

Technical Information

Liquiphant FTL41

Vibronic



Limit switch for liquids

Application

- Limit switch for minimum or maximum detection in tanks, containers and piping with all types of liquids, even in hazardous areas
- Process temperature range: -40 to +150 °C (-40 to +302 °F)
- Pressures up to 40 bar (580 psi)
- Viscosities up to 10 000 mPa·s
- Ideal substitute for float switches, as reliable function is not affected by flow, turbulence, air bubbles, foam, vibration, solids content or buildup.

Advantages

- No calibration needed: Quick, low-cost commissioning
- Design in accordance with ASME B31.3 and CRN approval
- No mechanically moving parts: No maintenance, no wear, long operating life
- Functional safety: Monitoring of vibration frequency of the tuning fork
- RFID TAG – easy measuring point identification and simplified data access

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About this document

Symbols

Safety symbols



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



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

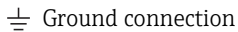


This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or medium injury.



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

Electrical symbols



Grounded clamp, which is grounded via a grounding system.

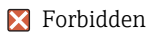


Ground terminals, which must be grounded prior to establishing any other connections. The ground terminals are located on the inside and outside of the device.

Symbols for certain types of information



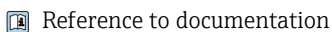
Procedures, processes or actions that are permitted.



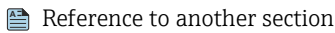
Procedures, processes or actions that are forbidden.



Indicates additional information



Reference to documentation



Reference to another section



Series of steps

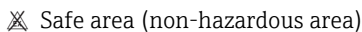
Symbols in graphics

A, B, C ... View

1, 2, 3 ... Item numbers



Hazardous area



Safe area (non-hazardous area)

Function and system design

point level detection

Maximum or minimum detection for liquids in tanks or pipes in all industries. Suitable for leakage monitoring, dry-running protection, pump protection or overflow protection, for example .

Specific versions are suitable for use in hazardous areas.

The point level switch differentiates between the "covered" and "not covered" conditions.

Depending on the MIN (minimum detection) or MAX (maximum detection) modes, there are two possibilities in each case: OK status and demand mode

OK status

- In MIN mode, the fork is covered, e. g. pump protection
- In MAX mode, the fork is not covered e. g. overflow protection

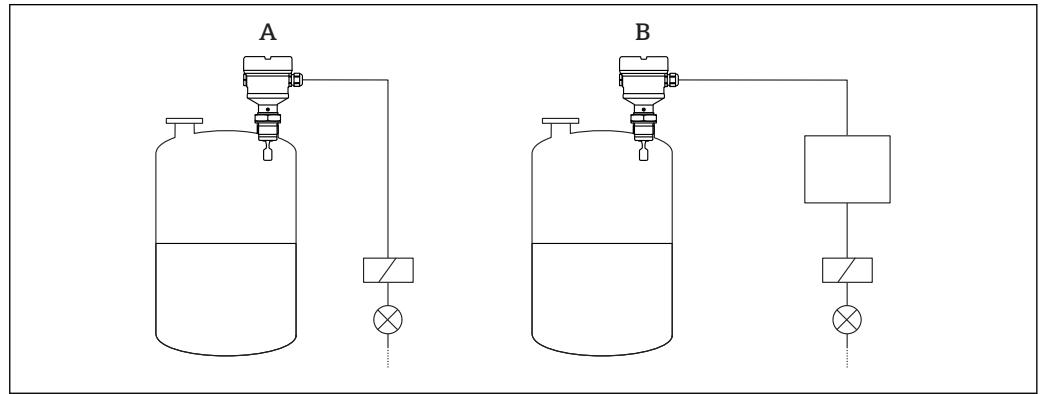
Demand mode

- In MIN mode, the fork is not covered e. g. pump protection
- In MAX mode, the fork is covered e. g. overflow protection

Measuring principle

The sensor's tuning fork vibrates at its intrinsic frequency. As soon as the liquid covers the tuning fork, the vibration resistance decreases. The change in frequency causes the point level switch to switch.

Measuring system



1 Example of a measuring system

A Device for direct connection of a load

B Device for connection to a separate switching unit or PLC

Input

Measured variable

Level (point level), MAX or MIN safety

Measuring range

Depends on the installation location and the pipe extension ordered

Output

Output and input variants

Electronic inserts

3-wire DC-PNP (FEL42)

- Three-wire direct current version
- Switches the load via the transistor (PNP) and separate connection, e. g. in conjunction with programmable logic controllers (PLC)

Universal current connection, relay output (FEL44)

Switches the loads via 2 floating change-over contacts

2-wire NAMUR > 2.2 mA/< 1.0 mA (FEL48)

- For separate switching unit
- Signal transmission H-L edge 2.2 to 3.8/0.4 to 1.0 mA as per EN 60947-5-6 (NAMUR) on two-wire cabling

Output signal**Switch output**

Preset switching times for the limit switches can be ordered for the following areas:

- 0.5 seconds when the tuning fork is covered and 1 second when it is uncovered (factory setting)
- 0.25 seconds when the tuning fork is covered and 0.25 seconds when it is uncovered (fastest setting)
- 1.5 seconds when the tuning fork is covered and 1.5 seconds when it is uncovered
- 5 seconds when the tuning fork is covered and 5 seconds when it is uncovered

Ex connection data

See safety instructions (XA): All data relating to explosion protection are provided in separate Ex documentation and are available from the Downloads Area of the Endress+Hauser-website. The Ex documentation is supplied as standard with all Ex devices.

3-wire DC-PNP (electronic insert FEL42)

- Three-wire direct current version
- Switches the load via the transistor (PNP) and separate connection, e. g. in conjunction with programmable logic controllers (PLC), DI modules as per EN 61131-2

Supply voltage**Failure to use the prescribed power unit.**

Risk of potentially life-threatening electric shock!

- ▶ The FEL42 may only be powered by power supply units with secure galvanic isolation in accordance with IEC 61010-1.

$$U = 10 \text{ to } 55 \text{ V}_{\text{DC}}$$



Observe the following in accordance with IEC/EN61010-1: Provide a suitable circuit breaker for the device and limit the current to 500 mA, e. g. through the installation of a 0.5 A fuse (slow-blow) in the power supply circuit.

Power consumption

$$P < 0.5 \text{ W}$$

Current consumption

$$I \leq 10 \text{ mA (without load)}$$

The red LED flashes in the event of an overload or short-circuit. Check for an overload or short-circuit every five seconds.

Load current

$$I \leq 350 \text{ mA}$$

Residual current

$$I < 100 \text{ } \mu\text{A (for blocked transistor)}$$

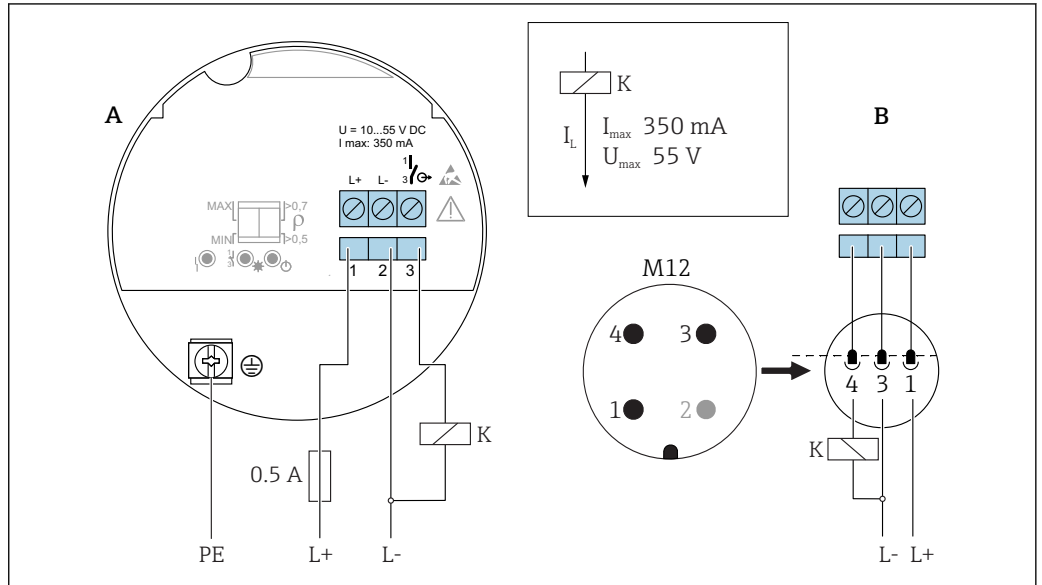
Residual voltage

$$U < 3 \text{ V (for switched through transistor)}$$

Behavior output signal

- OK status: switched through
- Demand mode: blocked
- Alarm: blocked

Terminal assignment



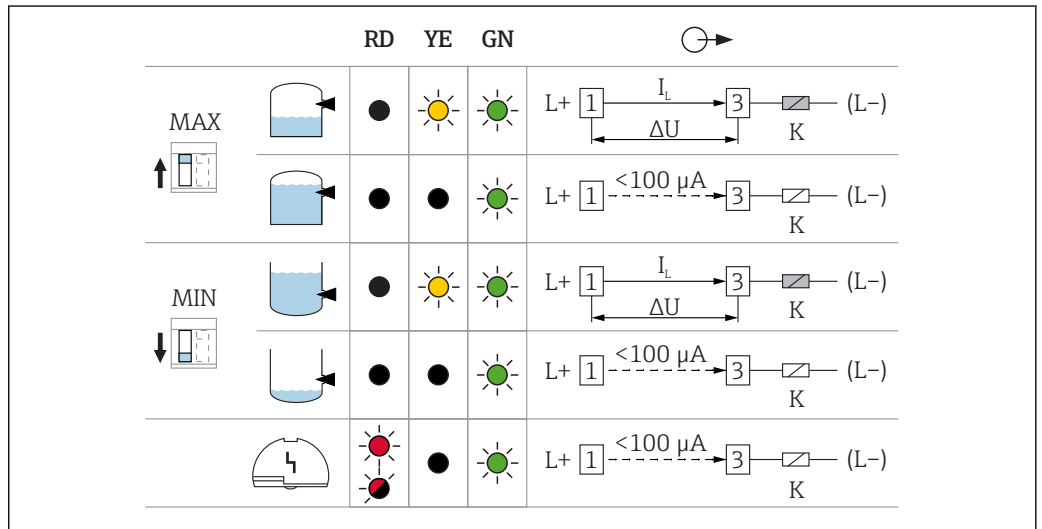
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2 Terminal assignment FEL42

A Terminal assignment at electronic insert

B Terminal assignment on connector M12

Behavior of the switch output and signaling



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3 FEL42 switching behavior, signaling LED

MAXDIP switch for setting the MAX safety

MIN DIP switch for setting the MIN safety

RD LED red for warning or alarm

YE LED yellow switch status

GN LED green operational status, device on

I_L Load current switched through

Universal current connection with relay output (electronic insert FEL44)

- Switches the loads via 2 floating change-over contacts
- Two separate change-over contacts (DPDT)

⚠ WARNING

In the event of an error, the electronic insert can exceed the limit temperature for touchable surfaces, posing the risk of burns.

- ▶ Do not touch the electronics in the event of an error!

Supply voltage

$U = 19 \text{ to } 253 \text{ V}_{AC} / 19 \text{ to } 55 \text{ V}_{DC}$

i Observe the following in accordance with IEC/EN61010-1: Provide a suitable circuit breaker for the device and limit the current to 500 mA, e. g. with the installation of a 0.5 A fuse (slow-blow) in the phase (not the neutral conductor) of the power supply circuit.

