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Operating Instructions
Liquiphant FTL31 IO-Link

Point level switch for liquids

IO-Link

Endress+Hauser
People for Process Automation

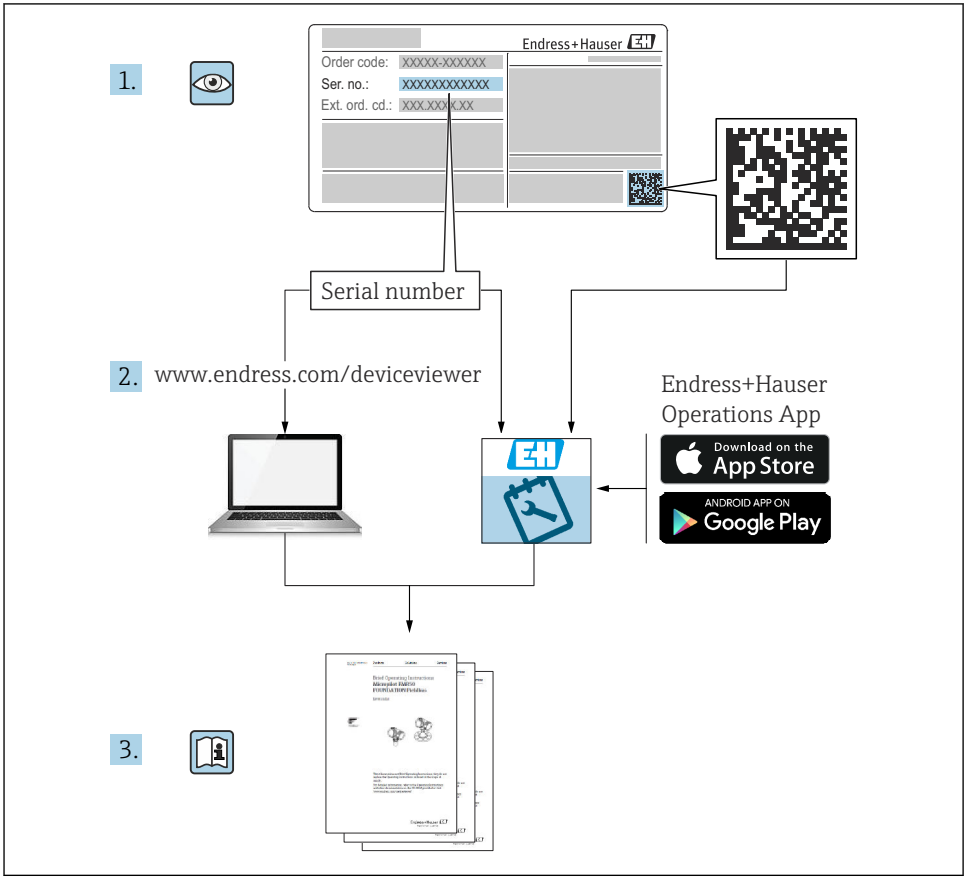
1.
Endress+Hauser
Order code: XXXXX-XXXXXX
Ser. no.: XXXXXXXXXXX
Ext. ord. cd.: XXX.XXX-XXX
Serial number
2.
www.endress.com/deviceviewer
Endress+Hauser
Operations App
Download on the
App Store
ANDROID APP ON
Google Play
3.

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Table of contents

1 About this document

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 symbols

⚠ CAUTION

This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or medium injury.

⚠ DANGER

This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.

NOTICE

This symbol contains information on procedures and other facts which do not result in personal injury.

⚠ WARNING

This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.

1.2.2 Tool symbols

Open-ended wrench

1.2.3 Symbols for certain types of information

Permitted
Procedures, processes or actions that are permitted

Preferred
Procedures, processes or actions that are preferred

Forbidden
Procedures, processes or actions that are forbidden

Tip
Indicates additional information

Reference to documentation

Reference to page

▶
Notice or individual step to be observed

1., 2., 3.
Series of steps

↳
Result of a step

1.2.4 Symbols in graphics

1, 2, 3, ...
Item numbers

A, B, C, ...
Views

1.2.5 Communication-specific symbols

Light emitting diode is off

Light emitting diode is on

Light emitting diode is flashing

1.2.6 Symbols on the device

Safety instructions
Observe the safety instructions contained in the associated Operating Instructions

Temperature resistance of the connection cables
Specifies the minimum value of the temperature resistance of the connection cables

1.3 Documentation

The following types of documentation are available in the Download Area of the Endress +Hauser website (www.endress.com/downloads):

For an overview of the scope of the associated Technical Documentation, refer to the following:
- *W@M Device Viewer* (www.endress.com/deviceviewer): Enter the serial number from nameplate
- *Endress+Hauser Operations App*: Enter the serial number from the nameplate or scan the 2D matrix code (QR code) on the nameplate

1.3.1 Technical Information (TI): planning aid for your device

The document contains all the technical data on the device and provides an overview of the accessories and other products that can be ordered for the device.

1.3.2 Supplementary documentation

- **TI00426F**
  Weld-in adapters, process adapters and flanges (overview)
- **SD01622P**
  Installation instructions for weld-in adapter G 1", G ¾"
- **BA00361F**
  Installation instructions for weld-in adapter M24x1.5

1.4 Registered trademarks

IO-Link

is a registered trademark of the IO-Link Consortium.

2 Basic safety instructions

2.1 Requirements for the personnel

The personnel must fulfill the following requirements to carry out the necessary tasks, e. g., commissioning and maintenance:

- ▶ Trained, qualified specialists must have a relevant qualification for the specific function and task
- ▶ Are authorized by the plant owner/operator
- ▶ Are familiar with federal/national regulations
- ▶ Must have read and understood the instructions in the manual and supplementary documentation
- ▶ Follow instructions and comply with conditions

2.2 Designated use

The measuring device described in this manual may be used only as a point level switch for liquids. Incorrect use may pose a hazard. To ensure that the measuring device remains in perfect condition during the operating time:

- Measuring devices must be used only for media to which the process-wetted materials have an adequate level of resistance.
- Comply with the limit values in the "Technical data" section.

2.2.1 Incorrect use

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

Residual risks

Due to heat transfer from the process, the temperature of the electronics housing and the assemblies contained therein may rise to 80 °C (176 °F) during operation.

Danger of burns from contact with surfaces!
- ▶ In the event of elevated medium temperatures, ensure protection against contact to prevent burns.

2.3 Workplace safety

For work on and with the device:
- ▶ Wear the required protective equipment according to federal/national regulations.

2.4 Operational safety

Risk of injury!
- ▶ Operate the device only if it is in proper technical condition, free from errors and faults.
- ▶ 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.

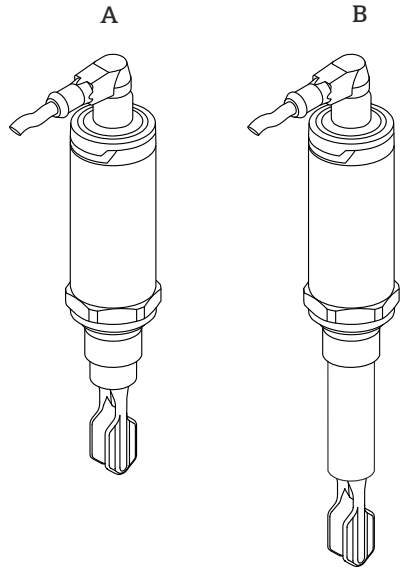
It meets general safety standards and legal requirements. It also complies with the EU directives listed in the device-specific EU Declaration of Conformity. Endress+Hauser confirms this by affixing the CE mark to the device.

3 Product description

The Liquiphant FTL31 is a point level switch for universal use in all liquids. It is used preferably in storage tanks, mixing vessels and pipes.

3.1 Product design

The point level switch is available in different versions, which can be combined in accordance with user specifications.



1 *Examples of variants*

Versions	Examples	
	A	B
Electrical connection	M12 plug	M12 plug
Housing (sensor design) for process temperatures up to:	150 °C (302 °F)	150 °C (302 °F)
Sensor type	Compact version	Short tube version

More detailed information and documentation are available:
- Product Configurator on the Endress+Hauser website www.endress.com
- Endress+Hauser sales organization www.addresses.endress.com

4 Incoming acceptance and product identification

4.1 Incoming acceptance

Check the following during incoming acceptance:

❑ Are the order codes on the delivery note and the product sticker identical?

❑ Are the goods undamaged?

❑ Do the nameplate data match the ordering information on the delivery note?

❑ If required (see nameplate): Are the safety instructions (XA) provided?

If one of these conditions is not met, please contact the manufacturer's sales office.

4.2 Product identification

The following options are available for the identification of the measuring device:
- Nameplate specifications
- Extended order code with breakdown of the device features on the delivery note

- ▶ Enter the serial number from the nameplates into *W@M Device Viewer* (www.endress.com/deviceviewer)
  - ↳ All the information about the measuring device and the scope of the associated Technical Documentation are displayed.

- ▶ Enter the serial number from the nameplate into the *Endress+Hauser Operations App* or use the *Endress+Hauser Operations App* to scan the 2-D matrix code (QR Code) provided on the nameplate
  - ↳ All the information about the measuring device and the scope of the associated Technical Documentation are displayed.

4.3 Manufacturer address

Endress+Hauser SE+Co. KG
Hauptstraße 1
79689 Maulburg, Germany

Place of manufacture: See nameplate.

