Reference Manual
00809-0600-4026, Rev BA
December 2011

Commissioning Manual

Rosemount 5300 and 5400 Series

ROSEMOUNT®

www.rosemount.com

EMERSON™
Process Management

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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, Emerson Process Management 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 Emerson Process Management 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 Emerson Process Management 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.

⚠WARNING

When installing in hazardous areas, local regulations and specifications in applicable certificates must be observed.

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 safety 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-authorized parts or repair, other than exchanging the complete transmitter head or probe assembly, may jeopardize safety and is prohibited.

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 Equipment ratings and certifications are no longer valid on any products that have been damaged or modified without the prior written permission of Emerson Process Management.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

MANUAL OVERVIEW

This manual provides commissioning information for the Rosemount 5300 and 5400 Series Radar Transmitters.

Section 2: Rosemount 5300 Series Quick Installation Guide

- Step 1. Mount the transmitter
- Step 2. Connect the wiring
- Step 3. Configure
- Safety instrumented systems (4-20 mA only)

Section 3: Rosemount 5300 Series Installation & Configuration

- Step 1. Complete the QIG
- Step 2. Complete the basic configuration
- Step 3. Complete the advanced configuration
- Step 4. Verification
- Step 5. Common problems and recommended actions
- Step 6. Archive files

Section 4: Rosemount 5300 Series Commissioning

- Verification
- Configuration
- Verification procedure

Section 5: Rosemount 5400 Series Quick Installation Guide

- Step 1. Mount the transmitter
- Step 2. Connect the wiring
- Step 3. Configure
- Safety instrumented systems (4-20mA only)

Section 6: Rosemount 5400 Series Installation & Configuration

- Step 1. Complete the QIG
- Step 2. Complete the basic configuration
- Step 4. Verification
- Step 5. Archive files

Section 7: Rosemount 5400 Series Commissioning

- Verification
- Configuration
- Verification procedure

Appendix A: Commissioning Checklist

- Commissioning checklist

TOOLS AND DOCUMENTS

The following tools and documents are recommended to use during the installation and commissioning procedures:

Rosemount 5300 and Rosemount 5400

- Field Communicator 375/475 / laptop with Rosemount Radar Master or AMS
- HART modem / FOUNDATION Fieldbus modem
- Multimeter
- Screw driver, Phillips 2 mm or flat head 6 mm (for wire terminals)
- Screw driver, flat head 8 mm (for external ground screw)
- Adjustable spanner (for cable glands)
- Wrench, 54 mm (to install or remove the transmitter head)

Rosemount 5300

- Allen key, 3 mm, 4 mm, and 5 mm (to loose and fix the weight)
- Allen key, 2 mm (to secure the coaxial probe)
- Hack saw (to shorten the rigid probes)
- Heavy duty nipper (to shorten the flexible probes)
- Drilling fixture (to mount the centrering discs)

Rosemount 5400

- Allen key, 3 mm (to exchange the cone antennas)

Documents

Rosemount 5300

Rosemount 5300 Series Superior Performance Guided Wave Radar Reference Manual (Document No. 00809-0100-4530)

Rosemount 5300/5400 Series with HART to Modbus Converter Manual Supplement (Document No. 00809-0500-4530)

Rosemount 5300 Series - Using Guided Waver Radar for Level in High Pressure Steam Applications Technical Note (Document No. 00840-0100-4530)

Rosemount 5300 Series Superior Performance Guided Wave Radar Level and Interface Transmitter Quick Installation Guide (Document No. 00825-0100-4530)

Rosemount 5400

Rosemount 5400 Series Two-Wire Radar Level Transmitter Reference Manual (Document No. 00809-0100-4026)

Rosemount 5400 Series Two-Wire Radar Level Transmitter with FOUNDATION™ Fieldbus Reference Manual (Document No. 00809-0100-4032)

Rosemount 5400 Series Safety Manual - Rosemount 5400 Series (4-20 mA only) Manual Supplement (Document No. 00809-0400-4026)

Rosemount 5400 Series Superior Performance Two-Wire Non-Contacting Radar Level Transmitter Quick Installation Guide (Document No. 00825-0100-4026)

Section 2 5300 Quick Installation Guide

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

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 services other than those contained in this manual unless you are qualified.

Process leaks could result in death or serious injury.

Make sure that the transmitter is handled carefully. If the Process Seal is damaged, gas might escape from the tank if the transmitter head is removed from the probe.

⚠WARNING

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

Probes covered with plastic and/or with plastic discs may generate an ignition-capable level of electrostatic charge under certain extreme conditions. Therefore, when the probe is used in a potentially explosive atmosphere, appropriate measures must be taken to prevent electrostatic discharge.

⚠WARNING

This installation guide provides basic guidelines for the Rosemount 5300 Series. Refer to Rosemount 5300 Series Reference Manual (Document No. 00809-0100-4530) for more instructions. The manual and this Quick Installation Guide (QIG) are also available electronically on www.rosemount.com.

⚠WARNING

Failure to follow safe installation and service 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 QIG and the Reference Manual. Failure to do so may impair the protection provided by the equipment.
- Do not perform any services other than those contained in this manual unless you are qualified.

Explosions could result in death or serious injury

- Verify that the operating environment of the transmitter is consistent with the appropriate hazardous locations specifications. See section Product Certifications in the Quick Installation Guide.
- To prevent ignition of flammable or combustible atmospheres, disconnect power before servicing.
- Before connecting a HART®, FOUNDATION™ fieldbus, or Modbus 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.
- To avoid process leaks, only use o-rings designed to seal with the corresponding flange adapter.

Electrical shock can result in death or serious injury

- Avoid contact with the leads and terminals. High voltage that may be present on leads can cause electrical shock.
- Make sure the main power to the Rosemount 5300 Series transmitter is off and the lines to any other external power source are disconnected or not powered while wiring the transmitter.

Probes with non-conducting surfaces

- Probes covered with plastic and/or with plastic discs may generate an ignition-capable level of electrostatic charge under certain extreme conditions. Therefore, when the probe is used in a potentially explosive atmosphere, appropriate measures must be taken to prevent electrostatic discharge.

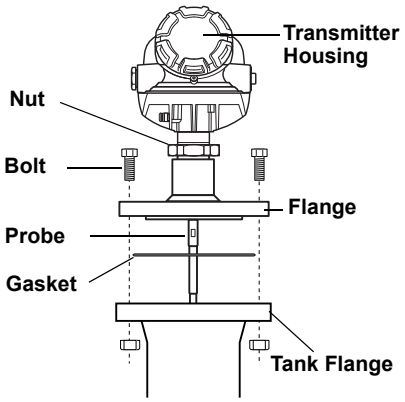
⚠WARNING

Any substitution of non-authorized parts or repair, other than exchanging the complete transmitter head or probe assembly, may jeopardize safety and is prohibited.

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

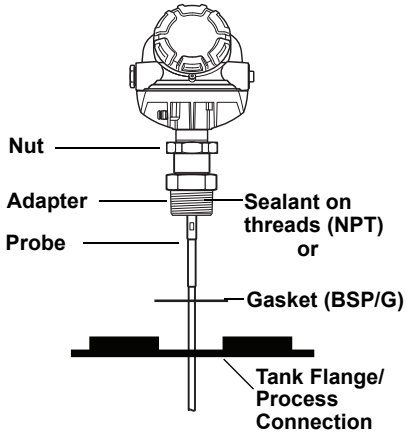
QUICK INSTALLATION GUIDE

Step 1. Mount The Transmitter



Tank Connection with Flange

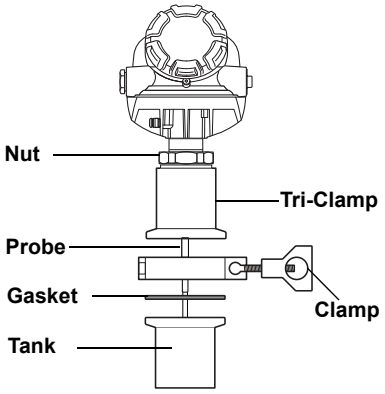
1. Place a gasket on top of the tank flange.
2. Lower the probe with flange into the tank.
3. Tighten the bolts and nuts with sufficient torque regarding flange and gasket choice.
4. Loosen the nut that connects the housing to the probe and rotate the housing to the desired direction.
5. Tighten the nut.



Threaded Tank Connection

1. For adapters with BSP/G threads, place a gasket on top of the tank flange.
2. Lower the probe into the tank.
3. Mount the adapter into the process connection.
4. Loosen the nut that connects the housing to the probe and rotate the housing to the desired direction.
5. Tighten the nut.

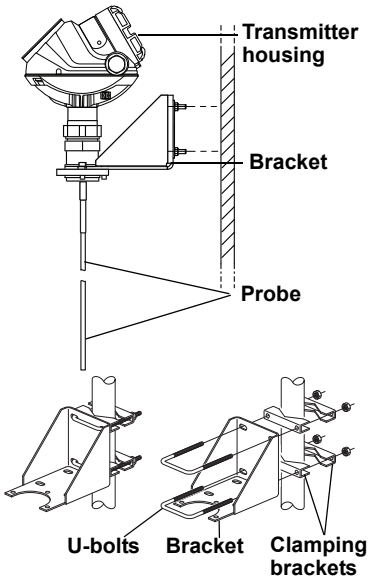
NOTE
For adapters with NPT threads, pressure-tight joints require a sealant.



Tri-Clamp Tank Connection

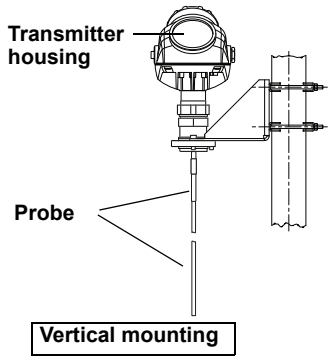
1. Place a gasket on top of the tank flange.
2. Lower the transmitter and probe into the tank.
3. Fasten the Tri-Clamp to the tank with a clamp.
4. Loosen the nut that connects the transmitter housing to the probe slightly.
5. Rotate the transmitter housing so the cable entries/display face the desired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

Refer to Rosemount 5300 Series Reference Manual (Document No. 00809-0100-4530) for details regarding the mounting of transmitter head/probe.



Bracket Mounting, on Wall

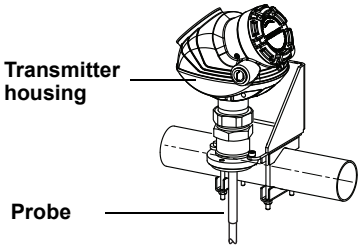
1. Mount the bracket directly to the wall with screws suitable for the purpose.
2. Mount the transmitter with probe to the bracket and secure the installation with the three supplied screws.



Vertical mounting

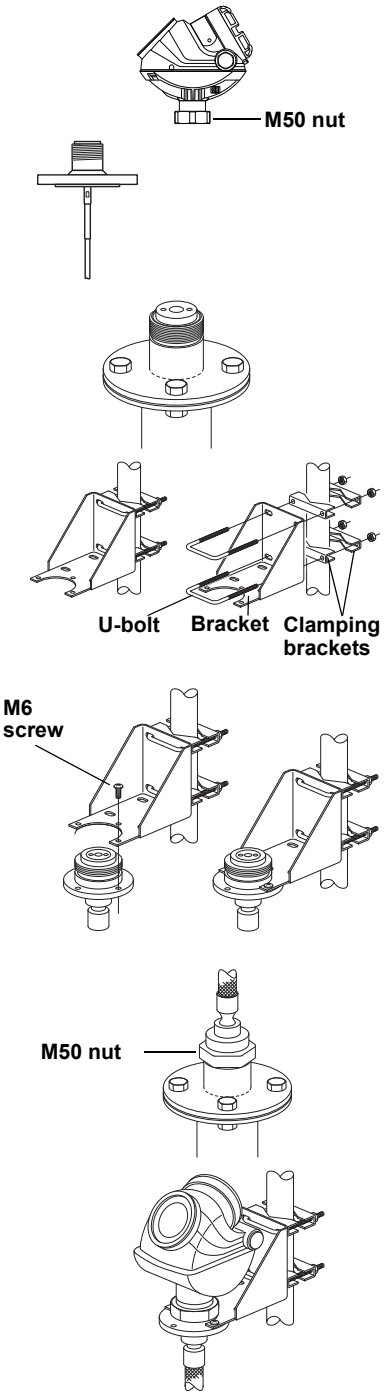
Bracket Mounting, on Pipe

1. Put the two U-bolts through the holes of the bracket. Holes are available for both vertical and horizontal pipe mounting.
2. Put the clamping brackets on the U-bolts and around the pipe.
3. Fasten the bracket to the pipe using the four supplied nuts.
4. Mount the transmitter with probe to the bracket and secure with the three supplied screws.



Horizontal mounting

See the Rosemount 5300 Series Reference Manual (Document No. 00809-0100-4530) for more installation details.



Remote Housing

1. Remove the transmitter head from the probe by unscrewing the M50 nut.
2. Mount the probe in the tank.
3. Mount the bracket to the pole, making sure the distance between the probe and bracket does not exceed the length of the remote connection.
   - Put the two U-bolts through the holes of the bracket. Several holes are available for vertical/horizontal pipe mounting.
   - Put the clamping brackets on the U-bolts and around the pipe.
   - Use the supplied nuts to fasten the bracket to the pipe.
4. Fasten the housing support to the bracket using the M6 screws. The screws are threaded through the top of the mounting bracket and into the housing support.
5. Mount the probe housing on the probe, making sure that the M50 nut is properly tightened.
6. Connect the transmitter head on the housing support, making sure that the M50 nut is properly tightened.

Step 2. Connect The Wiring

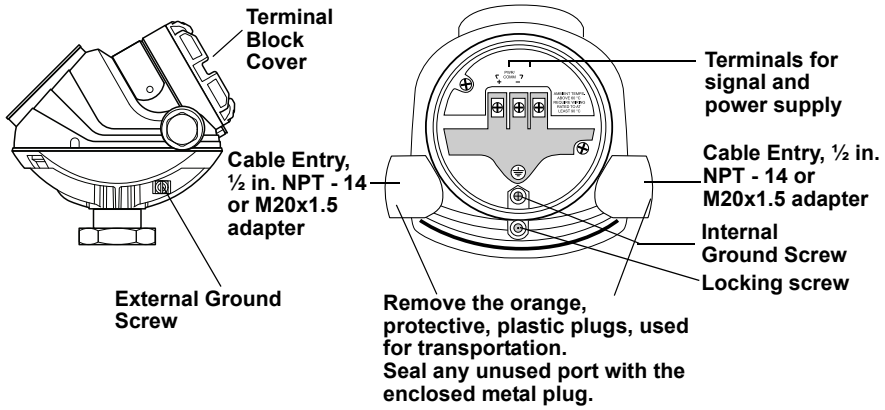
It is recommended that shielded twisted pair wiring (18-12 AWG) suitable for the supply voltage be used and, if applicable, approved for use in hazardous areas. For electrical information, such as power supply, see diagrams and drawings for HART, Modbus, and FOUNDATION fieldbus on the following pages.

To Connect the Transmitter

1. Make sure the housing is grounded (including IS ground inside Terminal compartment) according to Hazardous Locations Certifications, national and local electrical codes.
2. Verify that the power supply is disconnected.
3. Remove the terminal block cover (see picture below).
4. Pull the cable through the cable gland/conduit. For Explosion-proof / Flameproof installations, only use cable glands or conduit entry devices certified Explosion-proof or Flameproof. Install wiring with a drip loop where the bottom of the loop must be lower than the cable/conduit entry.
5. To connect the wires, see the illustrations on the following pages.
6. Use the enclosed metal plug to seal any unused port.
7. Tighten the cable gland.
8. Mount the cover and make sure it is fully engaged to meet Explosion-proof requirements (adapters are required if M20 glands are used).
   For ATEX, IECEx, NEPSI, INMETRO, and TIIS installations, lock the cover with the locking screw.
9. Connect the power supply.

NOTE
Use PTFE tape or other sealant at the NPT threads in the Cable Entries.

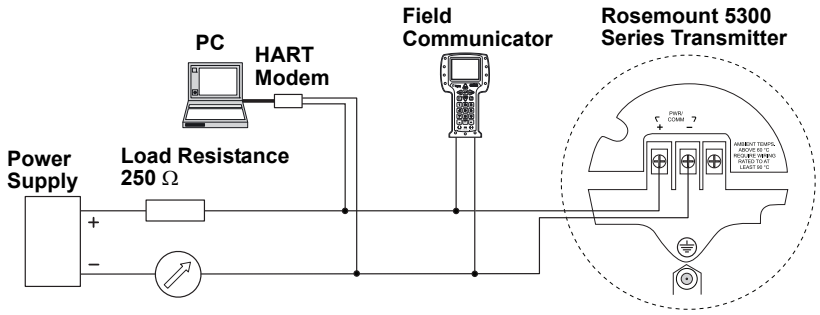
Terminal Block



HART Communication

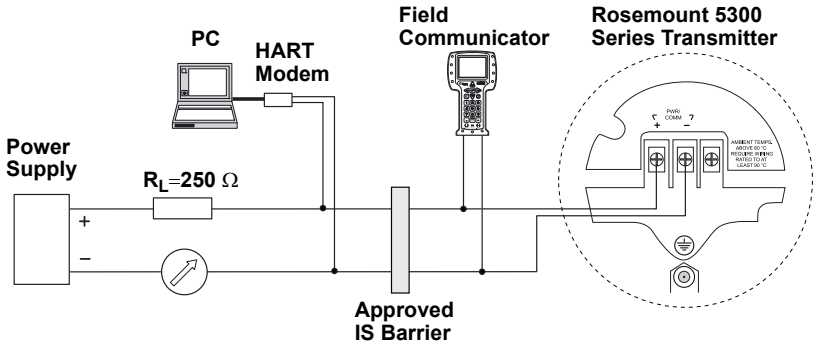
The Rosemount 5300 Series transmitter operates with power supply ranging from 16-42.4 Vdc (16-30 Vdc in IS applications, 20-42.4 Vdc in Explosion-proof / Flameproof applications and in Non-Sparking / Energy Limited applications).
All configuration tools for HART communication, such as the Field Communicator and Rosemount Radar Master (RRM), require a minimum load resistance (R_L) of 250 Ω within the loop in order to function properly, see diagrams below.

Non-Intrinsically Safe Power Supply



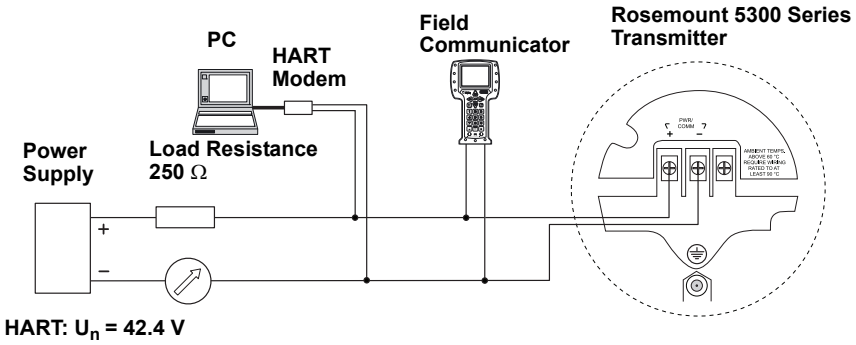
NOTE
Rosemount 5300 Series Transmitters with Flameproof/Explosion-proof Output have a built-in barrier; no external barrier needed.

Intrinsically Safe Power Supply



For IS Parameters, see the Product Certifications chapter in the Rosemount 5300 Series Reference Manual (Document No. 00809-0100-4530).

Type n Approvals : Non-Sparking / Energy Limited Power Supply

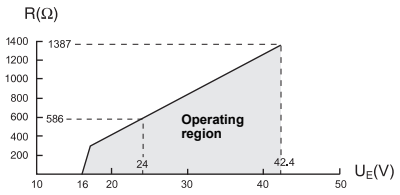


HART: U_n = 42.4 V

Load Limitations

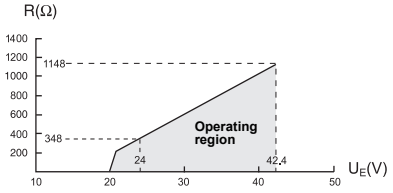
The Field Communicator requires a minimum load resistance of 250 Ω within the loop to function properly. The maximum load resistance can be obtained from the following diagrams.

Non-Hazardous Installations, and Non-Sparking / Energy Limited Power Supply



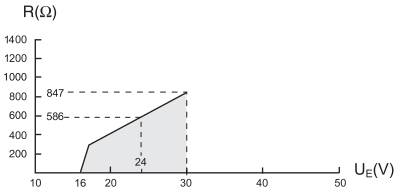
R(Ω): Maximum Load Resistance
U_E(V): External Power Supply Voltage

Explosion-proof/Flameproof (Ex d) Installations



R(Ω): Maximum Load Resistance
U_E(V): External Power Supply Voltage

Intrinsically Safe Installations



R(Ω): Maximum Load Resistance
U_E(V): External Power Supply Voltage

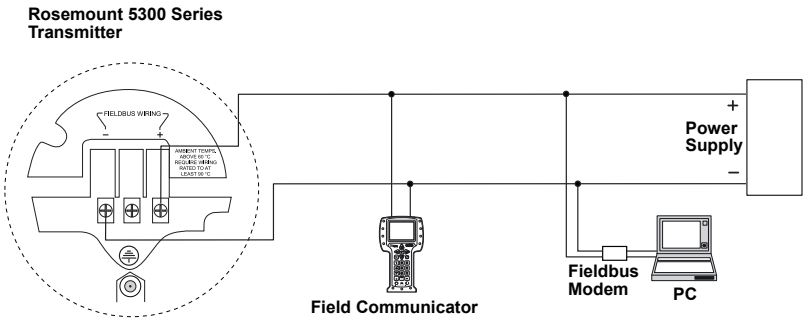
NOTE
For Flameproof / Explosion-proof installations, the diagram is only valid if the HART load resistance is at the + side and if the - side is grounded. Otherwise, the load resistance value is limited to 435 Ω.

NOTE
Rosemount 5300 Series Transmitters with Flameproof/Explosion-proof Output have a built-in barrier; no external barrier needed.

FOUNDATION fieldbus

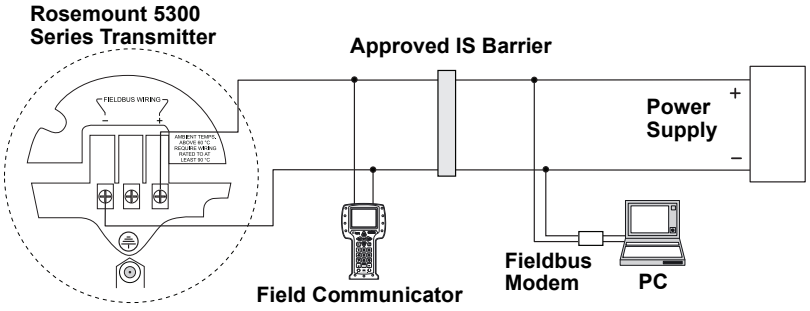
The Rosemount 5300 Series transmitter, FOUNDATION fieldbus version, operates with power supply ranging from 9-32 Vdc (9-30 Vdc in IS applications and 16-32 Vdc in Explosion-proof / Flameproof and in Non-Sparking / Energy Limited applications). FISCO, IS applications: 9-17.5 Vdc.

Non-Intrinsically Safe Power Supply



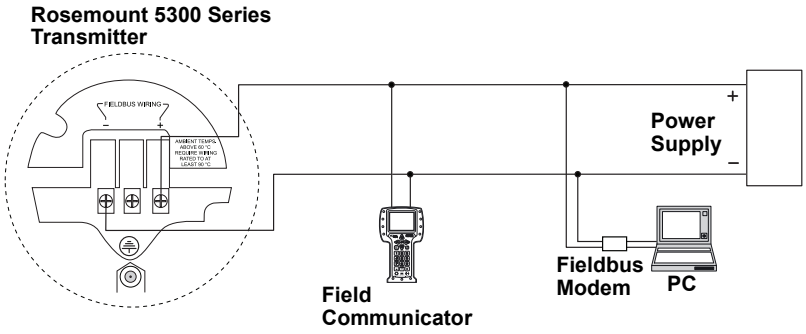
NOTE
Rosemount 5300 Series Transmitters with Flameproof/Explosion-proof Output have a built-in barrier; no external barrier needed.

