Reference Manual
00809-0100-4029, Rev AB
July 2008

Rosemount 2110
Compact Vibrating Fork Liquid Level Switch

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EMERSON™
Process Management

Reference Manual
00809-0100-4029, Rev AB
July 2008

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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SECTION 1 INTRODUCTION

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 award 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 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 3/4-in. or 1-in. threaded or hygienic fitting.

Overfill 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 overfill 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).

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^3 (600 kg/m^3).
  - 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.

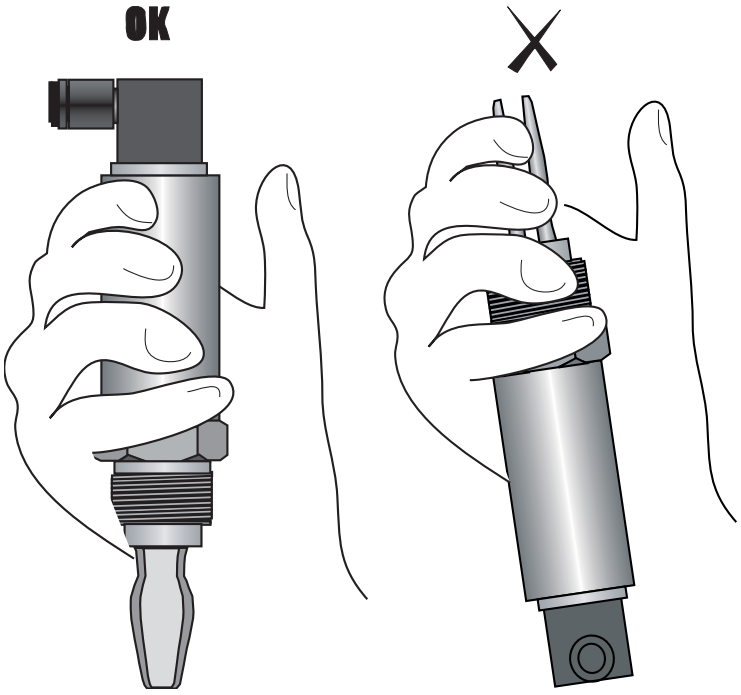

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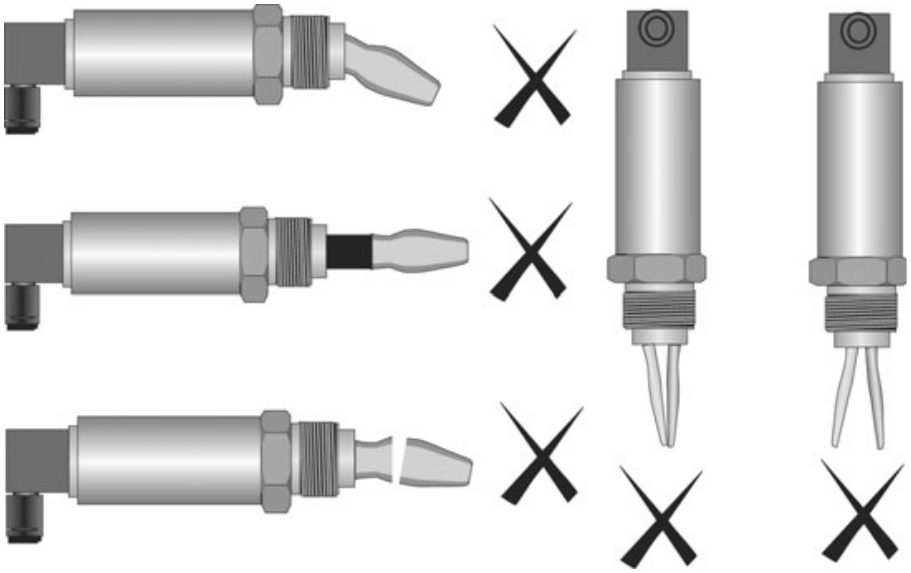
Figure 1-2. Do not alter the 2110 in any way.



