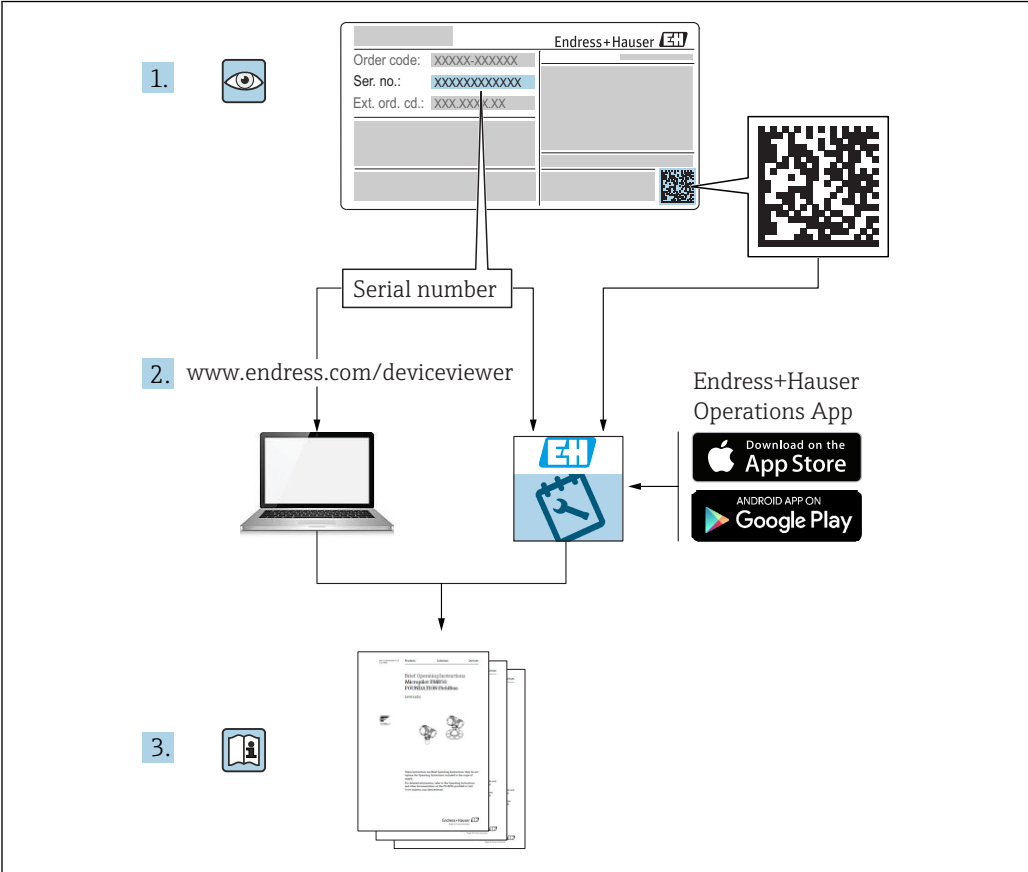


Operating Instructions

Liquiphant FTL41

Vibronic
Limit switch for liquids





A0023555

Table of contents

| | | | | |
|-----------|--|-----------|--|--|
| 1 | About this document | 5 | | |
| 1.1 | Symbols | 5 | | |
| 1.1.1 | Safety symbols | 5 | | |
| 1.1.2 | Electrical symbols | 5 | | |
| 1.1.3 | Symbols for certain types of information | 5 | | |
| 1.1.4 | Symbols in graphics | 5 | | |
| 2 | Basic safety instructions | 6 | | |
| 2.1 | Requirements for the personnel | 6 | | |
| 2.2 | Designated use | 6 | | |
| 2.2.1 | Incorrect use | 6 | | |
| 2.3 | Workplace safety | 6 | | |
| 2.4 | Operational safety | 6 | | |
| 2.5 | Product safety | 7 | | |
| 3 | Product description | 7 | | |
| 3.1 | Product design | 7 | | |
| 4 | Incoming acceptance and product identification | 8 | | |
| 4.1 | Incoming acceptance | 8 | | |
| 4.2 | Product identification | 8 | | |
| 4.2.1 | Nameplate | 8 | | |
| 4.2.2 | Manufacturer address | 8 | | |
| 4.3 | Storage and transport | 9 | | |
| 4.3.1 | Storage conditions | 9 | | |
| 4.3.2 | Transporting the device | 9 | | |
| 5 | Mounting | 9 | | |
| 5.1 | Mounting conditions | 10 | | |
| 5.1.1 | Taking the switch point into consideration | 10 | | |
| 5.1.2 | Take viscosity into consideration | 10 | | |
| 5.1.3 | Avoiding buildup | 11 | | |
| 5.1.4 | Take clearance into consideration | 12 | | |
| 5.1.5 | Support the device | 12 | | |
| 5.1.6 | Weld-in adapter with leakage hole | 13 | | |
| 5.2 | Mounting the measuring device | 13 | | |
| 5.2.1 | Required tools | 13 | | |
| 5.2.2 | Installation | 13 | | |
| 5.3 | Sliding sleeves | 15 | | |
| 5.4 | Post-installation check | 15 | | |
| 6 | Electrical connection | 15 | | |
| 6.1 | Connection conditions | 15 | | |
| 6.1.1 | Connecting protective earth (PE) | 15 | | |
