth variables (variable assignment is configured in the Model 3300). It is also possible to enable or disable a channel from this menu. See “Special Functions“ on page 4-24 for further information on how to install a Tri-Loop.

Using More than one transmitter on the bus

The 3300 transmitter can be run in multidrop mode. In the multidrop mode each transmitter has a unique HART address.

Figure 3-15. Multidrop connection



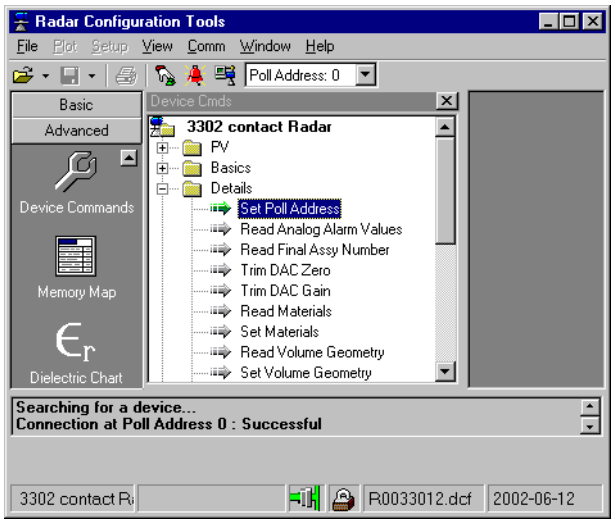
MULTIDROP

The poll address can be changed by using a HART 275 Communicator or by using the Rosemount Configuration Tools software.

To change the poll address using a 275 Communicator choose HART command [1, 4, 5, 2, 1].

To change the poll address using the Rosemount Configuration Tools (RCT) software do the following:

1. Choose the View>Device Commands option.
   or
   choose the Device Commands icon from the Project Bar Advanced section.



RCT_DEVICECOMMANDS_POLLADDRESS.TIF

2. Open the Details folder.
3. Choose the Set Poll Address option.
4. Set the desired address.

Section 4 Start-Up

SAFETY MESSAGES

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

CONFIGURATION PARAMETERS

The Model 3301 transmitter can be configured for level and volume measurements. The Model 3302 is designed to measure interface level and interface distance as well.

The Rosemount 3300 transmitter can be pre-configured according to the ordering specifications in the Configuration Data Sheet.

Basic Configuration

The basic transmitter configuration includes setting the tank geometry parameters. For interface measurements the dielectric constant of the top liquid must also be given. For some applications with heavy vapor, the vapor dielectric must be given as well.

Figure 4-1. Tank Geometry

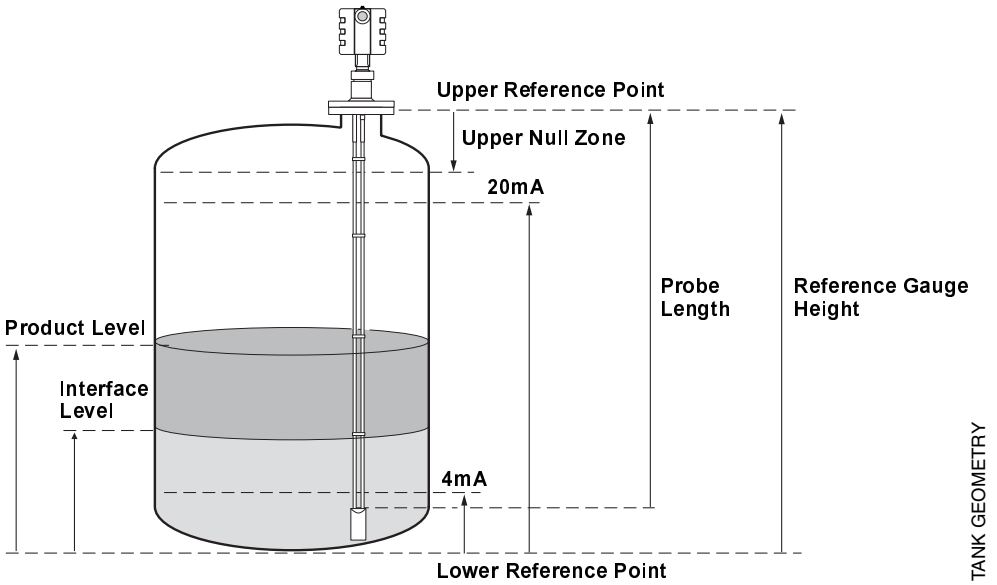
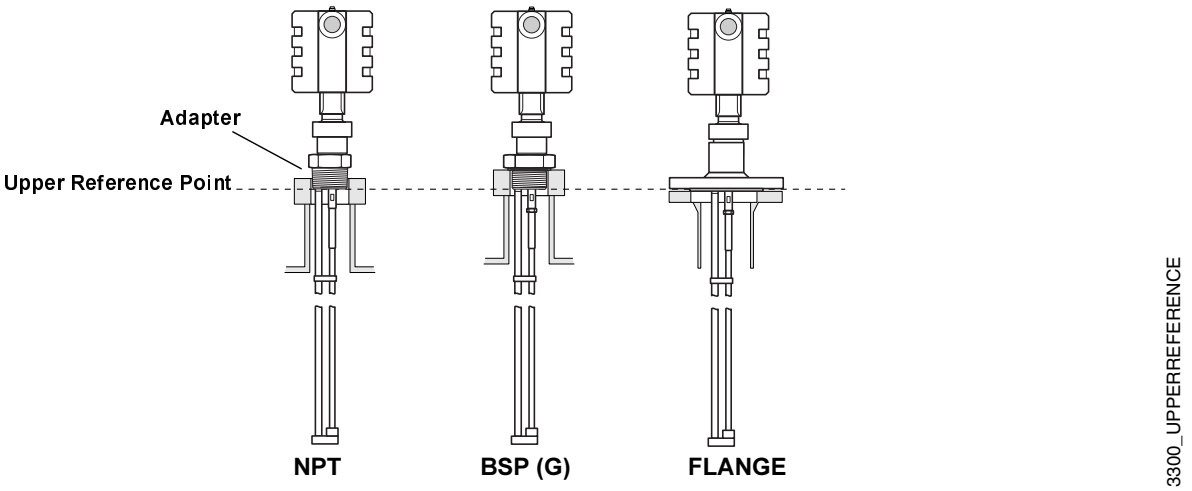


Figure 4-2. Upper Reference Point

For the different tank connections the Upper Reference Point is located at the underside of the threaded adapter or at the underside of the welded flange, as illustrated in Figure 4-2:



Reference Gauge Height

The Reference Gauge Height is the distance from the Upper Reference Point to the bottom of the tank. The transmitter measures the distance to the product surface and subtracts this value from the Reference Gauge Height to determine the level.

Probe Length

The probe length is the distance between the Upper Reference Point and the end of the probe. If a weight is used at the end of the probe it shall not be included.

This parameter is pre-configured at factory. It must be changed if the probe is shortened.

Probe Type

The transmitter is designed to optimize measurement performance for each probe type.

This parameter is pre-configured at factory. This value needs to be changed if the probe type is changed.

Flexible and Rigid probes require different radar electronics and can not be used with the same transmitter head.

Dielectric Constant of Upper Product

For interface measurements the dielectric constant of the upper product is essential in order to obtain good accuracy. See section “Interface” on page 2-9 for further information on dielectric constants.

If the dielectric constant of the lower product is significantly smaller than the dielectric constant of water, you may need to make special adjustments. See section “Interface Measurements for Semi-Transparent Bottom Products” on page 6-5 for further information.

For level measurements the Upper Product Dielectric parameter corresponds to the actual dielectric constant of the product in the tank. Normally this parameter does not need to be changed even if the actual dielectric constant of the product deviates from the Upper Product Dielectric parameter value. However, for some products measurement performance can be optimized by setting the proper product dielectric constant.

Dielectric Constant of Vapor

In some applications there is heavy vapor above the product surface having a significant influence on the level measurement. In such cases the vapor dielectric can be entered to compensate for this effect.

The default value is equal to 1 which corresponds to the dielectricity of vacuum. Normally this value does not need to be changed since the effect on measurement performance is very small for most vapors.

Upper Null Zone

This parameter should only be changed if there are measurement problems in the upper part of the tank. Such problems may occur if there are disturbing objects close to the probe. By setting the Upper Null Zone the measuring range is reduced. See *Section 6: Disturbances at the top of the tank* for further information.

4 mA point

The 4 mA point should be set above the Lower Dead Zone (see *Section 2: Dead Zones*). If the 4 mA point is set to a point within the Dead Zone or below the probe end, the full range of the analog output is not used.

20 mA point

Make sure that the 20 mA point is below the Upper Null Zone.

The 20 mA point should be set below the Upper Dead Zone (see *"Dead Zones" on page 2-7*). If the 20 mA point is set to a point within the Dead Zone the full range of the analog output is not used.

Probe angle

If the transmitter is not mounted vertically the angle from vertical position must be given.

Volume Configuration

For volume calculations you can choose one of the standard tank shapes or the strapping option. Choose None if volume calculation is not used.

Tank Type

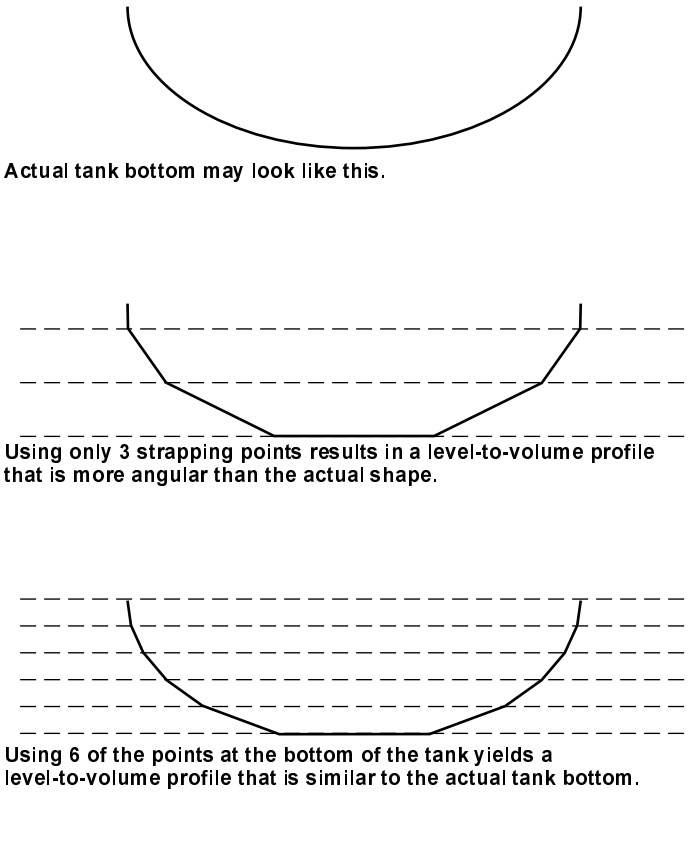
You can choose one of the following options:

- Strap table
- Vertical Cylinder
- Horizontal Cylinder
- Vertical Bullet
- Horizontal Bullet
- Sphere
- None

Strapping Table

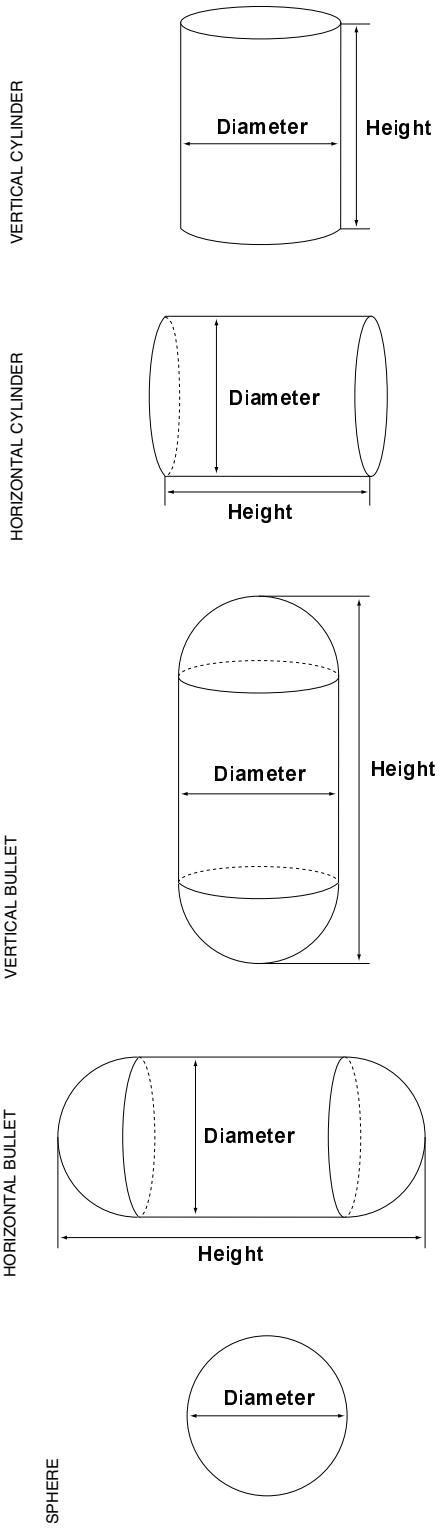
Use a strapping table if a standard tank type does not provide sufficient accuracy. Use most of the strapping points in regions where the tank shape is non-linear. A maximum of 10 points can be added to the strapping table.

Figure 4-3. Strapping points



Standard Tank Shapes

Figure 4-4. Standard tank shapes



Vertical Cylinder

Vertical Cylinder tanks are specified by Diameter and Height.

Horizontal Cylinder

Horizontal Cylinders are specified by Diameter and Height.

Vertical Bullet

Vertical Bullet tanks are specified by Diameter and Height. The volume calculation model for this tank type assumes that the radius of the bullet end is equal to the Diameter/2.

Horizontal Bullet

Horizontal Bullets are specified by Diameter and Height. The volume calculation model for this tank type assumes that the radius of the bullet end is equal to the Diameter/2.

Sphere

Spherical tanks are specified by Diameter.

CONFIGURATION USING A 275 HART COMMUNICATOR

This section describes how to configure the 3300 transmitter by using a HART 275 Communicator.

Appendix A provides brief instructions on the use of the HART Communicator. For information on all the capabilities, refer to the HART Communicator Product Manual.

Figure 4-5. The HART 275 Communicator.

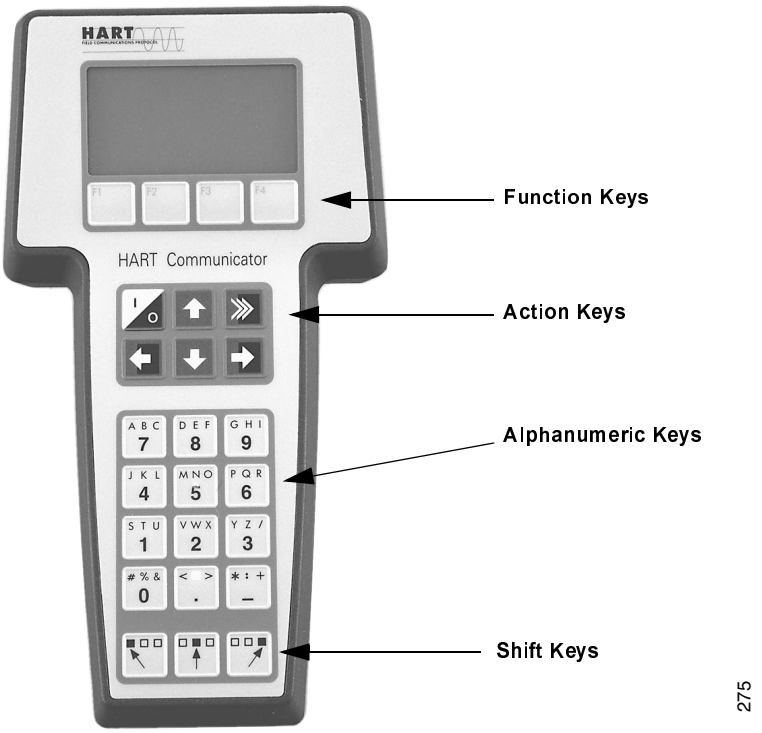
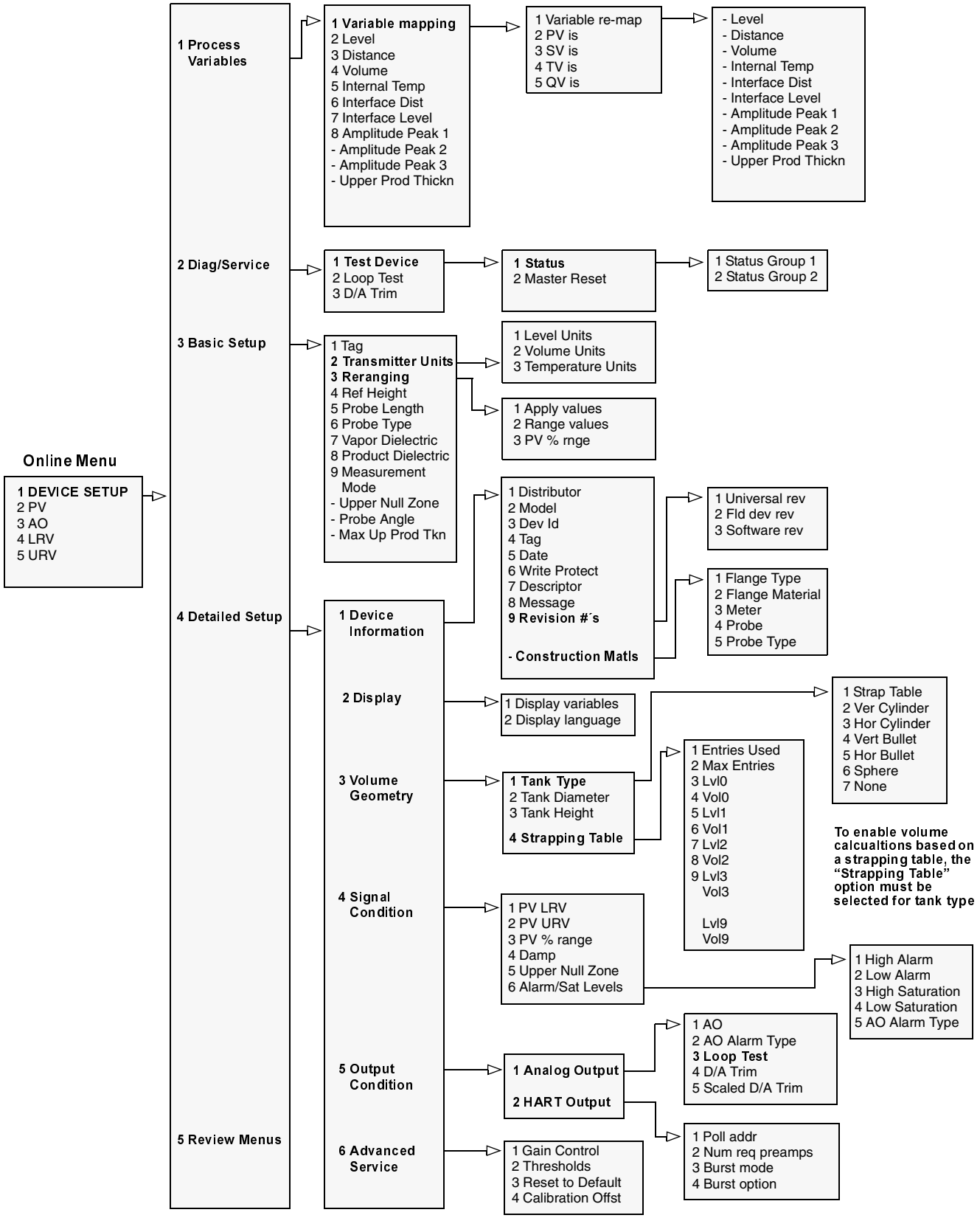


Figure 4-6. HART Communicator Menu Tree



BASIC CONFIGURATION

This section describes the various HART commands used to configure the 3300 Series of transmitters for level measurements. The transmitter outputs a 4 - 20 mA signal proportional to the primary variable. Three additional variables are available through the HART signal.

Transmitter Variables

HART Comm	1, ,1 ,1, 1

You may assign up to four transmitter variables. Typically, the primary variable (PV) is configured to be Aggregate Level, Interface Level or Volume.

For the model 3301 the primary variable is typically set to be Level. If the transmitter is in the Immerse Probe mode (see section “Measurement Mode”) the PV is normally set to Interface Level.

For the model 3302 the PV is typically set to Interface Level, but Level and other options may also be used.

Transmitter Units

HART Comm	1, 3, 2

Set transmitter units for level and temperature.

Reference Gauge Height

HART Comm	1, 3, 4

The Reference Gauge Height is the distance from the Upper Reference Point to the bottom of the tank (see Figure 4-1 on page 4-2). When setting the Reference Gauge Height, keep in mind that this value is used for all level measurements performed by the 3300 Series transmitter.

The Reference Gauge Height must be set in linear (level) units, such as feet or meters, regardless of primary variable assignment.

Probe Length

HART Comm	1, 3, 5

The probe length is the distance from the Upper Reference Point to the end of the probe, see Figure 4-1. If the probe is anchored to a weight do not include the height of the weight. This parameter is pre-configured at factory. The Probe Length needs to be changed if for example the probe is shortened.

Probe Type

HART Comm	1, 3, 6

The transmitter automatically makes an initial calibration based on the type of probe that is used. This parameter is pre-configured at factory and only needs to be set if the probe is changed to another type. Choose one of the following options:

- Rigid Twin Lead
- Flexible Twin Lead
- Coaxial
- Rigid Single Lead
- Flexible Single Lead

NOTE
Flexible and Rigid probes require different radar electronics and can not be used with the same transmitter head.

Product Dielectric

HART Comm	1, 3, 8

For interface measurements the dielectric constant of the upper product is essential for calculating the interface level and the upper product thickness. By default the Product Dielectric parameter is about 2.

If the dielectric constant of the lower product is significantly smaller than the dielectric constant of water, you may need to make special adjustments. See section *"Interface Measurements for Semi-Transparent Bottom Products" on page 6-5* for further information.The dielectric constant of the product is used for setting the appropriate signal amplitude thresholds, see *Section 6: Service and Troubleshooting* for more information on amplitude threshold settings. Normally this parameter does not need to be changed for level measurements. However, for some products measurement performance can be optimized by setting the proper product dielectric constant.

The Rosemount Configuration Tool (RCT) software includes a Dielectric Chart wich lists the dielectric constants of a wide range of products. RCT also includes a tool which allows you to calculate dielectric constants based on measurements of the Upper Product Thickness.

Vapor Dielectric

HART Comm	1, 3, 7

In some applications there is heavy vapor above the product surface having a significant influence on the level measurement. In such cases the vapor dielectric can be entered to compensate for this effect.

The default value is equal to 1 which corresponds to the dielectric constant of vacuum. Normally this value does not to be changed since the effect on measurement performance is very small for most vapors.

Measurement Mode

HART Comm	1, 3, 9

Normally the Measurement Mode does not need to be changed. The transmitter is pre-configured according to the specified model:

Table 4-1. Measurement Mode

Model	Measurement Mode
3301	*Level*[1], *Interface Immersed probe*
3302	*Level, Level and Interface*[1], *Interface Immersed probe*

(1) Default setting

Interface Immersed Probe is used for applications where the probe is fully immersed in liquid. In this mode the transmitter ignores the upper product level. See *Section 6: Interface measurements with fully immersed probes* for more information.

NOTE!
Only use *Interface Immersed Probe* for applications where interface is measured for a fully immersed probe.

Probe Angle

HART Comm	1, 3, 11

Enter the angle between the probe and the vertical line. The default value is equal to zero. Do not change this value if the transmitter is mounted with the probe along the vertical line (which is normally the case).