4.4 Storage and transport

4.4.1 Storage conditions

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

4.4.2 Transporting the product to the measuring point

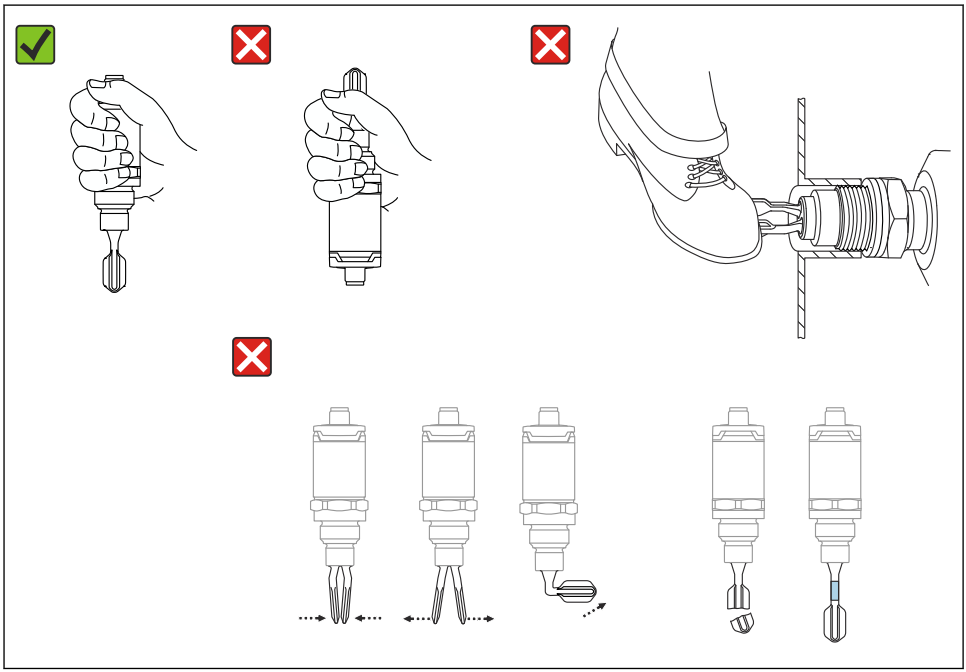
Transport the device to the measuring point in the original packaging.

4.4.3 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!



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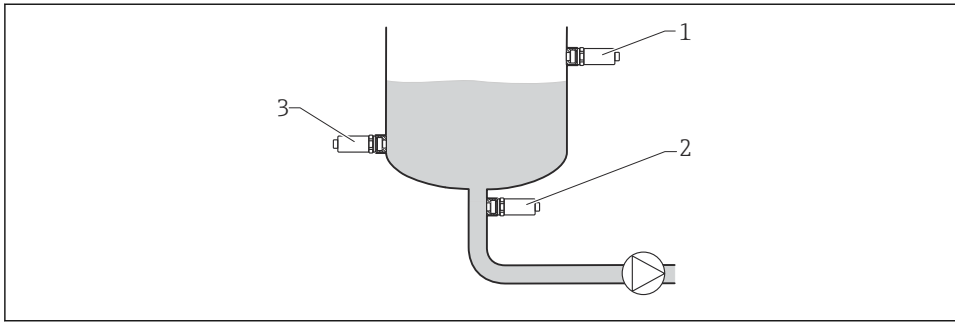
2 Handling of the device

5 Installation

5.1 Mounting conditions

5.1.1 Orientation

Installation is possible in any position in a vessel, pipe or tank.



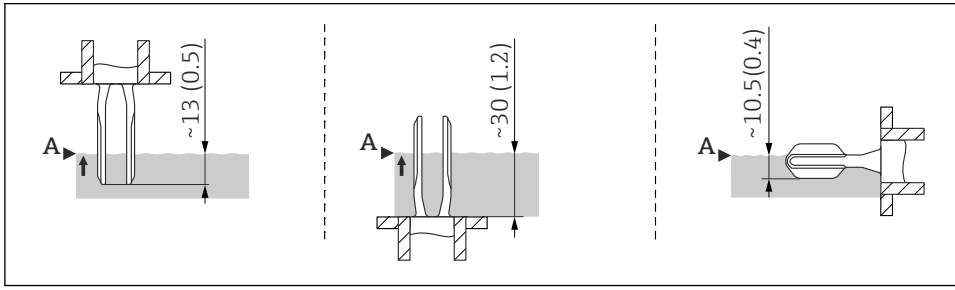
3 Installation examples

1 Overfill prevention or upper level detection (maximum safety)
2 Dry running protection for pump (minimum safety)
3 Lower level detection (minimum safety)

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).

Configuration is possible via IO-Link.

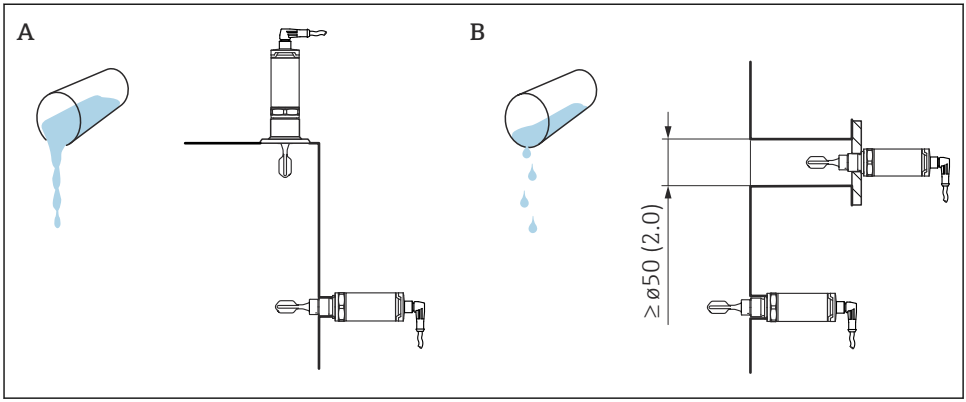


4 Orientation: vertical from above, vertical from below, horizontal; dimensions in mm (in)

5.1.3 Viscosity

Switching delays may occur in the case of highly viscous liquids. Make sure 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).



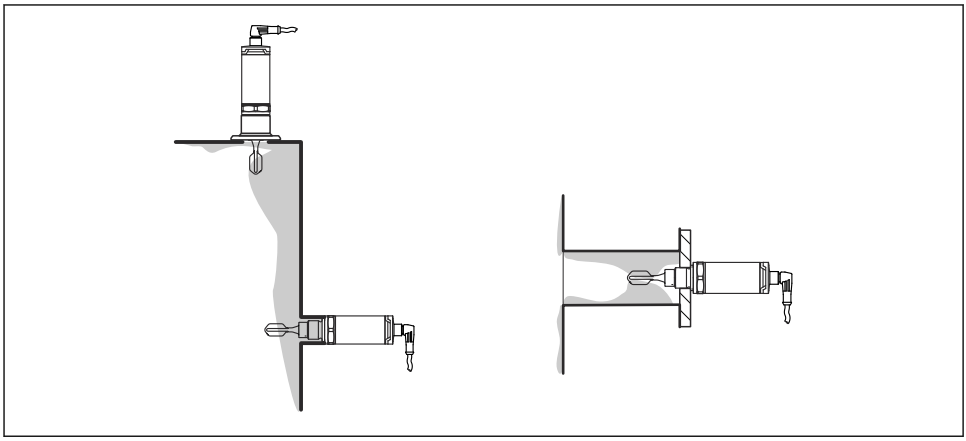
5 Installation options with consideration given to the liquid viscosity, dimensions in mm (in)

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.



6 Buildup on tank wall, pipe wall and tuning fork

5.1.5 Weld-in adapter with leakage hole

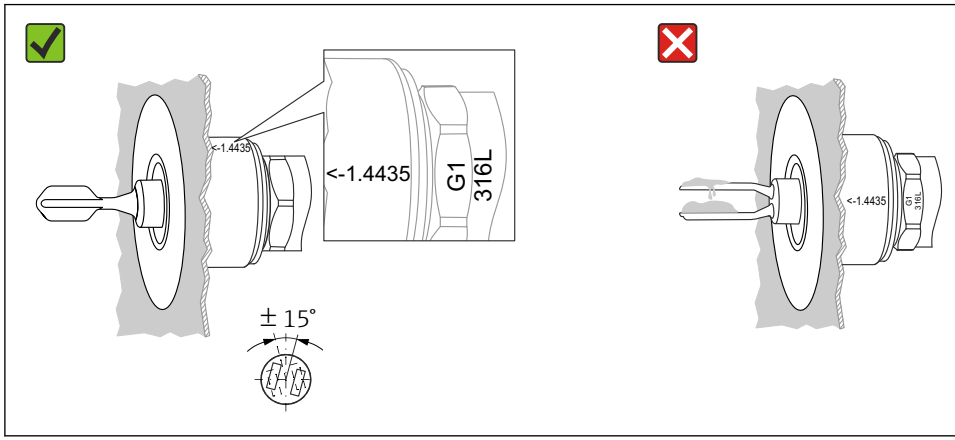
If installed horizontally, make sure that the leakage hole is pointing down. This allows leaks to be detected as quickly as possible.

5.1.6 Marking

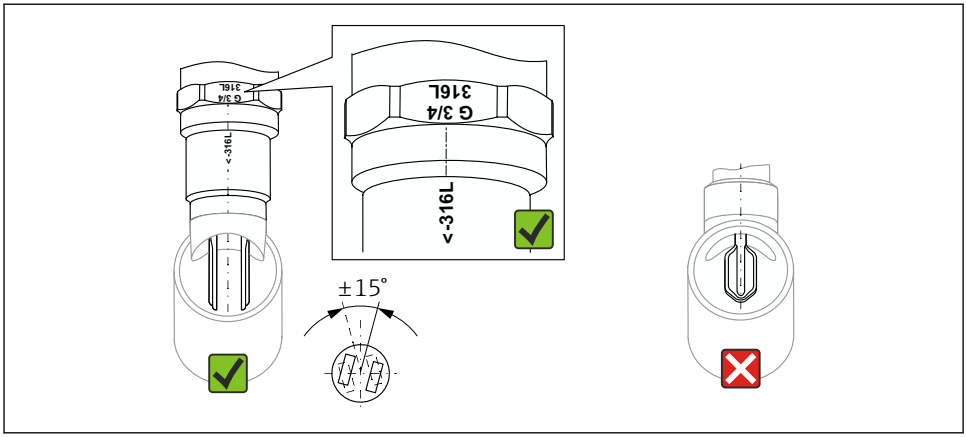
The marking indicates the position of the tuning fork. If installed horizontally in vessels, the marking is face up.