Intrinsically Safe Power Supply



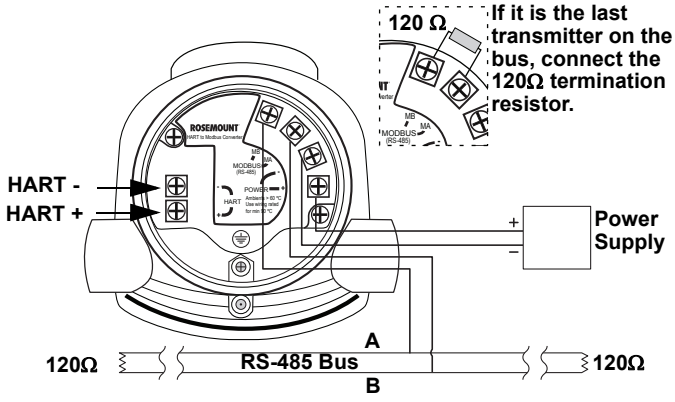
For IS Parameters, see the Product Certifications chapter in the Rosemount 5300 Series Reference Manual (Document No. 00809-0100-4530).

Type n Approvals : Non-Sparking / Energy Limited Power Supply



RS-485 with Modbus communication

The 5300 Series RS-485 with Modbus communication transmitter version operates using a power supply ranging from 8-30 Vdc (max. rating). See the Rosemount 5300/5400 Series with HART to Modbus Converter Manual Supplement (Document No. 00809-0500-4530) for details.
Power Consumption:
< 0.5 W (with HART address=1)
< 1.2 W (incl. four HART slaves)



NOTE
Rosemount 5300 Series Transmitters with Flameproof/Explosion-proof Output have a built-in barrier; no external barrier needed.

Step 3. Configure

If the transmitter is pre-configured at the factory, it is only necessary to proceed with the following steps if you need to verify or change the settings.

Basic configuration can easily be done either with the Rosemount Radar Master (RRM), a Field Communicator, the AMS™ Suite, DeltaV®, or any other DD (Device Description) compatible host system. For advanced configuration features, RRM is recommended.

The Rosemount Radar Master Guided Setup includes a Wizard for Basic Configuration and a Device Specific Setup. These are sufficient for most cases. Further configuration options are available using the Setup Functions, described in the Rosemount 5300 Series Reference Manual (Document No. 00809-0100-4530).

Configuration with the Rosemount Radar Master Guided Setup is described on the following pages and the corresponding Field Communicator fast key sequence and FOUNDATION fieldbus parameters are given.

Help is accessed by selecting the Contents option from the Help menu. Help is also available through a Help button in most windows.

The configuration instructions in this Quick Installation Guide cover standard installations. For more complicated situations, e.g interface applications or for installations that have disturbing objects within the radar beam etc, see the Rosemount 5300 Series Reference Manual (Document No. 00809-0100-4530).

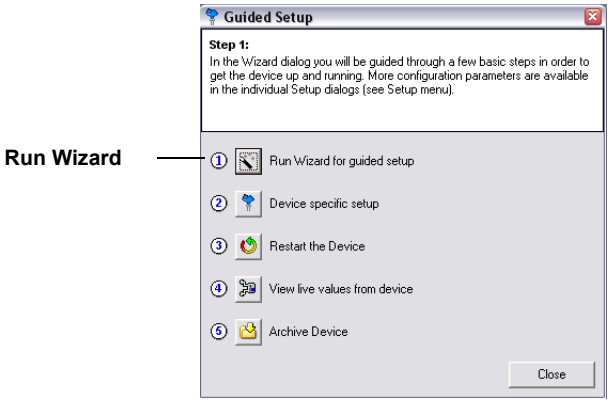
Installing the Rosemount Radar Master Software

To install the Rosemount Radar Master (RRM) software:

1. Insert the installation CD into your CD-ROM drive.
2. Follow the instructions. If the installation program does not start automatically, run **Setup.exe** from the CD.

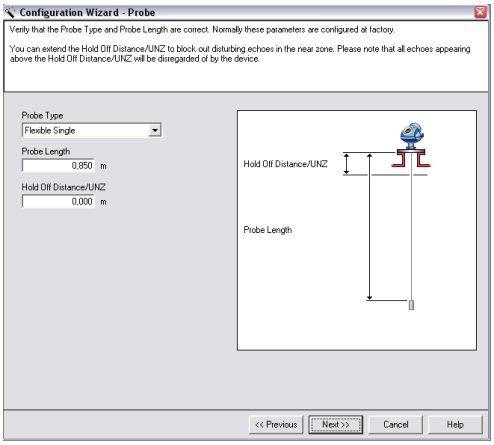
Configuration using the Rosemount Radar Master Software

1. Start the Radar Master software (*Programs>Rosemount>Rosemount RadarMaster*).
2. Connect to the desired transmitter. Once the transmitter is connected, the *Guided Setup* window appears automatically.



3. Click the "**Run Wizard for guided setup**" button. Follow the instructions for a Basic Configuration and you will be guided through a short transmitter installation procedure.

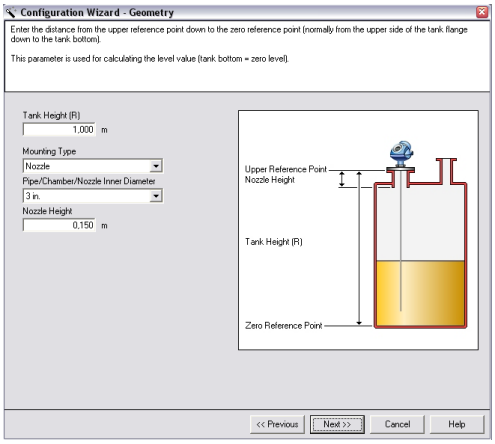
4. The first window in the Configuration Wizard presents general information such as **Device Model** (5301 / 5302 / 5303), serial number, **Probe Type**, **Probe Length**, communication protocol, and device address. Check that the information complies with the ordering information and click Next.
5. The *General* window lets you enter **Tag**, **Message**(1), **Descriptor**(1), and **Date**(1). This information is not required for operation of the transmitter and can be left out if desired. Fast Key Sequence [2, 2, 1]. Click Next and the following window appears (Probe).



6. Verify that the parameters in the *Probe* window are correct. The parameters are normally configured at the factory, but can be changed if, for example, the probe is cut in the field, or if disturbing objects in the near zone need to be blocked out (Hold Off Distance/Upper Null Zone (UNZ)).
   Fast Key Sequence [2, 1, 2].
   FOUNDATION fieldbus parameters:
   TRANSDUCER 1100>PROBE_TYPE
   TRANSDUCER 1100>PROBE_LENGTH
   TRANSDUCER 1100>GEOM_HOLD_OFF_DIST

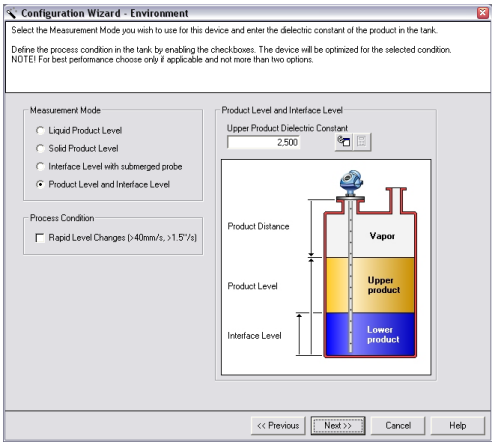
(1) Only for HART communication.

Click Next and the following window appears (Geometry).



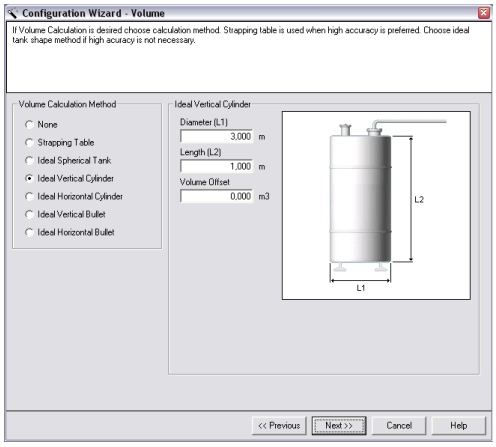
7. Enter **Tank Height**, the distance from the Upper Reference Point to the Lower Reference Point (which is the tank bottom in the screenshot above), making sure it is as accurate as possible. See Configuration in the Rosemount 5300 Series Reference Manual (Document No. 00809-0100-4530) for details.
   Set **Mounting Type**. Set **Diameter** if Mounting Type is Nozzle or Pipe/Chamber. Set **Nozzle** Height if Mounting Type is Nozzle.
   Fast Key Sequence [2, 1, 3]
   FOUNDATION fieldbus parameters:
   TRANSDUCER 1100>GEOM_TANK_HEIGHT
   TRANSDUCER 1100>MOUNTING_TYPE
   TRANSDUCER 1100>PIPE_DIAMETER
   TRANSDUCER 1100>NOZZLE_HEIGHT

Click Next and the following window appears (Tank Environment).



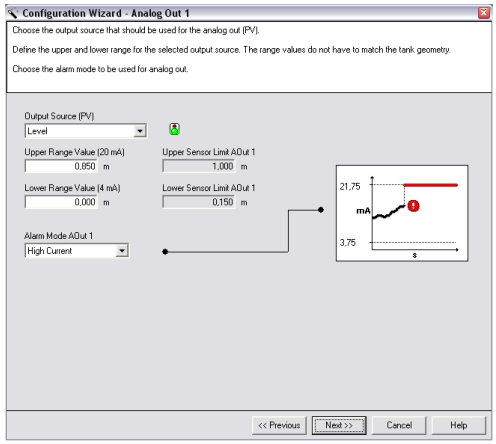
8. In the Environment window, select **Measurement Mode**. If the surface is moving - up or down at rates over 40 mm/s (1.5 in./s), the **Rapid Level Changes** box should also be selected. Enter the **Upper Product Dielectric Constant** (icons for help functions are available to the right). For **Interface Level with Submerged Probe** and **Product and Interface measurement** modes, it is important that the dielectric constant value is exact.
   See the Rosemount 5300 Series Reference Manual (Document No. 00809-0100-4530) for details.
   Fast Key Sequence [2, 1, 4]
   FOUNDATION fieldbus parameters:
   TRANSDUCER 1100>MEAS_MODE
   TRANSDUCER 1100>PRODUCT_DIELEC_RANGE
   TRANSDUCER 1100>UPPER_PRODUCT_DC
   TRANSDUCER 1100>ENV_ENVIRONMENT

Click Next and the following window appears (Volume).



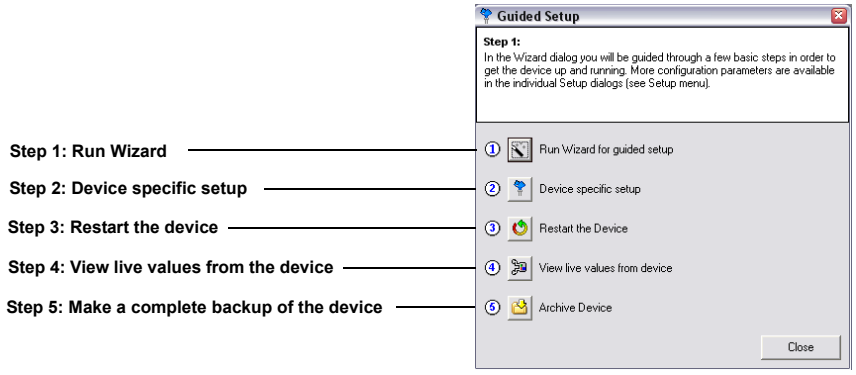
9. If volume calculation is desired, choose a pre-defined **Volume Calculation Method** and tank dimensions based on a tank shape that corresponds to the actual tank. Choose **Strapping Table** if the actual tank does not match any of the available pre-defined tank options, or if high volume accuracy is desired.
   Choose **None** if volume calculation is not desired.
   Fast Key Sequence [2, 1, 5]
   FOUNDATION fieldbus parameters:
   TRANSDUCER 1300>VOL_VOLUME_CALC_METHOD
   TRANSDUCER 1300>VOL_IDEAL_DIAMETER
   TRANSDUCER 1300>VOL_IDEAL_LENGTH
   TRANSDUCER 1300>VOL_VOLUME_OFFSET

Click **Next** and the following window appears (Analog Output).



NOTE
The 4-20 mA range must not include the upper transition zone, the lower transition zone, or the upper null zone. See the Reference Manual (Document No. 00809-0100-4530) for details.

10. This step is not applicable for FOUNDATION fieldbus. The parameters are entered in the AI-block instead.
    Fast Key Sequence [2, 1, 6]
    For HART communication, choose Primary Variable, **PV**.
    Specify the analog output range by setting the **Upper Range Value** (20 mA) and the **Lower Range Value** (4 mA) to the desired corresponding level values.
    The **Alarm Mode** specifies the output state when a measurement error occurs. Choose between the following:
    High: 21.75 mA (standard) or 22.5 mA (Namur)
    Low: 3.75 mA (standard) or 3.6 mA (Namur)
    Freeze: the output current is set to the last valid value at the time when the error occurs.
    Click Next.
11. Continue with Steps 2 to 5 in the *Guided Setup* window:
    Step 2: Device specific setup might advise you to make further configurations. Fast Key Sequence [2, 1, 7, 2].
    Step 3: Restart the device to make sure all configuration changes are properly activated.
    Step 4: View live values from the device to verify that the transmitter works correctly.
    Step 5: Make a complete backup of the device.
12. The Basic Configuration with the Radar Master Wizard is now finished. Proceed with the Device Specific Setup to see which additional configuration is needed. It will recommend to calibrate Vapor Compensation or Probe End Projection, or to perform a Trim Near Zone if it needs to be done. For further information, see the Rosemount 5300 Series Reference Manual (Document No. 00809-0100-4530).

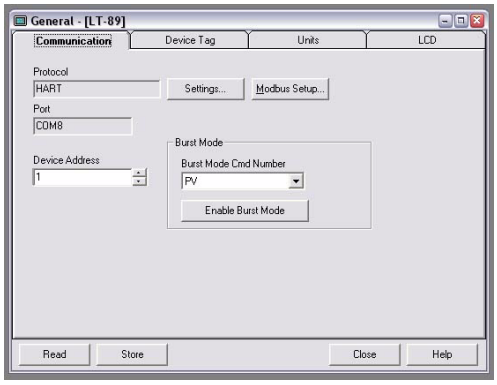


For Signal Quality Metrics information and further configuration, see the Rosemount 5300 Series Reference Manual (Document No. 00809-0100-4530).

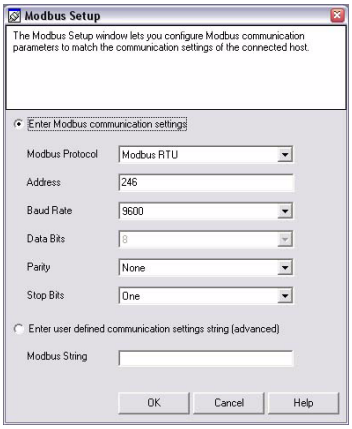
Setup - Modbus Communication Parameters

For transmitters with the Modbus option, do the following to configure the communication parameters:

1. In the **Setup** menu select **General**. The following window appears.



2. Choose the **Communication** tab.



3. Enter the desired Modbus communication settings.

Safety Instrumented Systems (4-20 mA only)

The following section is applicable to the Rosemount 5300 Prior-Use option (Special certification: QS). Additional Safety Instrumented Systems information is available in the Rosemount 5300 Series Reference Manual (Document No. 00809-0100-4530). The manual is available electronically at www.rosemount.com or by contacting an Emerson Process Management representative.

To identify a 5300 Prior-Use option transmitter:

- Verify the QS option code in the model code, on the label affixed to the outside of the transmitter head or
- Field Communicator: Fast Key Sequence [1, 7, 8]. Verify that the Prior-Use safety device is ON or
- Open Rosemount Radar Master, right click on the device, and select Properties. Verify that the Safety Device (QS Option) is present

Installation

The device should be installed and configured as a level sensing device per manufacturer's instructions. The materials must be compatible with process conditions and process fluids. No special installation is required in addition to the standard installation practices outlined in this document.

Environmental limits are available in the Rosemount 5300 Series Reference Manual (Document No. 00809-0100-4530), Appendix A: Reference Data.

The loop must be designed so the terminal voltage does not drop below the minimum input voltage, see values in Table 4, when the transmitter output is 22.5 mA.

Table 4. Minimum input voltage (U_i) at different currents

Hazardous approval	Current			
	3.60 mA	3.75 mA	21.75 mA	22.50 mA
	Minimum input voltage (U_I)			
Non-Hazardous Installations and Intrinsically Safe Installations	16 Vdc	16 Vdc	11 Vdc	11 Vdc
Explosion-proof / Flameproof Installations	20 Vdc	20 Vdc	15.5 Vdc	15.5 Vdc

Configuration

Use a HART-compliant master, such as Rosemount Radar Master or Field Communicator to communicate with and verify configuration of the Rosemount 5300. A full review of configuration methods is available in the Rosemount 5300 Series Reference Manual (Document No. 00809-0100-4530).

NOTE
The Rosemount 5300 Series transmitter is not safety-rated during maintenance work, configuration changes, multidrop, loop test, or other activity that affects the Safety Function. Alternative means should be used to ensure process safety during such activities.

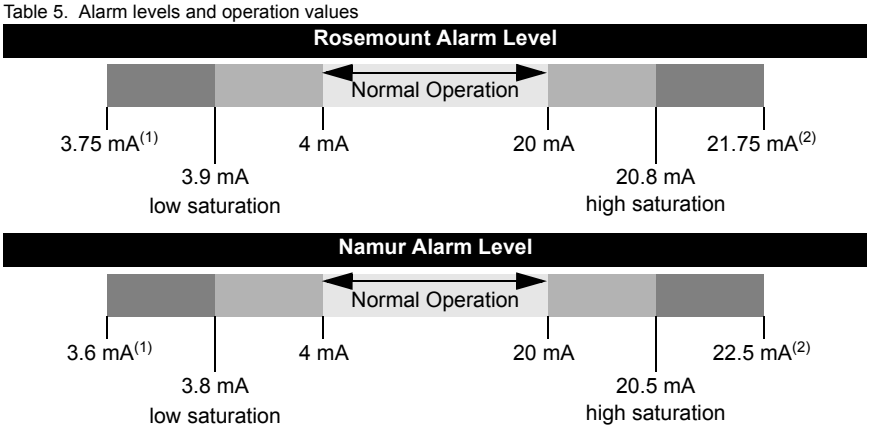
Damping

User adjusted damping affects the transmitter's ability to respond to process changes. Therefore, the *damping values + response time* should not exceed the loop requirements.

Alarm and Saturation Levels

DCS or safety logic solver should be configured to match transmitter configuration. Table 5 identifies the alarm levels available and their operation values.(1)

Table 5. Alarm levels and operation values



(1) Transmitter Failure, hardware or software alarm in Low position.
(2) Transmitter Failure, hardware or software alarm in High position.

It is assumed that the current output signal is fed to a Safety Integrity Level 2 (SIL2) -compliant analog input board of a safety logic solver. For instructions on alarm level settings, see the Rosemount 5300 Series Reference Manual (Document No. 00809-0100-4530), "Analog Output (HART)" section.

NOTE
Only the High or Low Alarm Mode can be used for the Safety Function. Do not choose Freeze Current as an error will not be announced in the current loop.

Write Protection

A Rosemount 5300 transmitter can be protected from unintentional configuration changes by a password protected function. It is recommended to use write protection described in the Rosemount 5300 Series Reference Manual (Document No. 00809-0100-4530), "Write Protecting a Transmitter" section.

Site Acceptance

After the installation and configuration, proper operation of the transmitter should be verified. A site acceptance test is therefore recommended. The proof test outlined in this section can be used for this.

(1) In certain cases, the transmitter does not go into the user defined alarm state. For example, in case of a short circuit, the transmitter goes into High Alarm state even if Low Alarm has been configured.

Operation and Maintenance

The Rosemount 5300 Series Prior-Use option must be tested at regular intervals to confirm that the overfill and empty tank protection function result in the desired system response. The following proof test is recommended. If an error is found in the safety functionality, the measuring system must be switched out of service and the process held in a safe state by means of other measures.

Proof test results and corrective actions taken must be documented at www.emersonprocess.com/rosemount/safety.

The required proof test intervals depend on the transmitter configuration and process environment. Refer to the reference manual and the Failure Modes, Effects, and Diagnostic Analysis (FMEDA) report for further information.

Proof test

This test detects approximately 95% of the possible Dangerous Undetected (DU) failures of the transmitter including the sensor element, not detected by the transmitter's automatic diagnostics. See the Rosemount 5300 Reference Manual (Document No. 00809-0100-4530) for additional details and instructions. Prior to this test, the echo curve should be inspected to ensure no disturbing echoes affecting the measurement performance are present in the tank.

Required tools: Field Communicator and mA meter.

1. Bypass the safety logic solver or take other appropriate actions to avoid false trip.
2. Disable write protection if the function is enabled.
3. Using Loop Test, enter the mA value representing a high alarm current output. Verify that the analog current reaches that value using the reference meter.
   This tests for compliance voltage problems, such as a low loop power supply voltage or increased wiring resistance.
4. Using Loop Test, enter the mA value representing a low alarm current output. Verify that the analog current reaches that value using the reference meter.
   This tests for possible quiescent current related failures.
5. Perform a two-point calibration check of the transmitter by applying level to two points on the probe within the measuring range(1). Verify that the current output corresponds to the level input values using a known reference measurement.
   This step verifies that the analog output is correct in the operating range and that the Primary variable is properly configured.
6. Enable write protection.
7. Restore the loop to full operation.
8. Remove the bypass from the safety logic solver or otherwise restore normal operation.
9. Document the test result for future reference.

Inspection

Visual Inspection

It is recommended to inspect the probe for possible build up or clogging.

(1) For best performance, use the 4 - 20 mA range points as calibration points.

Special Tools

Not required.

Product Repair

All failures detected by the transmitter diagnostics or by the proof test must be reported. Feedback can be submitted electronically at www.emersonprocess.com/rosemount/safety (**Contact Us**).

The 5300 is repairable by major component replacement. Additional information is available in the Rosemount 5300 Series Reference Manual (Document No. 00809-0100-4530).

References

Specifications

The Rosemount 5300 must be operated in accordance with the functional and performance specifications provided in the Rosemount 5300 Series Reference Manual (Document No. 00809-0100-4530), Appendix A: Reference Data.

Failure Rate Data

The FMEDA report includes failure rates and common cause Beta factor estimates. The full report is accessible at www.emersonprocess.com/rosemount/safety/PriorUse.htm.

Useful Lifetime

The established failure rates of electrical components apply within the useful lifetime, which should be based on experience. According to IEC 61508-2, 7.4.7.4, note 3, the useful lifetime often lies within a range of 8 to 12 years.

Section 3 5300 Installation & Configuration

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

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 services other than those contained in this manual unless you are qualified.

Process leaks could result in death or serious injury.

Make sure that the transmitter is handled carefully. If the Process Seal is damaged, gas might escape from the tank if the transmitter head is removed from the probe.

⚠WARNING

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

Probes covered with plastic and/or with plastic discs may generate an ignition-capable level of electrostatic charge under certain extreme conditions. Therefore, when the probe is used in a potentially explosive atmosphere, appropriate measures must be taken to prevent electrostatic discharge.