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Rosemount Identification

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

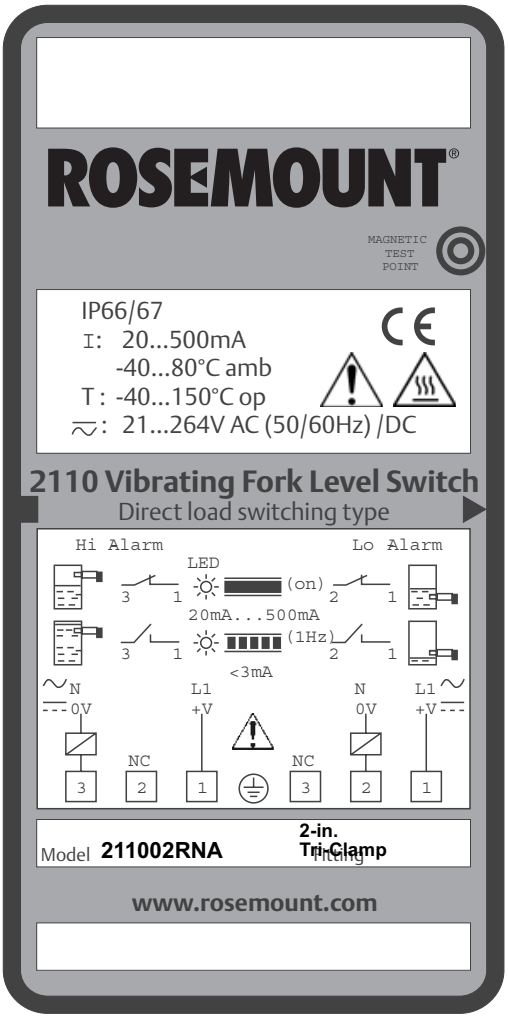
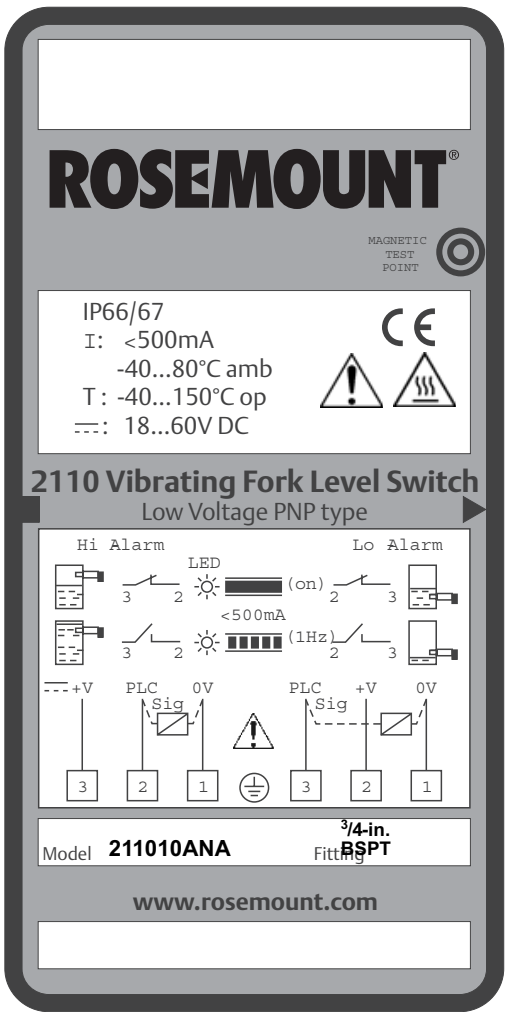


Figure 1-4. PNP solid state output Models: dc low voltage



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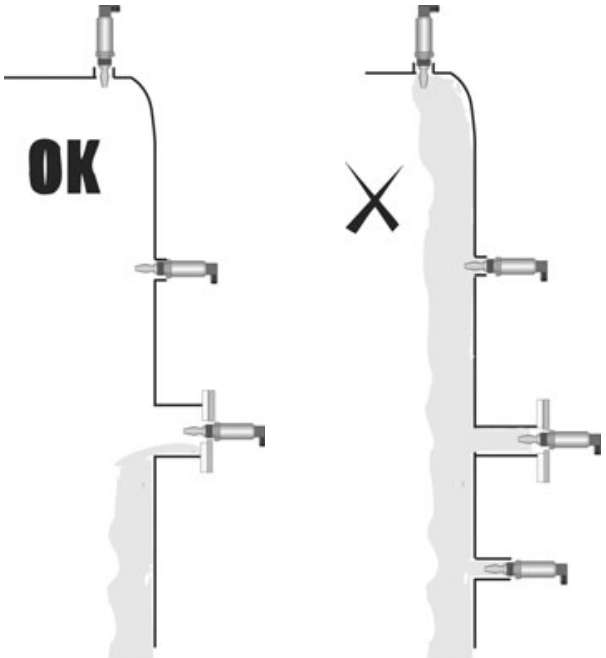
Installation Considerations and Recommendations

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.



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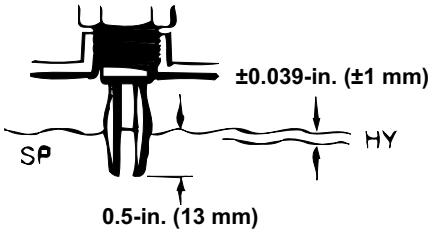
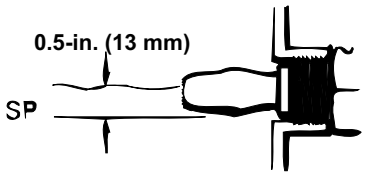
Switchpoint

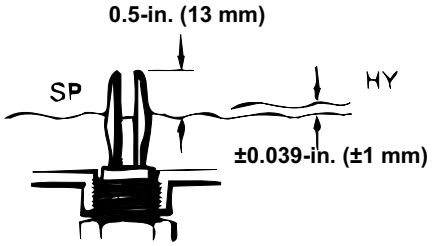
In the top diagram a lower density media will give switchpoint closer to the connection. A higher density media will give switchpoint closer to fork tip.





