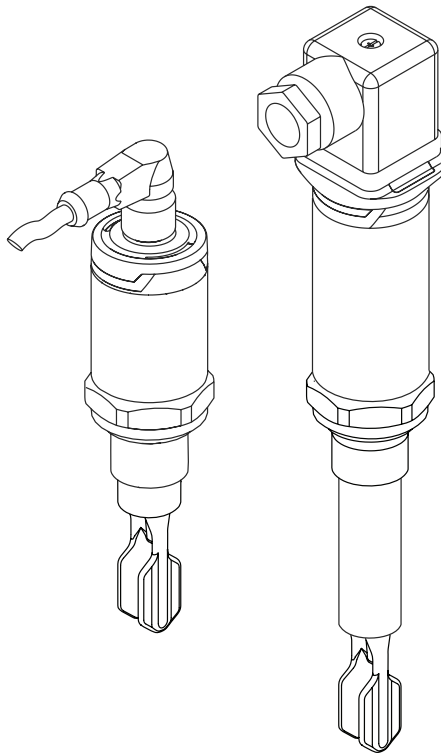


# PROSENSE VFL SERIES LIQUID LEVEL SWITCHES



## OPERATING INSTRUCTIONS

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# 1 Document Information

## 1.1 Document function



These Operating Instructions contain all the information that is required in various phases of the life cycle of the device: from product identification, incoming acceptance and storage, to mounting, connection, operation and commissioning through to troubleshooting, maintenance and disposal.

## 1.2 Symbols



### 1.2.1 Safety instructions




Symbol	Meaning
	<b>DANGER!</b> This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.
	<b>WARNING!</b> This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.
	<b>CAUTION!</b> This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or medium injury.
	<b>NOTICE!</b> This symbol contains information on procedures and other facts which do not result in personal injury.

### 1.2.2 Electrical symbols

Symbol	Meaning
	<b>Ground connection</b> A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.
	<b>Protective ground connection</b> A terminal which must be connected to ground prior to establishing any other connections.

### 1.2.3 Symbols for certain types of information


Symbol	Meaning
	Permitted Indicates procedures, processes or actions that are permitted.
	Forbidden Indicates procedures, processes or actions that are forbidden.

Symbol	Meaning
	Tip Indicates additional information.
	Reference to documentation Refers to the corresponding device documentation.
	Reference to page Refers to the corresponding page number.

### 1.2.4 Symbols for graphics

Symbol	Meaning
1, 2, 3, ...	Item numbers
A, B, C, ...	Views

### 1.2.5 Symbols for tools

Symbol	Meaning
	Open-ended wrench

## 1.3 Documentation

Additional technical specifications and documentation available at [www.automationdirect.com](http://www.automationdirect.com)

## 2 Basic Safety Instructions

### 2.1 Requirements for the personnel

The personnel for installation, commissioning, diagnostics and maintenance must fulfill the following requirements:

- Trained, qualified specialists must have a relevant qualification for this specific function and task
- Are authorized by the plant owner/operator
- Are familiar with federal/national regulations
- Before beginning work, the specialist staff must have read and understood the instructions in the Operating Instructions and supplementary documentation as well as in the certificates (depending on the application)
- Following instructions and basic conditions

The operating personnel must fulfill the following requirements:

- Being instructed and authorized according to the requirements of the task by the facility's owner/operator
- Following the instructions in these Operating Instructions

### 2.2 Designated use

The measuring device described in these Operating Instructions may only be used as a level limit switch for liquids. Incorrect use may pose a hazard. To ensure that the measuring device remains in proper condition for the operation time:

- The measuring devices may only be used for media against which the process-wetted materials are adequately resistant.

- The limit values in “Technical Data” must be observed.

### **2.2.1 Incorrect use**

The manufacturer is not liable for damage caused by improper or non-designated use.

### **Residual risks**

Heat transfer from the process can heat up the electronics housing and the modules it contains to up to 80 °C (176 °F) during operation.

Danger of burns from contact with surfaces!

- For elevated fluid temperature, ensure protection against contact to prevent burns.

## **2.3 Workplace safety**

For work on and with the device:

- Wear the required personal protective equipment according to federal/national regulations.
- Switch off the supply voltage before connecting the device.

## **2.4 Operational safety**

Risk of injury!

- Operate the device in proper technical condition and fail-safe condition only.
- The operator is responsible for interference-free operation of the device.

## **2.5 Product safety**

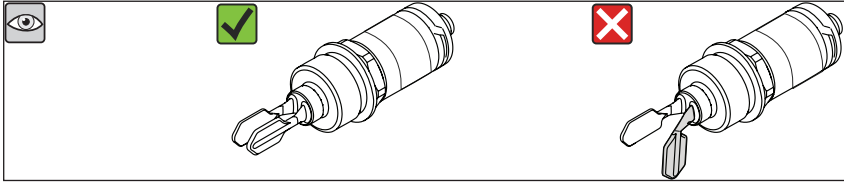
This measuring device is designed in accordance with good engineering practice to meet state-of-the-art safety requirements, has been tested, and left the factory in a condition in which it is safe to operate. It meets general safety standards and legal requirements. It also complies with the CE directives listed in the device-specific CE Declaration of Conformity.

# **3 Product Description**

The ProSense VFL series is a point level switch for universal use in all compatible liquids. It is used preferably in storage tanks, mixing vessels and pipes.