INSTALLATION & CONFIGURATION

Step 1. Complete the QIG

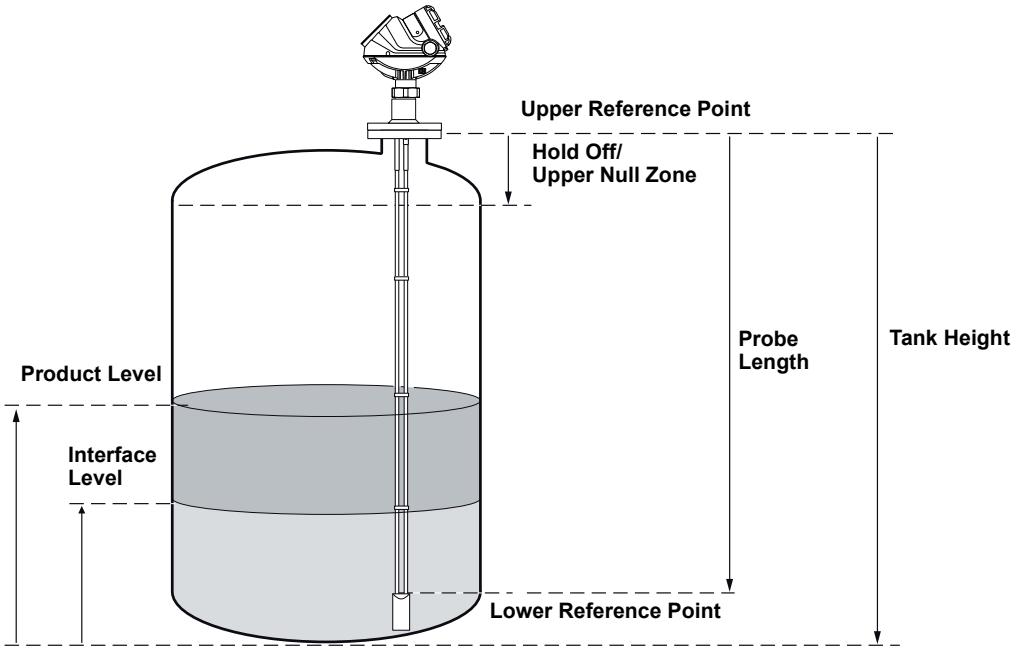
Follow the instructions provided in Section 2: 5300 Quick Installation Guide.

Step 2. Complete the Basic Configuration

Basic Configuration Parameters

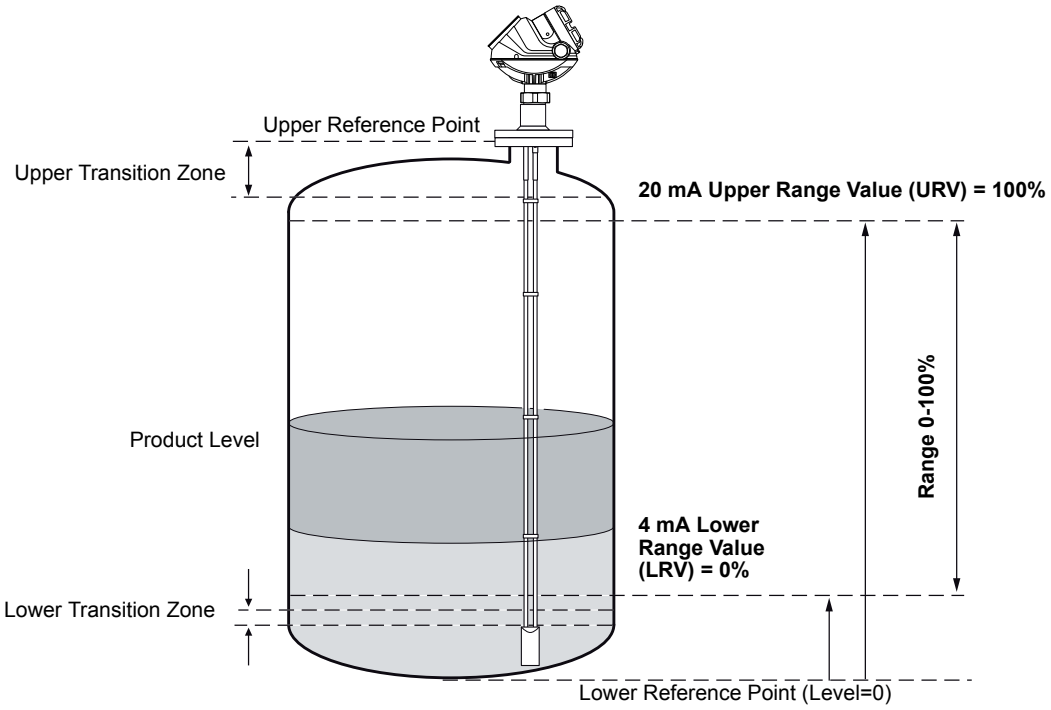
- HART/FF Address
- Device Tag
- Measurement Units
- Tank Geometry

Figure 3-1. Tank Geometry



- Probe Type
- Hold Off/Upper Null Zone
  This parameter should only be changed if there are disturbing objects close to the antenna, e.g. nozzle disturbances. No valid measurements are possible above the Hold Off Distance.
- Measurement Mode
- Rapid Level Changes
- Dielectric Constant
- 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.
- Analog Output (HART)

Figure 3-2. Example of Range Value settings (HART)



For more information, see the Rosemount 5300 Series Reference Manual (Document No. 00809-0100-4530) section “Basic Configuration Parameters”.

- AI Block (FOUNDATION Fieldbus)

  A minimum of four parameters are required to configure the AI Block:

  1. **Channel** - Corresponds to the desired sensor measurement
  2. **L_TYPE** - Defines the relationship to the desired output of the AI Block. Direct or indirect root.
  3. **XD_SCALE** - Include 0%, 100%, and engineering units.
  4. **OUT_SCALE** - Include 0%, 100%, and engineering units.

For more information, see the Rosemount 5300 Series Reference Manual (Document No. 00809-0100-4530) section “FOUNDATION Fieldbus Overview”.

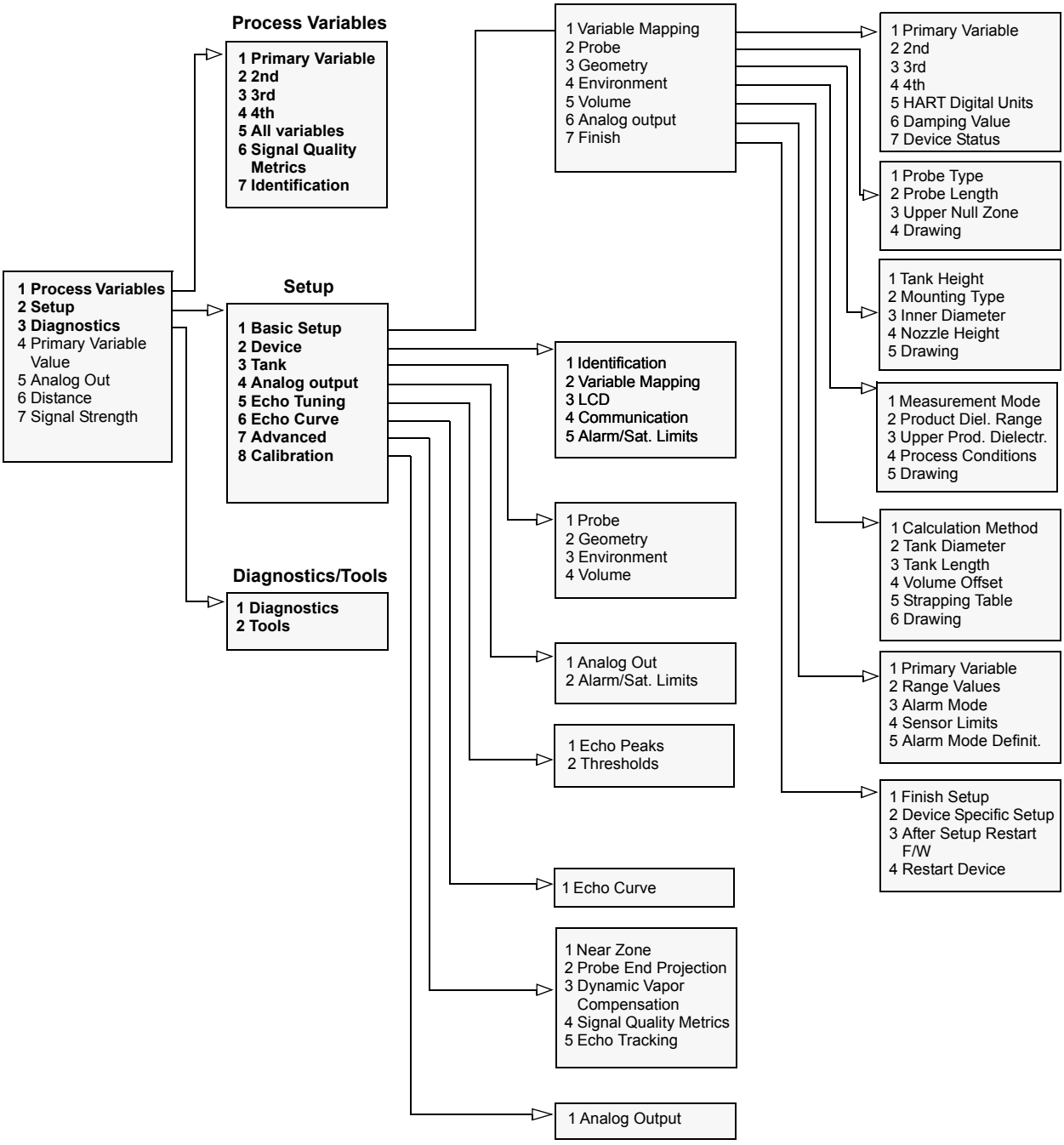
Basic Configuration Using Rosemount Radar Master

1. Start the Guided Setup
2. Start the Configuration Wizard
3. Click the Device specific setup button
   This will show if any additional configuration is needed.
4. Restart the transmitter
5. View live values from the device
6. Backup

For more information, see the Rosemount 5300 Series Reference Manual (Document No. 00809-0100-4530) section “Basic Configuration Using Rosemount Radar Master”.

Basic Configuration Using a Field Communicator

Figure 3-3. Field Communicator Menu Tree corresponding to Device Revision 3



For more information, see the Rosemount 5300 Series Reference Manual (Document No. 00809-0100-4530) section “Basic Configuration Using A 375 Field Communicator”.

Basic Configuration Using AMS Suite (HART) or DeltaV

The Rosemount 5300 Series can also be configured using AMS Suite or DeltaV.

For more information, see the Rosemount 5300 Series Reference Manual (Document No. 00809-0100-4530) section “Basic Configuration Using AMS Suite (HART)”.

Step 3. Complete the Advanced Configuration

Trim Near Zone

Use Trim Near Zone when mounted in a nozzle, chamber, or still-pipe. An exception is narrow nozzles as defined below:

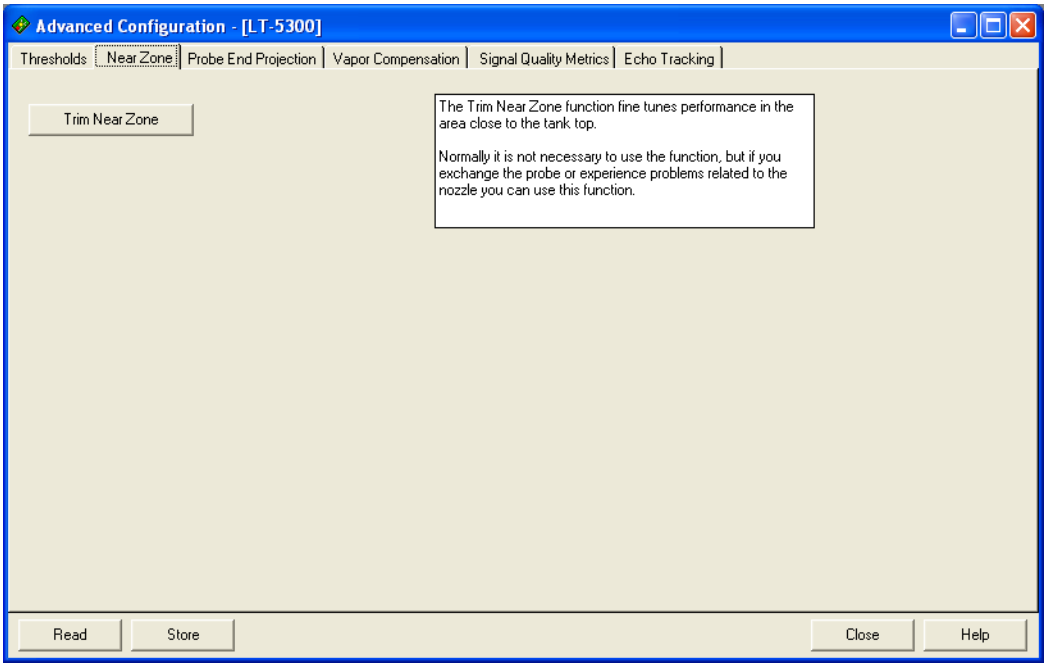
- 2 in. (50 mm)< Nozzle height < 12 in. (300 mm)
- Nozzle diameter < 2 in. for all single probes
  (Nozzle diameter < 3 in. for 13 mm single rigid)

To complete the Trim Near Zone function:

1. Make sure the product level is below the near zone region (0-3.3 ft (0-1 m)).
2. Click Trim Near Zone and follow the instructions.

For more information, see the Rosemount 5300 Series Reference Manual (Document No. 00809-0100-4530) section “Handling Of Disturbances From Nozzle”.

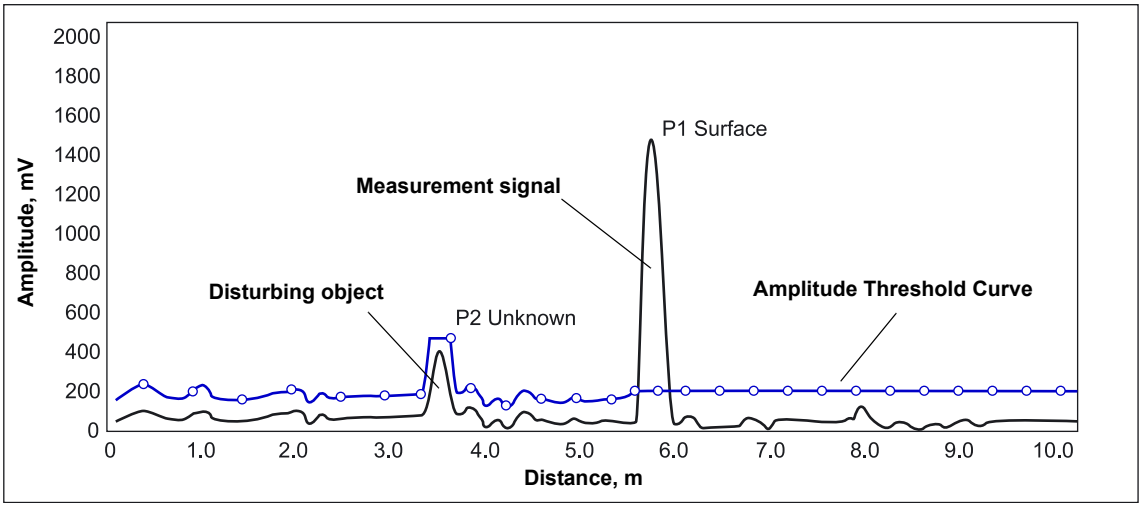
Figure 3-4. Trim Near Zone using RRM



Measure and Learn

The Measure and Learn function automatically creates an Amplitude Threshold Curve (ATC) adapted to the shape of the measurement signal, and helps to handle disturbing echoes.

Figure 3-5. Disturbing echoes can be filtered out by creating an amplitude threshold



1. For best performance execute Measure and Learn with an empty tank/chamber.
2. Click Measure and Learn, and follow the instructions.

For more information, see the Rosemount 5300 Series Reference Manual (Document No. 00809-0100-4530) section “The Configuration Mode Tab”.

Probe End Projection

Probe End Projection (PEP) allows you to measure product level when the surface pulse is too weak to be detected, e.g. long measuring range, solids, and boiling hydrocarbonates.

1. Make sure there are no disturbing echoes above the surface threshold.
2. In Rosemount Radar Master, click the Guided Probe End Projection and follow instructions.

For more information, see the Rosemount 5300 Series Reference Manual (Document No. 00809-0100-4530) section ”Probe End Projection”.

NOTE
This function is only available for liquid/solid product level measurement modes and a well defined probe end echo (i.e. ensure that the probe end/centering disc/weight is either always in contact with the tank wall or never in contact with the tank wall).

NOTE
Probe End Projection is not compatible with Signal Quality Metrics, Dynamic Vapor Compensation, high DC applications and Interface Measurement.

Dynamic Vapor Compensation (DVC)

For high pressure saturated steam applications with a varying pressure and/or temperature, certain models of the Rosemount 5300 Series have a built-in function (DVC) that automatically compensates for varying vapor dielectric constants. Option "4V" or "4U" in model code.

It is important that the vapor compensation function is calibrated after installation.

1. Install unit in pipe/chamber
2. The surface level must be at least 19.7 in. (0.5 m) below the end of the reflector (It is recommended to empty the pipe/chamber and to ensure it is free from vapor or condensate remains)
3. Perform the calibration at ambient pressure and temperature conditions, i.e. when the vapor dielectric constant is close to 1.0
4. Click Calibrate Vapor Compensation, and follow instructions

For more information and instructions, see the Rosemount 5300 Series Reference Manual (Document No. 00809-0100-4530) section “Dynamic Vapor Compensation”.

Step 4. Verification

Viewing Measurement Data

- In Rosemount Radar Master
  Rosemount Radar Master > Tools > Device Display

Figure 3-6. Presentation of measurement data in Rosemount Radar Master

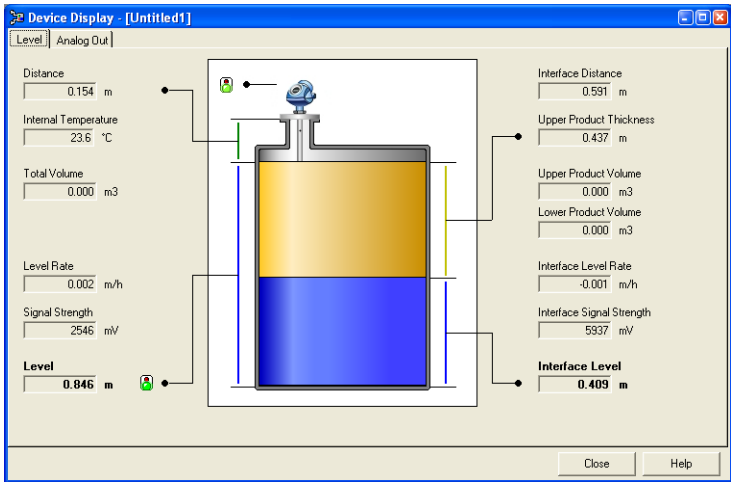
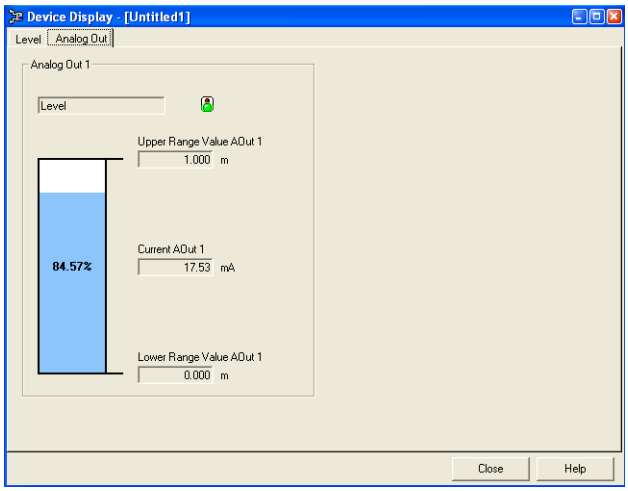


Figure 3-7. Presentation of Analog Output value in Rosemount Radar Master



For more information, see the Rosemount 5300 Series Reference Manual (Document No. 00809-0100-4530) section “Viewing Measurement Data In RRM”.

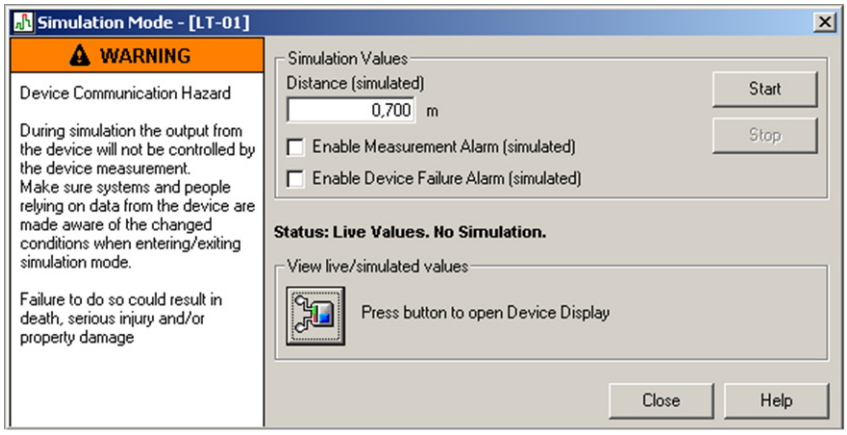
Verify Analog Output (HART devices only)

Ensure that the loop has been set to manual mode in the DCS for the applicable transmitter.

Use the transmitter's built-in simulation mode to verify the analog output settings. Output at least one arbitrary level or interface and verify that the readings in the DCS match up.

Rosemount Radar Master > Tools > Simulation Mode

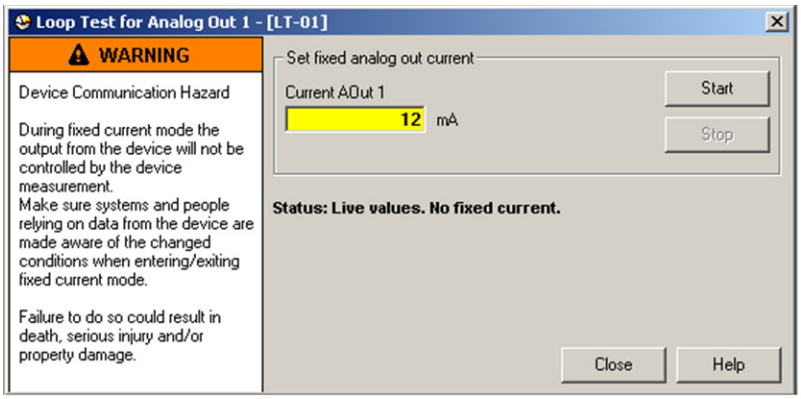
Figure 3-8. Simulation Mode



Also, or alternatively, activate the transmitter's loop test function. Output 4, 12, and 20 mA and verify that the readings in the DCS match up.

Rosemount Radar Master > Output > Analog Out > Loop Test

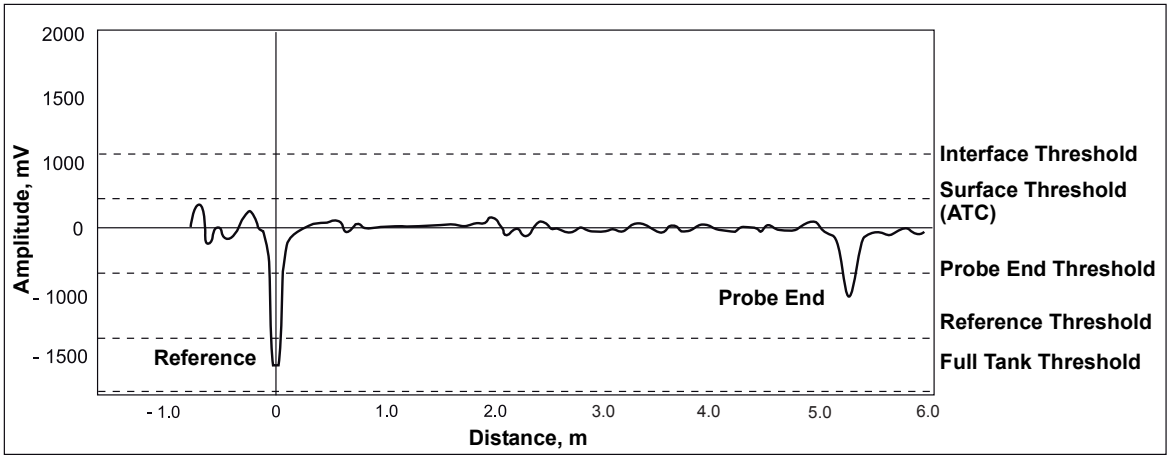
Figure 3-9. Loop test for Analog Out 1



Echo Curve Verification

1. Download and review the echo-curve

Figure 3-10. The Echo Curve presents all visible echoes



2. Verify that the reference pulse is detected
3. Review peak amplitudes

   Verify that the probe end pulse is visible. If the probe is grounded or SST centering disk is used, the pulse is positive. Otherwise the pulse will be negative.

