

# Rosemount 2110 Compact Vibrating Fork Liquid Level Switch



CE DIBt



# 2110 Compact Vibrating Fork Liquid Level Switch

## IMPORTANT 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.

The United States has two toll-free assistance numbers and one International number.

Customer Central

1-800-999-9307 (7:00 a.m. to 7:00 P.M. CST)

International

1-(952) 906-8888

**National Response Center**

1-800-654-7768 (24 hours a day)

Equipment service needs

## 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 Emerson Process Management nuclear-qualified products, contact your local Emerson Process Management Sales Representative.

## CAUTION

Rosemount pursues a policy of continuous development and product improvement. The specification in this document may therefore be changed without notice. To the best of our knowledge, the information contained in this document is accurate and Rosemount cannot be held responsible for any errors, omissions or other misinformation contained herein. No part of this document may be photocopied or reproduced without the prior written consent of Rosemount.





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


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# SECTION 1 INTRODUCTION

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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 caution symbol (). The external hot surface symbol () is used when a surface is hot and care must be taken to avoid possible burns. If there is a risk of an electrical shock the () symbol is used. Refer to the safety messages listed at the beginning of each section before performing an operation preceded by this symbol.

## CAUTION

**Failure to follow these installation guidelines could result in death or serious injury.**

- Protection afforded by compliance to EN61010-1 (2001) may be impaired if the equipment is not used as specified.
- The Rosemount 2110 is a liquid level switch. It must be installed, connected, commissioned, operated and maintained by suitably qualified personnel only, observing any national and local requirements that may apply.
- Ensure the wiring is suitable for the electrical current and the insulation is suitable for the voltage, temperature and environment.

** External Surface may be hot.**

- Care must be taken to avoid possible burns.

**Process leaks could result in death or serious injury.**

- Do not remove the level switch while in operation. Removing while in operation may cause process fluid leaks.

** Electrical shock could cause death or serious injury.**

- If the level switch is installed in a high voltage environment and a fault condition or installation error occurs, high voltage may be present on switch leads and terminals.
- Use extreme caution when making contact with the leads and terminals.



**CAUTION**

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.

**Switch Overview**

The Rosemount 2110 is a liquid point level switch based on the vibrating short fork technology. It is a compact switch with a rugged stainless steel body and forks for use in a wide range of liquid applications. Economical  $\frac{3}{4}$ -in. or 1-in. threaded mounting in pipes or tanks or hygienic mounting for food industry use. Direct load switching suits all supplies or PNP output for direct interface to PLCs. For use in safe area only.



2110clear\_rev.tif

**Short Fork Technology**

The natural frequency (~1300Hz) of the fork is chosen to avoid interference from plant vibration which may cause false switching. This also gives short fork length for minimal intrusion into vessel and pipe. Using Short Fork Technology, the Rosemount 2110 is designed for use in virtually all liquid applications. Extensive research has maximized the operational effectiveness of the fork design making it suitable for almost all liquids, including coating liquids (avoid bridging of forks), aerated liquids, and slurries.

**Rosemount 2110 Application and Mounting Examples**

For most liquids including coating and aerated liquids and slurries, the function is virtually unaffected by flow, turbulence, bubbles, foam, vibration, solid particles, build-up or properties of the liquid.

For use in safe area and process temperatures up to 302°F (150°C).

Mount in any position in the tank or pipe. Mounting is by  $\frac{3}{4}$ -in. or 1-in. threaded or hygienic fitting.





**Overflow Protection**

Spillage caused by overfilling can be hazardous to people and the environment, resulting in lost product, and clean up costs. The 2110 is a limit level switch used to signal overflow at any time.



**Pump Protection**

Short forks mean minimum intrusion wetside and allow simple low cost installation at any angle into your pipes or vessels. With the fork projecting only 2-in. (50 mm) (dependant on connection type), the 2110 can be installed in even small diameter pipes. By selecting the option of direct load switching electronics, the 2110 is ideal for reliable pump control and can be used to protect against pumps running dry.



**High and Low Level Alarm**

Maximum and minimum level detection in tanks containing many different types of liquids are an ideal application for the 2110. The robust 2110 operates continuously at temperatures up to 302°F (150°C) and operating pressure up to 1450 psig (100 barg) making it perfect for use as a high or low level alarm. It is common practice to fit an independent high level alarm switch to provide extra back up to the level switch in case of failure.



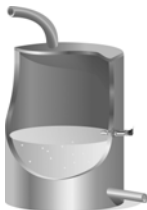
**Leak Detection**

Flanges, gaskets, seals, corrosive liquids – they all have the potential to leak at the most inconvenient times. Many users site tanks and vessels above trays or in containments to prevent any liquids from escaping. A level switch can quickly and accurately detect any leakage and thereby eliminating cost.