Power consumption

$P < 25 \text{ VA}, < 1.3 \text{ W}$

Connectable load

Loads switched via 2 floating change-over contacts (DPDT)

- $I_{AC} \leq 6 \text{ A}$ (Ex de 4 A), $U \sim \leq AC 253 \text{ V}$; $P \sim \leq 1500 \text{ VA}$, $\cos \varphi = 1$, $P \sim \leq 750 \text{ VA}$, $\cos \varphi > 0.7$
- $I_{DC} \leq 6 \text{ A}$ (Ex de 4 A) to DC 30 V, $I_{DC} \leq 0.2 \text{ A}$ to 125 V

According to IEC 61010, the following applies: Total voltage from relay outputs and power supply $\leq 300 \text{ V}$

Electronic insert FEL42 DC PNP preferred for small DC load currents, e. g. for connection to a PLC.

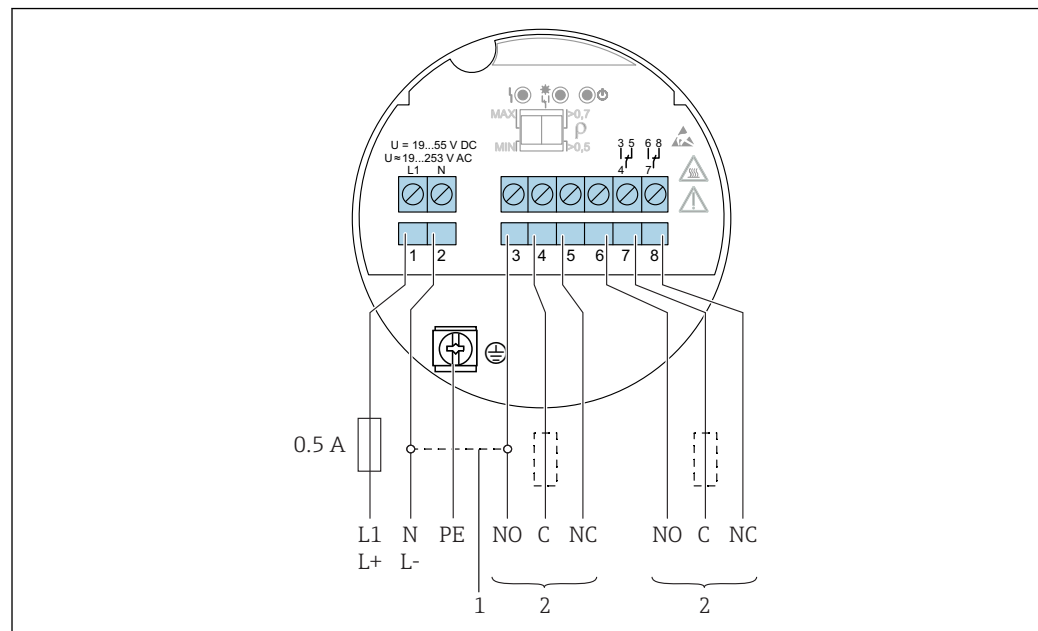
Relay contact material: silver/nickel AgNi 90/10

When connecting a device with high inductivity, provide spark quenching to protect the relay contact. A fine-wire fuse (depending on the connected load) protects the relay contact in the event of a short-circuit.

Both relay contacts switch simultaneously.

Behavior output signal






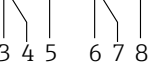


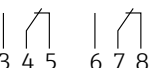




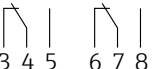







- OK state: Relay energized
- Demand mode: Relay de-energized
- Alarm: Relay de-energized

Terminal assignment


4 Universal current connection with relay output, electronic insert FEL44

- 1 When bridged, the relay output works with NPN logic
- 2 Connectable load

Behavior of the switch output and signaling

		RD	YE	GN	
MAX 		●			
		●	●		
MIN 		●			
		●	●		
			●		

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 5 FEL44 switching behavior, signaling LED

MAXDIP switch for setting the MAX safety

MIN DIP switch for setting the MIN safety

RD LED red for alarm

YE LED yellow switch status

GN LED green operational status, device on

2-wire NAMUR > 2.2 mA / < 1.0 mA (electronic insert FEL48)

- For connection to the isolating switch repeater as per NAMUR (IEC 60947-5-6), e.g. Nivotester FTL325N from Endress+Hauser
- Signal transmission H-L edge 2.2 to 3.8 mA / 0.4 to 1.0 mA as per IEC 60947-5-6 (NAMUR) on two-wire cabling

Supply voltage

U = 8.2 V_{DC}



Observe the following in accordance with IEC/EN61010-1: Provide a suitable circuit breaker for the device.

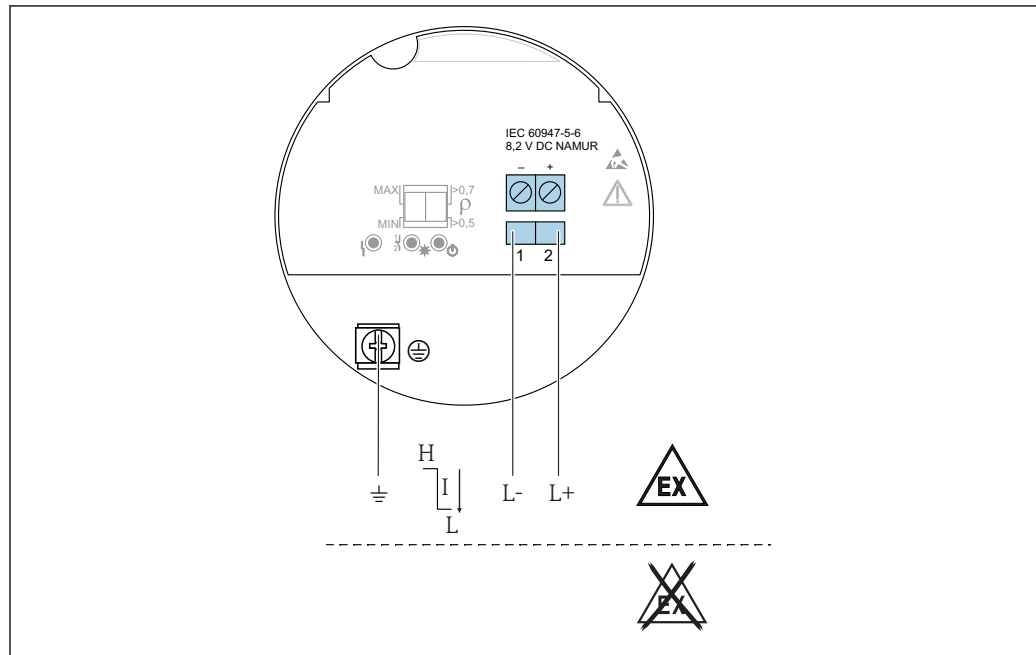
Power consumption

P < 50 mW

Behavior output signal

- OK state: Current 2.2 to 3.8 mA
- Demand mode: Current 0.4 to 1.0 mA
- Alarm: Current 0.4 to 1.0 mA

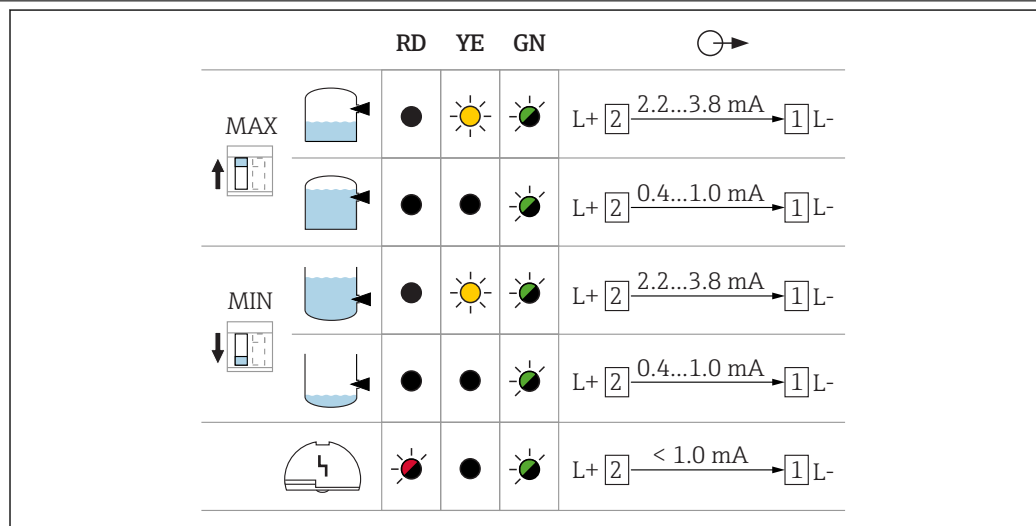
Terminal assignment



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6 2-wire NAMUR > 2.2 mA / < 1.0 mA, electronic insert FEL48

Behavior of the switch output and signaling



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7 FEL48 switching behavior and signaling

MAX DIP switch for setting the MAX safety

MIN DIP switch for setting the MIN safety

RD LED red for alarm

YE LED yellow switch status

GN LED green operational status, device on

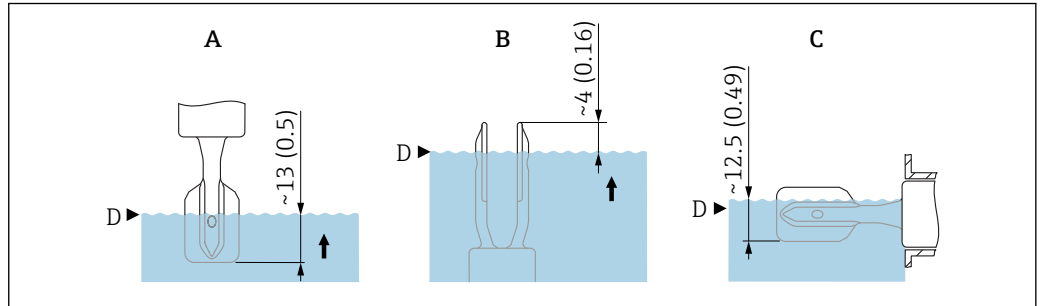
Performance characteristics

Reference operating conditions

- Ambient temperature: 23 °C (73 °F)
- Process temperature: 23 °C (73 °F)
- Density (water): 1 g/cm³
- Medium viscosity: 1 mPa·s
- Process pressure: ambient pressure/unpressurized
- Sensor installation: vertically from above
- Density selection switch: > 0.7 g/cm³ (SGU)
- Switch direction of sensor: uncovered to covered

Taking the switch point into consideration

Typical switch points, depending on the orientation of the point level switch
(water +23 °C (+73 °F))

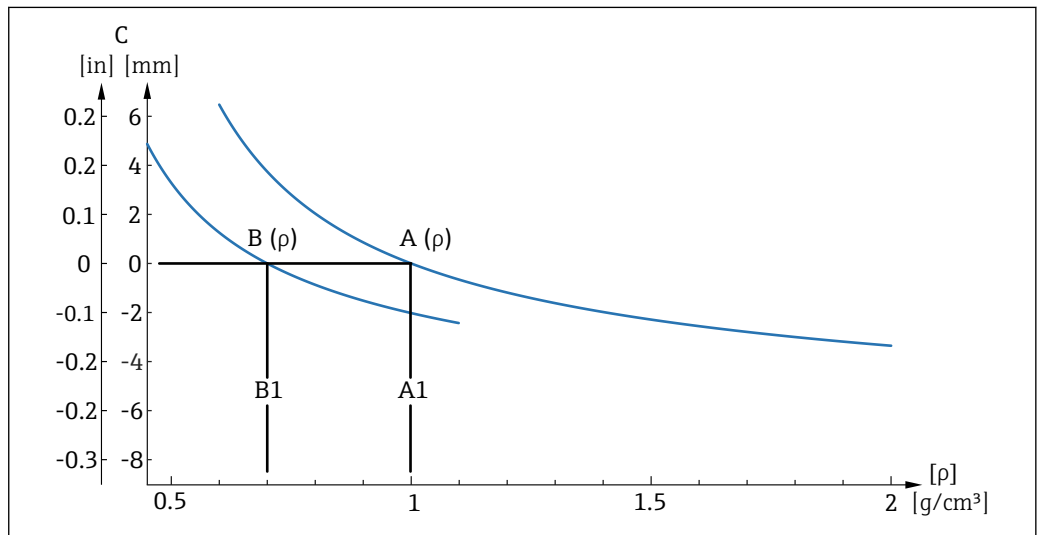


8 Typical switch points. Unit of measurement mm (in)

- A Installation from above
- B Installation from below
- C Installation from the side
- D Switch point