   Verify that no disturbing echoes are present above the Surface Threshold (ATC).

Step 5. Common Problems and Recommended Actions

Double Bounce

Tall, narrow, and/or rough nozzles may create double bounces, which disturb the measurement signal. The double bounce always appears at twice the disturbance distance.

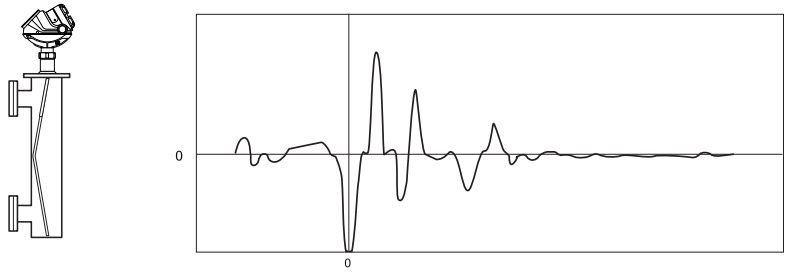
Recommended Actions:

- Verify that mounting considerations as described in the Rosemount 5300 Series Reference Manual (Document No. 00809-0100-4530) section “Mounting Considerations“ are followed
- Perform Trim Near Zone, see the Rosemount 5300 Series Reference Manual (Document No. 00809-0100-4530) section “Trim Near Zone” for activation details. Fine-tune performance by trimming echoes in the near zone
- Adjust Upper Null Zone (UNZ), see the Rosemount 5300 Series Reference Manual (Document No. 00809-0100-4530) section “Changing the Upper Null Zone” for details. Exclude any echo "before" the UNZ
- Adjust Surface Threshold (ATC), see the Rosemount 5300 Series Reference Manual (Document No. 00809-0100-4530) section “Using the Rosemount Radar Master” for details. Exclude any echo weaker than the threshold

Strong fixed echo - Bent probe / Probe contacting Nozzle

A bent probe in contact with metal creates strong echo and measurement will lock onto the strong echo. Note that contamination also may create strong disturbance echoes.

Figure 3-11. Measurement data using a bent probe



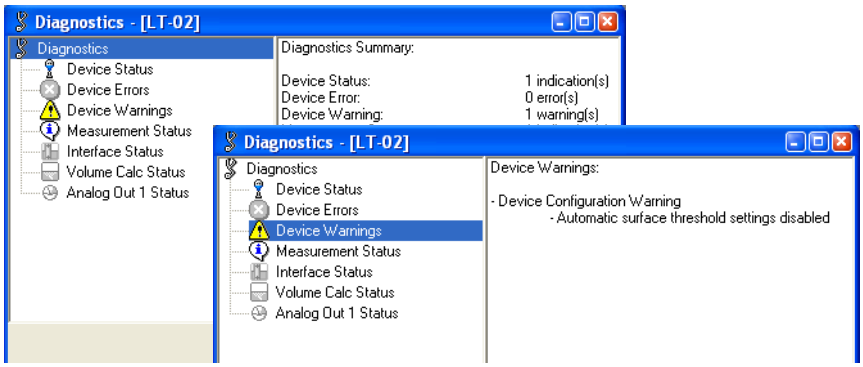
Recommended Actions:

- If bent probe, try to straighten it gently. If this is not possible, a replacement of the complete probe assembly may be required
- Verify that mounting considerations described in the Rosemount 5300 Series Reference Manual (Document No. 00809-0100-4530) section “Mounting Considerations” are fulfilled. The probe length should match the tank/chamber length. For more information, refer to the Using Guided Wave Radar for Level in High Pressure Steam Applications Technical Note (Document No. 00840-0100-4530)
- Consider adding a centering disk at the bottom of the probe, for more information see the Rosemount 5300 Series Reference Manual (Document No. 00809-0100-4530) section “Mounting a Centering Disc for Pipe Installations”. This helps to keep the probe centered in the chamber/still-pipe. For more information, refer to the Using Guided Wave Radar for Level in High Pressure Steam Applications Technical Note (Document No. 00840-0100-4530)
- If flexible probe in contact with nozzle, consider using a long stud, for more information see the Rosemount 5300 Series Reference Manual (Document No. 00809-0100-4530) section “Mounting Considerations”.

Read Diagnostics

Verify that no Errors or unattended Warnings are present.

Figure 3-12. The Diagnostics window in RRM



To view Diagnostics in Rosemount Radar Master:

Rosemount Radar Master > Tools > Diagnostics

For more information, see the Rosemount 5300 Series Reference Manual (Document No. 00809-0100-4530) section “Diagnostics”.

Step 6. Archive Files

Save Echo Curve and Config File

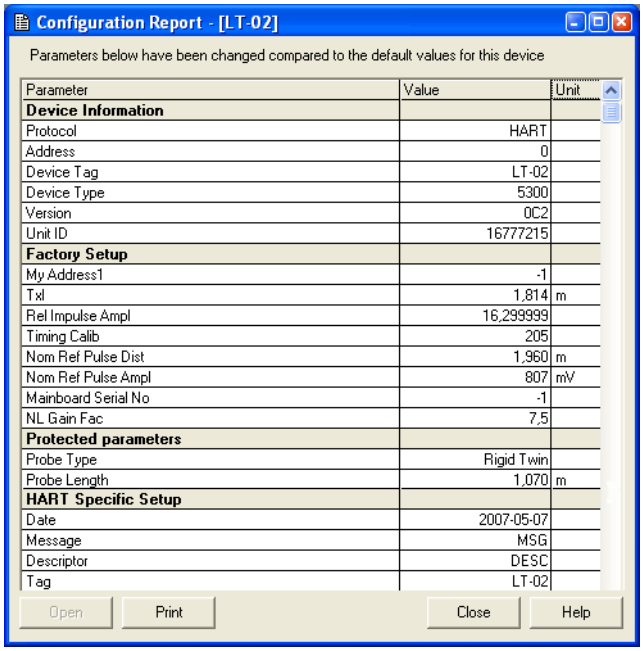
Permanently store the echo-curve and configuration back-up files for future use, with re-occurring verification procedures.

In Rosemount Radar Master:

Rosemount Radar Master > Device > Backup Config to file

Rosemount Radar Master > Tools > Echo Curve > Record

Figure 3-13. The Configuration Report window in Rosemount Radar Master



Section 4 5300 Commissioning

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.

Process leaks could result in death or serious injury.

Make sure that the transmitter is handled carefully. If the Process Seal is damaged, gas might escape from the tank if the transmitter head is removed from the probe.

⚠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 5300 transmitter is off and the lines to any other external power source are disconnected or not powered while wiring the gauge.

Probes covered with plastic and/or with plastic discs may generate an ignition-capable level of electrostatic charge under certain extreme conditions. Therefore, when the probe is used in a potentially explosive atmosphere, appropriate measures must be taken to prevent electrostatic discharge.

COMMISSIONING

Follow this commissioning procedure for the first time the process is started at actual operating conditions and actual process media.

Verification

Review and verify that the following matches application and installation requirements, as described in Section 2: 5300 Quick Installation Guide and Section 3: 5300 Installation & Configuration.

- Mounting Considerations
- Mechanical Installation
- Electrical Installation
- Basic Configuration
- Advanced Configuration

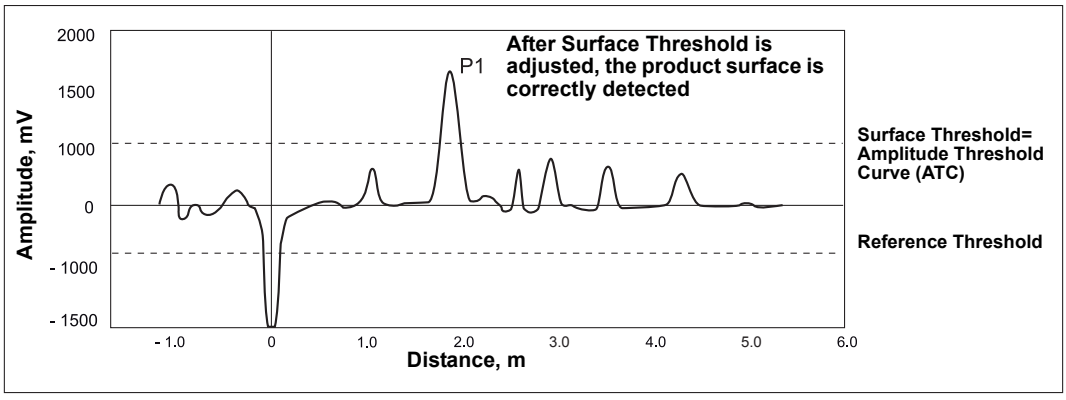
Configuration

Threshold settings

Recommended Threshold settings for the Rosemount 5300 Series:

1. Review threshold settings
2. If needed, use the following best practices to apply custom threshold adjustments:
   - Generally, the threshold should be at 40-50% of the surface peak. Example: If the surface is 2000 mV, the threshold should be set at 800-1000 mV.
   - It should never be closer than 300 mV to any disturbing objects. Example: If there is a 1100 mV peak from an inlet-pipe, the threshold around it should be 1400 mV.
   - The threshold should never be below 800 mV in the range 0-1 ft (0.3 m) and never below 500 mV from 1 ft (0.3 m) upwards.

Figure 4-1. Echo Curve after surface threshold was adjusted



Probe End Projection

Probe End Projection allows you to measure product level when the surface pulse is too weak to be detected, such as long measuring ranges, solids, and boiling hydrocarbons. The calibration should be completed first with an empty tank during cold commissioning, and then a second time with a filled tank, but do not overwrite the empty tank calibration.

1. Make sure the surface echo is above the threshold
2. In Rosemount Radar Master click Guided Probe End Projection and follow instructions

For more information, see the Rosemount 5300 Series Reference Manual (Document No. 00809-0100-4530) section “Probe End Projection”.

NOTE
Probe End Projection is not compatible with Signal Quality Metrics, Dynamic Vapor Compensation, Interface Measurement, and High DC applications.

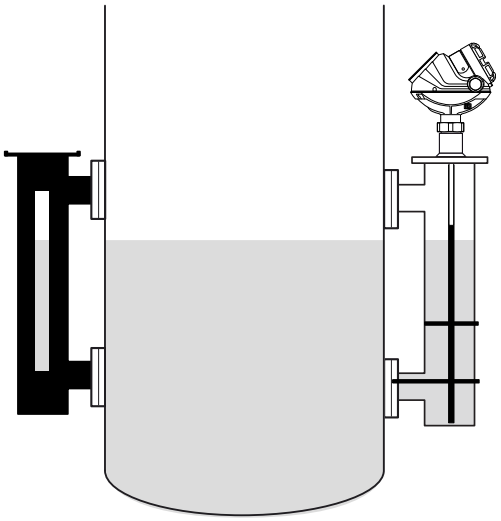
Verification Procedure

Step 1. Verify the Correctness of Level Reading

At normal operating conditions, compare the transmitter level, or interface reading, with an independent measurement. Unfortunately, it often happens that two independent measurements will not match up perfectly, but check the sanity and the acceptable deviation.

The independent measurement can be done using a number of different complementary devices, ranging from sight-glasses and hand-dipping to redundant differential-pressure and displacer.

Figure 4-2. The verification of measurement data using a sight-glass



Step 2. Analog Output Signal Validation

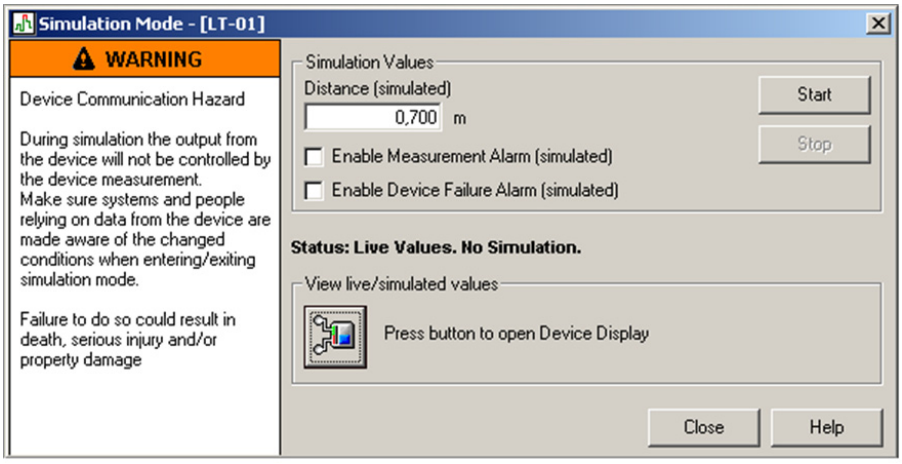
NOTE
This section refers to 4-20 mA/HART units only.

Ensure that the loop has been set to manual mode in the DCS for the applicable transmitter.

Use the transmitter's built-in simulation mode to verify the analog output settings. Output at least one arbitrary level or interface and verify that the readings in the DCS match up.

Rosemount Radar Master > Tools > Simulation Mode

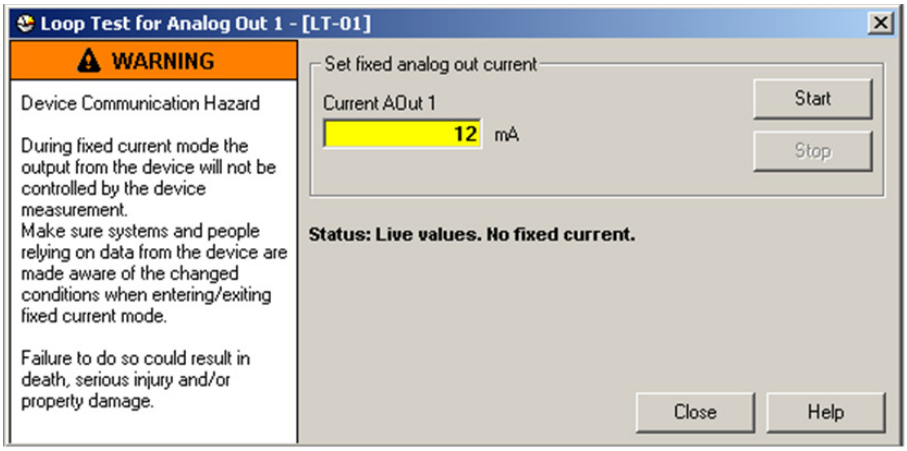
Figure 4-3. Simulation Mode - [LT-01)



Also, or alternatively, activate the transmitter's loop test function. Output 4, 12, and 20 mA and verify that the readings in the DCS match up.

Rosemount Radar Master > Output > Analog Out > Loop Test

Figure 4-4. Loop test for Analog Out 1 - [LT-01]



Step 3. Echo-Curve Verification at Operating Conditions

At normal operating conditions, download and review the echo-curve according to the following steps:

1. *Check Reference Pulse amplitude and position*
   Compare the result against the previous plots, taken during cold start-up.
2. *Review peak amplitudes and threshold settings*
   Verify that the surface and/or interface peaks are visible and that the thresholds have been set as described in threshold settings. See table below for rough guidelines of amplitudes. For information on threshold settings, see “Threshold settings“ on page 4-3.
3. *Store the echo-curve*
   Permanently store the echo-curve for future use, with re-occurring verification procedures.

Figure 4-5. Peak amplitudes and threshold settings

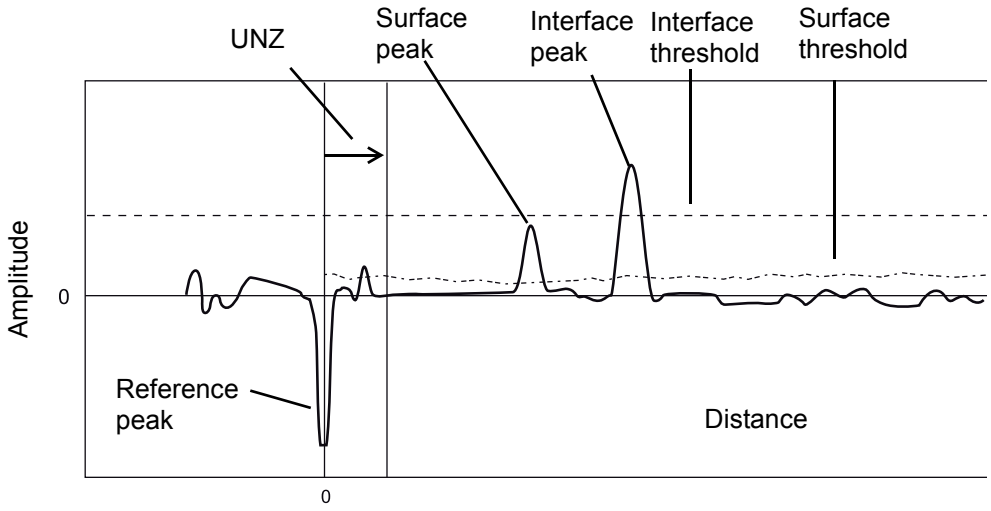


Table 4-1. Typical peak amplitudes for Rosemount 5300 Series with single lead probe in 4 in. chambers

Peak	Approximate signal strength, ideal conditions for single lead probe in 4 in. (100 mm) chambers
Reference peak	~10,000 mV(1)
Surface peak, 5301 with oil (DC=2)	~2,000 mV
Surface peak, 5301 with water (DC=80) at 3 ft (1 m) distance	~10,000 mV
Interface peak, 5302 with oil and water	~8,000 mV

(1) This value does not apply and may be considerably lower when the probe is completely submerged in product.

Common Problems and Recommended Actions

- Surface pulse not detected

Figure 4-6. Surface threshold is too high

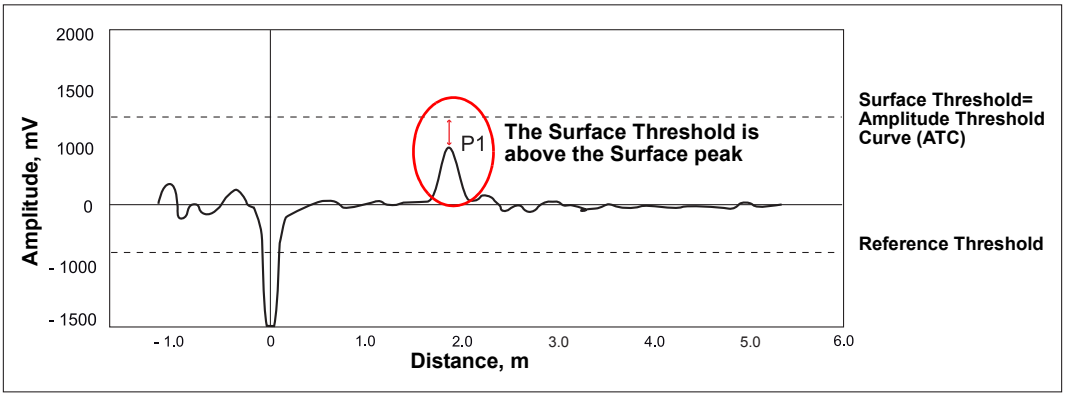
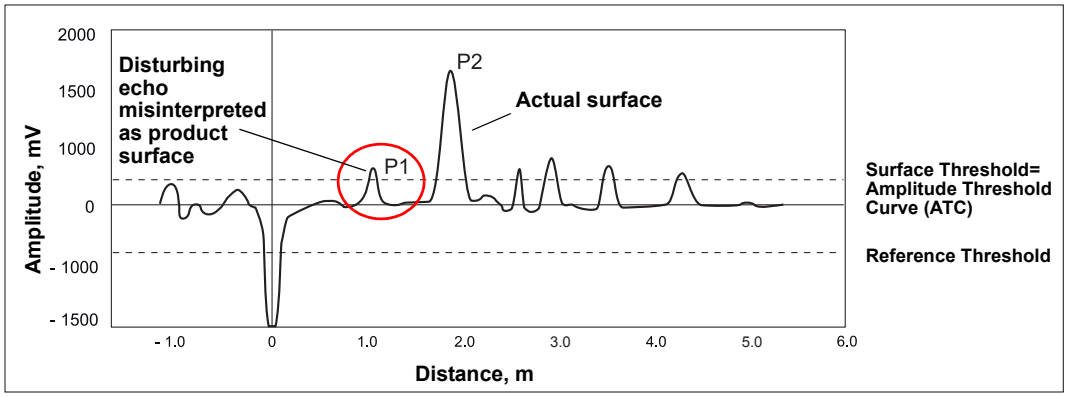


Figure 4-7. Surface threshold is too low



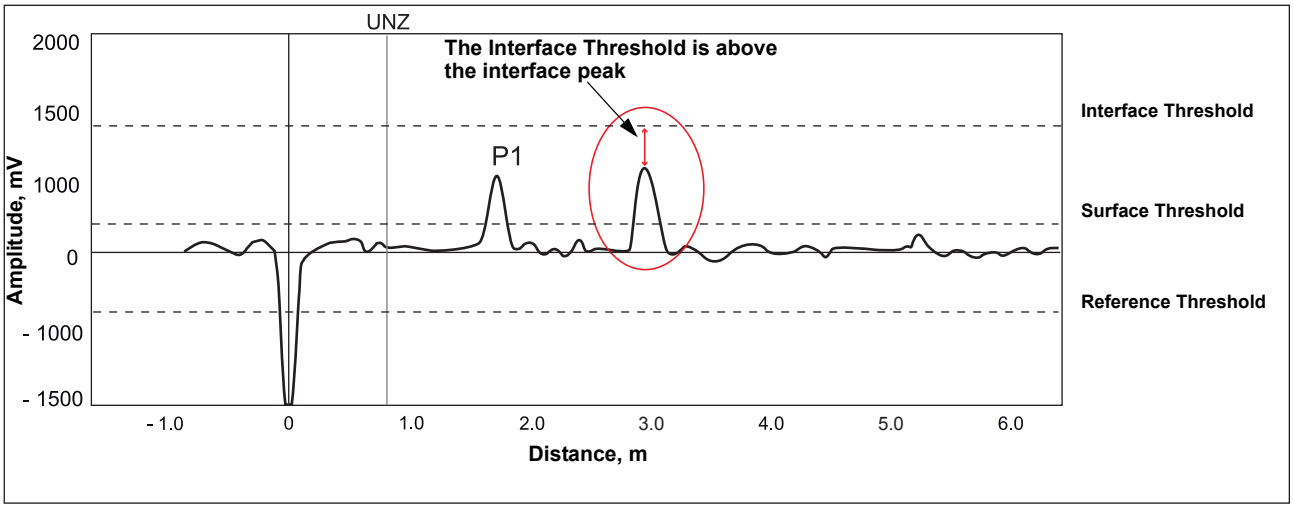
Recommended Actions

Adjust ATC threshold to detect the actual surface peak.

Alternatively adjust Upper Null Zone.

- Interface pulse not detected

Figure 4-8. Echo Curve plot indicating that the amplitude threshold for the interface peak is too high



If the Interface Threshold is too high, the signal amplitude peak at the interface between the upper and lower products is not detected.

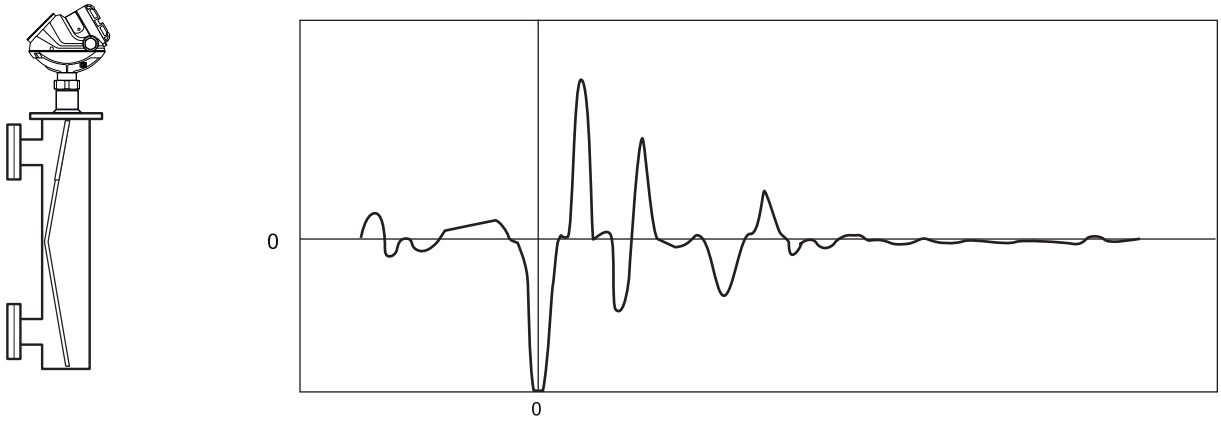
Recommended Actions

Lower Interface Threshold.