The marking is either a material specification (e.g. 316L) or a type of thread (e.g. G ½") and is located:

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



7 *Orientation in the vessel*



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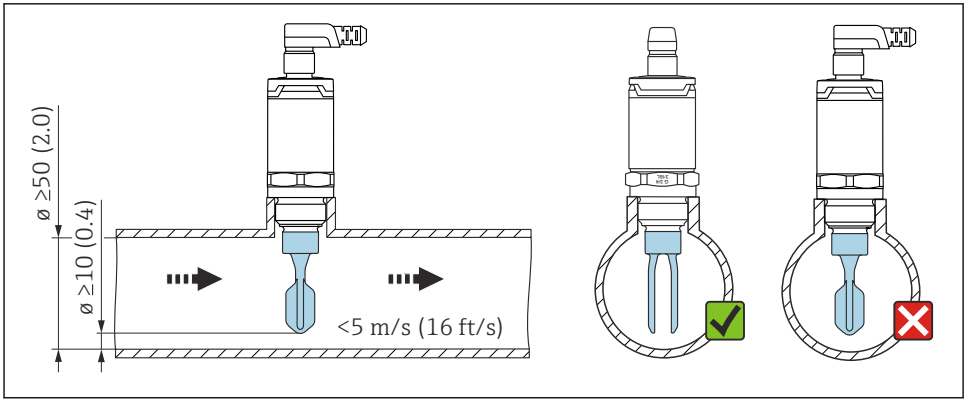
8 Orientation in the pipe

5.1.7 Installation in pipes

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



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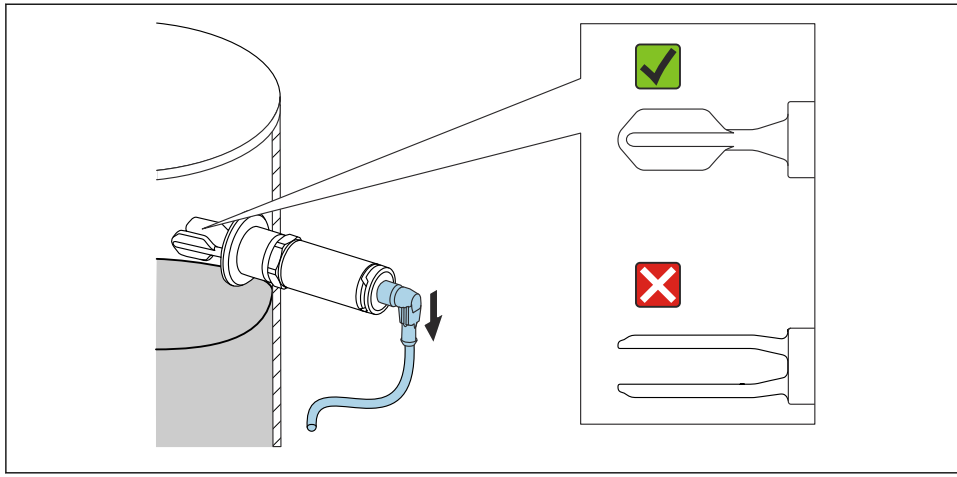
9 Position of the tuning fork in pipes. Unit of measurement mm (in)

5.1.8 Installation in vessels

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

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



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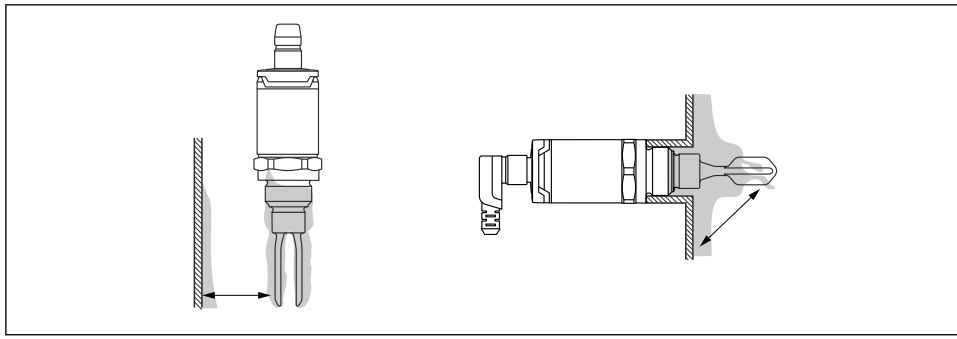
10 *Position of the fork in the case of horizontal installation in a vessel*

5.1.9 Distance from wall

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



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5.2 Mounting the measuring device

Use in accordance with WHG: Prior to mounting the device, pay attention to the WHG approval documents. Documents available in the Download Area of the Endress+Hauser website: www.endress.com → download

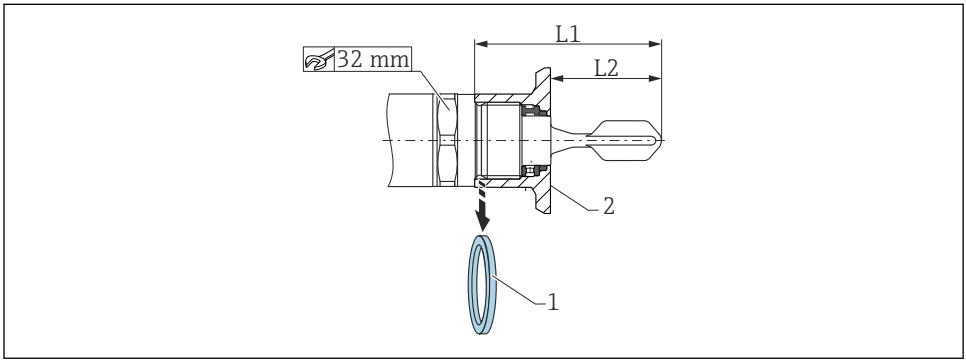
5.2.1 Required tool

- Open-ended wrench: only turn by the hex bolt when screwing in.
  Torque: 15 to 30 Nm (11 to 22 lbf ft)
- Socket wrench: The socket wrench AF32 is available as an accessory.

Pay attention to the temperature and pressure specifications for seals used at the customer site.

5.2.2 Installation

"Weld-in adapter accessories" thread



11 *"Weld-in adapter accessories" thread*

1 Flat seal
2 Weld-in adapter

G ¾"
- L1: 63.9 mm (2.52 in)
- L2: 38.0 mm (1.5 in)

G 1"
- L1: 66.4 mm (2.61 in)
- L2: 48.0 mm (1.89 in)

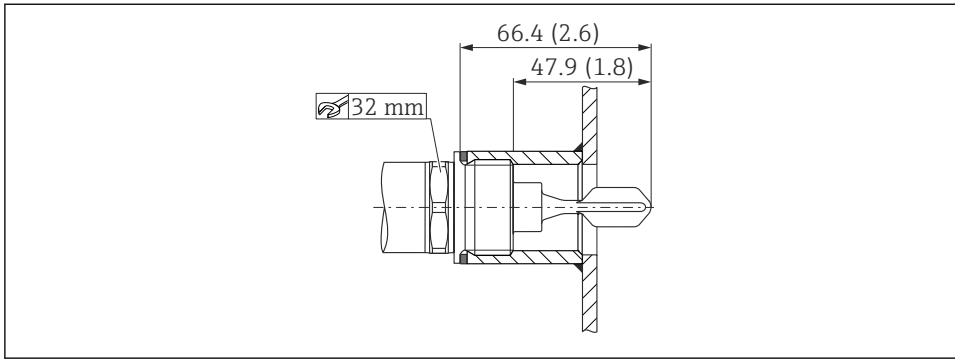
Pressure and temperature (maximum):

+25 bar (+362 psi) at +150 °C (+302 °F)

+40 bar (+580 psi) at +100 °C (+212 °F)

When using a weld-in adapter with flush-mount seal, remove the supplied flat seal (1) from the thread before mounting.

Metric thread in customer nozzle



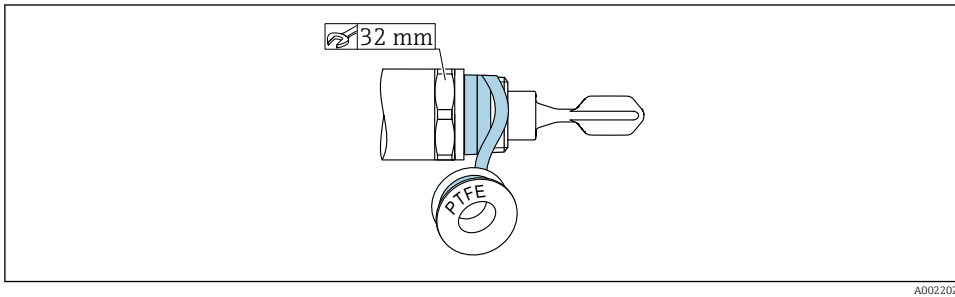
12 Metric thread in customer nozzle

G 1"

Pressure and temperature (maximum):

+40 bar (+580 psi) at 150 °C (302 °F)

NPT thread (ANSI B 1.20.1)



13 NPT thread (ANSI B 1.20.1)

Pressure and temperature (maximum):

+40 bar (+580 psi) at +150 °C (+302 °F)

Wrap in sealing material if necessary.

5.3 Post-installation check

❑Are the device and cable undamaged (visual inspection)?

❑Does the device comply with the measuring point specifications?
- Process temperature
- Process pressure
- Ambient temperature range
- Switch point/measuring range

❑Are the measuring point identification and labeling correct (visual inspection)?

❑Is the device adequately protected against moisture and direct sunlight?

❑Is the device adequately protected against impact?

❑Are all mounting and safety screws securely tightened?

❑Is the device properly secured?

6 Electrical connection

6.1 Connection conditions

The measuring device has two modes of operation:

- Maximum point level detection (MAX): e.g. for overfill protection
  The device keeps the electrical switch closed as long as the sensor is not yet covered by liquid or the measured value is within the process window.
- Minimum point level detection (MIN): e.g. to protect pumps from dry running.
  The device keeps the electrical switch closed as long as the sensor is covered by liquid or the measured value is outside the process window.

Choosing the "MAX"/"MIN" mode of operation ensures that the device switches in a safety-oriented manner even in the event of an alarm condition, e.g. if the power supply line is disconnected. The electronic switch opens if the point level is reached, if a fault occurs or if the power fails (quiescent current principle).

