

Rosemount Ultrasonic 3107 Level and 3108 Flow Transmitters

The Rosemount 3107 and 3108 are sealed 4–20 mA loop-powered liquid level transmitters, and are designed for use in waste water and effluent treatment plant applications. The 3108 is MCERTS certified for open flow channel applications.

These rugged UPVC transmitters are certified Intrinsically Safe for use in Zone 0 areas, and factory fitted with up to 164 ft. (50 m) of two-core cable for simple low cost installation in sumps, wet-wells and over open channel flow structures.

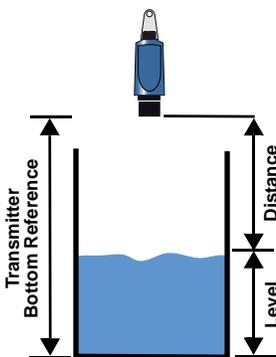
The transmitters can be connected directly to a plant control system, or used with a Rosemount 3490 Control Unit for programmable control functionality.

Measurement Principle

The 3107 and the 3108 are based on ultrasonic technology. Ultrasonic pulse signals are transmitted and reflected from the liquid surface. The transmitter 'listens' for reflected signals (echoes) and measures the time-delay between transmitting and receiving.

The distance to the liquid surface is automatically calculated using the computed time-delay.

The 3107 has an integrated sensor for automatically compensating the *Distance* for temperature effects.



The 3108 has a factory fitted remote temperature sensor to continuously measure the air temperature around the transmitter.

It then computes the *speed of sound in air*, automatically compensating *Distance* for temperature effects.

The level measurement (Bottom Ref minus Distance) is sent through the 4–20 mA or HART® output.

Level Measurement

When programmed with the bottom reference of the application, usually the tank bottom, the transmitter will calculate the liquid depth (Level).

The calculated Level can be sent through the 4–20 mA or HART output.

Volume Measurement

The 3107 and the 3108 can calculate the contents (volume) of liquid in a tank. The transmitters have a library of profile shapes for selection.

The calculated volume can be sent through the 4-20 mA or HART output.

Open Channel Flow Measurement

The 3107 and the 3108 can also calculate the rate of liquid flow in an open channel. The transmitters have a library of standard open channel flow structure profiles, but also supports a user-defined flow profile that is plotted or calculated.

A ten-point strapping table for non-standard tank shapes and flow structures can be input into the transmitter.

The calculated flow rate can be sent through the 4–20 mA or HART output.

The 3108 is MCERTS certified and forms part of an MCERTS certified system when used with the Rosemount 3490 Series Control Unit.

Special Features

Advanced Software Features

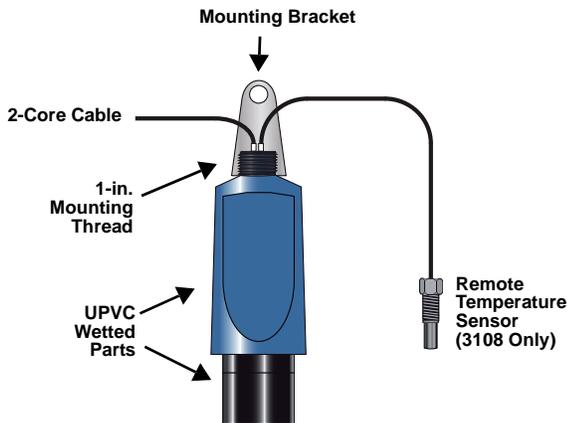
- Learn routine (false echo registration)
The transmitter can learn to ignore up to four false echoes, caused by the pulse signal reflecting off obstructions, until the actual level is seen.
- Present depth
The bottom reference can be automatically set using a known user-entered depth.
- Distance offset
The distance to the surface can be adjusted by a user-entered positive or negative offset value.
- Level offset
The level can be adjusted by a user-entered positive or negative offset value.