| 6.2 | Connecting the measuring device | 15 | | |
| 6.2.1 | 3-wire DC-PNP (electronic insert FEL42) | 15 | | |
| 6.2.2 | Universal current connection with relay output (electronic insert FEL44) | 17 | | |
| 6.2.3 | 2-wire NAMUR > 2.2 mA/< 1.0 mA (electronic insert FEL48) | 19 | | |
| 6.2.4 | Cable entry | 20 | | |
| 6.3 | Post-connection check | 21 | | |
| 7 | Operation options | 21 | | |
| 7.1 | Overview of operation options | 21 | | |
| 7.1.1 | Operation concept | 21 | | |
| 7.1.2 | Elements on the electronic insert | 22 | | |
| 8 | Commissioning | 22 | | |
| 8.1 | Function check | 22 | | |
| 8.2 | Powering up the measuring device | 22 | | |
| 9 | Diagnostics and troubleshooting ... | 22 | | |
| 9.1 | LED at electronic insert | 22 | | |
| 10 | Maintenance | 23 | | |
| 10.1 | Maintenance tasks | 23 | | |
| 10.1.1 | Cleaning | 23 | | |
| 11 | Repair | 24 | | |
| 11.1 | General information | 24 | | |
| 11.1.1 | Repair concept | 24 | | |
| 11.1.2 | Repair of Ex-certified devices | 24 | | |
| 11.2 | Spare parts | 24 | | |
| 11.3 | Return | 24 | | |
| 11.4 | Disposal | 25 | | |
| 12 | Accessories | 25 | | |
| 12.1 | Device-specific accessories | 25 | | |
| 12.1.1 | Weather protection cover for single-compartment housing, metal | 25 | | |
| 12.1.2 | Plug-in jack | 25 | | |
| 12.2 | Sliding sleeves for unpressurized operation | 26 | | |
| 12.3 | High pressure sliding sleeves | 27 | | |
| 13 | Technical data | 28 | | |
| 13.1 | Input | 28 | | |
| 13.1.1 | Measured variable | 28 | | |
| 13.1.2 | Measuring range | 28 | | |
| 13.2 | Output | 28 | | |
| 13.2.1 | Output and input variants | 28 | | |
| 13.2.2 | Output signal | 29 | | |
| 13.2.3 | Ex connection data | 29 | | |
| 13.3 | Environment | 30 | | |
| 13.3.1 | Ambient temperature range | 30 | | |
| 13.3.2 | Storage temperature | 30 | | |