- IO-Link: Communication on pin 4; switch mode on pin 2.
- SIO mode: If there is no communication, the device switches to the SIO mode = standard IO mode.

The functions configured in the factory for the MAX and MIN modes can be changed via IO-Link:

- HNO/HNC hysteresis
- FNO/FNC window

6.2 Supply voltage

SIO mode
10 to 30 VDC

IO-Link mode
18 to 30 VDC

IO-Link communication is guaranteed only if the supply voltage is at least 18 V.

6.3 Connecting the device

⚠ WARNING

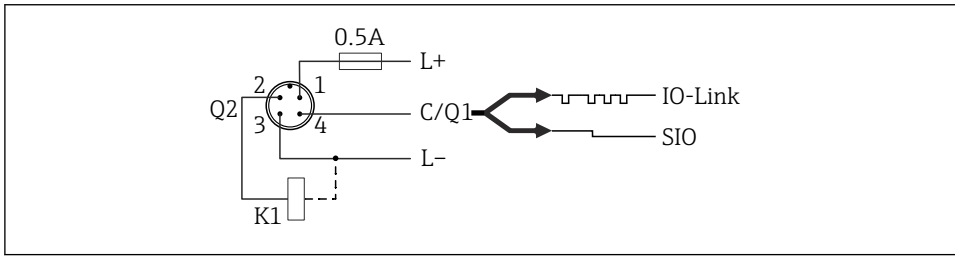
Risk of injury from the uncontrolled activation of processes!

- ▶ Switch off the supply voltage before connecting the device.
- ▶ Make sure that downstream processes are not started unintentionally.

⚠ WARNING

An incorrect connection compromises electrical safety!

- ▶ In accordance with IEC/EN61010 a suitable circuit breaker must be provided for the device.
- ▶ Voltage source: Non-hazardous contact voltage or Class 2 circuit (North America).
- ▶ The device must be operated with a 500 mA fine-wire fuse (slow-blow).
- ▶ Protective circuits against reverse polarity are integrated.



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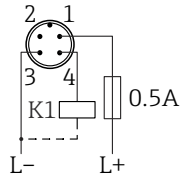
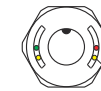
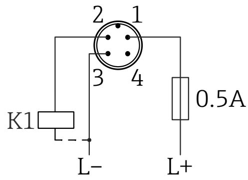
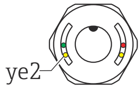
Pin 1 Supply voltage +
Pin 2 1st switch output
Pin 3 Supply voltage -
Pin 4 IO-Link communication or 2nd switch output (SIO mode)

6.3.1 SIO mode (without IO-Link communication)

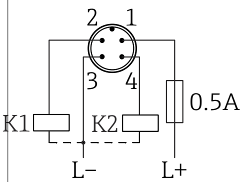
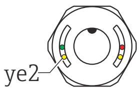
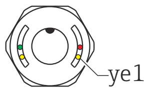
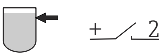
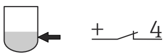
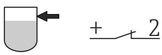
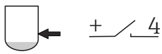
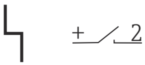
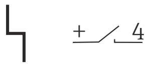
K1, K2: External load

Minimum safety		
Terminal assignment	**MIN output**	**LED yellow (ye) 1**
	 A0037919	
		
		

Maximum safety		
Terminal assignment	**MAX output**	**LED yellow (ye) 2**
	 A0037918	
		
		

Function monitoring with M12 plug

When both outputs are connected, the MIN and MAX outputs assume opposite states (XOR) when the device is operating fault-free. In the event of an alarm condition or a line break, both outputs are de-energized. This means that function monitoring is possible in addition to level monitoring. The behavior of the switch outputs can be configured via IO-Link.

Connection for function monitoring using XOR operation					
Terminal assignment	**MAX output**	**LED yellow (ye) 2**	**MIN output**	**LED yellow (ye) 1**	**LED red (rd)**
	 A0037918		 A0037919		
					
					
					

6.4 Post-connection check

- ❑Are the device and cable undamaged (visual inspection)?
- ❑Does the supply voltage match the specifications on the nameplate?
- ❑If supply voltage is present, is the green LED lit?
- ❑With IO-Link communication: is the green LED flashing?

7 Operation options

7.1 Operation with operating menu

7.1.1 IO-Link information

IO-Link is a point-to-point connection for communication between the measuring device and an IO-Link master. The measuring device features an IO-Link communication interface type 2 with a second IO function on pin 4. This requires an IO-Link-compatible assembly (IO-Link master) for operation. The IO-Link communication interface enables direct access to the process and diagnostic data. It also provides the option of configuring the measuring device while in operation.

Physical properties of the IO-Link interface:
- IO-Link specification: version 1.1
- IO-Link Smart Sensor Profile 2nd Edition [1)]
- SIO mode: Yes
- Speed: COM2; 38.4 kBaud
- Minimum cycle time: 6 ms
- Process data width: 16 bit
- IO-Link data storage: Yes
- Block configuration: Yes
- Device operational: The measuring device is operational 1 s after the supply voltage has been applied

7.1.2 IO-Link download

http://www.endress.com/download
- Select "Software" as the media type
- Select "Device Driver" as the software type
  Select IO-Link (IODD)
- In the "Text Search" field enter the device name.

https://ioddfinder.io-link.com/
Search by
- Manufacturer
- Article number
- Product type

7.1.3 Structure of the operating menu

The menu structure has been implemented according to VDMA 24574-1 and complemented by Endress+Hauser-specific menu items.

→ "Overview of the operating menu" section.

1) Supports minimum scope of IdentClass

8 Overview of the operating menu

Depending on the parameter configuration, not all submenus and parameters are available. Details → "Description of parameters" section → "Note".

IO-Link	Level 1	Level 2
Identification	Serial number	
	Firmware version	
	Extended order code	
	ProductName	
	ProductText	
	VendorName	
	Hardware Version	
	ENP_VERSION	
	Application Specific Tag	
	Device type	
Diagnosis	Actual Diagnostics (STA)	
	Last Diagnostic (LST)	
	Forkfrequency	
	Simulation Switch Output 1 (OU1)	
	Simulation Switch Output 2 (OU2)	
	Device search	
	Sensor check	
Parameter	Application	Active switchpoints (OU1)
		Reset user switchpoints
		Switch point value, Output 1 (SP1/FH1)
		Switchback point value, Output 1 (rP1/FL1)
		Switching delay time, Output 1 (dS1)
		Switchback delay time, Output 1 (dR1)
		Output 1 (OU1)
		Active switchpoints (OU2)
		Reset user switchpoints
		Switch point value, Output 2 (SP2/FH2)
		Switchback point value, Output 2 (rP2/FL2)
		Switching delay time, Output 2 (dS2)

IO-Link	Level 1	Level 2
		Switchback delay time, Output 2 (dR2)
		Output 2 (OU2)
	System	Operating hours
		µC-Temperature
		Unit changeover (UNI) - µC-Temperature
		Minimum µC-Temperature
		Maximum µC-Temperature
		Reset µC-Temperatures [button]
		Standard Command
		DeviceAccessLocks.DataStorage
Observation	Forkfrequency	
	Switch State Output 1 (OU1)	
	Switch State Output 2 (OU2)	

9 System integration

9.1 Process data

The FTL3x devices can be configured with one or two switch outputs. The status of the switch output is transmitted in the form of process data via IO-Link.

- In the SIO mode, switch output 1 is switched at pin 4 on the M12 plug. In the IO-Link communication mode, this pin is reserved exclusively for communication.
- The device's process data are transmitted cyclically in 16-bit chunks.

Bit	0 (LSB)	1	...	12	13	14	15 (MSB)
Measuring device	Fork frequency [0 to 100.0 %], resolution 0.1 %					OU1	OU2

lsb: least significant bit
msb: most significant bit

Bit 14 and bit 15 indicate the status of the switch outputs.

Here, 1 or 24 V_{DC} corresponds to the logical "closed" state on the switch output.

The remaining 14 bits contain the value for the fork frequency [0 to 100 %]. A conversion is not necessary.

Bit	Process value	Value range
15	OU2	0 = open 1 = closed
14	OU1	0 = open 1 = closed
0 to 13	Raw value, not coverage [0 to 100]	Integer

The fork frequency is provided by the device as int13. The decimal separator must then still be determined using a gradient.

9.2 Reading out and writing device data (ISDU – Indexed Service Data Unit)

Device data are always exchanged acyclically and at the request of the IO-Link master. Using the device data, the following parameter values or device statuses can be read out:

9.2.1 Endress+Hauser-specific device data

Designation ISDU (dec) ISDU (hex)	Size (byte) Data type	Access	Default value	Value range	Offset/ gradient	Data storage	Range limits
Extended order code 259 0x0103	60 String	r/-					
ENP_VERSION 257 0x0101	16 String	r/-	02.03.00				
Device Type 256 0x0100	2 Uinteger16	r/-	0x92FD				
Forkfrequency 79 0x004F	2 UInt16	r/-		0 to 1300	0 / 0.02	No	
Simulation Switch Output 1 (OU1) 89 0x0059	1 UInt8	r/w	0~off	0 ~ off 1 ~ ou1 = high 2 ~ ou1 = low	0 / 0	No	0..2
Simulation Switch Output 2 (OU2) 68 0x0044	1 UInt8	r/w	0~off	0 ~ off 1 ~ ou1 = high 2 ~ ou1 = low	0 / 0	No	0..2