Switchpoint (H_20) (SP)

Switching hysteresis (HY)



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

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 award 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

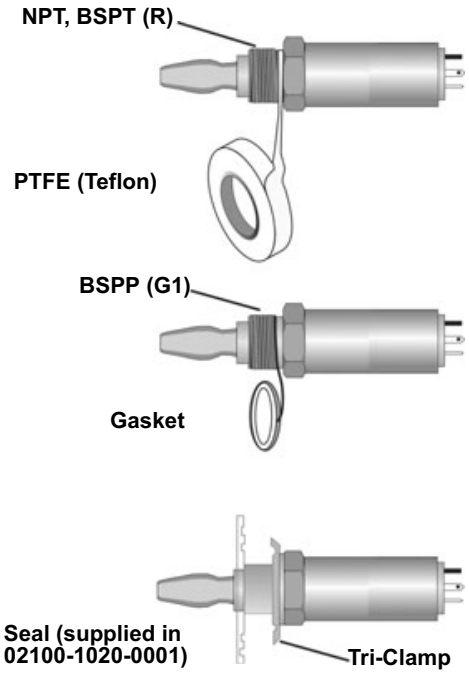
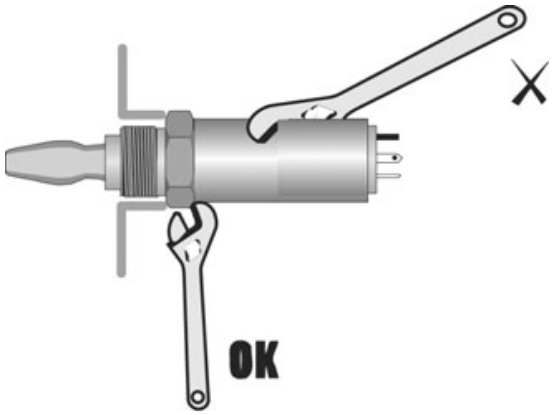
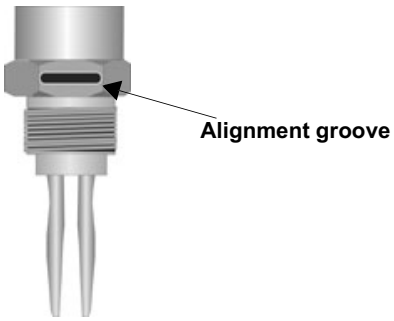


Figure 2-2. Tighten the Switch



Correct Fork Alignment

Ensure correct fork alignment.



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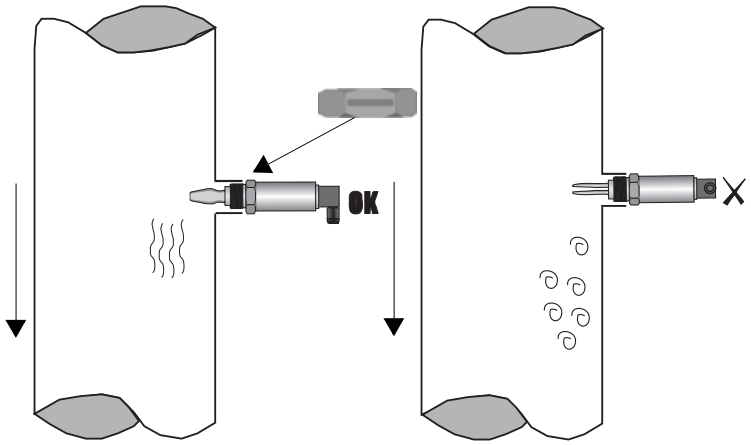
Pipe Installation



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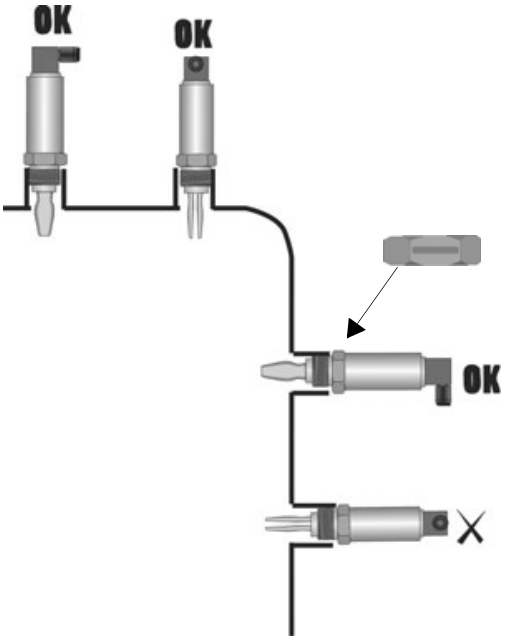
Vessel Installation