Maximum measured error	At reference operating conditions: max. ±1 mm (0.04 in)
Hysteresis	Typically 2.5 mm (0.1 in)
Non-repeatability	2 mm (0.08 in)
Influence of the process temperature	The switch point moves between +1.4 to -2.6 mm (+0.06 to -0.1 in) in the temperature range from -50 to +150 °C (-58 to +302 °F)
Influence of the process pressure	The switch point moves between 0 to 2.6 mm (0 to 0.1 in) in the pressure range from -1 to +64 bar (14.5 to 928 psi)

Influence of the density of the process medium (at room temperature and normal pressure)



9 Switch point deviation over density

- A Density switch setting ($\rho > 0.7$)
- A1 reference operating condition $\rho = 1 \text{ g/cm}^3$
- B Density switch setting ($\rho > 0.5$)
- B1 Reference operating condition $\rho = 0.7 \text{ g/cm}^3$
- C Switch point deviation

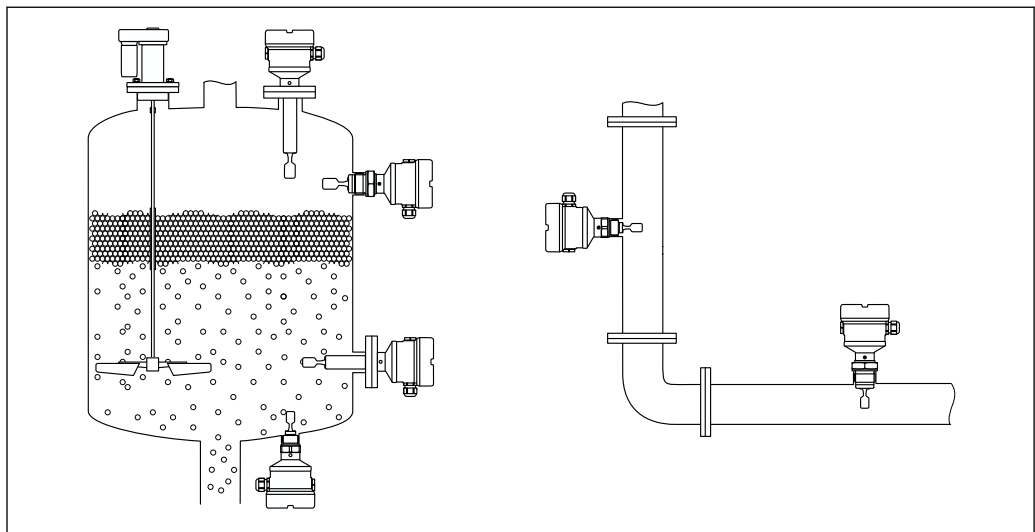
Density setting

- TK_{type} [mm/10 k]
 - $\rho > 0.7$: -0.2
 - $\rho > 0.5$: -0.2
- Pressure_{type} [mm/10 bar]
 - $\rho > 0.7$: -0.3
 - $\rho > 0.5$: -0.4

Mounting

i Open the device only in a dry environment!

Mounting location, orientation



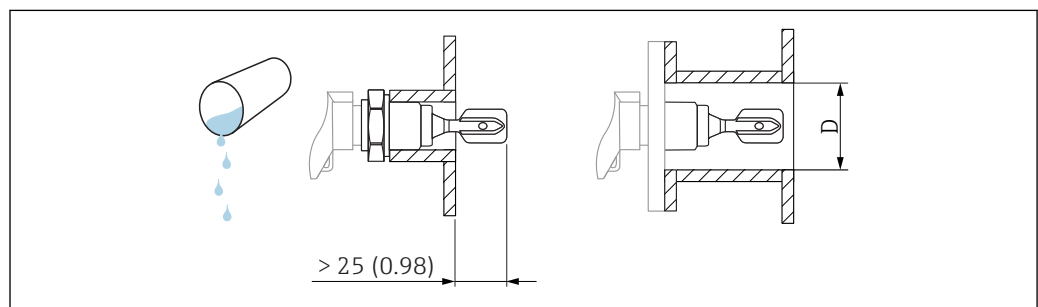
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10 Installation in any position in container, pipe or tank

Installation instructions

Take viscosity into consideration

Low viscosity



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11 Installation example for low-viscosity liquids. Unit of measurement mm (in)

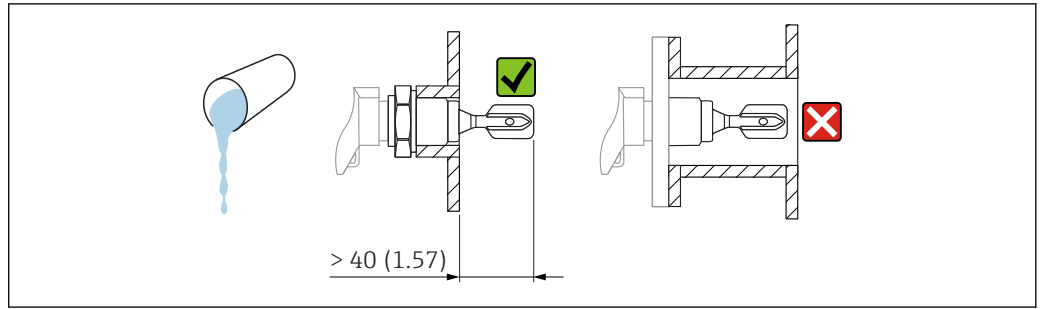
D Diameter of installation socket: at least 50 mm (2.0 in)



Low viscosity, e. g. water: < 2 000 mPa·s

It is permitted to position the tuning fork within the installation socket.

High viscosity



12 Installation example for a highly viscous liquid. Unit of measurement mm (in)

NOTICE

Highly viscous liquids may cause switching delays.

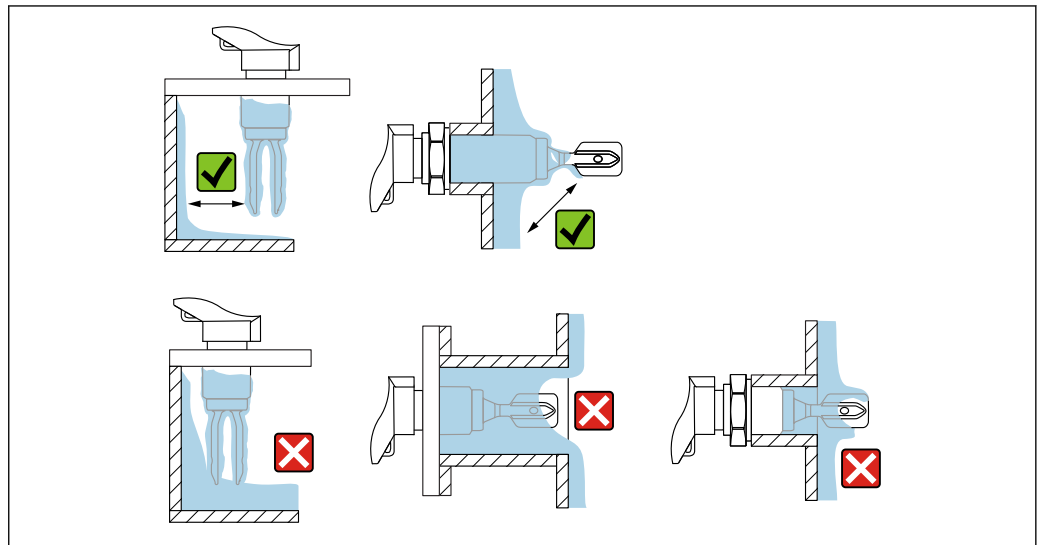
- ▶ Make sure that the liquid can run off the tuning fork easily.
- ▶ Deburr the socket surface.



High viscosity, e. g. viscous oils: < 10 000 mPa·s

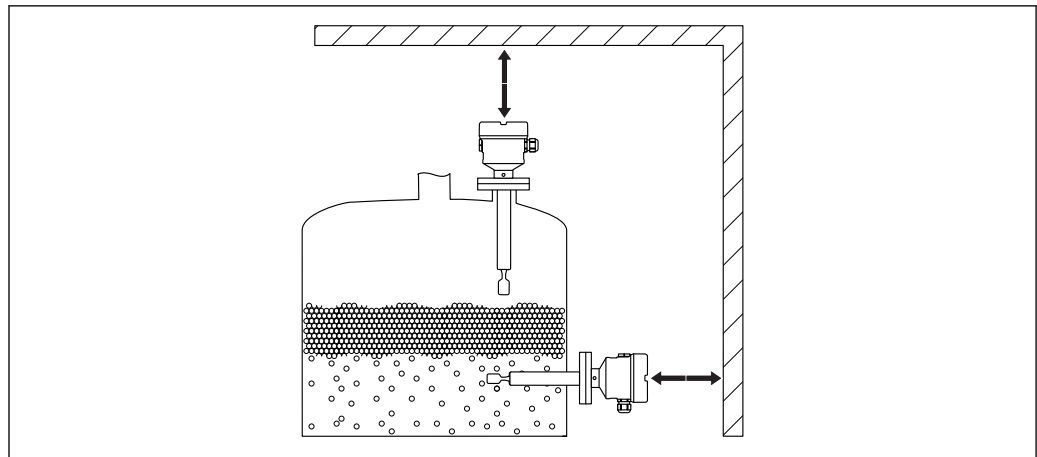
The tuning fork must be located outside the installation socket!

Avoiding buildup



13 Installation examples for a highly viscous process medium

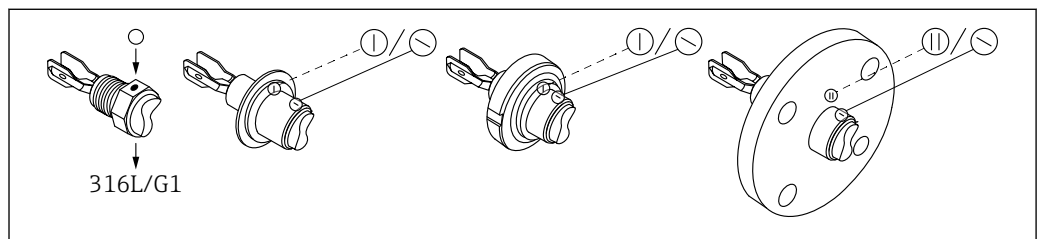
- Use short installation sockets to ensure that the tuning fork can project freely into the vessel.
- Install preferably flush-mounted on vessels or in pipes.
- Leave sufficient distance between the buildup expected on the tank wall and the tuning fork.

Take clearance into consideration

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14 Take clearance into consideration

Allow sufficient space outside the tank for mounting, connection and settings involving the electronic insert.