Rosemount 3107 and 3108

SELECTING A TRANSMITTER

Overview of Models

The Rosemount 3107 and Rosemount 3108 are certified Intrinsically Safe and are used for level or distance measurements in hazardous areas. They also feature volume and open channel flow calculations, and a 4–20 mA / HART output.



Housing Material

The housing is available in UPVC (stabilized).

Process Connection

Threaded Connection

Mounting Thread: 1-in. BSPP (G1) or 1-in. NPT.

Electrical Connections

Factory fitted two-core shielded cable up for external power supply and communication (signal output).

3107 cable lengths: 10, 65, or 164 ft. (3, 20, or 50 m)
3108 cable length: 65 ft. (20 m)

An external power supply is required:

- 12 to 40 Vdc in a non-hazardous area
- 12 to 30 Vdc in hazardous area

Signal Output

The 3107 and 3108 have a 4–20 mA output with HART communications, powered by the voltage supply to the transmitter.

NOTE

See Product Data Sheet 00813-0200-4840 for the full specification.

Temperature Sensor

The 3107 has an integrated sensor for automatically compensating for temperature effects.

The 3108 has a factory fitted Rosemount Remote Temperature Sensor that provides dynamic temperature compensation. The sensor is installed in between the transmitter and the liquid surface, or in a shaded area of an open channel.



Remote Temperature Sensor Specification:

- 316 stainless steel body with locknut
- M8 thread
- Sensor working temperature: –40 to 185 °F (–40 to 85 °C)
- Cable length of 6.5 ft. (2 m)

Measurements and Calculations

Level (or distance), volume, and open channel flow.

Measurement Range

3107: 1 to 39 ft (0,3 to 12 m)
3108: 1 to 11 ft (0,3 to 3,3 m)

Product Certifications

Hazardous Area Installation

The 3107 and 3108 are available for ATEX, IECEx, FM, and CSA Intrinsically Safe installation.

MCERTS

The 3108 is MCERTS certified and forms part of an MCERTS certified system when used with the Rosemount 3490 Series Control Unit.

NOTE

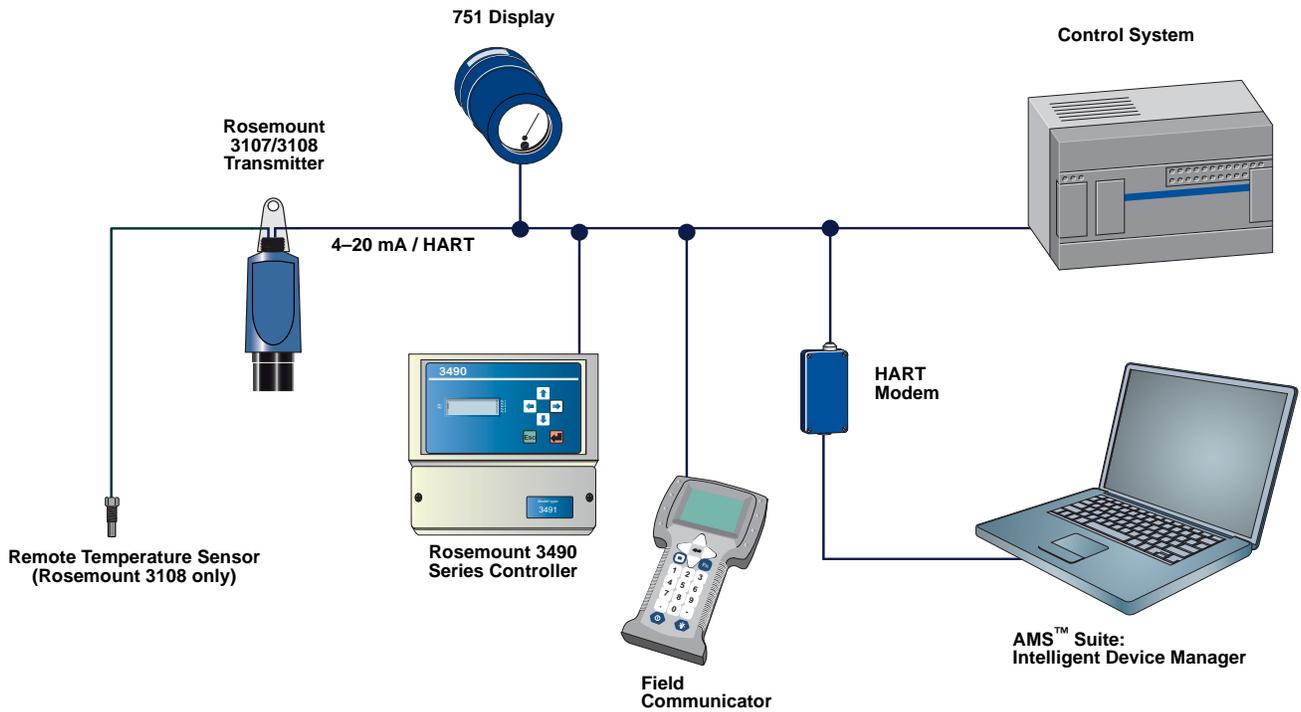
The Rosemount 3490 Control Unit software must be version 3.40 or later.