**Pump Control**

Many processes have batching and header tanks, and there is usually the need to control a pump to maintain levels between set points. These tanks are often manufactured from thin wall materials and cannot support the weight of heavy instrumentation.



**Hygienic Applications**

With the option of highly polished forks providing a surface finish (Ra) better than 0.8 µm, the 2110 meets the principle design criteria of the most stringent hygienic requirements used in food and beverage, and pharmaceutical applications. Manufactured in stainless steel the 2110 is robust enough to easily withstand steam cleaning (CIP) routines at temperatures up to 302°F (150°C).

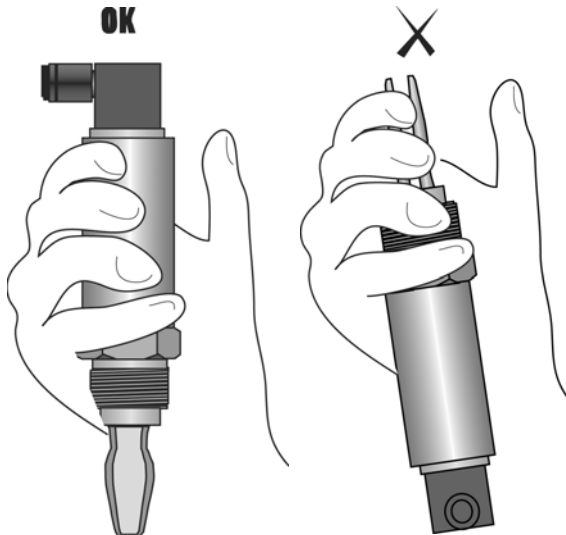
## Rosemount 2110

**Application Considerations**

- Ensure liquid is inside the temperature and pressure ranges (see specifications).
- Check that the liquid is inside recommended viscosity range 0.2 to 10,000 cP.
  - Examples of products with too high of viscosity is chocolate syrup, ketchup, peanut butter and bitumen. The switch will still detect these products but the drain time can be very long.
- Check that the liquid density is above 37.5 lb/ft<sup>3</sup> (600 kg/m<sup>3</sup>).
  - Examples of products with too low of density is acetone, pentane and hexane.
- Check for risk of build-up on the forks.
  - Avoid situations where drying and coating products may create excessive build-up.
  - Ensure no risk of bridging the forks.
  - Examples of products that can create bridging of forks are dense paper slurries and bitumen.
- Check if solid content in liquid
  - Problems may occur if product coats and dries causing caking
  - As a guideline 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 factory

**Handling the 2110**

Figure 1-1. Do not hold the 2110 by forks.



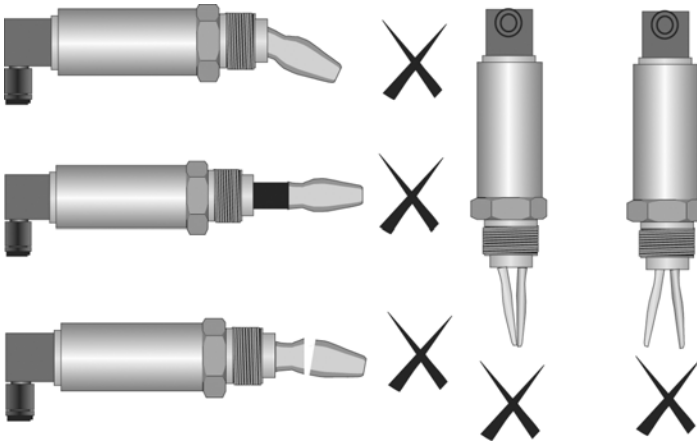
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**Reference Manual**

00809-0100-4029, Rev AA  
July 2005

**Rosemount 2110**

Figure 1-2. Do not alter the 2110 in any way.