Maximum Upper Product Thickness

HART Comm	1, 3, 12

For interface measurements the Maximum Upper Product Thickness parameter may be used in special cases when the dielectric constant of the upper product is relatively high. By setting this parameter you can avoid that interface measurements are getting out of range.

Damping

HART Comm	1, 4, 4, 4

The default Damping value is 10. Normally this value does not need to be changed. The Damping parameter determines how quickly the transmitter responds to level changes and how robust the measurement signal is against noise. See *"High Level Rates" on page 6-7* for more information.

Display panel

HART Comm	1, 4, 2

Choose which variables to be displayed and the desired language to be used. The display toggles between the selected variables every two seconds.

4 and 20 mA Points

HART Comm	1, 3, 3, 2

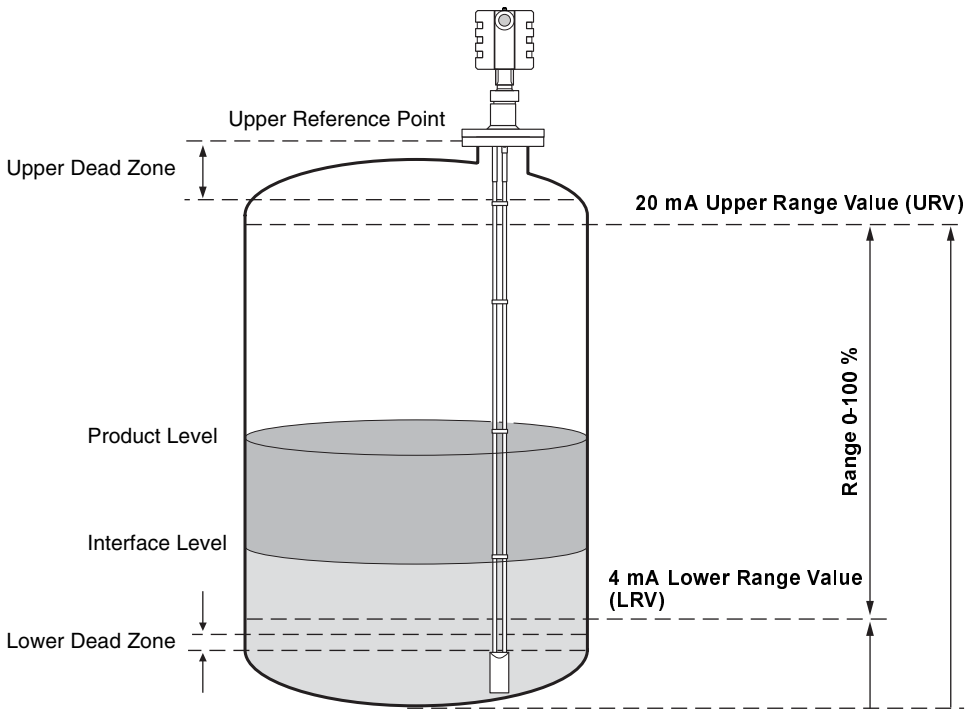
When setting the range values, it is possible to enter the values directly using the keypad on the HART 275 Communicator, or you may use actual values (HART command [1, 3, 3, 1]). Keep in mind that the 20 mA value should be below the Upper Dead Zone. If the 20 mA point is set to a point within the Dead Zone the full range of the analog output is not used.

Also make sure that the 20 mA value is below the Upper Null Zone (UNZ). (This parameter may be used if there are measurement problems in the upper part of the tank, see *Section 6: Disturbances at the top of the tank*). The UNZ is equal to zero in the default configuration.

The 4 mA point should be above the Lower Dead Zone. If the 4 mA point is set to a point within the Dead Zone or below the probe end (tank bottom for example), the full range of the analog output is not used.

See Section 2: Dead Zones for more information on the size of Upper and Lower Dead Zones.

Figure 4-7. Range Values



VOLUME CONFIGURATION

Transmitter Variables

HART Comm	1, 1, 1, 1

Select the Volume option in order to configure the transmitter for volume measurements.

Volume Units

HART Comm	1, 3, 2, 2

Choose one of the following units:

- Gallons
- Liters
- Imperial Gallons
- Cubic Meters
- Barrels
- Cubic Yards
- Cubic Feet
- Cubic Inch

Tank Type

HART Comm	1, 4, 3, 1

Choose a standard tank shape, or select the strapping option. Standard shapes are: Vertical Cylinder, Horizontal Cylinder, Vertical Bullet, Horizontal Bullet or Sphere. (If Primary Variable is Level choose None for Tank Type).

If your tank does not correspond to any of the above tank shapes, select Strap Table.

Tank Dimensions

HART Comm	1, 4, 3, 2

If a standard tank type was chosen, enter the diameter and height of the tank. See “Volume Configuration” on page 4-5 for information on how to specify tank dimensions.

Strapping Table

HART Comm	1, 4, 3, 4

If tank type Strapping Table was chosen, enter how many entries you will use and the actual level and volume points. You can enter from 2 to 10 points. The strapping points must be entered such that the first point corresponds to the lowest level, and the last point corresponds to the topmost level of the tank.

CONFIGURATION USING THE RADAR CONFIGURATION TOOL

The Radar Configuration Tool (RCT) is a user-friendly software tool that allows you to configure the 3300 transmitter. You can choose either of the following two methods to configure a 3300 transmitter:

- Start the Wizard for a guided installation if you are un-familiar with the 3300 transmitter.
- Use the Setup function if you are already familiar with the configuration process or if you just want to change the current settings.

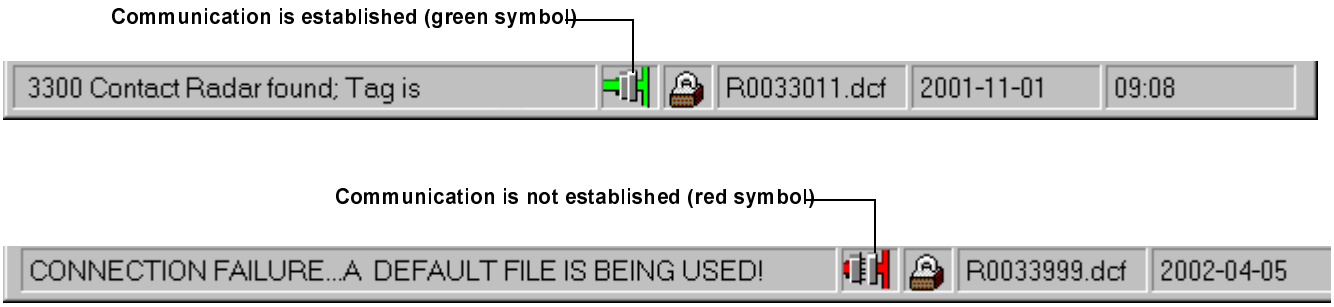
Installing the RCT software

To install the Rosemount Configuration Tool:

1. Insert the installation CD into your CD-ROM drive.
2. If the installation program is not automatically started, from the windows Start Bar choose Run and type D:**Setup.exe** where D is the CD-ROM drive.
3. Follow the instructions on the screen.

To start the RCT:

1. From the Start menu click Programs>RCT Tools>RCT.
2. In the RCT Status Bar check that RCT communicates with the transmitter:

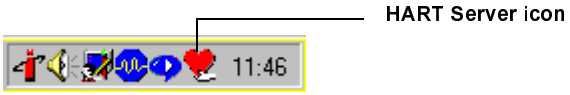


Specifying the COM Port

If communication is not established open the HART Communication Server window and check that the right COM Port is selected.

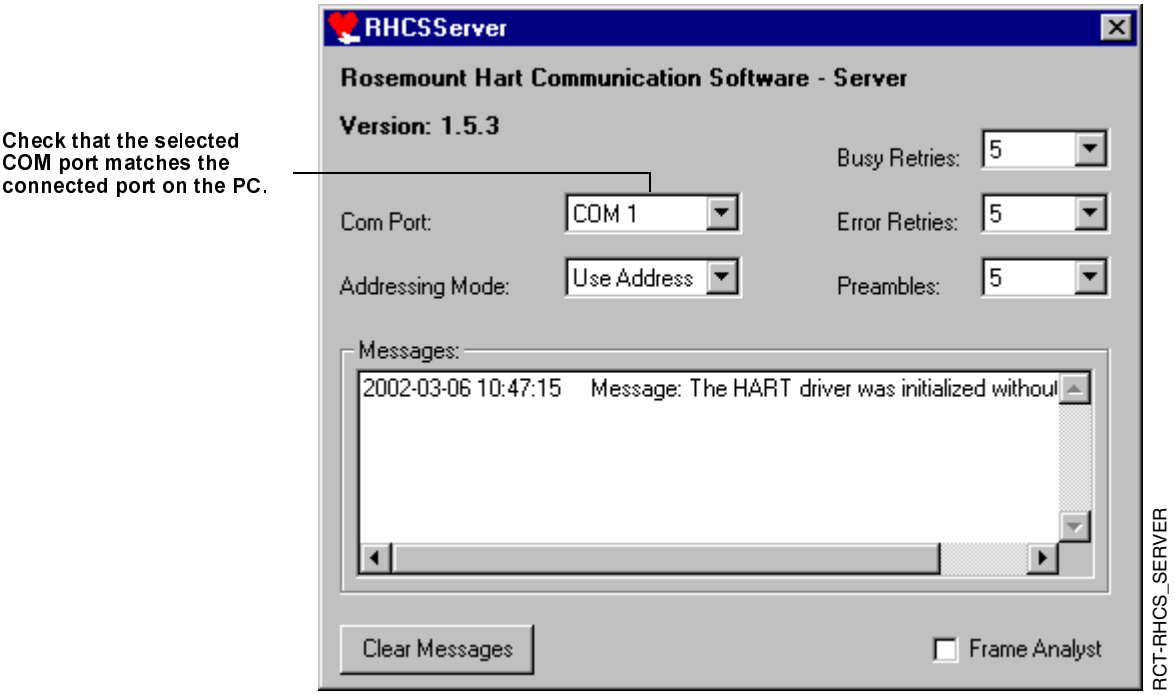
To check the current COM port settings do the following:

1. Locate the HART Server icon in the lower right corner of the screen.

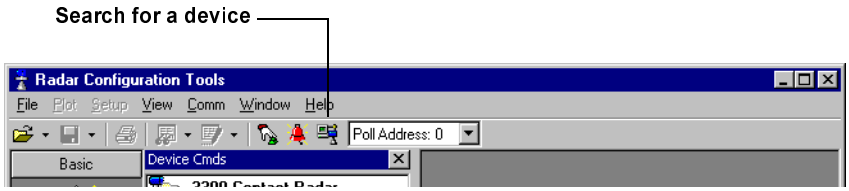


2. Double-click the HART Server icon.

Figure 4-8. RHCS Server window



3. Check the COM port.
4. Choose the COM Port option that matches the COM Port connected to the transmitter.
5. If communication is intermittent, increase *Busy Retries* and *Error Retries* to 5 and 5 respectively.
6. Click the Search for a device icon in the RCT tool bar:



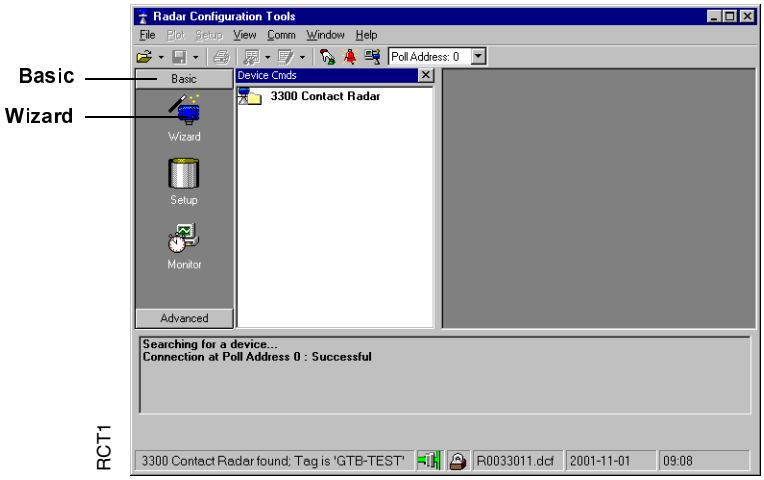
Help In RCT

Help is accessed by pressing the F1 key or by selecting the Contents option from the Help menu. If the F1 key is pressed a help text appears with information about the window that is currently open. If a menu option is selected a help text appears with information about that particular menu.

Using the Setup Wizard

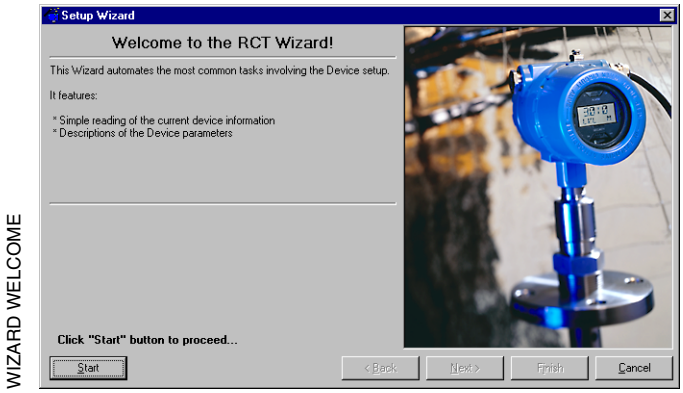
To install a 3300 transmitter by using the installation **Wizard** do the following:

Figure 4-9. RCT workspace



1. Start the RCT software.
2. In the RCT workspace click the Wizard icon (make sure that the Basic section is open),
   or
   choose the View>Wizard menu option.

Figure 4-10. RCT Wizard

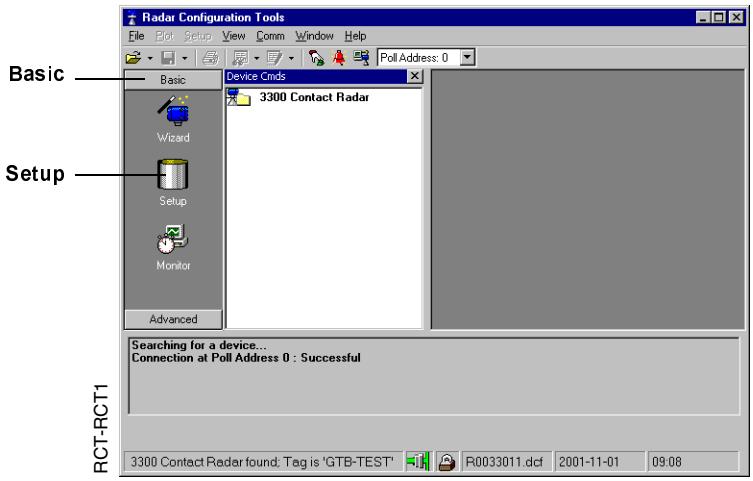


3. Click the **Start** button and follow the instructions. Now you will be guided through a number of dialogs allowing you to configure the transmitter.

Using the Setup Function

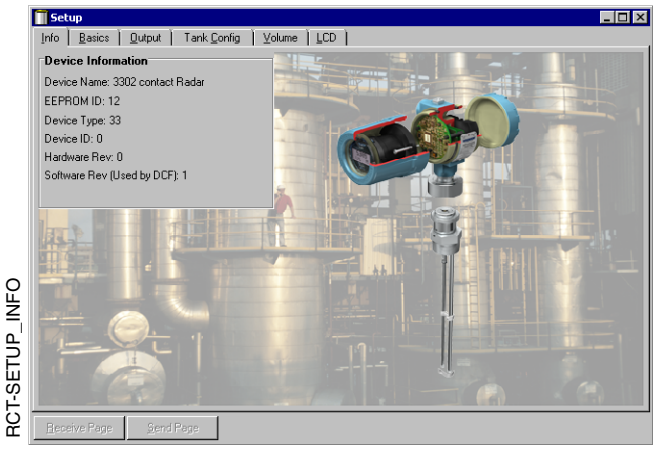
To install a 3300 transmitter by using the **Setup** function do the following:

Figure 4-11. RCT workspace



1. Start the RCT software.
2. In the RCT workspace click the Setup icon (make sure that the Basic area is open),
   or
   choose the View>Setup menu option.

Figure 4-12. Setup Info



3. Choose the appropriate tab:

   Info: information about the device.

   Basics: Set Probe Type and measurement units.

   Analog: Variable assignment and range value settings.

   Tank Config: Tank height and other geometry settings, dielectric constants for vapor and upper product.

   Volume: specification of tank geometry for volume calculations.

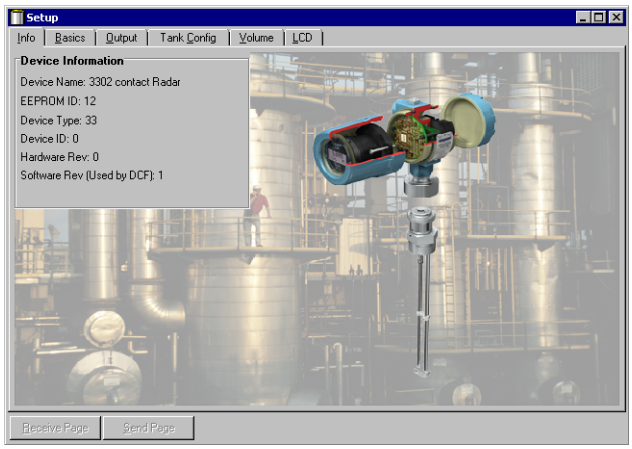
   LCD: display panel settings.

NOTE
When working with the Setup window keep in mind that for all tabs except the Info tab, data is updated by clicking the Receive button. To download data to the transmitter click the Send button.

Setup - Info

The **Title** tab shows information about the connected transmitter.

Figure 4-13. Setup Title tab

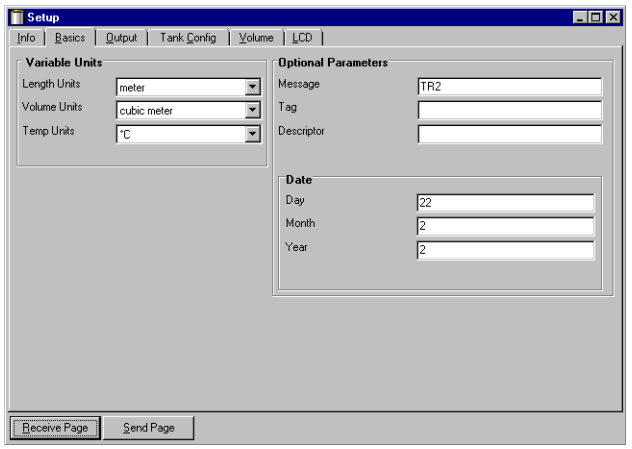


Device Name: designation of the current transmitter model.
EPROM ID:current transmitter database version.
Device Type: designates the transmitter type. 33 is used for the 3300 Series.
Device ID: a unique identifier for each 3300 Series transmitter.
Hardware Rev: the current revision of the transmitter electronic board.
Software Rev:the current revision of the transmitter software that controls measurement, communication, internal checks etc.

Setup - Basics

The **Basics** tab lets you choose **Measurement Units** for Level, Volume and Temperature. These units are used wherever measurement and configuration data is presented.

Figure 4-14. Setup Basic tab

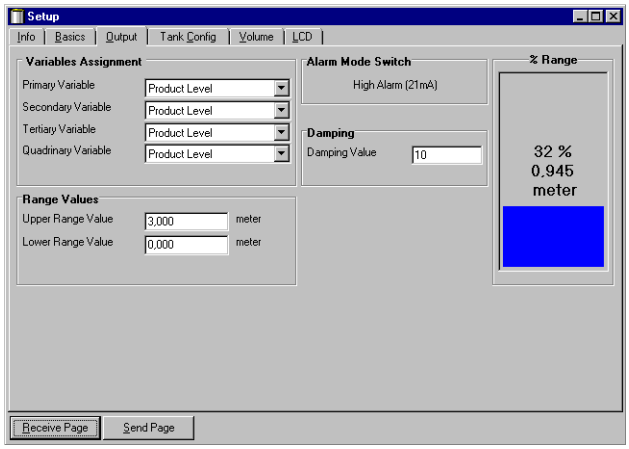


This window also allows you to enter some general information about the transmitter like Message, Tag, Descriptor and Date. This information is not required for the operation of the transmitter and can be left out if desired.

Setup - Output

The **Output** tab lets you assign up to four transmitter variables

Figure 4-15. Setup output tab



Typically, the **Primary Variable** (PV) is configured to be Product Level, Interface Level or Volume.

Other variables like Product Distance, Interface Distance, Upper Product Thickness, etc. are available as well.

For model 3301 the primary variable is typically set to be Level. If the transmitter is in the Immersed Probe mode (see section “Measurement Mode”) the PV is normally set to Interface Level.

For the model 3302 the PV is typically set to Interface Level, but Level and other options may also be used.

Set the **Lower Range Value** (4 mA) and the **Upper Range Value** (20 mA) to the desired values. Keep in mind that the 20 mA value should be below the Upper Dead Zone, and the 4 mA point should be above the Lower Dead Zone if you want to use the full 4-20 mA range within the measuring range of the transmitter.

Also make sure that the 20 mA value is set below the Upper Null Zone (UNZ). (the UNZ parameter may be used if there are measurement problems in the upper part of the tank, see *Section 6: Disturbances at the top of the tank*). The UNZ is equal to zero in the default configuration.

See *Section 2: Dead Zones* for more information on Upper and Lower Dead Zones.

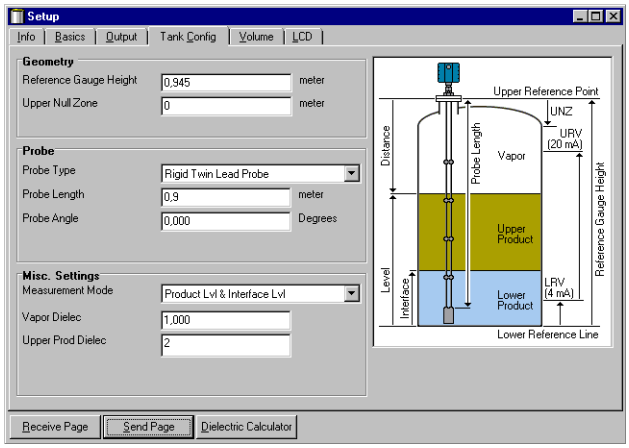
See *Section 4: Basic Configuration* for more information on setting the Upper and Lower Range values.

The default **Damping** value is 10. Normally this value does not need to be changed. The Damping parameter may be changed if there are high filling rates, see “High Level Rates” on page 6-7 for more information.

Setup - Tank Config

The **Tank Configuration** tab contains information on tank geometry parameters and dielectrics.

Figure 4-16. Setup Tank Configuration tab



Tank Geometry

The **Reference Gauge Height** is the distance from the Upper Reference Point to the bottom of the tank (see Figure 4-1 on page 4-2). When setting the Reference Gauge Height, keep in mind that this value is used for all level and volume measurements performed by the 3300 transmitter.

The Reference Gauge Height must be set in linear (level) units, such as feet or meters, regardless of primary variable assignment.

The **Upper Null Zone** (UNZ) should not be changed unless there are disturbances at the top of the tank. By increasing the Upper Null Zone value measurements in this region can be avoided. See *Section 6: Disturbances at the top of the tank* for more information on how to use the UNZ. The UNZ is equal to zero in the factory configuration.

Probe

The 3300 Series transmitter automatically makes some initial calibrations based on the chosen **Probe Type**. The following Probe Types are available:

- Twin Lead
- Flexible Twin Lead
- Coaxial
- Rigid Single Lead
- Flexible Single Lead

NOTE
Flexible and Rigid probes require different radar electronics and can not be used with the same transmitter head

The **Probe Length** is the distance from the Upper Reference Point to the end of the probe, see Figure 4-1. If the probe is anchored to a weight do not include the height of the weight.