## 4 Product Identification and Acceptance

### 4.1 Incoming acceptance

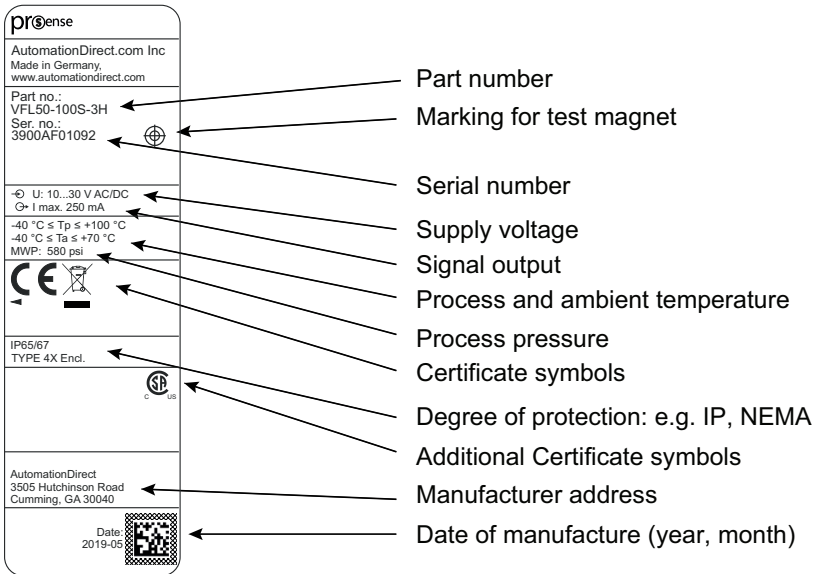


### 4.2 Product Identification

The following options are available for identification of the measuring device:

- Nameplate data

#### 4.2.1 Nameplate



## 4.3 Storage and transport

### 4.3.1 Storage conditions

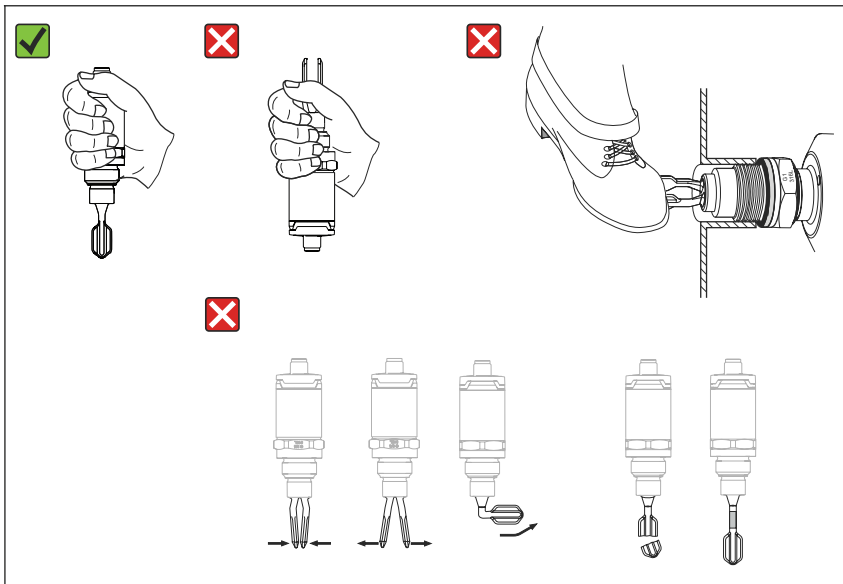
- Permitted storage temperature:  $-40$  to  $+85$  °C ( $-40$  to  $+185$  °F)
- Use original packaging.

### 4.3.2 Handling of the device

#### NOTICE

#### Risk of injury! Housing or fork may become damaged or tear!

- Transport the device to the measuring point in its original packaging or by the housing.
- Do not hold the device by the fork!
- Do not use the device as a ladder or climbing aid!
- Do not bend the fork!
- Do not shorten or lengthen the fork!