| | | |
|---------|-------------------------------------|----|
| 13.3.3 | Humidity | 30 |
| 13.3.4 | Operating altitude | 30 |
| 13.3.5 | Climate class | 30 |
| 13.3.6 | Degree of protection | 31 |
| 13.3.7 | Vibration resistance | 31 |
| 13.3.8 | Shock resistance | 31 |
| 13.3.9 | Mechanical load | 31 |
| 13.3.10 | Electromagnetic compatibility | 31 |
| 13.4 | Process | 31 |
| 13.4.1 | Process temperature range | 31 |
| 13.4.2 | Thermal shock | 32 |
| 13.4.3 | Process pressure range | 32 |
| 13.4.4 | Test pressure | 32 |
| 13.4.5 | Density | 33 |
| 13.4.6 | Pressure tightness | 33 |
| 13.5 | Additional technical data | 33 |

1 About this document

1.1 Symbols

1.1.1 Safety symbols

DANGER

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

WARNING

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


CAUTION

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

NOTICE

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

1.1.2 Electrical symbols

 Ground connection

Grounded clamp, which is grounded via a grounding system.

 Protective earth (PE)

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.

1.1.3 Symbols for certain types of information

 Permitted


Procedures, processes or actions that are permitted.


 Forbidden

Procedures, processes or actions that are forbidden.

 Tip

Indicates additional information

 Reference to documentation

 Reference to another section


 1, 2, 3. Series of steps

1.1.4 Symbols in graphics

A, B, C ... View

1, 2, 3 ... Item numbers

 Hazardous area

 Safe area (non-hazardous area)

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

Only use the measuring device as a limit switch for liquids. Improper use can pose hazards. Ensure that the measuring device is free of defects while it is in operation.

- Use the measuring device only for media to which the process-wetted materials have an adequate level of resistance
- Do not exceed or drop below the limit values for the measuring device
TI01402F/00/EN

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!

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

Conversions to the device

Unauthorized modifications to the device are not permitted and can lead to unforeseeable dangers.

- ▶ If, despite this, modifications are required, consult with Endress+Hauser.

Repair

To ensure continued operational safety and reliability,

- ▶ Carry out repairs on the device only if they are expressly permitted.
- ▶ Observe federal/national regulations pertaining to repair of an electrical device.

- ▶ Use original spare parts and accessories from Endress+Hauser only.

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.

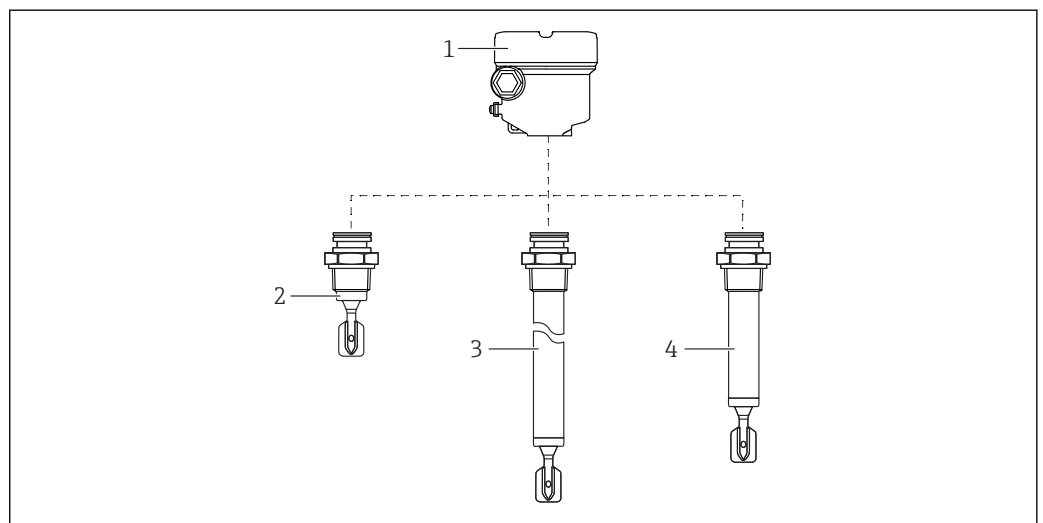
It meets general safety standards and legal requirements. It also complies with the EC directives listed in the device-specific EC Declaration of Conformity. Endress+Hauser confirms this by affixing the CE mark to the device.