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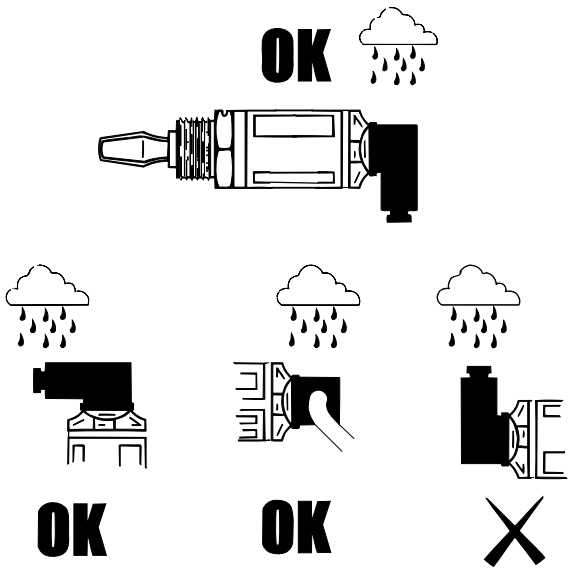
Cover Orientation



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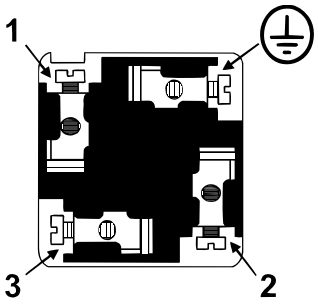
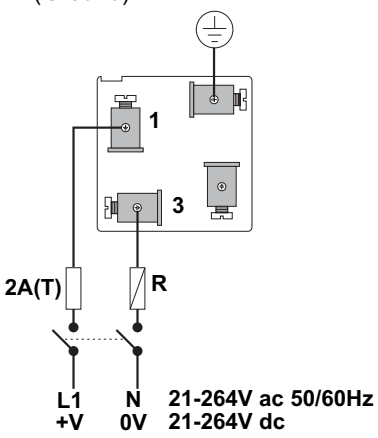
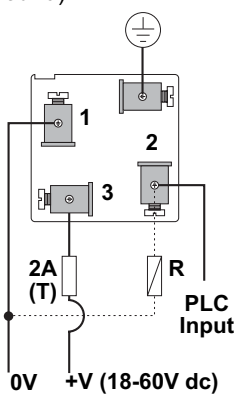
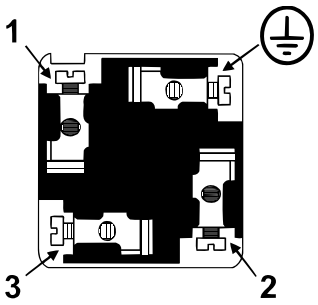
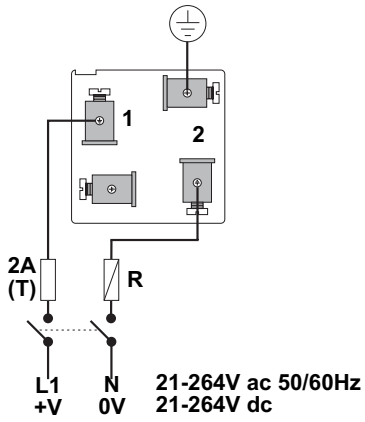
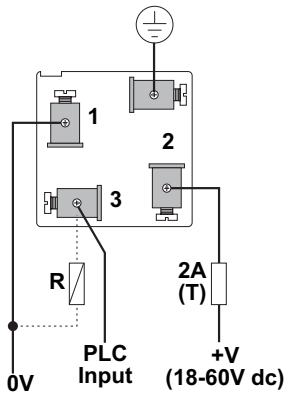
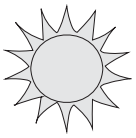
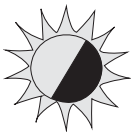
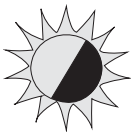
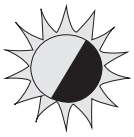
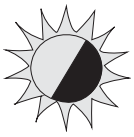
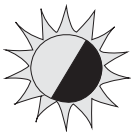
Electrical Installation