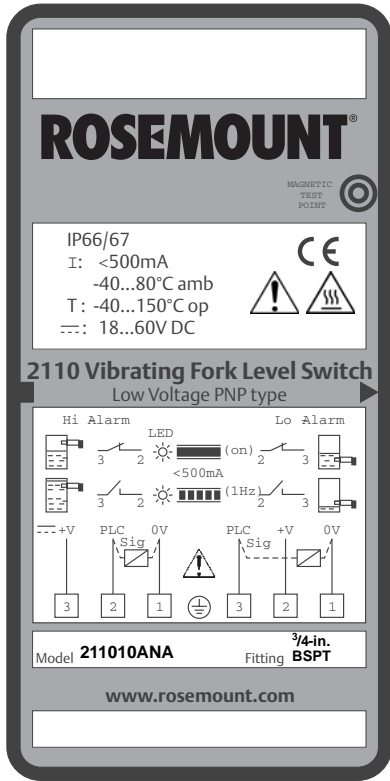
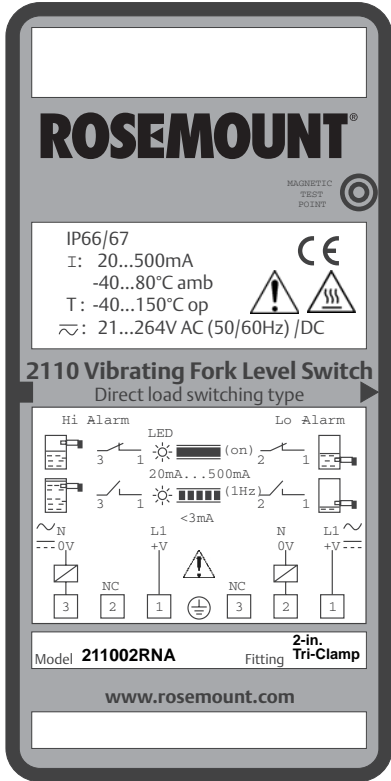
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Rosemount 2110

Rosemount Identification

Figure 1-3. Load Switching Models: ac/dc

Figure 1-4. PNP solid state output Models:  
 dc low voltage



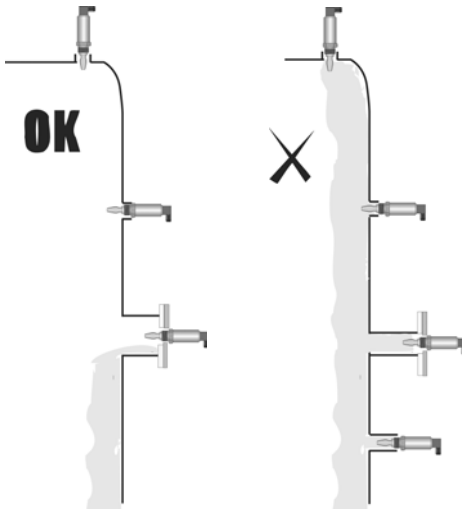
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## Installation Considerations and Recommendations

Before you install the Rosemount 2110 Level Switch, consider specific installation recommendations and mounting requirements.

- Install in any orientation in tank containing liquid.
- Always install in the normally "on" state
  - For high level recommendation is Dry = on (see "Function" on page 2-6).
  - For low level recommendation is Wet = on (see "Function" on page 2-6).
- Always ensure the system is tested by using the local magnetic test point during commissioning (see "Magnetic Test Point" on page 3-1).
- Ensure sufficient room for mounting and electrical connection (see "Dimensional Drawing" on page A-5).
- Ensure that the forks do not come into contact with the tank wall or any internal fittings or obstructions.
- Ensure the forks does not come into contact with the tank wall of any internal fitting.
- Avoid installing the 2110 where it will be exposed to liquid entering the tank at the fill point.
- Avoid heavy splashing on fork
- Avoid product buildup
  - Ensure no risk of bridging the forks.
  - Ensure there is sufficient distance between build-up on the tank wall and the fork.
  - Ensure installation does not create tank crevices around the forks where liquid may connect (important in high viscosity and high density liquids).
- Extra consideration is needed if the plant vibration is close to the 1300 Hz operating frequency of the 2110.
- Ensure sufficient clearance for the fork so highly viscous liquids quickly flow off the forks.
- Extra consideration is needed if the plant vibration is close to the 1300 Hz operating frequency of the 2110.

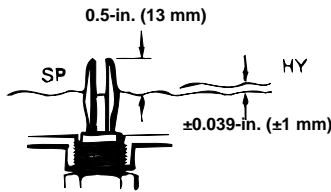
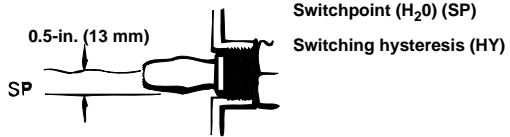
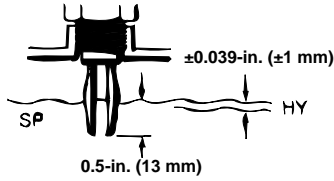
Figure 1-5. Example of OK and not OK build-up on tank wall.



Rosemount 2110

Switchpoint

In the top diagram a lower density media will give switchpoint closer to the connection. A higher density media will give switchpoint closer to fork tip.



2120/fig12.eps

## **Service Support**

To expedite the return process outside of the United States, contact the nearest Rosemount representative.

Within the United States, call the Rosemount National Response Center using the 1-800-654-RSMT (7768) toll-free number. 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.

Rosemount National 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.