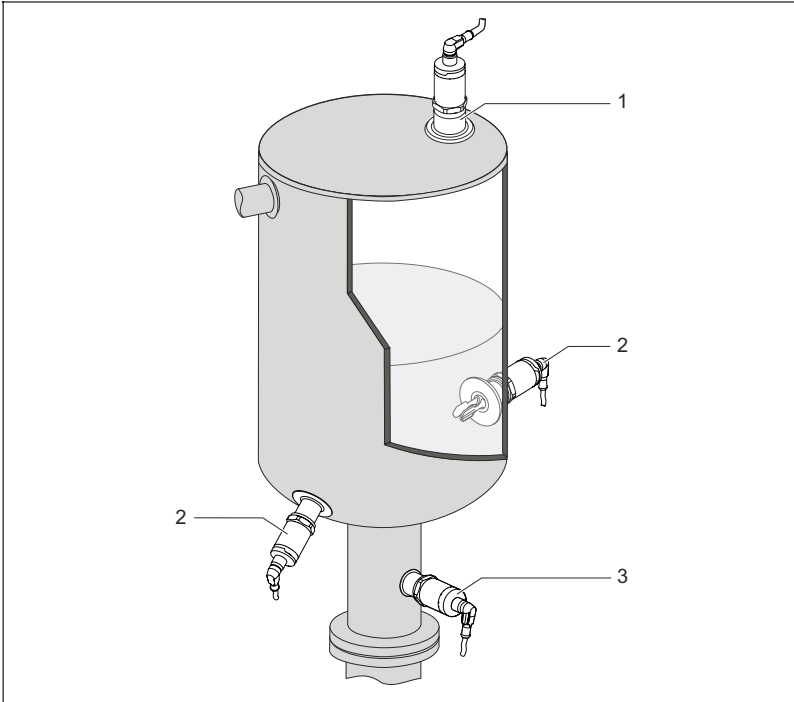


## 5 Installation

### 5.1 Installation conditions

#### 5.1.1 Orientation

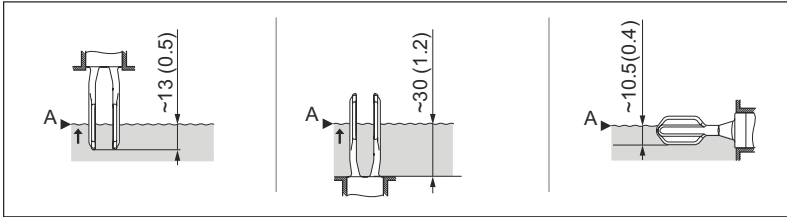
The point level switch can be installed in any position in a vessel, pipe or tank.



1. Overfill prevention or upper level detection
2. Lower level detection
3. Dry running protection for pump

### 5.1.2 Switch point

The switch point (A) on the sensor depends on the orientation of the point level switch (water +25 °C (+77 °F), 1 bar (14.5 psi)).

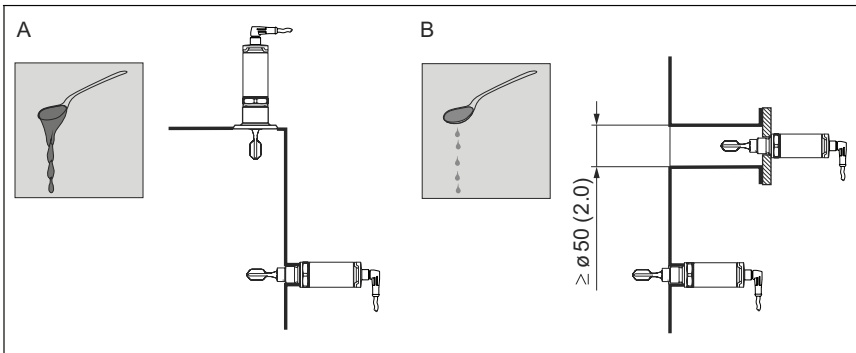


**Vertical and horizontal orientation, dimensions in mm (in)**

### 5.1.3 Viscosity

Switching delays may occur in the case of highly viscous liquids. Ensure that the liquid can easily run off the tuning fork:

- If installing in vessels with high-viscosity liquids (A), the tuning fork may not be located in the installation socket!
- If installing in vessels with low-viscosity liquids (B), the tuning fork may be located in the installation socket!
- The installation nozzle must be no less than the minimum diameter of 50 mm (2.0 in).



**Installation options with consideration given to the liquid viscosity, dimensions in mm (in)**

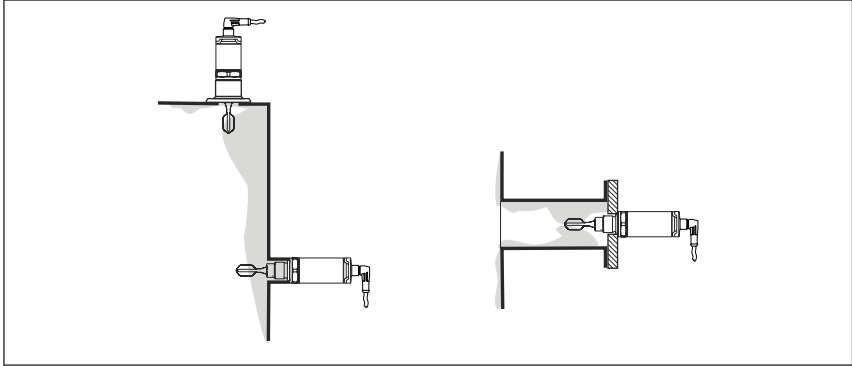
- A. High viscosity (< 10,000 mPa·s)
- B. Low viscosity (< 2,000 mPa·s)

### 5.1.4 Buildup

Make sure that the installation socket does not exceed a certain length so that the tuning fork can project freely into the vessel.

Possibilities for optimization:

- A vertical orientation of the point level switch keeps buildup to a minimum.
- Preferably flush-mounted on vessels or in pipes.