Mode Selection

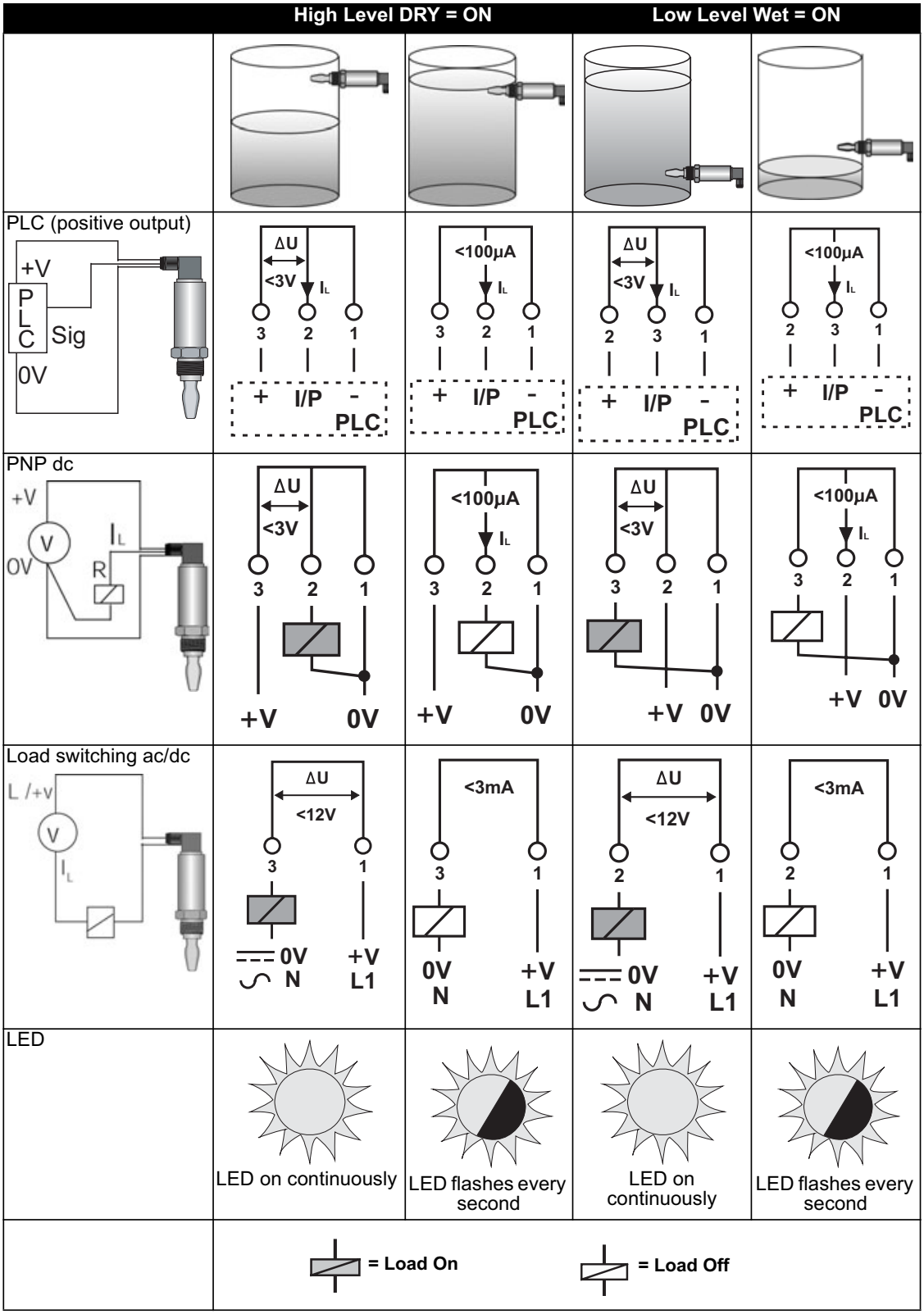
Mode Selection by customer wiring.

<table>
<tr><th>Code</th><th>0</th><th>1</th></tr>
<tr><td></td><td>Load Switching: ac/dc
Direct load switching: ac/dc</td><td>PNP Output: dc
NP for PLC/SPS connection: dc</td></tr>
<tr><td>DRY = ON: High level alarm
 
</td><td>PE (Ground)
 
</td><td>PE (Ground)
 
</td></tr>
<tr><td>WET = ON: Low level alarm
 
</td><td>PE (Ground)
 
</td><td>PE (Ground)
 
</td></tr>
<tr><td></td><td>  R = External Load (must be wired)</td><td>  = External Load</td></tr>
<tr><td></td><td colspan="2">Maximum inrush current: 5A (Over current protected)</td></tr>
<tr><td></td><td colspan="2">I Maximum continuous: 500 mA</td></tr>
<tr><td></td><td>I Minimum continuous: 20mA</td><td>Supply current: 3mA nominal</td></tr>
<tr><td></td><td>Voltage drop: 6.5V @ 24V dc /
5.0V @ 240 V ac</td><td>Voltage drop: <3V</td></tr>
<tr><td></td><td>I Load off: <3mA</td><td>I Load off: <0.5mA</td></tr>
</table>

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)