- Strong fixed echo - Bent probe / Probe contacting Nozzle

A bent probe in contact with metal creates a strong echo and measurement will lock onto the strong echo. Note that contamination also may create strong disturbance echoes.

Figure 4-9. Measurement data using a bent probe from refining best practices



Recommended Actions
Verify that Mounting Considerations described in Section 2 are fulfilled.

If probe is bent, try to straighten it gently. If not possible, a replacement of the complete probe assembly may be required.

For chamber / Pipe installations consider adding a centering disk at the bottom of the probe. For more information, see the Rosemount 5300 Series Reference Manual (Document No. 00809-0100-4530) section “Mounting a Centering Disc for Pipe Installations”.

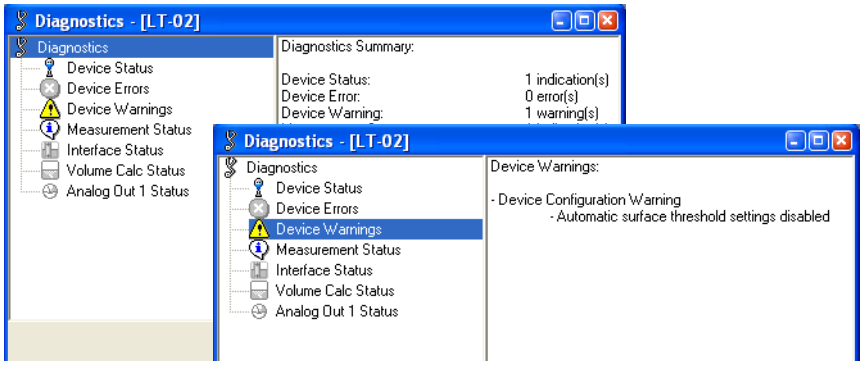
For flexible probes in nozzles consider using a long stud. For more information, see the Rosemount 5300 Series Reference Manual (Document No. 00809-0100-4530) section “Mounting Considerations”.

For more information on Common Problems and Recommended Actions, see the Rosemount 5300 Series Reference Manual (Document No. 00809-0100-4530) section “Surface Pulse Not Found”.

Step 4. Transmitter Diagnostics Review

Verify that no Errors or unattended Warnings are present.

Figure 4-10. The Diagnostics window in RRM



To view Diagnostics in Rosemount Radar Master:

Rosemount Radar Master > Tools > Diagnostics

For more information, see the Rosemount 5300 Series Reference Manual (Document No. 00809-0100-4530) section “Diagnostics”.

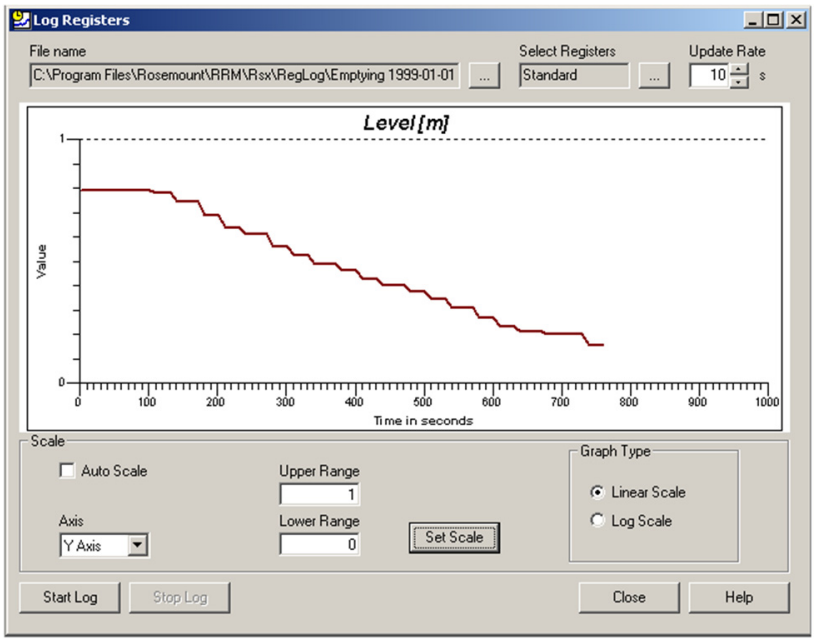
Step 5. Monitor Level while Emptying

During Step 1, the current level/interface reading was verified correct. This step will verify that the transmitter correctly tracks the surface during the emptying of the tank.

Begin by activating log functionality for the transmitter level/interface output. Either the DCS-trend or a stand-alone tool can be used:

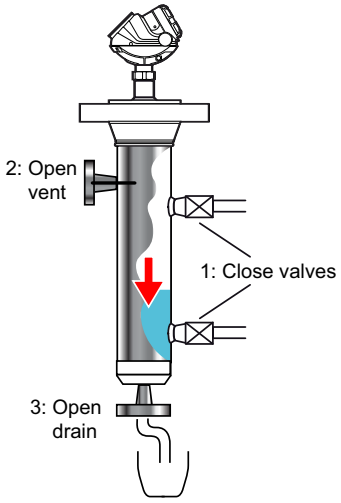
Rosemount Radar Master > Tools > Log

Figure 4-11. Log Registers



Start emptying the tank or chamber making sure not to stop until it is completely empty. With a chamber, do not forget to close the process valves before draining.

Figure 4-12. Emptying a tank or chamber



Finally, review the level/interface trend for accuracy.

Step 6. Echo-Curve Verification with Empty Tank

When the tank or chamber is empty, download and review the echo-curve according to the following steps:

1. *Compare echo-curve with previous plots*
   Compare the echo-curve with previous plots, taken during commissioning. There should be no major differences. Especially make sure to review:
   - the amplitude and position of the reference pulse
   - if all noise is below the threshold
   - the amplitude and position of the bottom or probe-end pulse.

2. *Store the echo-curve*
   Permanently store the echo-curve for future use, with re-occurring verification procedures.

Step 7. Monitor Level while Filling

Repeat Step 5, but fill the tank or chamber instead of emptying it.

Step 8. Archive Files

Save Echo Curve and Config File

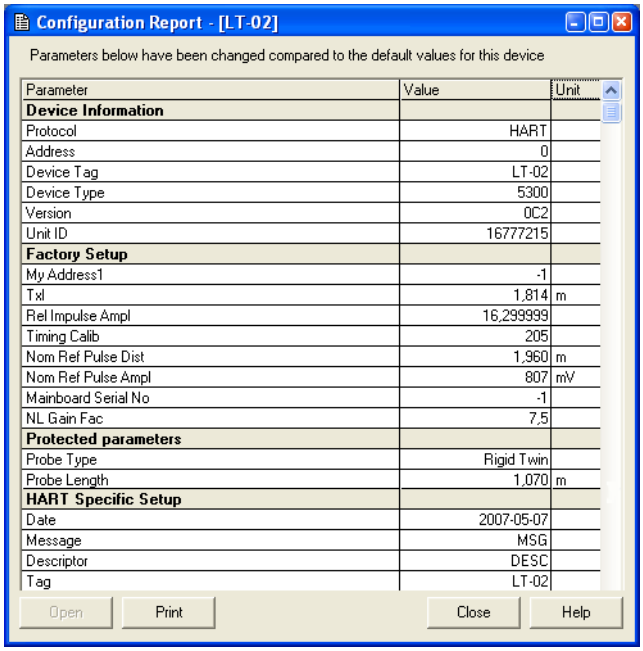
Permanently store the echo-curve and configuration back-up files for future use, with re-occurring verification procedures.

In Rosemount Radar Master:

Rosemount Radar Master > Device > Backup Config to file

Rosemount Radar Master > Tools > Echo Curve > Record

Figure 4-13. The Configuration Report window in Rosemount Radar Master



Section 5 5400 Quick Installation Guide

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

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 services other than those contained in this manual unless you are qualified.

Process leaks could result in death or serious injury.

Make sure that the transmitter is handled carefully. If the Process Seal is damaged, gas might escape from the tank if the transmitter head is removed from the probe.

⚠WARNING

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

Probes covered with plastic and/or with plastic discs may generate an ignition-capable level of electrostatic charge under certain extreme conditions. Therefore, when the probe is used in a potentially explosive atmosphere, appropriate measures must be taken to prevent electrostatic discharge.

⚠WARNING

This installation guide provides basic guidelines for the Rosemount 5400 Series. It does not provide detailed information. Refer to the Rosemount 5400 Series Reference Manual (Document No. 00809-0100-4026) for more instructions. The Reference Manual and this Quick Installation Guide (QIG) are also available electronically on www.rosemount.com.

⚠WARNING

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

- Make sure only qualified personnel perform installation or service.
- Use the equipment only as specified in this Quick Installation Guide (QIG) and the Reference Manual. Failure to do so may impair the protection provided by the equipment.
- Any substitution of non-recognized spare parts may jeopardize safety. Repair, e.g. substitution of components etc, may also jeopardize safety and is under no circumstances allowed.

Explosions could result in death or serious injury

- Verify that the operating environment of the transmitter is consistent with the appropriate hazardous locations specifications.
- In an Explosionproof/Flameproof installation, do not remove the transmitter cover when power is applied to the unit.
- Before connecting a HART®, FOUNDATION™ fieldbus, or Modbus-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 can result in death or serious injury

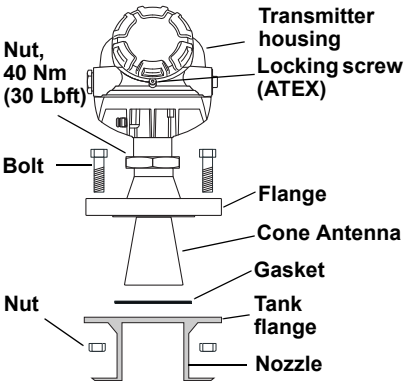
- Avoid contact with the leads and terminals. High voltage that may be present on leads can cause electrical shock.
- Make sure the main power to the 5400 Series transmitter is off and the lines to any other external power source are disconnected or not powered while wiring the transmitter.

Antennas with non-conducting surfaces

- Antennas with non-conducting surfaces (e.g. Rod antenna and Process Seal antenna) may generate an ignition-capable level of electrostatic charge under extreme conditions.
  Therefore, when the antenna is used in a potentially explosive atmosphere, appropriate measures must be taken to prevent electrostatic discharge.

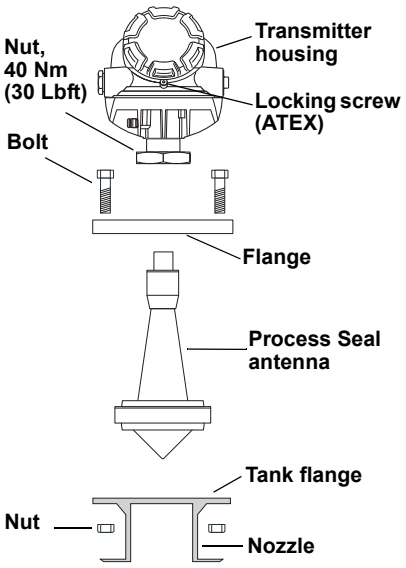
QUICK INSTALLATION GUIDE

Step 1. Mount The Transmitter



Cone antenna with flange

1. Place a gasket on top of the tank flange.
2. Lower the transmitter with antenna and flange into the tank nozzle.
3. Tighten the bolts and nuts with sufficient torque for the flange and gasket choice.



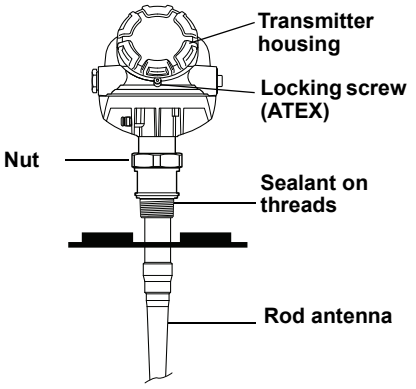
Process Seal antenna with flange(1)

1. Place the antenna on top of the nozzle.
2. Mount the flange and tighten the bolts cross-wise. For torque information, see Table 5-1.
3. Mount the transmitter head and tighten the nut to 40 Nm (30 Lbft).
4. Re-tighten the flange bolts after 24 hours.

(1) The mounting information applies to the updated Process Seal antenna design, released in January 2012. Antennas manufactured before this date have wetted o-rings and require a different installation procedure. For installation guidelines, refer to the Rosemount 5400 Series Quick Installation Guide (Document No. 00825-0100-4026, Rev DA and prior) and the Rosemount 5400 Series Reference Manual (Document No. 00809-0100-4026, Rev FA and prior).

Table 5-1. Tightening torque for Process Seal flanges.

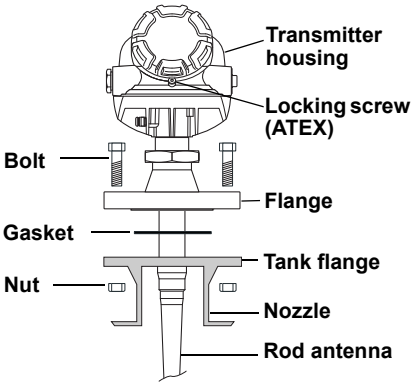
Flange	Torque (Nm)	Torque (Lbft)
2 in. (50 mm), 150 lb	40	30
2 in. (50 mm), 300 lb	40	30
3 in. (75 mm), 150 lb	60	44
3 in. (75 mm), 300 lb	60	44
4 in. (100 mm), 150 lb	50	37
4 in. (100 mm), 300 lb	50	37
DN 50 PN 40	40	30
DN 80 PN 40	60	44
DN 100 PN 16	50	37
DN 100 PN 40	50	37
50A 10K	40	30
80A 10K	60	44
100A 10K	50	37
150A 10K	50	37



Rod antenna with threaded connection

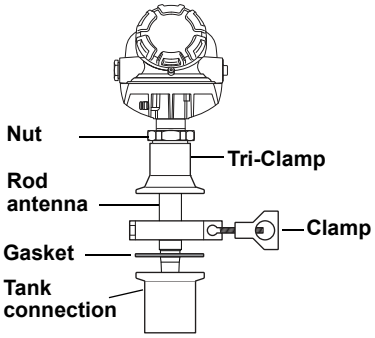
1. Lower the transmitter and antenna into the tank.
2. Turn the transmitter until it is properly secured in the process connection.

NOTE
Tank connections with NPT threads require a sealant for pressure-tight joints.



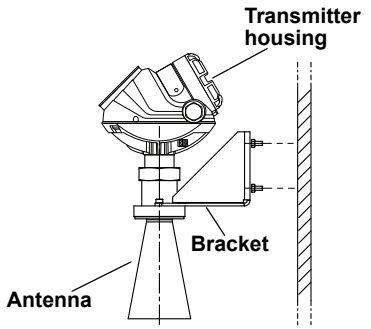
Rod antenna with flange

1. Place a gasket on top of the tank flange. The gasket thickness and material must be suitable for the process.
2. Lower the transmitter with antenna and flange into the tank nozzle.
3. Tighten the bolts and nuts with sufficient torque for the flange and gasket choice.



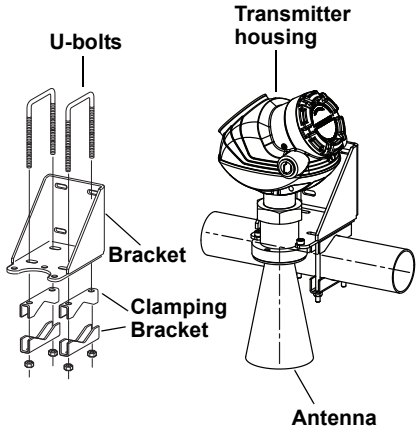
Tri-Clamp Tank Connection

1. Place a gasket on top of the tank flange.
2. Lower the transmitter and antenna into the tank.
3. Fasten the Tri-Clamp to the tank with a clamp.
4. To rotate the transmitter housing, loosen the nut.
5. Rotate the transmitter housing so the cable entries/display face the desired direction.
6. Tighten the nut.



Bracket Mounting, on Wall

1. Mount the bracket directly to the wall with screws suitable for the purpose.
2. Mount the transmitter with antenna to the bracket and secure the installation with the three supplied screws.



Bracket Mounting, on Pipe

1. Put the two U-bolts through the holes of the bracket. Holes are available for both vertical and horizontal pipe mounting.
2. Put the clamping brackets on the U-bolts and around the pipe.
3. Fasten the bracket to the pipe using the four supplied nuts.
4. Mount the transmitter with antenna to the bracket and secure with the three supplied screws.

See the Rosemount 5400 Series Reference Manual (Document No. 00809-0100-4026) for more installation details.

Step 2. Connect The Wiring

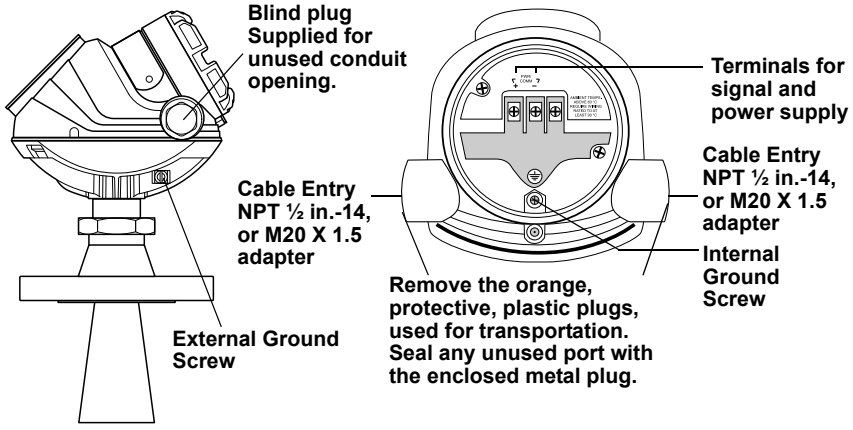
It is recommended that shielded twisted pair wiring (18-12 AWG) that is suitable for the supply voltage and approved for use in hazardous areas be used. For electrical information such as power supply, see diagrams and drawings for HART®, FOUNDATION™ fieldbus, and Modbus on the following pages.

To Connect the Transmitter

1. Make sure the housing is grounded (including IS ground inside Terminal compartment) in accordance with Hazardous Locations Certifications, national, and local electrical codes.
2. Make sure the power supply is disconnected.
3. Remove the terminal block cover (see picture).
4. Pull the cable through the cable gland/conduit. For Explosion-proof/ Flameproof installations, use cable glands or conduit entry devices certified Explosion-proof or Flameproof. Install the wiring with a drip loop, with the bottom of the loop lower than the cable/conduit entry.
5. Connect wires as illustrated on the following pages.
6. Remove the orange, protective, plastic plugs, used for transportation. Seal any unused port with the enclosed metal plug.
7. Mount the cover and tighten the cable gland making sure the cover is fully engaged to meet explosion-proof requirements (adapters are required if M20 glands are used).
   For ATEX, IECEx, NEPSI, INMETRO, and TIIS installations, lock the cover with the locking screw.
8. Connect the power supply.

NOTE
Use PTFE tape or other sealant at the NPT threads in the Cable Entries.

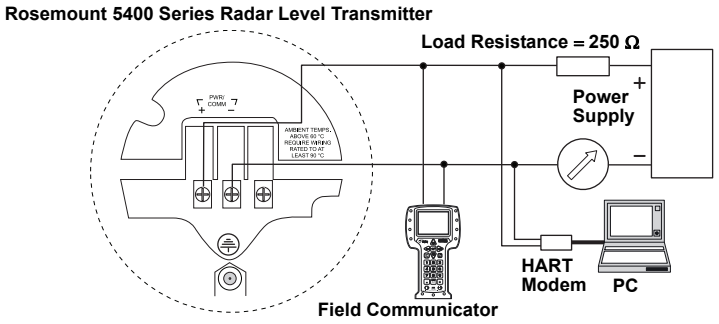
Terminal Block



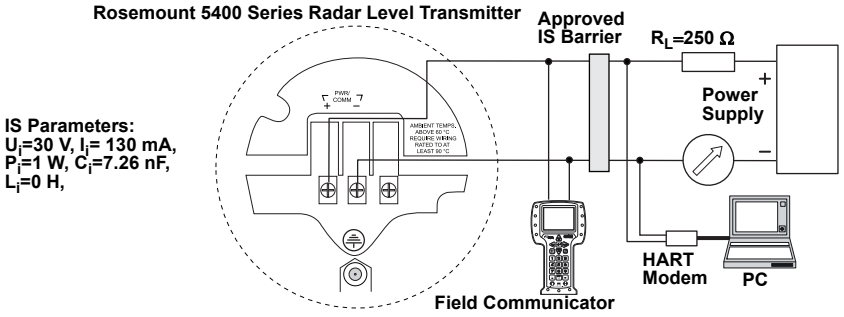
HART Communication

The 5400 Series transmitter operates using a power supply ranging from 16-42.4 Vdc (16-30 Vdc in IS applications, 20-42.4 Vdc in Explosion-proof/Flameproof applications).
The Field Communicator requires a minimum load resistance (R_L) of 250 Ohms within the loop in order to function properly, see diagrams below.

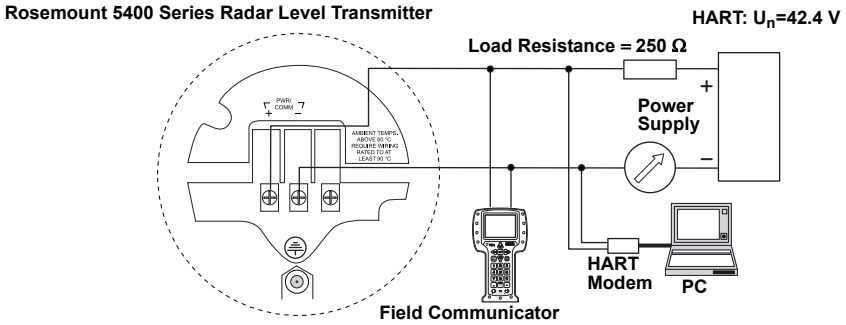
Non-Intrinsically Safe Power Supply



Intrinsically Safe Power Supply



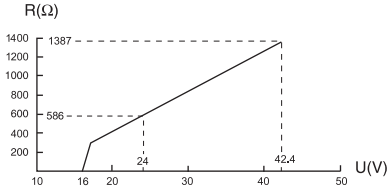
Type n Approvals: Non-Sparking / Energy Limited Power Supply



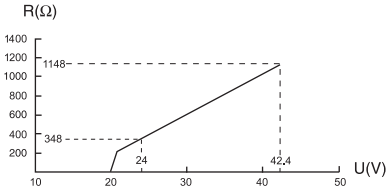
Load Limitations

The Field Communicator requires a minimum load resistance of 250 Ohms within the loop in order to function properly. The maximum load resistance is shown in the following diagram.

Non-Hazardous Installations, and Non-Sparking / Energy Limited Power Supply

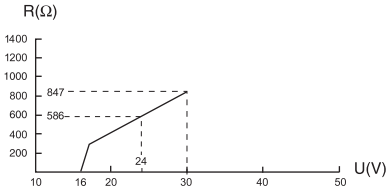


Explosionproof/Flameproof Installations



R: Maximum Load Resistance
U: External Power Supply Voltage

Intrinsically Safe



R: Maximum Load Resistance
U: External Power Supply Voltage

NOTE
For Flameproof / Explosion-proof installations, the diagram is only valid if the HART load resistance is at the + side and if the - side is grounded. Otherwise, the load resistance value is limited to 435 Ω.

