

# Rosemount 2160 Wireless Vibrating Fork Liquid Level Switch

The Rosemount 2160 Wireless Level Switch is based on vibrating short fork technology, and is designed for use in extreme temperatures of -94 to 500 °F (-70 to 260 °C). It is suitable for virtually all liquid applications.

Features include a complete range of process connections, aluminum housing, a choice of wetted parts materials, dry-to-wet and wet-to-dry switching functions, extended fork lengths, and hazardous area approvals. This makes the Rosemount 2160 an ideal choice for a wide variety of challenging applications in the chemical, power generation, and oil and gas industries.

(2160\*\*\*S)



(2160\*\*\*E)



## Short Fork Technology

The natural frequency (~1400Hz) of the fork avoids interference from plant vibration that may cause false switching. This allows for minimum intrusion into the tank or pipe through the use of a short fork.

Using Short Fork Technology, the Rosemount 2160 can be used in almost all liquid applications. Extensive research has maximized the operational effectiveness of the fork design, making it suitable for most liquids including coating liquids, aerated liquids, and slurries.

## SPECIAL FEATURES

### Instrument Health Monitor and Continuous Self-Check

The 2160 continuously performs instrument health diagnostics to self-check the condition of the fork and sensor. These diagnostics can detect damage to the forks including corrosion, internal or external damage to the forks, and breakages to the internal wiring.

### Fork Design

The “fast drip” fork design draws liquid away from the fork tips, and together with a short switching delay, allows the 2160 to react quickly and with greater sensitivity to density variations.

### Battery Powered

The 2160 is powered by an integral battery. The fork sensor requires very little power and the battery life remains long even with fast update rates.

### Adjustable Time Delay

There is an adjustable time delay to virtually eliminate the risk of false switching in turbulent or splashing applications.

## MEASUREMENT PRINCIPLE

The Rosemount 2160 is designed using the principle of a tuning fork. A piezo-electric crystal oscillates the forks at their natural frequency. Changes to this frequency are continuously monitored.

The frequency of the vibrating fork sensor changes depending on the medium in which it is immersed. The denser the liquid, the lower the frequency.

When used as a **low level alarm**, the liquid in the tank or pipe drains down past the fork, causing a change of natural frequency that is detected by the electronics and *switches* the output state to a **Dry condition**.

When the 2160 switch is used as a **high level alarm**, the liquid rises in the tank or pipe making contact with the fork, causing the output state to *switch* to a **Wet condition**.

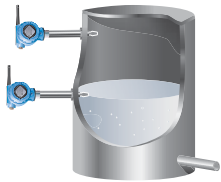
The output state, along with other parameters, are regularly transmitted over a secure wireless connection to a Smart Wireless Gateway.

## Rosemount 2160 Application Examples



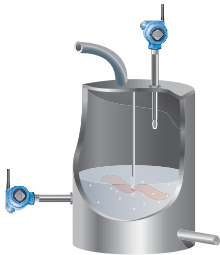
### Overfill Protection

Spillage caused by overfilling can be hazardous to people and the environment, resulting in lost product and potentially high clean up costs.



### High and Low Level Alarm

Maximum and minimum level detection in tanks containing different types of liquids are ideal applications. The Rosemount 2160 is robust and operates continuously across the temperature range of  $-94$  to  $500$  °F ( $-70$  to  $260$  °C) and operating pressures of up to 1450 psig (100 barg), making it perfect for use as a high or low level alarm. It is common practice to have an independent high level alarm switch as a backup to an installed level device in case of primary failure.



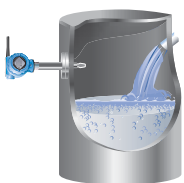
### Pump Control (Limit Detection)

Batch processing tanks often contain stirrers and agitators to ensure mixing and product 'fluidity'. The standard user-selectable time delay, from 0 to 3600 seconds, virtually eliminates the risk of false switching from splashing.



### Pump Protection or Empty Pipe Detection

With the fork projecting only 2 in. (50 mm) (dependant on connection type), the 2160 can be installed in small diameter pipes. Short forks mean minimum intrusion on the wet side and allow for simple, low cost installation at any angle into tanks or pipes.



### Extreme Temperature Applications

The 2160\*\*\*E is designed for extreme temperatures and is suitable for continuous operation within the temperature range of  $-94$  to  $500$  °F ( $-70$  to  $260$  °C).



