Reference Manual
00809-0100-4840, Rev. BA
July 2008

Rosemount 3100 Series

Ultrasonic Liquid Level Transmitters

ROSEMOUNT®

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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, Rosemount Inc. has two toll-free assistance numbers.

Customer Central: 1-800-999-9307(*7:00 a.m. to 7:00 p.m. CST)*
Technical support, quoting, and order-related questions.

North American Response Center:

Equipment service needs.

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

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

⚠CAUTION

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

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

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

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

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Section 1 Introduction

SAFETY MESSAGES

Procedures and instructions in this manual may require special precautions to ensure the safety of the personnel performing the operations. Information that raises potential safety issues is indicated by a warning symbol (⚠). Refer to the 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-recognized parts may jeopardize safety. Repair, e.g. substitution of components etc., may also jeopardize safety and is under no circumstances allowed.

MANUAL OVERVIEW

This manual provides installation, configuration and maintenance information for the Rosemount 3100 Series ultrasonic level transmitters.

Section 2: Transmitter Overview

Section 3: Installation

Section 4: Starting Up

Section 5: Service and Troubleshooting

Appendix A: Reference Data

Appendix B: Product Certifications

Appendix C: Integrated Display Menus

Appendix D: Rosemount 3490 Series

Appendix E: HART Communicator

Appendix F: Parameters accessed over HART Communications

SERVICE SUPPORT

To expedite the return process outside of the United States, contact the nearest Emerson Process Management representative.

Within the United States, call the Emerson Process Management Instrument and Valves Response Center using the toll-free number 1-800-654-RSMT (7768). This center, available 24 hours a day, will assist you with any needed information or materials.

The center will ask for product model and serial numbers, and will provide a Return Material Authorization (RMA) number. The center will also ask for the process material to which the product was last exposed.

Emerson Process Management Instrument and Valves Response Center representatives will explain the additional information and procedures necessary to return goods exposed to hazardous substance can avoid injury if they are informed of and understand the hazard. If the product being returned was exposed to a hazardous substance as defined by OSHA, a copy of the required Material Safety Data Sheet (MSDS) for each hazardous substance identified must be included with the returned goods.

Section 2 Transmitter Overview

THEORY OF OPERATION

The Rosemount 3100 Series transmitter is designed to be mounted above a liquid, and uses ultrasonic pulses to continuously measure the distance to the surface of the liquid. The microprocessor-controlled electronics calculates distance to the liquid level from the time delay between the transmitting and receiving of the signals (Figure 2-1).

When programmed with the bottom reference of the application – usually the bottom of a tank – The Rosemount 3101 will compute the liquid depth (level), and output a 4–20 mA signal proportional to that level.

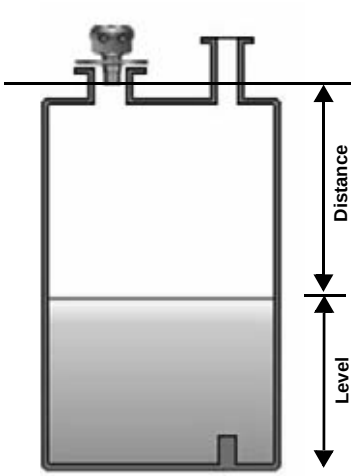
The Rosemount 3102 and Rosemount 3105 can compute level, distance-to-surface, volume, or flow, and output a 4–20 mA signal proportional to the selected variable.

An LCD inside the enclosure displays the selected measurement.

Programming is achieved using integral push buttons inside the enclosure, or by remote communication using HART® (on The 3102 and The 3105 only).

The 3105 may be mounted in a hazardous area if powered from a protected power supply.

Figure 2-1. Typical Application Using a Rosemount 3100 Series Transmitter

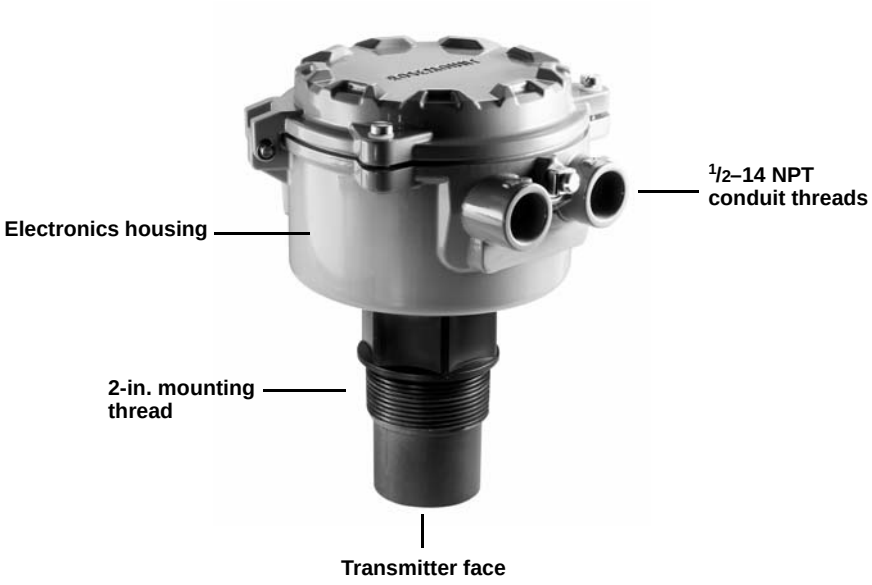


COMPONENTS OF THE TRANSMITTER

The Rosemount 3100 Series transmitter has a *housing* containing advanced electronics for signal processing, and terminals for connecting the external power supply. The *electronics* produces an ultrasonic signal from the transmitter face.

See “Specifications” on page A-1.

Figure 2-2. The 3100 Series



SYSTEM ARCHITECTURE

The Rosemount 3100 Series is loop-powered which means it uses the same two wires for both power supply and output signal.

The transmitter can be connected to any suitable 24 Vdc power source using two-core, shielded cable.

On The Rosemount 3101, the output is a 4–20 mA analog signal.

On The Rosemount 3102 and Rosemount 3105, the output can be a 4–20 mA analog signal or a digital HART signal.

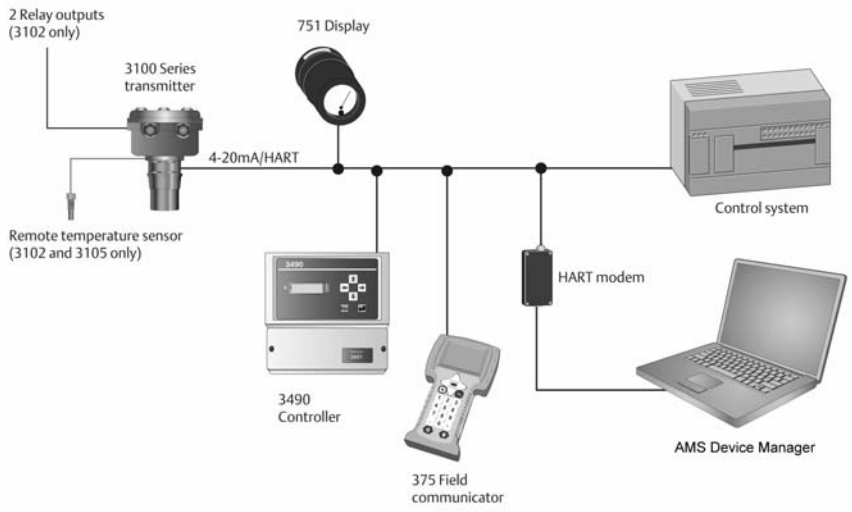
NOTE
It is possible to use the multidrop function with the HART protocol. In this case, communication is restricted to digital since current is fixed to 4 mA.

The transmitter can easily be configured by using a Rosemount 3490 Series Control Unit. Alternatively, a Field Communicator, or a PC with AMS™ Suite: Intelligence Device Manager software can be used to configure the transmitter.

The transmitter can be connected to a Rosemount 751 Field Signal Indicator.

A comprehensive specification for the Rosemount 3100 Series is in the section “Specifications” on page A-1.

Figure 2-3. System Architecture



Section 3 Installation

SAFETY MESSAGES

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

⚠WARNING

Explosions could result in death or serious injury:

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

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

Do not remove the housing 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.

⚠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 3100 Series transmitter is off and the lines to any other external power source are disconnected or not powered while wiring.

BEFORE YOU INSTALL

It is important to position the transmitter for reliable ultrasonic level measurement. The transmitter may be site-tuned to deal with most application conditions, but it is recommended that the following guidelines be adopted wherever relevant.

NOTE:
The Rosemount 3100 Series is designed to be mounted in a *non-metallic fitting* or *flange*. **The use of metallic fittings/flanges is not recommended.** Please see “Accessories for The Rosemount 3101/3102/3105“ on page A-9.

General Considerations

Guidelines:

a) Installation must be carried out by suitably trained personnel in accordance with the applicable code of practice.

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

   Aggressive Substances are acidic liquids or gases that may attack metals or solvents that may affect polymeric materials.

   Suitable Precautions are regular checks as part of routine inspections, or establishing, from the material's datasheet, that it is resistant to specific chemicals.

c) The equipment should only be cleaned with a damp cloth; do not use solvents.

d) The equipment is not intended to be repaired by the user and is to be replaced by an equivalent certified unit. Repairs should only be carried out by the manufacturer or approved repairer.

e) The transmitter is *Double Insulated*, and therefore Protective Earthing is not required. Internal and external earth terminals are provided on equipment with metal housings for Functional Earthing only.

f) To maintain protection against the possible spread of fire, the supply to the equipment must be limited to 3.75 Amps by a fuse or other means.

g) Note that if the equipment is used in a manner not specified by the manufacturer, the protection afforded by the equipment may be impaired.

h) This transmitter is classified Type A in accordance with the European EMC directive 2004/108/EC. To ensure electro-magnetic compatibility, in any member state, it should not be installed in a residential area.

NOTE:
It is not advisable to mount the transmitter in close proximity to a source of electrical noise such as a variable-speed drive, or other high-powered electrical device.

MECHANICAL INSTALLATION

Mounting Considerations

Guidelines:

a) The transmitter should be mounted above the liquid surface using the 2-inch thread provided.
(See “Mounting the Transmitter Above the Liquid Surface“ on page 3-5.)
(See “Accessories for The Rosemount 3101/3102/3105“ on page A-9.)

b) The transmitter should be mounted as near vertical as possible to ensure a *good echo* from the liquid surface and *maximum echo size* received. The beam angle (to the half-power-point) of the transmitter is 12 degrees inclusive.

c) Obstructions in the tank, or well, may generate echoes which can be confused with the real liquid surface echo. Obstructions within the beam angle generate strong false echoes. Wherever possible, the transmitter should be positioned to avoid false echoes.

d) To avoid detecting unwanted objects in the tank or well, it is advisable to maintain a distance of at least 1.3 in. from the center line of the transmitter for every foot (11 cm per meter) range to the obstruction.
(See Figure 3-1 on page 3-4.)

e) If the transmitter is located near the side of the tank or well, there will be no false echo generated if the wall is smooth and free of protrusions, but there will still be a reduction in the echo size. To avoid large echo size loss, it is recommended that the transmitter not be mounted closer than 12 in. (0,3 m) to the wall.

f) Fatty, dirty, or viscous liquids can cause a “scum line” to build-up on the tank or well wall. Avoid false echoes by enabling the “scum line prevention” software feature in a Rosemount 3490 Series Control Unit.

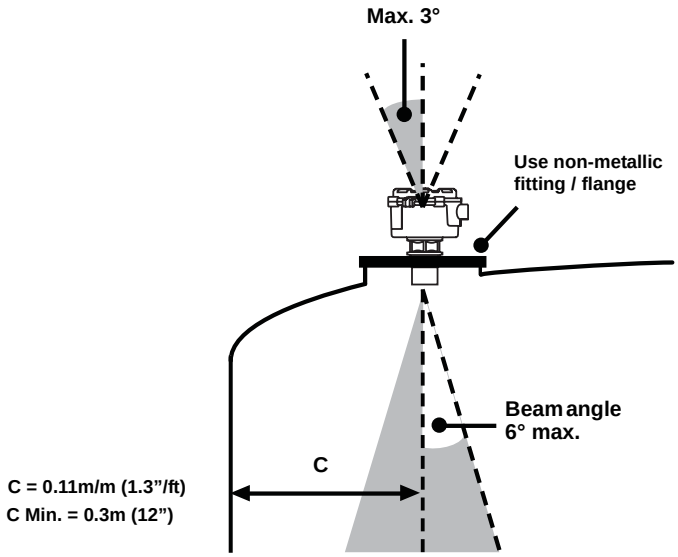
g) If the transmitter is mounted in an enclosed tank, avoid mounting the transmitter in the center of the tank roof because this could act as a parabolic reflector and create unwanted echoes. Avoid applications where heavy condensation could form on the transmitter face.

h) If the transmitter is mounted in a stand-off or nozzle, the transmitter face should protrude be at least 0.2 in. (5 mm) into the tank. If this is not possible, see “Mounting the Transmitter Above the Liquid Surface“ on page 3-5.

i) If the transmitter is used in environments where direct sunlight can cause very high surface temperatures on exposed instruments, a sun-shade is recommended.

j) The transmitter will not detect any liquid surface closer than 12 in. (0,3 m) to the transmitter face.

Figure 3-1. Min and max distances from vessel wall



Liquid Surface Conditions

Guidelines:

a) Foaming liquids can reduce the size of the returned echo because foam is a poor ultrasonic reflector. Mount an ultrasonic transmitter over an area of clear liquid, such as near the inlet to a tank or well. In extreme conditions, or where this is not possible, the transmitter may be mounted in a vented stilling tube provided that the inside measurement of the stilling tube is at least 4 in. (100 mm) and is smooth and free from joints or protrusions. It is important that the bottom of the stilling tube stays covered to prevent the ingress of foams.

b) Avoid mounting the transmitter directly over any inlet stream.

c) Liquid surface turbulence is not normally a problem unless it is excessive. The effects of turbulence are minor, but excessive turbulence can be dealt with by fine-tuning the transmitter on site, if necessary.

In-tank Effects

Guidelines:

a) Stirrers or agitators can cause a vortex. Mount the transmitter off-center of any vortex to maximize the return echo.

b) If stirrer blades become uncovered, they create echoes as they pass through the ultrasonic beam. The transmitter can learn to ignore these *false echoes* (see “Learn About Echoes From False Targets (The 3102/3105)“ on page 5-12.

c) In non-linear tanks with rounded or conical bottoms, mount the transmitter off-center. If needed, a perforated reflector plate can be installed on the tank bottom directly under the transmitter center line to ensure a satisfactory return echo.

d) Avoid mounting the transmitter directly above pumps because the transmitter will detect the pump casing as the liquid falls away. If this is not possible, fine-tuning of the transmitter on site may be required.

Mounting the Transmitter Above the Liquid Surface

A 2-in. thread is provided to mount the transmitter. The thread form is either **2-in. BSPT** or **2-in. NPT**, and is *clearly marked* on the hexagon of the transmitter body.

NOTE:
The Rosemount 3100 Series is designed to be mounted in a *non-metallic fitting* or *flange*. **The use of metallic fittings/flanges is not recommended.**

To help installation, flange accessories and bracket kits are available from Emerson Process Management. See “Accessories for The Rosemount 3101/3102/3105“ on page A-9.

Procedure:

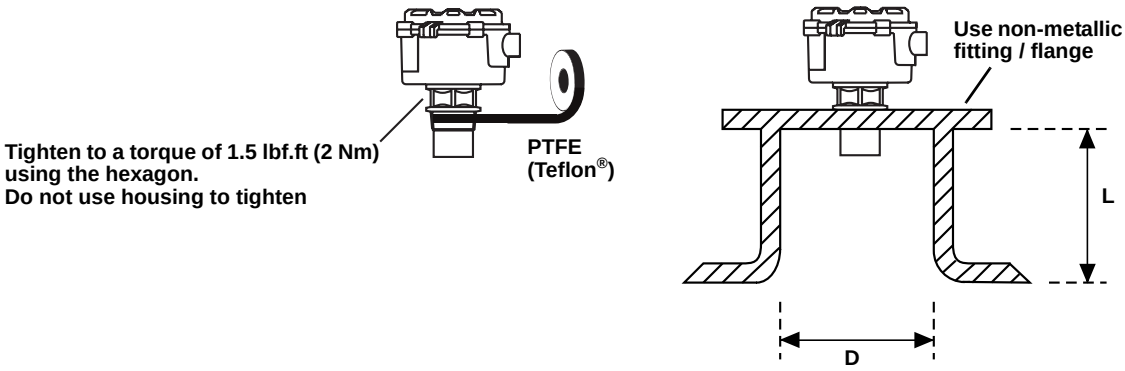
1. Ensure that the transmitter is *perpendicular* to the liquid surface to maximize the return echo size.
2. Check that the *maximum liquid level* will not enter the 12-in. (0,3-m) blanking zone of the transmitter.
3. When installing on a vessel with a nozzle or stand-off (Figure 3-2 on page 3-6):
   a) Use PTFE tape on the screw thread (Figure 3-2 on page 3-6).
   b) Lower transmitter into the tank through the process connection.
   c) Turn the transmitter until it is properly secured in the process connection (Figure 3-2 on page 3-6).
   d) Tighten to a torque of 1.5 lbf.ft (2 Nm) using the hexagon. *Do not use the transmitter housing to tighten.*

NOTE:
If the transmitter face does not protrude into the vessel, note the dimensions in Table 3-1 for Figure 3-2, and ensure that the nozzle/vessel weld is smooth and free from internal weld beads or other projections.

4. When installing using a bracket kit (Figure 3-3 on page 3-6):
   a) Attach bracket to the disc using the 3 screws provided.
   b) Attach bracket and disc to a support. The combined weight of bracket and disc is 16 oz (0,5 kg). For transmitter weight, see “Specifications“ on page A-1.
   c) Use PTFE tape on the screw thread of the transmitter (Figure 3-2 on page 3-6).
   d) Insert the transmitter into the disc.
   e) Tighten to a torque of 1.5 lbf.ft (2 Nm) using the hexagon. *Do not use the transmitter housing to tighten.*

NOTE:
The bracket kit contains a stainless steel angle bracket and PVC threaded disc, which may be used to mount the transmitter on a support over the liquid surface. The bracket and disc dimensions are in Figure A-2 on page A-5.

Figure 3-2.
Mounting the Rosemount 3100 Series Using a Nozzle/Stand-off

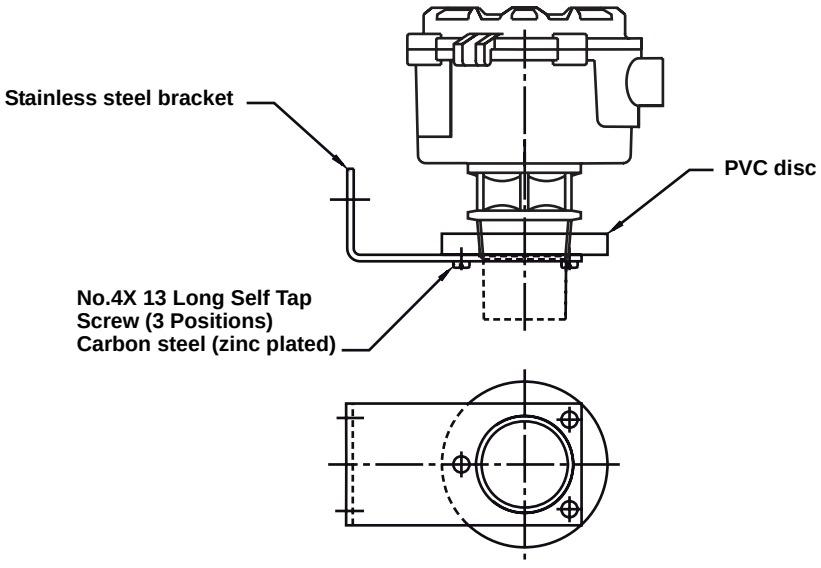


NOTE:
If the transmitter face does not protrude into the vessel, note the dimensions in Table 3-1 for Figure 3-2, and always ensure that the nozzle/vessel weld is smooth and free from internal weld beads or other projections.

Table 3-1. Nozzle Diameter Size (D) and Max Length (L)

Nozzle Diameter Size (D)	Maximum Nozzle Length (L)
DN50 (2 in.)	3/4 in, (18 mm)
DN80 (3 in.)	4 in. (100 mm)
DN100 (4 in.)	4 in. (100 mm)
DN125 (5 in.)	8 in. (200 mm)
≥DN150 (6 in.)	14 in. (350 mm)

Figure 3-3.
Mounting the Rosemount 3100 Series Using a Bracket Kit



Note: Combined weight of bracket and disc is 16 oz (0,5 kg)

Open Channel Flow Installations (The 3102/3105)

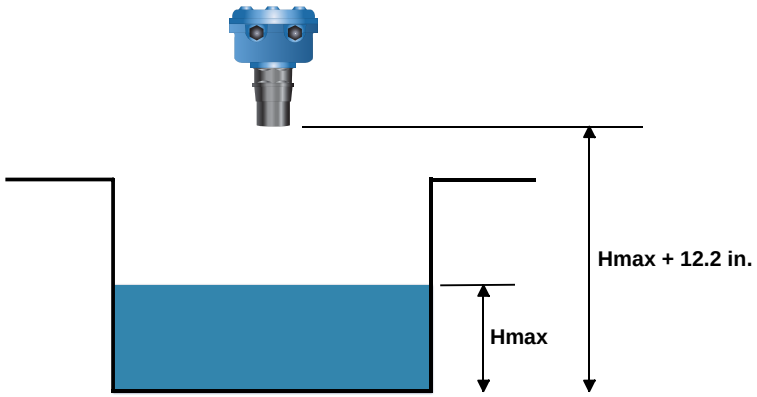
There are normally two distinct parts to an open channel flow measurement system; the primary element (flow structure) and the secondary element (Head measurement instrumentation). For accurate open channel flow measurement, both parts of the system must be installed accurately.

This manual explains some key aspects of the installation of the secondary element, which, in this case, is the ultrasonic transmitter. For full details of the installation of a primary element, such as a flume or weir, reference should be made to the relevant British (BS3680) or International standard.

Positioning of the transmitter is critical and should be the correct distance upstream from the flow structure as stated in BS3680 e.g. a distance of four to five times Hmax for a thin plate weir, or three to four times Hmax for a flume.

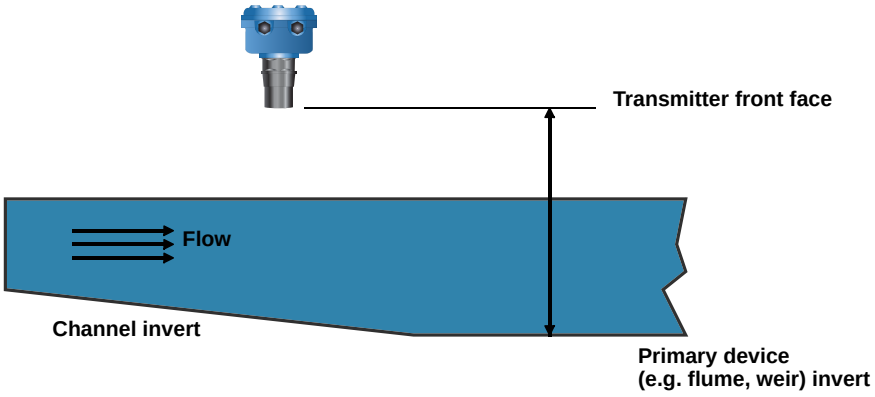
For optimum accuracy, the front face of the transmitter should be positioned at a height that is at least equal to the maximum flow depth plus the blanking distance of the transmitter (see Figure 3-4). **A minimum distance of 12.2 in. (0,31 m) from the flow is recommended.**

Figure 3-4. Choosing the Height Position Above a Flow



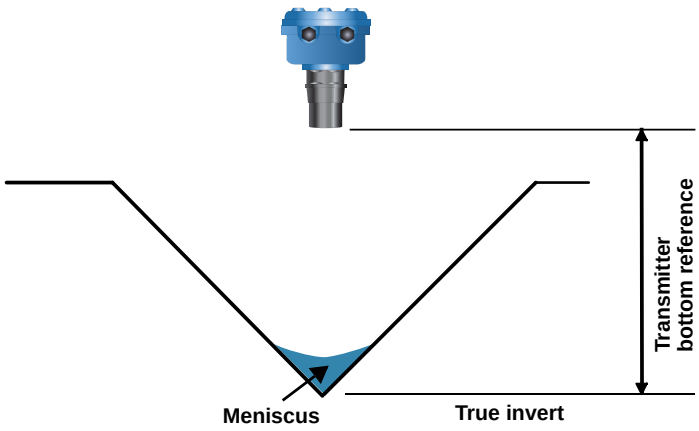
It is important to note that the *bottom reference* of the transmitter should be related to the center of the invert of the primary device (see Figure 3-5), and NOT the distance to the channel bottom directly below the transmitter.

Figure 3-5. Bottom Reference of a Flow Channel



In addition, when setting the bottom reference on a 'V' notch weir it is important that the true invert of the weir is taken (Figure 3-6), and NOT the meniscus liquid level that may be 1/8 in. (3 to 4 mm) above the true invert.

Figure 3-6. Bottom Reference of 'V' Notch Weir



NOTES:

- The liquid surface at the point of measurement must be stable, smooth, and have a uniform approach velocity. It must not be affected by baffles, foam, hydraulic jumps, or other object that may cause flow disruption.
- The primary element should be free from a situation where it is likely to 'drown' (refer to relevant Standard for further information.)
- The Rosemount 3100 Series has integral temperature compensation, and must be protected at all times from direct sunlight and any radiated heat. The Rosemount 3102 and Rosemount 3105 have the option of a Remote Temperature Sensor for temperature compensation (see page 3-14.)
- For maximum accuracy and stability of the level measurement reading, the transmitter should always be protected from direct sunlight.
- If the flow structure permits, mount the transmitter within the flow channel, or in a chamber. (A chamber is also known as a bridle or cage.)

ELECTRICAL INSTALLATION

Connecting the Transmitter

The Rosemount 3100 Series is a two-wire loop-powered transmitter accepting power supplies as follows:

- The 3101: 12 to 30 Vdc
- The 3102: 12 to 40 Vdc
- The 3105: 12 to 40 Vdc (non-hazardous), 12 to 30 Vdc (hazardous).

NOTE:
To comply with the CSA approval, The 3101 and The 3102 must be powered from a Rosemount 3490 Series Control Unit, or a class 2 or SELV source.

Each transmitter is supplied with two cable entries. A suitable conduit system or cable gland must be used to maintain the weather-proof rating and hazardous area protection. Any unused entry must be sealed with a suitably rated blanking plug.

To connect the transmitter:

1. Make sure that the power supply is disconnected.
2. Remove the cover of the transmitter housing.
3. Pull the cable through the cable gland/conduit.
4. Connect the cable wires:
   a) For The Rosemount 3101, connect wires according to the section “Wiring for The Rosemount 3101“ on page 3-10.
   b) For The Rosemount 3102, connect wires according to the section “Wiring for The Rosemount 3102“ on page 3-11.
   c) For The Rosemount 3105, connect wires according to the section “Wiring for The Rosemount 3105“ on page 3-12.
5. Make sure that the transmitter housing is grounded.
6. Replace the cover, tighten the cable gland, and connect the power supply.

After Completing the Wiring

To maintain the weather-proof rating and hazardous area protection of the transmitter, ensure all cable glands, blanking plugs, and seals are in good condition.

Check that the cover seal is in good condition, and not twisted or misaligned in the seal location groove. When replacing the cover, tighten the three cover screws evenly to exert uniform pressure on the cover seal.

Wiring for The Rosemount 3101

The Rosemount 3101 is not intrinsically safe, and is for use in non-hazardous (Ordinary Location) installations only.

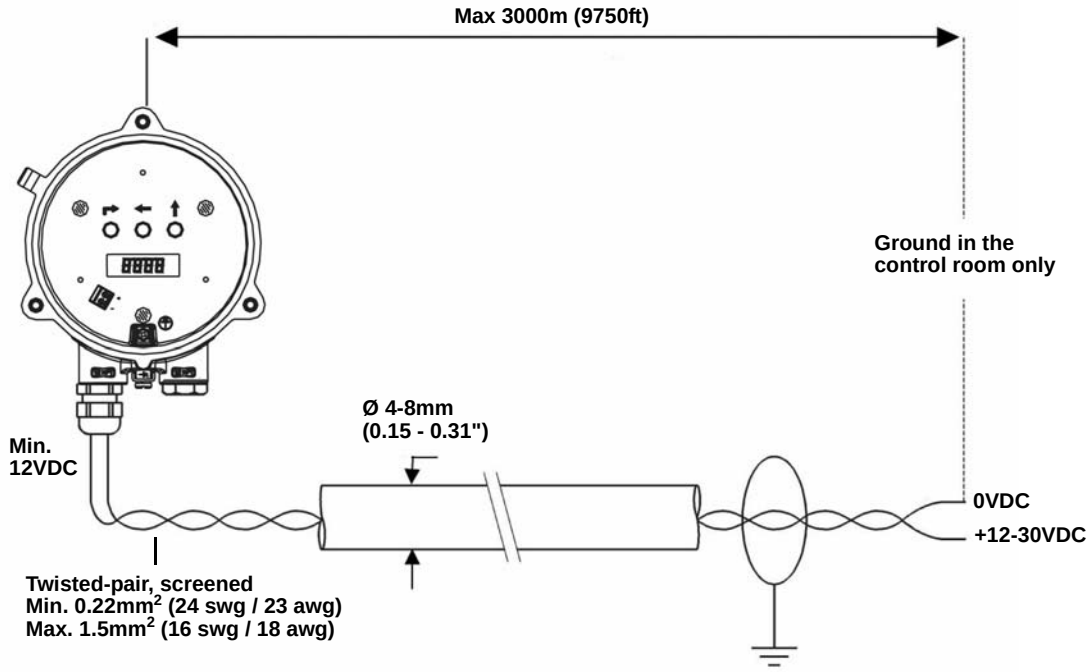
Wire the transmitter as shown in Figure 3-7.

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

Table 3-2.
Connections for The 3101

Connections	
Terminal 1	24 Vdc
Terminal 2	0 Vdc
Earth Screen	Connect to ground (earth) in the control room.

Figure 3-7. Wiring diagram for The Rosemount 3101.



Wiring for The Rosemount 3102

The Rosemount 3102 is not intrinsically safe, and is for use in non-hazardous (Ordinary Location) installations only.

Wire the transmitter as shown in Figure 3-8.