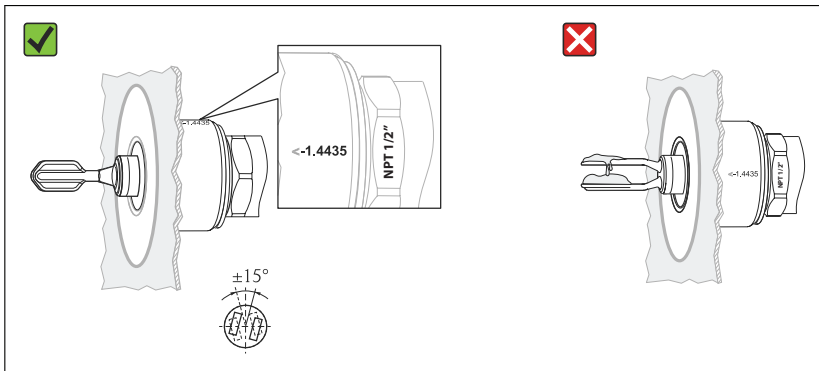
### Buildup on tank wall, pipe wall and tuning fork

### 5.1.5 Marking

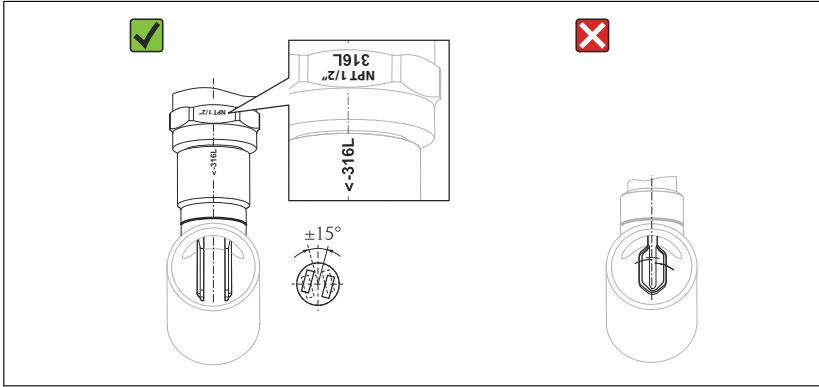
The marking indicates the position of the tuning fork. If installed horizontally in vessels, the marking is face up.

The marking appears either as a material specification (e.g. 316L) or a thread designation (e.g. NPT 1/2") in the following locations:

- On the hexagonal bolt of the process adapter
- On the nameplate



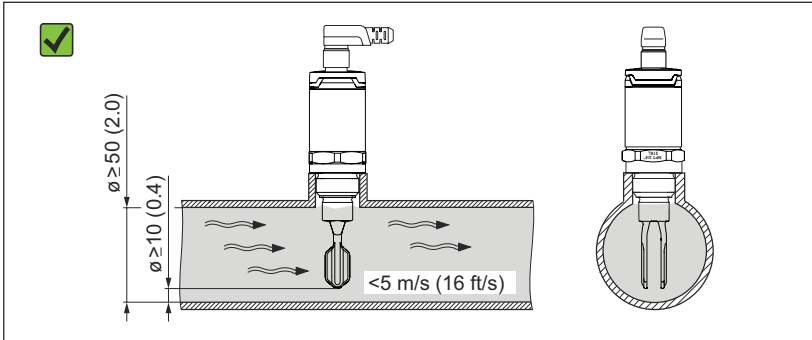
## Orientation in the vessel



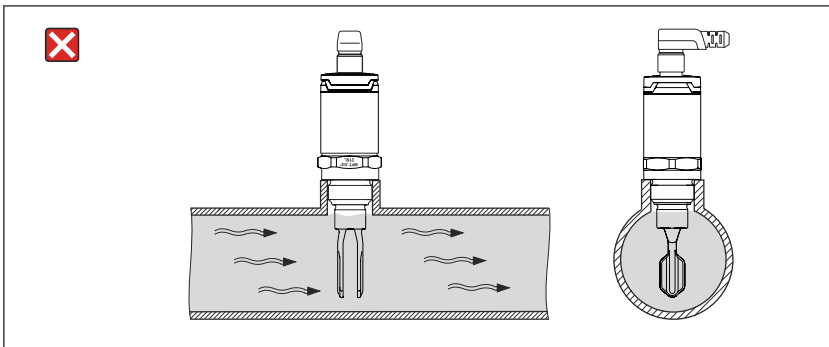
## Orientation in the pipe

### 5.1.6 Installation in pipes

During installation, pay attention to the position of the fork in order to minimize turbulence in the pipe.



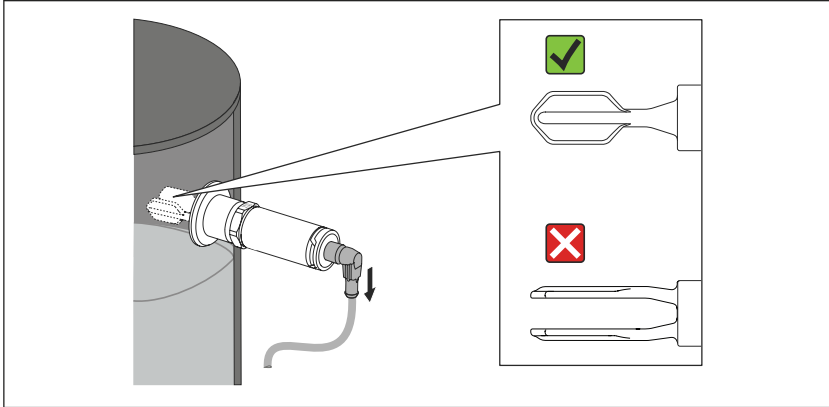
## Dimensions mm (in)



### 5.1.7 Installation in vessels

If installed horizontally, pay attention to the position of the tuning fork to ensure that the liquid can drip off easily.