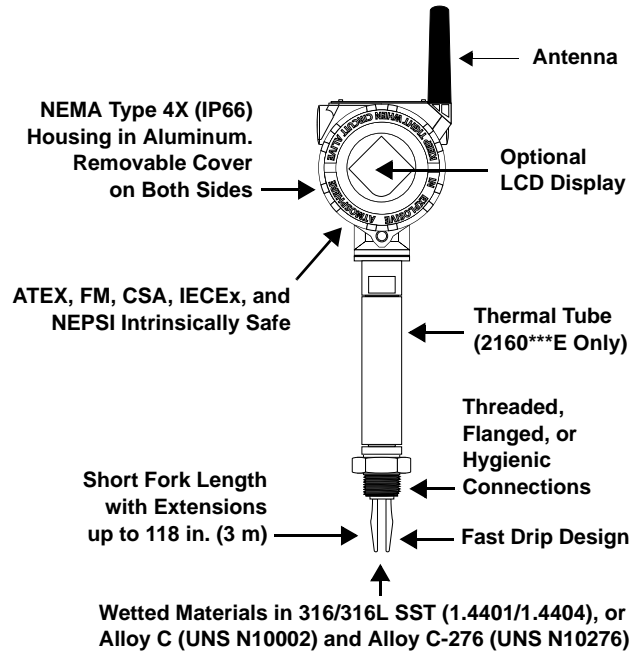
### Hygienic Applications

With the highly polished forks option providing a surface finish (Ra) better than  $0.4$   $\mu\text{m}$ , the 2160 meets the most stringent hygienic requirements used in food and beverage, and pharmaceutical applications. Manufactured in stainless steel, the 2160 is robust enough to easily withstand steam cleaning (CIP) routines.

## Selecting a Rosemount 2160 Wireless Level Switch

The Rosemount 2160 Wireless Level Switch consists of a housing, antenna, thermal tube (2160\*\*\*E only), process connection, and forks. The process connection and forks are the only wetted parts.

FIGURE 1. The 2160 Features



### Process Connection and Fork

#### Fork Length

Short fork, for minimum intrusion installation (minimum length is 2 in. [50 mm]). Fork extensions are available up to 118 in. (3 m)

#### NOTE:

See Product Data Sheet (00813-0100-4160) or web site for dimension drawings.

#### Threaded Connection

Threads:

R 3/4-in. and 1-in. (BSPT); G 3/4-in. and 1-in. (BSPP); 3/4-in. and 1-in. NPT.

Material:

316/316L SST (1.4401/1.4404) dual certified, or Alloy C and Alloy C-276.

Accessories:

A stainless steel adjustable clamp gland is available for use with the extended length 2160 (1-in. threaded models only).

This clamp gland has a 1 1/2-in. BSPP or NPT thread to connect to the tank or pipe, and allows the extended length 2160 to be raised or lowered, as desired, and clamped into position.

#### NOTE:

See Product Data Sheet (00813-0100-4160) for available accessories, and ordering information.

#### Flanged Connections

Flange:

ASME B16.5 (1 in. or larger) or EN 1092-1 (DN25 or larger).

Material:

316/316L SST (1.4401/1.4404) dual certified, or Alloy C and Alloy C-276.

#### NOTE:

See Product Data Sheet (00813-0100-4160) for available accessories and ordering information.

#### Hygienic Connections

Fittings:

1 1/2-in. (38 mm) or 2-in. (51 mm) Tri-Clamp, 1-in. BSPP (G) O-ring seal, or other on request.

Material:

316/316L SST (1.4401/1.4404) dual certified.

Options:

Hand polished wetside to a finish better than 0.4 µm meets the most stringent hygienic requirements.

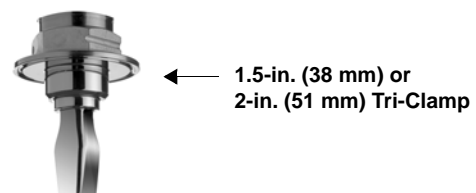
Accessories:

A mounting kit containing a fitting, Nitrile seal and clamp ring is available for use with the 2-in. (51 mm) Tri-Clamp version of the 2160. A fitting boss with Fluorocarbon (FPM/FKM) O-ring is available for use with the O-ring seal version of the 2160.