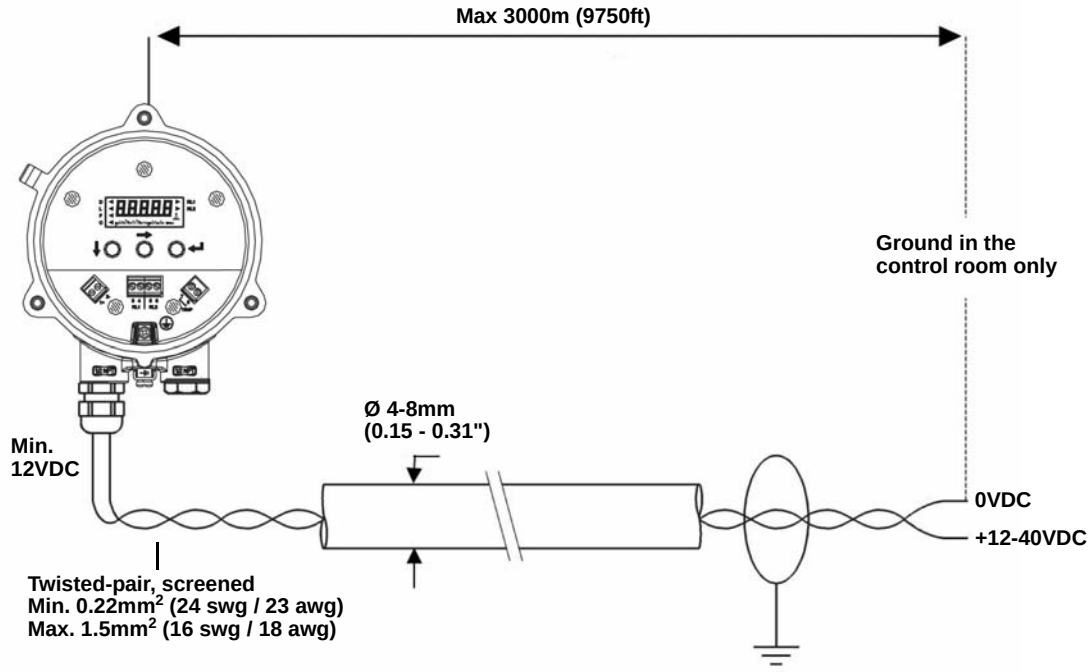
If HART® digital communications is required, see “Wiring to Allow HART® Communication“ on page 3-14

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

Table 3-3.
Connections to The 3102

Connections	
Terminal 1	24 Vdc
Terminal 2	0 Vdc
Terminal 3	RL1 (SPST) - see page 3-11,
Terminal 4	RL1 (SPST) - see page 3-11,
Terminal 5	RL2 (SPST) - see page 3-11,
Terminal 6	RL2 (SPST) - see page 3-11,
Terminal 7	Remote temperature sensor (if used) - see page 3-14,
Terminal 8	Remote temperature sensor (if used) - see page 3-14,
Earth Screen	Connect to a ground (earth) in the control room.

Figure 3-8. Wiring for The 3102



Relays

The 3102 has two integral relays which may be used for fault indication (default) or control purposes. These relays are for *light duty* and should be used as signal relays only, with control functions being performed by external control relays.

Relay number 2 is defaulted as a 'fault' relay - normally energized - but may be re-configured on-site as a set-point relay if required.

Relay status indicators are on the LCD inside the housing (see “Display and Push-buttons“ on page 4-2.)

Wiring for The Rosemount 3105

The Rosemount 3105 is for intrinsically safe installations. See Appendix B for the safety approvals and control drawings for the Rosemount 3100 Series.

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

If HART® digital communications is required, see “Wiring to Allow HART® Communication“ on page 3-14.

NOTE!
Make sure that the instruments in the loop are installed according to intrinsically-safe field wiring practices and control drawings, when applicable.

Installation In a Non-hazardous Area

For non-hazardous (Ordinary Location) installations, wire the transmitter as shown in Figure 3-9.

Installation In a Hazardous Area

When The 3105 is used with a Rosemount 3490 Series Control Unit, NO additional safety barriers are required as the output from the control unit is Intrinsically Safe. In this case, wire the transmitter as shown in Figure 3-9.

If powering the transmitter from any other power supply, ensure a suitable Intrinsically Safe barrier is fitted in the non-hazardous (safe) area.

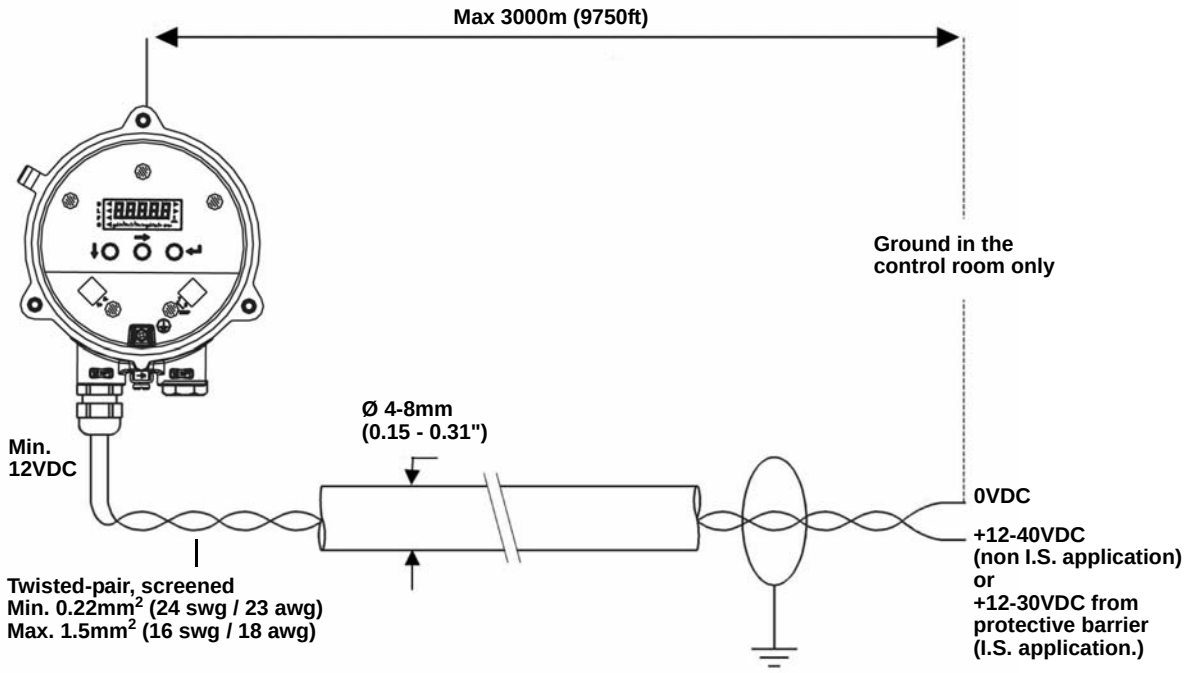
The barrier must be chosen such that its output parameters Uo, Io and Po are less than Ui, Ii and Pi of the transmitter (see Appendix B).

In addition, the sum of the capacitance and the inductance of the transmitter and the connecting cable fitted must not exceed the maximum specified for the barrier chosen.

Table 3-4.
Connections for The 3105

Connections	
Terminal 1	24 Vdc
Terminal 2	0 Vdc
Terminal 7	Remote temperature sensor (if used) - see page 3-14
Terminal 8	Remote temperature sensor (if used) - see page 3-14
Earth Screen	Connect to a ground (earth) in the control room.

Figure 3-9. Wiring Diagram for the Rosemount 3105.



Remote Temperature Sensor

The Rosemount 3102 and Rosemount 3105 accept input from a remote temperature sensor (see “Accessories for The Rosemount 3101/3102/3105“ on page A-9.)

This is a thermistor-based temperature sensor designed for use with The 3102 and The 3105. When connected to the transmitter, the remote temperature sensor may be installed in a hazardous area without the need for any additional protection / barriers.

NOTE:
Avoid connecting any other temperature sensor to The 3102 and The 3105. Full installation instructions are supplied with the temperature sensor, but it should be mounted out of direct sunlight in a position so that it can give a representative reading of the air temperature between the liquid surface and the transmitter.

Wiring to Allow HART® Communication

If HART communications (available on The 3102 and The 3105) is required, a 250 Ohm, 0.25 W load resistor must be installed in the loop.

NOTE:
When the transmitter is used with a Rosemount 3490 Series Control Unit, there is no need to install an external load resistor in the loop because a suitable resistor is built in to the control unit.

If the transmitter is being supplied through a safety barrier, ensure the type chosen will pass HART® information.

After the load resistor is installed, a 375 Field Communicator can be connected across the load resistor, or across the loop at any point downstream of the load resistor.

NOTE!
Make sure that the instruments in the loop are installed according to intrinsically-safe field wiring practices and control drawings, when applicable.

Lightning / Surge Protection and Other Loop Devices

Loop-powered or separately powered devices can be included in the two-wire loop if the transmitter receives a minimum voltage of 12 Vdc at 21 mA loop current.

If the area is prone to lightning strikes or voltage surges, a suppressor device should be installed between the transmitter and the control unit.

Section 4 Starting up

SAFETY MESSAGES

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

⚠WARNING

Explosions could result in death or serious injury:

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

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

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

⚠WARNING

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

Make sure only qualified personnel perform the installation.

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

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

OVERVIEW

Rosemount 3100 Series liquid level transmitters are operated from a menu of parameters, each held in a specific memory location within the transmitter. The memory locations may be pictured as a matrix, and navigated for programming the instrument using ↓ and → steps.

The Integral Display Menu structure is shown in Appendix C.

The transmitter is pre-programmed at the factory with a value in each parameter location so that when the power is first applied, the transmitter gives a sensible reading. Default values are listed in Appendix D.

The Rosemount 3102 and Rosemount 3105 are HART-enabled, allowing remote communications with the instrument. The transmitter can be programmed using a suitable HART-compatible master, or locally using the push-buttons provided inside the transmitter.

This section details the local programming. Refer to Appendix D or Appendix E for details of HART communications.

Display and Push-buttons

The integral display allows up to five characters. In **running mode**, the **Primary Value (PV)** measurement is displayed. In **programming mode**, data is displayed to assist with programming.

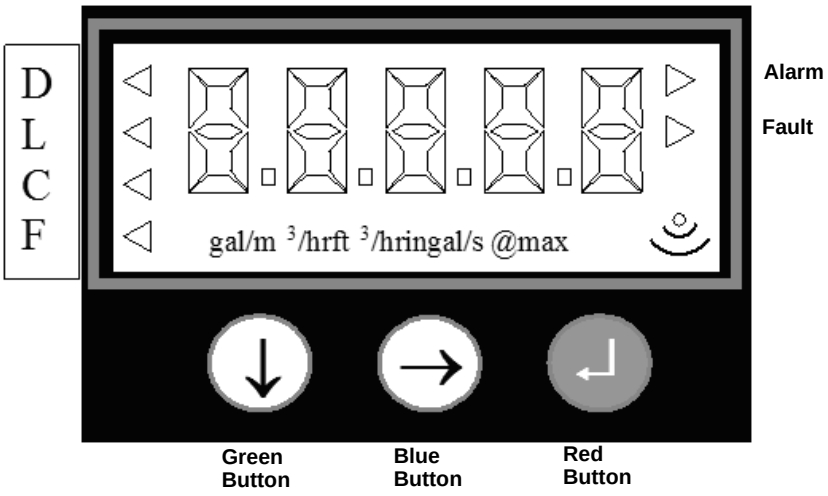
To the left of the main display are **four arrow icons**; one will be illuminated to indicate the selected duty.

To the right of the PV display on The Rosemount 3102 are **two arrow icons** that indicate the status of the transmitter relays. When illuminated, they indicate the relay contact is closed.

Under the PV display is a **text string** indicating the units of measurement. The transmitter will illuminate only those characters applicable to the units of measurement chosen.

To the right of the text string is an **echo received icon**. It is made up of three arc segments that continuously indicate the strength of the echo received (minimum, average, and good).

Figure 4-1.
Display and Push-buttons



Power Up

When the power is turned on, the transmitter takes several seconds to initialize. The display will run a set-up routine, first illuminating all display characters, and then showing the software revision number. Finally, a full set of zeros is displayed while the microprocessor identifies the correct return echo. After these checks are complete, the display indicates the live measurement based upon the factory default values in memory.

On a new instrument aimed at a good target, the transmitter calculates a level reading based upon the default value for the bottom reference.

The duty icon against the letter **L** on the top plate, and the **RL2** icon on The Rosemount 3102, will be illuminated. The **RL1** icon on The 3102 may be illuminated, depending on the level calculated by the transmitter at this time.

The transmitter is now ready to be set-up with details of the application.

The transmitter may be programmed prior to, or after, installation. All programmed data is retained in the transmitter memory after the power is turned off.

Before Programming

Important notes to help you program the transmitter:

a) Do not allow rain, or water, to enter the transmitter during programming or the circuit boards may be damaged.

b) See the instructions below on how to use the push-buttons to navigate through the programming menu and select or enter application data.

c) Push the buttons firmly, but not too hard, to avoid damaging the circuit boards. Also, to avoid entering incorrect data, do not push the buttons too fast.

d) Holding down the green button ↓ scrolls through any option list.

e) Pressing the red button ↵ at any time will return you to the previous level in the menu.

f) If the red button ↵ is pressed after new data has been entered, the new data will automatically be saved.

g) The transmitter has a “re-set default values” routine that reloads the transmitter memory with the factory default values. This will clear the memory of any previous data entered on site.

PROGRAMMING THE ROSEMOUNT 3101

Refer the Integral Display menu on a card tucked between the housing and body, and in Appendix C.

Display Units (The 3101)

The display units are indicated by the position of the decimal point in the displayed PV value:

Units	Display
m	8.000
ft.	26.24
in.	314.9

Default values are as follows:

3101****SC**: **m**

3101****RC**: **ft.**

NOTE:
See Figure C-1 on page C-2 for a map of the programming menu structure showing how to access all the menu options and return to the PV display.

To change the display units:

a) Start from the PV display (see the note above.)

b) Hold down the blue button → for 10 seconds, but do not release it yet.

c) The display units will then change according to the following sequence:

   3101****SC**: Metres to Feet, Feet to Inches, and Inches to Metres.
   3101****RC**: Feet to Inches, Inches to Metres, and Metres to Feet.

d) Continue to hold down the blue button → to change to the next display unit in the above sequence after every three seconds.

e) Confirm the display units by releasing the blue button →.

The same units must be used when programming in the bottom reference and the 4 and 20 mA points.

The 4–20 mA output may be set to operate over all or just a part of the total measuring range. There is no limit on the minimum span of the current output, although a span below 4 in. (100 mm) is not recommended.

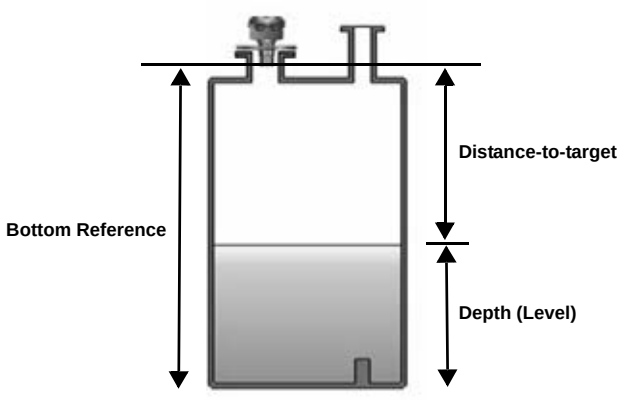
The 4 mA level may be set above or below the 20 mA level to suit the monitoring or control equipment.

NOTE:
The Rosemount 3101 measures and calculates in meters. The display units are derived as a last operation using a pre-programmed conversion factor.

First Measurements (The 3101)

With the transmitter installed and display units selected, the display will show what the instrument calculates as the liquid depth (level). This value is calculated by the microprocessor as being the difference between the distance-to-target being measured and the default value for the datum or bottom reference (**b.rEF**).

Figure 4-2. Bottom Reference



Before changing any of the default values, press the blue button → to change the PV display to indicate **distance-to-target**, as measured by the transmitter from the transmitter face. This value is shown alternately with the text "**diSt**" to indicate the display is in distance mode. The calculation can be checked against a manual measurement if required.

NOTE:
A useful feature at this stage is that the transmitter can be used as an electronic tape measure. With an empty tank or vessel, the transmitter will read the distance to the bottom of the tank. This distance can be noted and later used when setting **b.rEF**.

Press the blue button → again to get to the echo size. This is a scale of 0 to 100. (It is possible to record a value greater than 100). With the display in this mode, the central ":" cursor will flash once for every echo received, which under normal circumstances will be once per second.

NOTE:
It is useful at this point to check that the maximum echo size available is being received. Adjust the position of the instrument until the highest echo size is continually shown. In most applications, the signal strength will vary over a wide range: 20 to 80.

Press the blue button → again to return to the original level reading and start the calibration routine.

NOTE:
The output of the transmitter will vary during programming, as the various default values are changed. The display will automatically revert to the level or distance reading from any other display after a period of four minutes.

Setting the Bottom Reference (The 3101)

Screen display: **b.rEF**

NOTE:
See Figure C-1 on page C-2 for a map of the programming menu structure and how to access all the menu options.

To change the bottom reference (b.rEF) setting:

a) If entering the menu system from the PV display, press the green button ↓ to indicate the "**b.rEF**" menu option (see above note.)

b) Press the blue button → to enter the menu for **b.rEF**. The display indicates the present **b.rEF** value.

c) If this value is correct, press the red button ↵, and then press the green button ↓ to get to the next menu option.

d) Press the blue button → to start editing. The first digit flashes to indicate it can be edited.

e) Press the green button ↓ repeatedly to edit the flashing digit.

f) Press the blue button → to move to the next digit. The digit flashes to indicate it can be edited.

g) Repeat steps (e) and (f) until the last digit is flashing, and edited as required.

h) Press the blue button → to confirm the new **b.rEF** value. None of the digits should now be flashing.

i) If the new value is correct, press the red button ↵ to save. The display changes to the next menu option.

j) If the new value is incorrect, press the blue button → to exit to the menu. The "**b.rEF**" re-appears; re-start at step (b) or press ↓ for the next menu.

Setting 4 mA and 20 mA Levels (The 3101)

Screen display: **4** and **20**

The 4 mA level may be set above, or below, the 20 mA level to suit the monitoring or control equipment.

NOTE:
To set the 4 and 20 mA levels by ranging the transmitter to a fixed target, such as the level in the tank at any particular time, skip these menu options by pressing the green button ↓ twice to get to the next menu option.

NOTE:
See Figure C-1 on page C-2 for a map of the programming menu structure and how to access all the menu options.

To change the 4 mA value:

a) If entering the menu system from the PV display, press the green button ↓ repeatedly until the "**4**" menu option is indicated (see above note.)

b) Press the blue button → to enter the menu for the 4 mA level. The display indicates the present value of the 4 mA level.

c) If this value is correct, press the red button ↵, and then press the green button ↓ to get to the next menu option.

d) Press the blue button → to start editing. The first digit will flash to indicate it can be edited.

e) Press the green button ↓ repeatedly to edit the flashing digit.
f) Press the blue button → to move to the next digit. The digit flashes to indicate it can be edited.
g) Repeat steps (e) and (f) until the last digit is flashing, and edited as required.
h) Press the blue button → to confirm the new 4 mA level. None of the digits should now be flashing.
i) If the new value is correct, press the red button ↵ to save. The display changes to the next menu option.
j) If the new value is incorrect, press the blue button → to exit to the menu. The "**4**" re-appears; re-start at step (b) or press ↓ for the next menu.

NOTE:
See Figure C-1 on page C-2 for a map of the programming menu structure and how to access all the menu options.

To change the 20 mA value:

a) If entering the menu system from the PV display, press the green button ↓ repeatedly until the "**20**" menu option is indicated (see above note.)
b) Press the blue button → to enter the menu for the 20 mA level. The display indicates the present value of the 20 mA level.
c) If this value is correct, press the red button ↵, and then press the green button ↓ to get to the next menu option.
d) Press the blue button → to start editing. The first digit flashes to indicate it can be edited.
e) Press the green button ↓ repeatedly to edit the flashing digit.
f) Press the blue button → to move to the next digit. The digit flashes to indicate it can be edited.
g) Repeat steps (e) and (f) until the last digit is flashing, and edited as required.
h) Press the blue button → to confirm the new 20 mA level. None of the digits should now be flashing.
i) If the new value is correct, press the red button ↵ to save. The display changes to the next menu option.
j) If the new value is incorrect, press the blue button → to exit to the menu. The "**20**" re-appears; re-start at step (b) or press ↓ for the next menu.

Setting the Output Damping (The 3101)

Screen display: **d**

The damping value is a time constant in seconds, and is applied as smoothing to the level reading and the output current. A new value may be entered up to 999 seconds. A larger value will have the effect of smoothing out rapid changes of level, and smooth out the effects of turbulence and ripples on the liquid surface. (It would be unusual to select a value greater than 30 seconds.)

A value of zero may be edited, in which case no smoothing is applied to the Current Output and transmitter readings immediately change the output.

NOTE:
Because The Rosemount 3101 transmits nominally at once per second, a damping time of zero will not necessarily give an immediate response.

NOTE:
See Figure C-1 on page C-2 for a map of the programming menu structure and how to access all the menu options.

To change the output damping:

a) If entering the menu system from the PV display, press the green button ↓ repeatedly until the "**d**" menu option is indicated (see above note.)

b) Press the blue button → to enter the menu "**d**". The display indicates the present damping value.

c) If this value is correct, press the red button ↵ and then the green button to get to the next menu option.

d) Press the blue button → to start editing. The first digit flashes to indicate it can be edited.

e) Press the green button ↓ repeatedly to edit the flashing digit.

f) Press the blue button → to select the next digit. The digit flashes to indicate it can be edited.

g) Repeat steps (e) and (f) until the last digit is flashing, and edited as required.

h) Press the blue button → to confirm the new damping value. None of the digits should now be flashing.

i) If the new value is correct, press the red button ↵ to save. The display changes to the next menu option.

j) If the new value is incorrect, press the blue button → to exit to the menu. The "**d**" re-appears; re-start at step (b) or press ↓ for the next menu.

Selecting the Action on Alarm Condition (The 3101)

Screen display: **AL**

The transmitter signals an alarm condition if the target echo is lost for more than 10 seconds.

There are three options for an alarm condition:

Hi The current on the two-wire loop will increase to 21 mA and remain there until a correct target echo is recovered. The display flashes alternately "**LE**" and the alarm action.

Hold The current will freeze at the value it was last reading and remain there until a correct target echo is recovered. The display flashes alternately "**LE**" and the last valid reading.

Lo The current on the two wire loop will decrease to 3.6 mA and remain there until a correct target echo is recovered. The display flashes alternately "**LE**" and the alarm action.

NOTE:
See Figure C-1 on page C-2 for a map of the programming menu structure and how to access all the menu options.

To change from the default action of **Hold**:

a) If entering the menu system from the PV display, press the green button ↓ repeatedly until the "**AL**" menu option is indicated (see above note.)

b) Press the blue button → to enter the menu "**AL**". The display indicates the present action setting.

c) If this action is correct, press the red button ↵ and then the green button to get to the next menu option.

d) Press the blue button → to start editing. The action flashes to indicate it can be edited.

e) Press the green button ↓ repeatedly to scroll through the actions.

f) Press the blue button → to confirm an action. The flashing then stops.

g) If the new action is correct, press the red button ↵ to save. The display changes to the next menu option.

h) If the new action is incorrect, press the blue button → to exit to the menu. The "**AL**" re-appears; re-start at step (b) or press ↓ for the next menu.

Setting 4 mA and 20 mA Levels Using Ranging (The 3101)

Screen display: **S--4** and **S-20**

This is for setting the 4 mA or 20 mA levels by ranging the instrument to a known target, e.g. the present level in a vessel.

NOTE:
If the 4 and 20 mA levels are programmed as described above, this menu can be skipped. Press the green button ↓ to get to the final menu option, "**Lrn**".

NOTE:
See Figure C-1 on page C-2 for a map of the programming menu structure and how to access all the menu options.

To change the 4 mA level:

a) If entering the menu system from the PV display, press the green button ↓ repeatedly until the "**S--4**" menu option is indicated (see above note.)

b) Ensure the target is the 4 mA level and, with the display indicating that level, press the blue button →.

c) The display indicates the present 4 mA level setting, not the new level reading. If this setting is correct, press the red button ↵ and then the green button to get to the next menu option.

d) Press the blue button → to start editing. The display flashes alternately "**4**" and the new level reading.

e) Press the blue button → to confirm the new level reading is the new 4 mA level.

f) If the new 4 mA level is correct, press the red button ↵ to save. The display changes to the next menu option.

g) If the new 4 mA level is incorrect, press the blue button → to exit to the menu. The menu option "**S--4**" re-appears; re-start at step (b) or press ↓ for the next menu option.

NOTE:
See Figure C-1 on page C-2 for a map of the programming menu structure and how to access all the menu options.

To change the 20 mA level:

a) If entering the menu system from the PV display, press the green button ↓ repeatedly until the "**S-20**" menu option is indicated (see above note.)

b) Ensure the target is the 20 mA level and, with the display indicating that level, press the blue button →.

c) The display indicates the present 20 mA level setting, not the new level reading. If this value is correct, press the red button ↵ and then the green button to get to the next menu option.

d) Press the blue button → to start editing. The display flashes alternately "**20**" and the new level reading.

e) Press the blue button → to confirm the new level reading is the new 20 mA level.

f) If the new 20 mA level is correct, press the red button ↵ to save. The display changes to the next menu option.

g) If the new 20 mA level is incorrect, press the blue button → to exit to the menu. The menu option "**S-20**" re-appears; re-start at step (b) or press ↓ for the next menu option.

Learn About Echoes From False Targets (The 3101)

The Rosemount 3101 has an easy-to-use "**Lrn**" (Learn) routine that allows the instrument to learn up to two false echoes, which can then be ignored in future operations.

If the application is simple and there are no false echoes, press the green button ↓ to exit the integral display menu and return the instrument to indicating the level reading on the display.

After the transmitter is in operational, if an echo other than the true liquid surface echo is detected and an incorrect level reading is indicated, the instrument can learn to ignore this false echo. The "**Lrn**" routine may be used at any time, either during or after setting-up or if a problem occurs later.

NOTE:
See Figure C-1 on page C-2 for a map of the programming menu structure and how to access all the menu options.

To store a false target echo:

a) If entering the menu system from the PV display, press the green button ↓ repeatedly until the "**Lrn**" menu option is indicated (see above note.)

b) Press the blue button → to enter the "**Lrn**" menu. The display indicates "**LrnX**" where "X" (0, 1 or 2) is the number of stored false target echoes.

c) To exit to the menu at this stage, press the red button ↵ and then the green button ↓ to get to the next menu option.

d) To store a new false echo, hold the blue button down → for five seconds.

e) The display alternately flashes "**Lrn**" and the false target position. After four seconds, the false target position is stored and the display re-indicates "**LrnX**".

f) Press the red button ↵ to save this false echo and exit to the menu.

However, if this false echo shouldn't be saved, press the blue button → to exit to the menu.

g) To store another false target echo, re-start from step (b).

h) Press the green button ↓ to exit the menu and return to the PV display.

NOTE:
If there are two false echoes stored ("**Lrn2**"), the transmitter will not allow another echo to be stored until the memory is cleared (see next procedure.)

NOTE:
When a false echo is stored, the transmitter sets up a 'window' around the false target and ignores any echo from that window, unless the echo received from the liquid surface is larger than the stored false echo. There may be no change in the transmitter output current while the liquid level moves through this window, which is equivalent to a distance of 8 in. (20 cm).

NOTE:
See Figure C-1 on page C-2 for a map of the programming menu structure and how to access all the menu options.

To clear all the stored false echoes:

a) If entering the menu system from the PV display, press the green button ↓ repeatedly until the "**`Lrn`**" menu option is indicated (see above note.)
b) Press the blue button → to enter the "**`Lrn`**" menu.
c) With the display indicating "**`LrnX`**", press and hold the green button ↓ for ten seconds to clear the memory. The display then indicates "**`Lrn0`**".
d) Press the red button ↵ to exit to the menu.
e) Press the green button ↓ to exit the menu system and change to the PV display.

Changing to Distance Mode (The 3101)

If the transmitter will be measuring distance instead of level, the display can be changed accordingly. With the PV display indicating the level reading, press the blue button →, and the display will alternate between "**`Dist`**" and the distance-to-target.

NOTE:
The display will continue to alternate between "**`Dist`**" and distance-to-target until the red button ↵ is pressed to resume the level reading PV display.

PROGRAMMING THE 3102 AND THE 3105

Menu structures for this section are in Appendix C (Integrated Display Menus)

NOTE:

If using a HART Master Device for programming The 3102 or The 3105, refer to the following sections for menu structures and parameters:

- Appendix D (Rosemount 3490 Series)
- Appendix E (HART Communicator)
- Appendix F (Parameters accessed over HART Communications)

Overview (The 3102/3105)

Transmitter programming is most easily accomplished by *first* selecting the **duty** that the transmitter is to perform. After a duty is selected (see below), a "mini-wizard" programming assistant is invoked that asks only for information relevant to the selected duty. Entered data allows the mini-wizard to populate relevant parameters with application specific data and select the next step required to configure the transmitter.

NOTE:
It is advised to enter the "**dutY**" menu when programming the transmitter, initiating the mini-wizard to assist with programming.

After programming is complete, the data entered or calculated by the transmitter can be reviewed by going through the menu using the green button ↓. This is a manual navigation of the menus, and all menus are shown regardless of the duty selected; the mini-wizard is only initiated when a duty is selected. Ignore menus that do not relate to your application.

Selecting the Duty (The 3102/3105)

Screen display: **dutY**
Factory default setting: **Level**

The arrow icon on the left side of the PV display indicates the selected duty. The Rosemount 3102 and Rosemount 3105 may be programmed to perform one of four duties:

1. Distance measurement.
2. Level measurement (factory default setting).
3. Flow measurement.
4. Contents (Volume) measurement.

NOTE:
This menu option is in the programming menu. See Figure C-2 on page C-3 for a map of the menu structure and how to access the menu options.

To change the duty:

a) Press the green button ↓ to enter the menu system from the PV display (see the note above.) The display indicates "**dutY**".

b) Press the blue button → to enter the "**dutY**" menu and display the presently selected duty: "**LEVEL**", "**Flo**", "**cont**", or "**diSt**".

c) If the duty is correct, press the red button ↵ and then the green button ↓ to get to the next menu option.

d) Press the blue button → to start the editing mode. The duty flashes to indicate it may now be edited.

e) Press the green button ↓ repeatedly to scroll through the list of duties.
f) Press the blue button → to confirm the duty. The flashing then stops.
g) If the new duty is correct, press the red button ↵ to save. The display will change to the next menu option.
h) If the new duty is incorrect, press the blue button → to exit to the menu. The menu option "**dutY**" re-appears; re-start at step (b) or press ↓ to get to the next menu option.

Selecting the Units of Measurement (The 3102/3105)

Screen display: **unitS**
Factory default setting: **m** (metric) or **ft** (Imperial)

NOTE:

- The factory default units of measurement are dictated by the model part number (see "Ordering Information" on page A-6).
  A Metric unit can be re-configured to be an Imperial unit, or vice-versa, by changing the base units (**b.unit**) of the transmitter. See "Changing the Base Units (The 3102/3105)" on page 5-16.
- **Changing base units after programming the transmitter will cause all programmable data to be overwritten with factory default values.**

The transmitter is pre-programmed with selectable measurement units for each of the duties available:

1. Distance and Level measurement:
   m, **ft**, or **in**
2. Flow measurement:
   l/s, **l/m**, **m^3/hr**, **gal/m**, **m ga**, **ft^3/m (cfm)**, or **ft^3/hr**
3. Contents measurement:
   l, **m^3**, **gal**, or **ft^3**

NOTE:
This menu option is in the programming menu. See Figure C-2 on page C-3 for a map of the menu structure and how to access all the menu options.