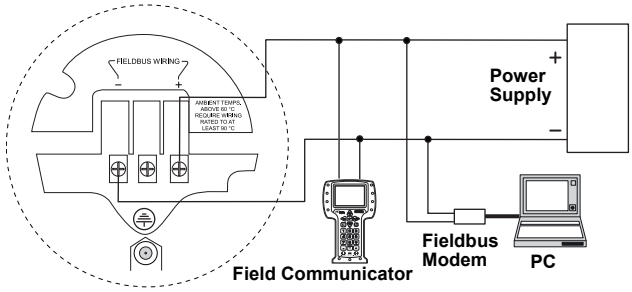
NOTE
Rosemount 5400 Series Transmitters with Flameproof/Explosion-proof Output have a built-in barrier; no external barrier needed.

FOUNDATION fieldbus

The Rosemount 5400 Series FOUNDATION fieldbus transmitter version operates using a power supply ranging from 9-32 Vdc (9-30 Vdc in IS applications, 16-32 Vdc in Explosion-proof / Flameproof applications, and 9-17.5 Vdc in FISCO, IS applications).

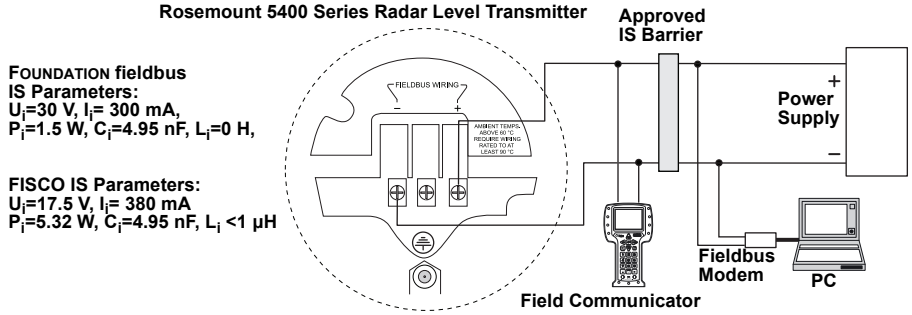
Non-Intrinsically Safe Power Supply

Rosemount 5400 Series Radar Level Transmitter

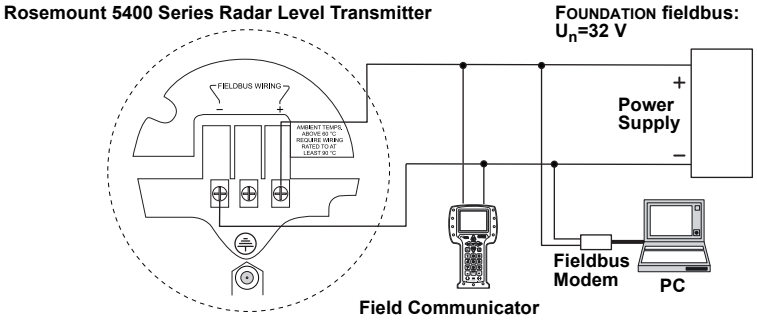


NOTE
Rosemount 5400 Series Transmitters with Flameproof/Explosion-proof Output have a built-in barrier; no external barrier needed.

Intrinsically Safe Power Supply

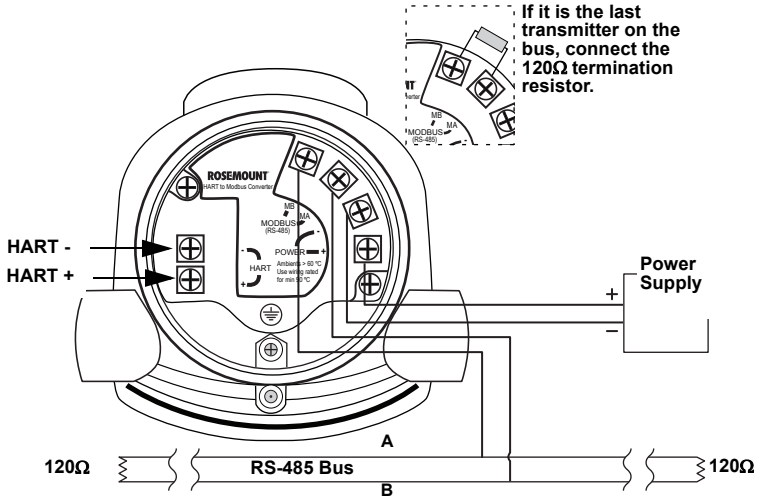


Type n Approvals: Non-Sparking / Energy Limited Power Supply



RS-485 with Modbus communication Power Supply

The Rosemount 5400 Series RS-485 with Modbus communication transmitter version operates using a power supply ranging from 8-30 Vdc (max. rating). See the Rosemount 5300/5400 Series with HART to Modbus Converter Manual Supplement (Document No. 00809-0500-4530) for details.
Power Consumption:
< 0.5 W (with HART address=1)
< 1.2 W (incl. four HART slaves)



NOTE
Rosemount 5400 Series Transmitters with Flameproof/Explosion-proof Output have a built-in barrier; no external barrier needed.

Step 3. Configure

If the transmitter is configured at the factory, it is not necessary to proceed with the following steps, unless you need to verify/change settings.

Basic configuration can easily be done with the Rosemount Radar Master (RRM), a Field Communicator, the AMS™ Suite, DeltaV®, DTM, or any other DD (Device Description) compatible host system. For advanced configuration features, RRM is recommended.

Latest version of all available configuration software for the Rosemount 5400 Series can be found at www.rosemount.com/levelsoftware.

The Rosemount RadarMaster Guided Setup includes a Wizard for Basic Configuration, which is sufficient in most cases. Further configuration options are available using the Setup Functions, as described in the Reference Manual (Document No. 00809-0100-4026).

Configuration with the Rosemount RadarMaster Guided Setup is described on the following pages and the corresponding Field Communicator fast key commands and FOUNDATION fieldbus parameters are given.

Standard installation configuration instructions are covered in this Quick Installation Guide. See the Reference Manual (Document No. 00809-0100-4026) for more complicated situations, e.g. extremely turbulent and boiling applications, or for installations that have disturbing objects within the radar beam etc.

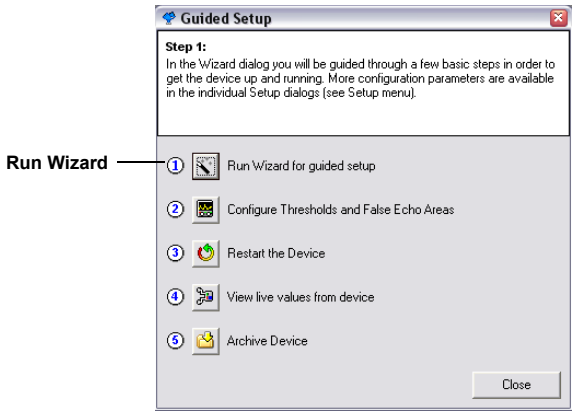
Installing the Rosemount RadarMaster Software

To install the RadarMaster (RRM) software:

1. Insert the installation CD into the CD-ROM drive.
2. Follow the instructions. If the installation program does not automatically start, run **Setup.exe** from the CD.

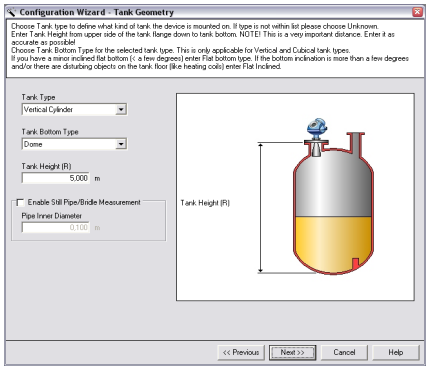
Configuration using the Rosemount Radar Master Software

1. Start the Radar Master software (*Programs> Rosemount>RRM*).
2. Connect to the desired transmitter. Once the transmitter is connected, the *Guided Setup* window automatically appears.



3. Click the "**Run Wizard for guided setup**" button. Follow the instructions for Basic Configuration and you will be guided through a short transmitter installation procedure.
4. The first window in the Configuration Wizard presents general information such as **Device Type** (5400), **Device Model** (5401 / 5402), **Antenna Type**, serial number, and communication protocol. Check that the information complies with the ordering information. Click Next.
5. The *General* window lets you enter **Tag**, **Tag Descriptor**(1), **Message**(1), and **Date**(1). This information is not required for the operation of the transmitter and can be left blank. Click Next.

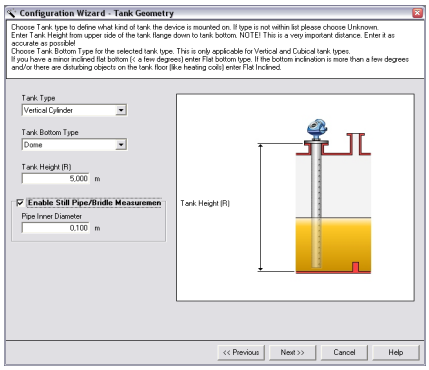
(1) Only for HART communication.



6. Choose the Tank Type that corresponds to the actual tank. If none of the available options matches the actual tank, choose Unknown.
   Fast Key Sequence [1,3,4,1]
   FOUNDATION fieldbus parameter: TRANSDUCER 1100 > GEOM_TANK_TYPE

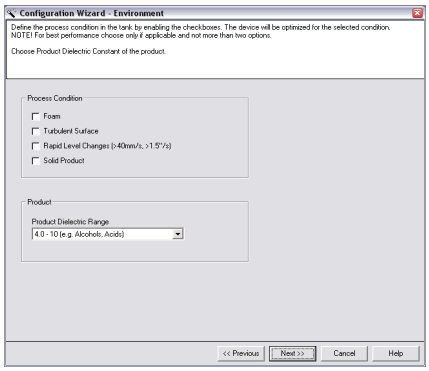
   Tank Bottom Type is important for measurement performance close to the tank bottom.
   Fast Key Sequence [1,3,4,2]
   FOUNDATION fieldbus parameter: TRANSDUCER 1100 > GEOM_TANK_BOTTOM_TYPE

   Tank Height is the distance from the Upper Reference Point to the tank bottom. Make sure this number is as accurate as possible. See the Reference Manual (Document No. 00809-0100-4026) for details.
   Fast Key Sequence [1,3,4,3]
   FOUNDATION fieldbus parameter: TRANSDUCER 1100 > GEOM_TANK_HEIGHT



If the transmitter is installed on a pipe or bridle, select the Enable Still-pipe/Bridle Measurement check box and enter the **Pipe Inner Diameter**.
Fast Key Sequence [1,3,4,4] (enable function) followed by 1,3,4,5
FOUNDATION fieldbus parameter:
TRANSDUCER 1100 >SIGNAL_PROC_CONFIG (enable function) followed by
TRANSDUCER 1100 > ANTENNA_PIPE_DIAM

Click Next and the following window appears.

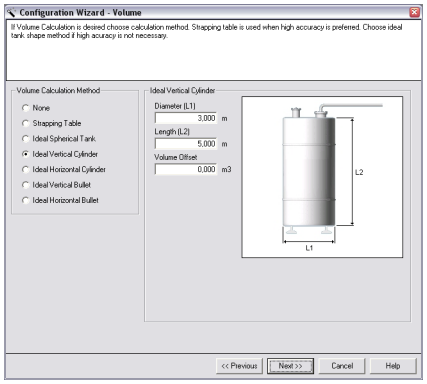


7. In the Process Condition box, select the check boxes corresponding to the conditions in the tank. Select as few options as possible, and no more than two. See the Reference Manual (Document No. 00809-0100-4026) for details.

   Process Condition
   Fast Key Sequence [1,3,4,6,1]
   FOUNDATION fieldbus parameter: TRANSDUCER 1100 > ENV_ENVIRONMENT

   Product Dielectric Constant
   Fast Key Sequence [1,3,4,6,2]
   FOUNDATION fieldbus parameter: TRANSDUCER 1100 > ENV_DIELECTR_CONST

   Click Next and the following window appears.



8. If volume calculation is desired, choose a pre-defined **Volume Calculation Method** based on a tank shape corresponding to the actual tank. If volume calculation is not desired, choose None.
   Fast Key Sequence [1,3,4,7,1]
   FOUNDATION fieldbus parameter: TRANSDUCER 1300> VOL_VOLUME_CALC_METHOD
   Choose Strapping Table if the actual tank does not match any of the available pre-defined tank options or if high volume accuracy is desired.

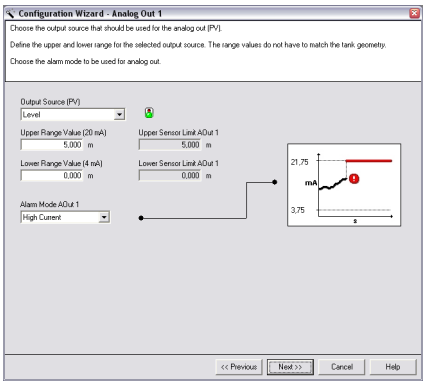
   Enter tank dimensions:

   Diameter
   Fast Key Sequence [1,3,4,7,2]
   FOUNDATION fieldbus parameter: TRANSDUCER 1300> VOL_IDEAL_DIAMETER

   Length
   Fast Key Sequence [1,3,4,7,3]
   FOUNDATION fieldbus parameter: TRANSDUCER 1300> VOL_IDEAL_LENGTH

   Volume Offset
   Fast Key Sequence [1,3,4,7,4]
   FOUNDATION fieldbus parameter: TRANSDUCER 1300> VOL_VOLUME_OFFSET

   Click Next and the following window appears.



NOTE
The 4-20 mA range is not recommended to include the transition zone or the upper null zone. See the Reference Manual (Document No. 00809-0100-4026) for details.

9. This step is not applicable for FOUNDATION fieldbus. Parameters are instead entered in the AI-block.
   For HART communication, choose Primary Variable, **PV.**
   Fast Key Sequence [1,3,5,1]
   Specify the analog output range by setting the **Upper Range Value** (20 mA) and the **Lower Range Value** (4 mA) to the desired corresponding level values.
   Fast Key Sequence [1,3,5,2]

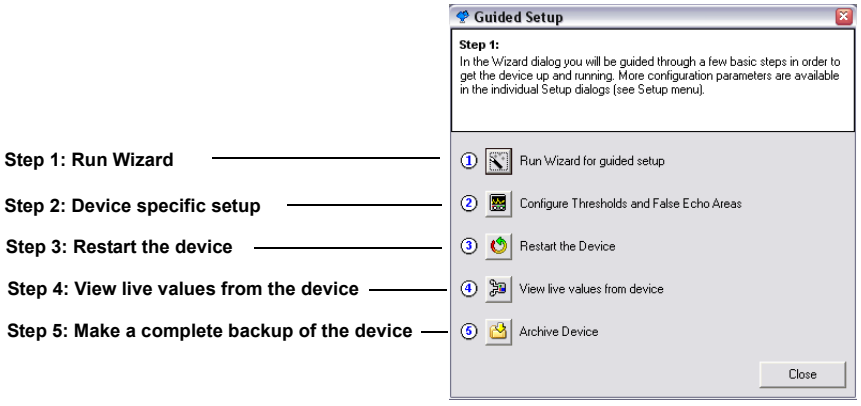
   The **Alarm Mode** specifies the output state when a measurement error occurs. Fast Key Sequence [1,3,5,3]
   The following values are used:
   High: 21.75 mA (standard) or 22.5 mA (Namur)
   Low: 3.75 mA (standard)
   Freeze: presents value when error occurs.
   Click Next.

10. The Basic Configuration with the Radar Master Wizard is now finished. Proceed with the Device Specific Setup to see which additional configuration is needed.

Continue with Steps 2 through 5 in the *Guided Setup* window:

- Configure thresholds and false echo areas. Fast Key Sequence [2,1,6,2]
- Restart the device. Fast Key Sequence [2,1,6,4]
- View live values from the device
- Make a complete backup of the device

See the Reference Manual (Document No. 00809-0100-4026) for further information.



Safety Instrumented Systems (4-20 mA only)

The following section applies to the 4-20 mA Rosemount 5400 Series with QS Prior-Use Certificate of FMEDA data transmitter used in Safety Instrumented Systems (SIS). Additional Safety Instrumented Systems information is available in the Rosemount 5400 Series Reference Manual supplement (Document No. 00809-0400-4026). The manual is available electronically at www.rosemount.com or by contacting an Emerson Process Management representative.

To identify a 5400 QS Prior Use transmitter, verify the option code QS in the model code, on the label affixed to the outside of the transmitter head.

NOTE
The Rosemount 5400 Series transmitter is not safety-rated during maintenance work, configuration changes, multidrop, loop test, or other activity that affects the Safety Function. Alternative means should be used to ensure process safety during such activities.

Installation

The device should be installed and configured as a level sensing device per manufacturer's instructions. The materials must be compatible with process conditions and process fluids. No special installation is required in addition to what is described in this document.

Environmental limits are available in the Rosemount 5400 Series Reference Manual (Document No. 00809-0100-4026), Appendix A: Reference Data.

NOTE
False echoes within the radar beam from obstructions may lead to a situation where the Rosemount 5400 Series can no longer be used for safety related functions with the listed failure rates, Safe Failure Fraction, and PFD_{AVG}. However, reduced proof test intervals can help to detect such unwanted causes.

The loop must be designed so the terminal voltage does not drop below the minimum input voltage, see values in Table 5-2, when the transmitter output is 21.75 mA. The input voltage U_i for HART is 16-42.4 Vdc (16-30 Vdc in IS applications, and 20-42.4 Vdc in Explosion-proof/Flameproof applications).

The HART loop must be referenced to ground in one point, located between the power supply and the load resistor. Either the negative or the positive pole of the power supply can be ground referenced, depending on the placement of the load resistor. See Figure 5-1 as an example.

Figure 5-1. Reference Ground when the Load Resistor is Inserted in the negative Line.

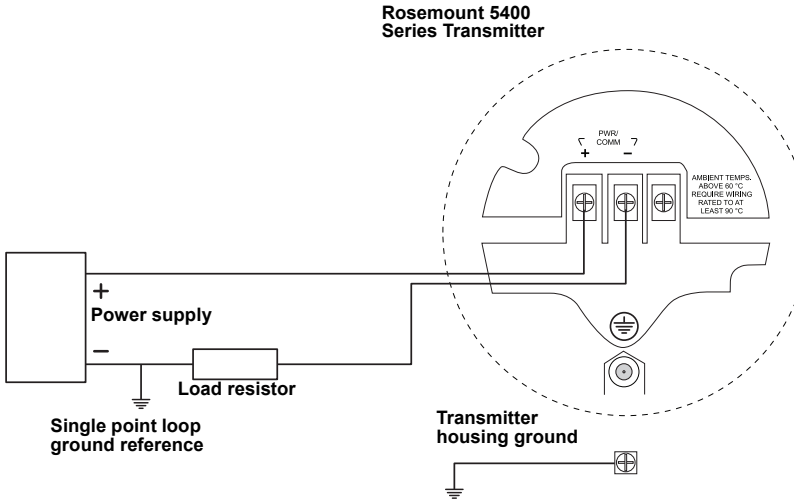


Table 5-2. Minimum input voltage (U_i) at Different Currents.

Hazardous approval	Current	
	3.75 mA	21.75 mA
	Minimum input voltage (U_I)	
Non-Hazardous Installations and Intrinsically Safe Installations	16 Vdc	11 Vdc
Explosion-proof / Flameproof Installations	20 Vdc	15.5 Vdc

Configuration

Use a HART-compliant master, such as Rosemount Radar Master or a Field Communicator, to communicate with and verify configuration of the Rosemount 5400 Series. A full review of configuration methods is available in Section 5: Configuration in the Rosemount 5400 Series Reference Manual (Document No. 00809-0100-4026). These instructions are applicable to the 5400 QS option with any differences noted.

Damping

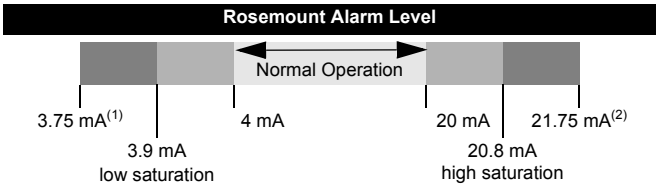
User adjusted damping will affect the transmitter's ability to respond to process changes. Therefore, the *damping values + response time* should not exceed the loop requirements.

Alarm and Saturation Levels

DCS or safety logic solver should be configured to handle both High alarm and Low alarm. It is also required that the transmitter is configured for High alarm (standard alarm setting). Table 5-3 identifies the alarm levels available and their operation values.(1)

(1) In certain cases, the transmitter does not go into the user defined alarm state. For example, in case of a short circuit, the transmitter goes into High Alarm state even if Low Alarm has been configured.

Table 5-3. Alarm levels and operation values



(1) Transmitter Failure, hardware or software alarm in Low position.
(2) Transmitter Failure, hardware or software alarm in High position.

For instructions on alarm level settings, see Section “Analog Output” in the Rosemount 5400 Series Reference Manual (Document No. 00809-0100-4026).

NOTE
Only the High Alarm Mode can be used for the Safety Function. Do not choose Freeze Current as an error will not be announced in the current loop.

Write Protection

A Rosemount 5400 Series transmitter can be protected from unintentional configuration changes by a password protected function. It is recommended to use write protection described in Section “Write Protecting a Transmitter” in the Rosemount 5400 Series Reference Manual (Document No. 00809-0100-4026).

Site Acceptance

After the installation and configuration, proper operation of the transmitter should be verified. A site acceptance test is therefore recommended. The proof test outlined in this section can be used for this. Note that re-verification of the transmitter operation is recommended if the configuration is changed.

Operation and Maintenance

The Rosemount 5400 Series QS option must be tested at regular intervals to confirm that the overfill and empty tank protection function result in the desired system response. The required proof test intervals are dependent on the configuration of the transmitter and process environment. Refer to the reference manual and the Failure Modes, Effects, and Diagnostic Analysis (FMEDA) report for further information.

The following proof test is recommended. If an error is found in the safety functionality, the measuring system must be switched out of service and the process held in a safe state by means of other measures. Proof test results and corrective actions taken must be documented at www.emersonprocess.com/rosemount/safety.

Proof test

This test detects approximately 95% of the possible Dangerous Undetected (DU) failures of the transmitter. See the Rosemount 5400 Reference Manual (Document No. 00809-0100-4026) for additional details and instructions. Note that prior to conducting the test, the echo curve should be inspected to ensure that no disturbing echoes affecting the measurement performance are present in the tank.

Required tools: Field Communicator and mA meter.

1. Bypass the logic solver or take other appropriate actions to avoid false trip.
2. Disable write protection if the function is enabled.
3. Using Loop Test, enter the mA value representing a high alarm current output and verify that the analog current reaches that value using the mA meter.
   This step tests for compliance voltage problems, such as low loop power supply voltage or increased wiring resistance.
4. Using Loop Test, enter the mA value representing a low alarm current output and verify that the analog current reaches that value using the reference meter.
   This step tests for possible quiescent current related failures.
5. Perform a two-point calibration check of the transmitter by adjusting the product level in two points in the measuring range(1). Verify that the current output corresponds to the level input values using a known reference measurement.
   This step verifies that the analog output is correct in the operating range and that the Primary Variable is properly configured.
6. Enable write protection.
7. Restore the loop to full operation.
8. Remove the bypass from the safety logic solver or otherwise restore normal operation.
9. Document the test result for future reference.

For troubleshooting the transmitter, see Section 7: Service and Troubleshooting in the Rosemount 5400 Series Reference Manual (Document No. 00809-0100-4026).

Inspection

Visual Inspection

It is recommended to inspect the antenna for possible build up or clogging.

Special Tools

Not required.

Product Repair

The Rosemount 5400 Series is repairable by major component replacement. All failures detected by the transmitter diagnostics or by the proof test must be reported. Feedback can be submitted electronically at www.emersonprocess.com/rosemount/safety (**Contact Us**).

Additional information is available in the Rosemount 5400 Series Reference Manual (Document No. 00809-0100-4026).

References

Specifications

The Rosemount 5400 Series must be operated in accordance with the functional and performance specifications provided in Appendix A: Reference Data in the Rosemount 5400 Series Reference Manual (Document No. 00809-0100-4026).

(1) For best performance, use the 4 - 20 mA range points as calibration points.

Failure Rate Data

The FMEDA report includes failure rates and common cause Beta factor estimates. The full report is accessible at www.emersonprocess.com/rosemount/safety/PriorUse.htm.