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

Limit switch for liquids

3.1 Product design



1 Product design

- 1 Housing with cover and electronic insert
- 2 Probe design compact
- 3 Probe design pipe extension
- 4 Probe design short pipe


i Identify the electronic insert via the order code on the nameplate .

4 Incoming acceptance and product identification

4.1 Incoming acceptance

Check the following during goods 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, e. g. XA, provided?
- Is the device properly secured?

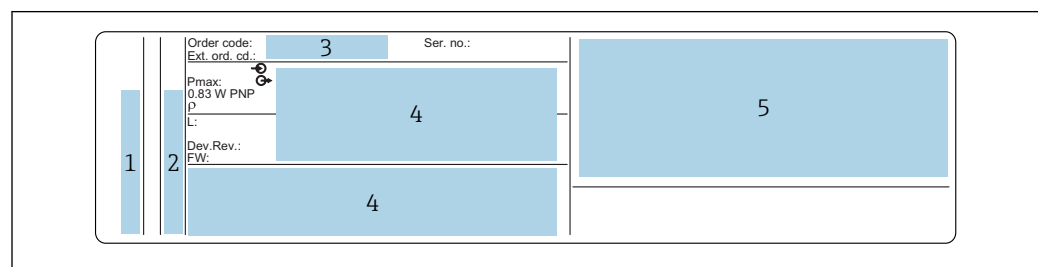
 If one of these conditions is not met, please contact the manufacturer's sales office.

4.2 Product identification

The measuring device can be identified in the following ways:

- Nameplate data
- Extended order code with breakdown of the device features on the delivery note
- Enter serial number from nameplates in *W@M Device Viewer* (www.endress.com/deviceviewer): All of the information on the measuring device is displayed along with an overview of the scope of technical documentation provided
- Enter the serial number on the nameplate into the *Endress+Hauser Operations App* or use the *Endress+Hauser Operations App* to scan the 2-D matrix code (QR Code) on the nameplate

4.2.1 Nameplate



 2 Nameplate specifications

- 1 Manufacturer name and device name
- 2 Manufacturer address
- 3 Order number, external order code, serial number
- 4 Technical data
- 5 Approval-specific information

4.2.2 Manufacturer address

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

Address of the manufacturing plant: See nameplate.

4.3 Storage and transport

4.3.1 Storage conditions

Use original packaging.

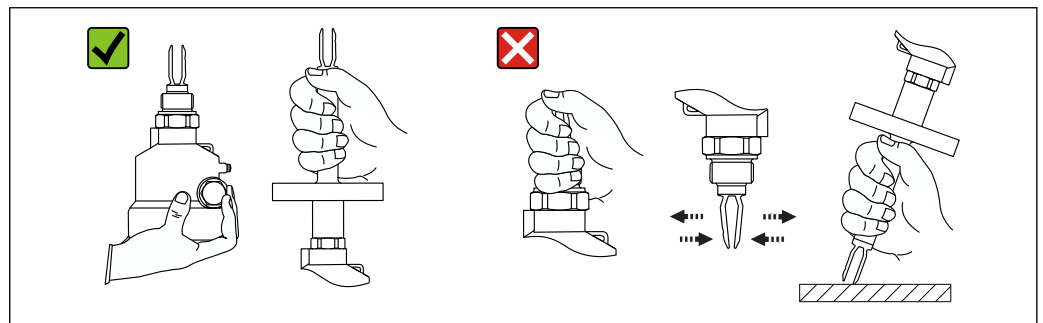
Storage temperature

-40 to +80 °C (-40 to +176 °F)

optional: -52 °C (-62 °F), -60 °C (-76 °F)