To change the measurement units:

a) If entering the menu system from the PV display, press the green button ↓ repeatedly until the "**unitS**" menu option is indicated (see note above.)
b) Press the blue button → to enter the "**unitS**" menu. (The presently selected units are indicated on the bottom display line.)
c) If the units are correct, press the red button ↵ and then the green button ↓ to exit to the next menu option.
d) Press the blue button → to start the editing mode. The present units flash to indicate it may be edited.
e) Press the green button ↓ repeatedly to scroll through the list of units.
f) Press the blue button → to confirm the new units. The flashing stops.
g) If the new units are correct, press the red button ↵ to save and get to the next menu option.
h) If the new units are incorrect, press the blue button → to exit to the menu. The menu option "**unitS**" re-appears; re-start at step (b) or press ↓ to get to the next menu option.

NOTE:

- When using the green button ↓ to scroll through the list of measurement units, allow three seconds after each button press for the transmitter to check and display the selection.

NOTE:

- After changing units, a scaling factor (see page 4-19) needs to be edited to see the correct PV.

Setting the Correct Bottom Reference (The 3102/3105)

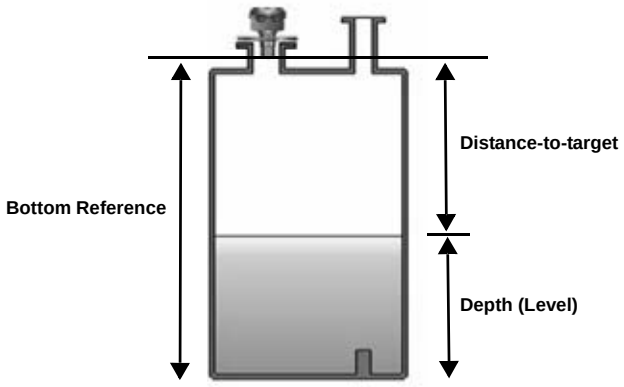
Screen display: **b.rEF**

Factory default value: **11**

The transmitter leaves the factory with the bottom reference pre-programmed to the maximum range of the instrument 36 ft (11 m).

NOTE:
It is important to not enter a value greater than the maximum range of the transmitter, which is 36 ft (11 m).

Figure 4-3. Bottom Reference



NOTE:
This menu option is in the programming menu. See Figure C-2 on page C-3 for a map of the menu structure and how to access the menu options.

To change the bottom reference:

a) If entering the menu system from the PV display, press the green button ↓ repeatedly until the "**b.rEF**" menu option is indicated (see note above.)

b) Press the blue button → to enter the "**b.rEF**" menu and display the present bottom reference (b.rEF) value.

c) If this value is correct, press the red button ↵ and then the green button to get to the next menu option.

d) Press the blue button → to start the editing mode. The first digit flashes to indicate it can now be edited.

e) Press the green button ↓ repeatedly to edit the flashing digit.

f) Press the blue button → to select the next digit. The digit flashes to indicate it can be edited.

g) Repeat steps (e) and (f) until the last digit is flashing, and edited as required.

h) Press the blue button → to confirm the new **b.rEF** value. None of the digits should now be flashing.

i) If the new **b.rEF** value is correct, press the red button ↵ to save. The display will change to the next menu option.

j) If the new value is incorrect, press the blue button → to exit to the menu. The "**b.rEF**" re-appears; re-start at step (b) or press ↓ for the next menu.

NOTE:

- If the saved duty is **Flow** or **Contents**, the next menu option is "**ProF**" (see "Selecting a Profile (The 3102/3105)" on page 4-15).
- If the saved duty is **Level** or **Distance**, the next menu option is "**4**" (see "Setting the 4 mA Point (The 3102/3105)" on page 4-22).

NOTE:
A useful feature at this stage is that the transmitter can be used as an electronic tape measure. With an empty tank or vessel, the transmitter will read the distance to the bottom of the tank. This distance can be noted and later used when setting **b.rEF**.

Selecting a Profile (The 3102/3105)

Screen display: **ProF**

Factory default value: **Lin**

This menu is offered if the selected duty is **Contents (Volume)** or **Flow**, or is shown when manually navigating the menu system - *this section can be ignored if the selected duty is Level or Distance*.

The transmitter is pre-programmed with popular profiles that are mathematical formulas to convert (scale) a **linear level** reading to a **flow** or **volumetric** PV. Once converted (scaled), the 4–20 mA Output and the Integral Display will operate according to the flow or volumetric PV.

The profile options are described in the following sections:

- "Contents (Volume) Measurement" on page 4-15
- "Flow measurement" on page 4-16

Contents (Volume) Measurement

Lin	Linear (factory default setting)
H.CYL.F	Horizontal cylinder on it' side with flat ends
SPH.	Spherical vessel
H.CYL.D	Horizontal cylinder on its side with dished ends

NOTE:
This menu option is in the programming menu. See Figure C-2 on page C-3 for a map of the menu structure and how to access the menu options.

To change the contents profile:

a) If entering the menu system from the PV display, press the green button ↓ repeatedly until the "**ProF**" menu option is indicated (see above note.)

b) Press the blue button → to enter the "**ProF**" menu and display the present profile selection.

c) If the selected profile is correct, press the red button ↵ to exit to the menu. (The menu option "**ProF**" re-appears. To get to the next menu, press ↓.)

d) Press the blue button → to start the editing mode. The selected profile flashes to indicate it can now be edited.

e) Press the green button ↓ repeatedly to scroll through the list of profiles (see above.)

f) Press the blue button → to confirm the new profile. (The flashing stops.)

g) If the new profile is correct, press the red button ↵ to save. The display will change to the next menu option.

h) If the new profile is incorrect, press the blue button → to exit to the menu. The "**ProF**" re-appears; re-start at step (b) or press ↓ for the next menu.

NOTE:

- If the saved profile is "**Lin**", the next menu option is "**SCALE**" (see "K-factor for the Flow Law (The 3102/3105)" on page 4-19).
- If another contents profile is saved, the next menu is "**Cont @ max**" (see "Maximum Contents (Volume) Entry (The 3102/3105)" on page 4-22.)

Flow measurement

Table 4-1 lists the options that select a standard flow structure for the profile and the conversion (scale) factors used to obtain the flow PV.

There are two other profiles:

- SPEC.P Special plotted: this option is only visible when the transmitter is configured using a HART Master (e.g. a Rosemount 3490 Series Control Unit.)
- SPEC.C Special calculated: this option is used when a standard profile is not available from the transmitter's library. A power factor and a K-factor can be edited for an unsupported flow structure, or to allow for imperfections in a standard flow structure. (See Power Factor for the Flow Law (The 3102/3105) and "K-factor for the Flow Law (The 3102/3105)" on page 4-19.)

NOTE:
This menu option is in the programming menu. See Figure C-2 on page C-3 for a map of the menu structure and how to access the menu options.

To change the flow profile:

a) If entering the menu system from the PV display, press the green button ↓ repeatedly until the "**ProF**" menu option is indicated (see above note.)

b) Press the blue button → to enter the "**ProF**" menu and display the present profile selection.

c) If the selected profile is correct, press the red button ↵ to exit to the menu. (The menu option "**ProF**" re-appears. To get to the next menu, press ↓.)

d) Press the blue button → to start the editing mode. The selected profile flashes to indicate it can now be edited.

e) Press the green button ↓ repeatedly to scroll through the list of profiles (see above profile SPEC.C, and Table 4-1 on page 4-18.)

f) Press the blue button → to confirm the new profile. (The flashing stops.)

g) If the new profile is correct, press the red button ↵ to save. The display changes to the next menu option.

h) If the new profile is incorrect, press the blue button → to exit to the menu. The "**ProF**" re-appears; re-start at step (b) or press ↓ for the next menu.

NOTE:

The next menu option will depend upon the flow profile chosen:

- 3/2 or 5/2: the transmitter will automatically calculate the Power factor and only requires the K factor to be entered. (see "K-factor for the Flow Law (The 3102/3105)" on page 4-19.)
- Manning: the next menu option is "**LEUEL @ max**" (see "Maximum Level Entry (The 3102/3105)" on page 4-20.)
- Parshall, FF, or FP: the transmitter will automatically calculate the appropriate Power factor and K factor, and will set the 4 mA point at zero flow and the 20 mA point at maximum flow. (See "Setting the Output Damping (The 3102/3105)" on page 4-24.)

Table 4-1.
Profile options for flow

		Hmax		Scale Factor			20 mA Point [1]	
Options	**Flow Structures**	**Metric (m)**	**Imperial (ft/in.)**	**Metric (m^3/hour)**	**Imperial (GPM[2])**	**Power Factor**	**Metric (m)**	**Imperial (ft/in.)**
3/2	Flume 3/2 flow law	-		(User)	(User)	1.5	(User)	(User)
5/2	V-Notch 5/2 flow law	-		(User)	(User)	2.5	(User)	(User)
mann	Manning formula	-		(User)	(User)	(User)	-	-
PAr01	1 inch Parshall flume	0.75	2.5	217.3	151.7	1.55	17.9	87.3
PAr02	2 inch Parshall flume	0.75	2.5	434.6	303.4	1.55	50.7	215
PAr03	3 inch Parshall flume	0.75	2.5	635.5	445.2	1.547	125	516
PAr06	6 inch Parshall flume	0.75	2.5	1372	924.5	1.58	389	1750
PAr09	9 inch Parshall flume	0.75	2.5	1927	1378	1.53	882	3980
PAr1	1 ft Parshall flume	0.75	2.5	2487	1795	1.522	1610	7240
PAr1.5	1 1/2 ft Parshall flume	0.75	2.5	3803	2693	1.538	2440	11000
PAr2	2 ft Parshall flume	0.75	2.5	5143	3590	1.550	3290	14900
PAr3	3 ft Parshall flume	0.75	2.5	7863	5386	1.566	5010	22600
PAr4	4 ft Parshall flume	0.75	2.5	10630	7181	1.578	6750	30500
PAr5	5 ft Parshall flume	0.75	2.5	13440	8976	1.587	8510	38400
PAr6	6 ft Parshall flume	0.75	2.5	16280	10770	1.595	10300	46400
PAr8	8 ft Parshall flume	0.75	2.5	22010	14360	1.607	13900	62600
PAr10	10 ft Parshall flume	0.75	2.5	84256	17672	1.6	20700	89200
FF01 [3]	Flume Flat 1 (m)	0.102		134.7877		1.5	9	
FF02 [3]	Flume Flat 2 (m)	0.191		178.2664		1.5	36	
FF03 [3]	Flume Flat 3 (m)	0.267		313.4177		1.5	90	
FF04 [3]	Flume Flat 4 (m)	0.406		541.7157		1.5	360	
FF05 [3]	Flume Flat 5 (m)	0.635		811.1058		1.5	900	
FF06 [3]	Flume Flat I	0.200		132.2		1.5	30	
FF07 [3]	Flume Flat II	0.250		177.7		1.5	60	
FF08 [3]	Flume Flat III	0.300		217.58		1.5	90	
FF09 [3]	Flume Flat III bis	0.3333		328.35		1.5	200	
FF10 [3]	Flume Flat III ter	0.400		272.0		1.5	200	
FF11 [3]	Flume Flat IV	0.400		352.1726		1.5	180	
FF12 [3]	Flume Flat V	0.500		442.932		1.5	360	
FF13 [3]	Flume Flat V bis	0.400		400.5		1.5	320	
FF14 [3]	Flume Flat VI	0.540		499.0569		1.5	720	
FF15 [3]	Flume Flat VII	0.700		623.7		1.5	1080	
FF16 [3]	Flume Flat VIII	0.600		881.16		1.5	1440	
FF17 [3]	Flume Flat VIII bis	0.666		798.0		1.5	1500	
FF18 [3]	Flume Flat IX	0.800		1065.186		1.5	1800	
FF19 [3]	Flume Flat IX bis	0.733		814.8		1.5	1700	
FF20 [3]	Flume Flat X	0.867		1322.2761		1.5	3600	
FF21 [3]	Flume Flat X bis	1.200		1609.0		1.5	7500	
FF22 [3]	Flume Flat X ter	0.959		1064.884		1.5	3500	
FF2 3[3]	Flume Flat XI	1.200		1650.99		1.5	7200	
FP01 [3]	Flume Parabolic 1	0.200		15878.5		2.3	20	
FP02 [3]	Flume Parabolic 2	0.250		17591.1		2.3	40	
FP03 [3]	Flume Parabolic 3	0.310		11645.6		2.2	90	
FP04 [3]	Flume Parabolic 4	0.380		13669.5		2.2	180	
FP05 [3]	Flume Parabolic 5	0.460		9802.7		2.1	360	
FP06 [3]	Flume Parabolic 6	0.600		11367.8		2.1	720	
FP07 [3]	Flume Parabolic 7	0.800		12227.7		2.1	1400	

(1) Upper range value if set to AUTO. Lower range value (4 mA) is set to 0.
(2) The gallons are US gallons.
(3) Flume option not available if base units are imperial.

Power Factor for the Flow Law (The 3102/3105)

Screen display: **P.FACt**

Factory default value: **1.000**

This menu is offered if the selected duty is Flow and a profile (e.g. "**SPEC.C**") requires the manual editing of a power factor in the formula:

Flow Q = kh* (where * = the power factor)

The transmitter is pre-programmed with appropriate power factors for many standard flow profiles, and will automatically select the appropriate factor (See Table 4-1 on page 4-18). Alternatively, the power factor may be edited to suit a specific flow structure.

NOTE:
This menu option is in the programming menu. See Figure C-2 on page C-3 for a map of the menu structure and how to access the menu options.

To change the power factor:

a) If entering the menu system from the PV display, press the green button ↓ repeatedly until the "**P.FACt**" menu option is indicated (see note above.)
b) Press the blue button → to enter the "**P.FACt**" menu and display the present power factor.
c) If the power factor is correct, press the red button ↵ to exit to the menu. (The menu option "**P.FACt**" re-appears. To get to the next menu, press ↓.)
d) Press the blue button → to start the editing mode. The first digit flashes to indicate it can now be edited.
e) Press the green button ↓ repeatedly to edit the flashing digit.
f) Press the blue button → to move to the next digit. The digit flashes to indicate it can be edited.
g) Repeat steps (e) and (f) until the last digit is flashing, and edited as required.
h) Press the blue button → to confirm the new value. (The flashing stops.)
i) If the new value is correct, press the red button ↵ to save. The display changes to the next menu option.
j) If the new value is incorrect, press the blue button → to exit to the menu. The "**P.FACt**" re-appears; re-start at step (b) or press ↓ for next menu.

K-factor for the Flow Law (The 3102/3105)

Screen display **SCALE**

Factory default value **1.000**

NOTE:
If a flow duty has been selected, the value entered into this parameter is in effect the K-factor in a flow law of the form Flow Q = kh*.

If a Distance, Level or Contents (Volume) duty has been selected, the value entered into this parameter is a factor used to scale the measured distance, level, or volume.

For a Level or Distance duty, the scaling factor is normally left at the value calculated by the transmitter (depending upon previously entered data and duty selected), or the default value of 1.000.

For a linear Contents duty, enter a scaling factor to convert the level measurement to a volume measurement. If the measurement units are "**m**", enter the volume contained in 1 m of liquid height in the tank. If the units of measurements are "**ft**", then enter the volume contained in 1 ft of liquid height in the tank.

NOTE:
This menu option is in the programming menu. See Figure C-2 on page C-3 for a map of the menu structure and how to access the menu options.

To change the scale factor:

a) If entering the menu system from the PV display, press the green button ↓ repeatedly until the "**SCALE**" menu option is indicated (see above note.)
b) Press the blue button → to enter the "**SCALE**" menu and to display the present scale factor.
c) If the scale factor is correct, press the red button ↵ to exit to the menu. (The menu option "**SCALE**" re-appears. To get to the next menu, press ↓.)
d) Press the blue button → to start the editing mode. The first digit flashes to indicate it can now be edited.
e) Press the green button ↓ repeatedly to edit the flashing digit.
f) Press the blue button → to move to the next digit. The digit flashes to indicate it can be edited.
g) Repeat steps (e) and (f) until the last digit is flashing, and edited as required.
h) Press the blue button → to confirm the new value. (The flashing stops.)
i) If the new value is correct, press the red button ↵ to save. The display changes to the next menu option.
j) If the new value is incorrect, press the blue button → to exit to the menu. The "**SCALE**" re-appears; re-start at step (b) or press ↓ for the next menu.

NOTE:
If the existing data entered allows the transmitter to calculate the maximum flow, the 4 mA and 20 mA points are set to 4 mA at zero flow and 20 mA at maximum flow.

Maximum Level Entry (The 3102/3105)

Screen display **LEUEL @ max**
Factory default value **1.000**

This menu option is offered if the selected duty is Flow and requires the level to be entered at which the maximum flow occurs.

NOTE:
This menu option is in the programming menu. See Figure C-2 on page C-3 for a map of the menu structure and how to access the menu options.

To change the Level@max value:

a) If entering the menu system from the PV display, press the green button ↓ repeatedly until the "**LEUEL @ max**" menu is indicated (see above note.)
b) Press the blue button → to enter the "**LEUEL @ max**" menu and display the present Level@max value.

c) If the indicated value is correct, press the red button ↵ to exit to the menu. (The "**LEUEL @ max**" re-appears. To get to the next menu, press ↓.)

d) Press the blue button → to start the editing mode. The first digit flashes to indicate it can now be edited.

e) Press the green button ↓ repeatedly to edit the flashing digit.

f) Press the blue button → to move to the next digit. The digit flashes to indicate it can be edited.

g) Repeat steps (e) and (f) until the last digit is flashing, and edited as required.

h) Press the blue button → to confirm the new value. (The flashing stops.)

i) If the new value is correct, press the red button ↵ to save. The display changes to the next menu option.

j) If the new value is incorrect, press the blue button → to exit to the menu. The menu option "**LEUEL @ max**" re-appears; re-start at step (b) or press ↓ for the next menu option.

Maximum Flow Entry (The 3102/3105)

Screen display **Flo @ max**

Factory default value **1.000**

This menu option is offered if the selected duty is Flow and requires entry of the maximum flow capability of the chosen structure (not the maximum flow expected in the application.)

NOTE:
This menu option is in the programming menu. See Figure C-2 on page C-3 for a map of the menu structure and how to access the menu options.

To change the Flo@max value:

a) If entering the menu system from the PV display, press the green button ↓ repeatedly until the "**Flo @ max**" menu is indicated (see above note.)

b) Press the blue button → to enter the "**Flo @ max**" menu and display the present Flo@max value.

c) If the Flo@max value is correct, press the red button ↵ to exit to the menu. (The menu "**Flo @ max**" re-appears. To get to the next menu, press ↓.)

d) Press the blue button → to start the editing mode. The first digit flashes to indicate it can now be edited.

e) Press the green button ↓ repeatedly to edit the flashing digit.

f) Press the blue button → to move to the next digit. The digit flashes to indicate it can be edited.

g) Repeat steps (e) and (f) until the last digit is flashing, and edited as required.

h) Press the blue button → to confirm the new value. (The flashing stops.)

i) If the new value is correct, press the red button ↵ to save. The display changes to the next menu option.

j) If the new value is incorrect, press the blue button → to exit to the menu. The menu option "**Flo @ max**" re-appears; re-start at step (b) or press ↓ for the next menu option.

NOTE:
If the data entered allows the transmitter to calculate the maximum flow, the 4 and 20 mA points are set to 4 mA at zero flow and 20 mA at maximum flow.

Maximum Contents (Volume) Entry (The 3102/3105)

Screen display **`Cont @ max`**

Factory default value **`1.000`**

This menu option is offered if the selected duty is Contents (Volume) and requires entry of the maximum contents of the vessel.

NOTE:
This menu option is in the programming menu. See Figure C-2 on page C-3 for a map of the menu structure and how to access the menu options.

To change the Cont@max value:

a) If entering the menu system from the PV display, press the green button ↓ repeatedly until the "**`Cont @ max`**" menu is indicated (see above note.)

b) Press the blue button → to enter the "**`Cont @ max`**" menu and display the present Cont@max value.

c) If the Cont@max value is correct, press the red button ↵ to exit to the menu. (The menu option "**`Cont @ max`**" re-appears. To get to the next menu, press ↓.)

d) Press the blue button → to start the editing mode. The first digit flashes to indicate it can now be edited.

e) Press the green button ↓ repeatedly to edit the flashing digit.

f) Press the blue button → to move to the next digit. The digit flashes to indicate it can be edited.

g) Repeat steps (e) and (f) until the last digit is flashing, and edited as required.

h) Press the blue button → to confirm the new value. (The flashing stops.)

i) If the new value is correct, press the red button ↵ to save. The display changes to the next menu option.

j) If the new value is incorrect, press the blue button → to exit to the menu. The menu option "**`Cont @ max`**" re-appears; re-start at step (b) or press ↓ for the next menu option.

Setting the 4 mA Point (The 3102/3105)

Screen Display: **`4`**

Factory default value: **`0.000`**

Enter the PV value to be signalled by 4 mA. The 4 mA point can be set above or below the 20 mA point to suit monitoring or control equipment.

The 4 and 20 mA points can be set by ranging the transmitter to a fixed target, such as the level in the vessel. If this is required, press the green button ↓ twice to get to the damping (**d**) menu option and see "Setting the Output Damping (The 3102/3105)" on page 4-24.

NOTE:
This menu option is in the programming menu. See Figure C-2 on page C-3 for a map of the menu structure and how to access the menu options.

To change the 4 mA point:

a) If entering the menu system from the PV display, press the green button ↓ repeatedly until the "**4**" menu option is indicated (see above note.)

b) Press the blue button → to enter the "**4**" menu and to display the present 4 mA point value.

c) If the 4 mA point value is correct, press the red button ↵ to exit to the menu. (The menu option "**4**" re-appears. To go to the next menu, press ↓.)

d) Press the blue button → to start the editing mode. The first digit flashes to indicate it can now be edited.

e) Press the green button ↓ repeatedly to edit the flashing digit.

f) Press the blue button → to move to the next digit. The digit flashes to indicate it can be edited.

g) Repeat steps (e) and (f) until the last digit is flashing, and edited as required.

h) Press the blue button → to confirm the new value. (The flashing stops.)

i) If the new value is correct, press the red button ↵ to save. The display changes to the next menu option.

j) If the new value is incorrect, press the blue button → to exit to the menu. The menu option "**4**" re-appears; re-start at step (b) or press ↓ for the next menu option.

Setting the 20 mA Point (The 3102/3105)

Screen Display: **20**

Factory default value: **10.7**

Enter the PV value to be signalled by 20 mA. The 20 mA point may be set above or below the 4 mA point to suit monitoring or control equipment.

NOTE:
This menu option is in the programming menu. See Figure C-2 on page C-3 for a map of the menu structure and how to access the menu options.

To change the 20 mA point:

a) If entering the menu system from the PV display, press the green button ↓ repeatedly until the "**20**" menu option is indicated (see above note.)

b) Press the blue button → to enter the "**20**" menu and to display the present 20 mA point value

c) If the 20 mA point is correct, press the red button ↵ to exit to the menu. (The menu option "**20**" re-appears. To get to the next menu, press ↓.)

d) Press the blue button → to start the editing mode. The first digit flashes to indicate it can now be edited.

e) Press the green button ↓ repeatedly to edit the flashing digit.

f) Press the blue button → to move to the next digit. The digit flashes to indicate it can be edited.

g) Repeat steps (e) and (f) until the last digit is flashing, and edited as required.

h) Press the blue button → to confirm the new value. (The flashing stops.)

i) If the new value is correct, press the red button ↵ to save. The display changes to the next menu option.

j) If the new value is incorrect, press the blue button → to exit to the menu. The menu option "**20**" re-appears; re-start at step (b) or press ↓ for the next menu option.

Setting the Output Damping (The 3102/3105)

Screen display: **d**

Factory default value: **3**

The damping value is a time constant in seconds, and is applied as smoothing to the displayed PV and the output current.

A new value may be entered up to 999 seconds. A large value will have the effect of smoothing out rapid changes to the PV value, and smooth out the effects of turbulence and ripples on the liquid surface. (It would be unusual to select a value greater than 30 seconds.)

A value of zero may be edited, in which case no smoothing is applied to the Current Output and transmitter readings immediately change the output.

NOTE:
Because The 3102 and The 3105 transmits nominally at once per second, a damping time of zero will not necessarily give an immediate response.

NOTE:
This menu option is in the programming menu. See Figure C-2 on page C-3 for a map of the menu structure, showing how to access the menus.

To change the damping value:

a) If entering the menu system from the PV display, press the green button ↓ repeatedly until the "**d**" menu option is indicated (see above note.)

b) Press the blue button → to enter the "**d**" menu and to display the present damping value.

c) If the damping value is correct, press the red button ↵ to exit to the menu. (The menu option "**d**" re-appears. To get to the next menu, press ↓.)

d) Press the blue button → to start the editing mode. The first digit flashes to indicate it can now be edited.

e) Press the green button ↓ repeatedly to edit the flashing digit.

f) Press the blue button → to move to the next digit. The digit flashes to indicate it can be edited.

g) Repeat steps (e) and (f) until the last digit is flashing, and edited as required.

h) Press the blue button → to confirm the new value. (The flashing stops.)

i) If the new value is correct, press the red button ↵ to save. The display changes to the next menu option.

j) If the new value is incorrect, press the blue button → to exit to the menu. The menu option "**d**" re-appears; re-start at step (b) or press ↓ for the next menu option.

Selecting the Alarm Condition Action (The 3102/3105)

Screen display: **AL**

Factory default value: **Hold**

The Rosemount 3102 and Rosemount 3105 can signal an alarm condition if the target echo is lost for 900 seconds or more. The 900 seconds is factory set and is changeable in the field.

There are three actions to choose from:

Hi The current on the two-wire loop increases to 21.75 mA (for the Rosemount Standard) or 22.5 mA (for NAMUR NE43), depending on full model code (see page “Ordering Information“ on page A-6). The current stays at that level until the correct target echo is recovered. The display flashes alternately “**LE**” and the last PV.

Hold The current freezes at the last PV value and stays frozen until the correct target echo is recovered. The display flashes alternately “**LE**” and the last PV.

Lo The current on the two-wire loop decreases to 3.75 mA (for Rosemount Standard) or 3.6 mA (for NAMUR NE43), depending on full model code (see page “Ordering Information“ on page A-6). The current stays at that level until the correct target echo is recovered. The display flashes alternately “**LE**” and the last PV.

NOTE:
This menu option is in the programming menu. See Figure C-2 on page C-3 for a map of the menu structure and how to access the menu options.

To change the selected action:

a) If entering the menu system from the PV display, press the green button ↓ repeatedly until the “**AL**” menu option is indicated (see above note.)

b) Press the blue button → to enter the “**AL**” alarm menu and display the selected action.

c) If the selected action is correct, press the red button ↵ to exit to the menu. (The menu option “**AL**” re-appears. To get to the next menu, press ↓.)

d) Press the blue button → to start the editing mode. The selected action flashes to indicate it can now be edited.

e) Press the green button ↓ repeatedly to scroll through the list of actions (see above.)

f) Press the blue button → to confirm the new action. (The flashing stops.)

g) If the new action is correct, press the red button ↵ to save. The display changes to the next menu option.

h) If the new action is incorrect, press the blue button → to exit to the menu. The menu option “**AL**” re-appears; re-start at step (b) or press ↓ for the next menu option.

Setting the Relay On and Off Points (The 3102)

The Rosemount 3102 has two integral signal relays. Both relays are the SPST (Single Pole, Single Throw) type.

RL1 is factory-set to be a *control relay*. It may be set to energize at any value of PV, and de-energize at any other value of PV. Setting the on and off points to a common PV will turn the relay off. The on value may be greater or smaller than the off value, and vice-versa.

RL2 is factory-set to be a *fault relay*. In this mode, it de-energizes under Lost Echo (LE) or fault conditions. The relay de-energizes if the power fails.

The mode of RL2 may be changed to control mode by entering on and off values (use RL1 instructions below). In control mode, RL2 ceases to be a fault relay until the On and Off values are reset to zero.

All relay set-point values must be entered in the units selected for the PV.

NOTE:
This menu option is in the programming menu. See Figure C-2 on page C-3 for a map of the menu structure and how to access the menu options.

To change the On PV point for control relay RL1 (or RL2):

a) If entering the menu system from the PV display, press the green button ↓ repeatedly until the "**`r1 on`**" (or "**`r2 on`**") menu option is indicated (see above note.)

b) Press the blue button → to enter the "**`r1 on`**" (or "**`r2 on`**") menu and display the present On PV value.

c) If the On PV value is correct, press the red button ↵ to exit to the menu. (The "**`r1 on`**" or "**`r2 on`**" re-appears. To get to the next menu, press ↓.)

d) Press the blue button → to start the editing. The first digit flashes to indicate it can be edited.

e) Press the green button ↓ repeatedly to edit the flashing digit.

f) Press the blue button → to move to the next digit. The digit flashes to indicate it can be edited.

g) Repeat steps (e) and (f) until the last digit is flashing, and edited as required.

h) Press the blue button → to confirm the new value. (The flashing stops.)

i) If the new value is correct, press the red button ↵ to save. The display changes to the next menu option.

j) If the new value is incorrect, press the blue button → to exit to the menu. The menu option "**`r1 on`**" (or "**`r2 on`**") re-appears; re-start at step (b) or press ↓ for the next menu option.

NOTE:
This menu option is in the programming menu. See Figure C-2 on page C-3 for a map of the menu structure and how to access the menu options.

To change the Off PV point for control relay RL1 (or RL2):

a) If entering the menu system from the PV display, press the green button ↓ repeatedly until the "**`r1 off`**" (or "**`r2 off`**") menu option is indicated (see above note.)

b) Press the blue button → to enter the "**`r1 off`**" (or "**`r2 off`**") menu and display the present Off PV value.

c) If the Off PV value is correct, press the red button ↵ to exit to the menu. (The menu option "**r1 OFF**" (or "**r2 OFF**") re-appears. To get to the next menu option, press ↓.)

d) Press the blue button → to start the editing. The first digit flashes to indicate it can be edited.

e) Press the green button ↓ repeatedly to edit the flashing digit.

f) Press the blue button → to move to the next digit. The digit flashes to indicate it can be edited.

g) Repeat steps (e) and (f) until the last digit is flashing, and edited as required.

h) Press the blue button → to confirm the new value. (The flashing stops.)

i) If the new value is correct, press the red button ↵ to save. The display changes to the next menu option.

j) If the new value is incorrect, press the blue button → to exit to the menu. The menu option "**r1 OFF**" (or "**r2 OFF**") re-appears; re-start at step (b) or press ↓ for the next menu option.

Setting the 4 and 20 mA Levels Using Ranging (The 3102 and The 3105)

Screen display: (**SEt 4** and **SEt 20**)

If you have already programmed the 4 and 20 mA levels as above, you do not need to enter this menu. All the programming is now complete and you should press the red button ↵ to exit the programming menu and return to the main PV display.