Designation ISDU (dec) ISDU (hex)	Size (byte) Data type	Access	Default value	Value range	Offset/ gradient	Data storage	Range limits
Device search 69 0x0045	1 UInt8	r/w	0~off	0 ~ off 1 ~ on	0 / 0	No	0..1
Sensor check 70 0x0046	1 UInt8	-/w			0 / 0	No	
Active switchpoints (OU1) 64 0x0040	1 UInt8	r/w	0 ~ Density >0.7g/cm³	0 ~ Density >0.7g/cm³ 1 ~ Density >0.5g/cm³ 2 ~ User			0..2
Reset user switchpoints 65 0x0041	1 UIntegerT	r/w	0 ~ False	0 ~ False 1 ~ switchpoints Ou1			0..1
Switch point value, Output 1 (SP1/FH1) 71 0x0047	2 UInt16	r/w	88.0		0 / 1	Yes	45 to 97
Switchback point value, Output 1 (rP1/ FL1) 72 0x0048	2 UInt16	r/w	91.0		0 / 1	Yes	45 to 97
Switching delay time, Output 1 (dS1) 81 0x0051	2 UInt16	r/w	0.5		0 / 0.1	Yes	0.3 to 60
Switchback delay time, Output 1 (dR1) 82 0x0052	2 UInt16	r/w	1		0 / 0.1	Yes	0.3 to 60
Output 1 (OU1) 85 0x0055	1 UInt8	r/w	0~HNO	0 ~ HNO 1 ~ HNC 2 ~ FNO 3 ~ FNC		Yes	0..3
Output 1 (OU1) 101 0x0065	1 UInt8	r/w	0~HNO	0 ~ HNO 1 ~ HNC		Yes	0..1
Active switchpoints (OU2) 77 0x004D	1 UInt8	r/w	0 ~ Density >0.7g/cm	0 ~ Density >0.7g/cm³ 1 ~ Density >0.5g/cm³ 2 ~ User			0..2

Designation ISDU (dec) ISDU (hex)	Size (byte) Data type	Access	Default value	Value range	Offset/ gradient	Data storage	Range limits
Reset user switchpoints 102 0x0066	1 UIntegerT	r/w	0~False	0 ~ False 1 ~ switchpoints Ou2			0..1
Switch point value, Output 2 (SP2/FH2) 75 0x004B	2 UInt16	r/w	88.0		0 / 1	Yes	45 to 97
Switchback point value, Output 2 (rP2/ FL2) 76 0x004C	2 UInt16	r/w	91.0		0 / 1	Yes	45 to 97
Switching delay time, Output 2 (dS2) 83 0x0053	/ UInt16		0.5		0 / 0.1		0.3 to 60
Switchback delay time, Output 2 (dR2) 84 0x0054	/ UInt16		1		0 / 0.1		0.3 to 60
Output 2 (OU2) 86 0x0056	1 UInt8	r/w	0~HNC	0 ~ HNO 1 ~ HNC 2 ~ FNO 3 ~ FNC		Yes	0..3
Output 2 (OU2) 95 0x005F	1 UInt8	r/w	0~HNC	0 ~ HNO 1 ~ HNC		Yes	0..1
Operating hours 96 0x0060	4 UInt32	r/-	0		0 / 0.016667	No	0 to 2^32
µC-Temperature 91 0x005B	1 Int8	r/-			°C: 0 / 1 °F: 32 / 1.8 K: 273.15 / 1	No	-128..127
Unit changeover (UNI) - µC-Temperature 80 0x0050	1 UInt8	r/w	°C	0 ~ °C 1 ~ °F 2 ~ K	0 / 0	Yes	0..2
Minimum µC-Temperature 92 0x005C	1 Int16	r/-	127		°C: 0 / 1 °F: 32 / 1.8 K: 273.15 / 1	No	−32768 .. 32767

Designation ISDU (dec) ISDU (hex)	Size (byte) Data type	Access	Default value	Value range	Offset/ gradient	Data storage	Range limits
Maximum µC-Temperature 93 0x005D	1 Int16	r/-	-128		°C: 0 / 1 °F: 32 / 1.8 K: 273.15 / 1	No	−32768 .. 32767
Reset µC-Temperatures [button] 94 0x005E	1 UIntegerT	-/w	0~False	0 ~ False 1 ~ Reset Temperature			0..1
Active switchpoints (OU1) 64 0x0040	1 UInt8	r/w	0 ~ Density >0.7g/cm³	0 ~ Density >0.7g/cm³ 1 ~ Density >0.5g/cm³ 2 ~ User			0..2
Reset user switchpoints 65 0x0041	1 UIntegerT	r/w	0~False	0 ~ False 1 ~ switchpoints Ou1			0..1

9.2.2 IO-Link-specific device data

Designation ISDU (dec) ISDU (hex)	Size (byte) Data type	Access	Default value
Serial number 21 0x0015	max. 16 String	r/-	
Firmware Version 23 0x0017	max. 64 String	r/-	
ProductID 19 0x0013	max. 64 String	r/-	FTL31 / FTL33
ProductName 18 0x0012	max. 64 String	r/-	Liquiphant
ProductText 20 0x0014	max. 64 String	r/-	Vibronic point level switch
VendorName 16 0x0010	max. 64 String	r/-	Endress+Hauser

Designation ISDU (dec) ISDU (hex)	Size (byte) Data type	Access	Default value
VendorId 7 ... 8 0x0007 to 0x0008		r/-	17
DeviceId 9 ... 11 0x0009 to 0x000B		r/-	0x000400
Hardware Version 22 0x0016	max. 64 String	r/-	
Application Specific Tag 24 0x0018	32 String	r/w	
Actual Diagnostics (STA) 260 0x0104	4 String	r/-	
Last Diagnostic (LST) 261 0x0105	4 String	r/-	

9.2.3 System commands

Designation ISDU (dec) ISDU (hex)	Value range	Access
Standard Command 2 0x0002	130	-/w
Device Access Locks.Data Storage Lock 12 0x000C	0 ~ False 2 ~ True	r/w

10 Commissioning

10.1 Function check

Prior to commissioning, make sure that the post-installation and post-connection checks have been performed.

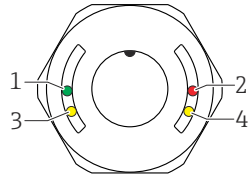
- → "Post-installation check" checklist
- → "Post-connection check" checklist

Function test: Immerse tuning fork in water

10.2 Commissioning the local display

10.2.1 Light signals (LEDs)

Position of LEDs in housing cover



A0037920

Position	LED color	Description of function
1	green (gn)	Status/communication ▪ Lit: SIO mode ▪ Flashing: Active communication, flash frequency ▪ Flashing with increased luminosity: Device search (device identification), flash frequency
2	red (rd)	Warning/Maintenance required Flashing: Error remediable, e.g. invalid calibration Fault/device failure Lit: → Diagnostics and troubleshooting
3	yellow (ye)2	Switch status/switch output 2 [1] With IO-Link communication following customer calibration: Sensor is covered by medium.
4	yellow (ye)1	Switch status/switch output 1 With IO-Link communication following customer calibration: Sensor is covered by medium.

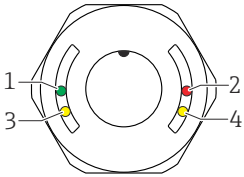
1) Activated only if both switch outputs are active.

There is no external signaling via LEDs on the metal housing cover (IP69). The M12 plug with an LED indicator is suitable for this → Accessories.

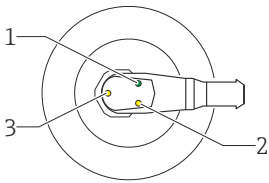
10.2.2 Function of LEDs

Any configuration of the switch outputs is possible. The following table shows the behavior of the LEDs in the SIO mode:

LEDs on housing cover with M12 plug, IO-Link

Operating modes	MAX		MIN		Warning	Fault
Sensor	free	covered	free	covered		
						
1: green (gn)						
2: red (rd)						
3: yellow (ye) 2						
4: yellow (ye) 1						

LEDs on M12 plug (signals status of switch outputs)

Operating modes	MAX		MIN		Warning	Fault
Sensor	free	covered	free	covered		
						
1: green (gn)					–	
2: yellow (ye)2					–	
3: yellow (ye)1					–	

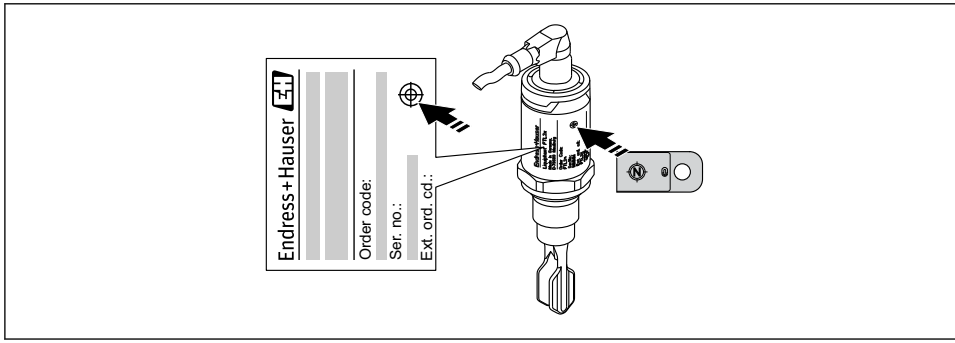
10.3 Function test with test magnet

WARNING

Risk of injury!

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

To perform a function test, hold the 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 switch status valid at that time is adopted.



14 Test magnet and marking

The test magnet is not included in the scope of delivery and can be ordered as an optional accessory , → "Accessories" section.

10.4 Commissioning with an operating menu

If an existing configuration is changed, measuring operation continues! The new or modified entries are only accepted once the setting has been made.

Parameter changes are not accepted until after the parameters have been downloaded.

If using block configuration, parameter changes are accepted only after the parameters have been downloaded.

WARNING

Risk of injury and damage to property due to uncontrolled activation of processes!

- Make sure that downstream processes are not started unintentionally.

IO-Link communication

- Commissioning with factory settings: The device is configured for use with water-based media. The device can be commissioned directly when used with water-based media. Factory setting: Output 1 and output 2 are configured for XOR operation.
- Commissioning with customer-specific settings: The device can be configured differently to the factory settings via IO-Link. Select "User" in the **Active switchpoints** parameter.

- Each change must be confirmed with Enter to ensure that the value is accepted.
- Incorrect switching is suppressed by adjusting the settings in the switching delay/ switchback delay (**Switching delay time/Switchback delay time** parameters).