## **Warranty**

Emerson Process Management will replace a faulty or failed 2110 with a new unit provided that the fault or failure is reported either directly or via an accredited representative, within 1 year from the date of supply, and the product has been installed and used in accordance with Emerson Process Management instruction manual 00809-0100-4029. Emerson Process Management reserves the right to examine such product and to refuse replacement at its discretion if the above conditions are not met.





## SECTION 2      INSTALLATION

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### 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 caution symbol (⚠). The external hot surface symbol (🔥) is used when a surface is hot and care must be taken to avoid possible burns. If there is a risk of an electrical shock the (⚡) symbol is used. Refer to the safety messages listed at the beginning of each section before performing an operation preceded by this symbol.

### Mechanical Installation

Figure 2-1. Sealing

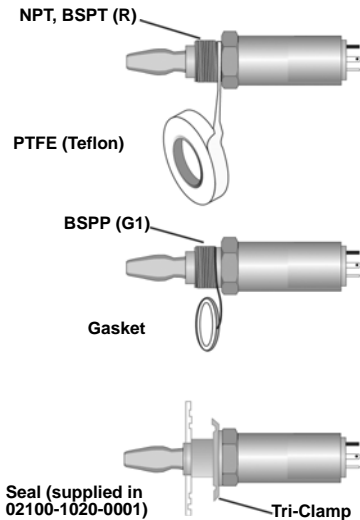
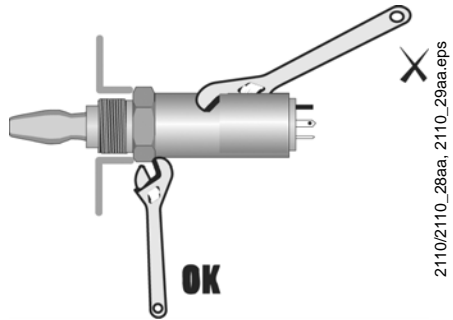


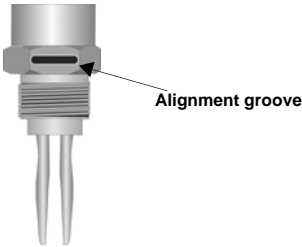
Figure 2-2. Tighten the Switch



# Rosemount 2110

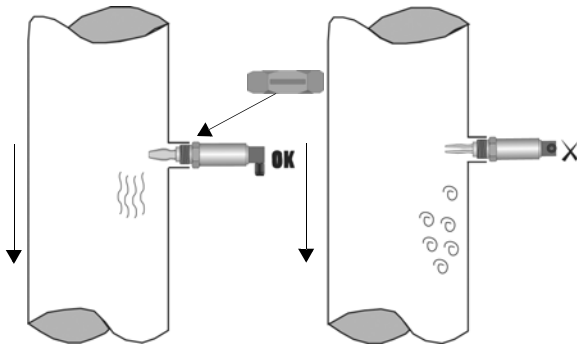
## Correct Fork Alignment

Ensure correct fork alignment.



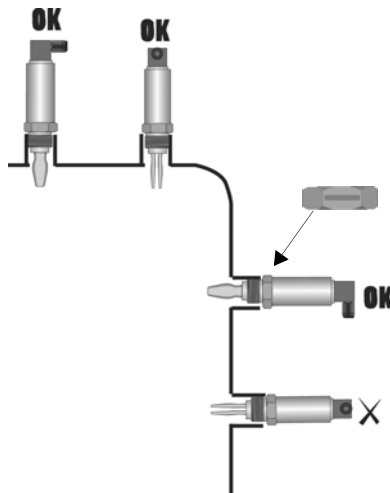
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## Pipe Installation



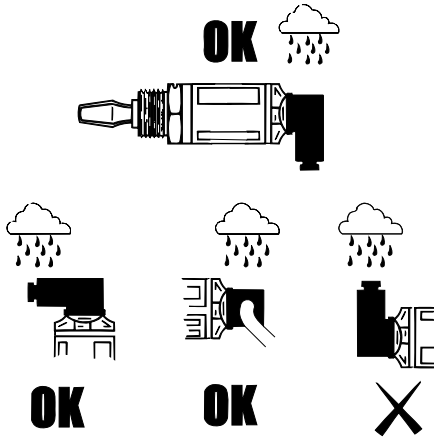
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## Vessel Installation



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Cover Orientation



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

Electrical Installation

Mode Selection

Mode Selection by customer wiring.