If, however, you wish to set the 4 or 20 mA level by ranging the instrument to a known target - perhaps the level in the vessel at this time - then press the blue button → to enter this menu.

NOTE:
This "**SEt 4**" menu option is in the programming menu.
See Figure C-2 on page C-3 for a map of the menu structure and how to access the menu options.

To set the 4 mA level:

a) If entering the menu system from the PV display, press the green button ↓ repeatedly until the "**SEt 4**" menu option is indicated (see note above.)

b) Press the blue button → to display the PV at 4 mA.

c) If the value is correct, press the red button ↵ to exit to the menu. (The "**SEt 4**" re-appears. To get to the "**SEt 20**" menu option, press ↓.)

d) With the transmitter aimed at a target a distance away equivalent to the 4 mA level, press the blue button → to start the ranging. The display alternately flashes "**4**" and the live measurement reading.

e) Press the blue button → to confirm the PV at 4 mA is to be changed to the same value as the live measurement reading.

f) If the new PV at 4 mA value is correct, press the red button ↵ to save and then the green button ↓ to get to the "**SEt 20**"menu option.

g) If the new PV at 4 mA value is incorrect, press the blue button → to exit to the menu. The menu option "**SEt 4**" re-appears; re-start at step (b) or press ↓ to get to the "**SEt 20**"menu option.

NOTE:
This "**SEt 20**" menu option is in the programming menu.
See Figure C-2 on page C-3 for a map of the menu structure and how to access the menu options.

To set the 20 mA level:

a) If entering the menu system from the PV display, press the green button ↓ repeatedly until the "**SEt 20**"menu option is indicated (see note above.)

b) Press the blue button → to display the PV at 20 mA.

c) If the value is correct, press the red button ↵ to exit to the menu. (The "**SEt 4**" re-appears. To get to the next menu option, press ↓.)

d) With the transmitter aimed at a target a distance away equivalent to the 20 mA level, press the blue button → to start the ranging. The display alternately flashes "**20**" and the live measurement reading.

e) Press the blue button → to confirm the PV at 20 mA is to be changed to the same value as the live measurement reading.

f) If the new PV at 20 mA value is correct, press the red button ↵ to save and then the green button ↓ to exit the menu system and return to the PV display.

g) If the new PV at 20 mA value is incorrect, press the blue button → to exit to the menu. The menu option "**SEt 20**" re-appears; re-start at step (b) or press ↓ to exit the menu system and change to the PV display.

Programming of the transmitter is now complete.

Check the main display to ensure the duty, units and PV are correct, and that relays are on or off according to the set points programmed. The cover may now be replaced (see "After Completing the Wiring" on page 3-9).

FINAL CHECKS

Final checks:

a) Check the display is reading correctly.

b) You may wish to check echo size again before re-fitting the enclosure lid.

c) Check that the cover seal is in place in the cover, and is good condition. It should not be twisted or kinked in any way.

d) Carefully set the cover on the transmitter, and tighten the three cover screws equally to seal the instrument.

e) Check that the cable gland is securely tightened and check sealing on the cable sheath.

POWER FAILURE

All parameters are held in EPROM memory. In the event of a power failure, or disconnection from the power supply, the transmitter will remember all of it's last parameter values and will resume correct operation once power is restored.

Section 5 Service and Troubleshooting

SAFETY MESSAGES

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

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⚠WARNING

Explosions could result in death or serious injury.

Verify that the operating environment of the transmitter is consistent with the appropriate approval 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 housing cover in explosive atmospheres when the circuit is alive.

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

Make sure only qualified personnel perform the installation.

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

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

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

Avoid contact with leads and terminals.

Make sure the main power to the Rosemount 3100 Series transmitter is off, and the lines to any other external power source are disconnected or not powered while wiring the transmitter.

SERVICING

The only maintenance required is to occasionally check the transmitter face to ensure it remains clean and check that the cover seal, wiring, and cable glands are in good condition.

There are no spare parts for the Rosemount 3100 Series. If a problem persists, contact Emerson Process Management for advice.

DIAGNOSTICS FOR THE 3101

General Troubleshooting

No Display

Check the power supply. Ensure there is a minimum of 12 Vdc at the instrument terminals. Check that the cable insulation is not preventing contact at the terminal block.

No Level Reading

Check that the instrument is ticking about once per second. If there is no ticking, the instrument should be replaced.

Error Messages

Flashing “LE” With “0000”

The transmitter is not receiving a return echo, which could mean the liquid surface is poor or that it is beyond the range of 26 ft (8 m) of the instrument. Change the position of the transmitter or contact Emerson Process Management for information on longer range instruments

This means that the transmitter is not receiving a return echo, possibly because the liquid surface is poor or beyond the range (8m/26ft) of the instrument. Re-locate the instrument or contact Emerson Process Management for details of longer range instruments.

Flashing “LE” With Level Reading

This means that the transmitter is no longer receiving satisfactory echoes from the liquid surface. This may be because of one of a variety of reasons, for example, excessive foaming, turbulence, or ullage vapors.

First, check that the transmitter face is free from contamination and condensation. The transmitter will operate with some condensation on the face, but excessive condensation may cause operational problems. If the vessel cannot be adequately vented to prevent condensation forming, contact Emerson Process Management for alternative solutions.

Second, check that the instrument is still vertically aligned above the liquid surface and check the echo received size. If the echo size is small (<3), re-position the transmitter or modify the vessel for the transmitter to operate above a more acceptable area of the liquid surface.

Lost echo (LE) is signalled when there has been no return echo for 10 seconds. Within the 10 seconds, the output will remain fixed. If, after the 10 seconds, no satisfactory has been received, the output will increase to the current selected level and the display flashes alternately “**LE**” and the last valid level reading.

If a satisfactory echo is received within the 10 seconds, a new output is established and the LE timer is re-set.

DIAGNOSTICS FOR THE 3102 AND THE 3105

Menu structures for this section are in Appendix C (Integrated Display Menus)

NOTE:

If using a HART Master Device for programming The 3102 or The 3105, refer to the following sections for menu structures and parameters:

- Appendix D (Rosemount 3490 Series)
- Appendix E (HART Communicator).
- Appendix F (Parameters accessed over HART Communications)

General Troubleshooting (The 3102/3105)

No Display

Check the power supply. Ensure there is a minimum of 12 Vdc at the instrument terminals. Check that the cable insulation is not preventing contact at the terminal block.

No Level Reading

Check that the instrument is ticking about once per second. If there is no ticking, the instrument should be replaced.

Diagnostic Data (The 3102/3105)

The Rosemount 3102 and The Rosemount 3105 can display diagnostic data that can aid setting-up and fault-finding.

To aid interpretation, the data will alternate with text to remind what data is being displayed. In the diagnostic menu, the data cannot be edited.

To enter the diagnostic menu from the PV display, press the blue button → to display the menu option "**diAg**".

NOTE:
See Figure C-3 on page C-4 for a map of the diagnostics menu structure.

Diagnostic information is then available by following this sequence:

1. Press the green button ↓ to display the distance-to-target in the selected base units (m, ft, or in.). The transmitter is measuring distance-to-target regardless of the duty selected.

   (Press the red button ↵ at any time to re-display the "**diAg**" menu option, and pressing it again restores the PV display.)

2. Press the green button ↓ to get to the next diagnostic data, "**LEUEL**".

   This is the level measurement in base units that the transmitter has calculated based upon the bottom reference and the distance measured, regardless of the duty chosen for the instrument.

3. Press the green button ↓ to get to the next diagnostic data, "**Echo. S**".

   This is the echo size being received on a scale of 0 to 100. It is recommended that a value greater than 10 be achieved.

4. Press the green button ↓ to get to the next diagnostic data, "**Echo. n**".

   This is the number of echoes being received and can be an indicator of the data being processed by the transmitter. A thorough understanding of ultrasonic level systems is required to interpret this data.

5. Press the green button ↓ to get to the next diagnostic data, "**F**".

   This is the frequency at which the transmitter is operating, and should read between 49 and 58 kHz.

6. Press the green button ↓ to get to the next diagnostic data, "**t**".

   This is the temperature being recorded by the integral temperature sensor (or remote temperature sensor, if fitted) and is being used by the transmitter to calculate the distance-to-target.

7. Press the green button ↓ and then the blue button → to change to the PV display.

Loop Test (The 3102/3105)

Screen display: **tESt**

The transmitter can cycle through the programmed operating range without any change in the liquid level, causing the current output to cycle through a normal operation (and energize/de-energize relays on The Rosemount 3102).

The transmitter can be programmed to fix the loop current at any value between 4 and 20 mA to allow testing of any other loop or control instruments.

To enter the loop test menu from the PV display, press the blue button → to display "**diAg**" and then press-and-hold the blue button → for at two seconds to display "**tESt**".

NOTE:
See Figure C-3 on page C-4 for a map of the diagnostics menu structure.

Cycle Function

Screen display: **CyCLE**

a) After entering the "**tESt**" menu (see above), press the green button ↓ to get to the "**CyCLE**" menu option.

b) Press the blue button → to enter the "**CyCLE**" menu. The display indicates "0.0000".

c) Press the blue button → to start the cycle.

   For 100 seconds, the transmitter cycles from the 4 mA value to the maximum PV value and back to the 4 mA value again.

   Press the green button ↓ at any time to pause and resume the cycle.

d) Press the blue button → to exit the cycle and re-display "**CyCLE**".

Loop-current Fixing

Screen display: **LOOP**

a) From the "**tESt**" or "**CyCLE**" display, press the green button ↓ to get to the "**LOOP**" menu.

b) Press the blue button → to enter the "**LOOP**" menu, and the display will zero to show "0.000".

c) Press the blue button → to start the editing mode. The first digit flashes to indicate it can now be edited.

d) Press the green button ↓ repeatedly to edit the flashing digit.

e) Press the blue button → to move to the next digit. The digit flashes to indicate it can be edited.

f) Repeat steps (d) and (e) until the last digit is flashing, and edited as required.

g) Press the blue button → to confirm the fixed loop current.

h) To change the fixed current value to a new value, press the blue button → to return to the "**LOOP**" menu and re-start at step (b).

i) Press the green button ↓ to return to displaying the "**tESt**" menu option.

j) From "**tESt**", press the red button ↵ to change to the PV display.

Alternatively, from "**tESt**", press and hold both the blue → and the red ↵ buttons together for 2 seconds to get to the Engineering "**Eng**" menu (see "Engineering Menu For The 3102 and 3105" on page 5-6.

ENGINEERING MENU FOR THE 3102 AND 3105

Menu structures for this section are in Appendix C (Integrated Display Menus)

NOTE:

If using a HART Master Device for programming The 3102 or The 3105, refer to the following sections for menu structures and parameters:

- Appendix D (Rosemount 3490 Series)
- Appendix E (HART Communicator).
- Appendix F (Parameters accessed over HART Communications)

Accessing the Engineering Menu (The 3102/3105)

Screen display: **`Eng`**

The transmitter can be fine-tuned if site or application conditions are unusual. It is recommended that all operational fine tuning parameters remain at the factory default settings unless there is a good understanding of the function and capability of the parameters.

The “reload factory defaults” function is found in this menu, and should be used if the transmitter has been configured incorrectly, or if the transmitter needs to be reset to factory default values.

To reach the Engineering menu option “**`Eng`**”:

a) Begin from the PV display.
(Figure C-2 on page C-3 is a map of the menu structure.)

b) Press the blue button → to indicate the “**`DiAg`**” menu option. (To exit to the PV display, press the red button ↵.)

c) Hold down the blue button → for 2 seconds, and then release. The display changes to the “**`tEst`**” menu option. (To exit to the PV display, press ↵.)

d) Hold down both the blue button → and red button ↵ for 2 seconds. The display changes to the “**`Eng`**” menu option. (To exit to the PV display, press ↵.)

e) Press the green button ↓ to enter the “**`Eng`**” menu. The display indicates the first engineering menu option “**`t.HoLd`**” (see below).

Setting the Threshold (The 3102/3105)

Screen display: **`t.HoLd`**

Factory default value: **`Auto`**

False echoes are rejected below the threshold value. “Auto” sets the threshold level for optimum performance based on echo sizes being received. A value up to 99 may be entered. However, a large value will have the effect of stopping false echo processing (see “Echo diagnostic” page 5-3).

NOTE:
This menu option is in the engineering menu “**`Eng`**”. See “Accessing the Engineering Menu (The 3102/3105)” on page 5-6 or see Figure C-4 on page C-5 for a map of the menu structure.

To change the threshold value:

a) After entering the “**`Eng`**” menu (see the note above), the first menu option indicated is “**`t.HoLd`**”.

b) Press the blue button → to enter the menu for "**t.HoLd**".
The display indicates the present threshold value.

c) If the threshold value is correct, press the red button ↵ to exit to the menu. (The menu option "**t.HoLd**" re-appears. To get to the next menu option, press the green button ↓.)

d) Press the blue button → to start the editing mode. If the present setting is "Auto", press the green button ↓ to change to a three digit number. The first of the three digits flashes to indicate a number can now be edited.

e) Press the green button ↓ repeatedly to edit the flashing digit.
(To restore the "**Auto**" setting, scroll past "**9**" and press the red button ↵ to save and exit.)

f) Press the blue button → to move to the next digit. The digit flashes to indicate it can be edited.

g) Repeat steps (e) and (f) until the last digit is flashing, and edited as required.

h) Press the blue button → to confirm the new value. (The flashing stops.)

i) If the new value is correct, press the red button ↵ to save. The display changes to the next menu option.

j) If the new value is incorrect, press the blue button → to exit to the menu. The "**t.HoLd**" re-appears; re-start at step (b) or press ↓ for next menu.

Setting Lost Echo Time (The 3102/3105)

Screen display: **LE**

Factory default value: **900**

The lost echo time is the seconds that the transmitter will wait before taking the lost echo alarm action (see "Selecting the Alarm Condition Action (The 3102/3105)" on page 4-25.)

A value up to 9999 can be entered. It is recommended that the lost echo time remains set to 900 seconds to avoid false trips and alarms from a temporary loss of echo caused by transient poor surface conditions.

A lower lost echo time should only be programmed if it is important that the lost echo alarm action is taken more quickly (see "Selecting the Alarm Condition Action (The 3102/3105)" on page 4-25.)

NOTE:
This menu option is in the engineering menu "**Eng**". See "Accessing the Engineering Menu (The 3102/3105)" on page 5-6 or see Figure C-4 on page C-5 for a map of the menu structure.

To change the lost echo time:

a) After entering the "**Eng**" menu (see the note above), press the green button ↓ repeatedly until "**LE**" is indicated.

b) Press the blue button → to enter the menu for "**LE**". The display indicates the present lost echo time value.

c) If this lost echo time is correct, press the red button ↵ to exit to the menu. (The menu option "**LE**" re-appears. To get to the next menu, press ↓.)

d) Press the blue button → to start the editing mode. The first digit flashes to indicate it can now be edited.

e) Press the green button ↓ repeatedly to edit the flashing digit.

f) Press the blue button → to move to the next digit. The digit flashes to indicate it can be edited.

g) Repeat steps (e) and (f) until the last digit is flashing, and edited as required.

h) Press the blue button → to confirm the new value. (The flashing stops.)

i) If the new value is correct, press the red button ↵ to save. The display changes to the next menu option.

j) If the new value is incorrect, press the blue button → to exit to the menu. The "**LE**" re-appears; re-start at step (b) or press ↓ for the next menu.

Setting the Dead Band (The 3102/3105)

Screen display: **dEAd**

Factory default value: **0.3** (m)

The dead band is a region below the transmitter face in where no measurements can be made. This is also known as the Blanking or Blocking zone, and is a feature common to all ultrasonic level transmitters, with a value dependent upon certain intrinsic properties of the transmitter.

The dead band should not be lower than the factory default minimum value unless advised by the manufacturer. A higher value may be entered to stop the processing of echoes from false targets, but real echoes in the dead band will also now be ignored.

NOTE:
This menu option is in the engineering menu "**Eng**". See "Accessing the Engineering Menu (The 3102/3105)" on page 5-6 or see Figure C-4 on page C-5 for a map of the menu structure.

To change the dead band:

a) After entering the "**Eng**" menu (see the note above), press the green button ↓ repeatedly until "**dEAd**" is indicated.

b) Press the blue button → to enter the dead band menu. The display indicates the present dead band value.

c) If this dead band is correct, press the red button ↵ to exit to the menu. (The menu option "**dEAd**" re-appears. To get to the next menu, press ↓.)

d) Press the blue button → to start the editing mode. The first digit flashes to indicate it can now be edited.

e) Press the green button ↓ repeatedly to edit the flashing digit.

f) Press the blue button → to move to the next digit. The digit flashes to indicate it can be edited.

g) Repeat steps (e) and (f) until the last digit is flashing, and edited as required.

h) Press the blue button → to confirm the new value. (The flashing stops.)

i) If the new value is correct, press the red button ↵ to save. The display changes to the next menu option.

j) If the new value is incorrect, press the blue button → to exit to the menu. The "**dEAd**" re-appears; re-start at step (b) or press ↓ for the next menu.

Setting the Frequency (The 3102/3105)

Screen display: **F**

Factory default value: **Auto**

The frequency at which the transmitter operates is automatically chosen by the microprocessor to ensure optimum signal size and performance.

"Auto" sets the frequency to obtain the best echo size and optimum performance. The actual frequency being used by the transmitter can be viewed in diagnostics (see page 5-3).

The limits of operating frequency are a function of the intrinsic properties of the transmitter itself, and may be set to operate at any frequency between 49 and 58 kHz.

The transmit frequency affects the quality of the echo being received, which may be used to improve a poor echo or reduce the quality of a false echo.

NOTE:
This menu option is in the engineering menu "**Eng**". See "Accessing the Engineering Menu (The 3102/3105)" on page 5-6 or see Figure C-4 on page C-5 for a map of the menu structure.

To change the frequency:

a) After entering the "**Eng**" menu (see the note above), press the green button ↓ repeatedly until "**F**" is indicated.

b) Press the blue button → to enter the frequency menu. The display indicates the present frequency setting.

c) If this frequency is correct, press the red button → to exit to the menu. (The menu option "**F**" re-appears. To get to the next menu, press ↓.)

d) Press the blue button → to start the editing mode. The present frequency setting flashes to indicate it can be edited.

e) Press the green button ↓ repeatedly to scroll through available options (49 to 58 kHz). (To restore the "**Auto**" setting, scroll past "**58 kHz**" and press the red button ↵ to save and exit.)

f) Press the blue button → to confirm the new setting. (The flashing stops.)

g) If the new setting is correct, press the red button ↵ to save. The display changes to the next menu option.

h) If the new setting is incorrect, press the blue button → to exit to the menu. The "**F**" re-appears; re-start at step (b) or press ↓ for the next menu.

Setting the Pulse Repetition Frequency (The 3102/3105)

Screen display: **Prf**

Factory default value: **1.0**

The rate of pulses transmitted is set at a factory default value of once-per-second.

The transmitter may be set to transmit faster or slower at selectable repetition rates between 0.5 and 2.0 times per second.

NOTE:
The is also ‘cycle time’ of the transmitter.

The pulse repetition frequency may be changed to overcome cross talk problems if more than one ultrasonic transmitter is mounted in the same tank.

NOTE:
This menu option is in the engineering menu “**Eng**”. See “Accessing the Engineering Menu (The 3102/3105)” on page 5-6 or see Figure C-4 on page C-5 for a map of the menu structure.

To change the pulse repetition frequency:

a) After entering the “**Eng**” menu (see the note above), press the green button ↓ repeatedly until “**Prf**” is indicated.

b) Press the blue button → to enter the pulse frequency menu. The display indicates the present frequency value

c) If this pulse frequency is correct, press the red button ↵ to exit to the menu. (The menu “**Prf**” re-appears”. To go to the next menu, press ↓.)

d) Press the blue button → to start the editing mode. The pulse repetition frequency flashes to indicate it can be edited.

e) Press the green button ↓ repeatedly to scroll through the available options (0.5 to 2.0).

f) Press the blue button → to confirm the new setting. (The flashing stops.)

g) If the new setting is correct, press the red button ↵ to save. The display changes to the next menu option.

h) If the new setting is incorrect, press the blue button → to exit to the menu. The “**Prf**” re-appears; re-start at step (b) or press ↓ for the next menu.

Setting Valid Echo Count (The 3102/3105)

Screen display: **Stir**

Factory default value: **4**

This parameter is normally used in vessels with a stirrer or agitator, particularly if there is slow movement. The transmitter may detect uncovered blades and treat them as a valid echo and calculate an incorrect level reading.

NOTE:
This menu option is in the engineering menu “**Eng**”. See “Accessing the Engineering Menu (The 3102/3105)” on page 5-6 or see Figure C-4 on page C-5 for a map of the menu structure.

To change the valid echo count:

a) After entering the "**Eng**" menu (see the note above), press the green button ↓ repeatedly until "**Stir**" is indicated.

b) Press the blue button → to enter the stirrer ("**Stir**") menu. The display indicates the present valid echo count.

c) If the value indicated is correct, press the red button ↵ to exit to the menu. (The menu option "**Stir**" re-appears". Press ↓ to get to the next menu.)

d) Press the blue button → to start the editing mode. The valid echo count flashes to indicate it can be edited.

e) Press the green button ↓ repeatedly to scroll through the options available (1 to 100).

f) Press the blue button → to confirm the new setting. (The flashing stops.)

g) If the new setting is correct, press the red button ↵ to save. The display changes to the next menu option.

h) If the new setting is incorrect, press the blue button → to exit to the menu. The "**Stir**" re-appears; re-start at step (b) or press ↓ for the next menu.

Setting Spike Rejection (The 3102/3105)

Screen display: **SPi**

Factory default value: **0** (disabled)

In applications with high levels of acoustic or electrical noise, a spike could incorrectly trigger the echo detection system. The value of SPi can be increased (0 to 100) and has the effect of rejecting spikes. Several different values may have to be tried to determine the best option.

NOTE:
This menu option is in the engineering menu "**Eng**". See "Accessing the Engineering Menu (The 3102/3105)" on page 5-6 or see Figure C-4 on page C-5 for a map of the menu structure.

To change the spike rejection:

a) After entering the "**Eng**" menu (see the note above), press the green button ↓ repeatedly until "**SPi**" is indicated.

b) Press the blue button → to enter the spike rejection menu. The display indicates the present SPi value

c) If this SPi is correct, press the red button ↵ to exit to the main menu. (The menu option "**SPi**" re-appears". Press ↓ to get to the next menu.)

d) Press the blue button → to start the editing mode. The SPi flashes to indicate it can be edited.

e) Press the green button ↓ repeatedly to scroll through the options available (1 to 100).

f) Press the blue button → to confirm the new setting. (The flashing stops.)

g) If the new setting is correct, press the red button ↵ to save. The display changes to the next menu option.

h) If the new setting is incorrect, press the blue button → to exit to the menu. The menu "**SPi**" re-appears; re-start at step (b) or press ↓ for next menu.

Learn About Echoes From False Targets (The 3102/3105)

Screen display: **Lrn**

The Rosemount 3102 and Rosemount 3105 has an easy-to-use "**Lrn**" (Learn) routine that allows the instrument to learn up to four false echoes, which can then be ignored in future operations.

If the application is simple and there are no false echoes, press the green button ↓ to exit the menu and return to the PV display.

After the transmitter is in operational, if an echo other than the true liquid surface echo is detected and an incorrect level reading is indicated, the instrument can learn to ignore this false echo. The "**Lrn**" routine may be used at any time, either during or after setting-up or if a problem occurs later.

NOTE:
This menu option is in the engineering menu "**Eng**". See "Accessing the Engineering Menu (The 3102/3105)" on page 5-6 or see Figure C-4 on page C-5 for a map of the menu structure.

To store a false target echo:

a) After entering the "**Eng**" menu (see the note above), press the green button ↓ repeatedly until "**Lrn**" is indicated.

b) Press the blue button → to enter the "**Lrn**" menu. The display indicates "**LrnX**" where "X" (0 to 4) is the number of stored false target echoes.

c) To store a new false echo, press and hold the blue button → for five seconds.

d) The display alternately flashes "**Lrn**" and the false target position. After four seconds, the false target position is stored and the display re-indicates "**LrnX**".

e) Press the red button ↵ to save this false echo and exit to the menu. If this false echo shouldn't be saved, press the blue button → to exit the menu.

f) To store another false target echo, re-start at step (b).

g) To get to the next menu option, press the green button ↓.

NOTE:
If there are four false echoes stored ("**Lrn4**"), the transmitter will not allow another echo to be stored until the memory is cleared (see procedure below).

NOTE:
When a false echo is stored, the transmitter sets up a 'window' around the false target and ignores any echo from that window, unless the echo received from the liquid surface is larger than the stored false echo. There may be no change in the transmitter output current while the liquid level moves through this window, which is equivalent to a distance of 20 cm.

To clear all the stored false echoes:

a) After entering the "**Eng**" menu (see the note above), press the green button ↓ repeatedly until "**Lrn**" is indicated.

b) Press the blue button → to enter the "**Lrn**" menu.

c) With the display indicating "**LrnX**", press and hold the green button ↓ for ten seconds to clear the memory. The display then indicates "**Lrn0**".

d) To exit to the menu system press the red button ↵. The menu option "**Lrn**" re-appears; see the previous procedure for how to store new false echoes or press the green button ↓ to get to the next menu option.

Setting the Ambient Temperature (The 3102/3105)

Screen display: **t**

Factory default value: **Auto**

The transmitter has an integral temperature sensor to measure the temperature of the air space surrounding it so that the speed of sound can be correctly computed for sending pulses. The distance-to-target is then calculated using the formula:

Distance to target = Speed of Sound in air * (Time for echo to return / 2)

Auto indicates the transmitter is set to continuously measure the temperature using the integral temperature sensor. It may, occasionally, be necessary to over-ride this automatic monitoring and fix the temperature to be used in speed-of-sound calculations, for example if the air temperature is not uniform and the temperature being recorded is not the true air temperature.

NOTE:
This menu option is in the engineering menu "**Eng**". See "Accessing the Engineering Menu (The 3102/3105)" on page 5-6 or see Figure C-4 on page C-5 for a map of the menu structure.

To edit and fix the temperature:

a) After entering the "**Eng**" menu (see the note above), press the green button ↓ repeatedly until "**t**" is indicated.

b) Press the blue button → to enter the temperature menu. The display indicates the present setting.

c) If this setting is correct, press the red button ↵ to exit to the menu. (The menu option "**t**" re-appears".)

d) Press the blue button → to start the editing mode. If the present setting is "Auto", press the green button ↓ to change to a three digit number. The first of the three digits flashes to indicate a number can now be edited.

e) Press the green button ↓ repeatedly to edit the flashing digit. (To restore the "**Auto**" setting, scroll past "**9**" and press the red button ↵ to save and exit.)

f) Press the blue button → to move to the next digit. The digit flashes to indicate it can be edited.

g) Repeat steps (e) and (f) until the last digit is flashing, and edited as required.

h) Press the blue button → to confirm the new value. (The flashing stops.)

i) If the new value is correct, press the red button ↵ to save. The display changes to the next menu option.

The next menu is "**t.CAL**" if using the optional Remote Temperature Sensor to measure the air temperature. If the Remote Temperature Sensor option is not fitted, the next menu is "**Ld.dEF**" (see "Loading Factory Default Values (The 3102/3105)" on page 5-15).

j) If the new value is incorrect, press the blue button → to exit to the menu. The menu "**t**" re-appears; re-start at step (b) or press ↓ for the next menu.

Temperature Calibration (The 3102/3105)

Screen display: **t.CAL**

This menu option is offered if using the optional Remote Temperature Sensor to monitor air temperature (see "Remote Temperature Sensor" on page 3-14).

NOTES:

- The Remote Temperature Sensor is of a negative temperature co-efficient (NTC) thermistor design.
- Due to the effects of cable length and electronic component tolerances, the air temperature measurement by the Remote Temperature Sensor could have an error of ±0.5 °C.

The recorded temperature can be trimmed to match a another plant reading.

NOTE:
This menu option is in the engineering menu "**Eng**". See "Accessing the Engineering Menu (The 3102/3105)" on page 5-6 or see Figure C-4 on page C-5 for a map of the menu structure.

To edit and fix the temperature:

a) After entering the "**Eng**" menu (see the note above), press the green button ↓ repeatedly until "**t.CAL**" is indicated.

b) Press the blue button → to enter the "**t.CAL**" menu. The display indicates the present setting.

c) If this setting is correct, press the red button ↵ to exit to the menu. (The menu option "**t.CAL**" re-appears". Press ↓ to get to the next menu.)

d) Press the blue button → to start the editing mode. The first digit flashes to indicate it can now be edited.

e) Press the green button ↓ repeatedly to edit the flashing digit.

f) Press the blue button → to move to the next digit. The digit flashes to indicate it can be edited.

g) Repeat steps (e) and (f) until the last digit is flashing, and edited as required.

h) Press the blue button → to confirm the new value. (The flashing stops.)

i) If the new value is correct, press the red button ↵ to save. The display changes to the next menu option.

j) If the new value is incorrect, press the blue button → to exit to the menu. (The menu option "**t.CAL**" re-appears; re-start at step (b) or press ↓ to get to the next menu.)

Loading Factory Default Values (The 3102/3105)

Screen display: **Ld.dEF**

It may, occasionally, be necessary to re-set the transmitter parameters to factory default values, particularly if the data already changed is in question.

NOTE:
Re-loading factory defaults overwrites all parameters and all site entered data will be lost.

To ensure that this operation is not initiated by accident, a specific push-button sequence is necessary to load factory defaults.

NOTE:
This menu option is in the engineering menu "**Eng**". See "Accessing the Engineering Menu (The 3102/3105)" on page 5-6 or see Figure C-4 on page C-5 for a map of the menu structure.

To load factory default values:

a) After entering the "**Eng**" menu (see the note above), press the green button ↓ repeatedly until "**Ld.dEF**" is indicated.

b) Press the blue button → to enter the load defaults "**Ld.dEF**" menu and display "**LOAD**".

c) Press and hold the blue button → for two seconds to flash the screen message "**SurE**".

d) Press the blue button → again to acknowledge the message and stop the message flashing.

e) Press the blue button → to abort and exit to the menu. (The menu option "**Ld.dEF**" re-appears". Press ↓ to get to the next menu.)

f) To load factory defaults, press and hold both the blue → and red ↵ buttons together for two 2 seconds.

   The screen flashes "**b.units**" and reloads all factory default values. The display changes to the PV display.

Changing the Base Units (The 3102/3105)

Screen display: **b.unit**

Factory default: metric (**m**) or imperial (**ft**)

The transmitter may be re-configured to operate in a choice of base units:

- meters
- feet
- inches

NOTE:
If the base units are changed, the transmitter automatically re-starts as if it were a new instrument on first power-up, but will default to the chosen base units and load factory default values into all other parameters.

NOTE:
This menu option is in the engineering menu "**Eng**". See "Accessing the Engineering Menu (The 3102/3105)" on page 5-6 or see Figure C-4 on page C-5 for a map of the menu structure.