SYSTEM INTEGRATION

The Rosemount 3107 and 3108 are loop-powered which means they use the same two wires for both **power supply** and **output signal**. The transmitter can be connected to any suitable direct current (dc) power source using the factory-fitted two-core, shielded cable. The output is a 4–20mA analog signal and a digital HART signal. The transmitters 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.

A comprehensive specification for the Rosemount 3107 and 3108 is in Product Data Sheet 00813-0200-4840.

Figure 1. System Integration



NOTE

It is possible to use the multidrop function with the HART protocol (see Figure 1). In this case, communication is restricted to digital since the current is fixed to 4 mA.

NOTE

The Rosemount 3490 Control Unit software must be version 3.40 or later.

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INSTALLATION BEST PRACTICES

The Rosemount 3107 and 3108 may be used for level and volume measurement in open or closed tanks, or open channel flow measurement.

The transmitter must be installed in a location where it is protected from ultraviolet radiation to prevent long term degradation of the plastics used in its construction e.g. shrouded from direct sunlight.

It is important to correctly position the transmitter for reliable ultrasonic level measurement. For maximum accuracy and stability of the level measurement reading, the transmitter should always be shrouded from direct sunlight and radiated heat.

The transmitter may be site-tuned to deal with most application conditions, but it is recommended that the following guidelines be adopted wherever relevant.

General Considerations

See Product Manuals 00809-0200-4840 or 00825-0200-4840 for safety information.

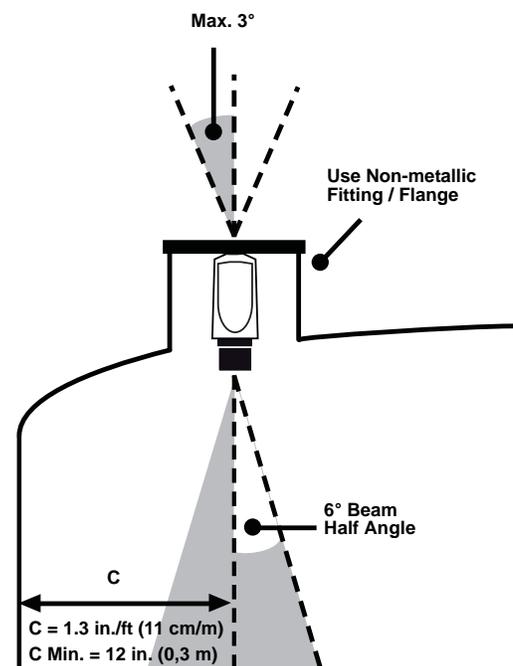
Installation Considerations

- a) Mount the transmitter above the liquid surface using the 1-in. thread provided, but not closer than 13.8 in. (0,35 m) to the surface. The transmitter does not detect any liquid surface closer than 12 in. (0,3 m) to the transmitter face.