Code	0	1
	<p>Load Switching: ac/dc Direct load switching: ac/dc</p>	<p>PNP Output: dc NP for PLC/SPS connection: dc</p>
<p>DRY = ON: High level alarm</p>	<p>PE (Ground)</p> <p>2A(T) R L1 N 21-264V ac 50/60Hz +V 0V 21-264V dc</p>	<p>PE (Ground)</p> <p>2A(T) R PLC Input 0V +V (18-60V dc)</p>
<p>WET = ON: Low level alarm</p>	<p>PE (Ground)</p> <p>2A(T) R L1 N 21-264V ac 50/60Hz +V 0V 21-264V dc</p>	<p>PE (Ground)</p> <p>R PLC Input 0V +V (18-60V dc)</p>
	<p>R = External Load (must be wired)</p>	<p>= External Load</p>
<p>Maximum inrush current: 5A (Over current protected)</p>		
<p>I Maximum continuous: 500 mA</p>		
<p>I Minimum continuous: 20mA</p>		<p>Supply current: 3mA nominal</p>
<p>Voltage drop: 6.5V @ 24V dc / 5.0V @ 240 V ac</p>		<p>Voltage drop: &lt;3V</p>
<p>I Load off: &lt;3mA</p>		<p>I Load off: &lt;0.5mA</p>

**LED Indication**

	LED Flash Rate	Switch Status
	Continuous	Output state is on
	1 every second	Output state is off
	1 every 2 seconds	Uncalibrated
	1 every 4 seconds	Load fault; load current too high; load short circuit
	2 times / second	Indication of successful calibration
	3 times / second	Internal fault (micro, ROM, or RAM)
	Off	Problem (e.g. supply)

Rosemount 2110

Function

	High Level DRY = ON		Low Level Wet = ON	
PLC (positive output)	 $\Delta U < 3V$ $< 100\mu A$ + I/P PLC	 $< 100\mu A$ + I/P PLC	 $\Delta U < 3V$ $< 100\mu A$ + I/P PLC	 $< 100\mu A$ + I/P PLC
PNP dc	 $\Delta U < 3V$ +V 0V	 $< 100\mu A$ +V 0V	 $\Delta U < 3V$ +V 0V	 $< 100\mu A$ +V 0V
Load switching ac/dc	 $\Delta U < 12V$ 0V N +V L1	 $< 3mA$ 0V N +V L1	 $\Delta U < 12V$ 0V N +V L1	 $< 3mA$ 0V N +V L1
LED				
	= Load On		= Load Off	

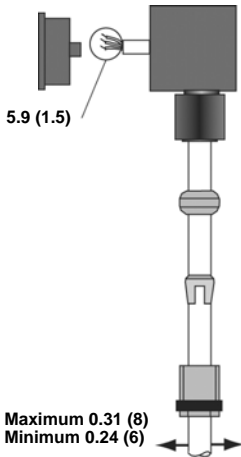
**Wiring**

The 2110 is IP66 and IP67 when correctly assembled with the supplied connector and suitable cable.

**NOTE**

Use only connector supplied.

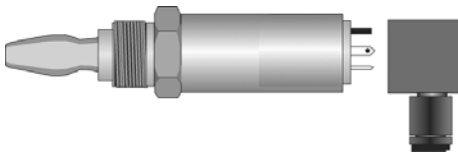
1. Insert cable into housing and connect to terminals.



2. Ensure both seals are in place to maintain the weatherproof rating.



3. Fit plug to body.



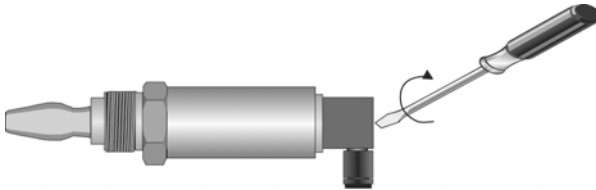
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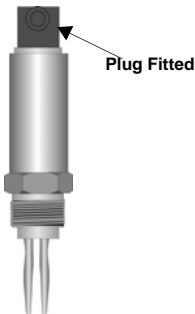
## Rosemount 2110

4. Tighten the screw.



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5. Plug fitted.



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**RELAY CONNECTION WARNING (FOR DIRECT LOAD SWITCHING)**

The Rosemount 2110 requires a minimum current of 3mA, which continues to flow when the 2110 is 'off'. If selecting a relay to wire in series with the 2110, the user must ensure that the drop-out voltage of the relay is greater than the voltage which will be generated across the relay coil when 3mA flows through it.

**NOTE (FOR DIRECT LOAD SWITCHING)**

DPST = 'Double Pole, Single Throw' (on/off) switch - must be fitted for safe disconnection of the power supply. Fit the switch as near to the 2110 as possible. Keep the switch free of obstructions. Label the switch to indicate that it is the supply disconnection device for the 2110.