4.3.2 Transporting the device

- Transport the device to the measuring point in the original packaging
- Hold the device by the housing, temperature spacer, flange or extension pipe
- Do not bend, shorten or extend the tuning fork



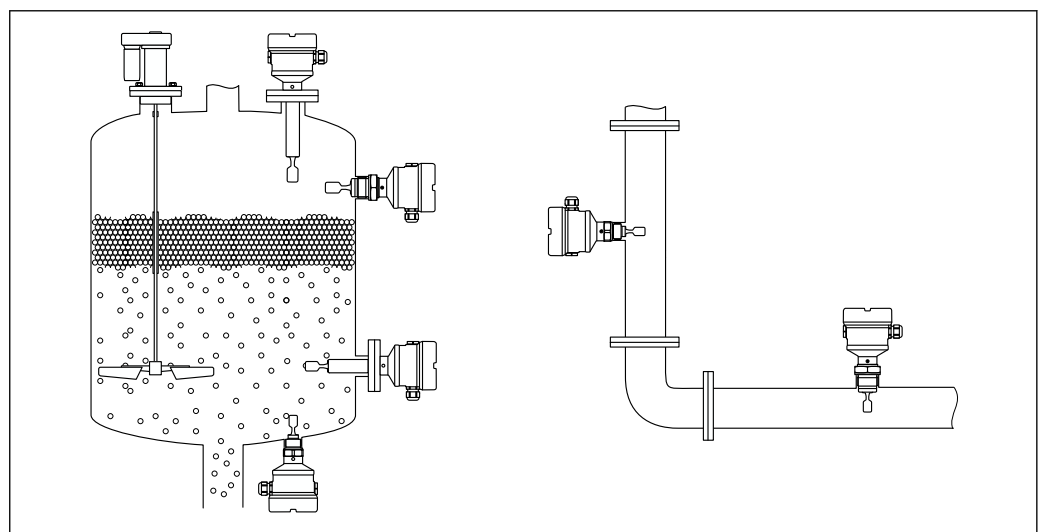
3 Handling the device during transportation

5 Mounting

⚠ WARNING

Loss of protection rating if the device is opened in a wet environment.

- Only open the device in a dry environment!