To change the base units:

a) After entering the "**Eng**" menu (see the note above), press the green button ↓ repeatedly until "**b.unit**" is indicated.

b) Press the blue button → to enter the base units selection menu. The display indicates the present base units on the bottom display line.

c) If these base units are correct, press the red button ↵ to exit to the menu. (The menu option "**b.unit**" re-appears. Press ↓ to get to the next menu.)

d) Press the blue button → to start the editing mode. The base units flash to indicate they can be edited.

e) Press the green button ↓ repeatedly to scroll through the three options.

f) Press the blue button → to confirm the selected base units. (The flashing stops.)

g) If the new setting is correct, press the red button ↵ to save. (The transmitter automatically re-starts as if it was a new instrument on first power-up.).

h) If the new setting is incorrect, press the blue button → to exit to the menu.

The menu option "**b.unit**" re-appears; re-start at step (b), or press ↓ to exit the "**Eng**" menu and then the blue button → to change to the PV display (see Figure C-4 on page C-5 for the menu structure.)

Appendix A Reference Data

SPECIFICATIONS

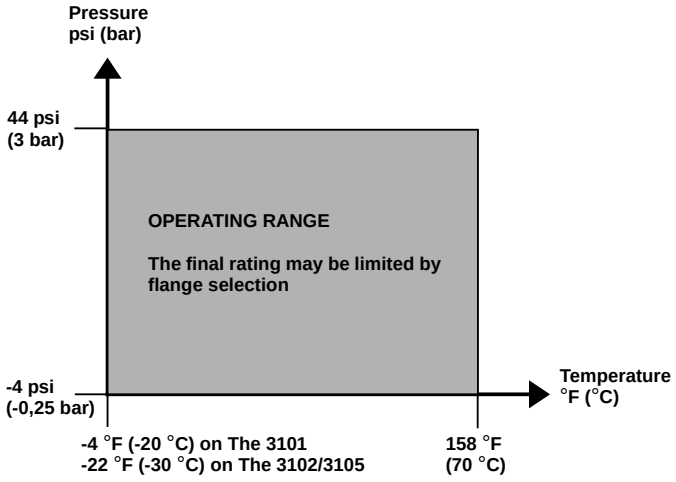
General	
Product	Rosemount 3100 Series liquid level transmitters: Rosemount 3101: Level and Distance measurement. Rosemount 3102: Level, Distance, Volume, Open channel flow measurement, two integral signal relays. Rosemount 3105: Level, Distance, Volume, Open channel flow measurement for hazardous locations.
Measurement principle	Ultrasonic, time-of-flight.
Measuring performance	
Measurement range	Rosemount 3101: 1 to 26 ft (0,3 to 8 m) Rosemount 3102: 1 to 36 ft (0,3 to 11 m) Rosemount 3105: 1 to 36 ft (0,3 to 11 m)
Level resolution	Better than $^{1}/_{16}$ in. (1 mm)
Level accuracy	The 3101: ± 0.2 in. (5 mm) for <3.3 ft (1 m), ± 0.5% of measured distance for > 3.3 ft (1 m) The 3102 and The 3105: ± 0.1 in. (2.5 mm) <3.3 ft (1 m), ±0.25% of measured distance for > 3.3 ft (1 m) under reference conditions (1)
Blanking distance (Dead Zone)	12 in.(0,3 m)
Update interval	1 second
Display / Configuration	
Integral Display	4/5 digit display for live measurement, and for configuration purposes.
Output Units	For Level or distance-to-surface: m, ft, in, or none For Contents: l, m^3, gal, or ft^3 For Flow: l/s, l/m, m^3/hr, gal/s, gal/m, ft^3/m (cfm), ft^3/hr, or none
Output Variables	Rosemount 3101: Level, or distance-to-surface Rosemount 3102: Level (or distance-to-surface), Content (Volume), and Flow. Rosemount 3105: Level (or distance-to-surface), Content (Volume), and Flow.
Configuration tools	Standard integral push-buttons with LCD. 375 Field Communicator. Rosemount 3490 Series Universal Control Unit. Rosemount AMS™ Suite
Materials of construction	
Wet-side material	PVDF.
Body and cover material	Polyurethane-covered Aluminum.
Cover seal	Silicone rubber.
Cover screws	316 Stainless Steel.
Transducer body seal	EPDM.

Electrical	
Power supply	Loop-powered (two-wire) Rosemount 3101: 12 to 30 Vdc Rosemount 3102: 12 to 40 Vdc Rosemount 3105: 12 to 40 Vdc (non-hazardous area), 12 to 30 Vdc (hazardous area).
Earthing	None required.
Current Output	Rosemount 3101: Analog 4–20 mA Rosemount 3102: Analog 4–20 mA, HART. Rosemount 3105: Analog 4–20 mA, HART.
Signal on alarm	Standard: Low = 3.75 mA. High = 21.75 mA Namur NE43: Low = 3.6 mA. High = 22.5 mA
Saturation levels	Standard: Low = 3.9 mA. High=20.8 mA. Namur NE43: Low = 3.8 mA. High = 20.5 mA
Relay output (on the Rosemount 3102)	Two integral signal relays, SPST rated 1A @ 30VDC (inductive) and 2A @ 30VDC (resistive)
Electrical parameters	U_i = 30 V, I_i = 120 mA, P_i = 0.82 W, L_i = 108μH, C_i = 0 nF.
Cable entry	½–14 NPT conduit entries for cable glands. Option: M20 x 1.5 conduit/cable adaptor.
Output Cabling	Single twisted-pair and shielded, min. 0.22 mm^2 (24 AWG), max. 1.5 mm^2 (15 AWG).
Mechanical	
Mounting thread size	2-in. NPT, or 2-in. BSP. Optional flange accessories available.
Measuring	
Temperature compensation	Rosemount 3101: Automatic Integral temperature compensation. Rosemount 3102: Automatic Integral temperature compensation. Optional remote temperature sensor for dynamic temperature compensation. (2) Rosemount 3105: Automatic Integral temperature compensation. Optional remote temperature sensor for dynamic temperature compensation. (2)
Environment	
Ambient temperature	Rosemount 3101: –4 to 158 °F (–20 to 70 °C) Rosemount 3102 and Rosemount 3105: –40 to 158 °F (–40 to 70 °C) (3)
Process temperature	Rosemount 3101: –4 to 158 °F (–20 to 70 °C) Rosemount 3102 and Rosemount 3105: –22 to 158 °F (–30 to 70 °C)
Process pressure	–4 to 44 psi (–0,25 to 3,0 bar)
Ingress protection	NEMA 4X, IP 66.
Electromagnetic compatibility	EN61326 (Class B)
Certifications	CE-mark, FM, CSA, ATEX, or IECEx - dependent on order code.

(1) Temperature: 68 °F (20 °C), Pressure: 101.3 kPa (atmospheric pressure), and Relative Humidity: 65%.
(2) See page A-9 for optional accessories.
(3) See page A-3 onwards for approval temperature ranges.

TEMPERATURE AND PRESSURE RATINGS

The process temperature/pressure rating depends on the design of the transmitter in combination with the flange materials.

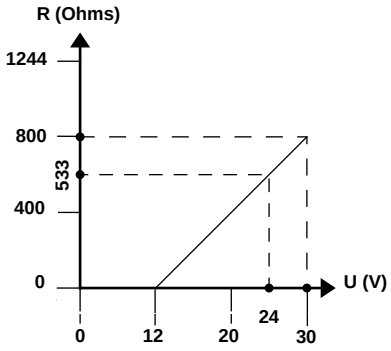


Process temperature and pressure diagram for The Rosemount 3100 Series

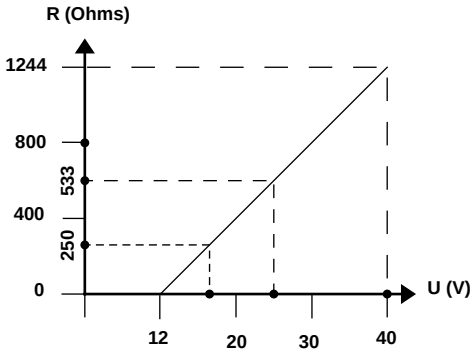
LOAD LIMITATIONS

A HART® Communicator requires a minimum load resistance of 250 Ohm within the loop in order to function properly. Communication with The Rosemount 3490 Universal Controller does not require additional resistance. The maximum load resistance can be determined from these diagrams:

Non-Intrinsically Safe Installations

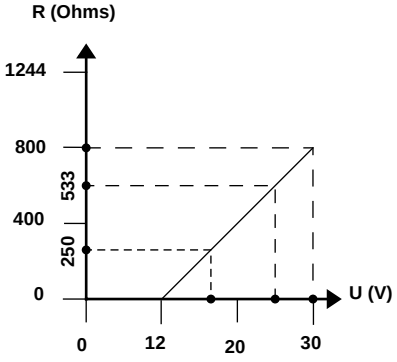


Rosemount 3101



Rosemount 3102 and 3105

Intrinsically Safe Installations

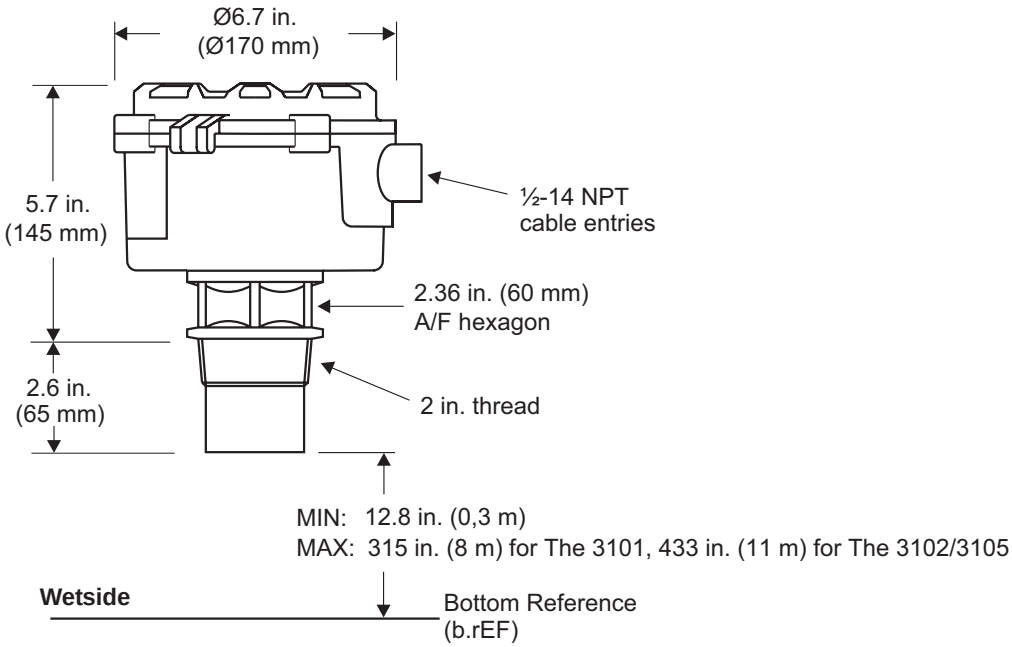


Rosemount 3105

NOTE
R = Maximum Load Resistance
U = External Power Supply Voltage

DIMENSIONAL DRAWINGS

Figure A-1. Dimensions of the 3100 Series transmitter



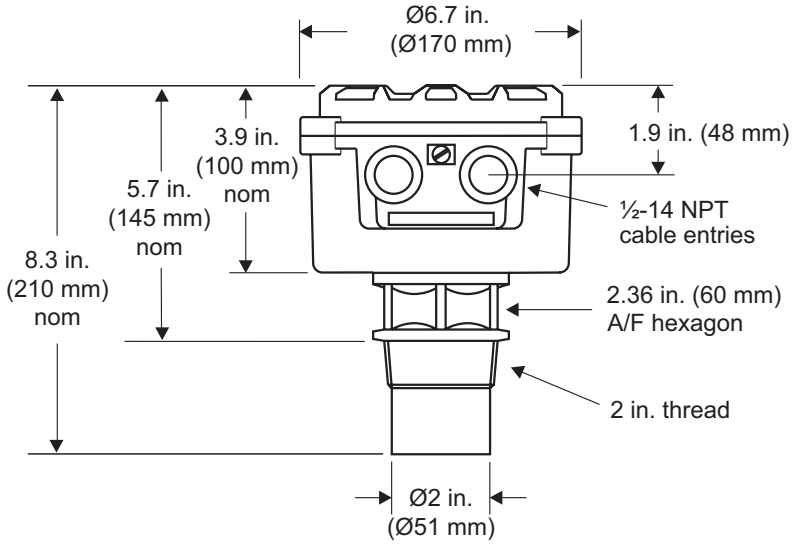
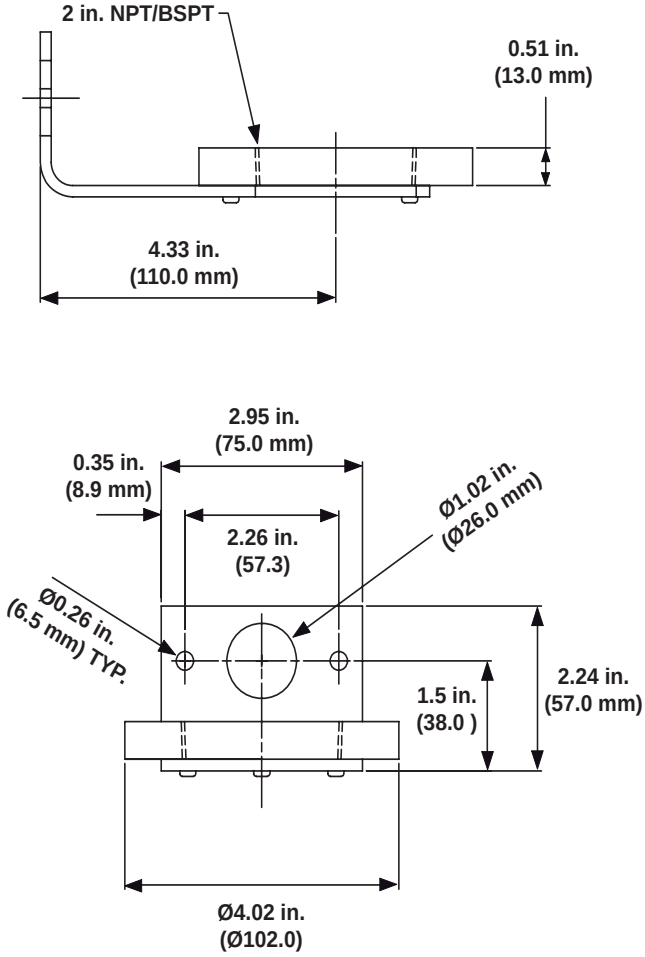


Figure A-2. 2-in. NPT/BSPT mounting bracket



ORDERING INFORMATION

The 3101, Level of liquids

Model	Product Description
3101	Ultrasonic level transmitter
Code	**Signal Output**
L	4–20 mA
Code	**Housing Material**
A	Polyurethane-covered Aluminum
Code	**Conduit / Cable Threads**
1	½–14 NPT
2	M20 x 1.5 adapter
Code	**Wet-side material**
F	PVDF
Code	**Process Connection**
RC	2-in. NPT thread (1)
SC	2-in. BSPT thread (2)
Code	**Certificates**
NA	No certification
G5	FM Ordinary Location
G6	CSA Ordinary Location
Code	**Options**
Tag Plate	
ST	Stainless Steel engraved tag plate
WT	Laminated paper tag plate

(1) Choosing this option implies US (Imperial) units of measurement are required for the default configuration. Configuration can be changed on-site.
(2) Choosing this option implies Metric units of measurement are required for the default configuration. Configuration can be changed on-site.

Example model order code: 3101-L-A-1-F-RC-G5-ST

The 3102, Level, Content (Volume) or Flow of liquids

Model	Product Description
3102	Ultrasonic level transmitter with two integral relays
Code	**Signal Output**
H	4–20 mA with HART® communication
Code	**Housing Material**
A	Polyurethane-covered Aluminum
Code	**Conduit / Cable Threads**
1	½–14 NPT
2	M20 x 1.5 adapter
Code	**Wet-side material**
F	PVDF
Code	**Process Connection**
RC	2-in. NPT thread (1)
SC	2-in. BSPT thread (2)
Code	**Certificates**
NA	No certification
G5	FM Ordinary Location
G6	CSA Ordinary Location
Code	**Options**
Alarms	
C4	Namur alarm and saturation levels; high alarm.
C5	Namur alarm and saturation levels; low alarm.
C8	Low alarm setting with standard Rosemount alarm and saturation levels.
Tag Plate	
ST	Stainless Steel engraved tag plate
WT	Laminated paper tag plate

(1) Choosing this option implies US (Imperial) units of measurement are required for the default configuration. Configuration can be changed on-site.
(2) Choosing this option implies Metric units of measurement are required for the default configuration. Configuration can be changed on-site.

Example model order code: 3102-H-A-1-F-RC-G5-C4-ST

The 3105, Level, Content (Volume) or Flow of liquids

Model	Product Description
3105	Ultrasonic level transmitter for hazardous areas
Code	**Signal Output**
H	4–20 mA with HART® communication
Code	**Housing Material**
A	Polyurethane-covered Aluminum
Code	**Conduit / Cable Threads**
1	½–14 NPT
2	M20 x 1.5 adapter
Code	**Wet-side material**
F	PVDF
Code	**Process Connection**
RC	2-in. NPT thread (1)
SC	2-in. BSPT thread (2)
Code	**Certificates**
I1	ATEX Intrinsically Safe
I5	FM Intrinsically Safe and Non-Incendive
I6	CSA Intrinsically Safe and Non-Incendive
I7	IEC Ex Intrinsically Safe
Code	**Options**
Alarms	
C4	Namur alarm and saturation levels; high alarm.
C5	Namur alarm and saturation levels; low alarm.
C8	Low alarm setting with standard Rosemount alarm and saturation levels.
Tag Plate	
ST	Stainless Steel engraved tag plate
WT	Laminated paper tag plate

(1) Choosing this option implies US (Imperial) units of measurement are required for the default configuration. Configuration can be changed on-site.
(2) Choosing this option implies Metric units of measurement are required for the default configuration. Configuration can be changed on-site.

Example model order code: 3105-H-A-1-F-RC-I5-ST

SPARE PARTS

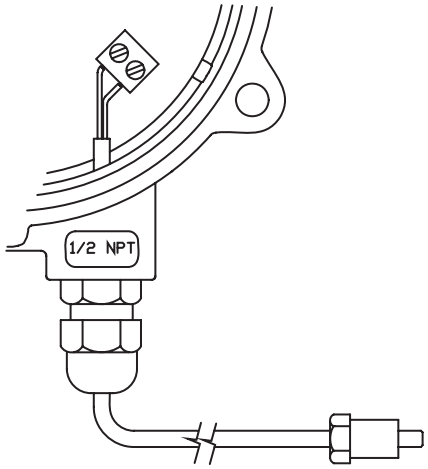
Accessories for The Rosemount 3101/3102/3105

Code	Accessory/Spare
Accessories	
03100-1001-0001	2-in. NPT to 2-in. ANSI Class 150 PVC Flange
03100-1001-0002	2-in. NPT to 3-in. ANSI Class 150 PVC Flange
03100-1001-0003	2-in. NPT to 4-in. ANSI Class 150 PVC Flange
03100-1001-0004	2-in. NPT to 6-in. ANSI Class 150 PVC Flange
03100-1002-0001	2-in. BSPT to DN50 PN16 PVC Flange
03100-1002-0003	2-in. BSPT to DN80 PN16 PVC Flange
03100-1002-0004	2-in. BSPT to DN100 PN16 PVC Flange
03100-1002-0005	2-in. BSPT to DN150 PN16 PVC Flange
03100-1003-0001 (1)	2-in. NPT Mounting Bracket
03100-1003-0002 (1)	2-in. BSPT Mounting Bracket
03100-0001-0001	Remote Temperature Sensor (The Rosemount 3102 and Rosemount 3105 only)
03100-0001-0002	1/2–14 NPT to M20 x 1.5 Conduit Adaptor (Pack of two)

(1) The dimensions are shown in Figure A-2 on page A-5.

Remote Temperature Sensor

Rosemount 3102/3105 Transmitter



External Temperature Sensor

Appendix B Product Certifications

SAFETY MESSAGES

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

⚠WARNING

Explosions could result in death or serious injury:

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

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

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

⚠WARNING

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

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

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

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

⚠WARNING

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

Avoid contact with leads and terminals.

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

EU CONFORMITY

NOTE:
To identify the approvals for your Rosemount 3100 Series transmitter, refer to the labelling on the housing, and see “Ordering Information” on page A-6.

The EC declaration of conformity for all applicable European directives for this product can be found on page B-12 and the Rosemount web site at www.rosemount.com. A hard copy may be obtained by contacting our local sales representative.

ATEX Directive (94/9/EC)

Complies with the ATEX Directive.

Pressure Equipment Directive (PED) (97/23/EC)

3100 Series is outside the scope of PED Directive.

Electro Magnetic Compatibility (EMC) Directive

EN61326 (Class B)

CE-mark

Complies with applicable directives

3101 (EMC), 3102 (EMC), and 3105 (EMC, ATEX)

NON-HAZARDOUS LOCATION CERTIFICATIONS

NOTE:
To identify the approvals for your Rosemount 3100 Series transmitter, refer to the labelling on the housing, and see “Ordering Information” on page A-6.

Factory Mutual (FM) Ordinary Location Certification

The 3101 and The 3102:

Project ID: 3024095

G5 The transmitter has been examined and tested to determine that the design meets basic electrical, mechanical, and fire protection requirements by FM, a nationally recognized testing laboratory (NRTL) as accredited by the Federal Occupational Safety and Health Administration (OSHA).

Canadian Standards Association (CSA) Ordinary Location Certification

The 3101 and The 3102:

Project ID: 1878089

G6 The transmitter has been examined and tested to determine that the design meets basic electrical, mechanical, and fire protection requirements by CSA, a nationally recognized testing laboratory as accredited by the Standards Council of Canada (SCC).

Special conditions for safe use:

1. For the CSA approval, power for the Rosemount 3100 Series must be supplied from a Rosemount 3490 Control Unit, or a class 2 or SELV source.

HAZARDOUS LOCATIONS CERTIFICATIONS

Transmitters that have the following labels attached have been certified to comply with the requirements of the approval agencies noted.

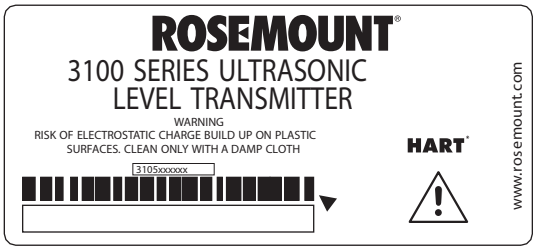
Factory Mutual (FM) Approvals

The 3105 only:

Project ID: 3024095

I5 Intrinsically Safe for Class I, Division 1, Groups A, B, C, and D.
Intrinsically Safe for Class I, Zone 0, AEx ia IIC.
Temperature code T4 at +60°C max ambient.
Temperature code T6 at +55°C max ambient.
Control Drawing: 71097/1216
Ui = 30 V, Ii = 120 mA, Pi = 0.82 W, Li = 108 μH, Ci = 0 μF
Non-incendive for Class I, Division 2, Groups A, B, C and D.
Non-incendive for Class I, Zone 2, AEx nA IIC
Temperature code T4 at +60°C max ambient.
Temperature code T6 at +55°C max ambient.
Control Drawing: 71097/1216
Ui = 30 V, Ii = 120 mA, Pi = 0.82 W, Li = 108 μH, Ci = 0 μF

Figure B-1. Approval Labels Factory Mutual (FM)



K9827_3105_NAMEPLATE

K9831_3105_FM_IS

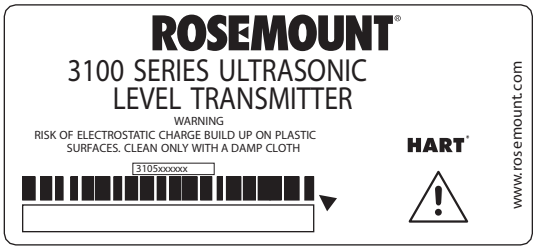
Canadian Standards Association (CSA) Approvals

The 3105 only:

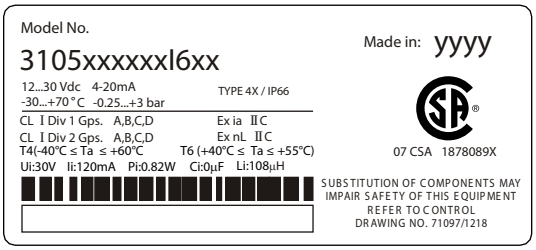
Project ID: 07CSA1878089X

I6 Intrinsically Safe for Class I, Division 1, Groups A, B, C, and D.
Intrinsically Safe for Class I, Zone 0, Ex ia IIC.
Temperature code T4 at +60°C max ambient.
Temperature code T6 at +55°C max ambient.
Control Drawing: 71097/1218
Ui = 30 V, Ii = 120 mA, Pi = 0.82 W, Li = 108 μH, Ci = 0 μF
Non-incendive for Class I, Division 2, Groups A, B, C and D.
Non-incendive for Class I, Zone 2, Ex nL IIC
Temperature code T4 at +60°C max ambient.
Temperature code T6 at +55°C max ambient.
Control Drawing: 71097/1218
Ui = 30 V, Ii = 120 mA, Pi = 0.82 W, Li = 108 μH, Ci = 0 μF

Figure B-2.
Approval Labels Canadian Standards Association (CSA)



K9827_3105_NAMEPLATE



K9832_3105_CSA_IS

ATEX Intrinsically Safe Approval

I1 Certificate: Sira 06ATEX2260X
Intrinsically Safe for II 1 G, EEx ia IIC
Temperature Class:

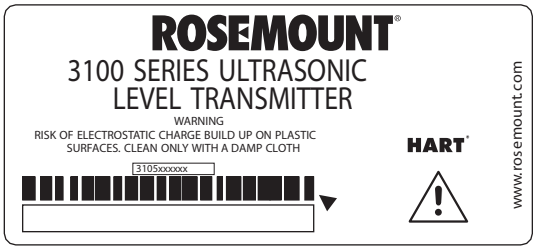
T4 (T_{amb} -40°C to +60°C)
T6 (T_{amb} -40°C to +55°C)

Ui = 30 V, Ii = 120 mA, Pi = 0.82 W, Li = 108 μH, Ci = 0 μF

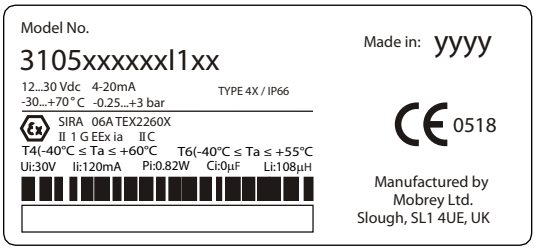
Special conditions for safe use:

1. All transmitter models have external plastic parts, which could present a risk of ignition due to electrostatic charge build-up. They shall not be directly installed in any process where its enclosure might be charged by the rapid flow of non-conductive media.
2. All transmitter models shall only be cleaned with a cloth.
3. When the transmitter housing uses aluminium alloy in its construction, this presents a risk of ignition due to impact and shall be taken into consideration on installation and use.

Figure B-3.
Approval Labels ATEX



K9827_3105_NAMEPLATE



K9833_3105_ATEX_IS

IECEx Intrinsically Safe Approval

I7 Certificate: IECEx SIR 06.0068X

Intrinsically Safe for Zone 0, Ex ia IIC

Temperature Class:

T4 (T_{amb} -40°C to +60°C)

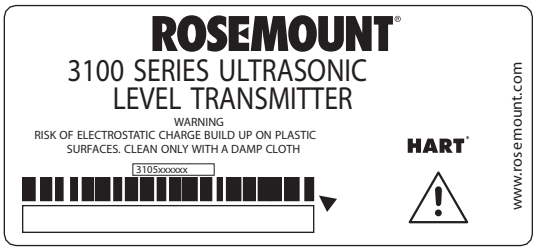
T6 (T_{amb} -40°C to +55°C)

Ui = 30 V, Ii = 120 mA, Pi = 0.82 W, Li = 108 µH, Ci = 0 µF

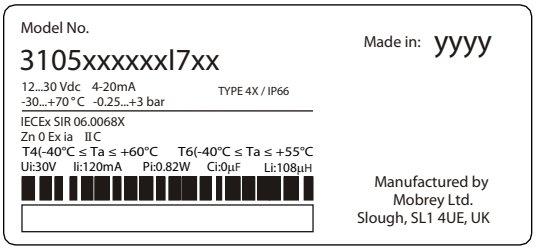
Special conditions for safe use:

1. All transmitter models have external plastic parts, which could present a risk of ignition due to electrostatic charge build-up. They shall not be directly installed in any process where its enclosure might be charged by the rapid flow of non-conductive media.
2. All transmitter models shall only be cleaned with a cloth.
3. When the transmitter housing uses aluminium alloy in its construction, this presents a risk of ignition due to impact and shall be taken into consideration on installation and use.

Figure B-4.
Approval Labels IECEx



K9827_3105_NAMEPLATE



K9834_3105__IECEX

National Supervision and Inspection Centre (NEPSI) Intrinsically Safe Approval

I3 Certificate: GYJ081008X

Intrinsic Safety: Ex ia IIC T4/T6

Ui = 30 V, Ii = 120 mA, Pi = 0.82 W, Ci ≈ 0 nF, Li = 108 μH

Certificate: GYJ081010X

Type of Protection 'n'

Ex nLC IIC T4/T6

The 3105 transmitter, manufactured by Mobrey Limited, has been certified by the National Supervision and Inspection Center for Explosion Protection and Safety of Instrumentation (NEPSI) and accords with the following standards:

Certificate **GYJ081008X**, GB3836.1-2000 and GB 3836.4-2000 Type of protection Ex ia IIC T4/T6.

Certificate **GYJ081010X**, GB3836.1-2000 and GB 3836.8-2003 Type of protection Ex nLC IIC T4/T6.

Special conditions for safe use:

1. The relationship between medium temperature, ambient temperature range and temperature class is as follows:

Temperature class	Ambient temperature class	Temperature of medium
T4	-40 to +60 °C	≤ 130°C
T6	-40 to +55 °C	≤ 80°C

2. End users are not permitted to change any components inside.
3. During installation, operation, and maintenance, the following standards are to be observed:
   - GB3836.13-1997

     "Electrical apparatus for explosive gas atmosphere Part 13: Repair and overhaul for apparatus used in explosive gas atmosphere".
   - GB3836.15- 2000

     "Electrical apparatus for explosive gas atmosphere Part 15: Electrical installations in hazardous area (other than mines)".
   - GB3836.16- 2000

     "Electrical apparatus for explosive gas atmosphere Part 16: Inspection and maintenance of electrical installations (other than mines)".
   - GB50257- 1996

     "Code for construction and acceptance of electric device for explosion atmospheres and fire hazard electrical equipment installation engineering".

Certificate GYJ081008X

1. Suffix "X" denotes that protective measures should be applied to avoid the danger of electrostatic charge when the transmitter is installed in the hazardous location, and plastic parts of transmitter shall only be cleaned by damp cloth.