## SECTION 3 TROUBLESHOOTING

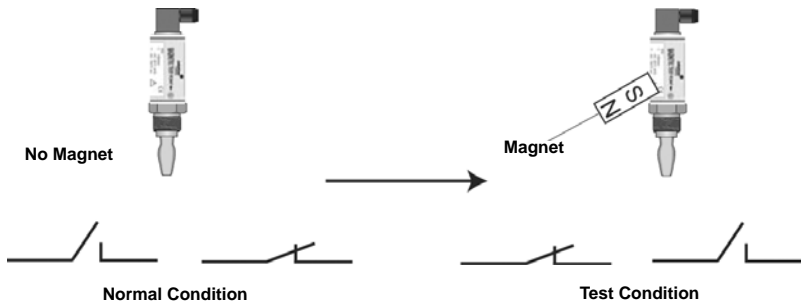
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### Magnetic Test Point

A magnetic test point is marked on the side of the housing allowing a functional test of the 2110. By touching a magnet on the target the 2110 output will change state for as long as the magnet is present.



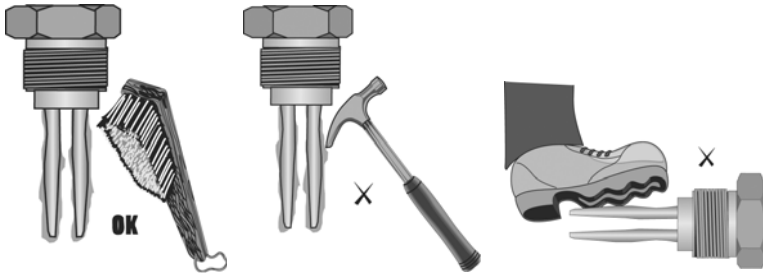
### Inspection

Visually examine the 2120 for damage. If it is damaged, do not use. Check connector and seals are correctly fitted, also that the connector fixing screw and gland are tight.

Ensure the LED flash rate is 1 Hz or continually on. If anything else is demonstrated see "LED Indication" on page 2-5.

## Rosemount 2110

## Maintenance



2110\_07aa, 2110\_20aa, 2110\_12aa

**NOTE**

If using a brush to clean, ensure it is of a soft type.

**Troubleshooting**

If there is a malfunction, see Table 3-1 for information on possible causes.

Table 3-1. Troubleshooting chart.

Fault	Symptom/Indication	Action/Solution
Does not switch	<ul style="list-style-type: none"> <li>No LED; no power</li> </ul>	<ul style="list-style-type: none"> <li>Check the power supply; (check load on direct load switching electronics model)</li> </ul>
	<ul style="list-style-type: none"> <li>LED 3 flashes per second</li> </ul>	<ul style="list-style-type: none"> <li>Internal failure; contact supplier</li> </ul>
	<ul style="list-style-type: none"> <li>LED 1 flash every 2 seconds</li> </ul>	<ul style="list-style-type: none"> <li>Uncalibrated; return to supplier</li> </ul>
	<ul style="list-style-type: none"> <li>LED 1 flash every 4 seconds</li> </ul>	<ul style="list-style-type: none"> <li>Load fault; load current too high, load short circuit; check installation</li> </ul>
	<ul style="list-style-type: none"> <li>Fork damaged</li> </ul>	<ul style="list-style-type: none"> <li>Replace</li> </ul>
	<ul style="list-style-type: none"> <li>Thick encrustation on forks</li> </ul>	<ul style="list-style-type: none"> <li>Clean the fork with care</li> </ul>
	<ul style="list-style-type: none"> <li>5 second delay on changing mode/delay</li> </ul>	<ul style="list-style-type: none"> <li>Wait 5 seconds</li> </ul>
Incorrect switching	<ul style="list-style-type: none"> <li>Dry = On, Wet = On set correctly</li> </ul>	<ul style="list-style-type: none"> <li>Check wiring in the connector. See "Mode Selection" on page 2-4</li> </ul>
Faulty switching	<ul style="list-style-type: none"> <li>Excessive electrical noise</li> </ul>	<ul style="list-style-type: none"> <li>Suppress the cause of the interference</li> </ul>

**Spare Parts**

See "Accessories" on page A-7.

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# APPENDIX A REFERENCE DATA

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## Physical Specifications

### Product

Rosemount 2110 Compact Liquid Level Switch

### Measuring principle

Vibrating Fork

### Applications

Most liquids including coating liquids, aerated liquids, and slurries

### Mechanical

#### Process material

316L Stainless Steel (1.4404)

For Tri-Clamp connection hand polished to better than 0.8 µm. Gasket material for 1 in. BSPP (G1) is Non-asbestos BS7531 Grade X carbon fiber with rubber binder.

#### Housing materials

Body: 304 SST with polyester label

LED window: Flame retardant Polyamide (Pa12) UL94 V2

Plug: Polyamide glass reinforced

Plug seals: Nitrile butadiene rubber 122-in. (50 mm)

#### Connections

See "Process Connection Size / Type" on page A-6.