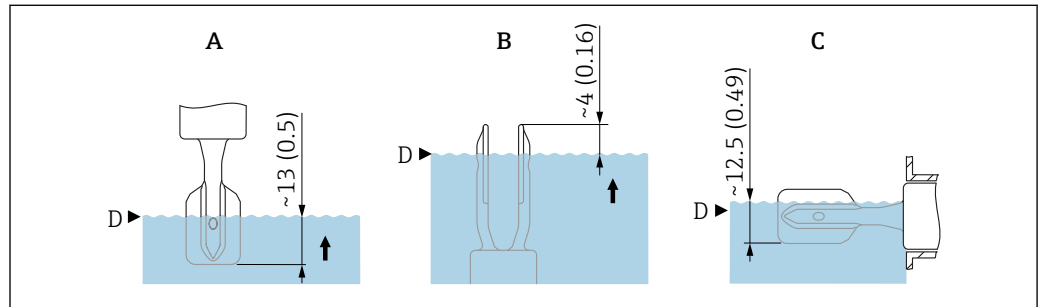


4 Installation in any position in container, pipe or tank

5.1 Mounting conditions

5.1.1 Taking the switch point into consideration

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

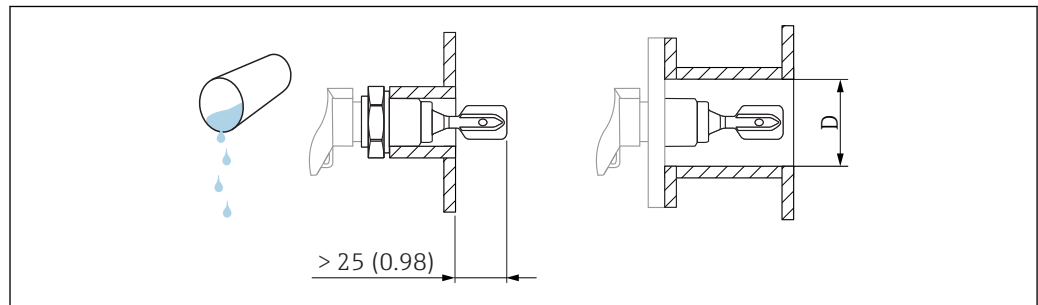


5 Typical switch points. Unit of measurement mm (in)

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

5.1.2 Take viscosity into consideration

Low viscosity



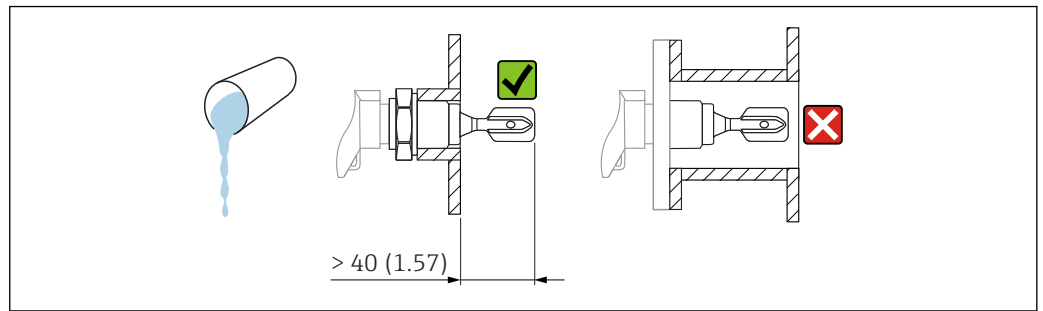
6 Installation example for low-viscosity liquids. Unit of measurement mm (in)

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

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

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

High viscosity



8 7 Installation example for a highly viscous liquid. Unit of measurement mm (in)

NOTICE

Highly viscous liquids may cause switching delays.

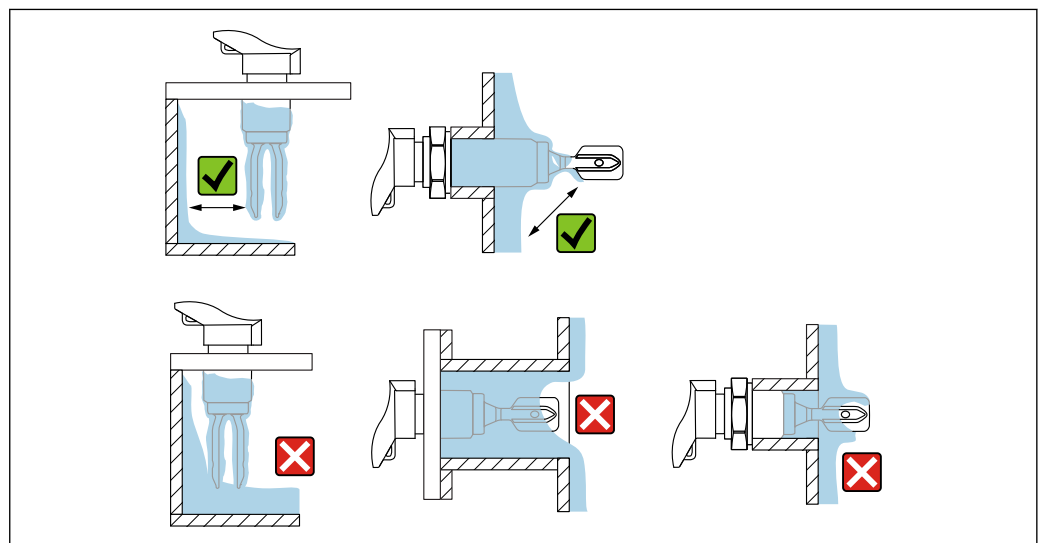
- ▶ Make sure that the liquid can run off the tuning fork easily.
- ▶ Deburr the socket surface.