11 Customer-specific IO-Link settings

11.1 Configuring a customer-specific switch point with configuration of a switching delay and switchback delay:

11.1.1 Switch point

1. Completely immerse sensor (tuning fork) in the medium.
2. Under "Process Data" --> "Forkfrequency", observe the oscillation frequency (as %). (Make a note of the value if necessary.)
3. Parameter --> Active switchpoints (OU1/OU2) --> "User"
4. Parameter --> Switch point value, Output 1/2 (SP1/2/FH1/2) and Switchback point value (rP1/2/FL1/2) to configure the switch point hysteresis.

11.1.2 Switching delay and switchback delay

1. Parameter --> Switching delay time, Out 1/2 (dS1/2), parameter for switching delay. Enter value in seconds.
2. Parameter --> Switchback delay time, Out 1/2 (dR1/2), enter parameter for switchback delay.

All entries must be confirmed with Enter.

- **Block write mode:** All modified parameters are written into the device using the Download function.
- **Direct write mode:** After confirming a parameter with the Enter key, the parameter is written directly into the device

12 Diagnostics and troubleshooting

Troubleshooting: If an electronic/sensor defect is present, the device changes to error mode and displays the diagnostic event F270. The status of the process data is rendered invalid. The switch output(s) is/are opened.

12.1 General troubleshooting

Device not responding

Supply voltage does not match the value indicated on the nameplate.
- ▶ Connect the correct voltage.

Supply voltage has incorrect polarity.
- ▶ Correct the polarity.

Connecting cables are not in contact with the terminals.
- ▶ Check for electrical contact between cables and correct.

No communication

Communication cable not connected.
- ▶ Check wiring and cables.

Communication cable incorrectly attached to device.
- ▶ Check wiring and cables.

Communication cable incorrectly attached to the IO-Link master.
- ▶ Check wiring and cables.

No transmission of process data

An error has occurred in the device, e.g. internal sensor error or electronics error.
- ▶ Correct all errors that are displayed as a diagnostic event .

12.2 Diagnostic information via LED indicator

LED indicator on housing cover

Green LED not lit

No supply voltage.
- ▶ Check plug, cable and supply voltage.

LED flashing red

Overload or short-circuit in load circuit.
- ▶ Rectify short-circuit.
- ▶ Reduce maximum load current to below 200 mA if one switch output is active.
- ▶ Maximum load current = 105 mA per output if both switch outputs are active.

Ambient temperature outside of specification.
- ▶ Operate measuring device in specified temperature range.

Test magnet held against marking for too long.
- ▶ Repeat function test.

Red LED continuously lit

Internal sensor error.
▶ Replace device.

There is no external signaling via LEDs on the metal housing cover (IP69).

LED indicator on M12 plug, can be ordered as an accessory

Green LED not lit

No supply voltage.
▶ Check plug, cable and supply voltage.

12.3 Diagnostic events

12.3.1 Diagnostic message

Faults that are detected by the device's self-monitoring system are displayed as a diagnostic message via IO-Link.

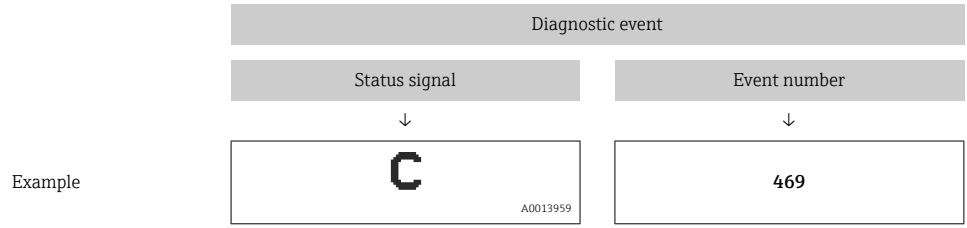
Status signals

The table lists the messages that may occur. The Actual Diagnostic (STA) parameter displays the message with the highest priority. The device has four different status information codes according to NE107:

F A0013956	**"Failure"** A device error has occurred. The measured value is no longer valid.
M A0013957	**"Maintenance required"** Maintenance is required. The measured value is still valid.
C A0013959	**"Function check"** The device is in the service mode (e. g. during a simulation).
S A0013958	**"Out of specification"** The device is being operated: ▪ Outside its technical specifications (e. g. during warmup or cleaning process) ▪ Outside the parameter configuration undertaken by the user (e. g. level outside of configured span)

Diagnostic event and event text

The fault can be identified using the diagnostic event.



If two or more diagnostic events are pending simultaneously, only the diagnostic message with the highest priority is shown.

The last diagnostic message is displayed: **Diagnosis** submenu → **Last Diagnostic (LST)** parameter.

12.4 Overview of diagnostic events

EventQualifier	Diagnostic event	EventCode	Event text
Warning (Warning)	S804	0x1801	▪ Load current > 200 mA ▪ Overload at switch output 2
	S825	0x1812	Ambient temperature outside of specification
	C485	0x8C01	Simulation active
Error (Fault)	F270	0x5000	Defect in electronics/ sensor
	F042	0x1816	Sensor corroded
Message	C103	0x1813	Sensor check failed
	C182	0x1807	Invalid calibration
	-	0x1814	Sensor check passed
Information	-	0x1815	Timeout Reedcontact

12.4.1 Causes and remedial action

Warning

S804

Load current > 200 mA
► Increase load resistance at switch output

Overload at switch output 2
► Check output circuit
► Replace device

S825

Ambient temperature outside of specification.
► Operate the device in the specified temperature range.

C485

When the simulation of a switch output or current output is active, the device displays a warning.
► Deactivate simulation.

Fault

F270

Electronics/sensor defective
► Replace device.

F042

Sensor corroded
- ▶ Replace device.

Message

C103

Sensor check failed.
- ▶ Repeat cleaning.
- ▶ New calibration recommended and check switching behavior.
- ▶ Replace device.

C182

Switch point/switchback point are too close together or interchanged.
- ▶ Check probe coverage.
- ▶ Perform configuration again.

Unsuitable medium used for automatic calibration.
- ▶ Check probe coverage.
- ▶ Use correct medium (not conductive and $\varepsilon r \geq 2$).

Message without diagnostic event

Sensor check
- ▶ Automatic sensor check.

Information

Information without diagnostic event

Timeout reed contact
- ▶ Remove test magnet.

12.5 Behavior of the device in the event of a fault

General information:
- Warnings and faults displayed via IO-Link
- The warnings and faults displayed are for information purposes only and do not have a safety function
- Errors diagnosed by the device are displayed via IO-Link in accordance with NE107

In accordance with the diagnostic message, the device behaves as per a warning or fault condition.

- **Warning:**
  - The device continues measuring if this type of error occurs. The output signal is not affected (exception: simulation is active).
  - The switch output remains in the state defined by the switch points.
- **Fault:**
  - The device does **not** continue measuring if this type of error occurs. The output signal assumes its fault state (switch outputs de-energized).
  - The fault state is displayed via IO-Link.
  - The switch output changes to the "open" state.

12.6 Resetting to factory settings (reset)

→ "Standard Command" parameter description.

13 Maintenance

No special maintenance work is required.

13.1 Cleaning

- Clean the sensor if necessary
- Cleaning can also be performed with the device installed in place, e.g. CIP cleaning in place/SIP sterilization in place
  → Do not damage the sensor in the process

14 Repair

Repair is not envisaged for this measuring device.

14.1 Return

The requirements for safe device return can vary depending on the device type and national legislation.

1. Refer to the website for more information:
   http://www.endress.com/support/return-material
2. Return the device if repairs or a factory calibration are required, or if the wrong device was ordered or delivered.

14.2 Disposal

If required by the Directive 2012/19/EU on waste electrical and electronic equipment (WEEE), the product is marked with the depicted symbol in order to minimize the disposal of WEEE as unsorted municipal waste. Do not dispose of products bearing this marking as unsorted municipal waste. Instead, return them to Endress+Hauser for disposal under the applicable conditions.

15 Description of device parameters

15.1 Diagnosis

Actual Diagnostics (STA)

Navigation Diagnosis → Actual Diagnostics (STA)

Description Displays the current device status.

Last Diagnostic (LST)

Navigation Diagnosis → Last Diagnostic (LST)

Description Displays the last device status (error or warning) that was rectified during operation.

Simulation Switch Output 1 (OU1)

Navigation Diagnosis → Simulation Switch Output 1 (OU1)

Description

The simulation affects the process data only. It does not affect the physical switch output. If a simulation is active, a warning to this effect is displayed so that it is obvious to the user that the device is in simulation mode. A warning is communicated via IO-Link (C485 - simulation active). The simulation must be ended actively via the menu. If the device is disconnected from the power supply during the simulation and power is then resupplied, simulation mode is not resumed, and instead the device continues operation in measuring mode.

Options

- OFF
- OU1 = HIGH
- OU1= LOW

Simulation switch Output 2 (OU2)

Navigation

Diagnosis → Simulation Switch Output 2 (OU2)

Description

The simulation affects the process data and the physical switch output. If a simulation is active, a warning to this effect is displayed via IO-Link so that it is obvious to the user that the device is in the simulation mode (C485 - simulation active). The simulation must be ended actively via the menu. If the device is disconnected from the power supply during the simulation and power is then resupplied, the simulation mode is not resumed, and instead the device continues operation in the measuring mode.

Options

- Off
- OU2 = high
- OU2 = low

Device search

Navigation

Diagnosis → Device search

Description

This parameter is used to uniquely identify the device during installation.
The green LED is lit (= operational) on the device and starts to flash with increased luminosity, flash frequency .

Note

On the metal housing cover (IP69), there is no external signaling via LEDs.

Options

- Off
- On

The function is deactivated after the device is restarted.

Factory setting

Off

Sensor check

Navigation

Diagnosis → Sensor check

Description

This parameter is used to test if the measuring point is functioning correctly.
The sensor must not be covered and must be free of residue.
The device compares the current measured values with the measured values from the factory adjustment.

IO-Link message

Check: Following the test, one of the following messages is displayed:
- Message (0x1814) for sensor check passed
- Message C103 (0x1813) for sensor check failed

15.2 Parameter

15.2.1 Application

Active switchpoints

Navigation

Parameter → Application → Active switchpoints

Description

Choice between standard (0.7 g/cm^3, 0.5 g/cm^3) or customer-specific, user-definable switch points

Switch-on value

Last setting selected prior to switching off device.