The **Probe Angle** is the angle between the probe and the vertical line. Set this value equal to zero if the transmitter is mounted with the probe along the vertical line (which is normally the case).

Measurement Mode

Normally the Measurement Mode does not need to be changed. The transmitter is pre-configured according to the specified model:

Table 4-2. Measurement Mode

Model	Measurement Mode
3301	*Level*[1], *Interface Immersed probe*
3302	*Level, Level and Interface*[1], *Interface Immersed probe*

(1) Default setting

Interface Immersed Probe is used for applications where the probe is fully immersed in liquid. In this mode the transmitter ignores the upper product level. See "*Section 6: Interface measurements with fully immersed probes*" for more information.

NOTE!
Only use *Interface Immersed Probe* for applications where interface is measured for a fully immersed probe.

Dielectrics

In some applications there is heavy vapor above the product surface having a significant influence on the level measurement. In such cases the **Vapor Dielectric** can be entered to compensate for this effect.

The default value is equal to 1 which corresponds to the dielectric constant of vacuum. Normally this value does not need to be changed since the effect on measurement performance is very small for most vapors.

For interface measurements the dielectric constant of the upper product is essential for calculating interface level and the upper product thickness. By default the **Upper Product Dielectric** parameter is about 2.

If the dielectric constant of the lower product is significantly smaller than the dielectric constant of water, you may need to make special adjustments. See section *"Interface Measurements for Semi-Transparent Bottom Products" on page 6-5* for further information.

The dielectric constant of the product is used for setting the appropriate signal amplitude thresholds, see *Section 6: Service and Troubleshooting* for more information on amplitude threshold settings. Normally this parameter does not need to be changed for level measurements. However, for some products measurement performance can be optimized by setting the proper product dielectric constant.

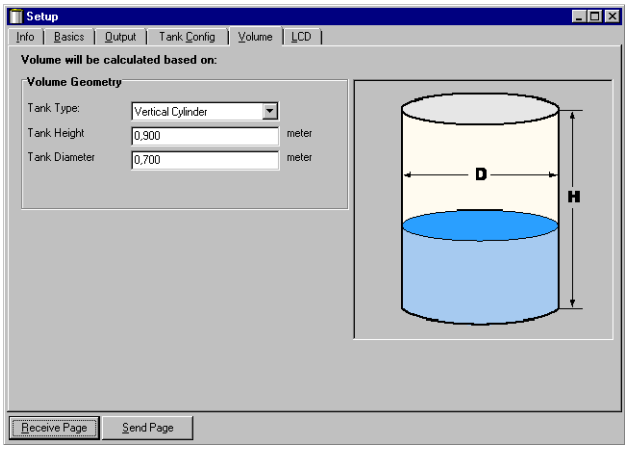
RCT contains tools to estimate the dielectric constant of the current product:

- The **Dielectric Chart** lists the dielectric constant of a large number of products. Use one of the two following methods to view the Dielectric Chart:
  - Choose the View>Dielectric>Dielectric Chart menu option.
  - Click the Dielectric Chart icon in the Project Bar Advanced section.
- The **Dielectric Calculator** lets you calculate the dielectric constant of the Upper Product based on the following input:
  - actual upper product thickness,
  - the dielectric constant value stored in the transmitter, and
  - the upper product thickness presented by the transmitter.

Setup - Volume

The **Volume** tab lets you configure the transmitter for volume calculations.

Figure 4-17. Setup Volume tab



You can choose one of the standard tank shapes or the strapping option. Choose None if volume calculation is not used at all.

Choose one of the following options:

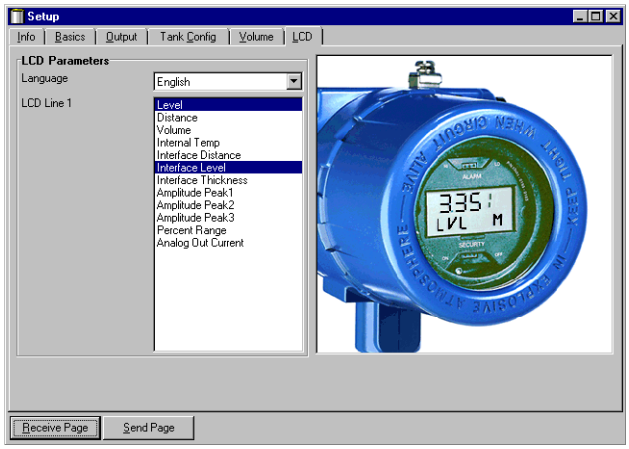
- Vertical Cylinder
- Horizontal Cylinder
- Vertical Bullet
- Horizontal Bullet
- Sphere
- Strap table
- None

See *Section 4: Volume Configuration* for more information on Volume configuration.

Setup - LCD

The **LCD** tab lets you specify which parameters to appear on the display panel. The display has two rows, the upper row with five characters is for the measured value and the lower row with six characters for the value name. The display toggles between the different variables every 2 seconds.

Figure 4-18. Setup LCD tab



Choose one of the following options:

Table 4-3. LCD parameters

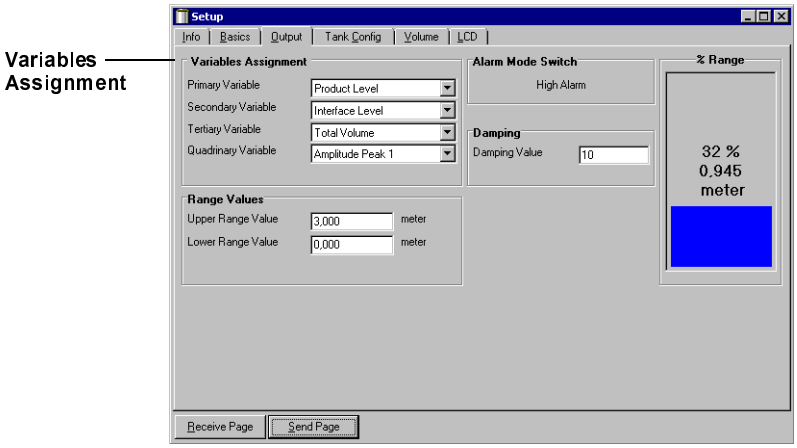
Parameter	Description
Level	Product level.
Distance	Distance from the upper reference point to the product surface.
Volume	Total product volume.
Internal Temperature	Temperature inside the transmitter housing.
Interface Distance	Distance between the upper reference point and the interface between the upper and lower product.
Interface Level	Level of the lower product.
Interface Thickness	Thicknes of the upper product.
Amplitude Peak 1	Signal amplitude of the reflected signal from the reference pulse.
Amplitude Peak 2	Signal amplitude of the reflected signal from the product surface.
Amplitude Peak 3	Signal amplitude of the reflected signal from the surface of the bottom product (interface measurements).
Percent Range	Level value in percent of total measurement range.
Analog Output Current	4 -20 mA current.

SPECIAL FUNCTIONS

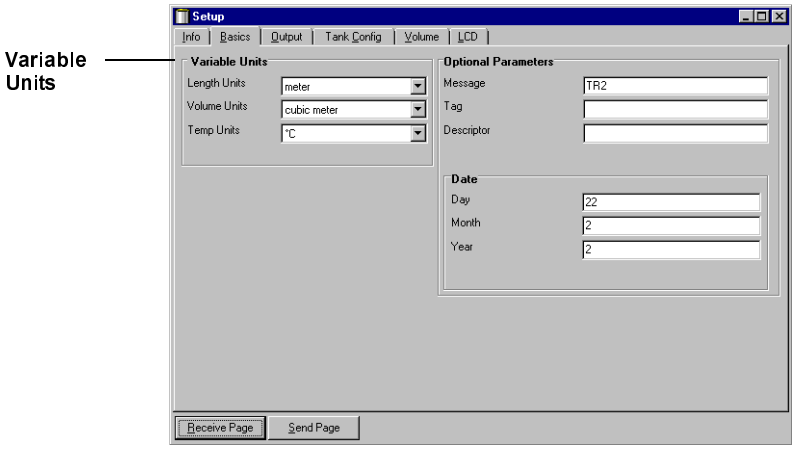
TriLoop

The Model 333 HART Tri-Loop HART-to-Analog Signal Converter is capable of converting a digital HART burst signal into three additional 4-20 mA analog signals. This is a brief description of how to connect the HART Tri-Loop to the Model 3300 transmitter.

1. Configure the 3300 transmitter.
2. Assign transmitter variables Primary Variable, Secondary Variable etc.
   HART command [1,1,1,1].
   RCT: Setup>Output tab.

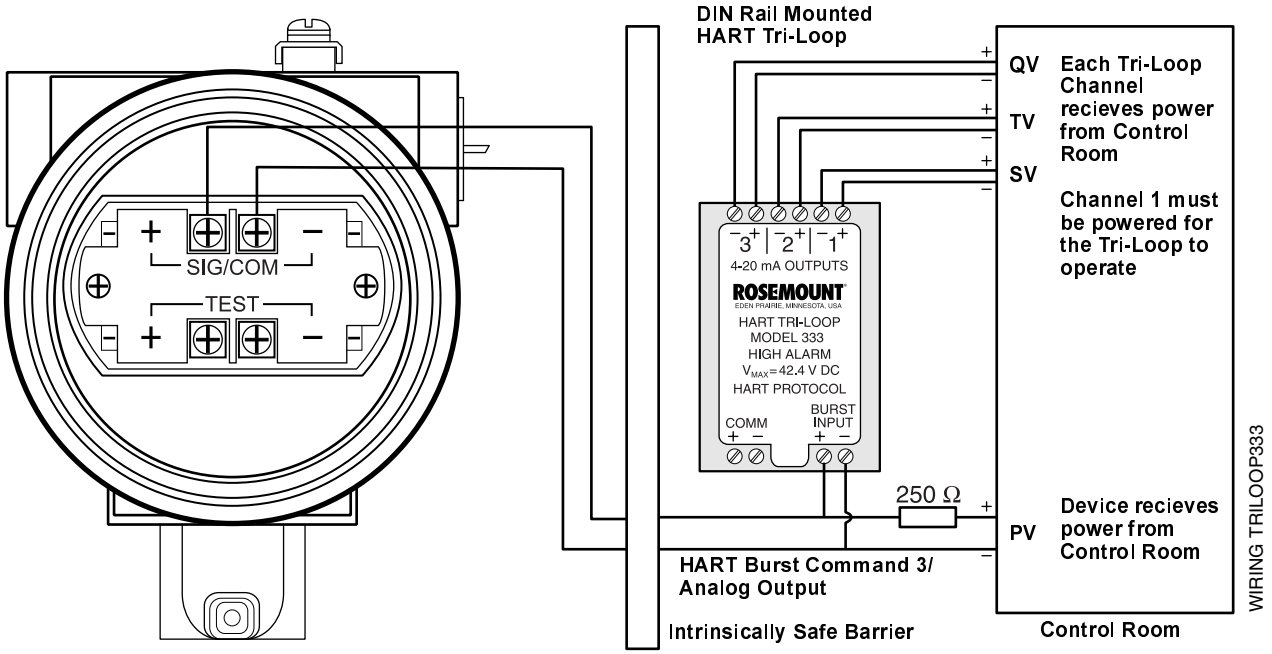


3. Configure variable units: Length, Volume and Temperature.
   HART command [1,3,2,1-3].
   RCT: Setup>Basics tab.



4. Put the 3300 in Burst mode.
   HART command [1, 4, 5, 2, 3].
   RCT: Device Commands>Details>Set Burst Mode option.
5. Select Burst option 3=Process variables and current (Process vars/crnt).
   HART command [1,4,5,2,4].
6. Install the Tri-Loop. Connect channel 1 wires, and optionally wires for Channel 2 and Channel 3.
7. Configure Tri-Loop Channel 1:
   a. Assign variable: Tri-Loop HART command [1,2,2,1,1].
      Make sure that the SV, TV, and QV match the configuration of the 3300 transmitter.
   b. Assign units: Tri-Loop HART command [1,2,2,1,2]. Make sure that the same units are used as for the 3300 transmitter.
   c. Set the Upper Range Value and the Lower Range Value: Tri-Loop HART command [1,2,2,1,3-4].
   d. Enable the channel. Tri-Loop HART command [1,2,2,1,5].
8. (Optional) Repeat steps a-d for Channels 2 and 3.
9. Connect wires to Tri-Loop Burst Input.
10. Enter the desired tag, descriptor and message information:
    Tri-Loop HART command [1,2,3].
11. (Optional) If necessary, perform an analog output trim for Channel 1 (and Channel 2 and 3 if they are used).
    Tri-Loop HART command [1,1,4].

Figure 4-19. Tri-Loop wiring.



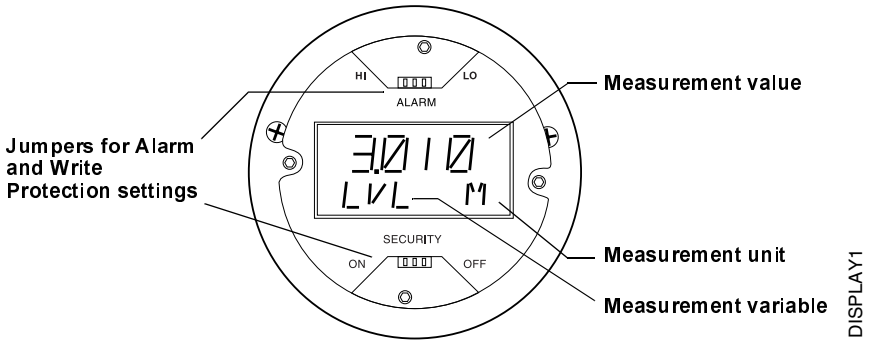
See the reference manual for the *Model 333 HART Tri-Loop HART-to-Analog Signal Converter* for further information on how to install and configure the Tri-Loop.

Section 5 Operating the Display Panel

DISPLAY FUNCTIONALITY

The 3300 transmitter uses the display for presentation of measurement variables. The display has two rows, the upper row with five characters is for the measured value and the lower row with six characters for the value name and measurement unit. The display toggles between the different variables every 2 seconds. Variables to be presented are configurable by using a HART 275 Communicator or by using the Radar Configuration Tools software.

Figure 5-1. Presentation of measurement data



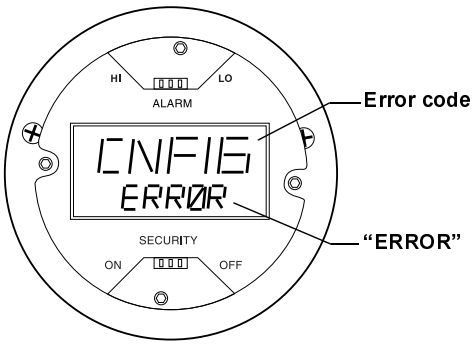
Model 3300 can display the following variables:

- Level
- Distance
- Volume
- Internal Temperature
- Interface Distance
- Interface Level
- Amplitude 1, 2 and 3 (see chapter 6 for more information)
- Interface Thickness
- Percent of range
- Analog current out

ERROR MESSAGES

The display can alos be used for presentation of software errors. The upper row shows error codes and the lower row shows 'ERROR'.

Figure 5-2. Presentation of error messages



DISPLAY ERROR

The following errors can be displayed:

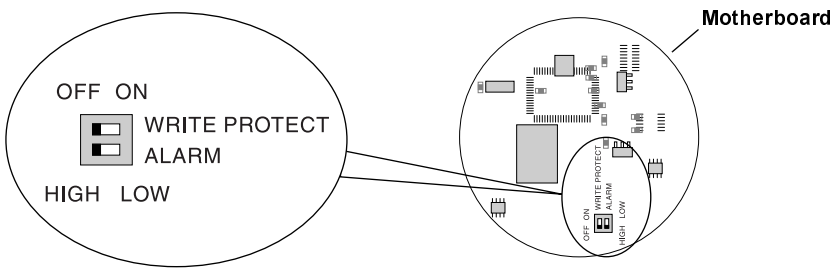
Code	Error
CNFIG	Invalid Configuration
00001	Ram Failure
00002	ROM Checksum
00006	Waveform Acquisition Failure
00007	EEprom Factory Checksum
00010	Software Error
00013	Probe Failure

See also "Errors." on page 6-20.

ALARM AND WRITE PROTECTION

When mounting the Integral Display panel it is important that the Alarm and Write Protection switches on the transmitter mother board are correctly set. Make sure that the Alarm switch is in the HIGH position and the Write Protection switch is in the OFF position, see Figure 5-3. See also *Section 3: Before You Install* for more information.

Figure 5-3. Alarm and Write Protection switches.



SWITCH_WRP_ALARM_DISPLAY

Once the mother board positions are set, then the display positions become the master.

Section 6 Service and Troubleshooting

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 gauge 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 gauge 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.

⚠WARNING

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

Avoid contact with leads and terminals.

Make sure the main power to the Rosemount 3300 Transmitter is off and the lines to any other external power source are disconnected or not powered while wiring the gauge.

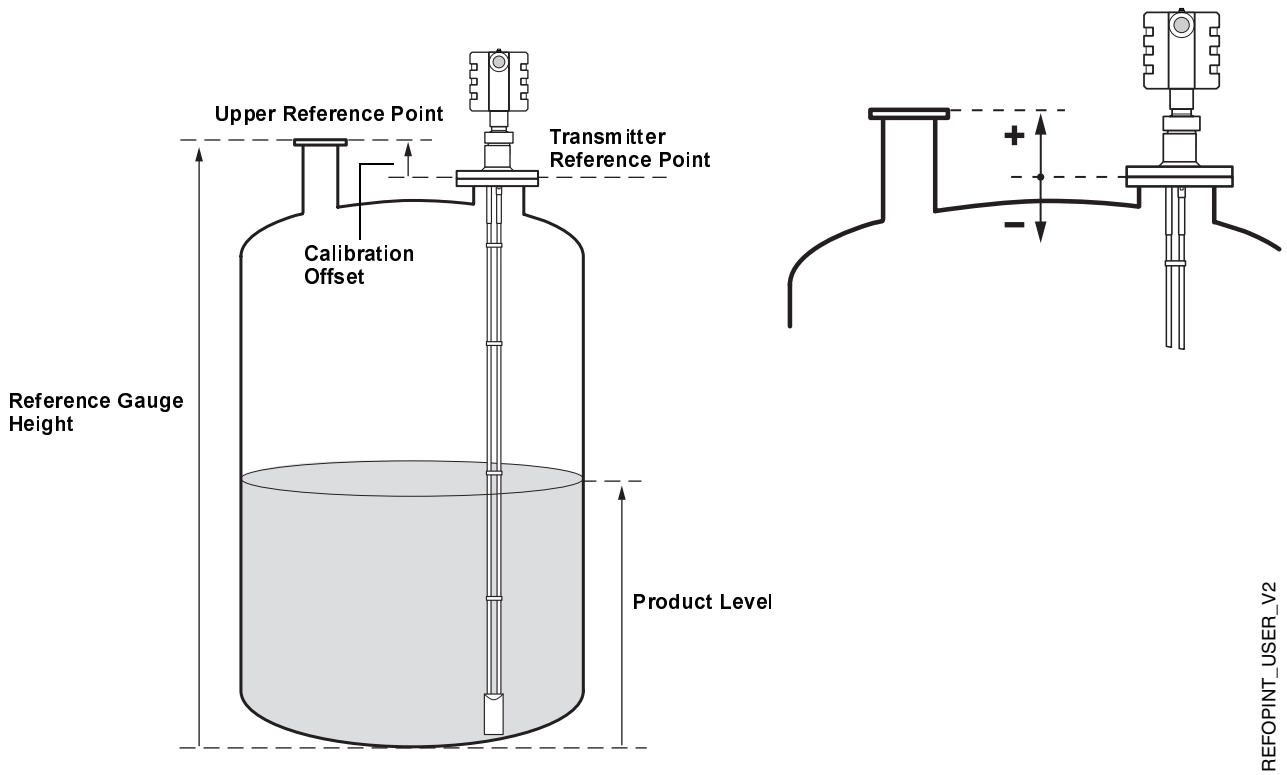
ADVANCED CONFIGURATION

This section covers non-standard configuration.

User defined Upper Reference Point

If you want to specify your own Upper Reference Point you can do this by setting the *Calibration Offset* parameter.

Figure 6-1. Tank Geometry



To set the desired upper reference point do the following:

1. Adjust the **Reference Gauge Height** to the distance from the tank bottom to the desired **Upper Reference Point**.
2. Add the the distance between the **Upper Reference Point** and the **Transmitter Reference Point** to the Calibration Offset value that is stored in the transmitter database.
   With the HART Communicator the Calibration Offset is available as HART Fast Key sequence [1, 3, 7].
   In Radar Configuration Tool (RCT) the Calibration Offset is available under the Advanced section in the RCT Project Bar:
   Device Commands>Basic>Set Calibration Offset.

Plotting the measurement signal

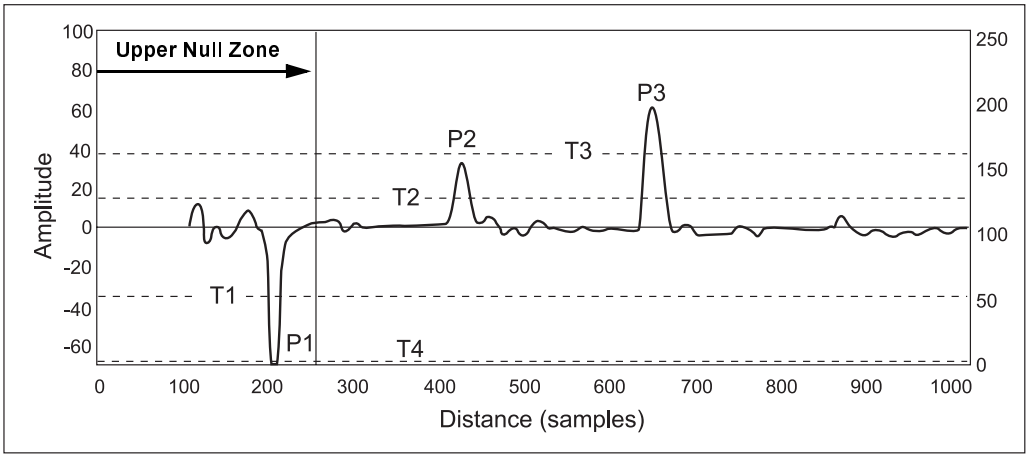
The Radar Configuration Tool (RCT) has powerful tools for advanced troubleshooting. By using the Waveform Plot function you get an instant view of the tank signal. Measurement problems can be solved by studying the position and amplitude of the different pulses.

To plot the measurement signal:

1. Start the Radar Configuration Tool program.
2. Choose the **View**>**Plotting** menu option, or choose the Plotting icon in the RCT workspace (Advanced page at the left side of the workspace) and click the Read button.

Figure 6-2. Waveform plot in RCT

WAVEFORMPLOT_GENERAL



In a typical measurement situation the following pulses appear in the diagram:

P1 - Reference pulse. This pulse is caused by the transition between transmitter head and probe. It is used by the transmitter as a reference at level measurements.

P2 - Product surface. This pulse is caused by a reflection on the product surface. In Measurement Mode=Interface when Immersed Probe however, P2 indicates the interface since the surface of the upper product is ignored.

P3 - Interface or probe end. This pulse is caused by reflection on the interface between an upper product and a bottom product with a relatively high dielectric constant. It may also be caused by the probe end if there is no product above. This pulse is shown when the transmitter is in Measurement Mode=Level & Interface.

Different amplitude thresholds are used in order to filter out unwanted signals. The following amplitude thresholds are used for the 3300 transmitter:

T1 - amplitude threshold for detection of the Reference pulse P1.

T2 - amplitude threshold for detection of the product level peak P2.

T3 - amplitude threshold for detection of the interface level peak P3.