Useful Lifetime

The established failure rates of electrical components apply within the useful lifetime, which should be based on experience. According to IEC 61508-2, 7.4.7.4, note 3, the useful lifetime often lies within a range of 8 to 12 years for transmitters.

Section 6 5400 Installation & Configuration

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

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 services other than those contained in this manual unless you are qualified.

Process leaks could result in death or serious injury.

Make sure that the transmitter is handled carefully. If the Process Seal is damaged, gas might escape from the tank if the transmitter head is removed from the probe.

⚠WARNING

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

Probes covered with plastic and/or with plastic discs may generate an ignition-capable level of electrostatic charge under certain extreme conditions. Therefore, when the probe is used in a potentially explosive atmosphere, appropriate measures must be taken to prevent electrostatic discharge.

INSTALLATION & CONFIGURATION

Step 1. Complete the QIG

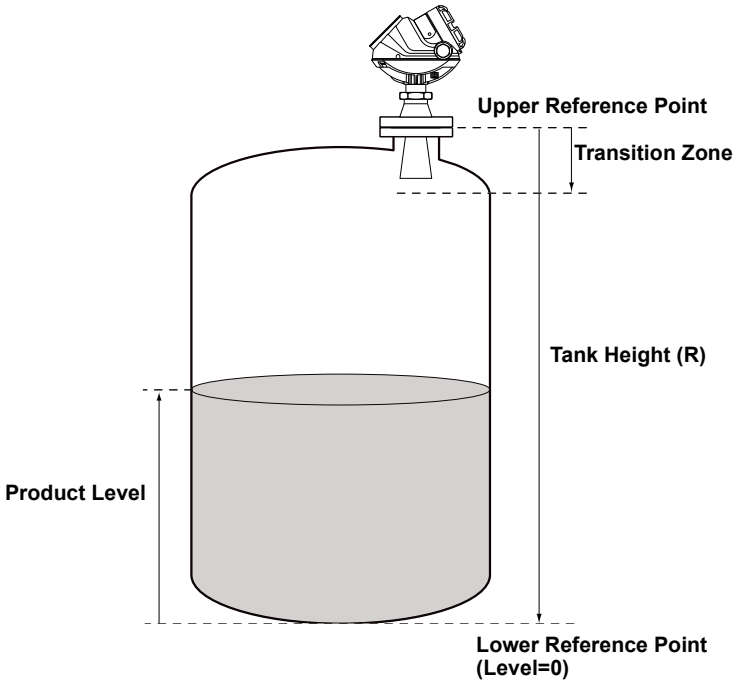
Follow the instructions provided in Section 5: 5400 Quick Installation Guide.

Step 2. Basic Configuration

Basic Configuration Parameters

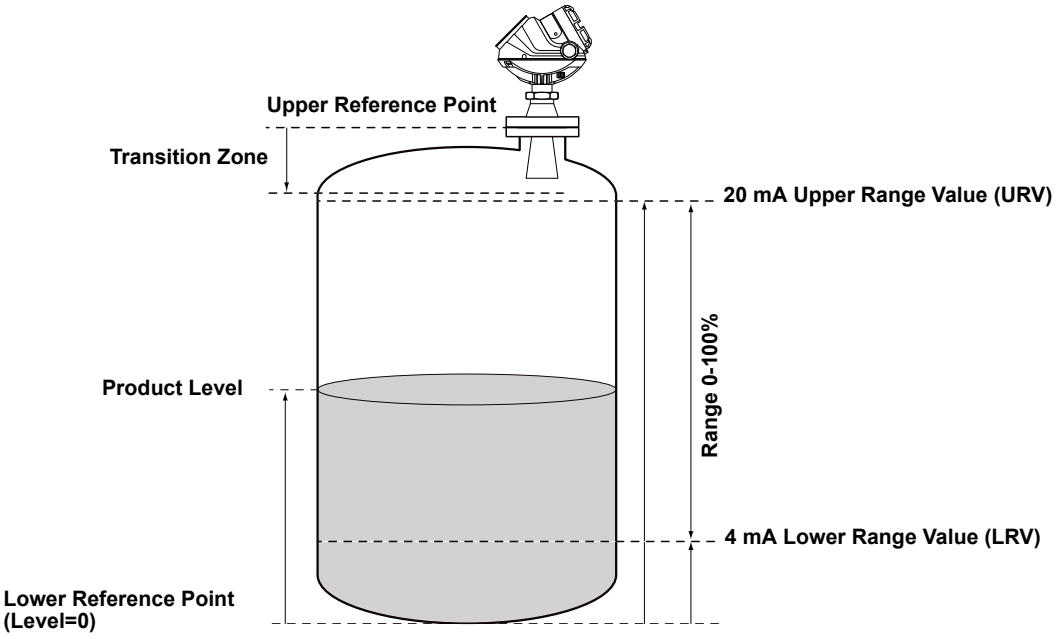
- HART/FF Address and Device Tag
- Measurement Units

Figure 6-1. Tank Geometry



- Tank Height
- Tank Type and Tank Bottom Type
- Pipe Diameter if applicable
- Hold Off/Upper Null Zone
  This parameter should only be changed if there are disturbing objects close to the antenna, e.g. nozzle disturbances. No valid measurements are possible above the Hold Off Distance.
- Process Conditions
  For best performance, select only if applicable, and no more than two options.
- Product Dielectric Range
- Volume Configuration, if needed
- Analog Output (HART)

Figure 6-2. Standard Range Value settings



For more information, see the Rosemount 5400 Series Reference Manual (Document No. 00809-0100-4026) section “Basic Configuration Parameters”.

- Configure the AI Block (FOUNDATION Fieldbus)

  A minimum of four parameters are required to configure the AI Block:

  1. **Channel** - Corresponds to the desired sensor measurement
  2. **L_TYPE** - Defines the relationship to the desired output of the AI Block. Direct or indirect root.
  3. **XD_SCALE** - Include 0%, 100%, and engineering units.
  4. **OUT_SCALE** - Include 0%, 100%, and engineering units.

For more information, see the Rosemount 5400 Series Reference Manual (Document No. 00809-0100-4026) section “Configure the AI Block”.

- Echo Tuning

Measure and Learn function automatically performs echo tuning including threshold setting and false echoes registration. Best Practice is to execute Measure and Learn with empty tank.

Figure 6-3. Weak disturbing echoes can be filtered out by creating an amplitude threshold

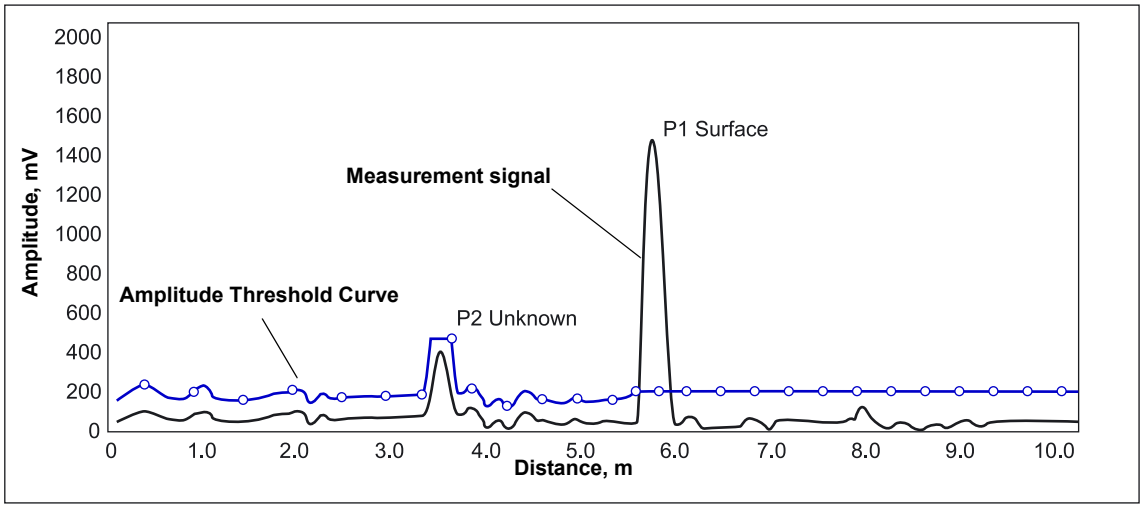
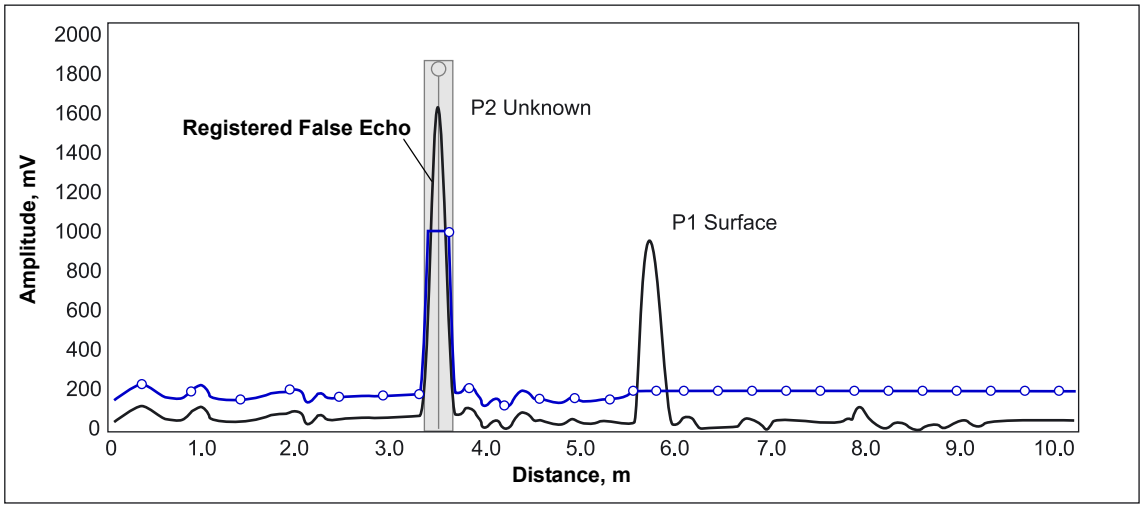


Figure 6-4. Disturbing echoes can be filtered out by registration as False Echoes



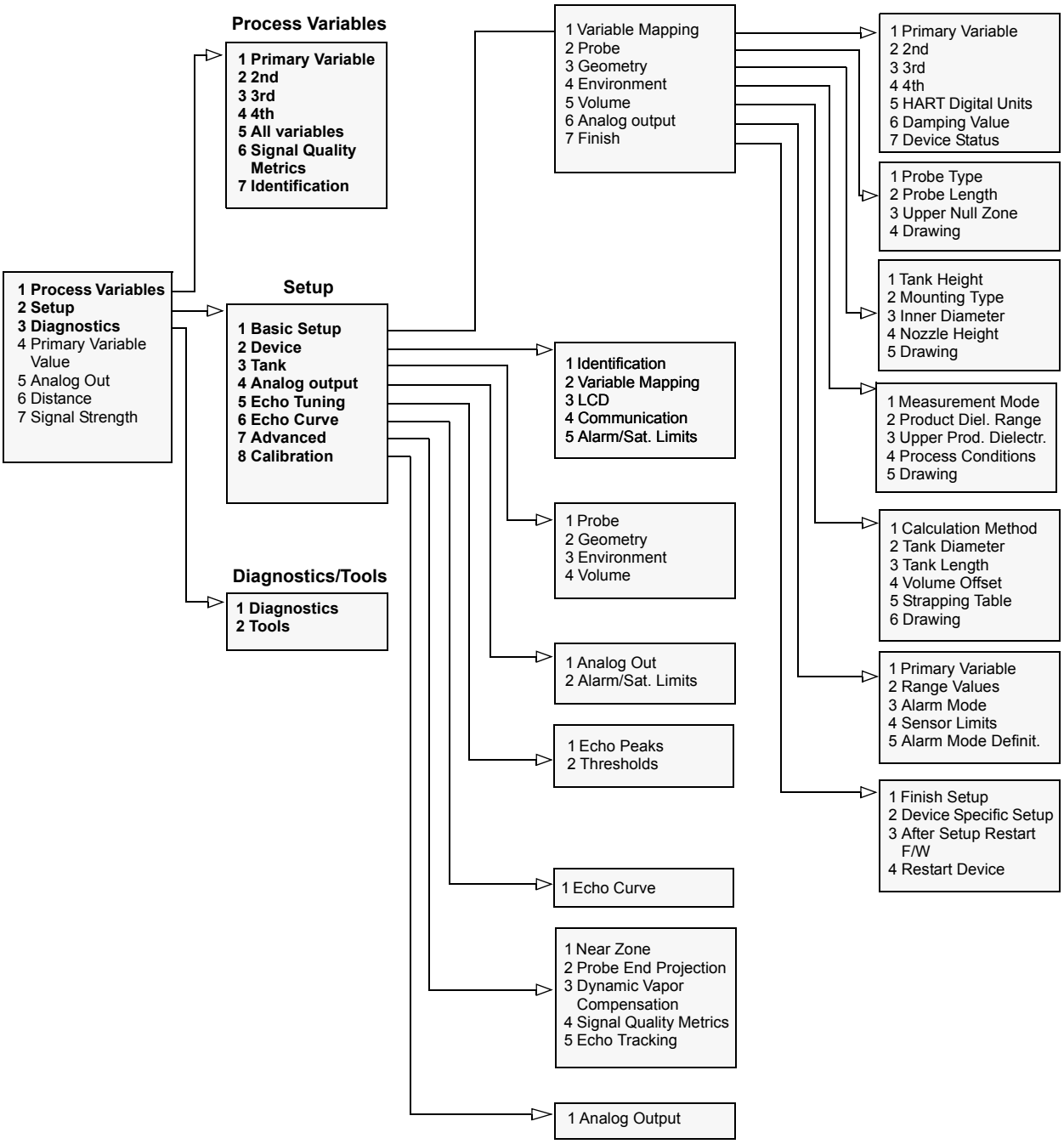
For more information, see the Rosemount 5400 Series Reference Manual (Document No. 00809-0100-4026) section “Echo Tuning”.

Basic Configuration Using Rosemount Radar Master

1. Start the Guided Setup
2. Start the Configuration Wizard and follow the instructions
3. Click Configure Thresholds and False Echo Areas to allow automatic echo tuning using the Measure and Learn function
4. Restart the transmitter
5. View live values from the device
6. Configuration Backup

Basic Configuration Using a Field Communicator

Figure 6-5. Field Communicator Menu Tree corresponding to Device Revision 3



For more information, see the Rosemount 5400 Series Reference Manual (Document No. 00809-0100-4026) section “Basic Configuration Using Rosemount Radar Master”, and the Rosemount 5400 Series Reference Manual Supplement (Document No. 00809-0100-4032) (Rev AA p.4-13 - 4-26).

Step 3. Verification

Viewing Measurement Data

- In Rosemount Radar Master
  Rosemount Radar Master > Tools > Device Display

Figure 6-6. Presentation of measurement data in RRM

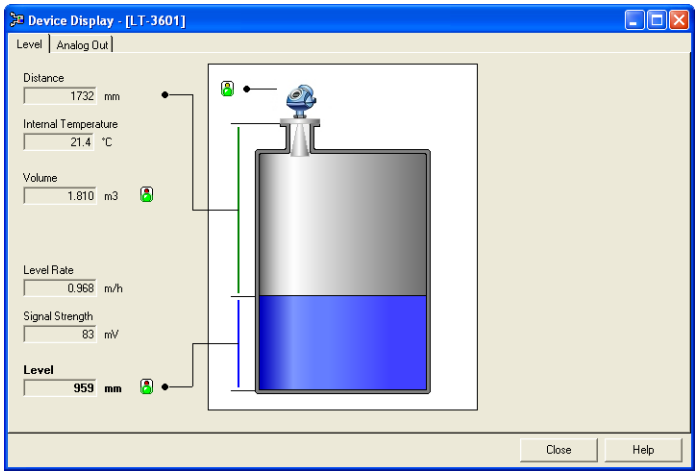
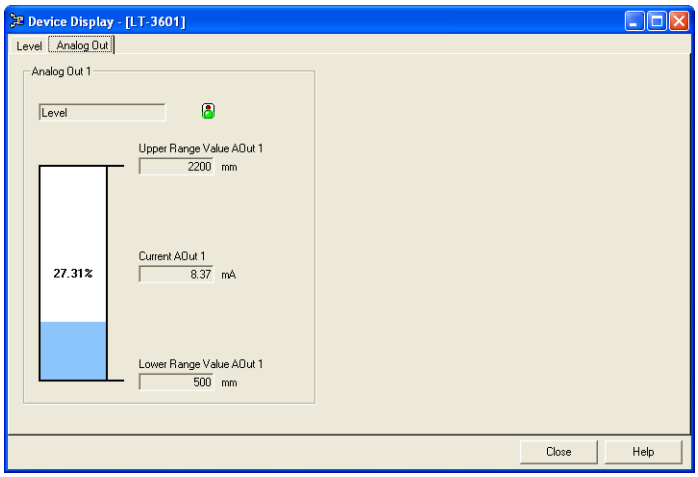


Figure 6-7. Presentation of Analog Output value in RRM



For more information, see the Rosemount 5400 Series Reference Manual (Document No. 00809-0100-4026) section “Viewing Measurement Data”.

- Viewing Measurement Data in AMS Suite

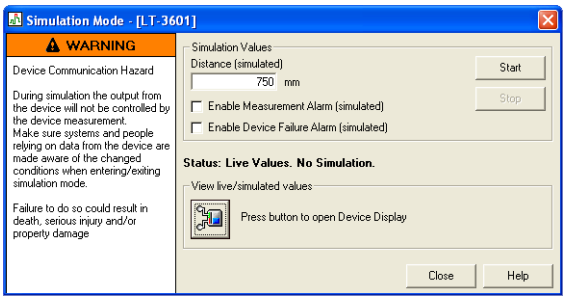
Verify Analog Output (HART devices only)

Ensure that the loop has been set to manual mode in the DCS for the applicable transmitter.

Use the transmitter's built-in simulation mode to verify the analog output settings. Output at least one arbitrary level or interface and verify that the readings in the DCS match up.

Rosemount Radar Master > Tools > Simulation Mode

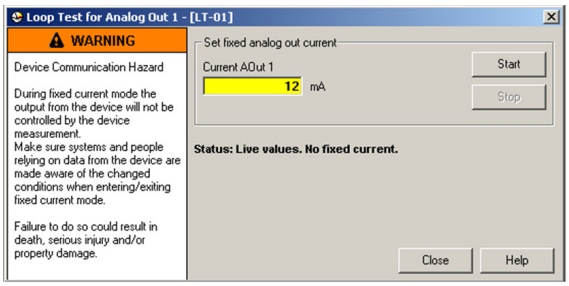
Figure 6-8. Simulation Mode



Also, or alternatively, activate the transmitter's loop test function. Output 4, 12, and 20 mA and verify that the readings in the DCS match up.

Rosemount Radar Master > Output > Analog Out > Loop Test

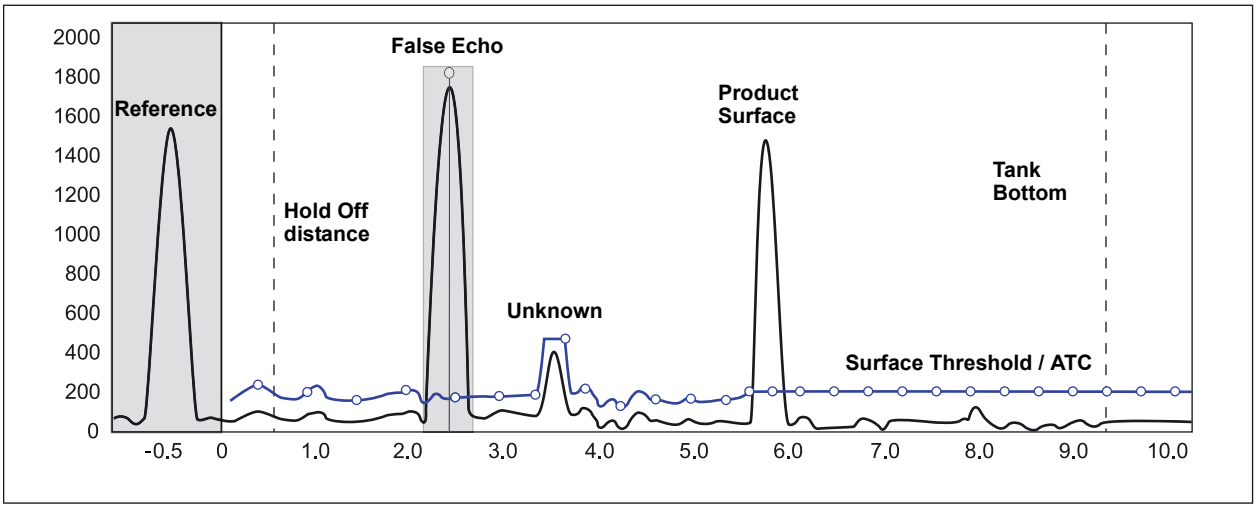
Figure 6-9. Loop test for Analog Out 1



Echo Curve Verification

1. Download and review the echo-curve

Figure 6-10. The Echo Curve presents all visible echoes



2. Take a back-up of the plot including the reference/antenna echo
3. Review peak amplitudes

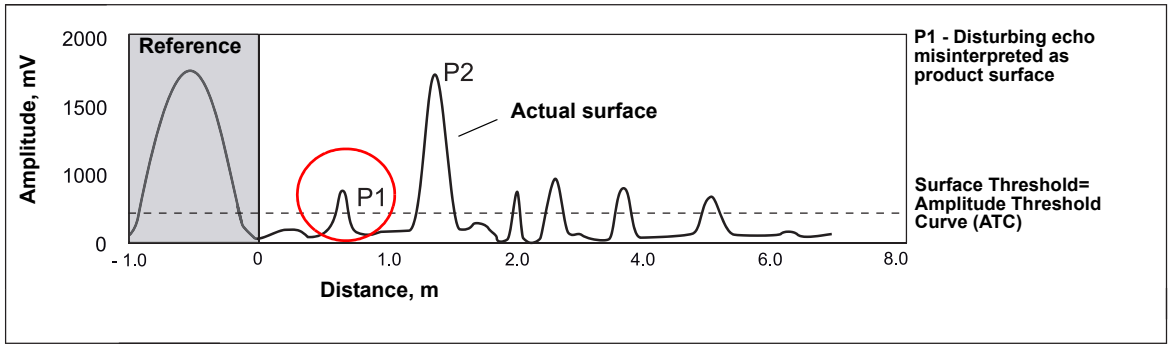
   Verify that no disturbing echoes are present above the Surface Threshold (ATC).

- Common Problems and Recommended Actions

  Surface Threshold (ATC) is too low

  If there are disturbing objects in the tank (e.g. nozzles, internal obstructions, gaps between still-pipe modules) the threshold must be set carefully to avoid locking on the wrong amplitude peak.

Figure 6-11. Surface threshold is too low



Read Diagnostics

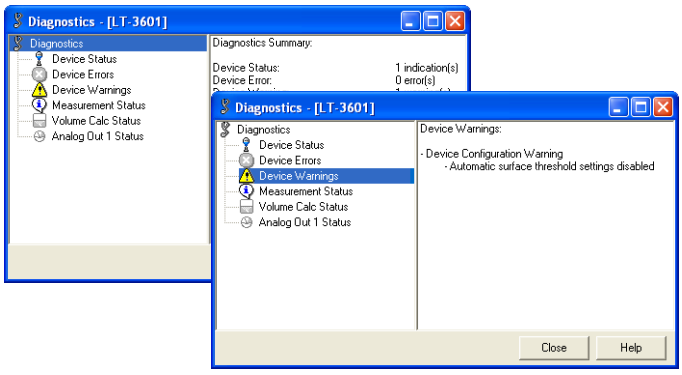
Verify that no Errors or unattended Warnings are present.

For more information, see the Rosemount 5400 Series Reference Manual (Document No. 00809-0100-4026) section “Diagnostic Messages”.

- To view Diagnostics in Rosemount Radar Master:

  Rosemount Radar Master > Tools > Diagnostics

Figure 6-12. The Diagnostics window in Rosemount Radar Master



For more information, see the Rosemount 5400 Series Reference Manual (Document No. 00809-0100-4026) section “Diagnostics”.