Selection

- Standard
- User

Factory setting Standard

Reset user switchpoints

Navigation Parameter → Application → Reset user switchpoints

Note This parameter is visible only if the User option is selected in the Active Switchpoint parameter.

Description After selecting an output, switch point OU1 or OU2, the switch output and its associated value are reset to the factory setting.

Selection
- False
- switchpoints OU1
- switchpoints OU2

Factory setting False

Switch point value (coverage), Output 1/2 (SP1/SP2), Output 1/2 (FL1/FL2) Switchback point value (coverage), Output 1/2 (rP1/rP2), Output 1/2 (FH1/FH2)

Navigation Parameter → Application → Switch point value, Output 1/2 (SP1/SP2)
Parameter → Application → Switchback point value, Output 1/2 (rP1/rP2)

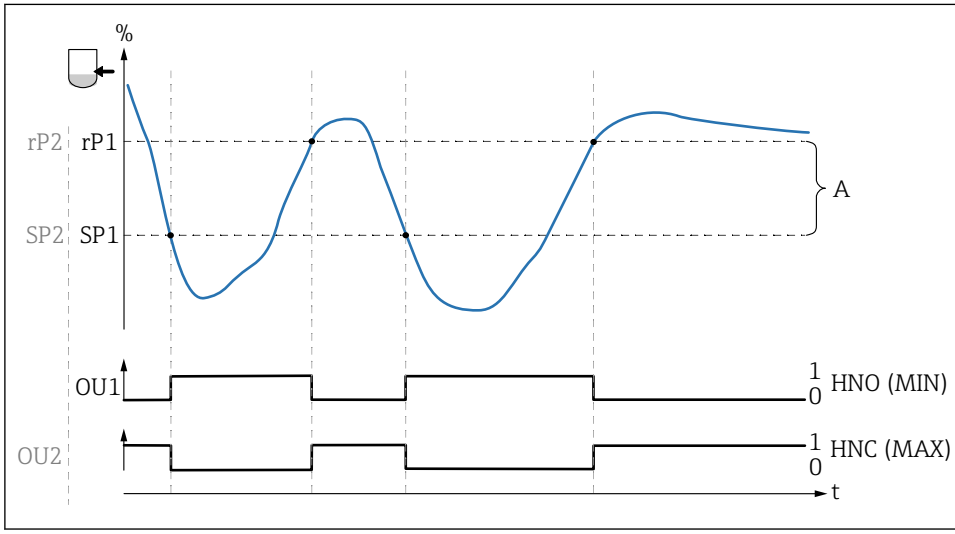
Note The switching sensitivity of the sensor is set using the SP1/rP1 or SP2/rP2 parameters. Since the parameter settings depend on one another, the parameters are described all together.
- SP1 = switch point 1
- SP2 = switch point 2
- rP1 = switchback point 1
- rP2 = switchback point 2
- FL1 = lower value of window 1
- FL2 = lower value of window 2
- FH1 = upper value of window 1
- FH2 = upper value of window 2

Description

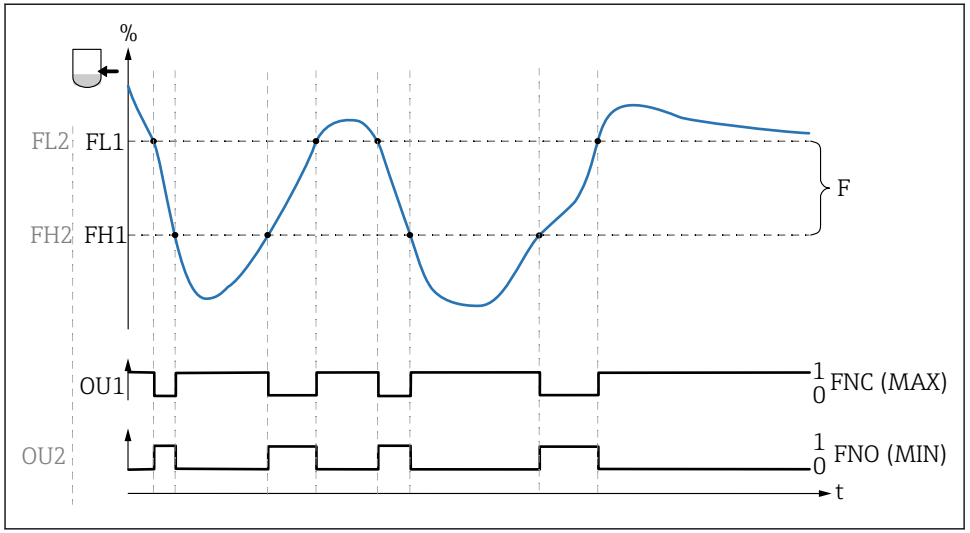
The switching sensitivity of the sensor can be configured using the switch point and switchback point. The switching sensitivity can be adapted to the medium.

- Sensor switches if there is slight coverage = very sensitive.
- Sensor switches if there is heavy buildup = not sensitive.

The set value for switch point SP1/SP2 must be less than switchback point rP1/rP2!
A diagnostic message is displayed if a switch point SP1/SP2 is entered that is ≥ switchback point rP1/rP2.
When the set switchback point rP1/rP2 is reached, an electrical signal change takes place again at the switch output (OU1/OU2). The difference between the value of the switch point SP1/SP2 and the value of the switchback point rP1/rP2 is known as the hysteresis.



0 *0-signal, output open*
1 *1-signal, output closed*
A *Hysteresis (difference between the value of the switch point SP1/SP2 and the value of the switchback point rP1/rP2)*
% *Fork frequency (100 % corresponds to frequency in air / uncovered)*
HNO *Normally open contact (MIN)*
HNC *Normally closed contact (MAX)*
SP1 *Switch point 1 / SP2: Switch point 2*
rP1 *Switchback point 1 / rP2: Switchback point 2*



A0037950

0 0-signal, output open
1 1-signal, output closed
F Window
% Fork frequency (100 % corresponds to frequency in air / uncovered)
FNO Normally open contact (MIN)
FNC Normally closed contact (MAX)
FL1 Lower value of window
FH1 Upper value of window

Note The various points for the switching delay can be adjusted to ensure that rapid switching back and forth at the switch limits is suppressed.

Switch-on value Last value selected prior to switching off.

Selection No selection. The user is free to edit the values.

Input range 45 to 97 %

Switching delay time, Output 1/2 (dS1/dS2)
Switchback delay time, Output 1/2 (dR1/dS2)

Navigation

Parameter → Application → Output Switch 1/2 → Switching delay time, Output 1/2 (dS1/dS2)
Parameter → Application → Output Switch 1/2 → Switchback delay time, Output 1/2 (dR1/dR2)

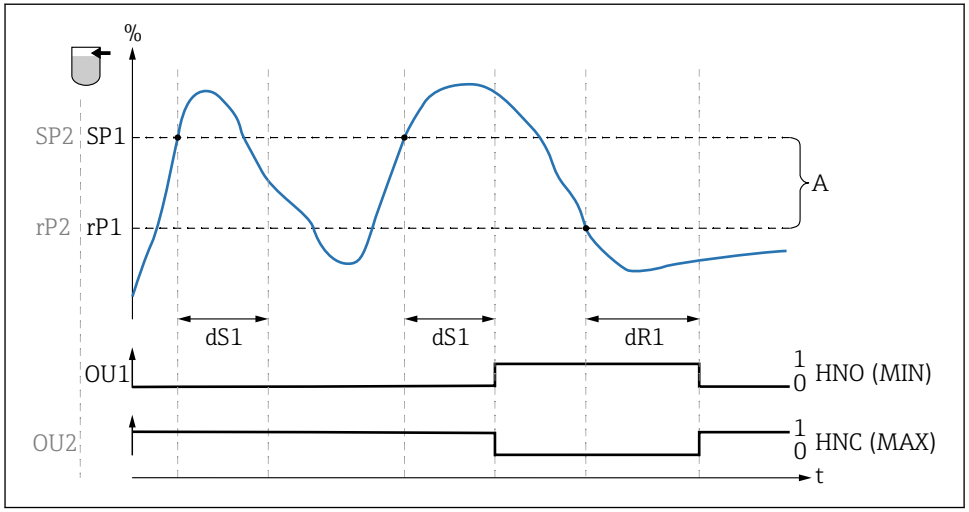
Note

The switching delay time/switchback delay time functions are implemented using the "dS1"/"dS2" and "dR1"/dR2" parameters. Since the parameter settings depend on one another, the parameters are described all together.

- dS1 = switching delay time, output 1
- dS2 = switching delay time, output 2
- dR1 = switchback delay time, output 1
- dR2 = switchback delay time, output 2

Description

Set the delay:
To prevent rapid switching back and forth when values are close to the switch point "SP1"/"SP2" or switchback point "rP1"/"rP2", a delay in the range of 0.3 to 60 seconds, to one decimal place, can be set for individual points.
If the measured value leaves the switching range during the delay time, the delay time starts again.



0 *0-signal, output open in the quiescent state*
1 *1-signal, output closed in the quiescent state*
A *Hysteresis (difference between the value of the switch point "SP1" and the value of the switchback point "rP1")*
HNO *Normally open contact (MIN)*
HNC *Normally closed contact (MAX)*
% *Coverage of sensor*
SP1 *Switch point 1/SP2: Switch point 2*
rP1 *Switchback point 1/rP2: Switchback point 2*
dS1 *Set time for which the specific switch point must be reached continuously without interruption until an electrical signal change takes place.*
dR1 *Set time for which the specific switchback point must be reached continuously without interruption until an electrical signal change takes place.*

Value at switch-on	Last value selected prior to switching off.
Selection	No selection. The user is free to edit the values.
Input range	0.3 to 60 s
Factory setting	0.5 s (Switching delay time dS1/dS2) 1.0 s (Switchback delay time dR1/dR2)

Output 1/2 (OU1/OU2)

Navigation Parameter → Application → Output Switch 1/2 → Output 1/2 (OU1/OU2)

Description Hysteresis: Determining whether sensor is free or covered.