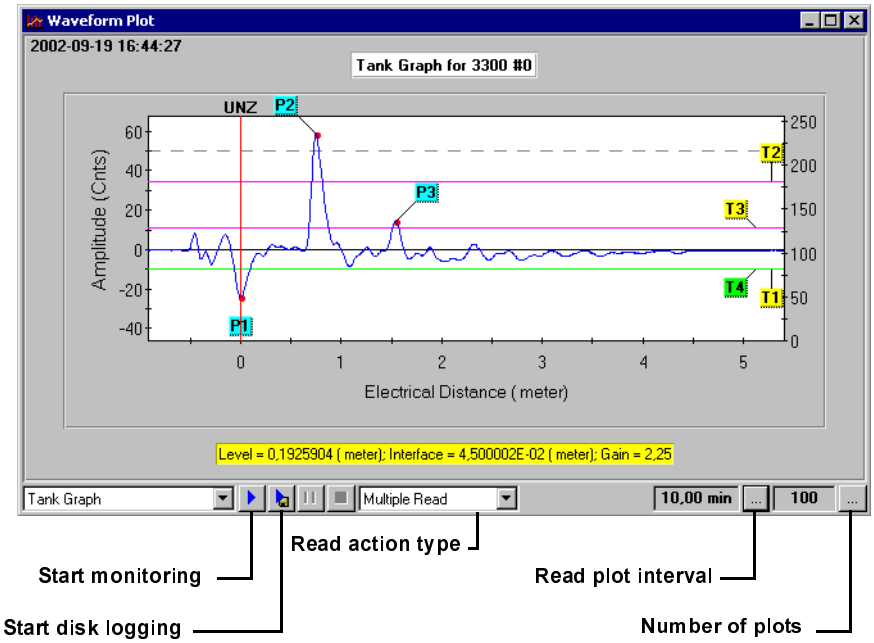
T4 - amplitude threshold that is used to detect whether the probe is fully immersed in the upper product or not.

Normally the thresholds are adjusted to approximately 50% of the signal peak amplitdue. To adjust the **Amplitude Thresholds** open the Advanced section in the RCT Project Bar and choose Device Commands>Details>Set Nominal Thresholds.

Logging and saving to disk

The Waveform plot can be automatically logged and saved to file by specifying the read plot interval and the number of plots to log.

Figure 6-3. Disk logging Waveform plot



The **Read Plot Interval** entry field specifies the time interval between plots that are saved to disk. For example, type 10 if you want the waveform plot to be updated every ten minutes.

Number of plots to log specifies the maximum number of plot files that will be stored. The default value is 100.

Click the **Start Disk Logging** button to start the log. Make sure that Read Action type is set to Multiple Read. Otherwise RCT will only save one log file. Choose a destination folder and enter a file name. For each new file the corresponding number is appended to the end of the file name.

Interface Measurements for Semi-Transparent Bottom Products

In interface applications where the bottom product has a low dielectric constant, or if the signal is attenuated in the upper product, the amplitude of the reflected signal is relatively low and difficult for the transmitter to detect. In such a case it may be possible to detect the reflected signal if the corresponding amplitude threshold is adjusted.

The Radar Configuration Tool (RCT) lets you view a waveform plot to analyze the measurement signal. The plot shows the signal and the thresholds used for the different amplitude peaks. By adjusting amplitude threshold T3 it is possible to detect even weak interface signals.

Guidelines for amplitude threshold settings:

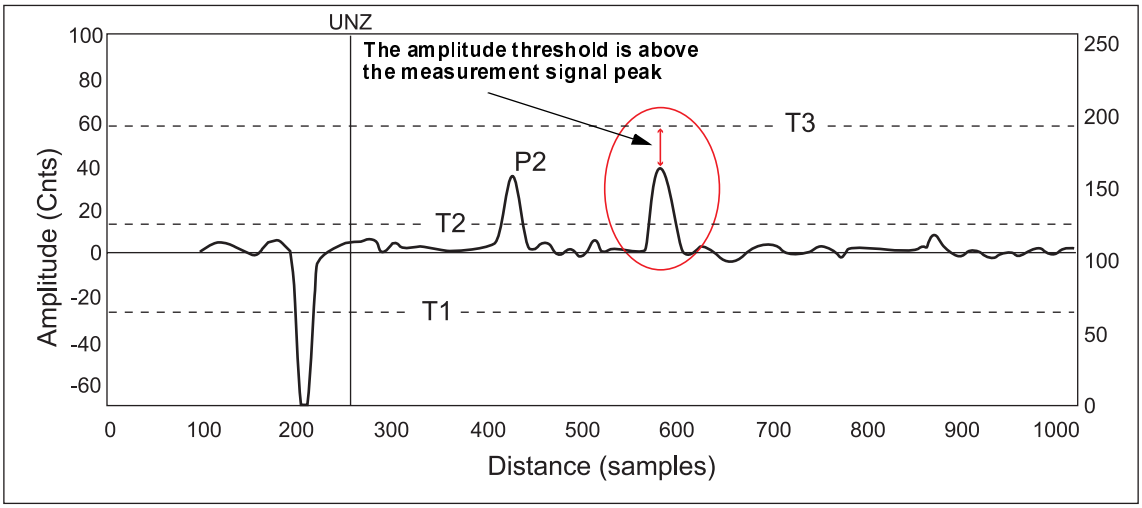
- The amplitude threshold T3 should be approximately 50 % of the interface signal amplitude.
- Threshold T3 should not be less than 3.
- If possible, T3 should be higher than T2.

You can use the RCT software or a HART 275 Communicator to change the amplitude thresholds. For the HART Communicator use the HART command [1, 4, 6, 2]. See also “Amplitude Threshold Settings” on page 6-13.

RCT lets you view a plot of the measurement signal along with the current thresholds:

1. From the **View** menu choose the **Plotting** option, or double-click the Plotting icon in the Advanced section of the RCT Project Bar.
2. Click the Read button .
3. To adjust the **Amplitude Thresholds** open the Advanced section in the RCT Project Bar and choose Device Commands>Details>Set Nominal Thresholds.

Figure 6-4. Waveform plot indicating that the amplitude threshold for the interface peak is too high.

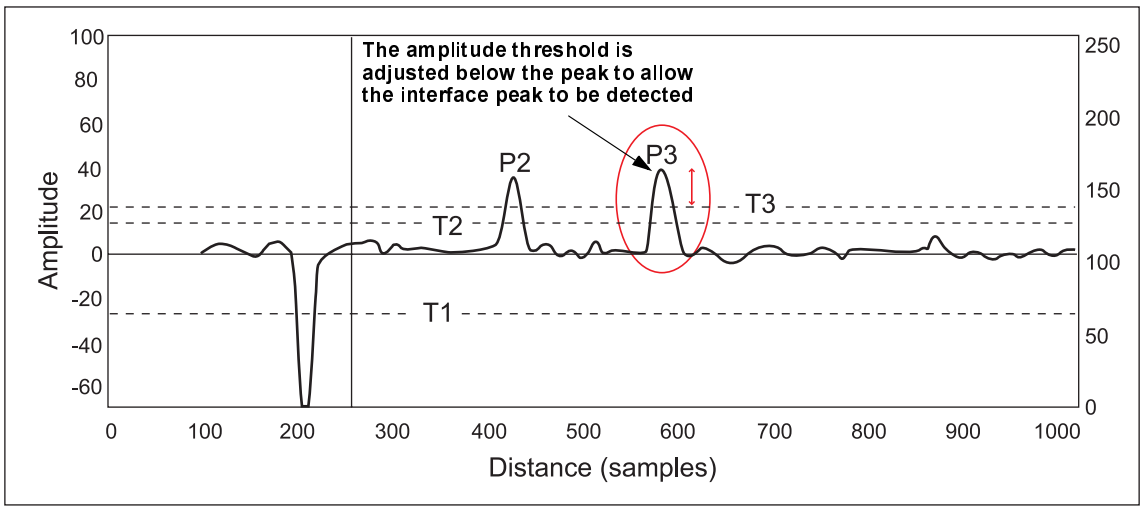


WAVEFORMPLOT INTERFACE LOW EPSILON

Figure 6-4 illustrates a situation where amplitude threshold T3 is too high. The signal amplitude peak at the interface between the upper and lower products is not detected in this case. By adjusting amplitude threshold T3, the peak at the interface between the upper and lower products is detected as illustrated in Figure 6-5:

Figure 6-5. After changing the amplitude threshold the transmitter detects the interface

WAVEFORMPLOT INTERFACE LOW EPSILON AFTER

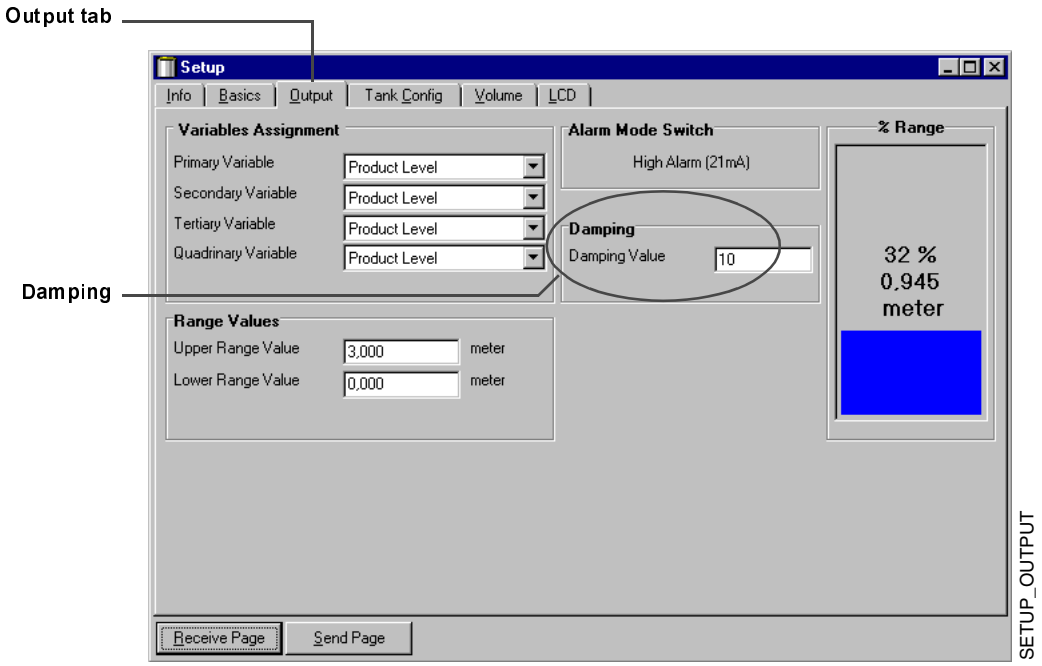


High Level Rates

The measurement signal is filtered in order to minimize the influence of disturbing noise. In most measurement situations this has no noticeable effect on the response time to level changes. If high level rates occur it may however be necessary to reduce the damping value in order to allow the transmitter to respond quicker. If there is too much noise the damping value may be increased in order to get a stable measurement signal.

You can use the RCT software or a HART 275 Communicator to change the Damping value. For the HART Communicator use the key sequence [1, 4, 4, 4].

In the RCT software open the **Setup**>**Output** tab and enter the desired Damping value:



The Damping parameter determines how quickly the transmitter responds to level changes and how robust the measurement signal is against noise. Technically, a damping value of 10 means that in 10 seconds the output from the transmitter is about 63% of the new level value. Consequently, when there are rapid level changes in the tank, it may be necessary to decrease the Damping value for the transmitter to be able to track the surface. On the other hand, in noisy environments, and if level rates are low, it may be better to increase the damping value to have a stable output signal.

Interface measurements with fully immersed probes

The 3300 series has a measurement option which makes it possible to handle interface measurements when the product level is not visible, for example in a full bridle pipe as illustrated in Figure 6-6. In this case the probe is fully immersed into the upper product, and only the interface level is detected by the transmitter. Even if the upper product level drops, it is ignored by the transmitter which continues to measure only the interface level, but the measurement accuracy is reduced since the transmitter does not take into account the influence of the air gap above the product surface.

The Measurement Mode parameter is available via the HART command [1, 3, 9]. Choose the *Interface when Immersed Probe* option.

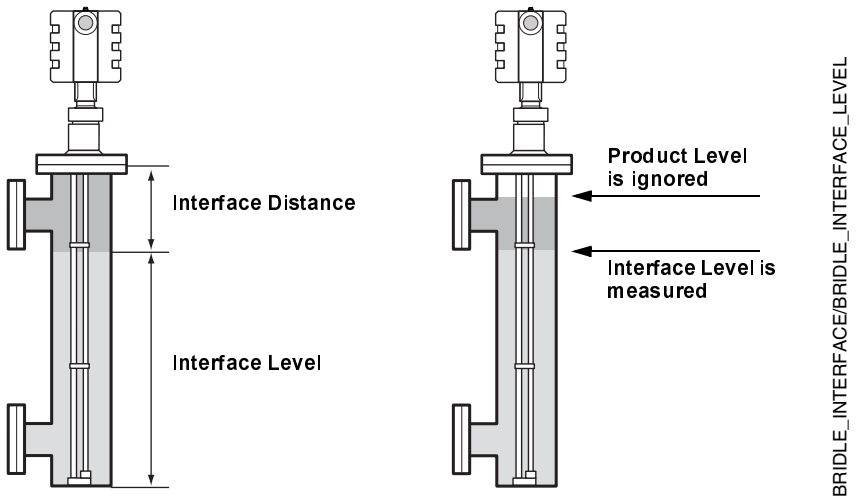
Measurement mode *Interface when Immersed Probe* can also be activated in the RCT software:

1. Open the Setup window.
2. Select the Tank Config tab.
3. Choose Measurement Mode *Interface when Immersed Probe*.
4. Click the Send Page button.

NOTE!
Do not use Measurement Mode *Interface when Immersed Probe* in “standard” applications when both Interface Level and Product Level are measured.

If the product level drops, the air filled region in the upper part of the pipe will slightly reduce the measurement accuracy of the interface level. To achieve high accuracy in this measuement mode the probe must be fully immersed.

Figure 6-6. Interface Level measurements in a full bridle pipe.



NOTE!
Adjust Threshold T2 if the level pulse is not detected.

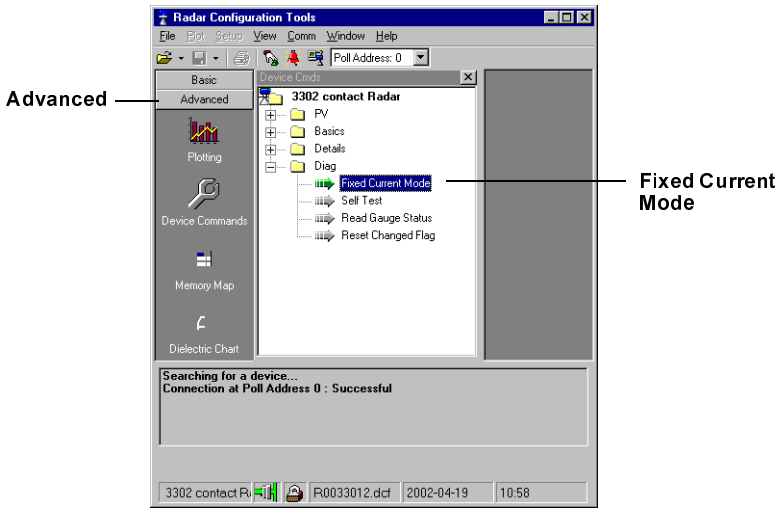
SERVICE

Analog Output calibration

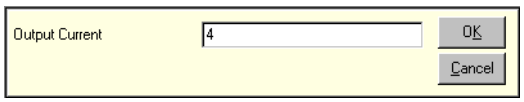
To calibrate the Analog Output current do the following:

1. Start RCT and make sure that the transmitter communicates with the PC (see Section 4: Installing the RCT software).
2. Open the Advanced section in the RCT workspace Project Bar and click the Device Commands icon,
   or
   choose the Device Commands option from the View menu.
3. Open the folder named Diag and double-click the Fixed Current Mode option.

WORKSPACE_ADVANCED_FIXEDCURRENT



4. Set the output current to 4 mA.



5. Measure the output current.
6. Open the folder named Details.
7. Choose the Trim DAC Zero option and enter the measured output current.
8. In the Diag folder double-click the Fixed Current Mode option and set the output current to 20 mA.
9. Measure the output current.
10. In the Details folder double-click the Trim DAC Gain option and enter the measured output current.
11. In the Diag folder double-click the Fixed Current Mode option and set the output current to 0 mA in order to leave the Fixed Current mode.

Level and Distance Calibration

When calibrating the transmitter it is important that the product surface is calm and that the tank is not being filled or emptied.

A complete calibration is performed in two steps:

1. Calibrate the Distance measurement by adjusting the Calibration Offset parameter.
2. Calibrate the Level measurement by adjusting the Reference Gauge Height.

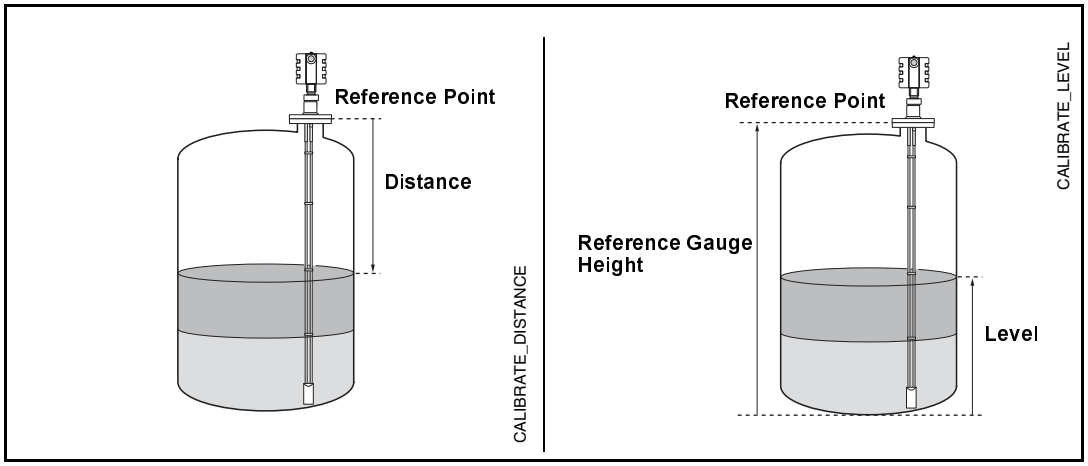
Distance calibration

1. Measure the actual distance between the Upper Reference Point and the product surface.
2. Adjust the Calibration Offset so that the Distance measured by the transmitter corresponds to the actual distance.
   The Calibration Offset parameter is available via
   HART command [1, 4, 6, 4],
   or,
   RCT: open the Advanced section in the Project Bar and choose Device Commands>Basics>Set Calibration Offset.

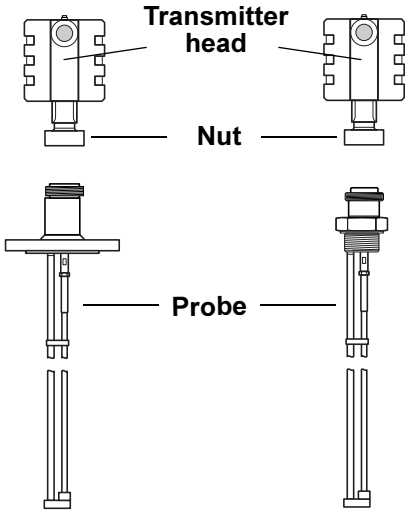
Level calibration

1. Measure the actual Product Level.
2. Adjust the Reference Gauge Height so that the measured Product Level corresponds with the actual level.

Figure 6-7. Distance and Level calibration



Changing the Probe



PROBE CHANGE FL/PROBE CHANGE THREAD

1. Loosen the nut.
2. Remove the old probe from the transmitter head and mount the new probe.
3. Fasten the nut again.

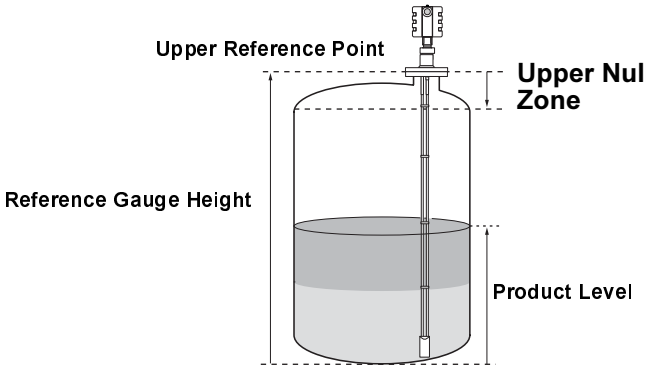
4. If the new probe is not of the same type as the original probe, update the transmitter configuration by setting the Probe Type parameter to the appropriate value:
   HART Fast Key sequence [1, 3, 6],
   or
   RCT Setup/Tank Config.
5. Measure the probe length and enter the measured value:
   HART Fast Key sequence [1, 3, 5],
   or
   RCT Setup/Tank Config.
6. Verify that the transmitter is calibrated.

NOTE
Flexible and Rigid probes require different radar electronics and can not be used with the same transmitter head.

Disturbances at the top of the tank

If there are measurement problems in the upper part of the tank it may be necessary to avoid measurements range in this region. Problems may occur if for example the nozzle diameter is too small or if there are disturbing objects close to the probe. By using the Upper Null Zone parameter, the measuring range in this region is reduced by avoiding measurements above a certain level.

Figure 6-8. Upper Null Zone



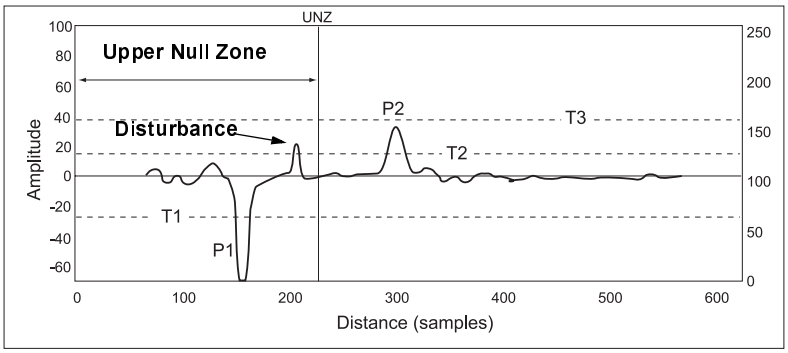
To set the Upper Null Zone do one of the following:

1. Select the HART command [1, 4, 4, 5].
2. Enter the desired value.

or

1. Start the **Radar Configuration Tool** (RCT).
2. Click the Setup icon in the RCT workspace Project Bar.
3. Choose the **Tank Config** tab in the Setup window.
4. Click the Receive Page button.
5. Type the desired value in the Upper Null Zone field.
6. Click the Send Page button. Now the Upper Null Zone is stored in the transmitter memory.

Figure 6-9. Using the Waveform Plot in RCT to set the Upper Null Zone



Amplitude Threshold Settings

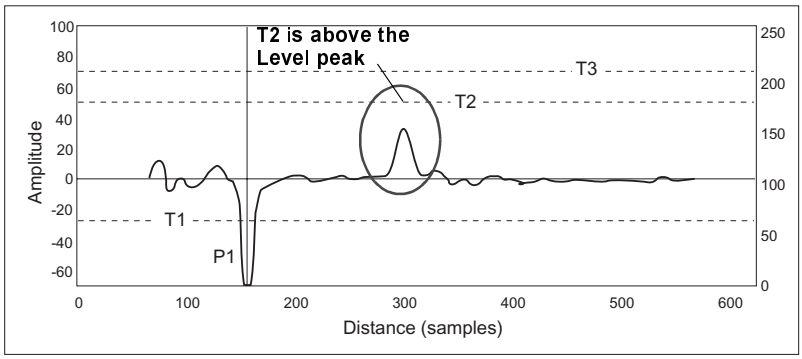
The amplitude thresholds are automatically adjusted to appropriate values in order to filter out noise and other non-valid measurements from the measurement signal.