Function

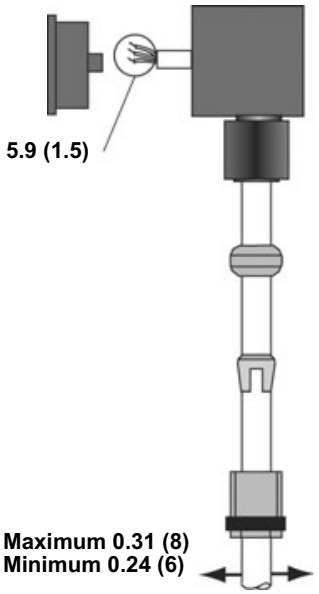

High Level DRY = ON
Low Level Wet = ON
PLC (positive output)
+V
PLC
Sig
0V
ΔU
<3V
IL
<100µA
3
2
1
+ I/P -
PLC
PNP dc
V
R
+V
0V
Load switching ac/dc
L /+V
<12V
<3mA
0V
N
+V
L1
LED
LED on continuously
LED flashes every second
= Load On
= Load Off

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 plug housing and connect to terminals.



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

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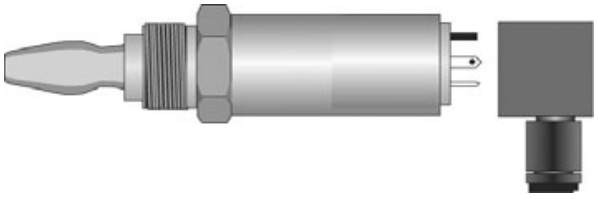
3. Fit plug to body.



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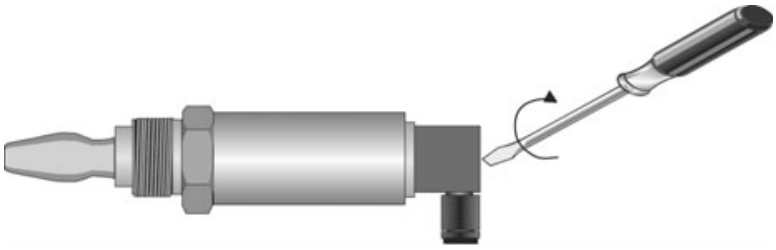
4. Tighten the screw.



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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.

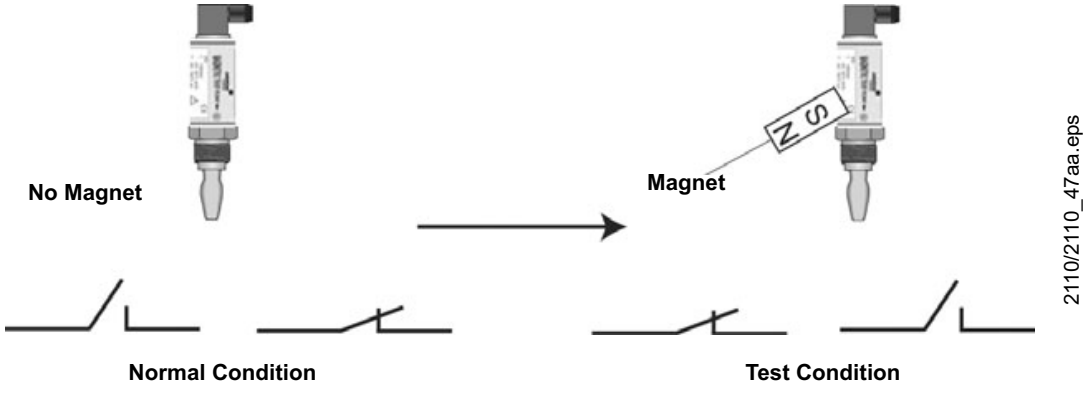
NOTE (FOR DIRECT LOAD SWITCHING)

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

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.

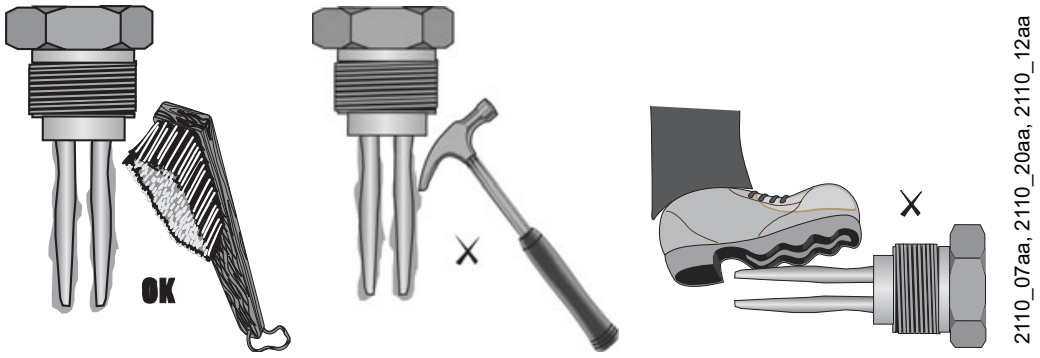


Inspection

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.