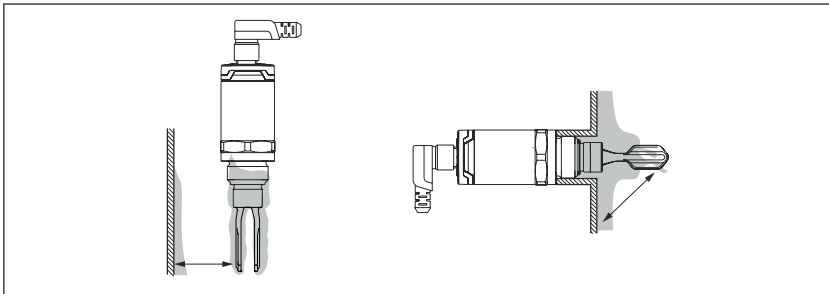
The electrical connection, e.g. M12 connector, should be pointing down with the cable. This can prevent moisture from penetrating.



### Position of the fork in the case of horizontal installation in a vessel

### 5.1.8 Distance from wall

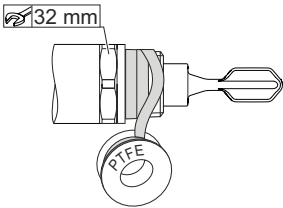

Ensure that there is sufficient distance between the expected buildup on the tank wall and the fork. Recommended distance from wall  $\geq 10$  mm (0.39 in).



## 5.2 Mounting the measuring device

### 5.2.1 Required tools

- Open-ended wrench: only turn by the hex bolt when screwing in. Maximum torque:  $\leq 30 \text{ Nm}$  (22 lbf ft).

View, dimensions in mm (in)	Description
 <p>The drawing shows a side view of the measuring device with a hexagonal nut and a PTFE seal. A dimension line indicates a length of 32 mm. The seal is labeled 'PTFE'.</p>	<p>NPT thread (ANSI B 1.20.1)</p> <p>Pressure and temperature (maximum): +40 bar (+580 psi) at +150 °C (+302 °F)</p> <p> Wrap in sealing material if necessary.</p>

## 5.3 Post-installation check

<input type="checkbox"/>	Is the device undamaged (visual inspection)?
<input type="checkbox"/>	Does the device conform to the measuring point specifications? For example: <ul style="list-style-type: none"> <li>• Process temperature</li> <li>• Process pressure</li> <li>• Ambient temperature</li> <li>• Switch point</li> </ul>
<input type="checkbox"/>	Are the measuring point identification and labeling correct (visual inspection)?
<input type="checkbox"/>	Is the device adequately protected from precipitation and direct sunlight?
<input type="checkbox"/>	Is the device secured properly?

## 6 Electrical connection

The device has two operating modes: maximum safety (MAX) and minimum safety (MIN). By choosing the corresponding operating mode, the user ensures that the device also switches in a safety-oriented manner even in an alarm condition, e.g. if the power supply line is disconnected.

### • Maximum safety (MAX)

The device keeps the electronic switch closed as long as the liquid level is below the fork. Sample application: overflow prevention

### • Minimum safety (MIN)

The device keeps the electronic switch closed as long as the fork is immersed in liquid. Sample application: Dry running protection for pumps

The electronic switch opens if the limit is reached, if a fault occurs or the power fails (quiescent current principle).

## 6.1 Connecting the device

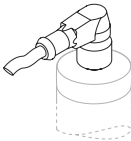
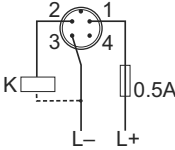
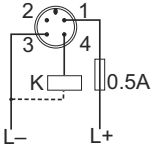
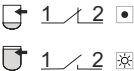
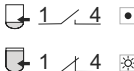


**i** In accordance with IEC/EN61010 a separate circuit breaker must be provided for the device.

### 6.1.1 Electronic version 3-wire DC-PNP

Voltage source: non-hazardous contact voltage or Class 2 circuit (North America)

#### M12 Connector

Depending on the analysis of the switch outputs, the device works in MAX or MIN mode.

Electrical connection	Operating mode	
	<b>MAX</b> 	<b>MIN</b> 
		
<div style="display: flex; justify-content: space-between; align-items: flex-start;"> <div style="font-size: small;"> <p> Yellow LED not lit</p> <p> Yellow LED lit</p> <p><b>K</b> external load</p> </div> <div style="text-align: right; font-size: x-small;">IEC 60947-5-2</div> </div>		

#### Function monitoring with M12 connector

Using a two-channel analysis, function monitoring of the sensor can be implemented in addition to level monitoring, e.g. per relay switch, PLC, I/O module, ....

When both outputs are connected, the MIN and MAX outputs assume opposite states when the device is operating fault-free (XOR). In the event of an alarm condition or a line break, both outputs are deenergized.

Connection for function monitoring		Yellow LED	Red LED
	Sensor covered	 	 *      •
	Sensor exposed	 	•      •
	Fault	  	•      *
* LED lit • LED not lit Fault or warning K1 / K2 external load		IEC 60947-5-2	

## Valve plug

Depending on the assignment of the connector, the device works in either the MAX or MIN operating mode.