#### Mounting

- 3/4-in. BSPT (R) or NPT
- 1-in. BSPT (R) or BSPP (G) thread, or
- Hygienic 2-in. (51 mm) Tri-clamp fitting

#### Dimensional Drawings

See "Dimensional Drawing" on page A-5

#### Ingress of Protection Rating

IP66/67 to EN60529



## Rosemount 2110

## Performance Specifications

**Hysteresis (water)**

±0.039-in. (± 1mm) nom.

**Switching point (water)**0.5-in. (13mm) from tip (vertical) / from edge (horizontal) of fork  
(this will vary with different liquid densities)

## Functional Specifications

**Maximum Operating Pressure**

Final rating depends on tank connection

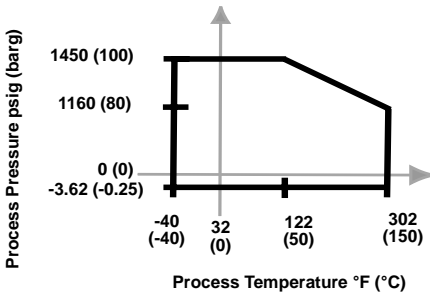
**Threaded Connection**

See Figure A-1.

**Hygienic Connection**

435 psig (30 barg)

Figure A-1. Process Pressure

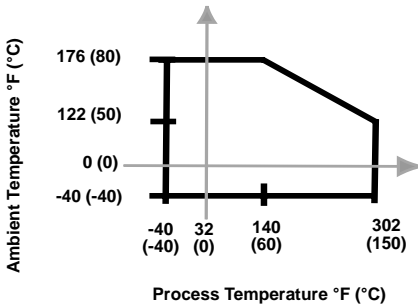


2120/2120\_18ab.eps

**Temperature**

See Figure A-2.

Figure A-2. Temperature



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### Liquid Density

Minimum 37.5 lb/ft<sup>3</sup> (600 kg/m<sup>3</sup>)

### Liquid Viscosity Range

0.2 to 10,000 cP (centiPoise)

### Solids Content and Coating

Maximum recommended diameter of solid particles in the liquid is 0.2-in. (5 mm).  
For coating product, avoid bridging of forks.

### Switching delay

1 sec dry to wet/wet to dry

### CIP (Clean In Place) Cleaning

Withstands steam cleaning routines up to 302°F (150°C)

## Electrical

### Switching mode

User selectable (Dry =on or Wet =on) by selecting plug wiring

### Cable connection

Via 4-way plug provided - DIN43650. Max. conductor size - 15AWG. Orientation 4-position (90/180/270/360 deg).

### Conductor size

Maximum 0.06 inch<sup>2</sup> (1.5 mm<sup>2</sup>)

### Cable gland

PG9 provided - cable diameter 0.24 to 0.31-in. (6 to 8 mm)

### Protection

Reverse polarity insensitive. Missing load / short circuit protection

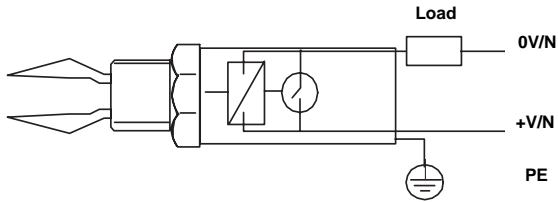
### Grounding

The 2110 should always be grounded either through the terminals or using the external ground connection provided.

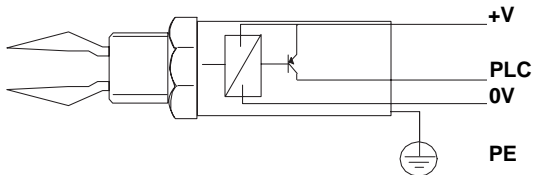
## Rosemount 2110

**Direct load switching (Code 0)**

Operating Voltage	21 to 264V ac (50-60Hz)/dc
Maximum switched load	500mA
Maximum peak load	5A for 40 ms max.
Minimum switched load	20mA continuous
Voltage drop	6.5V @ 24V dc / 5.0V @ 240V ac
Current draw (load off)	<3.0mA continuous

**PNP Switching (Code 1)**

Operating Voltage	18-60V dc
Maximum switched load	500mA
Maximum peak load	5A for 40 ms max.
Voltage drop	<3V
Supply Current	3mA nominal
Output current (load off)	<0.5mA