Maintenance



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	• No LED; no power	• Check the power supply; (check load on direct load switching electronics model)
	• LED 3 flashes per second	• Internal failure; contact supplier
	• LED 1 flash every 2 seconds	• Uncalibrated; return to supplier
	• LED 1 flash every 4 seconds	• Load fault; load current too high, load short circuit; check installation
	• Fork damaged	• Replace
	• Thick encrustation on forks	• Clean the fork with care
	• 5 second delay on changing mode/delay	• Wait 5 seconds
Incorrect switching	• Dry = On, Wet = On set correctly	• Check wiring in the connector. See “Mode Selection” on page 2-4
Faulty switching	• Excessive electrical noise	• Suppress the cause of the interference

Spare Parts

See “Accessories” on page A-7.

APPENDIX A REFERENCE DATA

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

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)

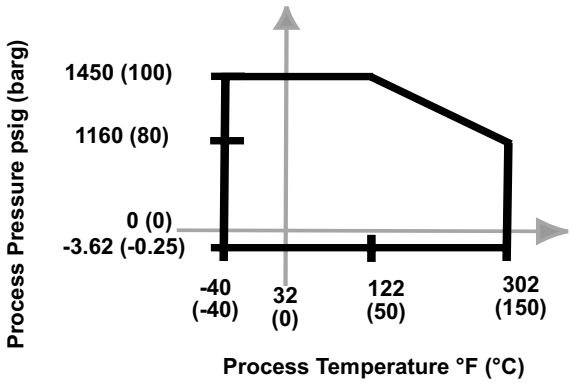
Functional Specifications

Maximum Operating Pressure
Final rating depends on tank connection

Threaded Connection
See Figure A-1.

Hygienic Connection
435 psig (30 barg)

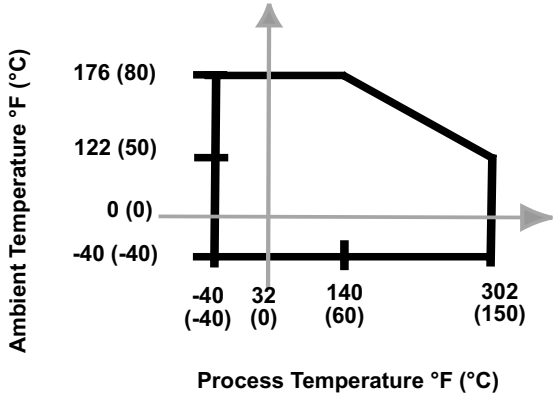
Figure A-1. Process Pressure



2120/2120_18ab.eps

Temperature
See Figure A-2.

Figure A-2. Temperature



2120/2120_18ac.eps

Liquid Density
Minimum 37.5 lb/ft^3 (600 kg/m^3)

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).

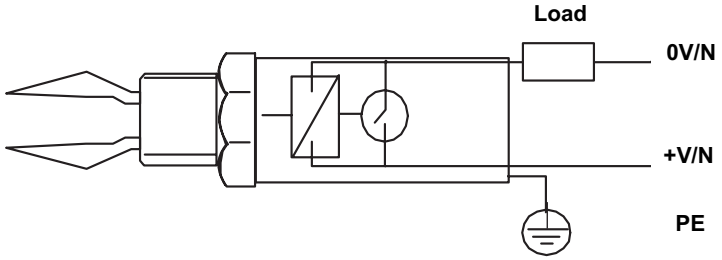
Conductor size
Maximum 0.06 inch^2 (1.5 mm^2)

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

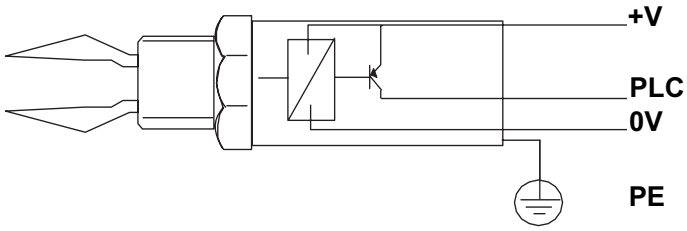
Protection
Reverse polarity insensitive. Missing load / short circuit protection