2. Safety Parameters:

   Power supply terminals (1, 2)

   Ui = 30 V, Ii = 120 mA, Pi = 0.82 W, Ci ≈ 0 nF, Li = 108 μH

   Sensor terminals (7, 8)

   Uo = 30 V, Io = 8.42 mA, Po = 63 mW, Co = 66 nF, Lo = 502 mH

3. The cable entry of transmitter should be protected to ensure the degree of protection of the enclosure IP 20(GB4208-1993) at least.
4. Associated apparatus should be installed in a safe location, and during installation, operation and maintenance, the regulations of the instruction manual have to be strictly observed.

Certificate GYJ081010X

1. Suffix "X" denotes following safe conditions:
   - "Transmitter should be protected from light”.
   - "Provision need to be made externally to prevent the transients exceeding 40% of the rated voltage at the power supply terminals”.
   - "Protective measures should be applied to avoid the danger of electrostatic charge when the transmitter is installed in the hazardous location, and plastic parts of transmitter shall only be cleaned by damp cloth”.
2. The cable entry of transmitter shall use cable entry in accordance with GB 3836.1-2000 or GB 3836.8-2003, with which the degree of protection of the enclosure IP 67(GB4208-1993) at least shall be ensured.

APPROVAL DRAWINGS

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

This section contains the following drawings:

Rosemount Drawing 71097/1216, Issue 2:

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

Rosemount Drawing 71097/1218, Issue 2:

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

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

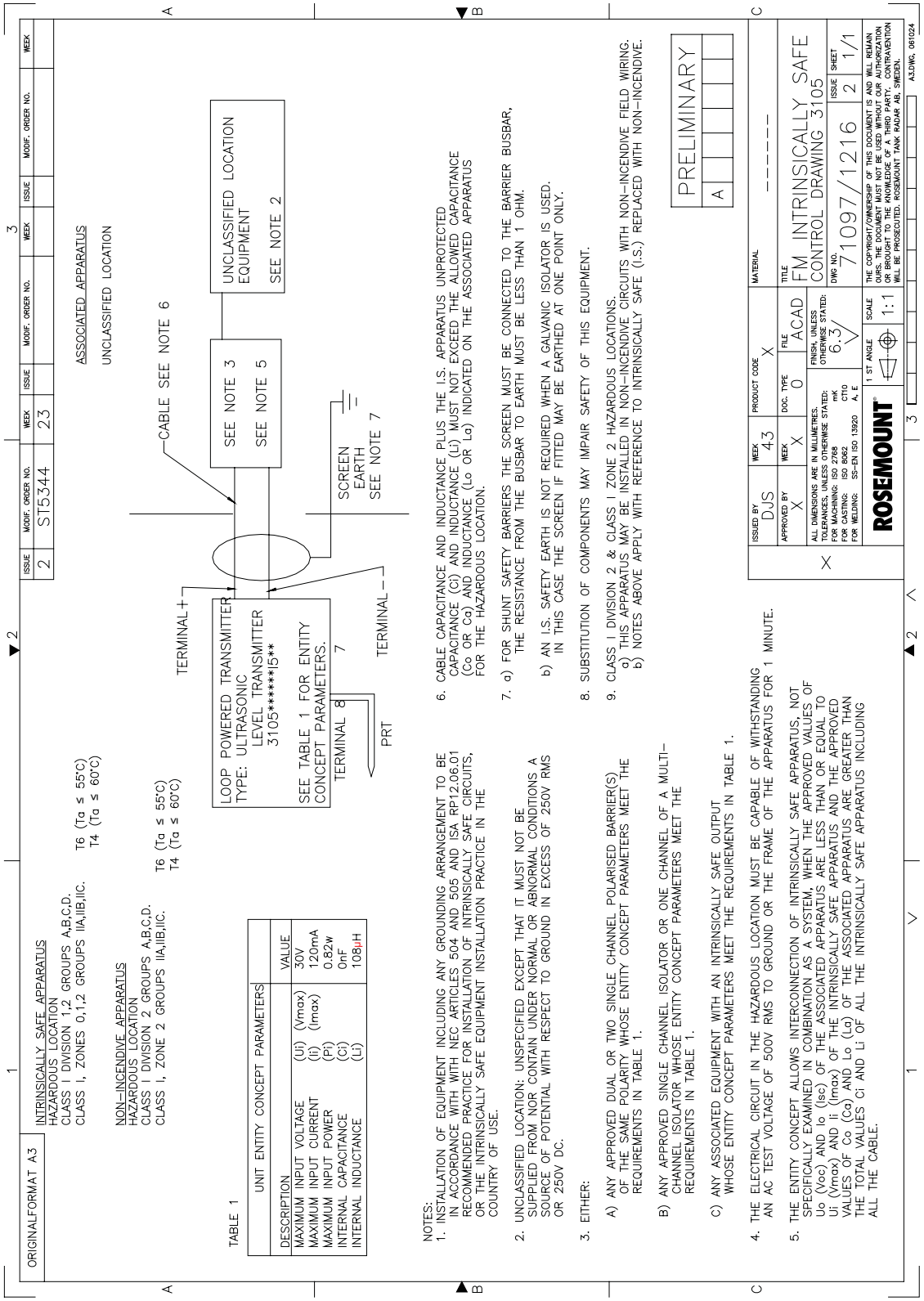


Figure B-6. System Control Drawing for hazardous location installation of intrinsically safe and non-incendive CSA approved apparatus.

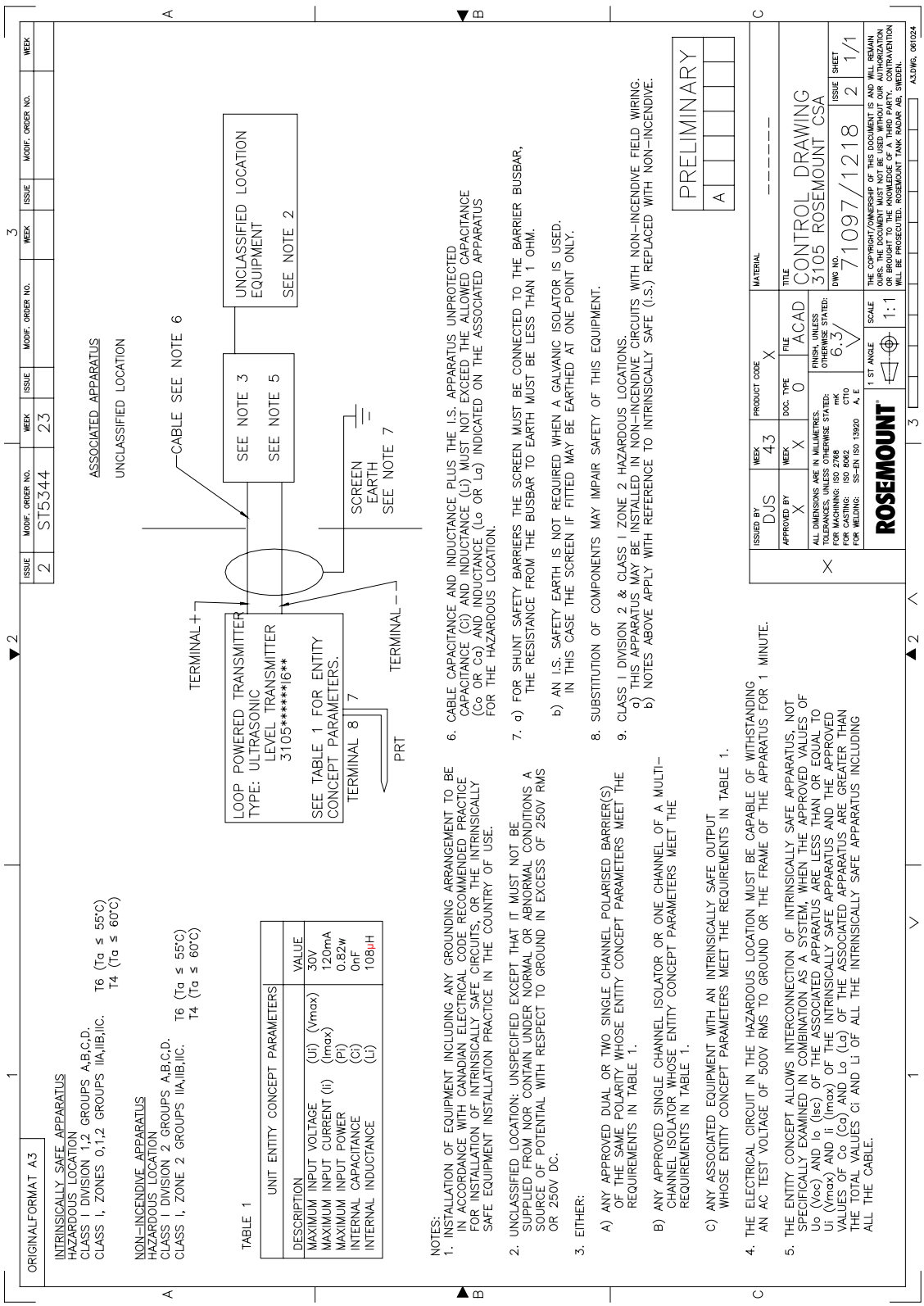


Figure B-7. EC Declaration of Conformity RMD 1062 Rev A

ROSEMOUNT

CE

EC Declaration of Conformity

No: RMD 1062 Rev. A

We,

Mobrey Ltd.
158 Edinburgh Avenue
Slough, SL1 4UE
GB

declare under our sole responsibility that the product,

Rosemount 3100 Series Ultrasonic Level Transmitter

manufactured by,

Mobrey Ltd.
158 Edinburgh Avenue
Slough, SL1 4UE
GB

to which this declaration relates, is in conformity with the provisions of the European Community Directives, including the latest amendments, as shown in the attached schedule.

Assumption of conformity is based on the application of the harmonized standards and, when applicable or required, a European Community notified body certification, as shown in the attached schedule.

(signature)

30TH MARCH 2007
(date of issue)

David J.Ross-Hamilton
(name - printed)

Global Approvals Consultant
(function name - printed)

EMERSON.
Process Management

Sheet 1 of 3

ROSEMOUNT

CE

Schedule
No: RMD 1062 Rev. A

EMC Directive (89/336/EEC)

Model 3101LA*FNA**, 3102HA*F**NA****, 3105HA*F**I1******
EN 61326-1:1997 with amendments A1, A2 and A3

ATEX Directive (94/9/EC)

Model 3105HA*FI1******
Sira 06ATEX2260X – Intrinsically Safe
Equipment Group II, Category 1 G (EEx ia IIC T4/T6)
EN50014:1997 + A1, A2; EN50020:2002, EN60079-26:2004

(Minor variations in design to suit the application and/or mounting requirements are identified by alpha/numeric characters where indicated * above)

EMERSON.
Process Management

Page 2 of 3

3100_RMD1062-A.doc

Sheet 2 of 3

ROSEMOUNT

CE

Schedule
No: RMD 1062 Rev. A

ATEX Notified Body for EC Type Examination Certificate
SIRA Certification Service [Notified Body Number: 0518]
Rake Lane, Eccleston, Chester
Cheshire, CH4 9JN, GB, GB

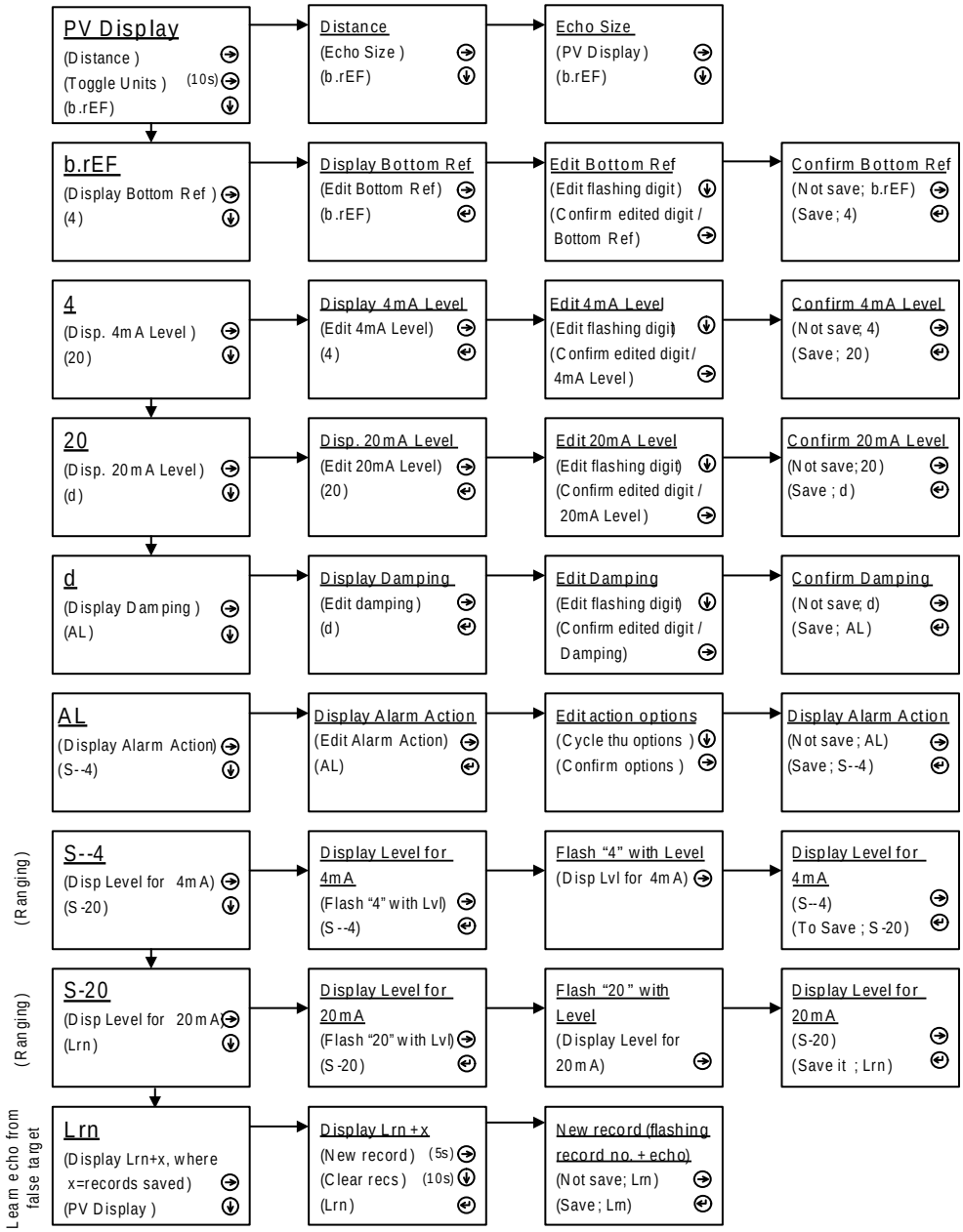
ATEX Notified Body for Quality Assurance
SIRA Certification Service [Notified Body Number: 0518]
Rake Lane, Eccleston, Chester
Cheshire, CH4 9JN, GB

EMERSON.
Process Management

Appendix C Integrated Display Menus

MENUS ON THE 3101

Figure C-1. Menu Programming on The 3101



MENUS ON THE 3102 AND THE 3105

Figure C-2. Main Menu Programming on The 3102/3105

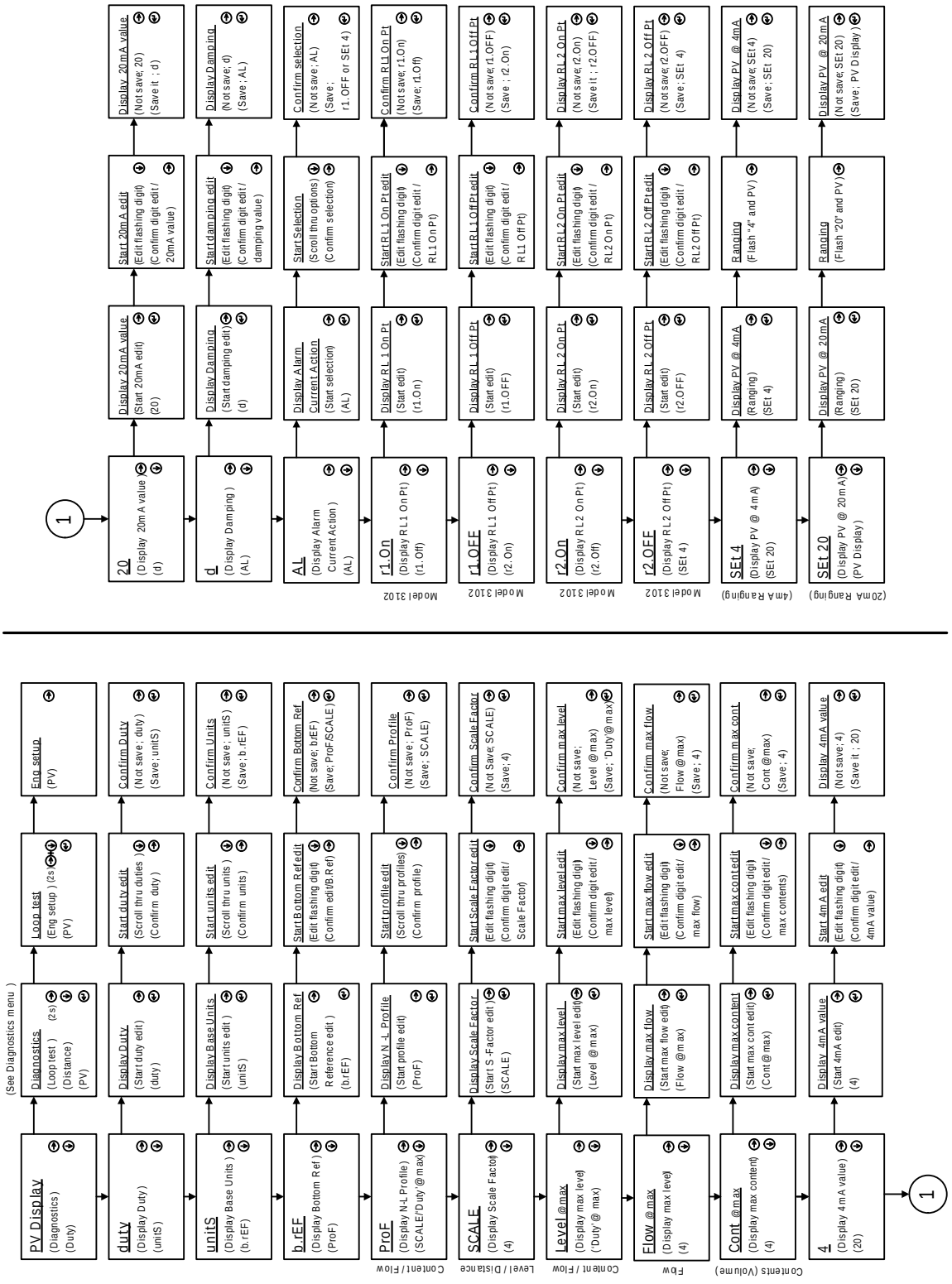


Figure C-3. Diagnostics Menu on The 3102/3105

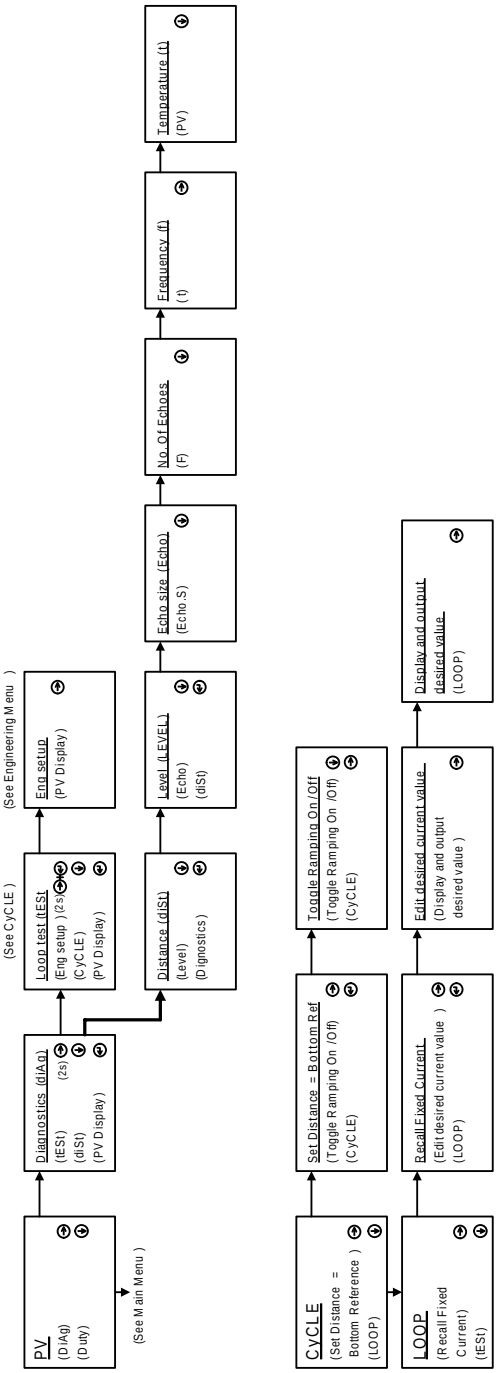
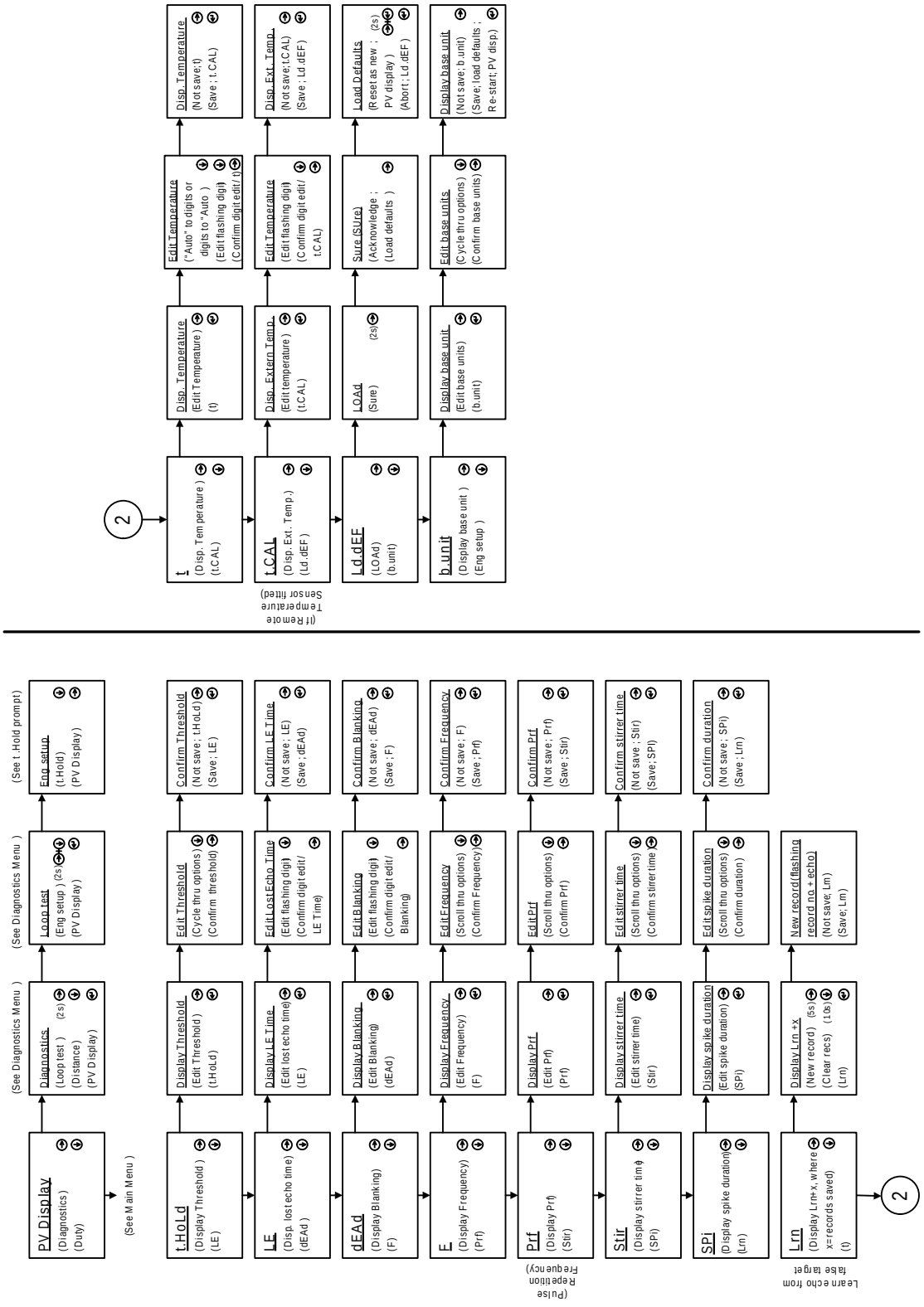


Figure C-4. Engineering Menu on The 3102/3105



Appendix D Rosemount 3490 Series

INTRODUCTION

The Rosemount 3102 and Rosemount 3105 can be used with The Rosemount 3490 Series Control Unit. This control unit supplies the 24 Vdc loop-power to the transmitter, and provides control functionality using the 4–20 mA signal from the transmitter. The control unit has HART® communications capability, and access to all of the parameters of the transmitter as shown in the following pages.

NOTE:
The Rosemount 3490 Series manual (Document No. 00809-0100-4841) provides detailed instructions on the use and features of the control unit.

MENUS AND PARAMETERS

Table D-1. Rosemount 3100 Series Transmitter (3102/3105)

Menu Level 1	Menu Level 2	Menu Level 3	Menu Level 4	Param ID	Parameter	Units	3102			3105		
							m	ft	In	m	ft	in
SETUP [1]	DUTY			P010	Bottom Reference	[2]	11.0	36.0	432.0	11.0	36.0	432.0
					Present Depth	[2]	-	-	-	-	-	-
					SET AS EMPTY	-	-	-	-	-	-	-
				P011	Tank Shape (Tank Type)	-	Linear			Linear		
				P060	Distance (Sensor) Offset	[2]	0.0	0.0	0.0	0.0	0.0	0.0
				P069	Level Offset	[2]	0.0	0.0	0.0	0.0	0.0	0.0
				P013	PV Scale Factor	-	1.0	1.0	1.0	1.0	1.0	1.0
				P014	Profile Height	[2]	1.0	1.0	1.0	1.0	1.0	1.0
		NLP CURVE		P030	Profile Point 1	%	10	10	10	10	10	10
				P031	Profile Point 2	%	20	20	20	20	20	20
				P032	Profile Point 3	%	30	30	30	30	30	30
				P033	Profile Point 4	%	40	40	40	40	40	40
				P034	Profile Point 5	%	50	50	50	50	50	50
				P035	Profile Point 6	%	60	60	60	60	60	60
				P036	Profile Point 7	%	70	70	70	70	70	70
				P037	Profile Point 8	%	80	80	80	80	80	80
				P038	Profile Point 9	%	90	90	90	90	90	90
				P039	Profile Point 10	%	100	100	100	100	100	100
		IDENTITY		P000	Message	-	MESSAGE			MESSAGE		
				P001	Tag	-	3102			3105		
				P002	Description	-	3102 XMTR			3105 XMTR		
	PV CALC			P012	Primary Variable Units (PV Units)	-	m	ft	in	m	ft	in
	OUTPUT	CURRENT		P015	Upper range value	[2]	10.7	34.5	414.0	10.7	34.5	414.0
				P016	Lower range value	[2]	0.0	0.0	0.0	0.0	0.0	0.0
				P020	Damping	sec	3.0	3.0	3.0	3.0	3.0	3.0
		RELAYS [3]	RELAY 1	P070	Relay 1 mode	-	Setpoint			-	-	-
				P071	Relay 1 PV ON Point	[2]	0.0	0.0	0.0	-	-	-
				P072	Relay 1 PV OFF Point	[2]	0.0	0.0	0.0	-	-	-
			RELAY 2	P073	Relay 2 mode	-	Fault/Setpoint			-	-	-
				P074	Relay 2 PV ON Point	[2]	0.0	0.0	0.0	-	-	-
				P075	Relay 2 PV OFF Point	[2]	0.0	0.0	0.0	-	-	-
	ENGINEERING			P021	LE Delay	sec	90	900	900	900	900	900
				P022	LE Action	-	Hold	Hold	Hold	Hold	Hold	Hold
				P023	Top Blanking	[2]	0.3	1.0	12	0.3	1.0	12
				P063	Bottom Blanking	[2]	0.0	0.0	0.0	0.0	0.0	0.0
				P024	Speed of Sound	(B.U.)/s	331.8	1088.6	13063	331.8	1088.6	13063
				P025	Temperature	°C or °F	Auto	Auto	Auto	Auto	Auto	Auto
				P026	Set Threshold	%	Auto	Auto	Auto	Auto	Auto	Auto

Menu Level 1	Menu Level 2	Menu Level 3	Menu Level 4	Param ID	Parameter	Units	3102 m	3102 ft	3102 In	3105 m	3105 ft	3105 in
		ADVANCED		P040	Transmit Power Control	-	Enabled			Enabled		
				P041	Pulse Repetition	sec	1.0	1.0	1.0	1.0	1.0	1.0
				P042	Echoes Needed	-	4	4	4	4	4	4
				P043	Threshold 1 Time	ms	2.9	2.9	2.9	2.9	2.9	2.9
				P044	Target Pulses	-	Auto	Auto	Auto	Auto	Auto	Auto
				P045	Target frequency	kHz	Auto	Auto	Auto	Auto	Auto	Auto
				P048	Threshold 1 Size	%	4.0	4.0	4.0	4.0	4.0	4.0
				P049	Spike Rejection	kHz	0	0	0	0	0	0
		FALSE ECHO DATA		P081	False Echo D 1	(2)	0.0	0.0	0.0	0.0	0.0	0.0
				P082	False Echo S 1	%	0.0	0.0	0.0	0.0	0.0	0.0
				P083	False Echo D 2	(2)	0.0	0.0	0.0	0.0	0.0	0.0
				P084	False Echo S 2	%	0.0	0.0	0.0	0.0	0.0	0.0
				P085	False Echo D 3	(2)	0.0	0.0	0.0	0.0	0.0	0.0
				P086	False Echo S 3	%	0.0	0.0	0.0	0.0	0.0	0.0
				P087	False Echo D 4	(2)	0.0	0.0	0.0	0.0	0.0	0.0
				P088	False Echo S 4	%	0.0	0.0	0.0	0.0	0.0	0.0
				D980	No. of false echoes stored	-	-	-	-	-	-	-
		FALSE ECHO ACTION		P089	Clear False Echoes	-	-	-	-	-	-	-
					LEARN FALSE ECHO	-	-	-	-	-	-	-
					AUTO TANK MAP	-	-	-	-	-	-	-
	SYSTEM				SIMULATION	-	-	-	-	-	-	-
					RESTART DEVICE	-	-	-	-	-	-	-
					DEFAULTS	-	-	-	-	-	-	-
					FACTORY USE	-	-	-	-	-	-	-
					Base Units	-	-	-	-	-	-	-
		FIXED		P004	Final Assembly Number	-	(As applicable)			(As applicable)		
				P005	Serial Number	-	(As applicable)			(As applicable)		
				P970	Transducer Material	-	Kynar			Kynar		
			HART	D949	Model Code	-	52			53		
				D950	HART Device Code	-	46			46		
				D951	Poll Address	-	0			0		
				D952	Hardware Revision	-	(As applicable)			(As applicable)		
				D953	Software Revision	-	(As applicable)			(As applicable)		
				D960	Manufacturer	-	Rosemount			Rosemount		
				D961	Unique ID	-	(As applicable)			(As applicable)		
				D962	Universal Command Revision	-	5	5	5	5	5	5
				D963	Txr Special Command Revision	-	(As applicable)			(As applicable)		
				D964	Number of Request Preambles	-	5	5	5	5	5	5
				D965	Transmitter Flags	-	-	-	-	-	-	-

Menu Level 1	Menu Level 2	Menu Level 3	Menu Level 4	Param ID	Parameter	Units	3102 m	3102 ft	3102 In	3105 m	3105 ft	3105 in
MONITOR (1)	READINGS	VARIABLES		D900	Primary Variable	As P012	-	-	-	-	-	-
				D901	Level (SV)	(2)	-	-	-	-	-	-
				D902	Distance (TV)	(2)	-	-	-	-	-	-
				D903	Transducer Temperature	°C or °F	-	-	-	-	-	-
		CURRENT		D906	Current Output	mA	-	-	-	-	-	-
				D905	% Current Output	%	-	-	-	-	-	-
				D908	Relay Status (3)	-	-	-	-	-	-	-
	DIAGNOSTICS			D910	Distance To Target	(2)	-	-	-	-	-	-
				D911	Echo Size	%	-	-	-	-	-	-
				D912	Echo Success Rate	%	-	-	-	-	-	-
				D913	Target Echoes	-	-	-	-	-	-	-
				D914	Speed Of Sound	(B.U.)/s	-	-	-	-	-	-
				D915	Temperature SoS calc	°C or °F	-	-	-	-	-	-
		OPERATION		D916	Transducer Frequency	kHz	-	-	-	-	-	-
				D917	Threshold in Use	%	-	-	-	-	-	-
				D918	Pulses In Use	-	-	-	-	-	-	-
				D919	Transmit Power	-	-	-	-	-	-	-
		STATUS		D991	Device Status Group 1	-	-	-	-	-	-	-
				D992	Device Status Group 2	-	-	-	-	-	-	-
				D993	Device Status Group 3	-	-	-	-	-	-	-
				D994	Device Status Group 4	-	-	-	-	-	-	-
				D995	Device Status Group 5	-	-	-	-	-	-	-
				D996	Device Status Group 6	-	-	-	-	-	-	-
		HISTORY		P003	Date	ddmmyy	-	-	-	-	-	-
				P046	Maximum Temperature	°C	50	50	50	50	50	50
				P047	Minimum Temperature	°C	-10	-10	-10	-10	-10	-10

(1) Selecting this menu presents a SELECT INSTRUMENT screen if a HART transmitter is assigned to a Current Input channel. Select TRANSMITTER tag to see Menu Level 1 options.
(2) Units are the same as Base Units selection.
(3) Available on The 3102 only.