Taking marking into account**Align the tuning fork in accordance with the marking.**

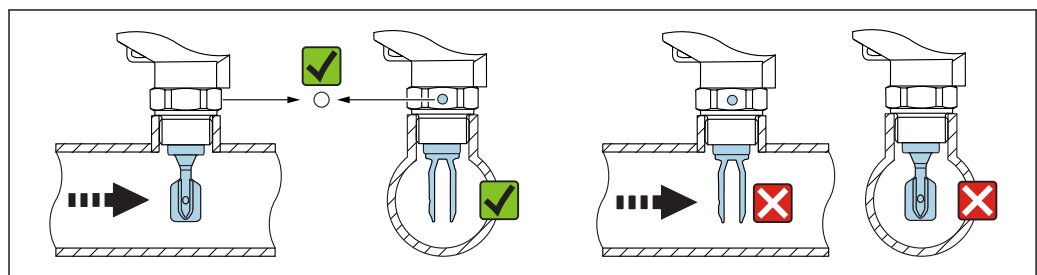
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15 Markings for aligning the tuning fork

Using the marking, the tuning fork can be aligned in such a way that medium can run off easily and buildup is avoided.

Markings may include the following:

- material specification, thread description or circle on hexagonal nut or welding neck
- Symbol II on rear of flange or Tri-Clamp

Installing in pipes

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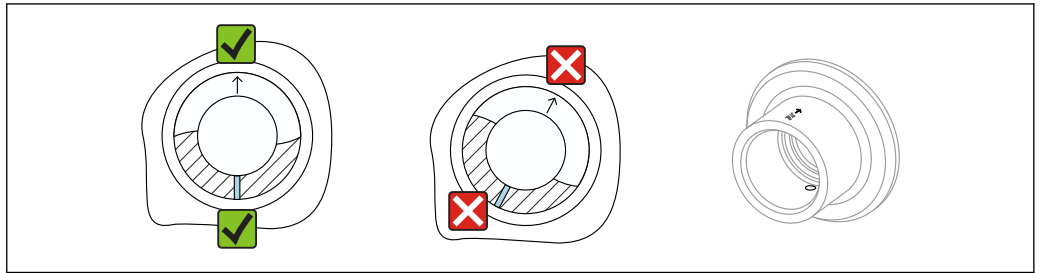
16 Installation in pipes

Flow velocities up to 5 m/s at a viscosity of 1 mPa·s and density of 1 g/cm³ (SGU)
Check the function in the event of other process medium conditions.

The flow will not be significantly impeded if the tuning fork is correctly aligned and the marking on the adapter is pointing in the direction of flow.

The marking is visible when installed.

Weld-in adapter with leakage hole



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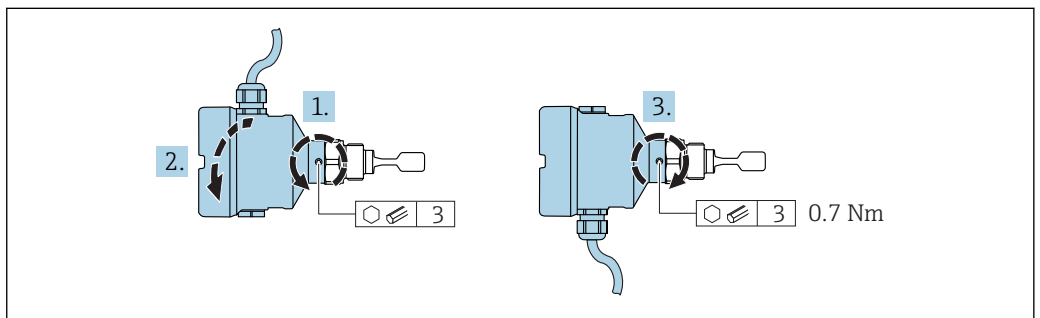
17 Weld-in adapter with leakage hole

Weld in the welding neck in such a way that the leakage hole is pointing downwards. This enables any leaks to be detected quickly.

Sliding sleeves

See the "Accessories" section.

Aligning the cable entry

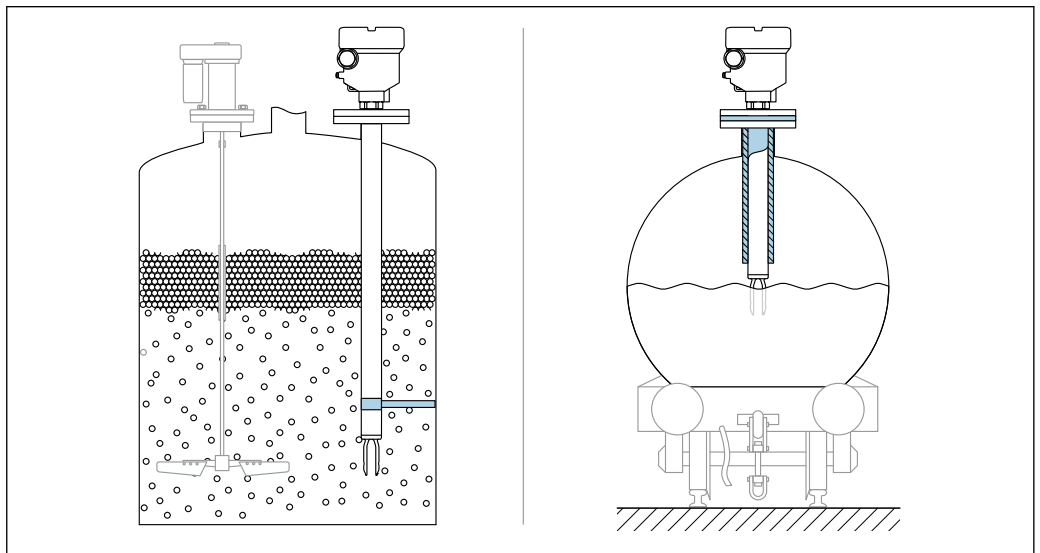


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18 Housing with external locking screw

Special mounting instructions

Support the device



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19 Support in the event of dynamic load

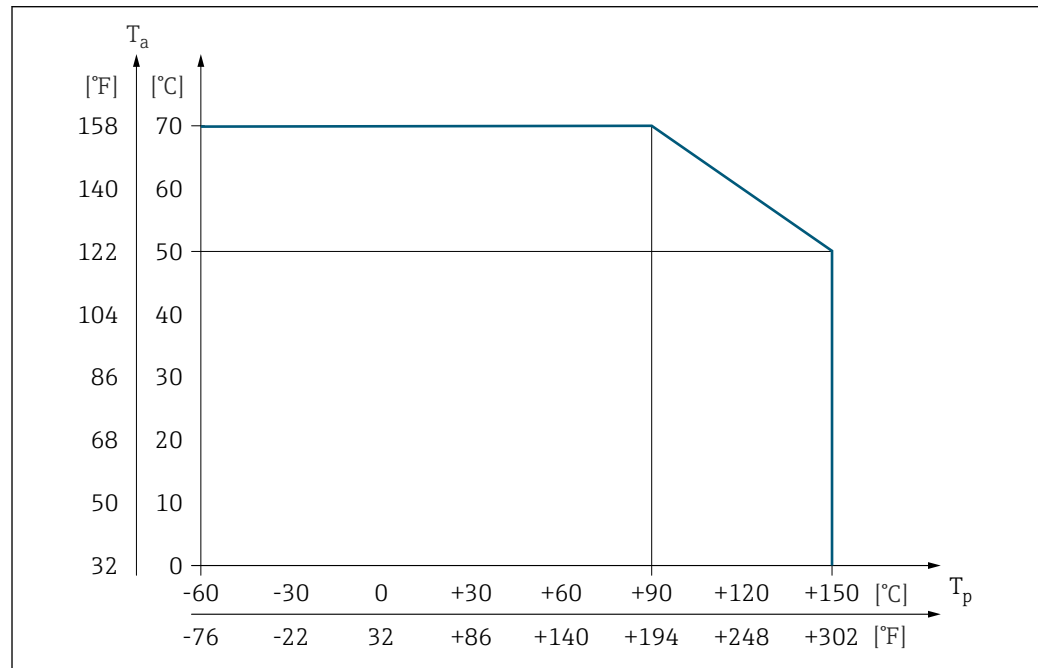
Support the device in the event of severe dynamic load. Maximum lateral loading capacity of the pipe extensions and sensors: 75 Nm (55 lbf ft).

Environment

Ambient temperature range -40 to +70 °C (-40 to +158 °F)

In the hazardous area, the permitted ambient temperature can be limited depending on the zones and gas groups. Pay attention to the information in the Ex documentation (XA).

The minimum permitted ambient temperature of the plastic housing is limited to -20 °C (-4 °F); for North America, "indoor use" applies.



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20 For process temperature and FEL44 $T_p > 90^\circ$ max. load current 4 A

For outdoor operation in strong sunlight:

- Mount the device in the shade
- Avoid direct sunlight, particularly in warmer climatic regions
- Use a protective cover, which can be ordered as an accessory

Storage temperature -40 to +80 °C (-40 to +176 °F)
optional: -52 °C (-62 °F), -60 °C (-76 °F)

Humidity Operate up to 100 %. Do not open in a condensing atmosphere.

Operating altitude As per IEC 61010-1 Ed.3:
 ■ Up to 2 000 m (6 600 ft) above sea level
 ■ Can be extended to 3 000 m (9 800 ft) above sea level if overvoltage protection is used

Climate class As per IEC 60068-2-38 test Z/AD

Degree of protection For housing with electrical connection

Coupling M20, plastic

- Single-chamber plastic: IP66/67 NEMA Type 4X
- Single-chamber aluminum: IP66/68 NEMA Type 4X/6P

Coupling M20, nickel-plated brass

Single-chamber aluminum: IP66/68 NEMA Type 4X/6P

Coupling M20, 316L

Single-chamber aluminum: IP66/68 NEMA Type 4X/6P

Thread M20

- Single-chamber plastic: IP66/67 NEMA Type 4X
- Single-chamber aluminum: IP66/68 NEMA Type 4X/6P

Thread G ½

- Single-chamber plastic: IP66/67 NEMA Type 4X
- Single-chamber aluminum: IP66/68 NEMA Type 4X/6P

Thread NPT ½

Single-chamber plastic: IP66/67 NEMA Type 4X

Thread NPT ¾

Single-chamber aluminum: IP66/68 NEMA Type 4X/6P

M12 plug

- Single-chamber plastic: IP66/67 NEMA Type 4X
- Single-chamber aluminum: IP66/67 NEMA Type 4X

Vibration resistance

As per IEC60068-2-64-2009
 a(RMS) = 50 m/s², f = 5 to 2 000 Hz, t = 3 axes x 2 h

Shock resistance

As per IEC60068-2-27-2008: 300 m/s² [=30 gn] + 18ms

Mechanical load

Lateral loading capacity

📖 Special mounting instructions

Electromagnetic compatibility

- Electromagnetic compatibility as per EN 61326 series and NAMUR recommendation EMC (NE21).
- The requirements of EN 61326-3-1 are fulfilled.

Process

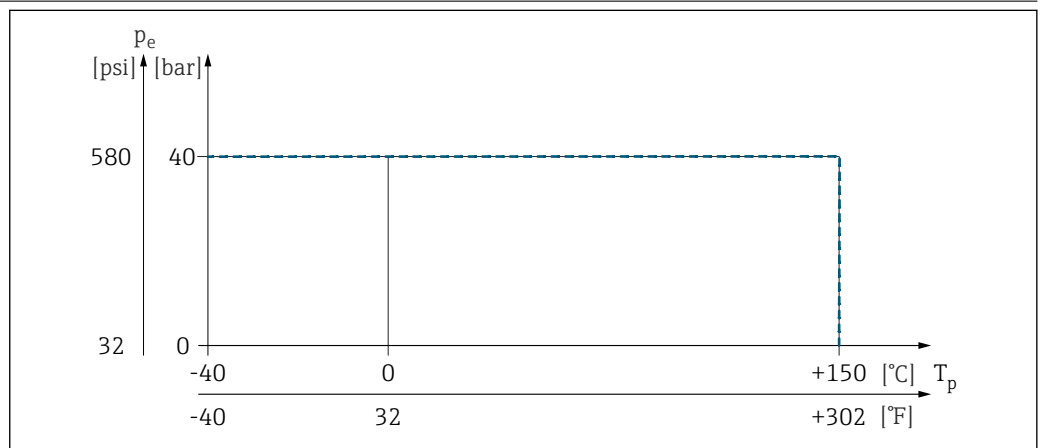
Process temperature range

Pay attention to the pressure and temperature dependence (see the "Sensor process pressure range" section)
 -40 to +150 °C (-40 to +302 °F)

Thermal shock

≤ 120 K/s

Process pressure range



📖 21 Process temperature FTL41

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⚠ WARNING

The maximum pressure for the measuring device is dependent on the lowest-rated element, with regard to pressure, of the selected components. This means that it is necessary to pay attention to the process connection as well as the sensor.