Step 4. Archive Files

Save Echo Curve and Config File

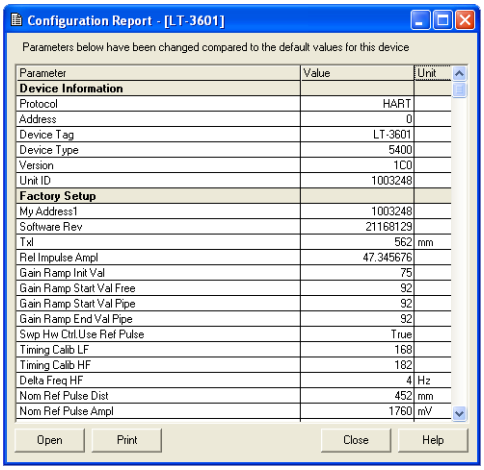
Permanently store the echo-curve and configuration back-up files for future use, with re-occurring verification procedures.

In Rosemount Radar Master:

Rosemount Radar Master > Device > Backup Config to file

Rosemount Radar Master > Tools > Echo Curve > Record

Figure 6-13. The Configuration Report window in Rosemount Radar Master



Section 7 5400 Commissioning

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.

Process leaks could result in death or serious injury.

Make sure that the transmitter is handled carefully. If the Process Seal is damaged, gas might escape from the tank if the transmitter head is removed from the probe.

⚠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 5300 transmitter is off and the lines to any other external power source are disconnected or not powered while wiring the gauge.

Probes covered with plastic and/or with plastic discs may generate an ignition-capable level of electrostatic charge under certain extreme conditions. Therefore, when the probe is used in a potentially explosive atmosphere, appropriate measures must be taken to prevent electrostatic discharge.

COMMISSIONING

Follow this commissioning procedure the first time the process is started at actual operating conditions and actual process media.

Verification

Review and verify that the following matches application and installation requirements, as described in Section 5: 5400 Quick Installation Guide and Section 6: 5400 Installation & Configuration.

- Mounting Consideration
- Mechanical Installation
- Electrical Installation
- Basic Configuration

Configuration

Threshold settings

1. Review thresholds settings
2. If needed, use the following best practices to apply custom threshold adjustments:
   - Generally, the threshold should be at 20% of the surface peak. Example: If the surface is 2000 mV, then the threshold should be set at 400 mV.
   - It should never be closer than 200 mV to any disturbing objects. Example: If there is a 500 mV peak from an obstacle, the threshold around it should be 700 mV.
   - The threshold should never be below 300 mV. For products with very low dielectric constants, such as hydrocarbons, it may be required to lower the threshold.

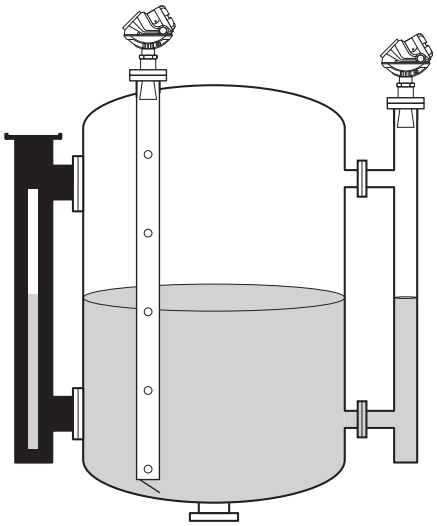
VERIFICATION PROCEDURE

Step 1. Verify the Correctness of Level Reading

At normal operating conditions, compare the transmitter level, or interface reading, with an independent measurement. Unfortunately, it often happens that two independent measurements will not match up perfectly, but check the sanity and the acceptable deviation.

The independent measurement can be done using a number of different complementary devices, ranging from sight-glasses and hand-dipping to redundant differential-pressure and displacer.

Figure 7-1. The verification of measurement data using a sight-glass



Step 2. Analog Output Signal Validation

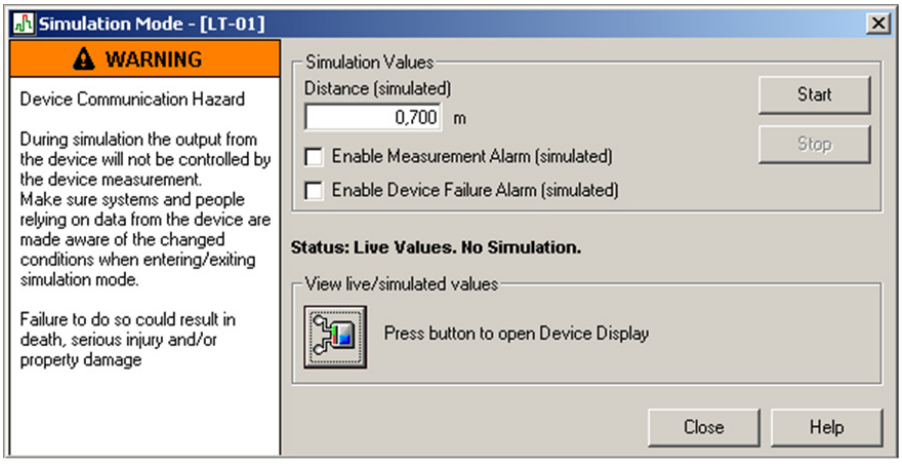
NOTE
This section refers to 4-20 mA/HART units only.

Ensure that the loop has been set to manual mode in the DCS for the applicable transmitter.

Use the transmitter's built-in simulation mode to verify the analog output settings. Output at least one arbitrary level or interface and verify that the readings in the DCS match up.

Rosemount Radar Master > Tools > Simulation Mode

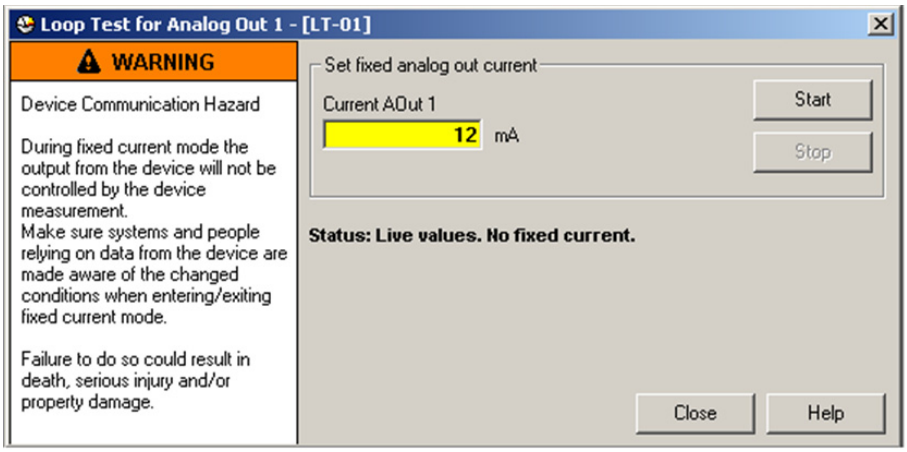
Figure 7-2. Simulation Mode - [LT-01)



Also, or alternatively, activate the transmitter's loop test function. Output 4, 12, and 20 mA and verify that the readings in the DCS match up.

Rosemount Radar Master > Output > Analog Out > Loop Test

Figure 7-3. Loop test for Analog Out 1 - [LT-01]

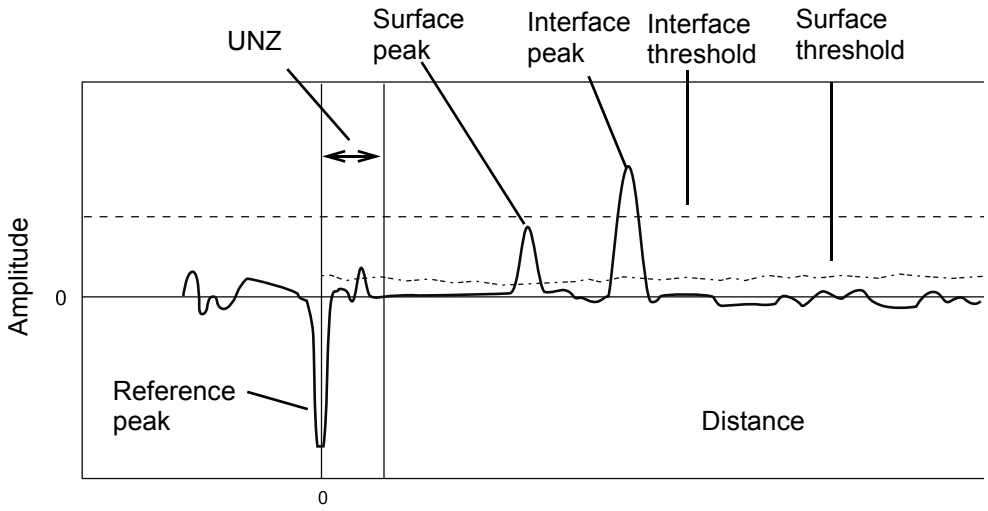


Step 3. Echo-Curve Verification at Operating Conditions

At normal operating conditions, download and review the echo-curve according to the following steps:

1. *Check Reference Pulse amplitude and position*
   Compare the result against the previous plots, taken during cold start-up.
2. *Review peak amplitudes and threshold settings*
   Verify that the surface peak is visible and that the thresholds have been set as described in threshold settings. For information on threshold settings, see “Threshold settings“ on page 7-3.
3. *Store the echo-curve*
   Permanently store the echo-curve for future use, with re-occurring verification procedures.
   The reference pulse can be displayed by adjusting the plot view to show negative values, that is up to -3.3 ft (-1 m) in the plot.

Figure 7-4. Peak amplitudes and threshold settings



Step 4. Transmitter Diagnostics Review

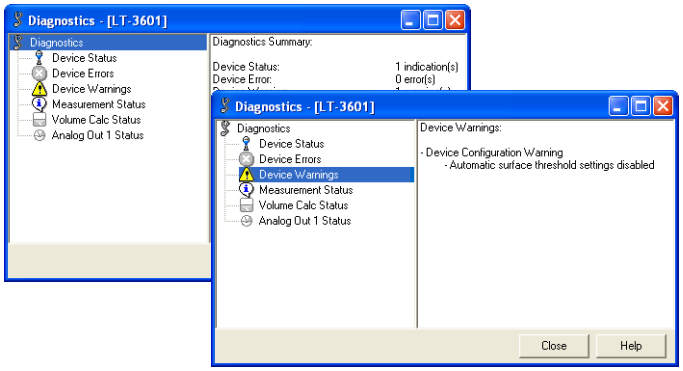
Verify that no Errors or unattended Warnings are present.

For more information, see the Rosemount 5400 Series Reference Manual (Document No. 00809-0100-4026) section “Diagnostic Messages”.

- To view Diagnostics in Rosemount Radar Master:

  Rosemount Radar Master > Tools > Diagnostics

Figure 7-5. The Diagnostics window in Rosemount Radar Master



For more information, see the Rosemount 5400 Series Reference Manual (Document No. 00809-0100-4026) section “Diagnostics”.

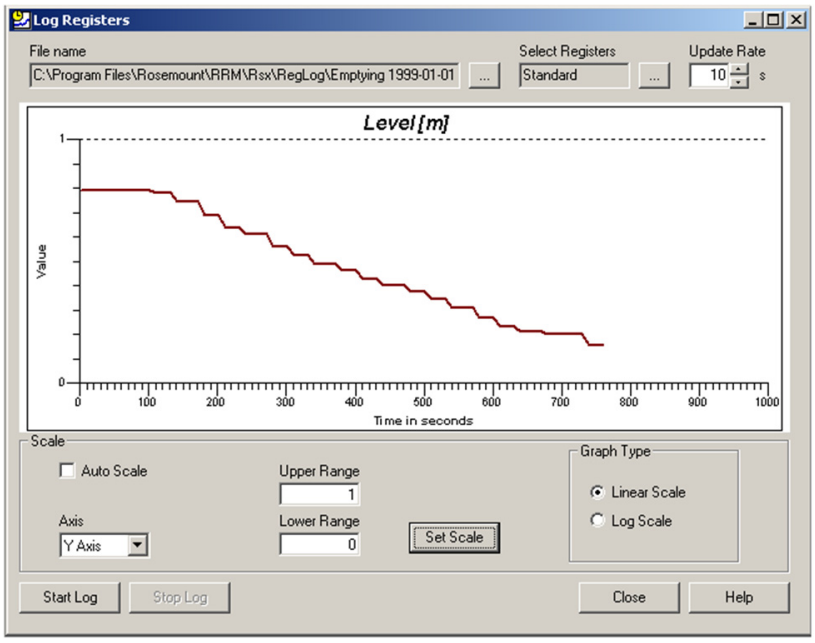
Step 5. Monitor Level while Emptying

During Step 1, the current level reading was verified correct. This step will verify that the transmitter correctly tracks the surface during the emptying of the tank.

Begin by activating log functionality for the transmitter level output. Either the DCS-trend or a stand-alone tool can be used:

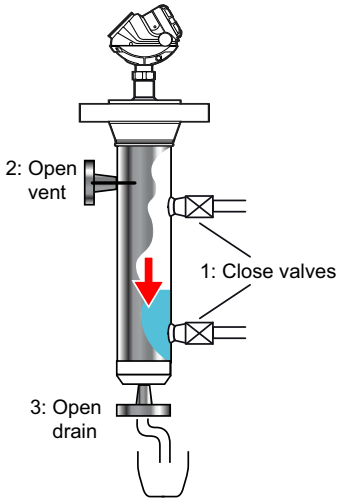
Rosemount Radar Master > Tools > Log

Figure 7-6. Log Registers



Start emptying the tank or chamber making sure not to stop until it is completely empty. With a chamber, do not forget to close the process valves before draining.

Figure 7-7. Emptying a tank or chamber



Finally, review the level trend for accuracy.

Step 6. Echo-Curve Verification with Empty Tank

When the tank or chamber is empty, download and review the echo-curve according to the following steps:

1. *Compare echo-curve with previous plots*
   Compare the echo-curve with previous plots, taken during commissioning. There should be no major differences. Especially make sure to review:
   - the amplitude and position of the reference pulse
   - if all noise is below the threshold

2. *Store the echo-curve*
   Permanently store the echo-curve for future use, with re-occurring verification procedures. Ensure that the reference echo is visible in the plot.

Step 7. Monitor Level while Filling

Repeat Step 5, but fill the tank or chamber instead of emptying it.

Step 8. Archive Files

Save Echo Curve and Config File

Permanently store the echo-curve and configuration back-up files for future use, with re-occurring verification procedures.

In Rosemount Radar Master:

Rosemount Radar Master > Device > Backup Config to file

Rosemount Radar Master > Tools > Echo Curve > Record

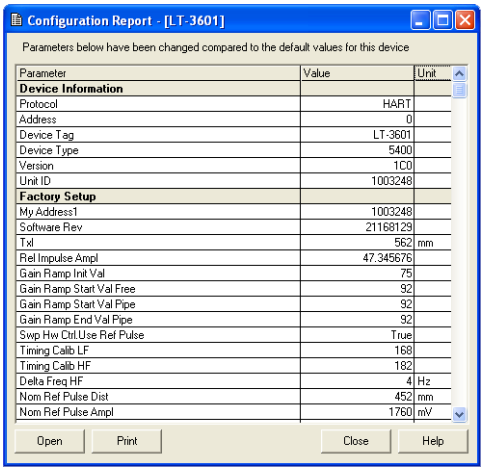


Figure 7-8. The Configuration Report window in Rosemount Radar Master

Appendix A Commissioning Checklist

NOTE
All fields in this form are not applicable to all transmitters.

Plant Information

❑ Completed ❑ Not completed

Plant name:	System No.:	Country:	
Issued by:	Issuing Agent / Company name:		Date:

General Information

❑ Completed ❑ Not completed

Gauge Type:	Serial No.:	Tag /Tank No:
❑ 3300 ❑ 5300 ❑ 5401 ❑ 5402 ❑ 5600		
Model String:		Unit ID (5600):
Start Code:		Software version:
		Display connected:
		❑ YES ❑ NO

Tank Information

❑ Completed ❑ Not completed

Short application description:		
Tank Type:		
❑ Vertical Cylinder ❑ Horizontal Cylinder ❑ Spherical ❑ Cubical ❑ Non-metallic tank		
❑ Open tank ❑ Other:		
Tank Environment:		
❑ Foam	❑ Agitators	❑ Rapid level changes
❑ Solid product	❑ Turbulent surface	❑ Splash loading (filling from top)
❑ Steam / Heavy vapor	❑ Insulated tank walls	❑ Condensation on antenna
❑ Obstacles below antenna (e.g. baffles, pipes, heating coils)		
❑ Emulsion	❑ Interface measurement	
Operating process temperature and pressure range:		
- ºC, or - ºF		- bar, or - psi
Product:		Dielectric constant range:
		❑ < 1.4-1.9 ❑ 1.9-2.5 ❑ 2.5-4 ❑ 4-10
		❑ >11-20 ❑ >20
Product characteristics - please comment:		
Antenna Type:		Pipe Diameter:
R - Tank Reference Height		**G** - Offset Distance
Tank Diameter:		Distance from transmitter to tank wall:
Volume:		
❑ Strapping Table	❑ Ideal Sphere	
❑ Ideal horizontal cylinder	❑ Ideal vertical cylinder	

Mechanical Installation

❑ Completed ❑ Not completed

For more information see the sections:
"Tank Connection with Flange" on page 2-3 (5300),
"Cone antenna with flange" on page 5-3 (5400)
and "Mechanical Installation" in the Reference Manual.

Common

Mounting type:			
❑ Pipe / Chamber ❑ Nozzle ❑ Direct / Bracket			
Nozzle diameter:			
Nozzle height:			
Nozzle orientation (position on tank, angled, vertical, horizontal, etc.):			
Is the still pipe/chamber (when applicable) smooth on the inside and without intruding welds, burrs, etc.?	❑ YES	❑ NO	❑ N/A
Proper cable glands in place?	❑ YES	❑ NO	
Cable glands properly tightened?	❑ YES	❑ NO	
Are the plastic protective plugs removed from all unused cable entries and metal blanking plugs fitted and tightened?	❑ YES	❑ NO	
Transmitter head - antenna/probe connection dry and tightened?	❑ YES	❑ NO	
Gaskets properly in place?	❑ YES	❑ NO	❑ N/A
Visual inspection of the radar installation	❑ YES	❑ NO	
Is the nozzle properly insulated (if applicable e.g. hot product)?	❑ YES	❑ NO	❑ N/A

Non-contacting Radar's unique (5401, 5402, 5600)

Does the antenna extend at least 0.4 in./10 mm below the nozzle?	❑ YES	❑ NO	
Is there any disturbing object(s) below the radar?	❑ YES	❑ NO	
If still pipe: Is inner diameter consistent, pipe smooth on the inside and free from gaps? Deposits and similar slots should be less than 0.4 in./10 mm in diameter.	❑ YES	❑ NO	❑ N/A
If ball valve: Is it of full bore/port type?	❑ YES	❑ NO	❑ N/A

Guided Wave Radar's unique (3300, 5300)

Probe clearance to wall/disturbing object(s) OK?	❑ YES	❑ NO	
Probe end anchored/grounded?	❑ YES	❑ NO	
Nozzle size within stated limits?	❑ YES	❑ NO	
If DVC: DVC conditions fulfilled?	❑ YES	❑ NO	❑ N/A

Electrical Installation

❑ Completed ❑ Not completed

For more information see the sections:
"Connect The Wiring" on page 2-6 (5300),
"It is recommended that shielded twisted pair wiring (18-12 AWG) that is suitable for the supply voltage and approved for use in hazardous areas be used. For electrical information such as power supply, see diagrams and drawings for HART®, FOUNDATION™ fieldbus, and Modbus on the following pages." on page 5-6 (5400)
and section "Electrical Installation" in the Reference Manual.

Power supply within limits	❑ YES ❑ NO
- Voltage measured at the terminal at the transmitter:	
Groundings according to manual and to local regulations	❑ YES ❑ NO
Ground check done with multimeter	❑ YES ❑ NO
- Voltage measured between - terminal and ground:	
- Voltage measured between + terminal and ground:	
- Resistance measured between transmitter head external ground terminal and tank ground terminal:	
Is the cable shield connected according to guidelines in the Reference Manual and to local regulations?	❑ YES ❑ NO
Is the transmitter head external ground terminal connected according to guidelines in the Reference Manual and to local regulations?	❑ YES ❑ NO
Type and size of cable used for the communication:	
Is the lid to the terminal compartment properly closed?	❑ YES ❑ NO
Is the product's Ex classification in accordance with requirements?	❑ YES ❑ NO

Output / Input Configuration

❑ Completed ❑ Not completed

For more information see the sections:
"Configure" on page 2-11 (5300),
"Configure" on page 5-10 (5400),
"Complete the Basic Configuration" on page 3-2 (5300),
"Basic Configuration" on page 6-2 (5400)
and section "Configuration/Start-Up" in the Reference Manual.

Primary Output: ❑ 4-20 mA HART ❑ 4-20 mA HART Active (5600) ❑ FOUNDATION Fieldbus ❑ Profibus ❑ Modbus Modbus SW version (33, 53, 5400): Bus address (if used):	
Source:	Alarm action (current):
	❑ High ❑ Freeze ❑ Low ❑ Namur ❑ Other (5600)
Lower Range (4 mA):	Upper Range (20 mA):

Echo Tuning

❑ Completed ❑ Not completed

For more information see the sections:
“Complete the Advanced Configuration” on page 3-5 (5300),
“Verification” on page 3-7 (5300),
“Verification” on page 6-7 (5400),
“Echo-Curve Verification at Operating Conditions” on page 4-6 (5300),
“Echo-Curve Verification at Operating Conditions” on page 7-5 (5400)
and section “Configuration/Start-Up/Echo Tuning” in the Reference Manual.

Configuration tool used:			
❑ RRM/RCT ❑ 375/475 ❑ DD (AMS) ❑ DTM - specify host:			
Software version:			
Firmware version:			
Measure and learn performed?	❑ YES	❑ NO	❑ N/A
Thresholds set at an appropriate level?	❑ YES	❑ NO	
Possible false echoes properly registered (non-contacting only)?	❑ YES	❑ NO	
Trim Near Zone done (guided wave radar only)?	❑ YES	❑ NO	
Probe End Projection properly activated (guided wave radar only)?	❑ YES	❑ NO	❑ N/A
UNZ configured?	❑ YES	❑ NO	❑ N/A
Echo amplitude and Signal-to-Noise Ratio OK?	❑ YES	❑ NO	
Transmitter measurement and data in the expected range?	❑ YES	❑ NO	

Backups and Plots

❑ Completed ❑ Not completed

For more information see the sections:
“Archive Files” on page 3-11 (5300),
“Archive Files” on page 6-10 (5400),
“Archive Files” on page 4-11 (5300) and
“Archive Files” on page 7-8 (5400).

Initial backup taken and enclosed	❑ YES	❑ NO	
Final backup taken and enclosed	❑ YES	❑ NO	
Initial plots taken and enclosed	❑ YES	❑ NO	
Final plots taken and enclosed	❑ YES	❑ NO	
Trends from DCS taken and enclosed	❑ YES	❑ NO	❑ N/A

Additional Comments / Type of Problem

In the need of support with a transmitter, send a commissioning report together with a backup file from the transmitter to your local Emerson Process Management representative.

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Reference Manual
00809-0600-4026, Rev BA
December 2011

Rosemount Process Radar

Standard Terms and Conditions of Sale can be found at www.rosemount.com\terms_of_sale.

Emerson Process Management
Rosemount Measurement
8200 Market Boulevard
Chanhassen MN 55317 USA
Tel (USA) 1 800 999 9307
Tel (International) +1 952 906 8888
Fax +1 952 906 8889

Emerson Process Management
Blegistrasse 23
P.O. Box 1046
CH 6341 Baar
Switzerland
Tel +41 (0) 41 768 6111
Fax + 41 (0) 41 768 6300

Emerson FZE
P.O. Box 17033
Jebel Ali Free Zone
Dubai UAE
Tel +971 4 811 8100
Fax + 971 4 886 5465

Emerson Process Management Asia Pacific Pte Ltd
1 Pandan Crescent
Singapore 128461
Tel +65 6777 8211
Fax +65 6777 0947
Service Support Hotline: +65 6770 8711
Email: Enquiries@AP.EmersonProcess.com

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