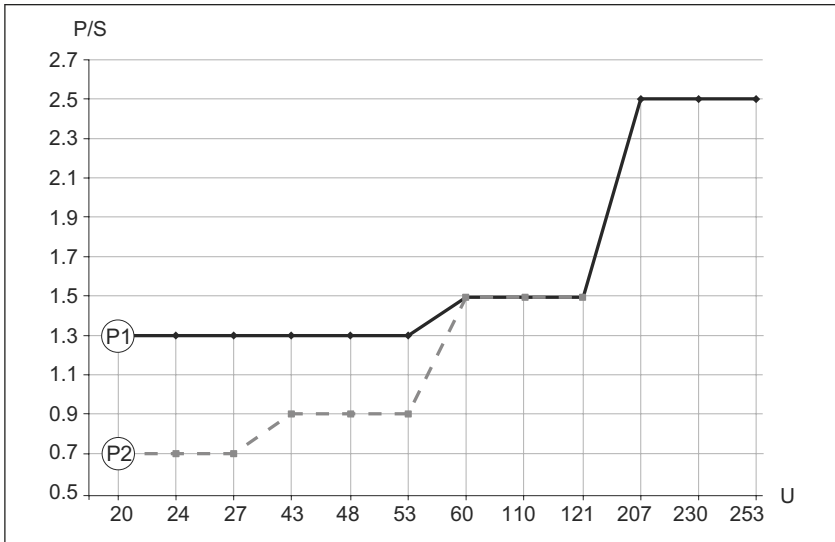
Electrical connection	Operating mode	
	MAX	MIN
	* •	• *
• Yellow LED not lit * Yellow LED lit K external load		Valve plug cable Ø 3.5 to 8 mm (0.14 to 0.26 in)



### 6.1.2 Electronic version 2-wire AC/DC

**Not suitable for connection to PLC inputs!**

Selection tool for relays



#### Minimum rated power of the load

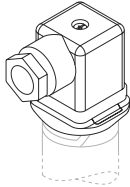
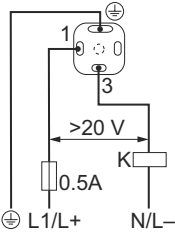
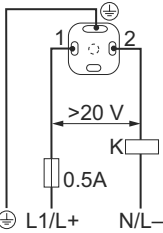
**P/S** Rated power in [W] / [VA]

**U** Operating voltage in [V]

Position	Supply voltage	Rated power	
		min	max
P1 AC mode	24 V	> 1.3 VA	< 6 VA
	110 V	> 1.5 VA	< 27.5 VA
	230 V	> 2.5 VA	< 57.5 VA
P2 DC mode	24 V	> 0.7 W	< 6 W
	48 V	> 0.9 W	< 12 W
	60 V	> 1.5 W	< 15 W

## Valve plug

Depending on the assignment of the connector, the device works in either the MAX or MIN operating mode.

Electrical connection	Operating mode	
	MAX	MIN
		
<p> <input type="checkbox"/> Yellow LED not lit  <input checked="" type="checkbox"/> Yellow LED lit                      K external load                 </p>	<p>Valve plug cable Ø 3.5 to 8 mm (0.14 to 0.26 in)</p>	

## 6.2 Post-connection check


<input type="radio"/>	Is the device or cable undamaged (visual check)?
<input type="radio"/>	Do the cables comply with the requirements ?
<input type="radio"/>	Do the cables have adequate strain relief?
<input type="radio"/>	Are the cable glands mounted and firmly tightened?
<input type="radio"/>	Does the supply voltage match the specifications on the nameplate?
<input type="radio"/>	Is the wiring correct?
<input type="radio"/>	3-wire DC-PNP: If required, is the functional earth connected?
<input type="radio"/>	2-wire AC/DC: Has the protective ground connection been established?
<input type="radio"/>	If supply voltage is present, is the green LED lit?

## 7 Commissioning

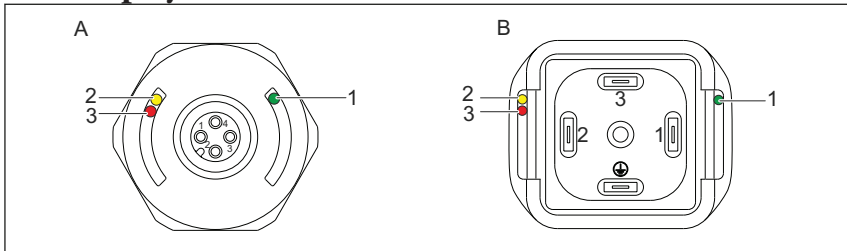
### 7.1 Function check

Before commissioning your measuring point, ensure that the post-installation and post-connection checks have been performed.

- “Post-installation check” checklist
- “Post-connection check” checklist

 The function of the tuning fork can be easily tested by immersing the tuning forks in a vessel containing water.