Optional flanges and bracket kits are available to help mounting. (See Product Data Sheet 00813-0200-4840 for spares and accessories).
- b) The transmitter should be mounted vertically to ensure a *good echo* from the liquid surface. The beam half angle of the transmitter is 6 degrees (See Figure 2).
- 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.

- e) No false echoes are generated if the transmitter is located near the side of the tank or well, and the wall is smooth and free of protrusions. However, there will still be a reduction in the echo size. It is recommended that the transmitter be mounted no closer than 12 in. (0,3 m) to the wall to avoid a large reduction in the echo size.
- f) Fatty, dirty, or viscous liquids can cause a “scum line” to build-up on the tank or well wall. Reduce the effect of 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 with a domed top, avoid mounting the transmitter in the center of the tank roof because this could act as a parabolic reflector and create unwanted echoes.
- h) Avoid applications where heavy condensation could form on the transmitter.
- i) If the transmitter is mounted in a stand-off or nozzle, the transmitter face should protrude at least 0.2 in. (5 mm) into the tank.
- j) If the transmitter is used in environments where direct sunlight can cause high surface temperatures on exposed instruments, a sun-shade is recommended.

Figure 2. Min and Max Distances From Tank Wall



Technical Note – Communicate

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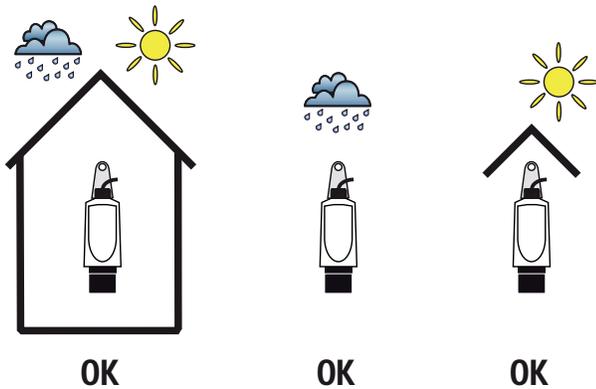
Rosemount 3107 and 3108

Environmental Considerations

The transmitters are Intrinsically Safe (IS) approved for hazardous area installations.

- The 3107 is designed for *open or closed tank* installation. It is weatherproof and protected against the ingress of dust
- The 3108 is designed for *open channel flow measurement*. It is weatherproof and protected against the ingress of dust
- Avoid installing the transmitter near heat sources

Figure 4. Environmental Considerations



Liquid Surface Conditions

- a) Foaming liquid is a poor ultrasonic reflector and can reduce the size of the returned echo. Mount an ultrasonic transmitter over an area of clear liquid. 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

- 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 false echoes.
- c) In 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 detecting pump casings, as the liquid falls away, by not mounting the transmitter directly above pumps. If this is not possible, fine-tuning of the transmitter on-site may be required.

Mounting the Transmitter Above the Liquid Surface

A 1-in. thread is provided to mount the transmitter. The thread form is either **BSPP (G1)** or **NPT**, and is *marked* below the mounting thread.

NOTE!

Never suspend the transmitter by the cable.

Mounting Bracket

The transmitter is supplied with a purpose made 316 Stainless Steel mounting bracket which should be used to mount the transmitter over the liquid surface. The bracket is designed to fit over the threaded neck of the transmitter and is retained by a locknut.

Use a chain or wire through the hole provided in the bracket, which is shaped to ensure the transmitter hangs perpendicular to the liquid surface. Check that the material of the chain or wire is corrosion resistant to the liquids and any vapors present.

Alternatively, the bracket may be bolted to a suitable cross member above the liquid surface. Ensure that the transmitter is perpendicular to the liquid surface to maximise the return echo size.

Check that the maximum liquid level will not enter the 12 in. (0,3 m) blanking zone of the transmitter.

NOTE

See Product Data Sheet 00813-0200-4840 for installation accessories.