Value at switch-on Last function selected prior to switching off.

Selection
- Hysteresis normally open (MIN)
- Hysteresis normally closed (MAX)

Factory setting Output 1 (OU1): HNO
Output 2 (OU2): HNC

15.2.2 System

Operating hours

Navigation Parameter → System → Operating hours

Description This parameter counts the operating hours in minutes during the period in which operating voltage is present.

µC-temperature

Navigation Parameter → System → µC-temperature

Description This parameter displays the current µC-temperature on the electronics.

Unit changeover (UNI) - µC-Temperature

Navigation Parameter → System → Unit changeover (UNI) - µC-Temperature

Description This parameter is used to select the electronics temperature unit. Once a new electronics temperature unit has been selected, the value is converted to the new unit and displayed.

Switch on value Last unit selected prior to switching off.

Options
- °C
- °F
- K

Factory setting °C

Minimum µC-temperature

Navigation Parameter → System → Minimum µC-temperature

Description This parameter is used as the minimum peak indicator and makes it possible to call up retroactively the lowest electronics temperature measured.
If the value of the peak indicator is overwritten, the value is automatically set to the temperature currently measured.

Maximum µC-temperature

Navigation Parameter → System → Maximum µC-temperature

Description This parameter is used as the maximum peak indicator and makes it possible to call up retroactively the highest electronics temperature measured.
If the value of the peak indicator is overwritten, the value is automatically set to the temperature currently measured.

Reset µC-Temperature

Navigation Parameter → System → Reset µC-Temperature

Description This parameter displays the current µC-temperature on the electronics.

Standard Command

Navigation Parameter → System → Standard Command

Description

⚠ WARNING

"Standard Command" cause an immediate reset to the factory setting when the device was delivered.
If the factory settings have been changed, downstream processes might be affected following a reset (the behavior of the switch output or current output might be changed).
- ▶ Make sure that downstream processes are not started unintentionally.

The reset is not subject to additional locking, such as in the form of device locking. The reset also depends on the device status.
Any customer-specific configuration carried out at the factory is not affected by a reset (customer-specific configuration remains).

Note The last error is not reset in a reset.

Device Access Locks.Data Storage Lock [1] Activation/deactivation of DataStorage

1) The "Device Access Locks.Data Storage Lock" parameter is an IO-Link standard parameter. The name of the parameter may exist in the configured language in the IO-Link operating tool used. The display depends on the operating tool in question.

Navigation Parameter → System → Device Access Locks.Data Storage Lock

Description The device supports DataStorage. If a device is being replaced, this allows the configuration of the old device to be written to the new device. If, when a device is being replaced, the original configuration of the new device is to be retained, the **Device Access Locks.Data Storage Lock** parameter can be used to prevent the parameters from being overwritten. If this parameter is set to "true", the new device does not adopt the data stored in the master's DataStorage.

Options
- false
- true

15.3 Observation

The process data are transmitted acyclically.

16 Accessories

More detailed information and documentation are available:
- Product Configurator on the Endress+Hauser website www.endress.com
- Endress+Hauser sales organization www.addresses.endress.com

Designation	Additional information
Weld-in adapter	For detailed information on weld-in adapters, see supplementary documentation. Available in the Download Area of the Endress+Hauser website (www.endress.com/downloads).
Seals, o-rings	
Socket wrench for mounting	Hexagon bolt, AF32, order number: 52010156
Test magnet	Order number: 71267011
Plug-in jack M12 with cable 5 m (16 ft)	IP67, coupling nut (Cu Sn/Ni) ▪ Straight, order number: 52006263 ▪ Elbowed 90°, order number: 52010285

Core colors for M12 plug:
- 1 = BN (brown)
- 2 = WT (white)
- 3 = BU (blue)
- 4 = BK (black)

17 Technical data

More detailed information and documentation are available:
- Product Configurator on the Endress+Hauser website www.endress.com
- Endress+Hauser sales organization www.addresses.endress.com

17.1 Power supply

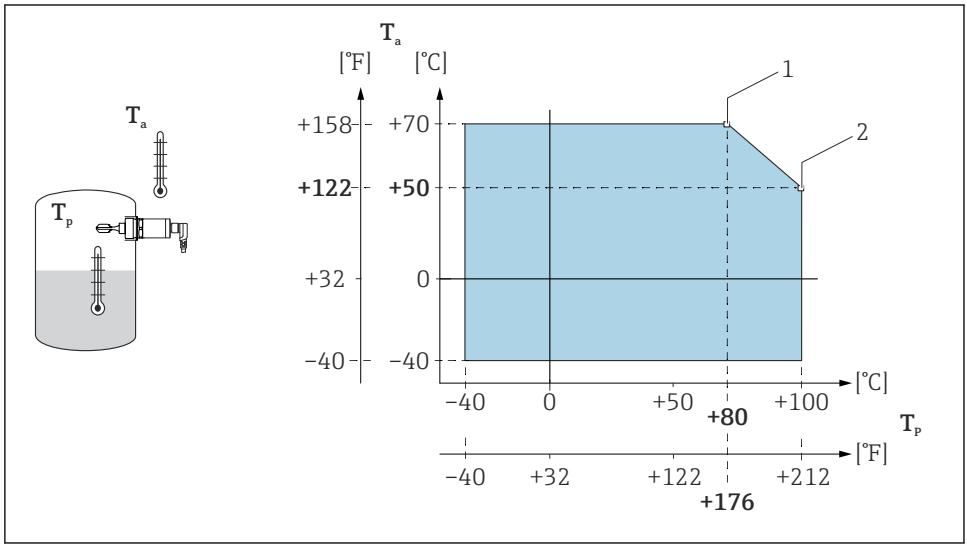
Electronic version	Supply voltage	Power consumption
SIO mode, DC-PNP	10 to 30 V DC	< 975 mW
IO-Link	18 to 30 V DC	< 975 mW

17.2 Environment

Ambient temperature range	−40 to +70 °C (−40 to +158 °F), → "Derating"
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 2 000 m (6 600 ft) above sea level

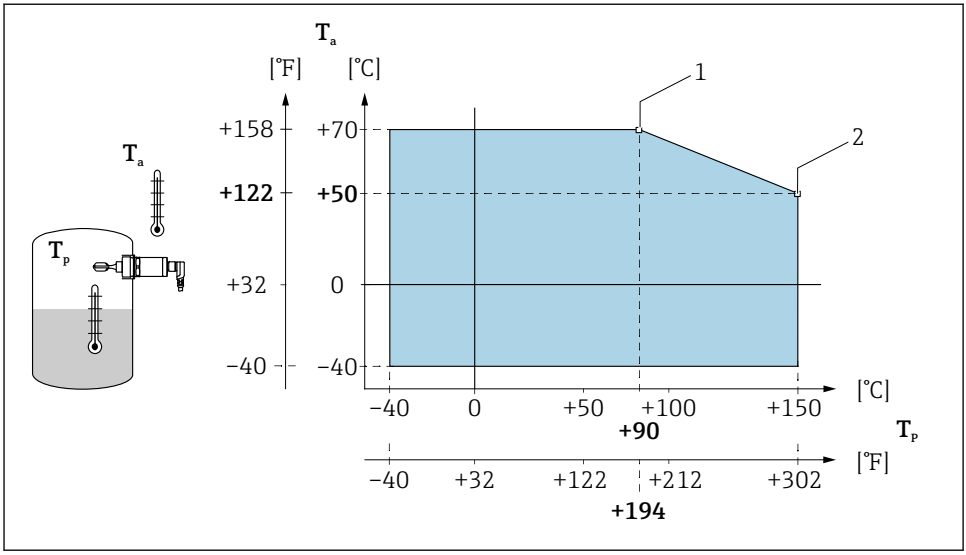
Shock resistance	a = 300 m/s² = 30 g, 3 axes x 2 directions x 3 shocks x 18 ms, as per test Ea, prEN 60068-2-27:2007
Vibration resistance	a(RMS) = 50 m/s², ASD = 1.25 (m/s²)²/Hz, f = 5 to 2 000 Hz, t = 3 x 2 h, as per test Fh, EN 60068-2-64:2008
Reverse polarity protection	**3-wire DC-PNP and IO-Link** Integrated. In the event of reverse polarity, the device is deactivated automatically.
Short-circuit protection	**3-wire DC-PNP and IO-Link** Overload protection/short-circuit protection at I > 200 mA; the sensor is not destroyed. For IO-Link communication: 105 mA per output if both switch outputs are active. Intelligent monitoring: Testing for overload at intervals of approx. 1.5 s; normal operation resumes once the overload/short-circuit has been rectified.
Degree of protection	▪ IP65/67 NEMA Type 4X Enclosure (M12 plug) ▪ IP66/68/69 NEMA Type 4X/6P Enclosure (M12 plug for metal housing cover)
Electromagnetic compatibility	Electromagnetic compatibility in accordance with all the relevant requirements of the EN 61326 series. For details, refer to the EC Declaration of Conformity. Available in the Download Area of the Endress+Hauser website: www.endress.com.

17.2.1 Derating



15 *Derating curve: 100 °C (212 °F)*

1 *I_{max}: 200 mA (DC-PNP)*
2 *I_{max}: 150 mA (DC-PNP)*
Ta Ambient temperature
Tp Process temperature



16 *Derating curve: 150 °C (302 °F)*

1 I_{max}*: 200 mA (DC-PNP)*
2 I_{max}*: 150 mA (DC-PNP)*
Ta Ambient temperature
Tp Process temperature

17.3 Process

Note the pressure and temperature derating depending on the selected process connection

Process temperature range	−40 to +100 °C (−40 to +212 °F) −40 to +150 °C (−40 to +302 °F)
Process pressure range	max. −1 to +40 bar (−14.5 to +580 psi)
Density	>0.7 g/cm³ (optionally available: >0.5 g/cm³), can be configured via IO-Link
State of aggregation	Liquid
Viscosity	1 to 10 000 mPa·s dynamic viscosity
Solids contents	ø < 5 mm (0.2 in)
Lateral loading capacity	Lateral loading capacity of the tuning fork: max. 200 N

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