### 7.2 LED display



























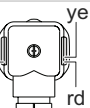
























A. M12 connector

B. Valve plug

Item	Function	Description
1	Green LED Lit	Device is operational
2	Yellow LED Lit	M12 connector Indicates the sensor state: tuning fork is covered by liquid  Valve plug Indicates the switching state: <ul style="list-style-type: none"> <li>• MAX operating mode (overflow prevention): sensor is not covered by liquid</li> <li>• MIN operating mode (dry running protection): the sensor is covered by liquid</li> </ul>
3	Red LED flashing Lit	Warning/maintenance required: error can be rectified, e.g. incorrect wiring Fault/device failure: error cannot be rectified, e.g. electronic error

### 7.2.1 Function of LEDs

Connection	Operating modes					
	Maximum safety (MAX)		Minimum safety (MIN)		Warning	Fault
1 						
2 	  	  	  	  	  	  
3 	  	  	  	  	  	  
1: Level display 2: M12 connector 3: Valve plug			 unlit  lit  flashing  fault/warning			
LED colors: gn = green, ye = yellow, rd = red						

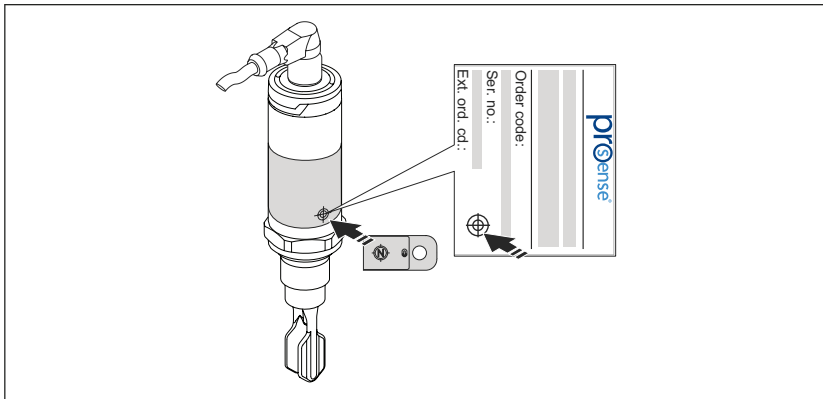
### 7.3 Function test with test magnet

**⚠ WARNING**

Risk of injury!

- Ensure that no dangerous processes are activated in the system.

To perform a function test, hold a test magnet against the marking on the nameplate (for at least 2 seconds). This inverts the current switching status and the yellow LED changes state. When the magnet is removed, the switching status valid at that time is adopted based on the presence or absence of liquid.



## Test magnet and marking

- i** The test magnet is not included. A 10mm Ø x 3mm disc magnet with a magnetic flux density of 250mT or approximately 2.5lbs of pull force can be used.

## 8 Diagnostics and troubleshooting

### 8.1 Diagnostic information via LED display

LED display on housing cover

Malfunction	Possible cause	Corrective action
Green LED Unlit	No power supply	Check connector, cable and power supply
Red LED flashing	Overload or short-circuit in load circuit	<ul style="list-style-type: none"> <li>Rectify short-circuit</li> <li>Reduce maximum load current to below 250 mA</li> </ul>
Red LED Lit	Internal sensor failure or sensor corroded	Replace device

Connection: 2-wire AC/DC to 20 to 253VDC

Malfunction	Possible cause	Corrective action
Unexpected behavior of yellow LED	Incorrect connector assignment or incorrect cable wiring	<p>Pay attention to the polarity of the power supply!</p> <p>Correct connection: Valve plug: L+ to PIN1, L- to PIN 3</p> <p>Result</p> <ul style="list-style-type: none"> <li>Tuning fork covered: yellow LED lit.</li> <li>Tuning fork not covered: yellow LED not lit.</li> </ul>

## 9 Maintenance

No special maintenance work is required.

### 9.1 Cleaning

The sensor must be cleaned if necessary. It can also be cleaned while installed (e.g. CIP Cleaning in Place / SIP Sterilization in Place). Care must be taken to ensure that no damage occurs to the sensor in the process.

## 10 Repair

The point level switch is not repairable.

## 10.1 Disposal

When disposing, separate and recycle the device components based on the materials.

## 11 Technical data

 Additional technical specifications and documentation available at [www.automationdirect.com](http://www.automationdirect.com)

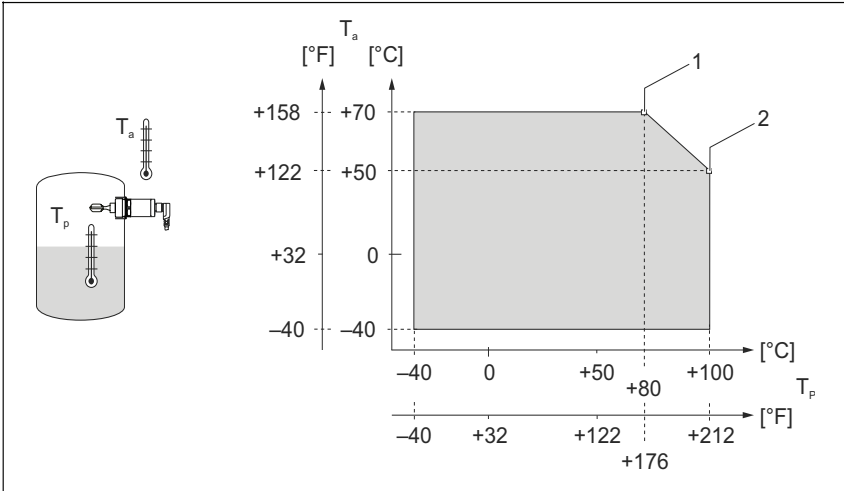
### 11.1 Power Supply

Electronic version	Supply voltage	Power consumption	Current consumption
3-wire DC-PNP	10 to 30 V DC	< 975 mW	< 15 mA
2-wire AC/DC	20 to 253 V	< 850 mW	< 3.8 mA