Appendix E HART Communicator

INTRODUCTION

The Rosemount 3102 and Rosemount 3105 support HART® communications, which may be used to program or interrogate the transmitter from any point on the two-wire loop.

The HART Communicator Product Manual (Document No. 00809-0100-4276) provides detailed instructions on the use and features of the HART Communicator. This brief summary in this appendix is not meant to replace the HART Communicator Product Manual.

This appendix contains the menu structure and Fast Key sequences.

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 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:

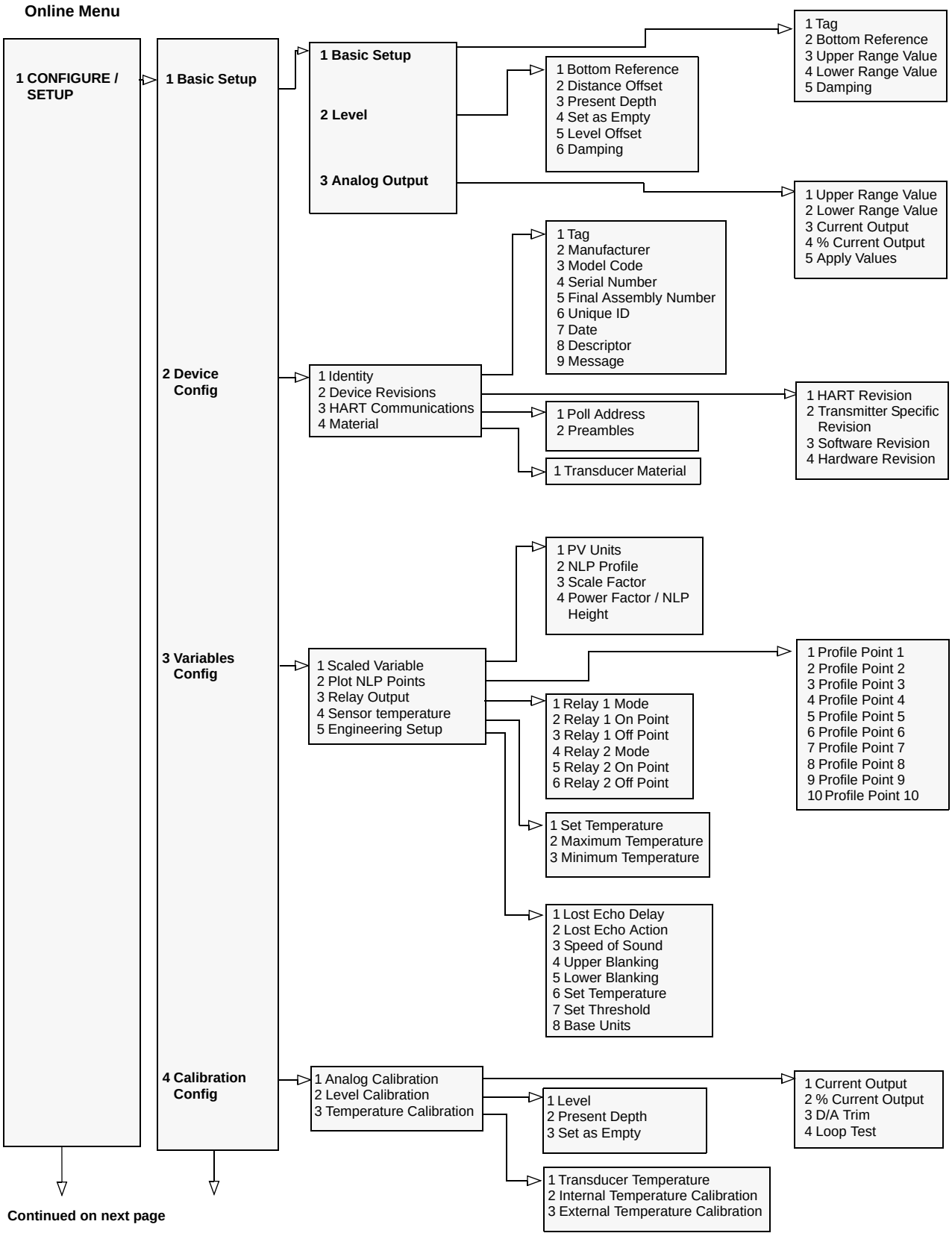
Make sure only qualified personnel perform the installation.

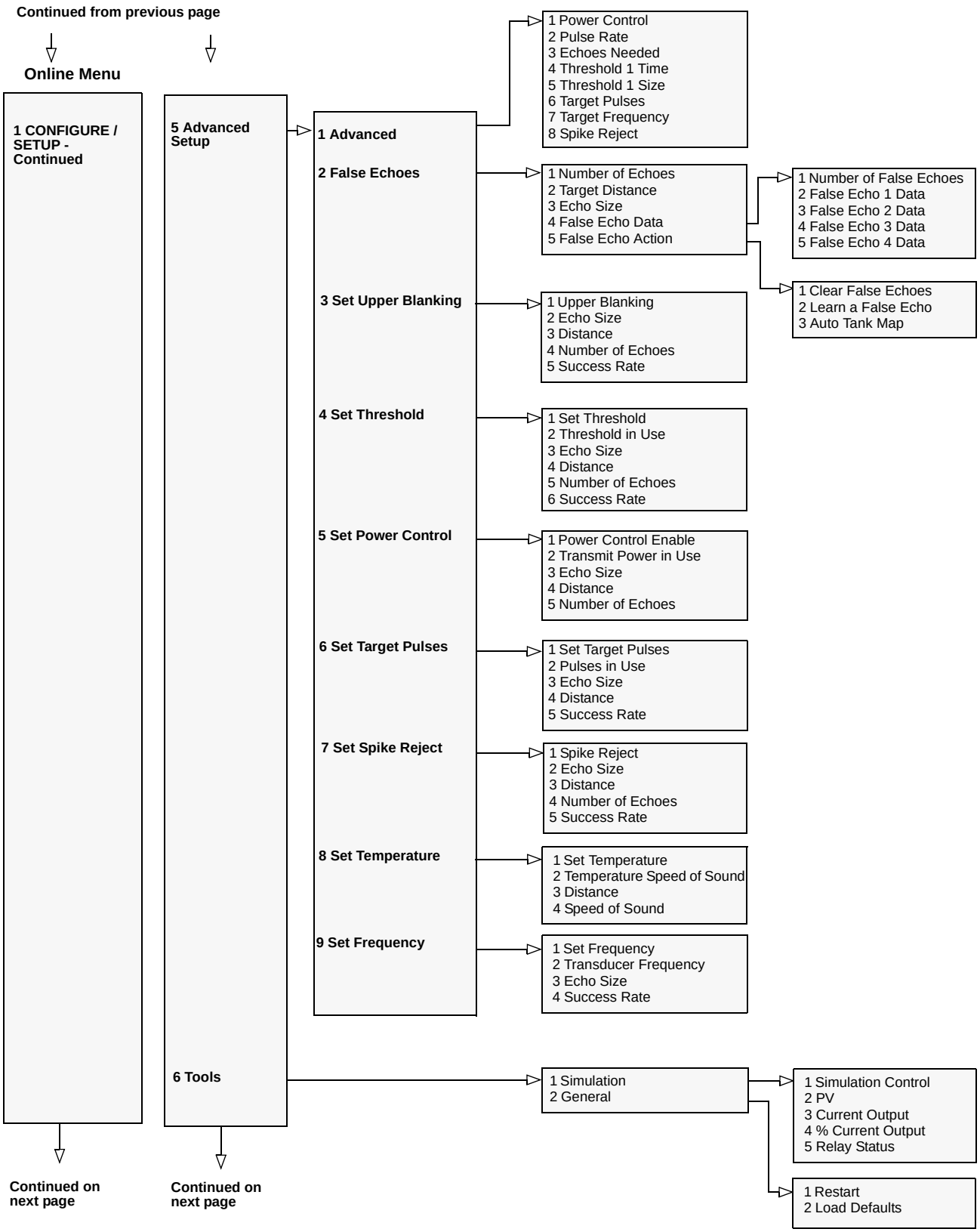
Use the equipment only as specified in this manual. Failure to do so may impair the protection provided by the equipment.

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

As a matter of routine, the Rosemount 3100 Series transmitter and all other equipment in your tank should be shut off prior to entering the tank.

Figure E-1. HART Communicator Menu Tree




Continued from previous page
Online Menu
1 CONFIGURE / SETUP - Continued
5 Advanced Setup
6 Tools
1 Advanced
2 False Echoes
3 Set Upper Blanking
4 Set Threshold
5 Set Power Control
6 Set Target Pulses
7 Set Spike Reject
8 Set Temperature
9 Set Frequency
1 Power Control
2 Pulse Rate
3 Echoes Needed
4 Threshold 1 Time
5 Threshold 1 Size
6 Target Pulses
7 Target Frequency
8 Spike Reject
1 Number of Echoes
2 Target Distance
3 Echo Size
4 False Echo Data
5 False Echo Action
1 Number of False Echoes
2 False Echo 1 Data
3 False Echo 2 Data
4 False Echo 3 Data
5 False Echo 4 Data
1 Clear False Echoes
2 Learn a False Echo
3 Auto Tank Map
1 Upper Blanking
2 Echo Size
3 Distance
4 Number of Echoes
5 Success Rate
1 Set Threshold
2 Threshold in Use
3 Echo Size
4 Distance
5 Number of Echoes
6 Success Rate
1 Power Control Enable
2 Transmit Power in Use
3 Echo Size
4 Distance
5 Number of Echoes
1 Set Target Pulses
2 Pulses in Use
3 Echo Size
4 Distance
5 Success Rate
1 Spike Reject
2 Echo Size
3 Distance
4 Number of Echoes
5 Success Rate
1 Set Temperature
2 Temperature Speed of Sound
3 Distance
4 Speed of Sound
1 Set Frequency
2 Transducer Frequency
3 Echo Size
4 Success Rate
1 Simulation
2 General
1 Simulation Control
2 PV
3 Current Output
4 % Current Output
5 Relay Status
1 Restart
2 Load Defaults
Continued on next page
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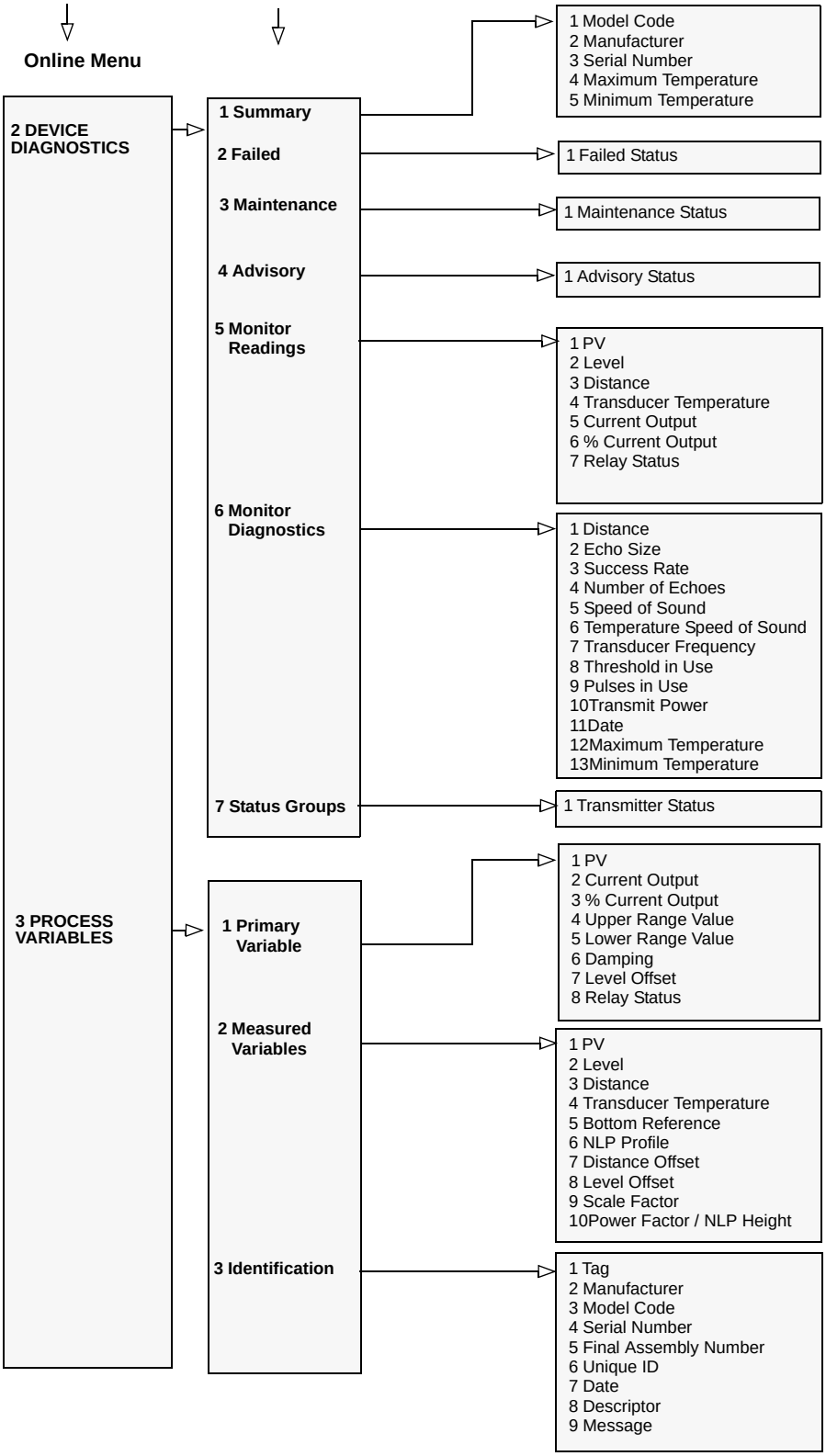


Table E-1. HART Fast Key Sequences

Base Units	1, 3, 5, 8
Bottom Reference	1, 1, 1, 2
Primary Value (PV)	3, 1, 1
Level (Secondary Variable)	3, 2, 2
Distance (Tertiary Variable)	3, 2, 3
Transducer Temperature (Fourth Variable)	3, 2, 4
Present Depth	1, 1, 2, 3
Set as empty	1, 1, 2, 4
PV Units	1, 3, 1, 1
PV Scale Factor	1, 3, 1, 3
NLP Profile	1, 3, 1, 2
Power Factor / NLP Height	1, 3, 1, 4
FALSE ECHO ACTIONS	1 5, 2, 5
FALSE ECHO DATA	1, 5, 2, 4
Echo Size	2, 6, 2
AUTO TANK MAP (Empty Tank)	1, 5, 2, 5, 3
Upper Range Value (PV @ 20 mA)	1, 1, 3, 1
Lower Range Value (PV @ 4 mA)	1, 1, 3, 2
Damping (output PV)	1, 1, 1, 5
Set-up relays (The 3102 only)	1, 3, 3
Relay status (The 3102 only)	3, 1, 8
Model code	1, 2, 1, 3
Serial number	1, 2, 1, 4
Transducer material	1, 2, 4
Load factory defaults	1, 6, 2, 2
Simulation	1, 6, 1, 1

Appendix F Parameters accessed over HART Communications

INTRODUCTION

The Rosemount 3102 and Rosemount 3105 support HART® communications, which may be used to program or interrogate the transmitter from any point on the two-wire loop.

This appendix describes the parameters that can be accessed over HART communications using a HART Master Device, such as the The Rosemount 3490 Series Control Unit or a Field Communicator.

NOTE:
For relevant menu structures, refer to Appendix D or Appendix E, whichever is appropriate for your HART Master Device.

TRANSMITTER ACTION PARAMETERS (THE 3102 AND 3105)

NOTE:
For relevant menu structures, refer to Appendix D or Appendix E, whichever is appropriate for your HART Master Device.

Parameter: BASE UNITS

When the transmitter is shipped from the factory, the default factory settings of transmitter parameters are **`metric`**, **`imperial ft`**, or **`imperial inch`**, depending on the model order code (see “Ordering Information” on page A-6).

To change base units, select the **`Base Units`** menu option and edit accordingly.

NOTE:
Keep a record of your programmed settings. Changing the base units will re-set parameters to their default factory settings.

NOTE:
The Display Units (Reported Units) of the transmitter’s Process Value can be changed to metric or imperial units of measurement using P012, but this does not automatically re-scale the PV value. See “P012 (PV Units)” on page F-12.

Parameter: SET AS EMPTY

Select the **`Set As Empty`** menu option. Options are to **`quit`** to the previous menu, or to perform the set as empty action.

If the Bottom Reference is unknown and the tank is empty, the transmitter can adjust the Bottom Reference (P010) value to be the same as the present distance measurement with the empty tank.

P010 = D910 - P060

Where:

P010 = Bottom Reference (see page F-5).

D910 = Distance measurement with empty tank.

P060 = Distance (sensor) offset (see page F-19).

Parameter: PRESENT DEPTH

Select the **`Present Depth`** menu option. Options are to **`quit`** to the previous menu, or **`edit`** a present depth value.

If the Bottom Reference is unknown and the present liquid depth is known, the transmitter can adjust the Bottom Reference (P010) value to take into account an edited present depth reading:

P010 = (Depth + D910) - P060 + P069

Where:

P010 = Bottom Reference (see page F-5).

depth = Edited present depth value.

D910 = Distance measurement.

P060 = Distance (sensor) offset (see page F-19).

P069 = Level offset (see page F-20).

Parameter: LEARN FALSE ECHO

Select the **`Learn False Echo`** menu option. Options are to **`quit`** to the previous menu, or **`start`** the learning process.

The transmitter can learn that the present distance measurement is calculated from an echo off a false target, and the false echo can be ignored. If there is an echo from yet another false target, repeat the learning process again. A maximum of **four** false echoes can be learned.

- To clear all learned false echoes, see **P089** on page F-21.
- To edit new or existing false echo data, see **P081** to **P088** on page F-21.
- For automatic learning, use the **`Auto Tank Map`** feature (see below).

Parameter: AUTO TANK MAP

Select the **`Auto Tank Map`** menu option to view the parameter screen. Options are to **`quit`** to the previous menu, or **`start`** the mapping process

The transmitter can be instructed to map up to **four** echoes from false targets within an empty tank. The tank needs to be empty so that echoes from all false targets are exposed.

- To clear the learned false echoes after using **`auto tank mapping`**, see **P089** on page F-21.
- To edit false echo data, see parameters **P081** to **P088** on page F-21.
- For non-automatic learning, use the **`Learn False Echo`** menu option.

Parameter: SIMULATION

Select the **`Simulation`** menu option to view the parameter screen. Options are to **`quit`** to the previous menu, or select a simulation.

The transmitter simulations automatically cycle the output Primary Value (PV) between the bottom of the tank and the nearest measurable distance.

Simulation options are:

- **`Run up`** – cycles up, and then down, repeatedly until stopped.
- **`Run down`** – cycles down, and then up, repeatedly until stopped.
- **`Run from Zero`** – as "**`Run up`**" except output PV initially starts from 0.

The direction of the cycle is given by the name of the simulation chosen.

A single cycle takes 100 seconds to complete. The Current Output, and relays (where fitted) respond according to the output PV.

The cycling may be paused by with the **`pause`** option, and then re-started by selecting a simulation.

To stop the cycling, select the **`normal`** option.

Parameter: RESTART DEVICE

By selecting this **`Restart Device`** menu option, the transmitter re-loads the user default parameter values, and then performs a restart. The resulting restart is identical to the normal power-up sequence when first taken out of the box.

Parameter: DEFAULTS

It may, occasionally, be necessary to re-set the transmitter parameters to factory default values, particularly if the data already changed and held in the transmitter is in question.

NOTE:
Re-loading factory defaults will overwrite all parameters and all site entered data will be lost.

Parameter:
FACTORY USE

This parameter is for factory use only.

TRANSMITTER P*** PARAMETERS (THE 3102 AND 3105)

NOTE:
For relevant menu structures, refer to Appendix D or Appendix E, whichever is appropriate for your HART Master Device.

The 'P' prefixed parameters (e.g. P010) are for adjusting the operational set-up of the transmitter. Parameters are listed here in numerical order.

P000 (Message)

P000 Description:

This allows a general 32-character message to be edited (12 characters on a Rosemount 3490 Series Control Unit). It can be used for any purpose, such as recording the initials of the person who programmed it, a support contact number, details of last programming change, etc.

P001 (Tag Number)

P001 Description:

This is for editing a tag number of up to 16 characters for the transmitter (8 characters on a Rosemount 3490 Series Control Unit). The tag is typically a reference number, but it can also be used to identify the location or duty of the transmitter in plant item terms.

NOTE:
This tag helps identify the transmitter being interrogated when using a HART Master Device such as the Rosemount 3490 Series Control Unit.

P002 (Description)

P002 Description:

This is for editing an optional 12-character description to expand on P001, if needed.

P004 (Final Assembly Number)

P004 Description:

This is a read-only parameter showing a multiple-digit number, used by the factory to track the manufacturing history of an individual transmitter.

P005 (Serial Number)

P005 Description:

This is a read-only parameter showing a multiple-digit number, used by the factory to identify a transmitter,

P010 (Bottom Reference)

P010 Description:

The Bottom Reference value is the distance measured vertically along the ultrasonic beam path from the transmitter face to the zero level of the vessel or open channel.

The zero level establishes where the transmitter starts to measure the process value (PV). It is not necessary to have the 4 mA output commence at the zero level; the 4 mA start-point can be any liquid height above (or below) this zero level.

This parameter is important for calibrating or configuring the transmitter.

P011 (Tank Shape)

P011 Description

This selects the shape of a vessel or open channel, and establishes the linear or non-linear relationship between the live liquid level (height) and the Process Value (PV) derived from that level.

The display (reported) units of measurement for the output PV are set using P012. Changing the units does not automatically re-scale the output PV value.

There are over 30 shape options available to select, including:

- “P011 = “Linear”” on page F-6
- “P011 = “Special”” on page F-6
- “P011 = “Horizontal Cyl Flat” (Horizontal cylinder, flat ends)” on page F-9
- “P011 = “Spherical”” on page F-9
- “P011 = “Flume/Weir-3/2”” on page F-10
- “P011 = “V-Notch-5/2”” on page F-11

P011 = “Linear”

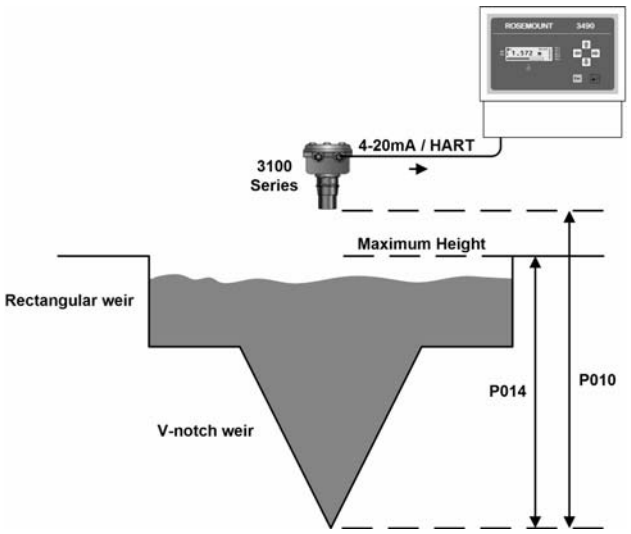
This setting is applicable when requiring level or content measurements involving a vessel with a constant cross-section. By selecting “Linear”, the level or content is a product (multiplication) of the liquid height above the zero level and a scaling factor (P013). If volume is not required, the scaling factor is set to 1.0 unless other units for the PV are required.

The volume of the contents can be shown by entering the volume per meter of height factor in to P013. If the liquid level is being measured in units of feet or inches, P013 will specify the volume per feet or volume per inch.

P011 = “Special”

By selecting “Special”, parameters P030 to P039 can be edited to plot the unique profile of an irregular shaped vessel or open channel (see Figure F-2).

Figure F-1.
Flow over a 2-stage weir



To derive up to 10 profile points, it is necessary to have tabulated or graphical data to relate the required Process Value (PV) to Liquid Height.

Figure F-2 on page F-7 shows an example graph of PV versus Liquid Height.

Parameters P030 to P039 are for entering up to 10 Y-axis values, actual percentages, which correspond to the 10 fixed percentages on the X-axis, and determines the plotted points.

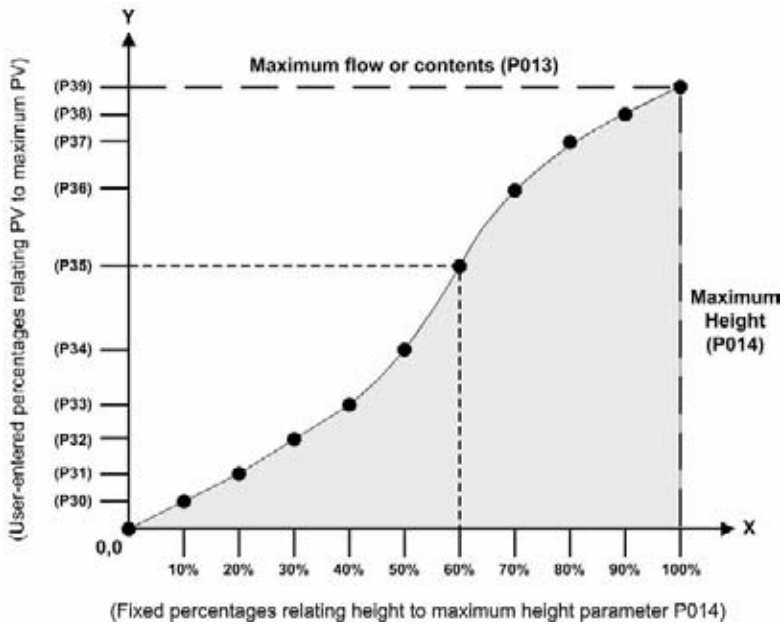
For example, 60% of the maximum height (P014) will relate to a percentage of the maximum PV (P013). This percentage, say 50%, is entered into P035.

The transmitter will interpolate linearly between the plotted points to give an accurate curve fit, which will determine the output PV from the live level measurement.

Setting-up Procedure for "Special":

1. Select units for the PV using P012.
2. Draw the graph of PV versus Liquid Height.
3. Choose the maximum point on the graph where measurements will be required.
4. Set P014 to liquid height (on X-axis) at this maximum point.
5. Set P013 to the flow rate or content (on Y-axis) at this maximum point.
6. Set P010 to the distance from the transmitter face to the zero point (Y = 0) on the graph.
7. Use parameters P030 - P039 to enter percentage values that correspond to the fixed percentages.

Figure F-2. First graph of PV versus Height



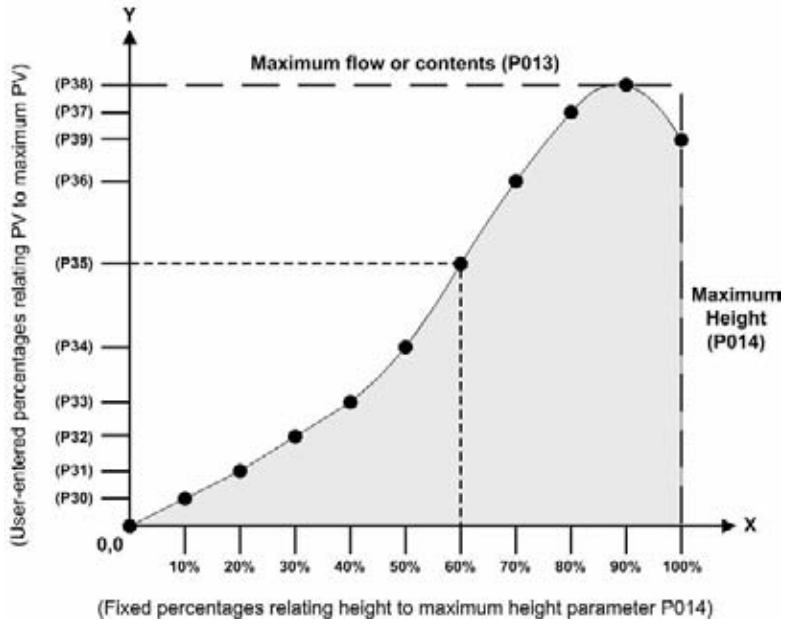
Each live level (height) measurement is converted into a percentage (0 to 100%), which is proportional to the maximum height (P014). In graph terms, the converted percentage corresponds to an X ordinate on the X-axis.