- ▶ For pressure specifications, see the "Mechanical construction" section.
- ▶ The measuring device must be operated only within the specified limits!
- ▶ The Pressure Equipment Directive (2014/68/EU) uses the abbreviation "PS". The abbreviation "PS" corresponds to the MWP (maximum working pressure) of the measuring device.

Approved pressure values of the flanges at higher temperatures, taken from the following standards:

- pR EN 1092-1: 2005 With regard to its stability-temperature property, the material 1.4435 is identical to 1.4404, which is classed as 13E0 in EN 1092-1 Tab. 18. The chemical composition of the two materials can be identical.
- ASME B 16.5
- JIS B 2220

In each case, the lowest value from the derating curves of the device and the selected flange applies.

Process pressure range of the sensors

PN: 40 bar (580 psi)

Test pressure**Overpressure**

PN = 40 bar (580 psi): Test pressure = 1.5 · PN max. 60 bar (870 psi) dependent on the process connection selected

The device function is limited during the pressure test.

The mechanical integrity is guaranteed at pressures up to 1.5 times the process nominal pressure PN.

Density

- Switch position > 0.7 g/cm³ = order configuration
Standard setting for liquids with a density > 0.7 g/cm³
- Switch position > 0.5 g/cm³ = can be set via DIP switch
For liquids with a density > 0.5 g/cm³ to < 0.8 g/cm³
- Order option: 0.4 g/cm³
For liquids with a density > 0.4 g/cm³ to < 0.6 g/cm³
If this option has been selected, the density setting is then always set to 0.4 g/cm³. The setting can no longer be changed.

Pressure tightness

Up to vacuum



In vacuum evaporation systems, the density of the liquids can drop to a very low value: select density setting 0.4.

Mechanical construction

For the dimensions, see the Product Configurator: www.endress.com

Search for product → click "Configuration" to the right of the product image → after configuration click "CAD"

The following dimensions are rounded values. For this reason, they may deviate slightly from the dimensions given on www.endress.com.

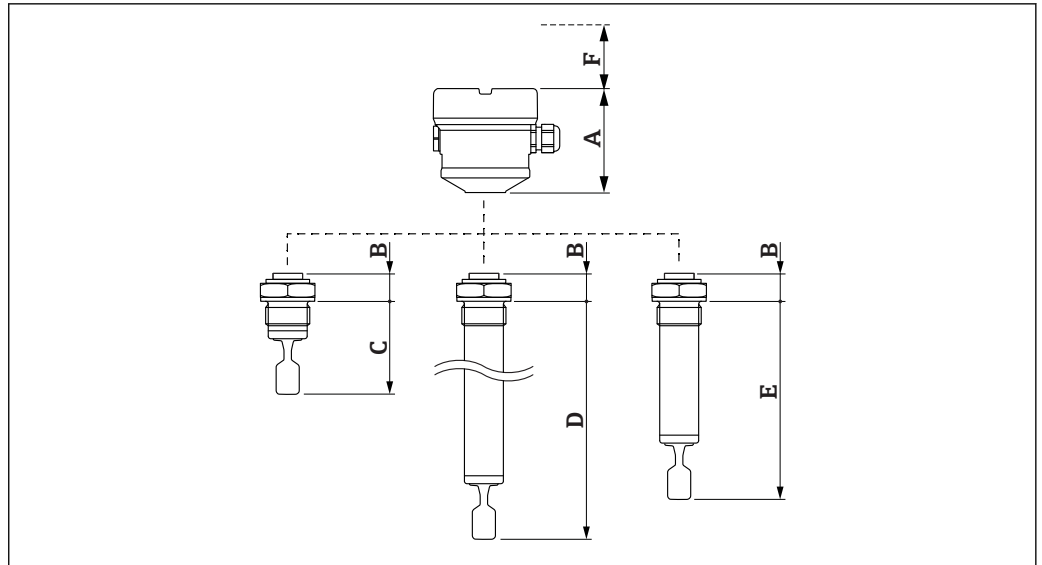
Design, dimensions**Device height**

The device height is made up of the following components:

- Housing including cover
- Pipe extension, short pipe or compact version
- Process connection

The individual heights of the components can be found in the following sections:

- Calculate device height and add the individual heights of the components
- Take the installation clearance into consideration (space that is required to install the device)



A0036789

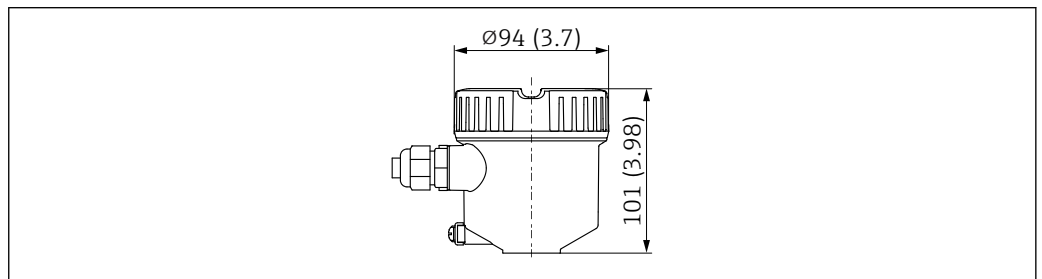
22 Components for calculating the device height

- A Housing
- B Process connections
- C Process connections
- D Pipe extension
- E Short pipe
- F Installation clearance

Dimensions

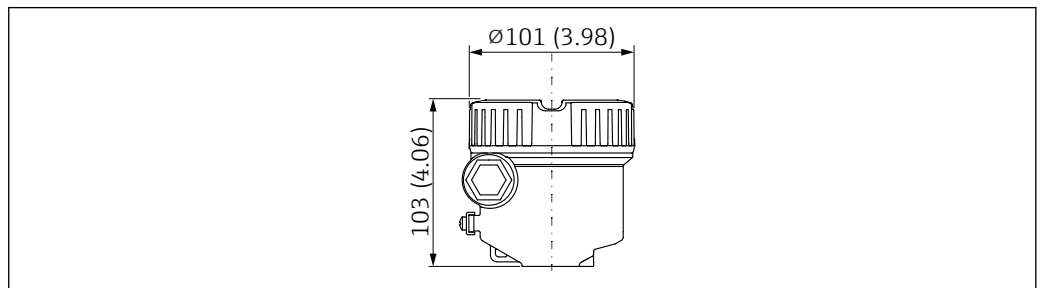
Housing

All housings can be aligned. On metal housings, the alignment of the housing can also be fixed by means of the locking screw.



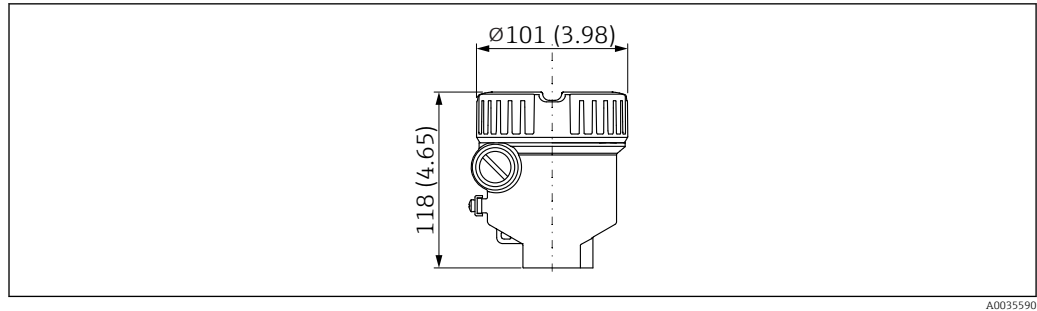
A0038712

23 Single chamber housing, plastic



A0038713

24 Single chamber housing, aluminum, coated



A0035590

▣ 25 Single chamber housing, aluminum, coated, suitable for Ex d/XP zone

Ground terminal

- Ground terminal inside the housing, max. conductor cross-section 2.5 mm² (14 AWG)
- Ground terminal outside the housing, max. conductor cross-section 4 mm² (12 AWG)
- Safety extra-low voltage used to supply power to electronic inserts; do not connect protective ground.

Cable glands

Cable diameter

- Nickel-plated brass: dia. 7 to 10.5 mm (0.28 to 0.41 in)
- Plastic: dia. 5 to 10 mm (0.2 to 0.38 in)

At delivery

- One fitted cable gland
- One cable gland sealed with dummy plug

The relay electronics additionally include a second cable gland (not fitted) with delivery.

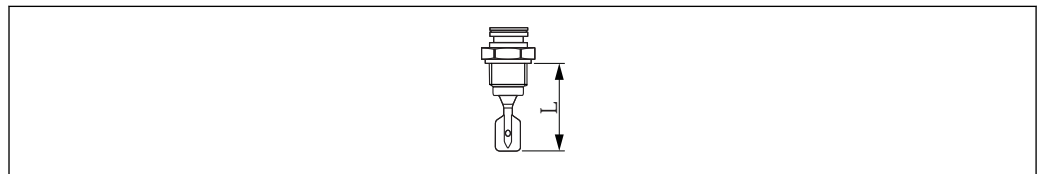
Exceptions: For Ex d/XP, only threaded insertions are permitted.

For Japanese Ex d approval, a special cable gland is enclosed.