Figure 3. Mounting Bracket



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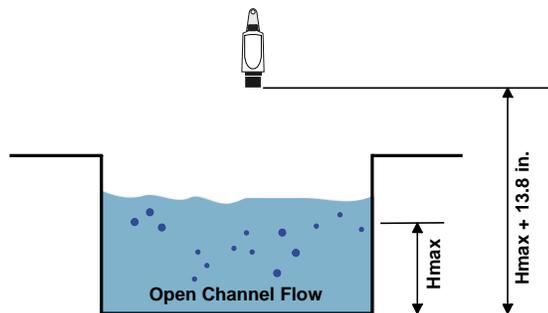
Open Channel Flow Installations

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

This section explains the important parts of installing the transmitter (secondary element). The flow structure (primary element) installation can be referenced in the British (BS3680) or ISO International standards.

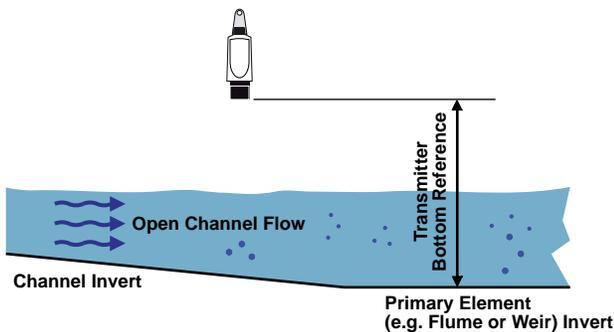
Positioning of the transmitter is critical, and should be the correct distance upstream from the flow structure as stated in the relevant standard for your country. For example, in the BS3680 standard, the distance should be four to five times the maximum height of the water (H_{max}) for a thin plate weir, or three to four times H_{max} for a flume. For optimum accuracy, the transmitter's front face should be positioned at a height equal to the flow depth plus 13.8 in. (350 mm).

Figure 5. Choosing the Height Position Above a Flow



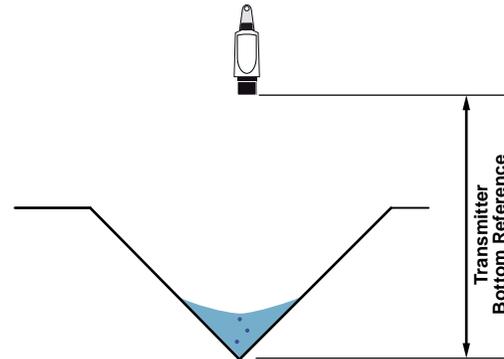
It is important that the **bottom reference** of the transmitter should be related to the datum of the primary measuring device (Figure 6).

Figure 6. Bottom Reference of a Flume or Weir



When setting the bottom reference on a 'V' notch weir, it is important the true invert is used and not the meniscus level (Figure 7).

Figure 7. Bottom Reference of a '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 objects that may cause flow disruption
- The transmitter should be free from a situation where it is likely to 'drown' (refer to the relevant standard for further information)

The Rosemount 3108 has a factory-fitted Remote Temperature Sensor. The temperature sensor is enclosed in a M8 x 1.5 threaded stainless steel body. It should be mounted in a location where it can get an accurate air temperature measurement, and is protected from sunlight.

If the flow structure permits, mount the transmitter within the flow channel or chamber. Shroud the transmitter from direct sunlight for maximum accuracy and stability.

For some installations, the use of a calibration device is mandatory. Emerson offers the Rosemount Head Verification Device for this purpose (See Product Data Sheet 00813-0200-4840 for accessories).

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**Emerson Process Management
Rosemount Inc.**
8200 Market Boulevard
Chanhassen, MN 55317 USA
T (U.S.) 1-800-999-9307
T (International) (952) 906-8888
F (952) 949-7001
www.rosemount.com

Emerson Process Management
Bleigistrasse 23
P.O. Box 1046
CH 6341 Baar
Switzerland
T +41 (0) 41 768 6111
F +41 (0) 41 768 6300

Emerson FZE
P.O. Box 17033
Jebel Ali Free Zone
Dubai UAE
T +971 4 883 5235
F +971 4 883 5312

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



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