The amplitude of the measurement signal, i.e. the amplitude of the signal that is reflected by the product surface, is related to the actual dielectric constant of the product. The amplitude threshold that is used by the transmitter is based on the parameter configuration of the current product dielectric constant (see *Section 4: Basic Configuration*). Normally no other threshold adjustment is needed, but if the transmitter still does not track the product surface correctly it may be necessary to adjust the threshold values.

The Radar Configuration Tool (RCT) has a plot function allowing you to view the reflections along the probe.

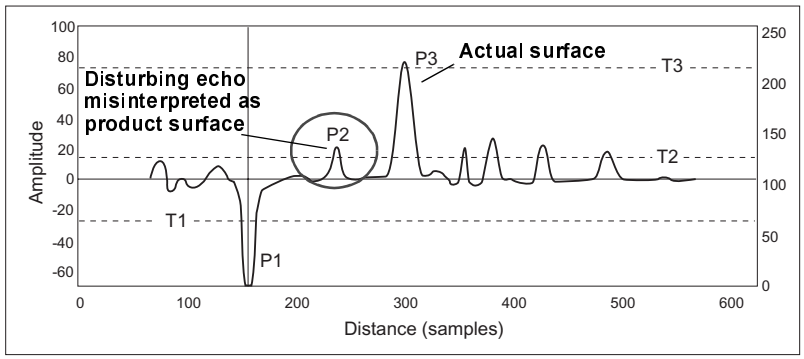
If the amplitude threshold is too high the product level is not detected as illustrated in Figure 6-10.

Figure 6-10. Example 1: amplitude threshold T2 is too high.



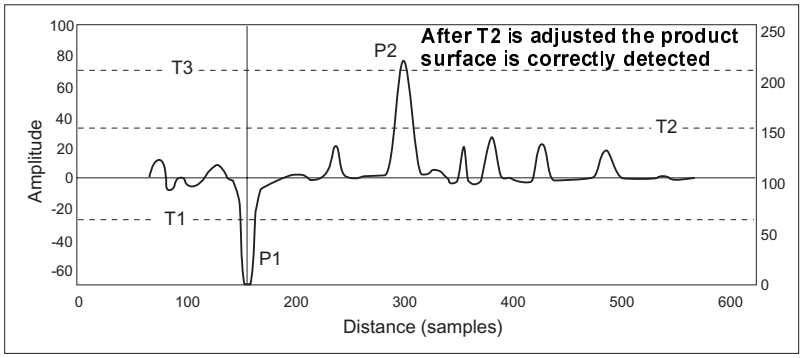
If there are disturbing objects in the tank the threshold must be carefully set in order to avoid locking on the wrong amplitude peak. In Figure 6-11 the transmitter has locked on a peak above the actual product surface, i.e. a disturbance was interpreted as the product surface, whereas the actual product surface was interpreted as an interface or the probe end.

Figure 6-11. Example 2: amplitude threshold T2 is too low.



By adjusting the amplitude threshold T2 the product surface is detected correctly as illustrated in Figure 6-12.

Figure 6-12. Waveform plot after threshold T2 was adjusted



WAVEFORMPLOT THRESHOLD ADJUSTED

To adjust the amplitude thresholds select HART command [1, 4, 6, 2]

or

1. Start the Radar Configuration Tool (RCT).
2. Choose the **Device Commands** option from the View menu.
3. Open the **Details** folder.
4. Click the **Set Nominal Thresholds** option.

The thresholds T2 and T3 should be set to about 50% of the measured signal amplitude for the product surface and the interface peaks, respectively.

NOTE
Amplitude thresholds should not be set to values less than 3.

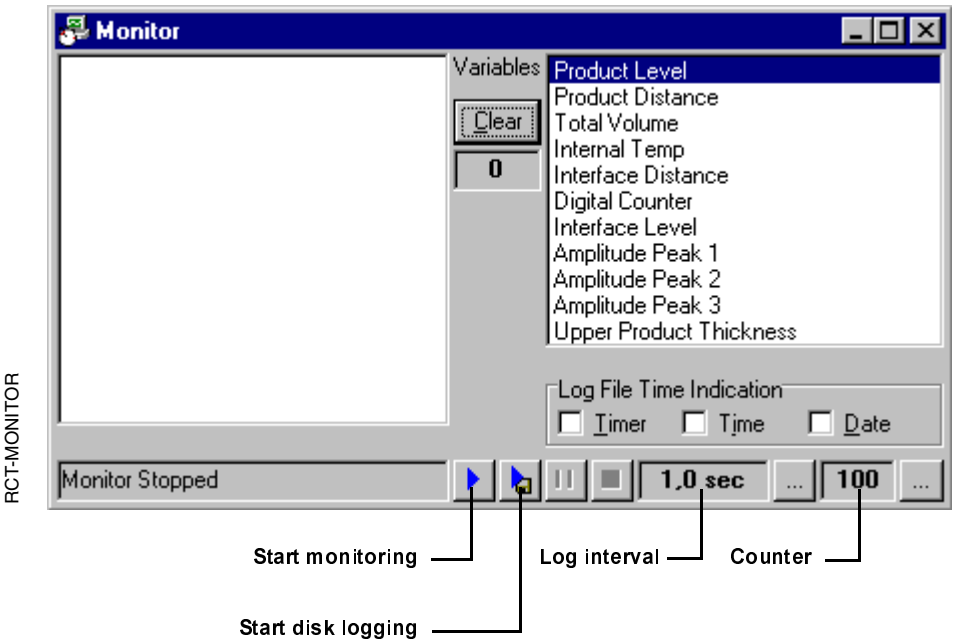
NOTE
Check that the dielectric constant parameter setting is reasonably close to the actual dielectric constant value of the upper product before changing the amplitude thresholds.

NOTE
Default Amplitude thresholds can be set by typing 0 as the new threshold value.

Logging measurement data

To start logging do the following:

1. Click the Monitor icon in the RCT workspace or choose the *Monitor* option from the *View* menu.



2. Choose the desired variables to be monitored and click the Start Monitor button.

Saving the log to disk

1. Choose the desired variables to be monitored.
2. Click the Log interval button ... and enter a time interval. For example, type 10 if you want data to be logged every tenth second.
3. Click the Counter button and enter the maximum number of files to be stored. The Counter is used to limit the amount of data stored on the hard disk. Each time the maximum number of entries in a log file is reached, the current log file is saved and a new file is created. This procedure continues up to the maximum number of files given by the Counter value. The file size is limited to 60000 entries which can easily be handled by spreadsheet programs like MS Excel.
4. Select the desired options for Timer, Time and Date. By selecting a check box the corresponding time indication is stored for each log entry in the log file.
5. Click the Start disk logging button.
6. Choose a destination folder and enter a file name.

Saving the Transmitter Configuration

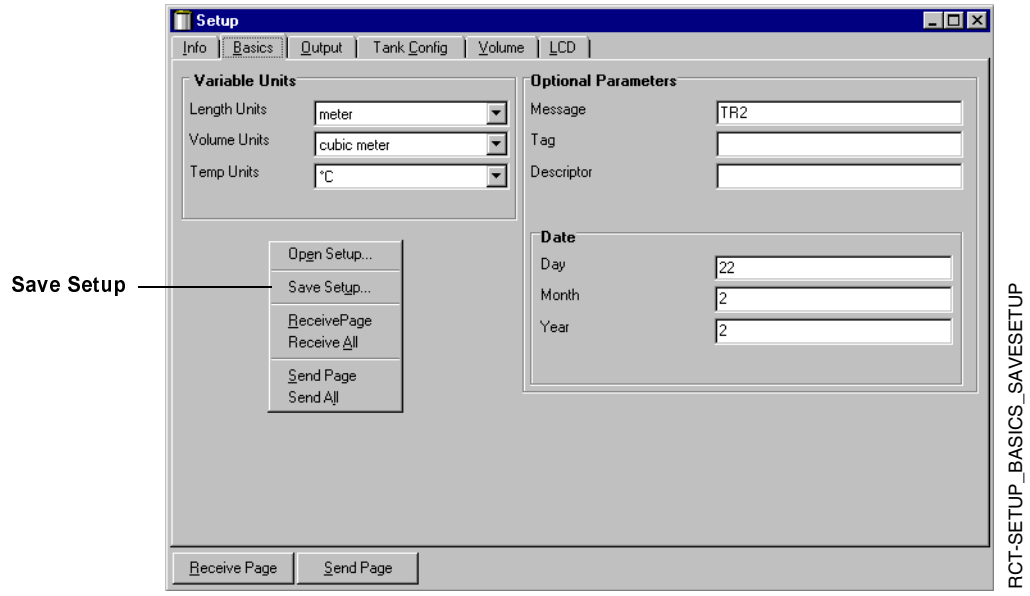
The Radar Configuration Tool offers different methods to save the current transmitter configuration:

- Save only the configuration specified in the Setup window.
- Use the more extensive function in the Memory Map window.

You can use a stored configuration file as a backup of the current configuration, or it can be distributed for service purposes.

To save the current transmitter setup do the following:

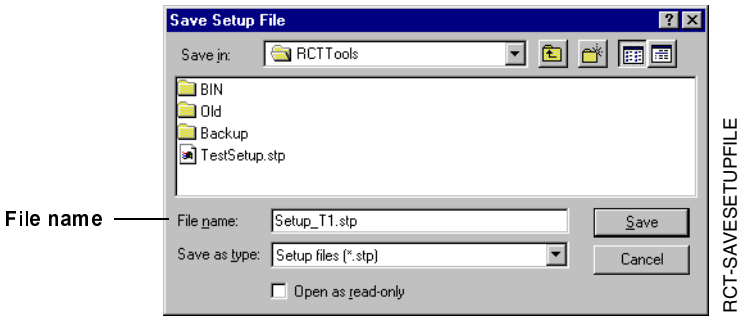
1. Click the Setup icon in the RCT workspace or choose the *Setup* option from the *View* menu to open the Setup window.



2. Click the right mouse button and choose the **Receive All** option,
   or
   from the Setup menu choose the **Receive All** option.
   Alternatively, you can use the Receive Page option on each individual page.

NOTE!
All pages must be received before the setup can be saved.

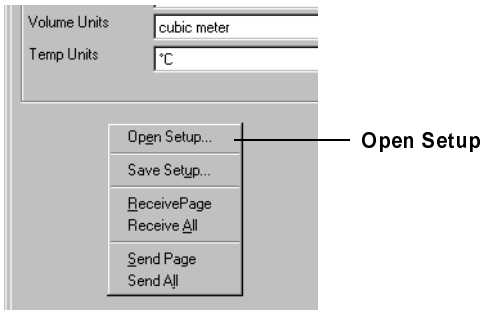
3. Click the right mouse button and choose the **Save Setup** option.



4. Choose a destination folder and enter a file name.
5. Click the **Save** button.

To load a setup

1. Click the Setup icon in the RCT workspace or choose the *Setup* option from the *File* menu.



RCT-SETUP_BASICS_SAVESETUP

2. In the *Setup* window click the right mouse button and choose the **Open Setup** option, or
   from the *File* menu choose the **Open Setup** option.
3. Open the source folder and select the desired setup file.
4. Click the **Open** button.

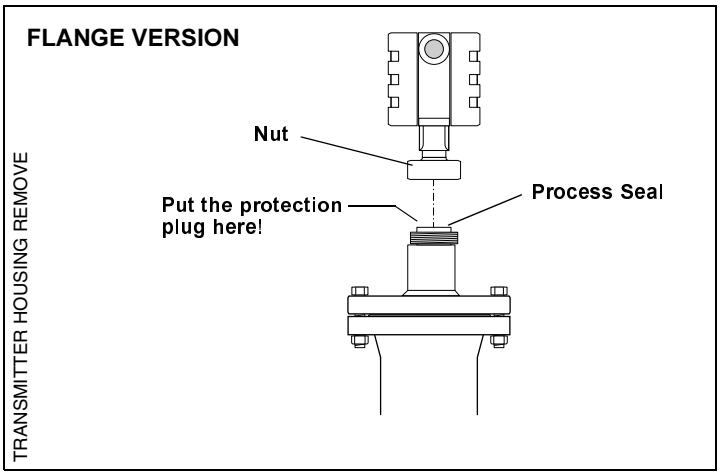
Memory Map

The Memory Map window lets you view the current transmitter database registers. It is also possible to save the current database for backup or service purposes, and it is also possible to download a backup database to the transmitter. To save configuration data in the Memory Map window:

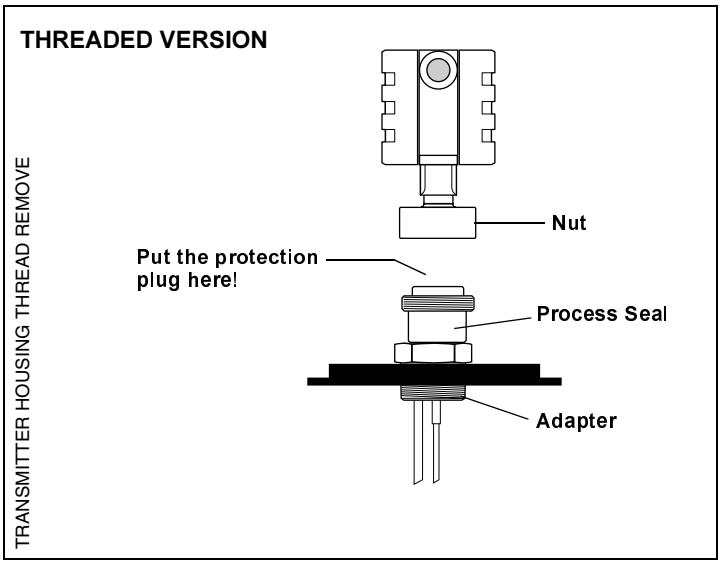
1. Start the RCT program.
2. Choose the **View>Memory** option, or click the **Memory Map** icon in the RCT workspace (Advanced section at the left side of the workspace window).
3. Choose the All EE option from the drop-down list.
4. Click the Receive button. (It may take a few minutes to read the database).
5. Click the right mouse button and choose the Save Memory As option.
6. Type the desired file name and click the OK button. Now the current database is stored.

See the Online Help in RCT for further information on how to open a saved database and how to download a database to the transmitter.

Removing the Transmitter Head



1. Losen the nut that connects the transmitter housing to the Process Seal.
2. Carefully lift the transmitter head.
3. Attach the protection plug to the Process Seal.



NOTE
Do not remove the Process Seal from the adapter!

DIAGNOSTIC MESSAGES

Troubleshooting

If there is a malfunction despite the absence of diagnostic messages, see Table 6-1 for information on possible causes.

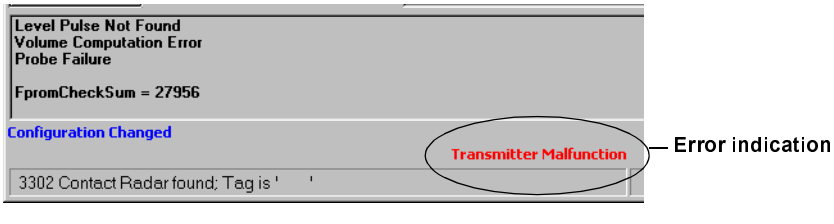
Table 6-1. Troubleshooting chart

Symptom	Possible cause	Action
No HART communication.	• COM Port configuration does not match the connected COM Port. • Cables may be disconnected. • Wrong HART adderss is used. • Hardwafe failure.	• Check that correct COM Port is selected in the HART server (see “Specifying the COM Port” on page 4-14. • Check wiring diagram. • Verify that the 250 Ohm resistor is in the loop. • Check cables. • Make sure that correct HART short address is used. Try address=0. • Check Analog Output current value to verify that transmitter hardware works.
Analog Out is set in Alarm.		Use the command “Read Gauge Status” in order to check active errors.
Both P2 and P3 are detected but Interface Level is reported as Not A Number (NAN) in the waveform plot.	Measurement Mode is set to “Level Only”.	Set Measurement Mode to “Level and Interface” (see “Basic Configuration” on page 4-9).
Both Level and Interface Level are reported as NAN.	Probe is not connected.	Use the command “Read Gauge Status” and check if error “Probe Failure” is active. If this is the case, check the probe connection.
Both P2 and P3 are detected but the interface level is equal to the product Level.	• P3 is identified as a double bounce. • P2 and P3 are very close.	Adjust thresholds T2 and T3, see “Amplitude Threshold Settings” on page 6-13 for more information.
P2 is detected but Level is incorrectly reported as Full or Empty.		Use the command “Read Gauge Status” and check if the warning “Probe Immersed” is active. If this is the case check that: • the transmitter is configured with correct probe type, • the reference pulse (P1) is below amplitude threshold T4. If not, adjust T4 to an appropriate value.
The reference pulse is not detected.	• The tank is full. • The transmitter is configured with wrong probe type. • Amplitude Threshold T1 is not correct.	• Check the product level. • Check that correct probe type is configured. • Check Amplitude Threshold T1.
Level accuracy seems off.	• Configuration error.	• Check the Reference Gauge Height parameter. • Check status information and diagnostic information.
Integral display does not work.		• Check the display configuration. • Check loop power. • Check Display connection.

Errors.

Table 6-2 is a list of diagnostic messages that may be displayed on the Integral Display, on the Model 275 HART Communicator, in AMS or by the Radar Configuration Tools (RCT) software. Errors normally result in Analog Output alarm.

Errors are indicated in RCT by the message “Transmitter malfunction”:



To see the error message do one of the following:

- Click the Read Gauge Status icon in the toolbar at the top of the RCT workspace.
- 1. Open the Advanced section in the RCT workspace Project Bar and click the Device Commands icon,
  or
  choose the Device Commands option from the View menu.
  2. Open the folder named Diag and double-click the Read Gauge Status option.

Table 6-2. Error messages.

Message	Description	Action
Invalid configuration.	At least one configuration parameter is outside allowed range. NOTE: the default values are used until the problem is solved.	• Load default database and restart the transmitter. • Contact Saab Rosemount service department if the problem persists.
RAM failure was detected during startup test.	The transmitter performs an immediate reset.	Contact Rosemount service department.
FPROM failure was detected during startup test.	The transmitter performs an immediate reset.	Contact Rosemount service department.
Waveform acquisition failure.	This error is probably caused by hardware failure.	Contact Rosemount service department.
EEPROM factory checksum.	Checksum error in the factory configuration parameters. Can be caused by power failure during configuration or by hardware error. NOTE: the default values are used until the problem is solved.	Contact Rosemount service department.
EEprom user checksum error.	Caused by error in the User Configuration parameters. Can be caused by power failure during configuration or by hardware error. NOTE: the default values are used until the problem is solved	• Load default database and restart the transmitter. • Contact Saab Rosemount service department if the problem persists.
Software error.		Contact Rosemount service department.
Probe failure.	Probe is not detected.	Check that the probe is correctly mounted.

Warnings.

Table 6-3 is a list of diagnostic messages that may be displayed on the Integral Display, on the Model 275 HART Communicator or by the Radar Configuration Tools (RCT) software. Warnings are less serious than errors and in most cases do not result in Analog Output alarms.

Warnings are indicated by a message at the bottom of the RCT workspace. To see the warning message do one of the following:

- Click the Read Gauge Status icon  in the toolbar at the top of the RCT workspace.
- 1. Open the Advanced section in the RCT workspace Project Bar and click the Device Commands icon,
  or
  choose the Device Commands option from the View menu.
  2. Open the folder named Diag and double-click the Read Gauge Status option.

Table 6-3. Warning messages.

Message	Description	Action
Reference pulse not found.	Possible cause: • Reference pulse immersed in high dielectric liquid. • Wrong threshold level T1. • Hardware error.	• View the waveform plot and check amplitude threshold T1. • Check that the tank is not overfull.
No level pulse is found.	Possible cause: • Wrong threshold level T2. • Liquid level in Dead Zone or below probe end.	• View the waveform plot and check amplitude threshold T2.
Interface pulse not found.	Possible cause: • Wrong threshold level T3. • Interface level too close to the upper product level. • No level pulse detected.	• View the waveform plot and check amplitude threshold T3.
Internal temperature out of range.	-40 ºC<Internal Temperature<85 ºC.	Contact Rosemount service department.
Volume computation warning.	• Volume configuration error. • Strapping table error.	• Check that correct tank type is selected for volume configuration. • Check that tank dimensions for volume are correct. • If strapping table is used, check the level vs. volume points.
Immersed probe.	• Wrong threshold level T4. • Reference pulse immersed in liquid.	• View the waveform plot and check amplitude threshold T4.

Appendix A Reference Data

SPECIFICATIONS

General	
Product	Rosemount Series 3300 Guided Wave Radar Level and Interface Transmitter; Model 3301 for Level (Interface available for fully immersed probe). Model 3302 for Level and Interface.
Measurement principle	Time Domain Reflectometry (TDR).
Reference Conditions	Twin Lead probe, 77 °F (25 °C) water
Microwave Output Power	Nominal 50 µW, Max. 2 mW.
CE-mark	Complies with applicable directives (R&TTE, EMC, ATEX)

Display / Configuration	
Integral Display	The integral display toggles between the following variables: level, distance, volume, internal temperature, interface distance, interface level, peak amplitudes, interface thickness, percent of range, analog current output. Note! The Integral Display can not be used for configuration purposes.
Output Units	For Level, Interface and Distance: ft, inch, m, cm or mm. For Volume: ft^3, $inch^3$, US gals, Imp gals, barrels, yd^3, m^3 or liters.
Output Variables	Model 3301: Level, Distance (to product surface) and Volume. With fully immersed probe: Interface Level and Interface Distance. Model 3302: Level, Distance (to product surface), Volume, Interface Level, Interface Distance and Upper Product Thickness.
HART device for remote confifguration	Rosemount hand-held communicator Model 275.
PC for remote configuration	Radar Configuration Tools software package. Rosemount AMS software.

Electric	
Power supply	Loop-powered (2-wire), 11 - 42 VDC (11 -30 VDC in IS applications, 16-42 VDC in Explosion Proof/Flame Proof applications).
Output	Analog 4 - 20 mA, HART.
Signal on alarm	Standard: Low=3.75 mA. High=21.75 mA. Namur NE 43: Low=3.60 mA. High=22.50 mA.
IS parameters	U_i = 30 V,I_i= 130 mA, P_i = 1 W, L_i=0, C_i=0.
Cable entry	½ - 14 NPT for cable glands or conduit entries. Optional: M20 x 1.5 conduit adapter or PG 13.5 conduit adapter.
Output Cabling	Twisted shielded pairs, 18-12 AWG..