Probe design

Compact

- Material: 316L
- Sensor length L: Dependent on process connection
See section on process connections: Thread G, ASME B1.20.3 MNPT, EN10226 R, tri-clamp

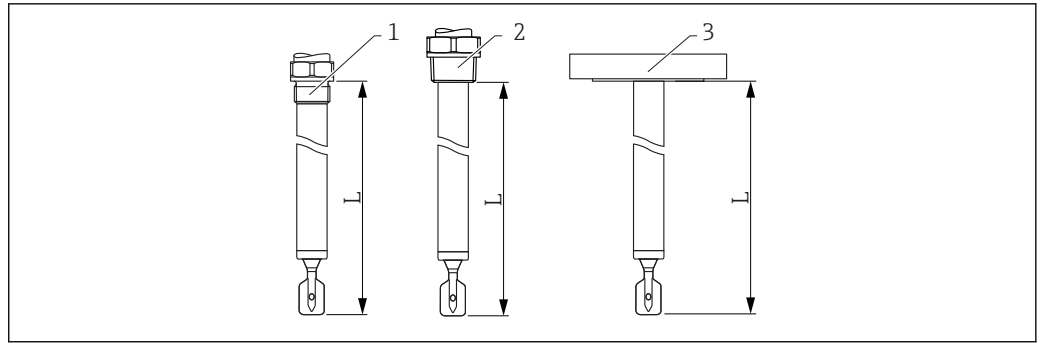


A0036848

▣ 26 Compact, sensor length L

Version: Probe design pipe extension

Material: 316L, sensor lengths L: 117 to 2 000 mm or 4.6 to 78.7 in



A0036860

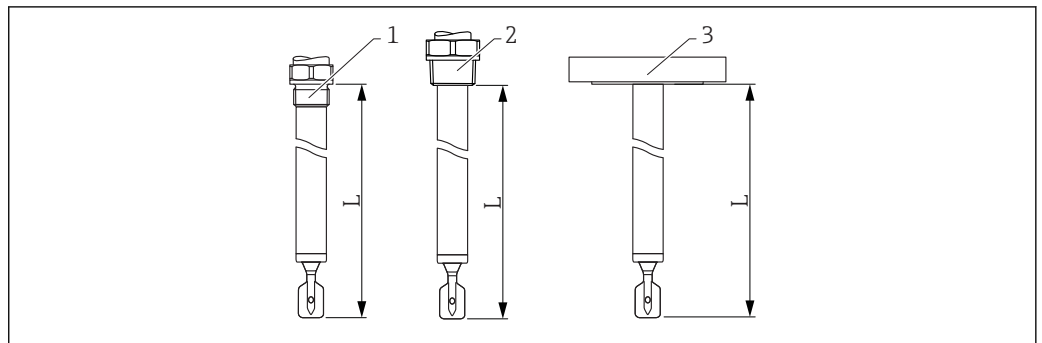
27 Pipe extension, sensor length L

- 1 G 3/4, G 1
- 2 NPT 3/4, NPT 1, R 3/4, R 1
- 3 Flange, tri-clamp

Version: Probe design short pipe

Material: 316L, sensor length L: Dependent on process connection

- Flange = 115 mm (4.53 in)
- Thread G 3/4 = 115 mm (4.53 in)
- Thread G 1 = 118 mm (4.65 in)
- Thread NPT, R = 99 mm (3.9 in)
- Tri-clamp = 115 mm (4.53 in)

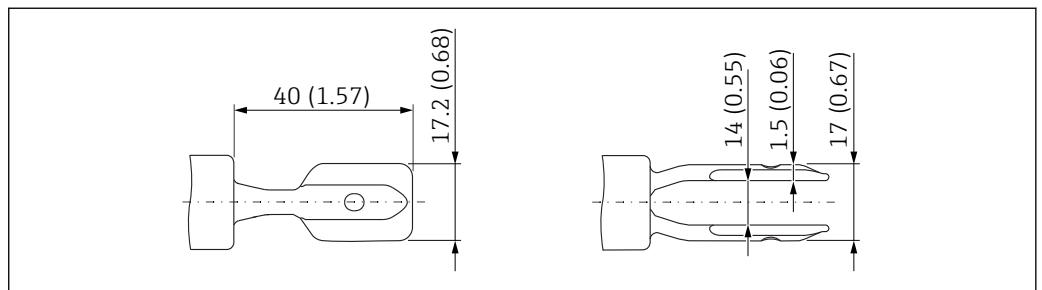


A0036861

28 Short pipe, sensor length L

- 1 G 3/4, G 1
- 2 NPT 3/4, NPT 1, R 3/4, R 1
- 3 Flange, tri-clamp

Tuning fork



A0038269


29 Tuning fork. Unit of measurement mm (in)

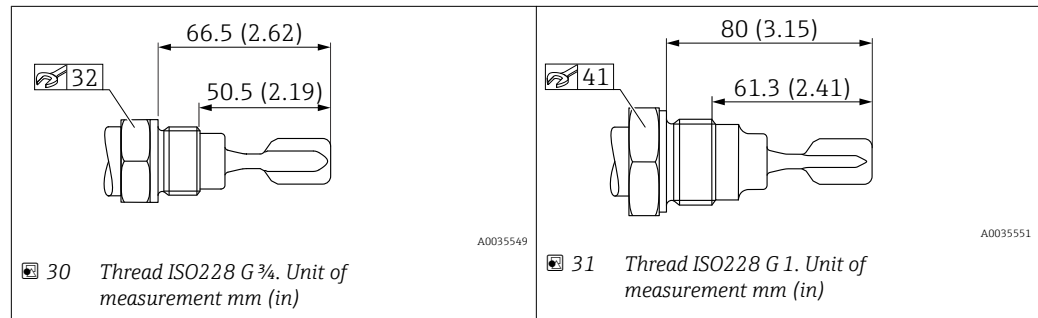
Process connections

Thread ISO228 G for installing in weld-in adapter

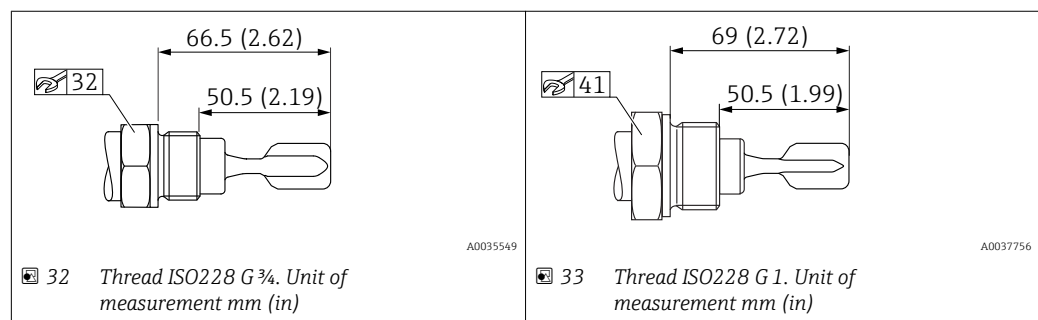
G ¾, G 1 suitable for installation in weld-in adapter

- Material: 316L
- Pressure rating, temperature: ≤ 40 bar (580 psi), ≤ 100 °C (212 °F)
- Pressure rating, temperature: ≤ 25 bar (363 psi), ≤ 150 °C (302 °F)
- Weight: 0.2 kg (0.44 lb)
- Accessory: weld-in adapter

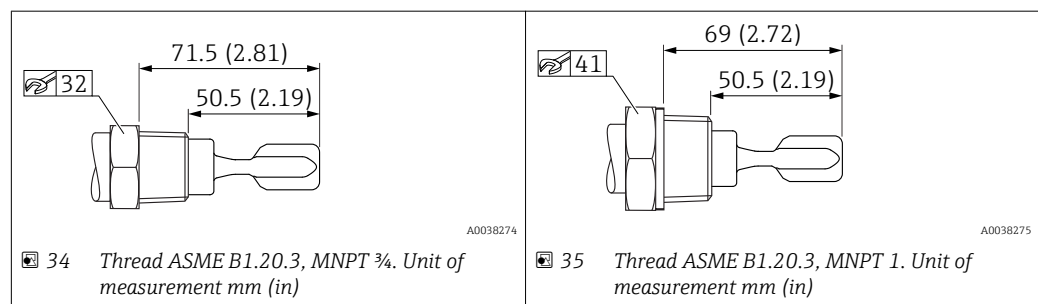
 The weld-in adapter is not included in the scope of delivery.



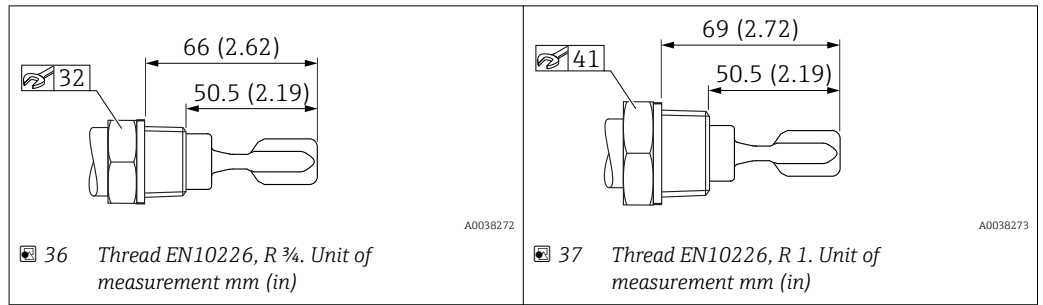
Thread ISO228 G with flat seal



Thread ASME B1.20.3, MNPT




Thread EN10226, R

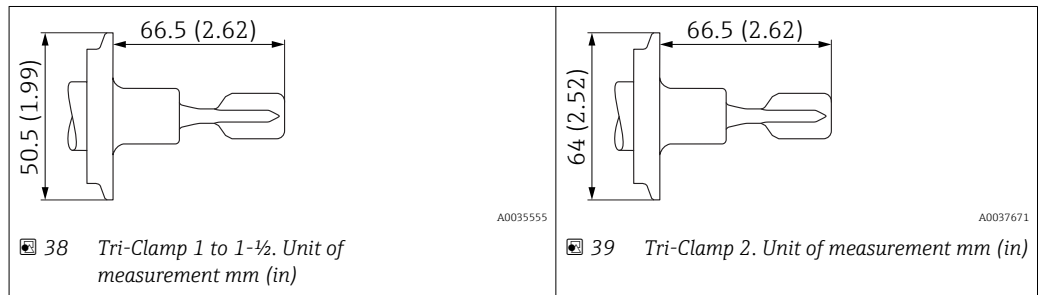


Tri-Clamp

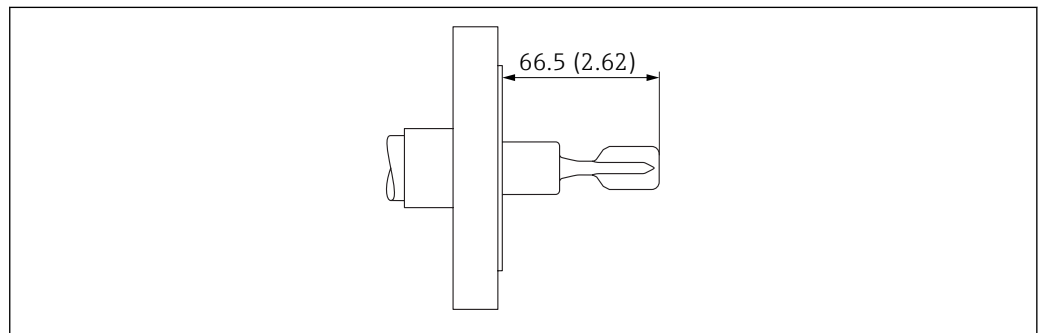
Version ISO2852 DN25-38 (1 to 1-1/2), DIN32676 DN25-40


- Material: 316L
- Pressure rating: ≤ 25 bar (363 psi)
- Temperature: ≤ 150 °C (302 °F)
- Weight: 0.1 (0.22)

 The maximum temperature and the maximum pressure are dependent on the clamping ring and the seal used. The lowest value applies in each case.