Given the X ordinate, the Y ordinate is then calculated to determine a percentage, related to the maximum PV (P013). The 'Y' ordinate, a percentage, is multiplied by the value of P013 by the transmitter to determine the final output PV.

NOTE:

- The origin (0,0) is used as the start point. It is not a parameter.
- Profile Point 10 may, or may not, occur at the height entered in P014. It is possible the PV corresponding to this height is less than 100% of P013. This means that P013 can be selected as any value above the maximum to be monitored. (See Figure F-3 on page F-8).

Figure F-3. Second graph of PV versus Height

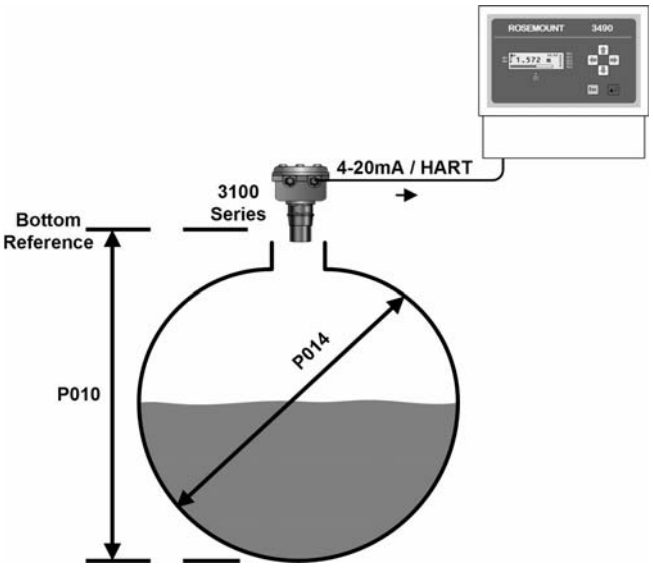


P011 = “Horizontal Cyl Flat” (Horizontal cylinder, flat ends)

This setting is applicable when volume of content measurements involving a horizontally oriented cylindrical vessel with a constant diameter is required – See Figure F-4 on page F-9 for a cross-sectional view.

By selecting “Horizontal Cyl”, the live volume of the content is derived from the raw measured liquid level, the full volume of the ideal cylindrical tank (P013), and the diameter of that vessel (P014).

Figure F-4. Sphere or Cylindrical Tank Example



P013 = Full volume of ideal cylindrical or spherical tank of constant diameter (P014)

P011 = “Spherical”

This setting is applicable when volume of content measurements involving a spherical vessel with a constant diameter is required – See Figure F-4 on page F-9 for a cross-sectional view.

By selecting “Spherical”, the live volume of the content is derived from the raw measured liquid level and the full volume of the ideal spherical vessel (P013) Reference (P010).

P011 = “Flume/Weir-3/2”

This setting is applicable when flow measurements involving an open channel with a flume or weir profile is required.

The rate of flow per second is calculated by:

$Q = k \times h^{pwr}$

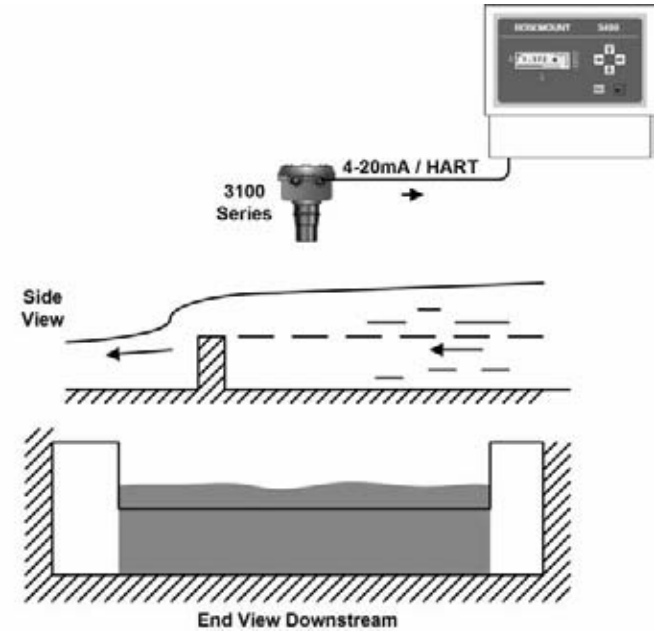
where h is the live liquid level, Q is flow rate per second, Pwr is the power (P014) and k is a user-entered factor (P013).

Flumes that deviate from the standard “3/2 power law”, such as round-bottomed flumes, must use the “Special” shape option (P011) that is based on flow versus height tabulations (see “P011 = “Special”” on page F-6).

Setting-up Procedure for “Flume/Weir-3/2”:

1. Select “Flume/Weir-3/2” option using P011.
2. Enter the K-factor in P013.

Figure F-5. Rectangular Weir Example (Using 3/2 Power Law)



P011 = “V-Notch-5/2”

This setting is applicable when flow measurements involving an open channel with a V-notch weir is required.

The rate of flow through a V-notch is calculated using:

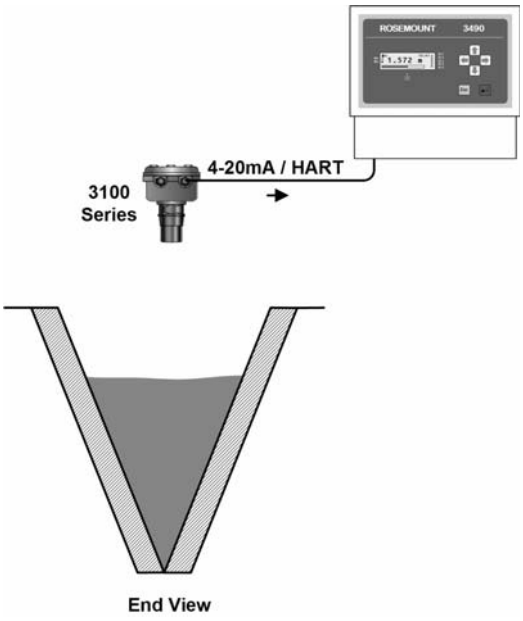
$Q = k^* h^{pwr}$

where h is the live liquid level, Q is flow rate per second, Pwr is the power (P014) and k is a user-factor (P013).

Setting-up Procedure for “V-Notch-5/2”:

1. Select “V-Notch-5/2” option using P011.
2. Enter the k-factor in P013.

Figure F-6. V-Notch Weir Example (Using 5/2 Power Law)



P012 (PV Units)

P012 Description:

Use this to select alternative Display Units of the PV, which are reported to the HART Master Device e.g. Rosemount 3490 Series Control Unit.

NOTE:
Selecting alternative Display Units does not re-scale the PV value.

Table F-1.
P012 (PV Units) Options

Category	Default Metric Units	Alternative Units
Level	“m” (meter)	“ft” (feet), “in” (inches), “cm” (centimetres), “mm” (millimetre)
Volume	“m3” (cubic meter)	“gal” (gallon), “l” (litre), “ft3” (cubic feet) or “bbl” (barrel)
Speed	“m/s” (meters/second)	“ft/s” (feet/second) or “in/s” (inches/second)
Flow	“m3/h”	“m3/d” (m3/day), “m3/m” (m3/minute), “m3/s” (m3/second) “g/d” (gallon/day), “g/h” (gallon/hour), “g/m” (gallon/minute), “g/s” (gallon/second), “l/h” (litre/hour), “l/m” (litre/minute), “l/s” (litre/second), “ft3/day” (ft3/day), “ft3/hour” (ft3/hour), “ft3/m” (ft3/minute), “ft3/s” (ft3/second), or “Mg/d” (Million gallons/day or MGD)
Mass	Kg	“ton” or “tne” (tonne)
Temperature	°C	°F
Fraction	%	-

P013 (PV Scale Factor)

P013 Description:

When calculating the level of liquid contents in metres, feet or inches, P013 is used for converting (scaling) the raw level measurement to alternative units before output. If alternative units are not required, keep P013 set to 1.0.

When calculating the volume of liquid contents, P013 is set to the volume of the ideal shaped cylinder, sphere or conical vessel (tank). P014 is set to the diameter (only applicable to horizontal cylinders), as shown by Figure F-4 on page F-9.

When calculating the volume of liquid contents or flow in an irregular shaped vessel or open channel, P013 is set to the maximum output PV - as described for the “Special” shape option of P011 (Tank Shape).

When calculating the rate of liquid flow in a standard open channel, parameters P013 and P014 are terms in a flow rate calculation, as specified for Flume/Weir options described for P011 (Tank Shape).

Minimum/Maximum value:

0.0/999999

P014 (Profile Height or Power)

P014 Description

When calculating the volume of liquid contents in an ideal horizontal cylinder or sphere, P014 is set to the diameter, as shown by Figure F-4 on page F-9.

When calculating the volume of liquid contents or flow in an irregular shaped vessel or open channel, P014 is set to the maximum height or flow rate, as shown by Figure 14 and Figure 15 on page 16.

When calculating the rate of liquid flow in a standard open channel, parameters P013 and P014 are terms in a flow rate calculation, as specified for Flume/Weir options described for P011 (Tank Shape).

Minimum/Maximum value

0.0/999999

P015 (Upper Range Value)

P015 Description

This defines the Process Value (PV) represented by a 20 mA current output from the transmitter.

The span of the 4–20 mA current output is defined by P015 and P016. It is not necessary for P015 to have a value that is greater than P016, in which case the current output will decrease for an increasing PV.

For example, consider a tank with the capacity for 120 gallons. When the tank is the full, a 20 mA current output is required from the transmitter. Therefore, P015 is set to 120 if the PV is being measured in gallons. P016 would normally be set to 0.0 (gallons) for 4 mA current output to indicate an empty tank.

Display (reported) units of measurement are as selected for the PV by P012.

Minimum/Maximum value

0.0/999999

P016 (Lower Range Value)

P016 Description

This defines the Process Value (PV) represented by a 4 mA current output from the transmitter.

The span of the 4–20 mA current output is defined by P015 and P016. It is not necessary for P015 to have a value that is less than P016, in which case, the current output will decrease for an increasing PV.

For example, consider a tank with the capacity for 120 gallons. When the tank is the empty, a 4 mA current output is required from the transmitter. P016 is set to 0.0 if the PV is being measured in gallons. P015 would normally be set to 120.0 (gallons) for 20 mA current output to indicate a full tank.

Display (reported) units of measurement are as selected for the PV by P012.

Minimum/Maximum value

0.0/999999

P020 (Damping / Smoothing Time)

P020 Description

This defines the time constant of the exponential smoothing used on the output Process Value (PV), and is entered as a value in seconds. The pulse repetition frequency of the transmitter is approximately one pulse per second, which means that the system response time cannot be faster than this.

Minimum/Maximum value

0.0/9999

P021 (Lost Echo Delay)

P021 Description

Lost Echo Delay is defined uniquely for pulse echo level measurement systems, where ultrasonic pulse echoes are lost due to adverse liquid surface conditions such as turbulence (or foam).

The ultrasonic pulse transmitted towards the surface is, sometimes, not returned, deflected away from the transmitter, or attenuated significantly. In these conditions, the transmitter holds the last valid data and transmits another pulse to see if the echo is returned.

The Lost Echo Delay (P021) sets the period that the transmitter will hold and display the present valid surface measurement, waiting to update the measurement when the next echo is recovered.

If the Lost Echo Delay period ends with no valid echoes returned, a fault condition (“LOST ECHO”) is signalled.

- A valid returned echo occurs inside a 'window' on either side of the liquid level, and the 'window' increases as the range to the target increases. All echoes within the ‘window’ are monitored and averaged to provide smoothing of the liquid level output under turbulent conditions.
- Any returned echo from closer to the transmitter than the liquid surface is considered valid if a minimum required number of echoes (P042) have been received. The output will then change to this new value.
- Any echo returned further from the transmitter than the liquid surface and outside the 'window' is ignored. However, if a lost echo condition is developing and a period (Lost Echo Time divided by two) has elapsed, any echoes received from further away targets are treated as valid. The liquid level measured will change to the new value after receiving four such echoes.

Minimum/Maximum value

0.0/9999

P022 (Lost Echo Action)

P022 Description

This defines what happens to the PV output when a Lost Echo condition exists, which is after the Lost Echo Delay period (P021) has elapsed.

NOTE
A lost echo is indicated on the Integral Display of the transmitter and Rosemount 3490 Series Control Unit. It can also be indicated by fault relay.

The selectable options for P022 are "**MINIMUM**", "**HOLD**", and "**MAXIMUM**".

P022 = "MINIMUM"

If this setting is selected, the PV is forced to zero while a Lost Echo condition exists. In addition, the current on the two-wire loop will decrease to 3.75 mA (for Rosemount Standard) or 3.6 mA (for NAMUR NE43), depending on the model order code (see page "Ordering Information" on page A-6).
The current will remain at that level until the correct target echo is recovered.

P022 = "MAXIMUM"

If this setting is selected, the PV is forced to the maximum while a Lost Echo condition exists. The maximum PV is the value that occurs when an echo is received from the transmitter face. In addition, the current on the two-wire loop will increase to 21.75 mA (for Rosemount Standard) or 22.5 mA (for NAMUR NE43), depending on the model order code (see page "Ordering Information" on page A-6). The current will remain at that level until the correct target echo is recovered.

P022 = "HOLD"

If this setting is selected, the current output is held at the last good value.

P023 (Top Blanking Distance)

P023 Description

The Top Blanking Distance defines a zone close the transmitter where an echo is ignored. Establishing this zone will eliminate echoes from false targets such as mounting fittings or the end of stub pipes.

P023 defines the vertical distance from the transmitter face to where a valid surface echo can be detected.

To avoid a false high level alarm, P023 should not be lower than the factory default.

If P023 is set to a value greater than the Bottom Reference (P010), the ultrasonic pulses transmission will cease.

If the sum of P023 and P063 is greater than the Bottom Reference (P010), the ultrasonic pulses transmission will cease.

See Figure F-7 on page F-20 for tank geometry.

Minimum/Maximum value

0.0/999999

P024 (Speed of Sound)

P024 Description

P024 is for entering the speed of sound of the gas above the liquid surface (ullage gas) in a closed vessel, at a temperature of 32 °F (0 °C).

The Speed of Sound (D914) is calculated for the ullage gas at the temperature and humidity level in the tank. The correction for temperature effects is made using P025, assuming the value for the speed of sound entered in P024 is valid at 32 °F (0 °C).

For systems monitoring aqueous liquids with air (or nitrogen) as the primary gas in the ullage space, the value entered in P024 should be 331.80 (metres/second). This setting is most accurate over the temperature range 32 to 104 °F (0 to 40 °C). It takes into account the typical variations in humidity and assumes the temperature compensation is based on the temperature sensor measurement.

If the tank vapor space is filled with a different gas, a revised value should be entered into P024. Gas mixtures have speed of sound values calculated as an average according to the proportion of the gases present.

Table F-2 shows Speed of Sound values for ullage gases at 32 °F (0 °C).

Minimum/Maximum value

0.0/999999

NOTE:
The speed of sound is inversely proportional to the molecular weight of the gas molecules. Certain triatomic gases attenuate ultrasound significantly, because of molecular resonance. Examples are carbon dioxide, oxides of nitrogen and sulphur and chlorine. Ultrasonics should not be used where carbon dioxide or chlorine is present in the ullage space and only after careful consideration in the case of oxides of nitrogen and sulphur. Operational performance of ultrasonic pulse echo systems is significantly reduced when such gases exceed small percentages in the Ullage space (e.g. 5%).

Table F-2.
Speed of sound of ullage gases

Ullage Gas	Speed of Sound
Acetaldehyde	244
Ammonia	415
Argon	308
Benzene	177
Carbon Dioxide	259
Carbon Tetrachloride	145
Cyclohexane	181
Ethane	316
Ethylalcohol	258

Ullage Gas	Speed of Sound
Ethylether	206
Methane	430
Methanol	335
Nitrogen	337
Nitric oxide	334
Oxygen	332
Propane	238
Sulphur hexafluoride	133

P025 (Temperature)

P025 Description

This is for temperature correcting of the speed of sound entered in P024. The corrected speed of sound is displayed in D914.

For automatic (dynamic) corrections using the integrated temperature sensor, select the AUTO option. The live temperature measurement is displayed at D915.

The temperature sensor measures the air temperature at the transmitter rather than measuring the average temperature across the ullage space. If the average temperature is known, this can be entered in P025. The same value is indicated by D915 and is used to calculate the speed of sound. (Negative values are allowed.)

If the temperature sensor fails and AUTO is selected, the P025 setting reverts to 68 °F (20 °C).

P026 (Threshold)

P026 Description

This sets the sensitivity of the echo detection circuits in the transmitter. P026 defines the minimum signal level as a percentage, above which an echo is detected and treated as a potentially valid surface or target.

When P026 is set to AUTO, the sensitivity is automatically adjusted over a range of values, depending on the echo strengths being received. The threshold is adjusted to one quarter of the peak value of the largest signal detected to give best overall performance.

P026 can be a constant value, which may be needed to overcome particular site difficulties or special conditions. For example, setting the threshold to 20 (%) may be used to avoid echoes from rough brickwork on a sump wall.

The value of P026 may be adjusted in conjunction with parameters P023, P043, P048, and P063.

Minimum value:

0.0 (if not using Auto)

Maximum value:

99.9 (if not using Auto)

P030 to P039 (Profile Points)

P030 to P039 Description

For the purpose of these parameters, see “P011 = “Special”” on page F-6.

P040 (Transmit Power Control)

P040 Description

The transmitted ultrasonic energy can be controlled automatically to avoid strong close echoes saturating the electronics of the transmitter.

When this mode is enabled, P044 has no affect.

P041 (Pulse Repeat)

P041 Description

The nominal rate of repetition for ultrasonic pulses from the transmitter is one pulse per second. If two transmitters were located within the same vessel, it is possible this would allow ultrasonic pulses from one unit to be received by the other. If pulses were occurring at the same time, the receiving transmitter could mistakenly identify this crosstalk as a valid surface echo. This can be prevented by having both transmitters operate with different rates of pulse repetition, which means this interference is rejected as not consistent (pulse-to-pulse).

P041 allows the pulse repetition interval to be adjusted by increments of 0.1 seconds in the range 0.5 to 2.0 seconds, allowing sufficient separation to avoid crosstalk problems.

Minimum/Maximum value:

“0.5s”/“2.0s”

P042 (Echoes Needed)

P042 Description

The transmitter monitors the echoes returned from the liquid surface or any other target within range. A valid surface echo exceeds the signal strength threshold, set by P043 and P048, consistently for more ultrasonic pulse cycles than set by P042.

The normal value for P042 is 4, meaning four echoes must be received consecutively from a new, closer surface before this is taken as the actual liquid level. In addition, surface echoes that are more distant are ignored for two seconds.

Typically, P042 is used to avoid stirrers, which give occasionally high liquid level signals when they protrude from the liquid surface. It may also be used to avoid unwanted input signals from spray, inflows or crosstalk from other transmitters.

P043 (Threshold 1 Time)

P043 Description

Frequently, false echoes occur close to the transmitter face. If they occur outside the top blanking distance, the threshold may be maintained at an artificially high level (size in %) for a programmable duration (in ms).

The programmable duration is set by P043. See “P048 (Threshold 1 Size)” on page F-19 for the corresponding programmable echo size.

P044 (Target Pulses)

P044 Description

This sets the number of ultrasonic pulses in the burst sent from the transmitter every second.

The AUTO option allows the transmitter to control the number of pulses.

Minimum/Maximum value:

“4” / “32”

P045 (Target Frequency)

P045 Description

P045 sets the frequency used for transmitting an ultrasonic pulse. The optimum frequency depends on the characteristics of the transmitter piezoelectric crystal, which are affected by temperature.

The transmitter has a look-up table to select a frequency value to give the highest echo strength from the prevailing conditions at the site. This operates when P045 is set to AUTO.

Occasionally, site or transmitter conditions require a fixed frequency, not a variable frequency. P045 is used to set a fixed frequency, but the actual frequency value used is selected from the look-up table and the nearest to that entered value is selected automatically.

D916 indicates the present frequency.

P048 (Threshold 1 Size)

P048 Description

Frequently there are false echoes close to the transmitter face. If they are outside of the desired top blanking distance, the threshold may be maintained at an artificially high level (size in %) for a programmable duration (in ms).

The programmable size is set by P048. See also P043 for the corresponding programmable duration.

P049 (Spike Reject)

P049 Description

P049 sets the minimum duration of a valid echo signal, and is used to reject transient electrical interference (spike) signals.

NOTE:
Spike rejection is switched-off when P049 is set to 0.

P060 (Distance Offset)

P060 Description

The Distance Offset is the distance from the Xmtr Reference Point to the Distance Reference Point (see Figure F-7 on page F-20). It is subtracted from the measured range to produce the final output Distance (D902).

P063 (Bottom Blanking Distance)

P063 Description

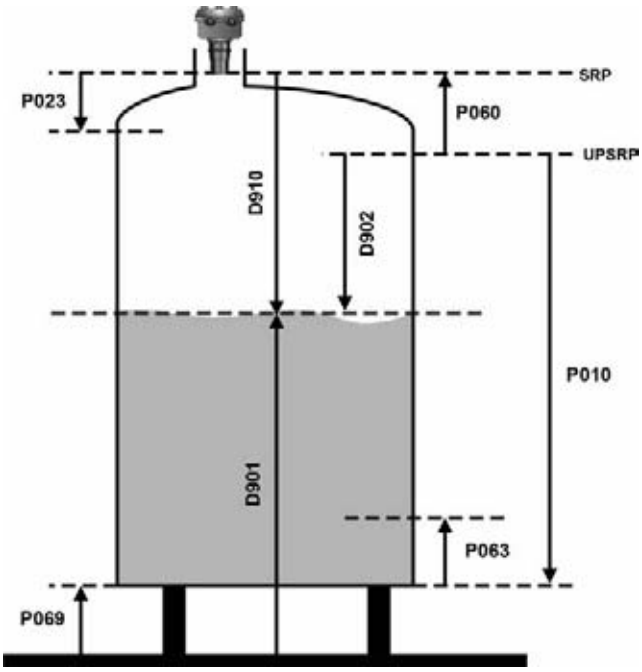
The Bottom Blanking Distance defines the zone above the Bottom Reference (P010) where an echo is ignored (see Figure F-7 on page F-20). This zone eliminates echoes from false targets (e.g. pumps) uncovered as the liquid level decreases.

P069 (Level Offset)

P069 Description

The Level Offset is the distance from the Bottom Reference (P010) to the Tank Reference Point (see Figure F-7 on page F-20). It is added to the measured level to produce the final output Level (D901).

Figure F-7. Tank Geometry



Abbreviations:
SRP = Sensor Reference Point
UPSRP = User Preferred SRP

Data processing sequence:

1. Echoes are processed that occur between P023 (Upper Blanking) and P063 (Lower Blanking).
2. D910 is derived from the Target Echo's Time of Flight and the calculated Speed of Sound:

   D910 = (ToF x SoS) / 2
3. D902 = D910 - P060
4. Liquid Level = P010 - D902
5. D901 = Liquid Level + P069

P070 to P072 (Relay 1 Setting-up)

P070 to P072 Description

P070 RL1 Mode

P071 RL1 PV On Point

P072 RL1 PV Off Point

On The Rosemount 3102, relay RL1 is a SPST (Single Pole, Single Throw) type. In the default mode of "**`Setpoint`**", RL1 is a control relay. It may be set to energize at any value of PV, and de-energize at any other value of PV. Setting the On and Off points to the same PV turns the relay off. The On point value may be greater or smaller than the Off point value.

All relay set-point values must be entered in the units selected for the PV.

P073 to P075 (Relay 2 Setting-up)

P073 to P075 Description

P073 RL2 Mode

P074 RL2 PV On Point

P075 RL2 PV Off Point

On The Rosemount 3102, relay RL2 is a SPST (Single Pole, Single Throw) type. In the default mode of "**`Fault`**", the relay de-energizes during Lost Echo or System Fault conditions. This relay de-energizes if the power fails.

The mode of RL2 may be changed to control mode by entering a non-zero On and Off Point value. In control mode, RL2 ceases to be a fault relay.

All relay set-point values must be entered in the units chosen for the PV.

P081 to P088 (False Echo Data)

P081 to P088 Description

P081 False Echo D1, and P082 False Echo S1

P083 False Echo D1, and P084 False Echo S1

P085 False Echo D1, and P086 False Echo S1

P087 False Echo D1, and P088 False Echo S1

These parameters are the four false echo data records, each storing a false echo as Distance-to-surface (e.g. 1.7 m) and Echo Size (e.g. 44%).
The transmitter will ignore these echoes from false targets.

See also:

- Section "Parameter: LEARN FALSE ECHO" on page F-3.
- Section "Parameter: AUTO TANK MAP" on page F-3.

P089 (Clear False Echoes)

P089 Description

This is to clear a specified False Echo record, or all False Echo records. Options are **`False Echo 1`**, **`False Echo 2`**, **`False Echo 3`**, **`False Echo 4`**, or **`All`**.

P970 (TX Material)

P970 Description

This read-only parameter describes the material of the transmitter.

TRANSMITTER D*** PARAMETERS (THE 3102 AND 3105)

NOTE:
For relevant menu structures, refer to Appendix D or Appendix E, whichever is appropriate for your HART Master Device.

The 'D' prefixed parameters (e.g. D900) monitor the transmitter operation. Parameters listed here are in numerical order.

D900 (Xmtr PV)

D900 Description

This displays the live Process Value (or PV) that drives the 4–20 mA output of the transmitter.

The factory default is for the PV to be a liquid level measurement in meters, feet, or inches. However, it can be another measurement e.g. volume of liquid content, if the transmitter has been programmed to calculate it.

In HART terminology, PV is the Primary Variable.

NOTE:
Display (Reported) units for PV are set by P012 – see page F-12.

D901 (Level, SV)

D901 Description

This displays the live liquid level measured by the transmitter. In HART terminology, SV is the Secondary Variable.

NOTE:
Units are metres, feet, or inches, depending on the Base Units selected - see “Parameter: BASE UNITS” on page F-2.

D902 (Distance, TV)

D902 Description

This displays the live distance-to-surface measured by the transmitter. In HART terminology, TV is the Tertiary Variable.

NOTE:
Units are meters, feet or inches, depending on the Base Units selected – see “Parameter: BASE UNITS” on page F-2.

D903 (Temperature, FV)

D903 Description

This displays the live ambient temperature measured by the transmitter. In HART terminology, FV is the Fourth Variable.

NOTE:
Units are °C or °F, depending on the Base Units selected –
see “Parameter: BASE UNITS” on page F-2.

D905 (% of Current Output)

D905 Description

This displays the percentage of the Current Output in use.
The calculation is based on Upper and Lower Range values (P015 and P016) whereby 0% represents 4 mA and 100% represents 20 mA.

NOTE:
When the poll address is a non-zero number, the transmitter is in multi-drop mode and the current output is fixed at 4 mA.

D906 (Current Output)

D906 Description

This displays the current used for the Current Output.

D910 (Target Range)

D910 Description

This gives the distance from the transmitter face to the liquid surface echo detected. It is a useful diagnostic tool because a false surface signal can be identified and related to the physical nature of the installation.

D911 (Echo Size)

D911 Description

The size of the echo returned from the liquid surface depends on the surface range, the turbulence, the presence of foam on the surface, draughts, gas composition and temperature, the transmitter performance, and other factors.

From pulse-to-pulse, the received echo strength may vary, but monitoring D911 gives the recorded echo strengths. The value of D911 is an averaged percentage of the last five echoes, with 100% representing a saturated returned signal.

D912 (Echo Success)

D912 Description

This is another measure of the quality of the echo returned. It is a percentage indicating the success rate achieved from the last ten pulse transmissions.

The success rate may fall below 100% due to the effect of extreme surface turbulence or stirrers, which might return a surface echo that is then rejected by the transmitter. A surface echo might be rejected because it is outside the allowed 'window' set-up to establish the liquid level (see “P021 (Lost Echo Delay)” on page F-14). This rejects invalid readings because liquid levels do not change very quickly.

One rejected surface echo causes D912 to decrease by 10%, but a subsequent valid surface echo reinstates this loss. The transmitter is biased to ignore sudden liquid level changes.

D913 (Target Echoes)

D913 Description

This gives the number of echoes detected by the transmitter. The maximum number displayed here is seven.

The echo closest to the transmitter face, i.e. the highest liquid level, is used to calculate the Process Value (PV). This is because the other echoes may be caused by multiple path surface reflections from tank walls or the roof.

D914 (Speed of Sound)

D914 Description

This is the temperature-corrected speed of sound calculated by the transmitter. It relates the returned echo time delay to a distance. The value is calculated using the base value for the speed of sound (P024) and temperature (D915).

D915 (Temperature)

D915 Description

This is the temperature used to calculate the temperature-corrected Speed of Sound (D914). The temperature may be a Live or Set value depending on the setting of P025.

NOTE:
D903 (FV) always indicates the live ambient temperature.

D916 (Frequency)

D916 Description

This is the transmitter operating frequency.

D917 (Threshold in Use)

D917 Description

The is the threshold limit below which false echoes are rejected. Normally, the Rosemount 3100 Series ultrasonic transmitter automatically sets the threshold level for optimum performance based on echo sizes being received.

D918 (Pulses in Use)

D918 Description

This is the number of pulses transmitted each second.

D919 (Transmit Power)

D919 Description

If this feature is enabled on the Rosemount 3100 Series ultrasonic transmitter, the transmitter optimizes the power needed for pulse transmission. The lower the number, the less power being transmitted. The higher the number, the more power being transmitted.

D949 (Model Code)

D949 Description

This is the model number of the transmitter.

D951 (Poll Address)

D951 Description

This is the polling address of the transmitter. The poll address range is 0 to 15. When it is 0, the transmitter is in 4–20 mA mode. For all other addresses, the transmitter is in multi-drop mode (current fixed to 4 mA).

D952 (Hardware Revision)

D952 Description

This is the overall revision number of hardware at time of manufacture.

D953 (Software Revision)

D953 Description

This is the revision number of the embedded software at time of manufacture.

D960 (Manufacturer)

D960 Description

This is the name of the manufacturer.

D961 (Unique ID)

D961 Description

This is used by the HART communications protocol. It is normally the same as the serial number.

D962 (HART Revision)

D962 Description

This is the major revision number of the standard for the HART communications protocol.

D963 (Txr Specific Command Revision)

D963 Description

This is the minor revision number of the commands supported by the transmitter.

D964 (Preambles)

D964 Description

This is read by a HART Master Device e.g. Rosemount 3490 Series Control Unit to determine how many preamble bytes are sent with each HART protocol message.

D965 (Flags)

D965 Description

This is used by the HART communications protocol.

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Rosemount 3100 Series

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