#### NOTE:

See Product Data Sheet (00813-0100-4160) for available accessories and ordering information.

FIGURE 2. Tri-Clamp Fitting



## Application and Installation Best Practices

### Application Considerations:

- Ensure the process is operating within the instrument temperature and pressure ranges
- Ensure the liquid viscosity is within the recommended viscosity range
- Check that the liquid density is higher than 31.2 lb/ft<sup>3</sup> (500 kg/m<sup>3</sup>)
- Check for risk of build-up on the forks. Drying and coating products may create excessive build-up
- Ensure there is no risk of 'bridging' the forks

Examples of products that can create bridging of forks are dense paper slurries and bitumen

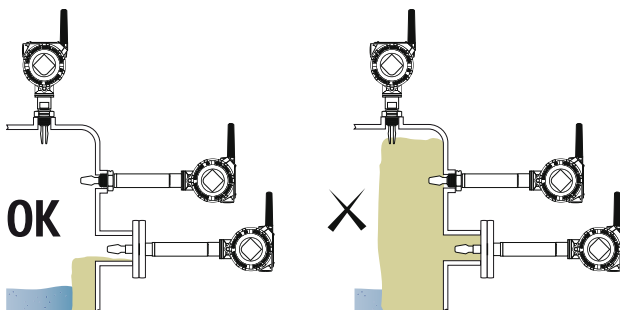
- Check the solids content in the liquid

As a guideline, the maximum solid particle diameter in the liquid is 0.2 in. (5 mm). Extra consideration is needed when dealing with particles bigger than 0.2 in. (5 mm). Consult the factory for advice.

- Problems may occur if product coats and dries causing caking.
- In almost all cases, the 2160 is insensitive to foams (i.e. does not see foams).

In rare cases, some very dense foams may be seen as liquid. An example of this is ice-cream and orange juice manufacturing.

FIGURE 3. Avoid Build-up On A Tank Wall



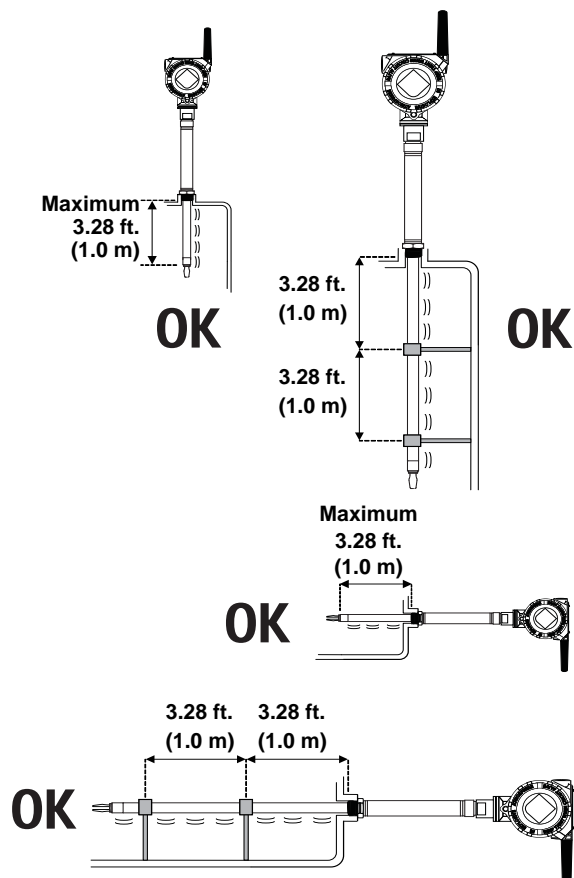
**NOTE:**

See Product Data Sheet 00813-0100-4160 for ordering information, specifications, approvals, and dimension drawings.

### Recommended Installation:

- Ensure there is sufficient room for mounting
- Avoid installing the 2160 near to liquid entering the tank at the fill point
- Avoid heavy splashing on the forks  
Increasing the switching time delay reduces accidental switching caused by splashing
- Ensure the forks do not come into contact with the tank wall, internal fittings, or obstructions
- Ensure there is sufficient distance between build-up on the tank wall and the fork (see Figure 3)
- Extra consideration is needed if the plant vibration is close to the 1400 Hz operating frequency of the 2160
- Supporting the fork avoids long fork length vibration (see Figure 4)

FIGURE 4. Supports For Long Fork Lengths





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