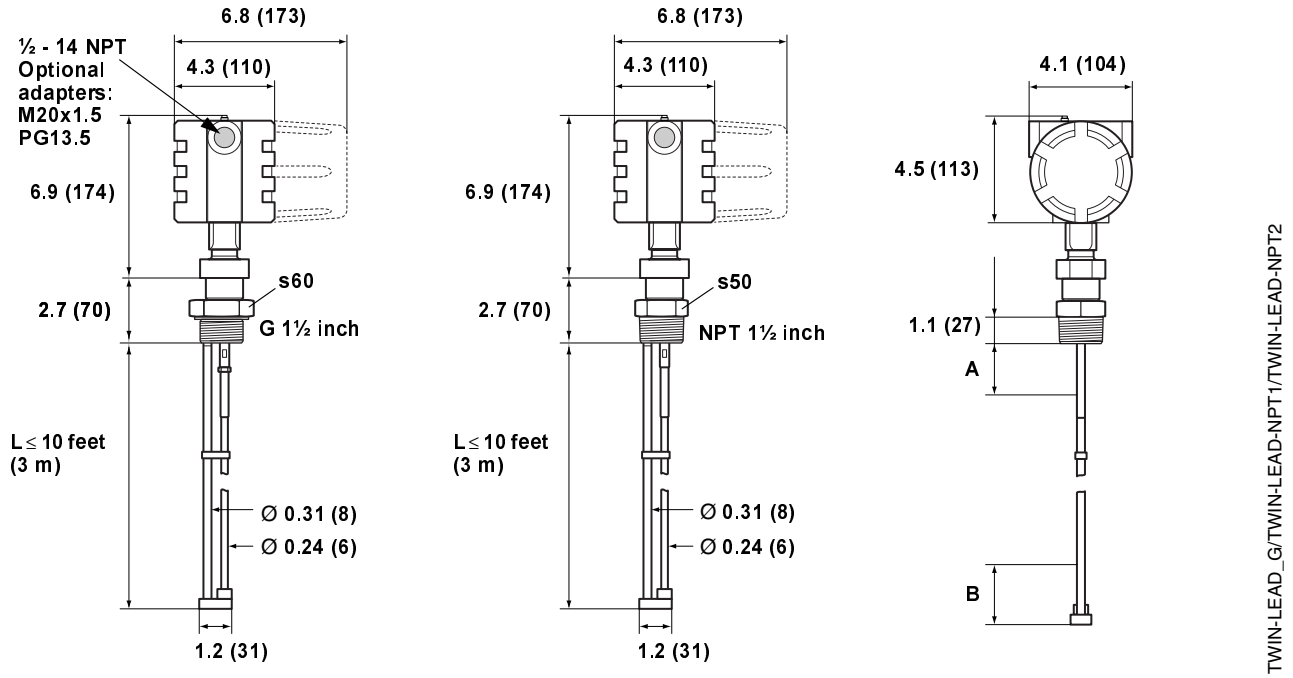
Mechanical	
Probes	Coaxial: 1.3 ft (0.4 m) to 19.7 ft (6 m). Rigid Twin Lead: 2 ft (0.6 m) to 9.8 ft (3 m). Flexible Twin Lead: 3.3 ft (1 m) to 65.6 ft (20 m). Rigid Single Lead: 2 ft (0.6 m) to 9.8 ft (3 m). Flexible Single Lead: 3.3 ft (1 m) to 65.6 ft (20 m). For further information see “Ordering Information” on page A-8.
Material exposed to tank atmosphere	316/316L SST (EN 1.4404), Teflon (PTFE, PFA) and O-ring materials (see ordering information).
Dimensions	See “Dimensional drawings” on page A-3.
Probe angle	0 to 90 degrees from vertical axis.
Housing / Enclosure	Polyurethane-covered Aluminium.
Flanges, Threads	See “Ordering Information” on page A-8.
Height above flange	See “Dimensional drawings” on page A-3.

Environment	
Ambient temperature	-40 °F to +185 °F (-40 °C to +85 °C), depends on approval (see App. B). For the LCD display the temperature range is -4 °F to +185 °F (-20 °C to +85 °C).
Process temperature	-40 °F to +302 °F (-40 °C to +150 °C).
Process pressure	Full vacuum to 580 psig (-1 to 40 Bar).
Humidity	0 - 100 % relative humidity
Ingress protection	NEMA 4X, IP 66.
Telecommunication (FCC and R&TTE)	FCC part 15 (1998) subpart B and R&TTE (EU directive 97/23/EC).
Factory sealed	Yes.
Vibration resistance	DIN EN 60068-2-64, IEC 68-2-64, ANSI/ISA-571.03 SA1, VC2.
Electromagnetic compatibility	Emission and Immunity: meets EN 61326-1 (1997) and amendment A1, class A equipment intended for use in industrial locations if installed in metallic vessels or still-pipes. When rigid/flexible single and twin lead probes are installed in plastic or wood silos influence of strong electromagnetic fields might affect measurements.
Built-in Lightning Protection	Meets EN 61000-4-4 Severity Level 4 and EN 61000-4-5 Severity Level 4.
Pressure Equipment Directive (PED)	Complies with 97/23/EC article 3.3 (confirmed by DNV).
Ordinary Location FM 3810,	Compliance.
Boiler Approval CSA B51-97	Compliance.

Measuring Performance	
Reference accuracy	± 0.2 inch (5 mm) for probes ≤ 16.4 ft (5 m) and ± 0.1% of measured distance for probes >16.4 ft (5 m).
Repeatability	± 0.04 inch (1 mm).
Ambient Temperature Effect	Less than 0.01 % of measured distance per °C.
Update interval	1 per second
Measuring range	8 inch (0.1 m) to 65 ft (20 m).

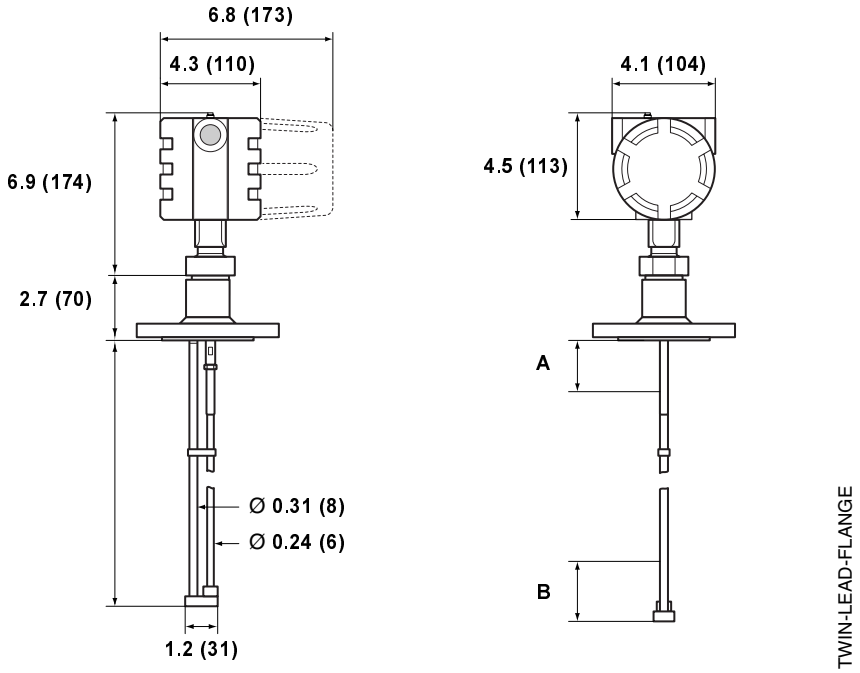
DIMENSIONAL DRAWINGS

Figure A-1. Rigid Twin Lead



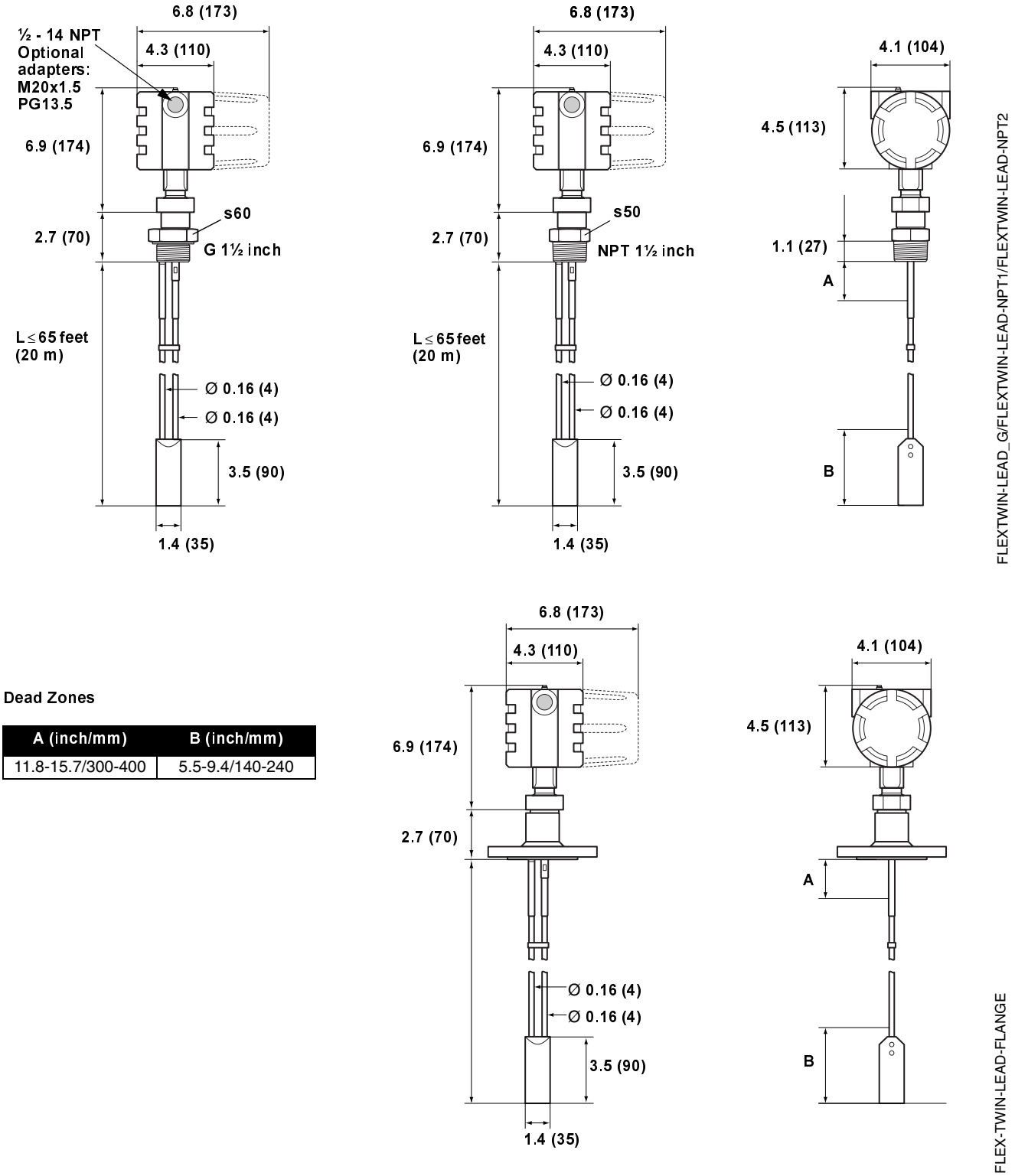
Dead Zones

A (inch/mm)	B (inch/mm)
7.9/200	2-2.8/50-70



Dimensions are in inches (millimeter).

Figure A-2. Flexible Twin Lead

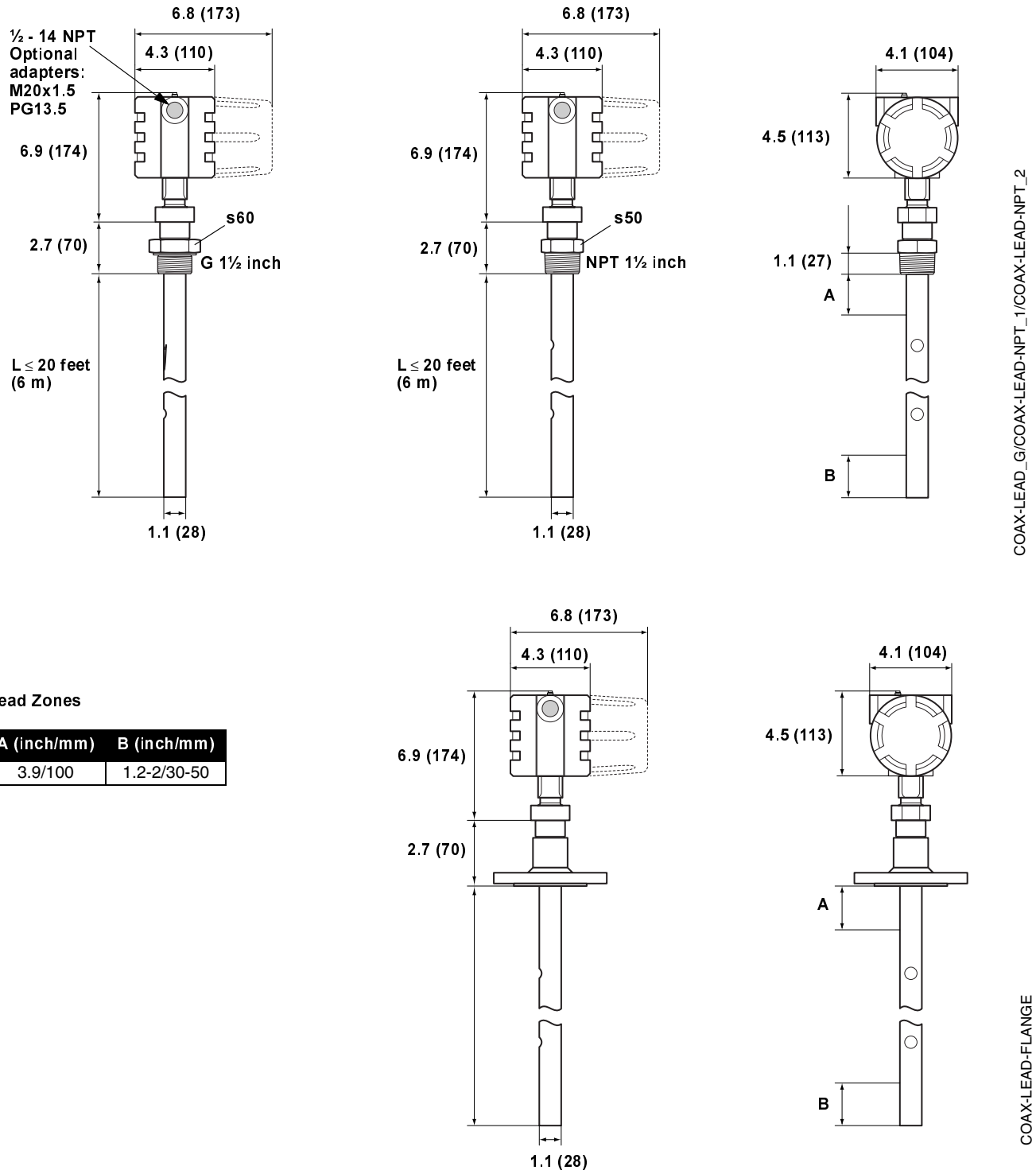


Dead Zones

A (inch/mm)	B (inch/mm)
11.8-15.7/300-400	5.5-9.4/140-240

Dimensions are in millimeter (inches).

Figure A-3. Coaxial

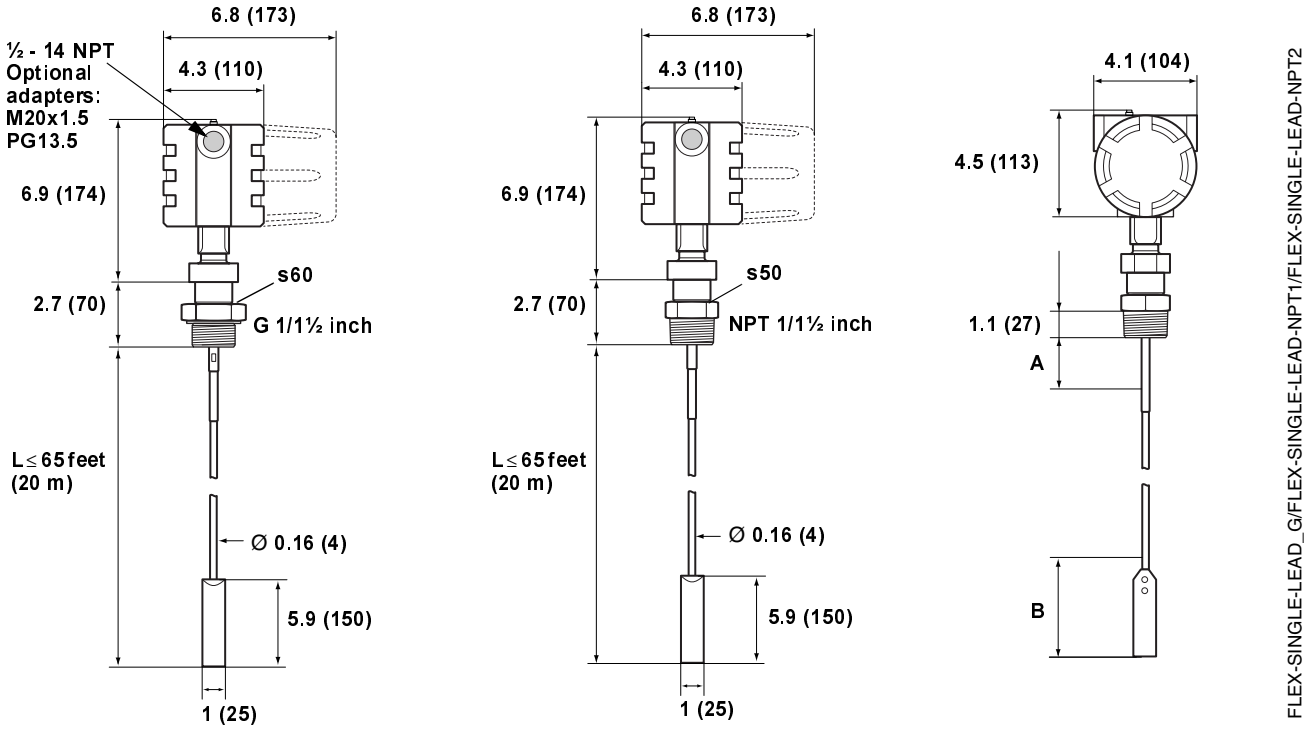


Dead Zones

A (inch/mm)	B (inch/mm)
3.9/100	1.2-2/30-50

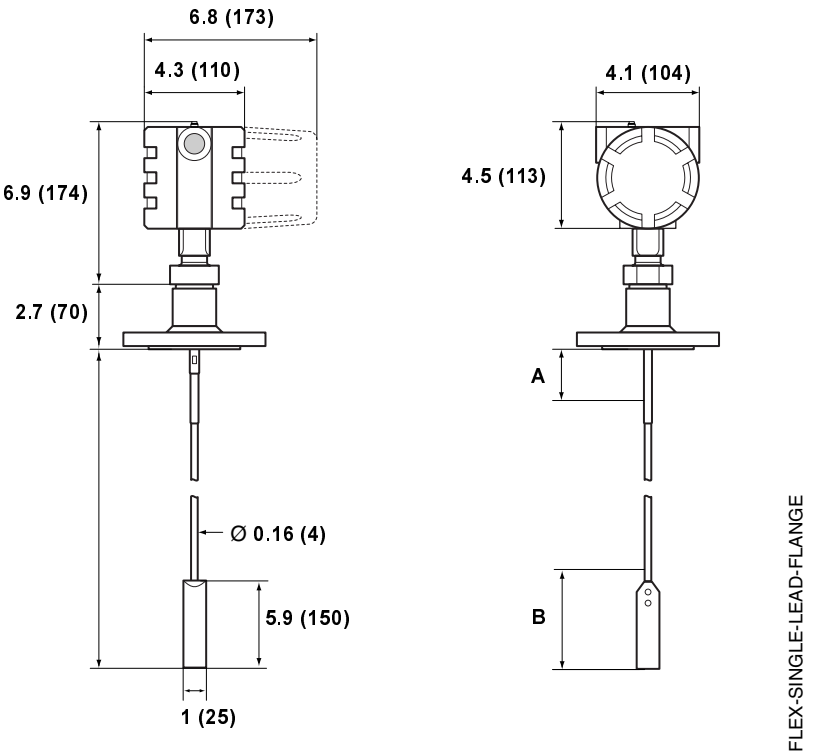
Dimensions are in inches (millimeter).

Figure A-4. Flexible Single Lead



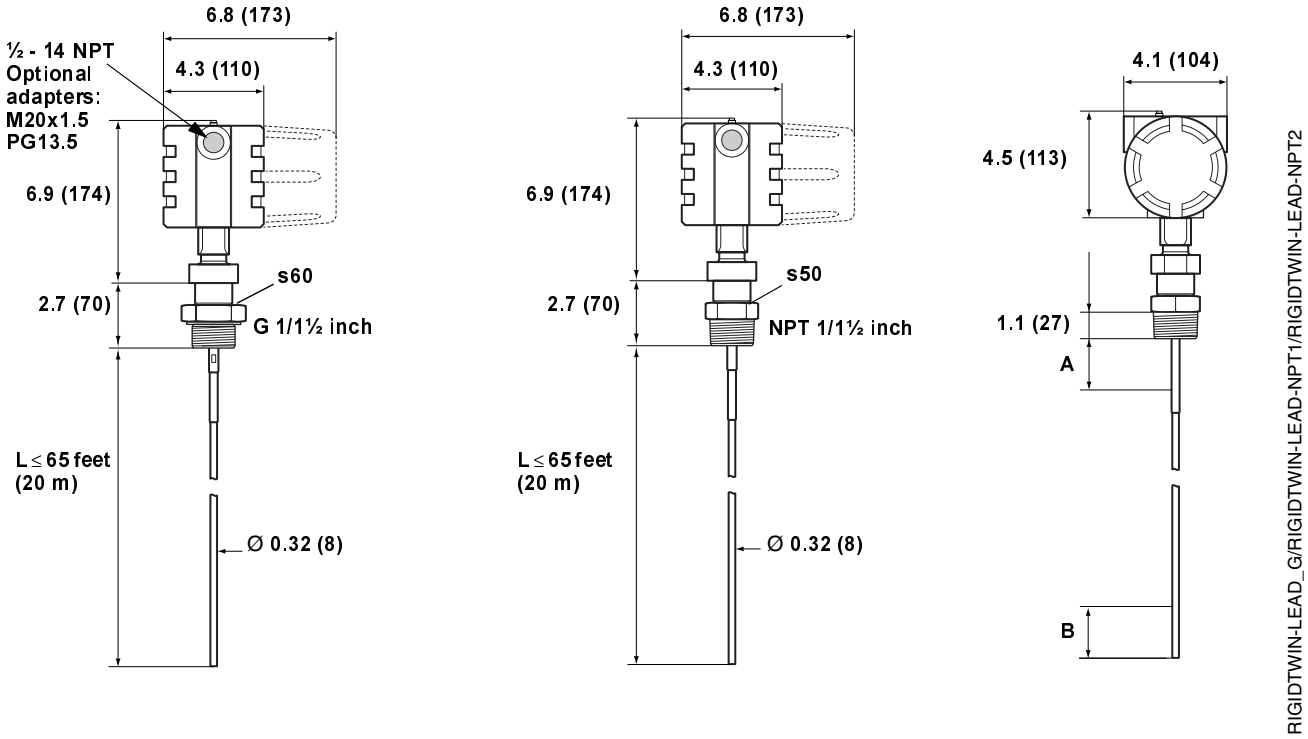
Dead Zones

A (inch/mm)	B (inch/mm)
11.8-19.7/300-500	7.9-10.6/200-270



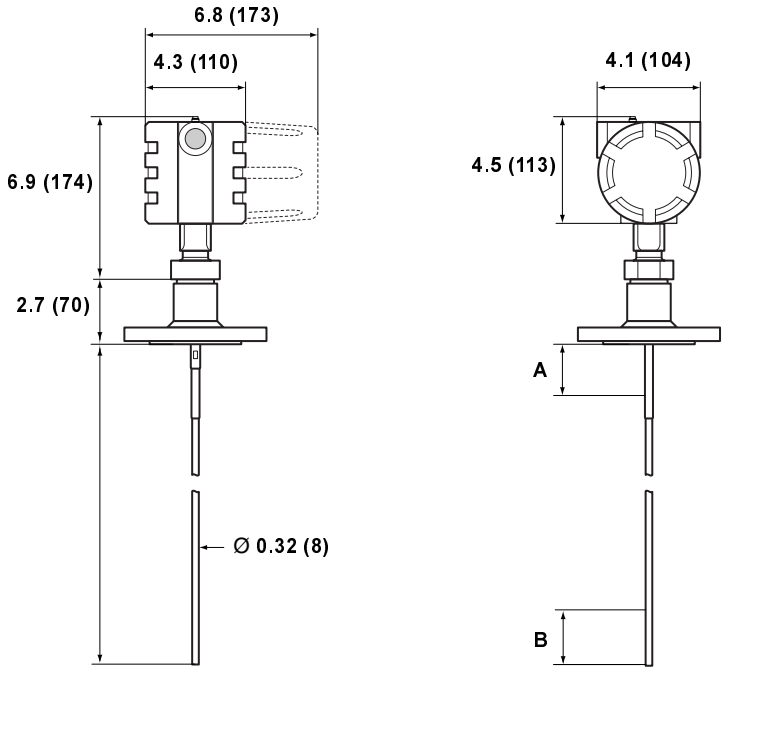
Dimensions are in inches (millimeter).