Sensor dimensions in the case of flanges



 40 Example with flange. Unit of measurement mm (in)

ASME B16.5 flanges, RJF

Pressure rating	Type	Material	Weight kg (lb)
Cl.300	NPS 2"	316/316L	3.2 (7.06)
Cl.300	NPS 4"	316/316L	11.5 (25.6)

EN flanges EN 1092-1, A

Pressure rating	Type	Material	Weight kg (lb)
PN6	DN32	316L (1.4404)	1.2 (2.65)
PN6	DN40	316L (1.4404)	1.4 (3.09)
PN6	DN50	316L (1.4404)	1.6 (3.53)
PN10/16	DN80	316L (1.4404)	4.8 (10.58)
PN10/16	DN100	316L (1.4404)	5.6 (12.35)
PN25/40	DN25	316L (1.4404)	1.3 (2.87)
PN25/40	DN32	316L (1.4404)	2.0 (4.41)
PN25/40	DN40	316L (1.4404)	2.4 (5.29)
PN25/40	DN50	316L (1.4404)	3.2 (7.06)
PN25/40	DN65	316L (1.4404)	4.3 (9.48)
PN25/40	DN80	316L (1.4404)	5.9 (13.01)
PN25/40	DN100	316L (1.4404)	7.5 (16.54)
PN40	DN50	316L (1.4404)	3.2 (7.06)

EN flanges EN 1092-1, B1

Pressure rating	Type	Material	Weight kg (lb)
PN6	DN32	316L (1.4404)	1.2 (2.65)
PN6	DN50	316L (1.4404)	1.6 (3.53)
PN10/16	DN100	316L (1.4404)	5.6 (12.35)
PN25/40	DN25	316L (1.4404)	1.4 (3.09)
PN25/40	DN50	316L (1.4404)	3.2 (7.06)
PN25/40	DN80	316L (1.4404)	5.9 (13.01)

JIS flanges B2220

Pressure rating	Type	Material	Weight kg (lb)
10K	10K 25A	316L (1.4404)	1.3 (2.87)
10K	10K 40A	316L (1.4404)	1.5 (3.31)
10K	10K 50A	316L (1.4404)	1.7 (3.75)


Process connection, sealing surface

- Thread ISO228, G
- Thread ASME, MNPT
- Thread EN10226, R
- Flange ASME B16.5, RF (Raised Face)
- Flange EN1092-1, Form A
- Flange EN1092-1, Form B1
- Flange JIS B2220, RF (Raised Face)
- Flange HG/T20592, RF (Raised Face), pending
- Flange HG/T20615, RF (Raised Face), pending

Other

Weight See the specific section.

Materials**Materials in contact with process**

- Process connection: 316L (1.4404 or 1.4435)
- Pipe extension: 316L (1.4404 or 1.4435)
- Flat seal for process connection G ¾ or G 1: Fiber-reinforced elastomer seal, asbestos-free as per DIN 7603
- Flanges,  mechanical construction
- Tuning fork: 316L (1.4435)

Seals

Seal included in delivery:

Metrical threads G ¾, G 1 standard, flat seal as per DIN7603

Seal not included in delivery:

- Tri-Clamp
- Flanges
- R and NPT thread
- Metrical threads G ¾, G 1 for installation in weld-in adapter

Materials not in contact with process**Aluminum housing**

- Housing: Alu-EN AC 44300
- Blind cover: Alu-EN AC 44300
- Cover sealing materials: HNBR
- TAG plate: Plastic film, stainless steel or provided by the customer
- Cable glands M20: Select material (stainless steel, nickel-plated brass, polyamide)

Plastic housing

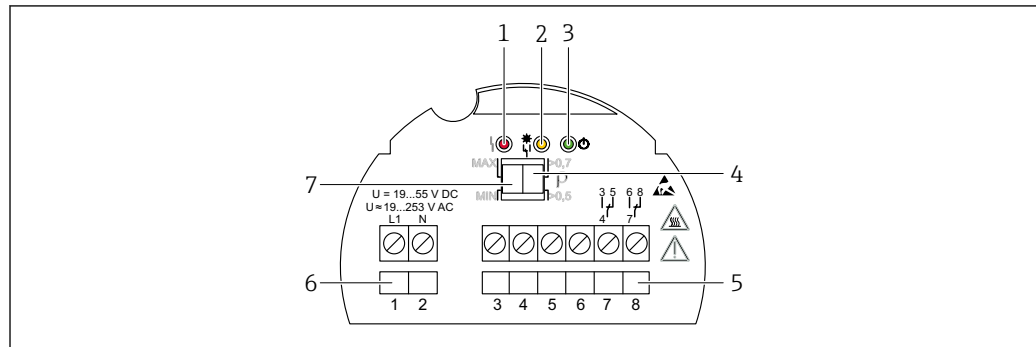
- Housing: PBT/PC
 - Blind cover: PBT/PC
 - Cover seal: EPDM
 - Potential equalization: 316L
 - Seal under potential equalization: EPDM
 - Plug: PBT-GF30-FR
 - M20 cable gland: PA
 - Seal on plug and cable gland: EPDM
 - Adapter as replacement for cable glands: 316L
 - TAG plate: Plastic film, metal or provided by the customer
-

Surface roughness The roughness of the surface in contact with the process is $R_a < 3.2 \mu\text{m}$ (126 μin).

Operability

Operation concept Operation with DIP switches on the electronic insert

Elements on the electronic insert



A0039317

41 Example electronic insert FEL44

- 1 LED red, for warning or alarm
- 2 LED yellow, switch status
- 3 LED green, operational status (LED green lights up = device on)
- 4 DIP switch to set the density to 0.7 or 0.5
- 5 Relay contact terminals
- 6 Power supply terminals
- 7 DIP switch for setting MAX/MIN safety

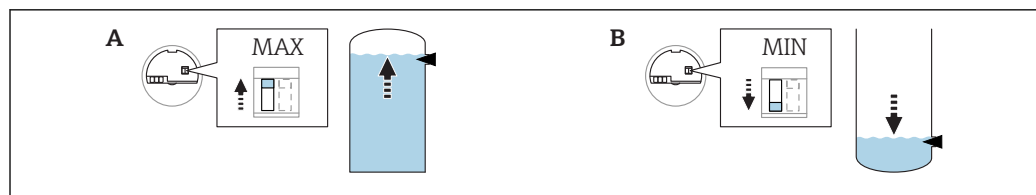
Terminals

Terminals for cable cross-section up to 2.5 mm² (14 AWG). Use ferrules for the wires.

Local operation

Operation at electronic insert

MAX/MIN fail-safe mode



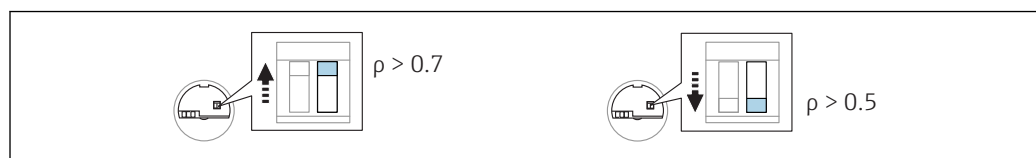
A0039470

42 Switch position on the electronic insert for fail-safe mode MAX/MIN

- A MAX (maximum fail-safe mode)
- B MIN (minimum fail-safe mode)

- Minimum/maximum quiescent current safety can be switched at the electronic insert
- MAX = maximum safety: The output switches to demand mode when the tuning fork is covered, used e. g. for overfill protection
- MIN = minimum safety: The output switches to demand mode when the tuning fork is uncovered, used e. g. to prevent pumps from running dry

Density switchover



A0039471

43 Switch position on the electronic insert for density

Factory setting density: 0.7

- Switch position $> 0.7 \text{ g/cm}^3$ = order configuration
Standard configuration for liquids with a density $> 0.7 \text{ g/cm}^3$
- Switch position $> 0.5 \text{ g/cm}^3$ = can be adjusted via DIP switch
For liquids with a density $> 0.5 \text{ g/cm}^3$ to $< 0.8 \text{ g/cm}^3$
- Order option: 0.4 g/cm^3
For liquids with a density $> 0.4 \text{ g/cm}^3$ to density $< 0.6 \text{ g/cm}^3$
If the option has been selected, the density setting is then always set to 0.4 g/cm^3 . The setting can no longer be changed.

Certificates and approvals

-  The certificates and approvals currently available can be accessed via the
- Product Configurator
 - Endress+Hauser website: www.endress.com → Downloads.

CE mark The measuring system complies with the statutory requirements of the applicable EC Directives. These are listed in the corresponding EC Declaration of Conformity along with the standards applied. Endress+Hauser confirms successful testing of the device by affixing to it the CE mark.


RCM-Tick marking The supplied product or measuring system meets the ACMA (Australian Communications and Media Authority) requirements for network integrity, interoperability, performance characteristics as well as health and safety regulations. Here, especially the regulatory arrangements for electromagnetic compatibility are met. The products are labelled with the RCM- Tick marking on the name plate.



A0029561


Ex approval All explosion protection data is listed in separate documentation which is available from the download area. The Ex documentation is supplied as standard with all Ex-systems.

Overfill protection Before mounting the device, observe the documentation from the WHG approvals (German Federal Water Act).
Approved for overfill protection and leakage detection.


-  Ordering information: Product Configurator, order code for "Additional approval", option "LD"

Marine approvals

- ABS (American Bureau of Shipping), option "LF"
- GL (Germanischer Lloyd)/DNV (Det Norske Veritas), option "LJ"
- LR (Lloyd's Register) marine approval, option "LG"
- BV (Bureau Veritas) marine approval, option "LH"

 Ordering information: Product Configurator, order code for "Additional approval", for option see items listed

CRN approval Versions with a CRN approval (Canadian Registration Number) are listed in the corresponding registration documents. CRN-approved devices are marked with a registration number.
Any restrictions regarding the maximum process pressure values are listed on the CRN certificate.

-  Ordering information: Product Configurator, order code for "Service", option "17"

Test reports

Test, report, declaration

The following documentation can be ordered:

- Inspection certificate 3.1, EN10204 (material certificate, wetted parts)
- ASME B31.3 Process Piping, declaration
- Pressure test, internal procedure, test report
- Helium leak test, internal procedure, test report
- Material identification check (PMI), internal procedure (wetted parts), test report

Service

- Cleaned of oil+grease (wetted)
- PWIS-free (paint-wetting impairment substances)
- Switching delay setting to be spec.
- Setting for MIN safety mode
- Default density setting > 0.4 g/cm³
- Default density setting > 0.5 g/cm³
- Product documentation on paper (test, certificate, declaration available for selection)

Pressure Equipment Directive

Pressure equipment with allowable pressure ≤ 200 bar (2 900 psi)

Pressure instruments with a flange and threaded boss that do not have a pressurized housing do not fall within the scope of the Pressure Equipment Directive, irrespective of the maximum allowable pressure.

Reasons:

According to Article 2, point 5 of EU Directive 2014/68/EU, pressure accessories are defined as "devices with an operational function and having pressure-bearing housings".

If a pressure instrument does not have a pressure-bearing housing (no identifiable pressure chamber of its own), there is no pressure accessory present within the meaning of the Directive.

Process seal as per ANSI/ISA 12.27.01

North American practice for the installation of process seals. In accordance with ANSI/ISA 12.27.01, Endress+Hauser devices are designed as either single seal or dual seal devices with a warning message. This allows the user to waive the use of – and save the cost of installing – an external secondary process seal in the protective conduit as required in ANSI/NFPA 70 (NEC) and CSA 22.1 (CEC). These devices comply with the North-American installation practice and provide a very safe and cost-effective installation for pressurized applications with hazardous process media. More information is provided in the Safety Instructions (XA) for the relevant device.



Aluminum and plastic housings are approved as single-seal devices.

China RoHS symbol

China RoHS 1, law SJ/T 11363-2006: The measuring system complies with the substance restrictions of the Restriction on Hazardous Substances Directive (RoHS).

RoHS

The measuring system complies with the substance restrictions of the Restriction on Hazardous Substances Directive 2011/65/EU (RoHS 2).

Additional certification

EAC conformity

The measuring system meets the legal requirements of the applicable EAC guidelines. These are listed in the corresponding EAC Declaration of Conformity together with the standards applied.

Endress+Hauser confirms successful testing of the device by affixing to it the EAC mark.

ASME B 31.3

Design and materials in accordance with ASME B31.3. The welds are through-penetration welded and meet the requirements of the ASME Boiler and Pressure Vessel Code, Section IX and EN ISO 15614-1.