Dimensional Drawing

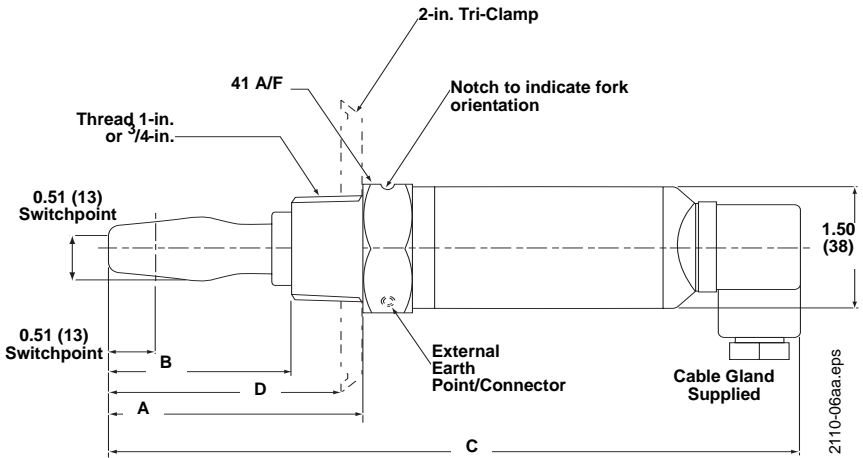


Table A-1. Dimensions are in inches (millimeters)

Connections	A	B	C	D
3/4-in. BSPT (R)	2.72 (69)	1.97 (50)	7.40 (188)	N/A
3/4-in. NPT	2.72 (69)	1.97 (50)	7.40 (188)	N/A
1-in. BSPT (R)	2.72 (69)	1.97 (50)	7.40 (188)	N/A
1-in. BSPP (G)	3.07 (78)	2.36 (60)	7.91 (201)	N/A
2-in. (51 mm) Tri-Clamp	2.72 (69)	1.97 (50)	7.40 (188)	2.52 (64)
1-in. Semi-extended	4.57 (116)	3.86 (98)	9.41 (239)	N/A

## Rosemount 2110

### Ordering Information

<b>Model</b>	<b>Product Description</b>
2110	Compact Vibrating Fork Liquid Level Switch
<b>Code</b>	<b>Electronic Type</b>
0	Direct load switching with plug connection (2 wire) 21 to 264 V ac 50/60 Hz, 21 to 264 V dc
1	PNP/PLC low voltage switching with plug connection 18 to 60 V dc
<b>Code</b>	<b>Process Connection Size / Type</b>
0A	<sup>3</sup> / <sub>4</sub> -in. BSPT (R) thread
1A	1-in. BSPT (R) thread
0D	<sup>3</sup> / <sub>4</sub> -in. NPT thread
2R	2-in. (51mm) Tri-clamp
1B	1-in. BSPP (G) thread
1L	1-in. BSPP (G) Semi-extended 4.6-in. (116 mm)
<b>Code</b>	<b>Product Certificates</b>
NA	No Hazardous Locations Certifications (safe area use only)
<b>Overfill</b>	
U1	DIBt/WHG Overfill protection
<b>Code</b>	<b>Options</b>
<b>Calibration Data Certificate</b>	
Q4	Certificate of functional test
<b>Tag Plates</b>	
ST	Tag plate SST engraved plate (maximum 16 digits)
WT	Tag plate laminated paper (maximum 40 digits)
<b>Typical Model: 2110 0 2R NA</b>	



# Reference Manual

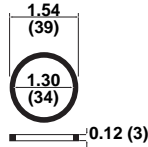
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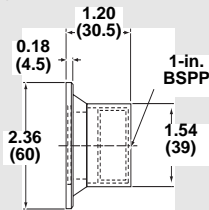
## Accessories

Part Number	Spares and Accessories
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02100-1000-0001	Seal for 1-in. BSPP (G1A). Material: Non-asbestos BS7531 grade X carbon fiber with rubber binder
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02100-1010-0001	Hygienic adaptor boss 1-in. BSPP. Material: 316 SS fitting. Viton 'O' ring
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02100-1020-0001	2-in. (51 mm) Tri-clamp kit including vessel fitting, clamp ring, seal. Material: 316 St. steel, NBR Nitrile
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02100-1030-0001	Telescopic test magnet
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## APPENDIX B PRODUCT CERTIFICATIONS

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<b>Approved Manufacturing Locations</b> .....	<b>page B-1</b>
<b>L.V. Directive</b> .....	<b>page B-1</b>
<b>Overfill Protection</b> .....	<b>page B-1</b>

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### L.V. Directive

EN61010-1 Pollution degree 2, Category II (264V max),  
Pollution degree 2, Category III (150V max)

### Electro Magnetic Compatibility (EMC) Directive

EN61326

### Overfill Protection

Option available for DIBt/WHG

### Approved Manufacturing Locations

Slough, UK





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