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

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

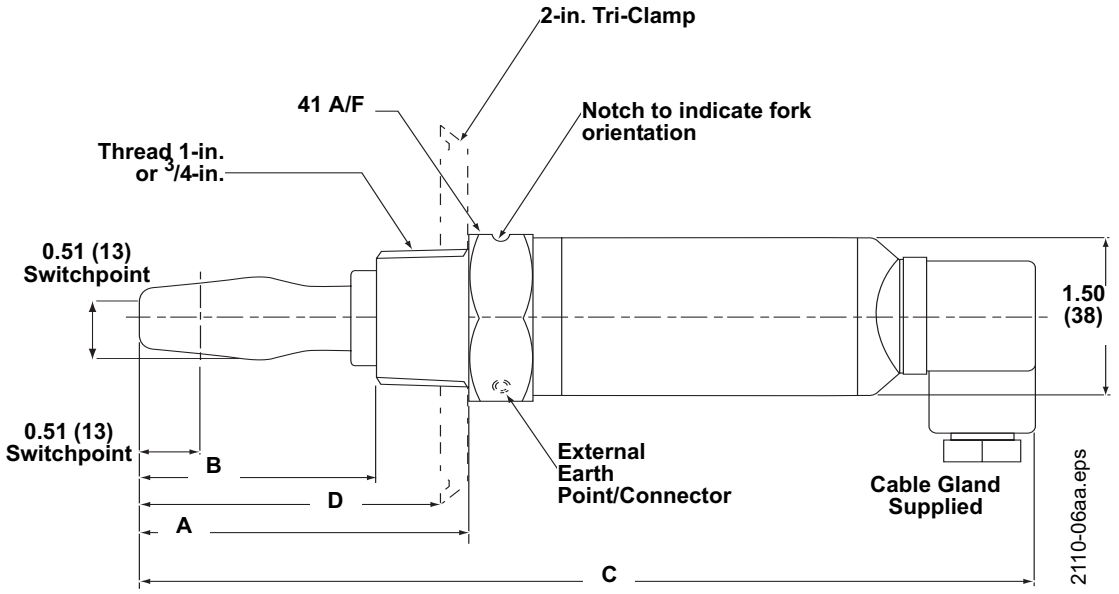


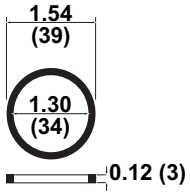
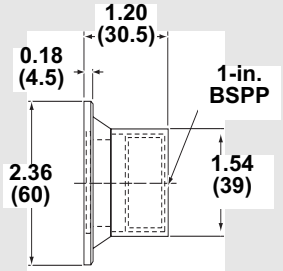
Table A-1. Dimensions are in inches (millimeters)

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

Ordering Information

Model	Product Description
2110	Compact Vibrating Fork Liquid Level Switch
Code	**Electronic Type**
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
Code	**Process Connection Size / Type**
0A	3/4-in. BSPT (R) thread
1A	1-in. BSPT (R) thread
0D	3/4-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)
Code	**Product Certificates**
NA	No Hazardous Locations Certifications (safe area use only)
	Overfill
U1	DIBt/WHG Overfill protection
Code	**Options**
	Calibration Data Certificate
Q4	Certificate of functional test
	Tag Plates
ST	Tag plate SST engraved plate (maximum 16 digits)
WT	Tag plate laminated paper (maximum 40 digits)
Typical Model: 2110 0 2R NA	

Accessories

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

APPENDIX B PRODUCT CERTIFICATIONS

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

含有China RoHS管控物质超过最大浓度限值的部件型号列表 Rosemount 2110
List of Rosemount 2110 Parts with China RoHS Concentration above MCVs

部件名称 Part Name	有害物质 / Hazardous Substances					
	铅 Lead (Pb)	汞 Mercury (Hg)	镉 Cadmium (Cd)	六价铬 Hexavalent Chromium (Cr +6)	多溴联苯 Polybrominated biphenyls (PBB)	多溴联苯醚 Polybrominated diphenyl ethers (PBDE)
电子组件 Electronics Assembly	X	O	O	O	O	O
壳体组件 Housing Assembly	O	O	O	O	O	O
传感器组件 Sensor Assembly	X	O	O	O	O	O

本表格系依据SJ/T11364的规定而制作.
This table is proposed in accordance with the provision of SJ/T11364.

O: 意为该部件的所有均质材料中该有害物质的含量均低于GB/T 26572所规定的限量要求.
O: Indicate that said hazardous substance in all of the homogeneous materials for this part is below the limit requirement of GB/T 26572.

X: 意为在该部件所使用的所有均质材料里，至少有一类均质材料中该有害物质的含量高于GB/T 26572所规定的限量要求. X: Indicate that said hazardous substance contained in at least one of the homogeneous materials used for this part is above the limit requirement of GB/T 26572.

Reference Manual
00809-0100-4029, Rev AB
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Emerson Process Management
Rosemount Inc.
8200 Market Boulevard
Chanhassen, MN USA 55317
T (US) (800) 999-9307
T (Intnl) (952) 906-8888
F (952) 949-7001

Emerson Process Management
Heath Place
Bognor Regis
West Sussex PO22 9SH
England
Tel 44 (1243) 863 121
Fax 44 (1243) 867 5541

Emerson Process Management
Asia Pacific Private Limited
1 Pandan Crescent
Singapore 128461
T (65) 6777 8211
F (65) 6777 0947 / (65) 6777 0743
Enquiries@AP.EmersonProcess.com

ROSEMOUNT®

www.rosemount.com

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