### 11.2 Environment

Ambient temperature range	-40 to +70 °C (-40 to +158 °F), see derating below
Storage temperature	-40 to +85 °C (-40 to +185 °F)
Climate class	DIN EN 60068-2-38/IEC 68-2-38: test Z/AD
Altitude	Up to 2000 m (6600 ft) above sea level
Shock resistance	a = 300 m/s <sup>2</sup> = 30 g, 3 planes x 2 directions x 3 shocks x 18 ms, as per test Ea, prEN 60068-2-27:2007
Vibration resistance	a(RMS) = 50 m/s <sup>2</sup> , ASD = 1.25 (m/s <sup>2</sup> ) <sup>2</sup> /Hz, f = 5 to 2000 Hz, t = 3 x 2 h, as per test Fh, EN 60068-2-64:2008
Reverse polarity protection	<p>2-wire AC/DC</p> <ul style="list-style-type: none"> <li>AC mode: the device has reverse polarity protection.</li> <li>DC mode: in the event of reverse polarity the maximum safety mode is always detected. Check the wiring and perform a function check before commissioning. The device is not damaged in the event of reverse polarity.</li> </ul> <p>3-wire DC-PNP Integrated. In the event of reverse polarity, the device is deactivated automatically</p>
Short-circuit protection	<p>2-wire AC/DC During switching the sensor checks whether a load, e.g. relay or contactor, is present (load check). If an error occurs, the sensor is not damaged. Smart monitoring: normal operation is resumed once the error is fixed.</p> <p>3-wire DC-PNP Overload protection/short-circuit protection at I &gt; 250 mA; the sensor is not destroyed. Smart monitoring: check for overload in intervals of approx. 1.5 s; normal operation is resumed once the overload/short-circuit is fixed.</p>
Degree of protection	<ul style="list-style-type: none"> <li>IP65/67 NEMA Type 4X Enclosure (M12 connector)</li> <li>IP65 NEMA Type 4X Enclosure (valve plug)</li> </ul>
Electromagnetic compatibility	Electromagnetic compatibility in accordance with all relevant requirements of the EN 61326 series and NAMUR recommendation EMC (NE21). For details, refer to the CE Declaration of Conformity at <a href="http://www.automationdirect.com">www.automationdirect.com</a>

### 11.2.1 Derating



Derating curve:  $100^\circ\text{C}$  ( $212^\circ\text{F}$ ) Models: VFLxx-100x-xx

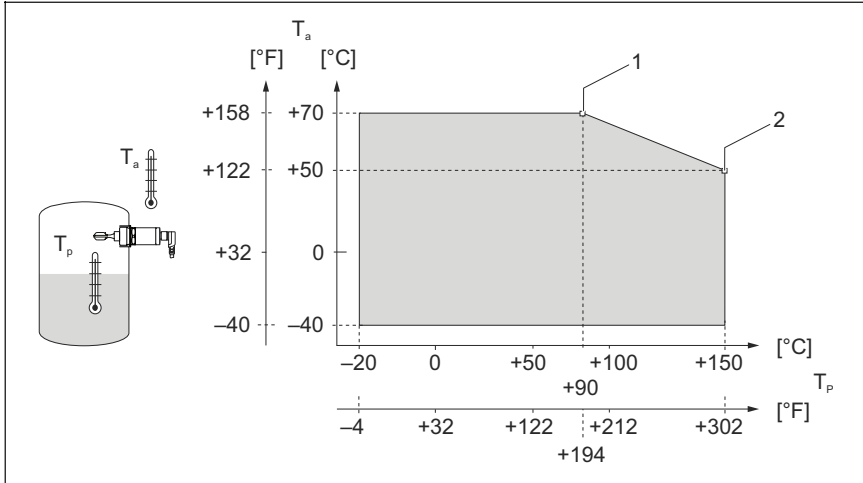
1 =  $I_{\text{max}}$ : 200mA (DC-PNP), 250mA (AC/DC)

2 =  $I_{\text{max}}$ : 150mA (DC-PNP), 150mA (AC/DC)

$T_a$  = Ambient temperature

$T_p$  = Process temperature

### 11.2.1 Derating Cont.



Derating curve: 150°C (302°F) Models: VFLxx-150x-xx

1 =  $I_{\text{max}}$ : 200mA (DC-PNP), 250mA (AC/DC)

2 =  $I_{\text{max}}$ : 150mA (DC-PNP), 150mA (AC/DC)

$T_a$  = Ambient temperature

$T_p$  = Process temperature

### 11.3 Process

#### NOTICE

- Pay attention to the pressure and temperature derating depending on the selected process connection

Process temperature range	-40 to +100 $^{\circ}\text{C}$ (-40 to +212 $^{\circ}\text{F}$ ) Models: VFLxx-100-x-xx -40 to +150 $^{\circ}\text{C}$ (-40 to +302 $^{\circ}\text{F}$ ) Models: VFLxx-150x-xx
Process pressure range	Max. -1 to +40 bar (-14.5 to +580 psi)
Density	> 0.7 g/cm <sup>3</sup>
Media	Liquid
Viscosity	1 to 10,000 mPa · s dynamic viscosity
Solids contents	$\varnothing < 5$ mm (0.2 in)
Lateral loading capacity	Lateral loading capacity of the tuning fork: max. 200 N



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