Ordering information

Detailed ordering information is available from the following sources:

- In the Product Configurator on the Endress+Hauser website: www.endress.com → Click "Corporate" → Select your country → Click "Products" → Select the product using the filters and search field → Open product page → The "Configure" button to the right of the product image opens the Product Configurator.
- Endress+Hauser sales center: www.addresses.endress.com

Product Configurator - the tool for individual product configuration

- Up-to-the-minute configuration data
- Depending on the device: Direct input of measuring point-specific information such as measuring range or operating language
- Automatic verification of exclusion criteria
- Automatic creation of the order code and its breakdown in PDF or Excel output format
- Ability to order directly in the Endress+Hauser Online Shop

TAG

Measuring point (tag)

The device can be ordered with a tag name.

Position of the tag name

In the additional specification, select:

- Tag plate, stainless steel
- Plastic film
- Supplied plate

Definition of the tag name

In the additional specification, specify:

3 lines, each containing up to maximum 18 characters

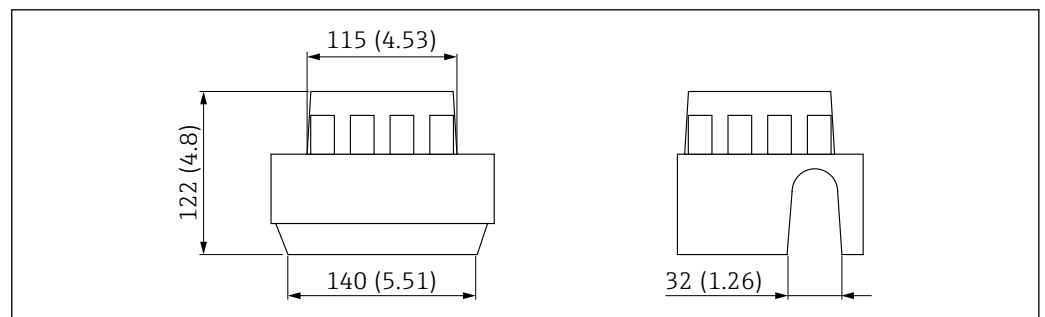
The specified tag name appears on the selected label and/or the RFID TAG.

Accessories

Device-specific accessories


Weather protection cover for single-compartment housing, metal

- Material: plastic
- Order number: 71438291



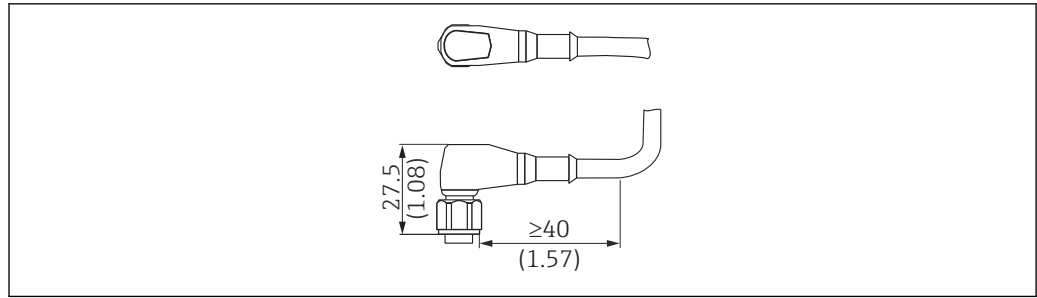
 44 Weather protection cover for single-compartment housing, metal. Unit of measurement mm (in)

Plug-in jack

 The plug-in jacks listed are suitable for use in the temperature range -25 to $+70$ °C (-13 to $+158$ °F).

Plug-in jack M12 IP69

- Terminated at one end
- Elbowed 90°
- 5 m (16 ft) PVC cable (orange)
- Slotted nut 316L (1.4435)
- Body: PVC (orange)
- Order number: 52024216

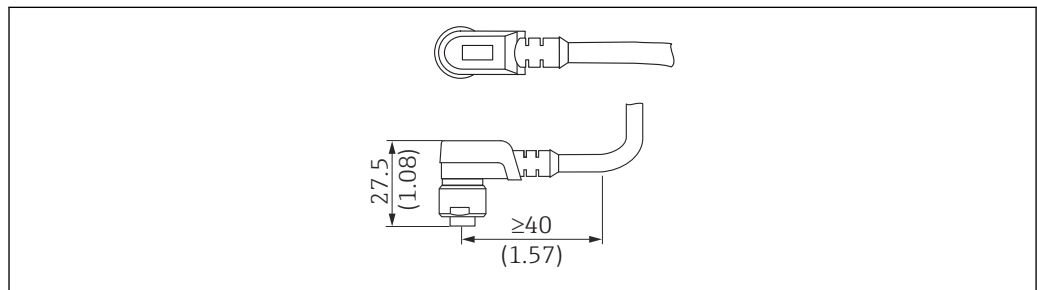


A0023713

45 Plug-in jack M12 IP69. Unit of measurement mm (in)

Plug-in jack M12 IP67

- Elbowed 90°
- 5 m (16 ft) PVC cable (gray)
- Slotted nut Cu Sn/Ni
- Body: PUR (blue)
- Order number: 52010285

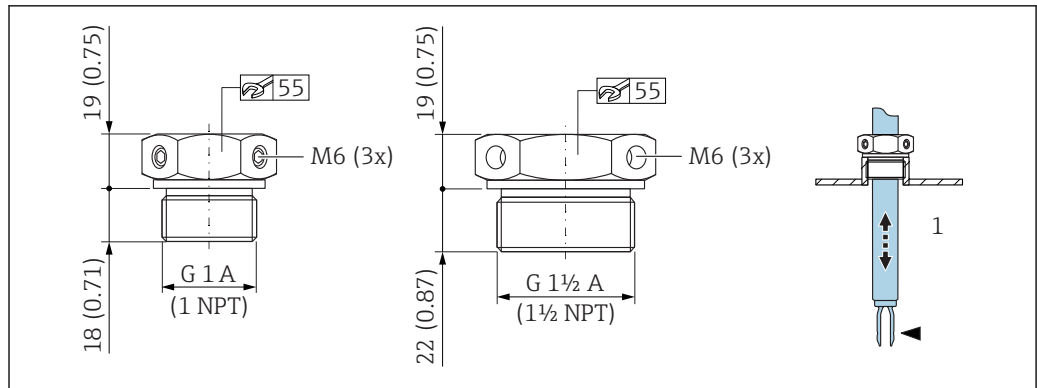


A0022292

46 Plug-in jack M12 IP67. Unit of measurement mm (in)

Sliding sleeves for unpressurized operation

Switch point, infinitely adjustable.



A0037666

47 Sliding sleeves for unpressurized operation. Unit of measurement mm (in)

1 $p_e = 0 \text{ bar}$ (0 psi)

G 1, DIN ISO 228/1

- Material: 1.4435 (AISI 316L)
- Weight: 0.21 kg (0.46 lb)
- Order number: 52003978
- Order number: 52011888, approval: with inspection certificate EN 10204 - 3.1 material

NPT 1, ASME B 1.20.1

- Material: 1.4435 (AISI 316L)
- Weight: 0.21 kg (0.46 lb)
- Order number: 52003979
- Order number: 52011889, approval: with inspection certificate EN 10204 - 3.1 material

G 1½, DIN ISO 228/1

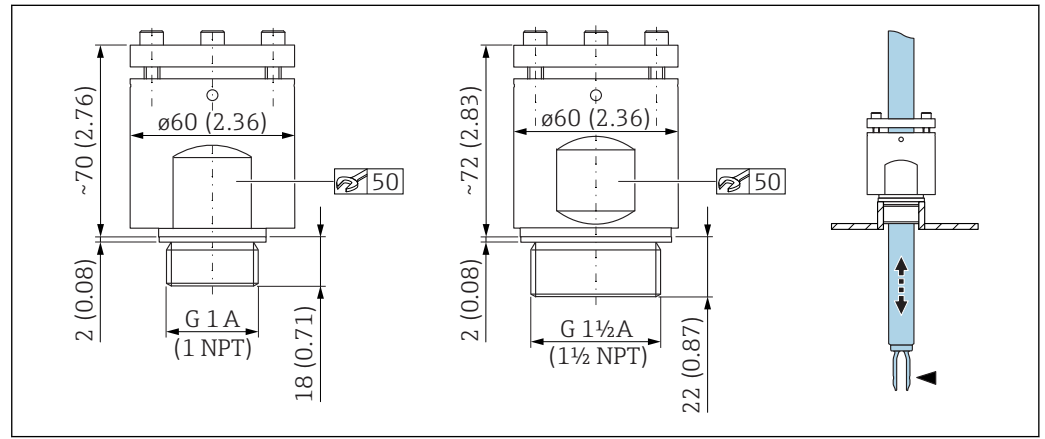
- Material: 1.4435 (AISI 316L)
- Weight: 0.54 kg (1.19 lb)
- Order number: 52003980
- Order number: 52011890, approval: with inspection certificate EN 10204 - 3.1 material

NPT 1½, ASME B 1.20.1

- Material: 1.4435 (AISI 316L)
- Weight: 0.54 kg (1.19 lb)
- Order number: 52003981
- Order number: 52011891, approval: with inspection certificate EN 10204 - 3.1 material

High pressure sliding sleeves

- Switch point, infinitely adjustable
- For use in hazardous areas,
- Seal package made of graphite
- For G 1, G 1½: seal included in delivery



48 High pressure sliding sleeves. Unit of measurement mm (in)

G 1, DIN ISO 228/1

- Material: 1.4435 (AISI 316L)
- Weight: 1.13 kg (2.49 lb)
- Order number: 52003663
- Order number: 52011880, approval: with inspection certificate EN 10204 - 3.1 material

G 1, DIN ISO 228/1

- Material: AlloyC22
- Weight: 1.13 kg (2.49 lb)
- Approval: with inspection certificate EN 10204 - 3.1 material
- Order number: 71118691

NPT 1, ASME B 1.20.1

- Material: 1.4435 (AISI 316L)
- Weight: 1.13 kg (2.49 lb)
- Order number: 52003667
- Order number: 52011881, approval: with inspection certificate EN 10204 - 3.1 material

NPT 1, ASME B 1.20.1

- Material: AlloyC22
- Weight: 1.13 kg (2.49 lb)
- Approval: with inspection certificate EN 10204 - 3.1 material
- Order number: 71118694

G 1½, DIN ISO 228/1

- Material: 1.4435 (AISI 316L)
- Weight: 1.32 kg (2.91 lb)
- Order number: 52003665
- Order number: 52011882, approval: with inspection certificate EN 10204 - 3.1 material

G 1½, DIN ISO 228/1

- Material: AlloyC22
- Weight: 1.32 kg (2.91 lb)
- Approval: with inspection certificate EN 10204 - 3.1 material

NPT 1½, ASME B 1.20.1

- Material: 1.4435 (AISI 316L)
- Weight: 1.32 kg (2.91 lb)
- Order number: 52003669
- Order number: 52011883, approval: with inspection certificate EN 10204 - 3.1 material

NPT 1½, ASME B 1.20.1

- Material: AlloyC22
- Weight: 1.32 kg (2.91 lb)
- Approval: with inspection certificate EN 10204 - 3.1 material
- Order number: 71118695

Supplementary documentation



The certificates and approvals currently available can be accessed via the

- Product Configurator
- Endress+Hauser website: www.endress.com → Downloads.

Special documentation

- TI00426F: Welding neck and flanges (overview)
- SDO1622F: Welding neck (assembly manual)

Device-dependent supplementary documentation

Document type: Operating Instructions (BA)

Installation and initial commissioning – contains all functions in the operating menu that are required for a typical measuring task. Functions beyond this scope are not included.
BA01893F

Document type: Brief Operating Instructions (KA)

Quick guide to the first measured value – includes all essential information from the incoming acceptance to the electrical connection.
KA01411F

Document type: Safety Instructions, certificates

Depending on the approval, Safety Instructions are also supplied with the device, e. g. XA. This documentation is an integral part of the Operating Instructions.
The nameplate indicates the Safety Instructions (XA) that are relevant to the device.



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