Figure A-5. Rigid Single Lead



Dead Zones

A (inch/mm)	B (inch/mm)
7.9-13.8/200-350	2-3.9/50-100



Dimensions are in inches (millimeter).

ORDERING INFORMATION

Model Code 3301, Level in Liquids

Model	Product Description		
3301	Guided Wave Radar Level Transmitter (interface only available for fully immersed probe)		
Code	**Signal Output**		
H	4-20 mA with HART communication		
Code	**Housing Material**		
A	Polyurethane-covered Aluminum		
Code	**Conduit Threads/Cable Threads**		
1	½ - 14 NPT		
2	M20x1.5 adapter		
3	PG 13.5 adapter		
Code	**Operating Temperature and Pressure**		
S	-15 psi (-1 Bar) to 580 psi (40 Bar) @ 302 °F (150 °C) (1)		
Code	**Material of Construction: Process Connection/Probe**		
1	316 / 316L SST (EN 1.4404), Teflon (PTFE, PFA)		
Code	**Sealing, O-ring Material (Consult factory for other o-ring materials)**		
V	Viton		
E	Ethylene Propylene		
K	Kalrez 6375		
B	Buna-N		
Code	**Probe Type**	**Process Connection**	**Probe Length**
1A	Rigid Twin Lead.	Flange or 1.5 inch Thread	Min: 2 ft (0.6 m) Max: 9 ft 10 inch (3 m)
2A	Flexible Twin Lead with weight	Flange or 1.5 inch Thread	Min: 3 ft 3 inch (1 m) Max: 65 ft 7 inch (20 m)
3A	Coaxial	Flange or 1.5 inch Thread	Min: 1 ft 3 inch (0.4 m) Max: 19 ft 8 inch (6 m)
4A	Rigid Single Lead	Flange, 1 or 1.5 inch Thread	Min: 2 ft (0.6 m) Max: 9 ft 10 (3 m)
5A	Flexible Single Lead with weight	Flange, 1 or 1.5 inch Thread	Min: 3 ft 3 inch (1 m) Max: 65 ft 7 inch (20 m)
5B	Flexible Single Lead with chuck	Flange, 1 or 1.5 inch Thread	Min: 3 ft 3 inch (1 m) Max: 65 ft 7 inch (20 m)
Code	**Probe Length Unit**		
E	English (feet, inch)		
M	Metric (meters, centimeters)		
Code	**Total Probe Length(2) (feet/m)**		
xx	0-65 feet or 0-20 m		
Code	**Total Probe Length(2) (inch/cm)**		
xx	0-11 inch or 0-99 cm		

3301	H	A	1	S	1	V	1A	M	02	05	(code continues on next page)

(1) Process seal rating. Final rating depends on flange and O-ring selection.
(2) Probe weight included if applicable. Give the total probe length in feet and inches or meters and centimeters, depending on selected probe length unit (see Model String Example). If tank height is unknown, please round up to an even length when ordering - probes can be cut to exact length in field. Maximum allowable length is determined by process conditions.

Code	Process Connection - Size/Type (consult factory for other process connections)
ANSI Flanges in 316 SST	
AA	2 inch ANSI, 150 lb
AB	2 inch ANSI, 300 lb
BA	3 inch ANSI, 150 lb
BB	3 inch ANSI, 300 lb
CA	4 inch ANSI, 150 lb
CB	4 inch ANSI, 300 lb
DA	6 inch ANSI, 150 lb
DIN Flanges in 316L SST	
HB	DN50, PN40
IA	DN80, PN16
IB	DN80, PN40
JA	DN100, PN16
JB	DN100, PN40
KA	DN150, PN16
Threaded	
RA	1.5 inch NPT thread
RB	1 inch NPT thread
SA	1½ inch BSP (G 1½ inch) thread
SB	1 inch BSP (G 1 inch) thread

Code	Hazardous Locations Certifications
NA	No hazardous Locations Certifications
E1	ATEX Flameproof
E5	FM Explosion proof
E6	CSA Explosion proof
I1	ATEX Intrinsic Safety
I5	FM Intrinsic Safety and Non-Incendive
I6	CSA Intrinsic Safety and Non-Incendive

Code	Options
M1	Integral Digital Display
BT	Bar Code Tag with tag number and purchase order number
P1	Hydrostatic testing
N2	NACE material recommendation per MR 01-75[1]
Cx - Special Configuration (Software)	
C1	Factory configuration (CDS required with order)
C4	Namur alarm and saturation levels, high alarm
C5	Namur alarm and saturation levels, low alarm
C8	Low alarm[2] (standard Rosemount alarm and saturation levels)
Qx - Special Certs	
Q4	Calibration Data Certification
Q8	Material Traceability Certification per EN 10204 3.1B[3]

AA I1 M1C1

(1) Valid for probe type 3A and 4A.
(2) The standard alarm setting is high.
(3) Option available for pressure retaining wetted parts

Example model string: 3301-H-A-1-S-1-V-1A-M-02-05-AA-I1-M1C1.

E-02-05 in model string denotes 2ft 5 inch probe length.

M-02-05 in model string denotes 2.05 m probe length.

Model Code 3302, Level and Interface in Liquids

Model	Product Description		
3302	Multivariable™ Guided Wave Radar Level and Interface Transmitter		
Code	**Signal Output**		
H	4-20 mA with HART communication		
Code	**Housing Material**		
A	Polyurethane-covered Aluminum		
Code	**Conduit Threads/Cable Threads**		
1	½ - 14 NPT		
2	M20x1.5 adapter		
3	PG 13.5 adapter		
Code	**Operating Temperature and Pressure**		
S	-15 psi (-1 Bar) to 580 psi (40 Bar) @ 302 °F (150 °C) (1)		
Code	**Material of Construction: Process Connection/Probe**		
1	316 / 316L SST (EN 1.4404), Teflon (PTFE, PFA)		
Code	**Sealing, O-ring Material (Consult factory for other o-ring materials)**		
V	Viton		
E	Ethylene Propylene		
K	Kalrez 6375		
B	Buna-N		
Code	**Probe Type**	**Process Connection**	**Probe Length**
1A	Rigid Twin Lead.	Flange or 1.5 inch Thread	Min: 2 ft (0.6 m) Max: 9 ft 10 inch (3 m)
2A	Flexible Twin Lead with weight	Flange or 1.5 inch Thread	Min: 3 ft 3 inch (1 m) Max: 65 ft 7 inch (20 m)
3B	Coaxial for interface measurements	Flange or 1.5 inch Thread	Min: 1ft 3 inch (0.4 m) Max: 19 ft 8 inch (6 m)
Code	**Probe Length Unit**		
E	English (feet, inch)		
M	Metric (meters, centimeters)		
Code	**Total Probe Length(2) (feet/m)**		
xx	0-65 feet or 0-20 m		
Code	**Total Probe Length(2) (inch/cm)**		
xx	0-11 inch or 0-99 cm		

3302	H	A	1	S	1	V	1A	M	02	05	(code continues on next page)

(1) Process seal rating. Final rating depends on flange and O-ring selection.

(2) Probe weight included if applicable. Give the total probe length in feet and inches or meters and centimeters, depening on which probe length unit was selected (see Model String Example). If tank height is unknown, please round up to an even length when ordering - probes can be cut to exact length in field. Maximum allowable length is determined by process conditions.

Code	Process Connection - Size/Type (consult factory for other process connections)
ANSI Flanges in 316 SST	
AA	2 inch ANSI, 150 lb
AB	2 inch ANSI, 300 lb
BA	3 inch ANSI, 150 lb
BB	3 inch ANSI, 300 lb
CA	4 inch ANSI, 150 lb
CB	4 inch ANSI, 300 lb
DA	6 inch ANSI, 150 lb
DIN Flanges in 316 SST	
HB	DN50, PN40
IA	DN80, PN16
IB	DN80, PN40
JA	DN100, PN16
JB	DN100, PN40
KA	DN150, PN16
Threaded	
RA	1.5 inch NPT thread
SA	1½ inch BSP (G 1½ inch) thread

Code	Hazardous Locations Certifications
NA	No hazardous Locations Certifications
E1	ATEX Flameproof
E5	FM Explosion proof
E6	CSA Explosion proof
I1	ATEX Intrinsic Safety
I5	FM Intrinsic Safety and Non-Incendive
I6	CSA Intrinsic Safety and Non-Incendive

Code	Options
M1	Integral Digital Display
BT	Bar Code Tag with tag number and purchase order number
P1	Hydrostatic testing
N2	NACE material recommendation per MR 01-75[1]
Cx - Special Configuration (Software)	
C1	Factory configuration (CDS required with order)
C4	Namur alarm and saturation levels, high alarm
C5	Namur alarm and saturation levels, low alarm
C8	Low alarm[2] (standard Rosemount alarm and saturation levels)
Qx - Special Certs	
Q4	Calibration Data Certification
Q8	Material Traceability Certification per EN 10204 3.1B[3]

AA I1 M1C1

(1) Valid for probe type 3B.
(2) The standard alarm setting is high.
(3) Option available for pressure retaining wetted parts

Example model string: 3302-H-A-1-S-1-V-1A-M-02-05-AA-I1-M1C1.

E-02-05 in model string denotes 2 ft 5 inch probe length.

M-02-05 in model string denotes 2.05 m probe length.

Appendix B Hazardous Approvals

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 gauge 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 gauge 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 the transmitter is installed by qualified personnel and in accordance with applicable code of practice.

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

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

⚠WARNING

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

Avoid contact with leads and terminals.

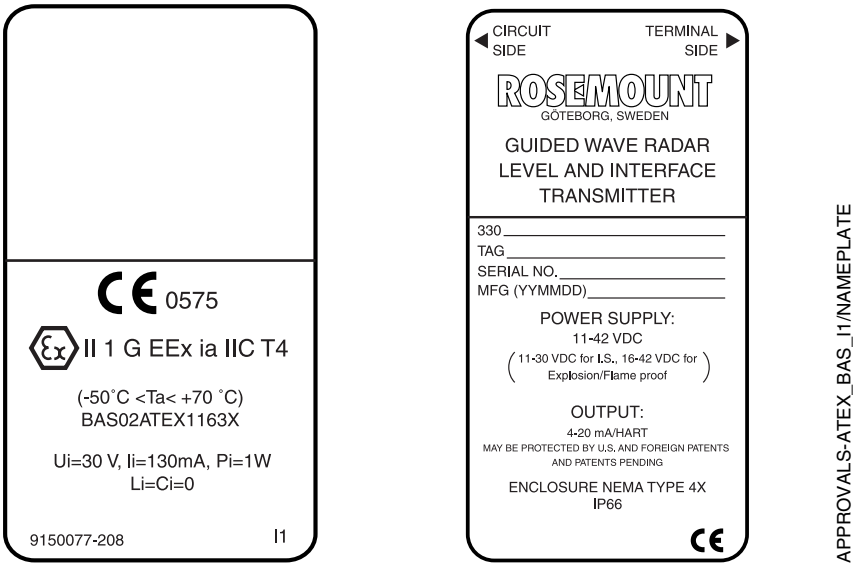
Make sure the main power to the Radar Transmitter is off and the lines to any other external power source are disconnected or not powered while wiring the gauge.

EUROPEAN ATEX DIRECTIVE INFORMATION

Intrinsic Safety

The Rosemount 3300 Series Guided Wave Radar Level and Interface Transmitter that has the following label attached 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 on 19-April-1994.

Figure B-1. Approval Label ATEX (BASEEFA) and Name Plate



The following information is provided as part of the label of the transmitter:

- Name and address of the manufacturer (Rosemount).
- CE Conformity Marking

  CE 0575
- Complete model number
- The serial number of the device
- Year of construction
- Marking for explosion protection:

  II 1 G
- EEx ia IIC T4 (-50 °C ≤ Ta ≤ +70 °C)
  Ui=30 V
  Ii=130 mA
  Pi=1 W
  Ci=0, Li=0
- BASEEFA ATEX certificate number: BAS02ATEX1163X

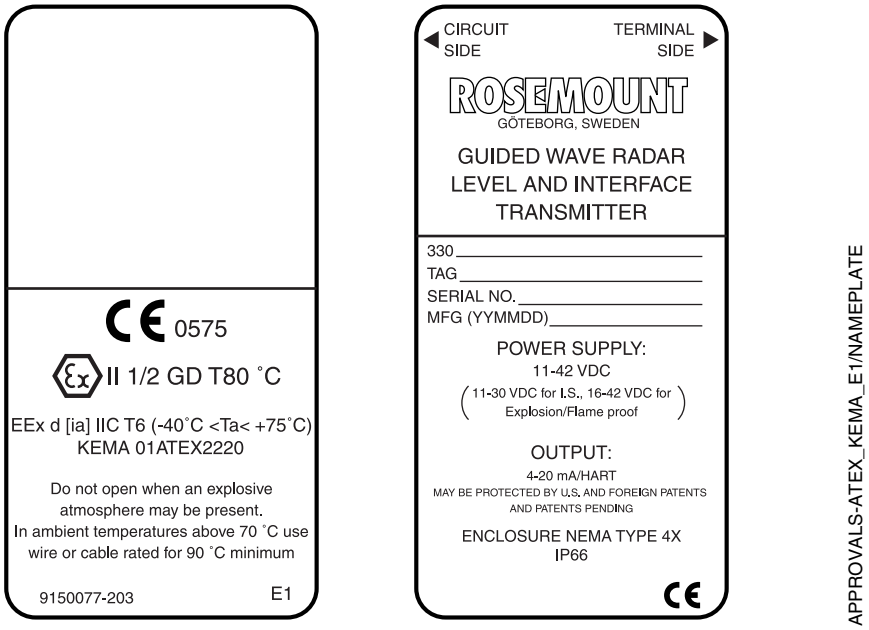
Special Conditions for Safe Use (X):

The apparatus is not capable of withstanding the 500 V test as defined in clause 6.4.12 of EN 50020. This must be considered during installation.

Flame Proof

The Rosemount 3300 Series Guided Wave Radar Level and Interface Transmitter that has the following label attached 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 on 19-April-1994.

Figure B-2. Approval Label ATEX (KEMA) and Name Plate



The following information is provided as part of the label of the transmitter:

- Name and address of the manufacturer (Rosemount).
- CE Conformity Marking

  CE 0575

- Complete model number
- The serial number of the device
- Year of construction
- Marking for explosion protection:

  II 1/2 GD T80˚C

- EEx d [ia] IIC T6 (-40 °C <Ta < +75 °C)
- KEMA ATEX certificate number: KEMA 01ATEX2220

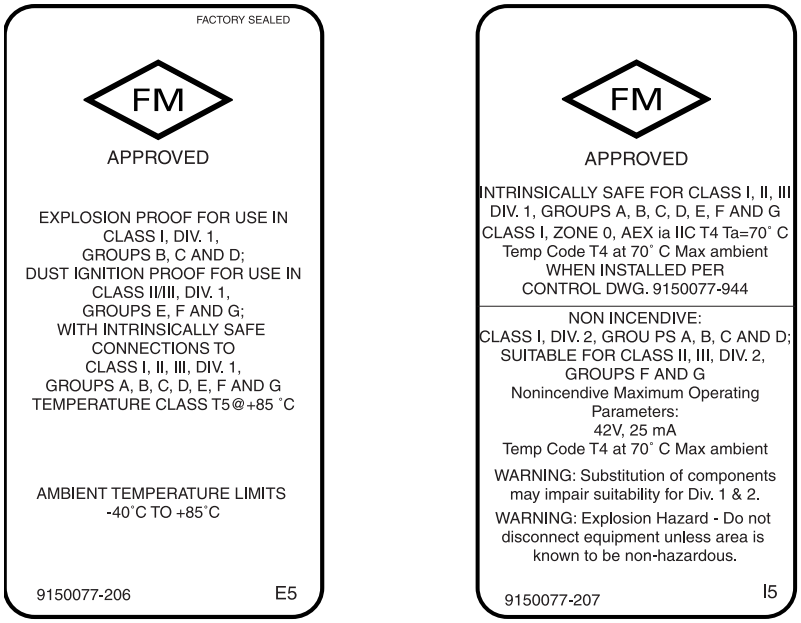
HAZARDOUS LOCATIONS CERTIFICATIONS

The Rosemount 3300 Series Guided Wave Radar Level and Interface Transmitters that have the following labels attached have been certified to comply with the requirements of the approval agencies noted.

Factory Mutual (FM) Approvals

Project ID: 3013394

Figure B-3. Approval Labels Factory Mutual (FM)



E5 Explosion-Proof for Class I, Division 1, Groups B, C and D.

Dust-Ignition proof for Class II/III, Division 1, Groups E, F and G; with intrinsically safe connections to Class I, II, III, Div 1, Groups A, B, C, D, E, F AND G.

Temperature class T5 @+85 °C.

Ambient temperature limits: -40°C to + 85°C

Factory Sealed.

I5 Intrinsically Safe for Class I, II, III, Division 1, Groups A, B, C, D, E, F and G.

Intrinsically Safe for Class I, Zone 0, AEX ia IIC T4 Ta=70°C.

Temperature code T4 at 70°C max ambient.

Control Drawing: 9150077-944.

Non-incendive for Class I, Division 2, Groups A, B, C and D.

Suitable for Class II, III, Division 2, Groups F and G.

Non-incendive maximum operating parameters: 42 V, 25 mA. Temperature code T4 at 70°C max ambient.

Canadian Standards Association (CSA) Approval

Cert. no. 2002.1250250.

Figure B-4. Approval Label Canadian Standards Association (CSA)

E6 Explosion-Proof for Class I, Division 1, Groups C and D.

Dust-Ignition proof for Class II, Division 1 and 2, Groups G and Coal Dust.

Dust-Ignition proof for Class III, Division 1, Hazardous Locations [Ex ia IIC T6].

Ambient temperature limits: -40°C to + 85°C.

Factory Sealed.

I6 Intrinsically Safe: Ex ia IIC T4.

Intrinsically Safe for Class I, Division 1, Groups A, B, C and D.

Temperature code T4.

Control Drawing: 9150077-945.

Non-incendive for Class III, Division 1, Hazardous Locations.

Non-incendive for Class I, Division 2, Groups A, B, C and D.

Ambient temperature limits: -40 °C to + 70 °C.

APPROVAL DRAWINGS

This section contains Factory Mutual installation drawings and Canadian Standards installation drawings. You must follow the installation guidelines presented in order to maintain certified ratings for installed transmitters.

This section contains the following drawings:

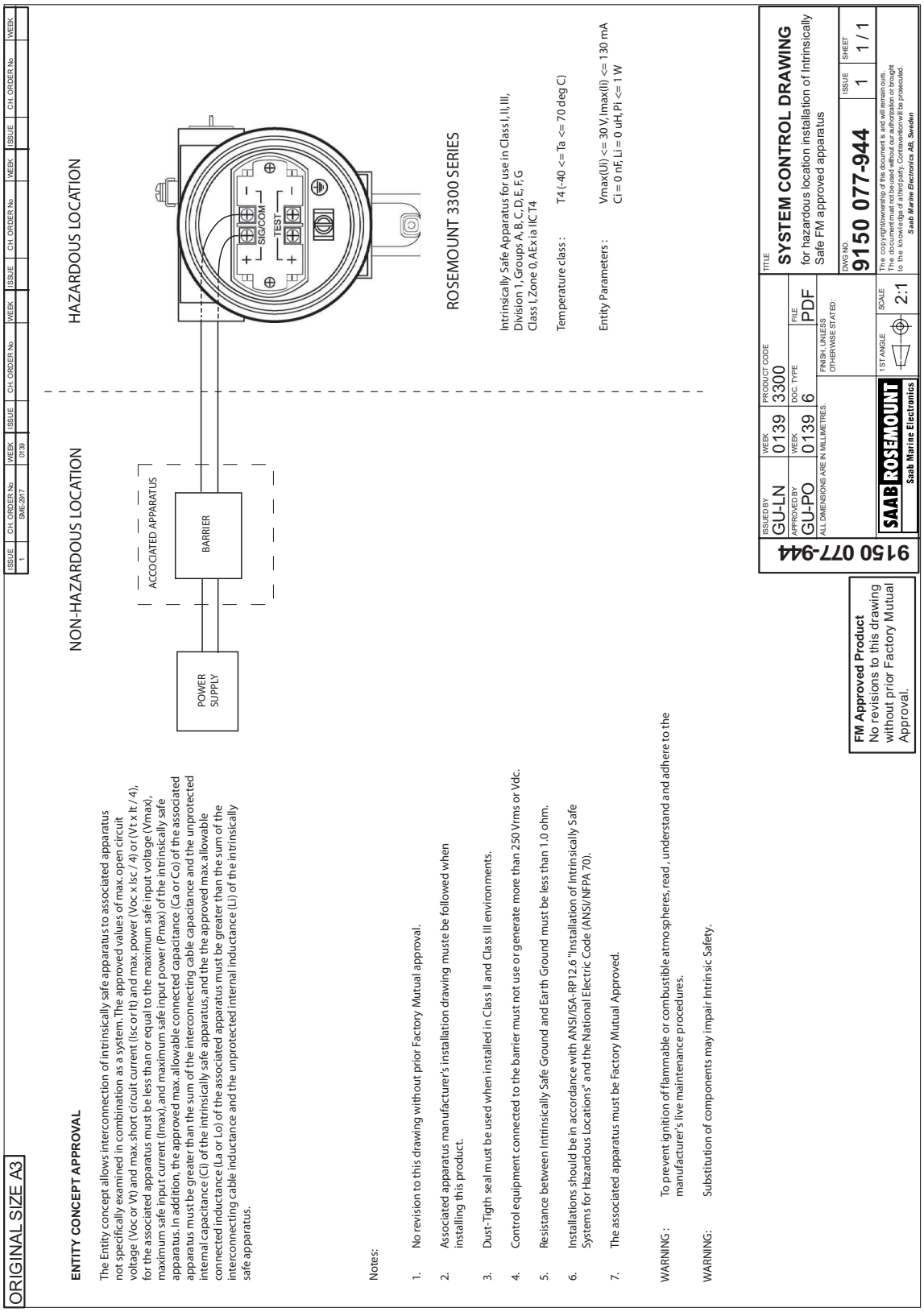
Saab Rosemount drawing 9150077-944, Issue 1:

System Control Drawing for hazardous location installation of intrinsically safe FM approved apparatus.

Saab Rosemount drawing 9150077-945, Issue 1:

System Control Drawing for hazardous location installation of CSA approved apparatus.

Figure B-5. System Control Drawing for hazardous location installation of intrinsically safe FM approved apparatus.



APPROVALS/077-945-1

Figure B-6. System Control Drawing for hazardous location installation of CSA approved apparatus.

ISSUE	CHANGE ORDER No	WEEK	ISSUE	CHANGE ORDER No	WEEK	ISSUE	CHANGE ORDER No	WEEK
1	SME-2918	0213						

NOTE 1.

The Entity concept allows interconnection of intrinsically safe apparatus to associated apparatus not specifically examined in combination as a system. The approved values of max. open circuit voltage (Uo) and max. short circuit current (Io) and max. power (Uo x Io / 4), for the associated apparatus must be less than or equal to the maximum safe input voltage (Ui), maximum safe input current (Ii), and maximum safe input power (Pi) of the intrinsically safe apparatus. In addition, the approved max. allowable connected capacitance (Co) of the associated apparatus must be greater than the sum of the interconnecting cable capacitance and the unprotected internal capacitance (Ci) of the intrinsically safe apparatus, and the the approved max. allowable connected inductance (Lo) of the associated apparatus must be greater than the sum of the interconnecting cable inductance and the unprotected internal inductance (Li) of the intrinsically safe apparatus.

INTRINSICALLY SAFE ENTITY PARAMETERS

GAS GROUP	Ui (Vmax)	Ii (Imax)	Ci	Li	Pi
A & B	30V	130 mA	0 nF	0 uH	1W
C	30V	130 mA	0 nF	0 uH	1W
D	30V	130 mA	0 nF	0 uH	1W

Note : The entity parameters listed above apply only to associated apparatus with linear output !

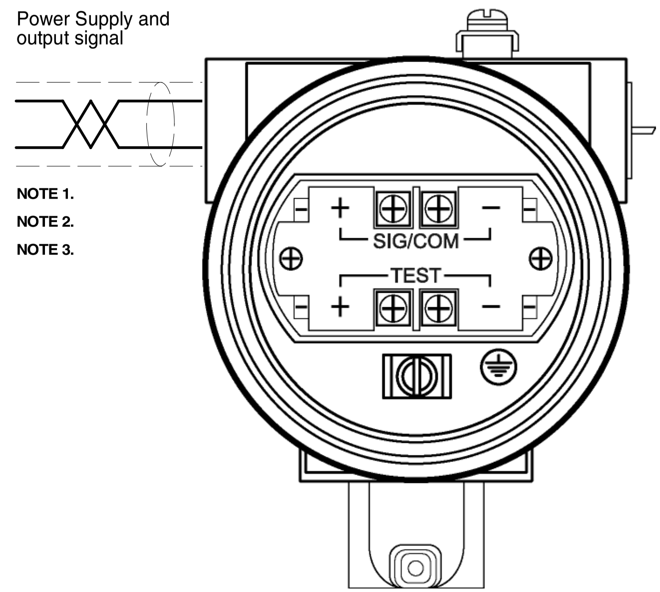
NOTE 2.

Installations in Canada shall be in accordance with the Canadian Electric Code.

NOTE 3.

The positive power supply terminal shall be connected to the terminal designated "+SIG/COM" and the negative supply to the terminal designated "-SIG/COM".

TRANSMITTER HEAD 3300 SERIES



EX-CERTIFIED PRODUCT.
No modifications permitted without reference to the Ex-certifying Authorities.

9150077-945

ISSUED BY	WEEK	PRODUCT CODE		TITLE
GU-LN	0213	3300		**SYSTEM CONTROL DRAWING** for hazardous location installation of CSA approved apparatus
APPROVED BY: GU-PO	WEEK: 0213	DOC. TYPE: 6	FILE: **OrCAD**	
ALL DIMENSIONS ARE IN MILLIMETRES.		FINISH, UNLESS OTHERWISE STATED:		DWG NO. **9150077-945** ISSUE 1 SHEET 1 / 1
SAAB ROSEMOUNT Saab Marine Electronics		1 ST ANGLE	SCALE 1:1	The copyright/ownership of this document is and will remain ours. The document must not be used without our authorization or brought to the knowledge of a third party. Contravention will be prosecuted. ***Saab Marine Electronics AB, Sweden***

APPROVALS/077-9451

Appendix C HART Communicator

INTRODUCTION

This appendix provides an introduction to using the HART Communicator with the Rosemount Model 3300 transmitter, including the HART Communicator keypad, connections, menu structure and Fast Key sequence features.

The HART Communicator manual provides detailed instructions on the use and features of the HART Communicator. This brief summary will familiarize you with the HART Communicator but is not meant to replace the HART Communicator manual. For information on all the capababilities of the HART Communicator, refer to the HART Communicator Product Manual (document 00809-0100-4275).

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 gauge 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 gauge 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.

As a matter of routine, the Model 3300 transmitter and all other equipment in your tank should be shut off prior to entering the tank.

Figure C-1. HART Communicator Menu Tree

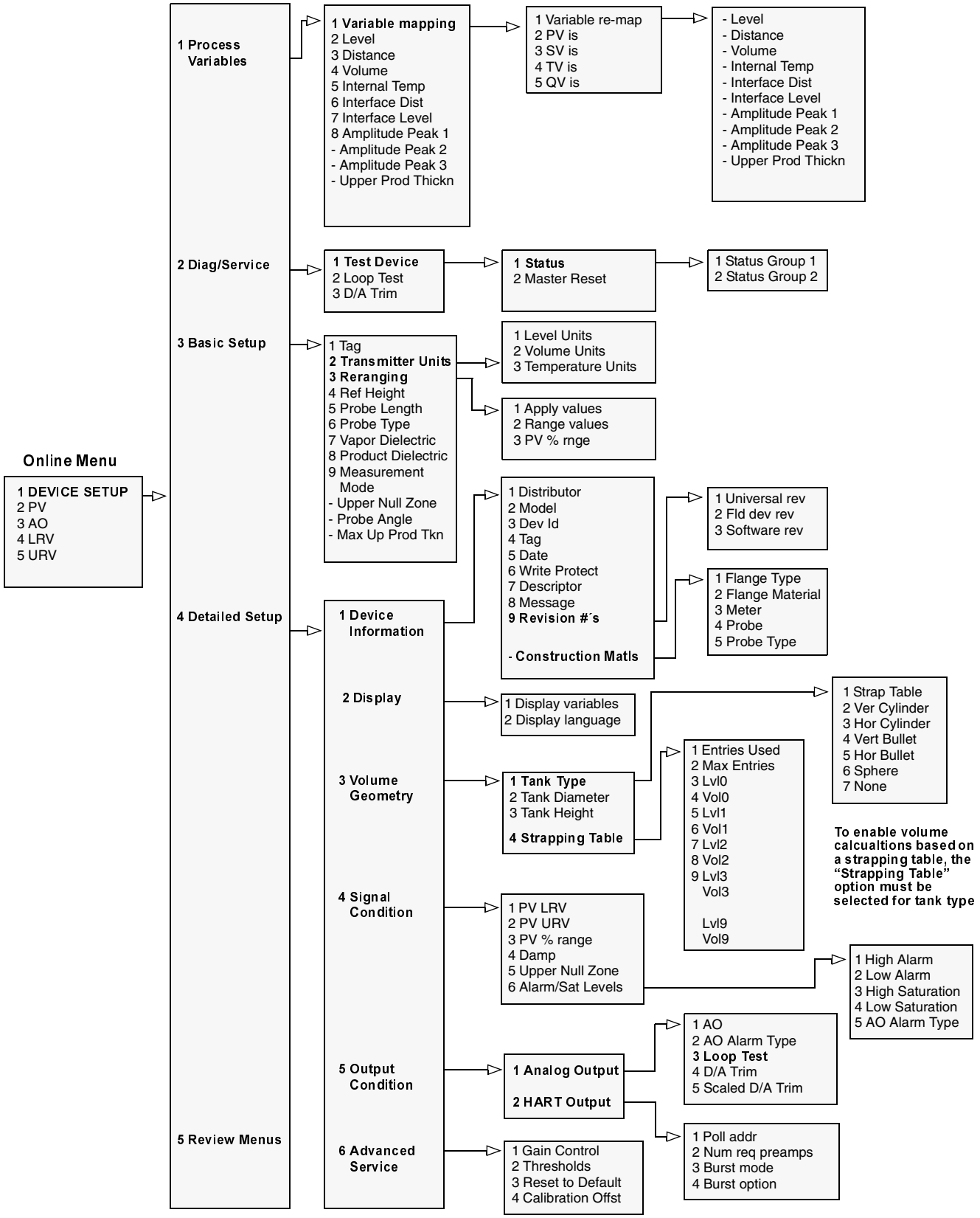


Table C-1. HART Fast Key Sequences

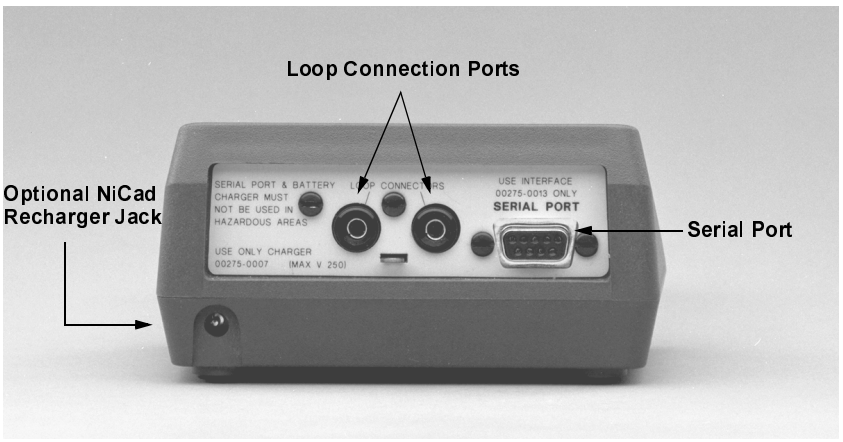
Function	HART Fast Key
Construction Materials	1, 4, 1, –
Device Information	1, 4, 1
Display Language	1, 4, 2, 2
Display Variables	1, 4, 2, 1
Level Units	1, 3, 2, 1
Loop Test	1, 2, 2
Lower Range Value (LRV) (4 mA)	1, 3, 3
Master Reset	1, 2, 1, 2
Measurement Mode	1, 3, 9
Poll Address	1, 4, 5, 2, 1
Primary Variable	1, 1, 1, 1
Probe Length	1, 3, 5
Probe Type	1, 3, 6
Process Variable Damping	1, 4, 4, 4
Product Dielectric	1, 3, 8
Range Values	1, 3, 3, 2
Reference Gauge Height	1, 3, 4
Strapping Table	1, 4, 3, 4
Tag	1, 3, 1
Tank Type	1, 4, 3, 1
Tank Diameter	1, 4, 3, 2
Temperature Units	1, 3, 2, 3
Upper Null Zone	1, 4, 4, 5
Upper Range Value (URV) (20 mA)	1, 3, 3
Vapor Dielectric	1, 3, 7
Variable Remapping	1, 1, 1, 1
Volume Units	1, 3, 2, 2

CONNECTIONS

The HART Communicator exchanges information with the 3300 Series transmitters 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 (see Figure C-2). The connections are non-polarized.

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

Figure C-2. Rear connection panel with Optional NiCad Recharger Jack



⚠ Before connecting the HART 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.

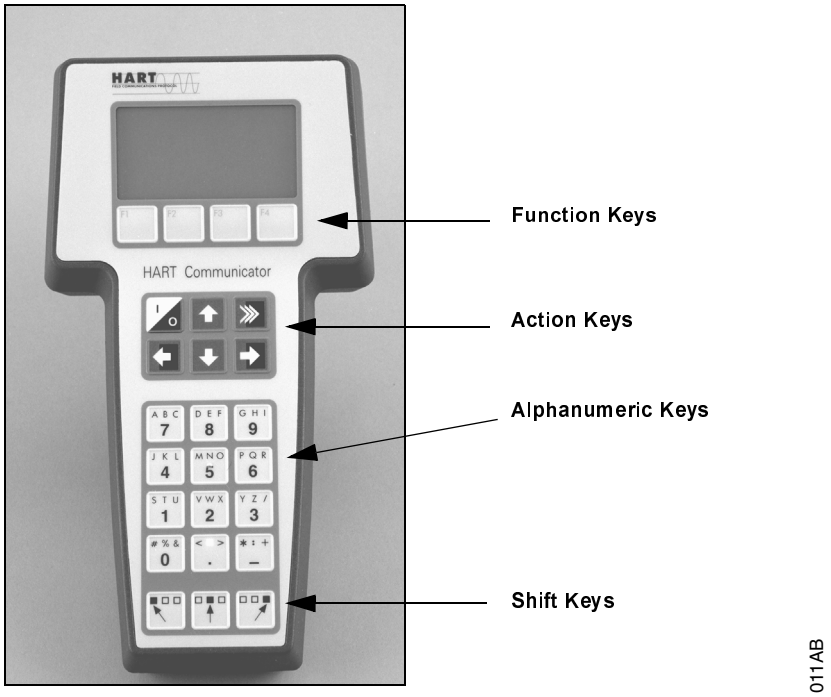
NOTE
The HART Communicator needs a minimum of 250 ohms resistance in the loop to function properly. The HART Communicator does not measure loop current directly.

NOTE
Loop must be broken to insert the 250 ohm load resistor.

BASIC FEATURES

The keys of the HART Communicator include action keys, function keys, alphanumeric keys, and shift keys.

Figure C-3. 275 HART Communicator



Action Keys

As shown in Figure C-3, the action keys are the six blue, white, and black keys located above the alphanumeric keys. The function of each key is described as follows

ON/OFF Key

Use this key to power the HART Communicator. When the communicator is turned on, it searches for a gauge on the 4–20 mA loop. If a device is not found, the communicator displays the message, “No Device Found. Press OK.”

If a HART-compatible device is found, the communicator displays the Online Menu with device ID and tag.

If a HART-compatible device is found, the communicator displays the Online Menu with device ID and tag.

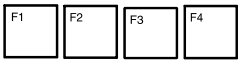
Directional Keys

Use these keys to move the cursor up, down, left, or right. The right arrow key also selects menu options, and the left arrow key returns to the previous menu.

HOT Key

Use this key to quickly access important, user-defined options when connected to a HART-compatible device. Pressing the Hot Key turns the HART Communicator on and displays the Hot Key Menu. See Customizing the Hot Key Menu in the HART Communicator manual for more information.

Function Keys



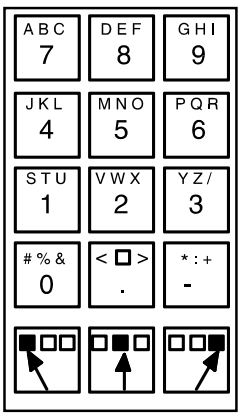
Use the four software-defined function keys, located below the LCD, to perform software functions. On any given menu, the label appearing above a function key indicates the function of that key for the current menu.

As you move among menus, different function key labels appear over the four keys. For example, in menus providing access to online help, the HELP label may appear above the F1 key. In menus providing access to the Home Menu, the HOME label may appear above the F3 key. Press the key to activate the function. See the HART Communicator manual for details on specific Function Key definitions.

Alphanumeric and Shift Keys

The Alphanumeric keys perform two functions: fast selection of menu options (refer to HART Fast Key Feature in this section) and data entry.

Figure C-4. HART Communicator Alphanumeric and Shift Keys



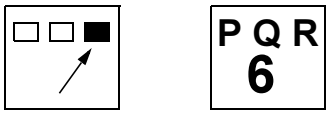
Some menus require data entry. Use the Alphanumeric and Shift keys to enter all alphanumeric information into the HART Communicator. If you press an Alphanumeric key alone from within an edit menu, the bold character in the center of the key appears. These large characters include the numbers zero through nine, the decimal point (.), and the dash symbol (–).

To enter an alphabetic character:

1. Press the Shift key that corresponds to the position on the Alphanumeric key of the letter you want.
2. Press the Alphanumeric key.

For example, to enter the letter R, first press the right Shift key, then the “6” key (see Figure C-5). Do not press these keys simultaneously, but one after the other.

Figure C-5. Data Entry Key Sequence



MENUS AND FUNCTIONS

The HART Communicator is a menu driven system. Each screen provides a menu of options that can be selected or provides direction for input of data, warnings, messages, or other instructions.

Main Menu

When the HART Communicator is turned on, one of two menus appears: the Online Menu or the Main Menu.

If the HART Communicator is connected to an operating loop, the communicator finds the device and displays the Online Menu.

If it is not connected to a loop, the communicator indicates that no device was found. When you press OK (F4), it displays the Main Menu.

The Main Menu provides the following options:

- *Offline* – The Offline option provides access to offline configuration data and simulation functions.
- *Online* – The Online option checks for a device and if it finds one, brings up the Online Menu. Online communication with the 3300 Series Transmitter automatically loads the current gauge data to the HART Communicator.
- *Transfer* – The Transfer option provides access to options for transferring data either from the HART Communicator (memory) to the 3300 Series Transmitter (device) or vice versa. Transfer is used to move offline data from the HART Communicator to the gauge, or to retrieve data from a gauge for offline revision.
- *Frequency Device* – The Frequency Device option displays the frequency output and corresponding pressure output of current-to-pressure transmitters.
- *Utility* – The Utility option provides access to the contrast control for the HART Communicator LCD screen and to the autopoll setting used in multidrop applications.

To select an option from the menu, you can use the up and down arrow keys and the select (right arrow) key or you can simply press the corresponding number on the alphanumeric keypad to “fast select” the option.

After selecting a Main Menu option, the HART Communicator provides the information you need to complete the operation. If further details are required, consult the *HART Communicator* manual.

Online Menu

The Online Menu can be selected from the Main Menu or it appears automatically if the HART Communicator is connected to an active loop and can detect an operating 3300 transmitter.

Online mode is used for direct evaluation of a particular meter, re-configuration, changing parameters, maintenance, and other functions.

When configuration variables are reset in online mode, the new settings are not activated until the data is sent to the gauge. Press SEND (F2) when it is activated to update the process variables of the 3300 transmitter.

NOTE
The Main Menu can be accessed from the Online Menu. Press the left arrow action key to deactivate the online communication with the gauge and to activate the Main Menu options.

HART Fast Key Feature

The HART Fast Key feature provides quick online access to gauge variables and functions. Instead of stepping your way through the menu structure using the Action Keys, you can press a HART Fast Key sequence to move from the Online Menu to the desired variable or function. On-screen instructions guide you through the rest of the screens.

The HART Fast Key sequences are made up of the series of numbers corresponding to the individual options in each step of the menu structure. For example, from the Online Menu you can change the **Date**. Following the menu structure, you would:

1. Press 1 to reach **Device Setup**.
2. Press 4 for **Detailed Setup**.
3. Press 1 for **Device Information**.
4. Press 5 for **Date**.

So, the corresponding HART Fast Key sequence is **1**, **4**, **1**, **5**.

HART Fast Keys are operational only from the Online Menu. If you use them consistently, you return to the Online Menu by pressing HOME (F3) when it is available. If you do not start at the Online Menu, the HART Fast Keys will not function properly.

Use Table C-1, an alphabetical listing of online functions, to find the corresponding HART Fast Keys. These codes are applicable only to the 3300 Series and the HART Communicator.

Hart Communicator Diagnostic Messages

The following table is a list of messages used by the HART Communicator and their corresponding descriptions.

Variable parameters within the text of a message are indicated with <*variable label*>.

Reference to the name of another message is identified by <*message*>.

Table C-2. HART Communicator Diagnostic Messages

Message	Description
Add item for ALL device types or only for this ONE device type.	Asks the user whether the hot key item being added should be added for all device types or only for the type of device that is connected.
Command Not Implemented	The connected device does not support this function.
Communication Error	Either a device sends back a response indicating that the message it received was unintelligible, or the HC cannot understand the response from the device.
Configuration memory not compatible with connected device	The configuration stored in memory is incompatible with the device to which a transfer has been requested.
Device Busy	The connected device is busy performing another task.
Device Disconnected	Device fails to respond to a command.
Device write protected	Device is in write-protect mode. Data can not be written.
Device write protected. Do you still want to shut off?	Device is in write-protect mode. Press YES to turn the HC off and lose the unsent data.
Display value of variable on hotkey menu?	Asks whether the value of the variable should be displayed adjacent to its label on the hotkey menu if the item being added to the hotkey menu is a variable.
Download data from configuration memory to device	Prompts user to press SEND softkey to initiate a memory to device transfer.
Exceed field width	Indicates that the field width for the current arithmetic variable exceeds the device-specified description edit format.
Exceed precision	Indicates that the precision for the current arithmetic variable exceeds the device-specified description edit format.
Field device has malfunctioned due to a Hardware Error or Failure	The 3300 transmitter may simply be configured incorrectly (20 mA point in upper Null Zone, etc.) Verify the configuration.
Ignore next 50 occurrences of status?	Asked after displaying device status. Softkey answer determines whether next 50 occurrences of device status will be ignored or displayed.
Illegal character	An invalid character for the variable type was entered.
Illegal date	The day portion of the date is invalid.
Illegal month	The month portion of the date is invalid.
Illegal year	The year portion of the date is invalid.
Incomplete exponent	The exponent of a scientific notation floating point variable is incomplete.
Incomplete field	The value entered is not complete for the variable type.
Looking for a device	Polling for multidropped devices at addresses 1–15.
Mark as read only variable on hotkey menu?	Asks whether the user should be allowed to edit the variable from the hotkey menu if the item being added to the hotkey menu is a variable.
No device configuration in configuration memory	There is no configuration saved in memory available to re-configure offline or transfer to a device.
No Device Found	Poll of address zero fails to find a device, or poll of all addresses fails to find a device if auto-poll is enabled.
No hotkey menu available for this device.	There is no menu named “hotkey” defined in the device description for this device.
No offline devices available.	There are no device descriptions available to be used to configure a device offline.
No simulation devices available.	There are no device descriptions available to simulate a device.
No UPLOAD_VARIABLES in ddl for this device	There is no menu named “upload_variables” defined in the device description for this device. This menu is required for offline configuration.
No Valid Items	The selected menu or edit display contains no valid items.
OFF KEY DISABLED	Appears when the user attempts to turn the HC off before sending modified data or before completing a method.
Online device disconnected with unsent data. RETRY or OK to lose data.	There is unsent data for a previously connected device. Press RETRY to send data, or press OK to disconnect and lose unsent data.
Out of memory for hotkey configuration. Delete unnecessary items.	There is no more memory available to store additional hotkey items. Unnecessary items should be deleted to make space available.

Table C-2. HART Communicator Diagnostic Messages

Message	Description
Overwrite existing configuration memory	Requests permission to overwrite existing configuration either by a device-to-memory transfer or by an offline configuration. User answers using the softkeys.
Press OK...	Press the OK softkey. This message usually appears after an error message from the application or as a result of HART communications.
Restore device value?	The edited value that was sent to a device was not properly implemented. Restoring the device value returns the variable to its original value.
Save data from device to configuration memory	Prompts user to press SAVE softkey to initiate a device-to-memory transfer.
Saving data to configuration memory.	Data is being transferred from a device to configuration memory.
Sending data to device.	Data is being transferred from configuration memory to a device.
There are write only variables which have not been edited. Please edit them.	There are write-only variables which have not been set by the user. These variables should be set or invalid values may be sent to the device.
There is unsent data. Send it before shutting off?	Press YES to send unsent data and turn the HC off. Press NO to turn the HC off and lose the unsent data.
Too few data bytes received	Command returns fewer data bytes than expected as determined by the device description.
Transmitter Fault	Device returns a command response indicating a fault with the connected device.
Units for <variable label> has changed. Unit must be sent before editing, or invalid data will be sent.	The engineering units for this variable have been edited. Send engineering units to the device before editing this variable.
Unsent data to online device. SEND or LOSE data	There is unsent data for a previously connected device which must be sent or thrown away before connecting to another device.
Use up/down arrows to change contrast. Press DONE when done.	Gives direction to change the contrast of the HC display.
Value out of range	The user-entered value is either not within the range for the given type and size of variable or not within the min/max specified by the device.
<message> occurred reading/writing <variable label>	Either a read/write command indicates too few data bytes received, transmitter fault, invalid response code, invalid response command, invalid reply data field, or failed pre- or post-read method; or a response code of any class other than SUCCESS is returned reading a particular variable.
<variable label> has an unknown value. Unit must be sent before editing, or invalid data will be sent.	A variable related to this variable has been edited. Send related variable to the device before editing this variable.

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Reference Manual
00809-0100-4811, Rev AA
October 2002

Rosemount 3300 Series

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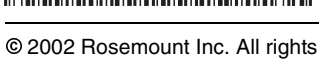

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