High viscosity, e. g. viscous oils: $< 10\,000 \text{ mPa}\cdot\text{s}$

The tuning fork must be located outside the installation socket!

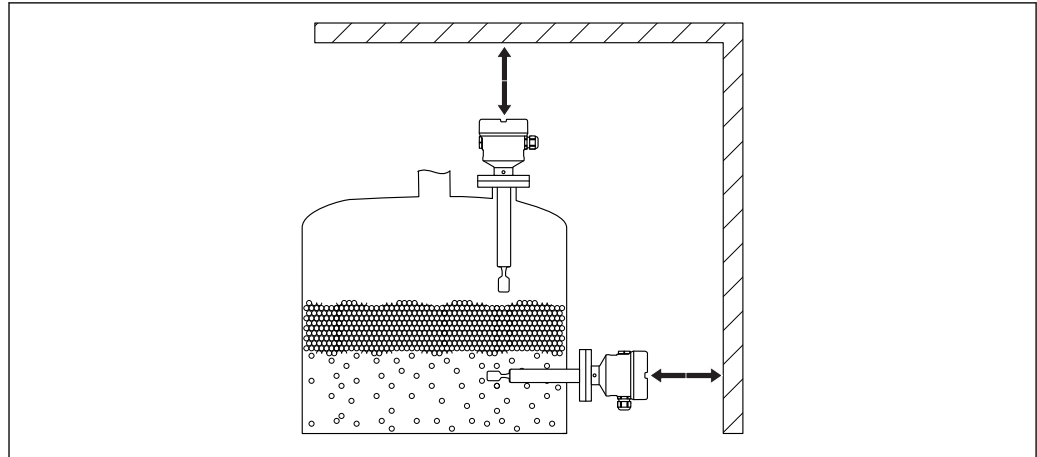
5.1.3 Avoiding buildup



8 8 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.

5.1.4 Take clearance into consideration

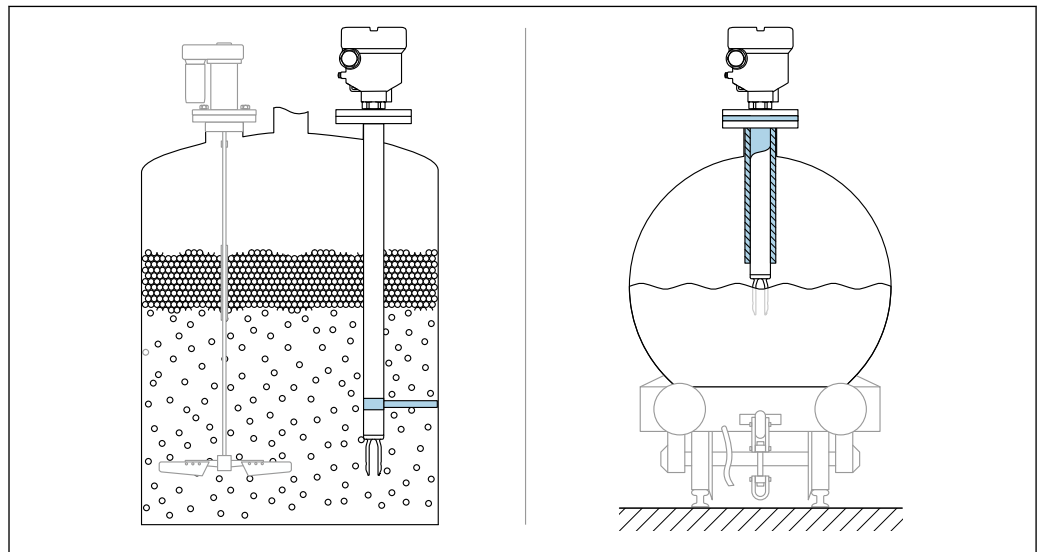


A0033236

9 Take clearance into consideration

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

5.1.5 Support the device

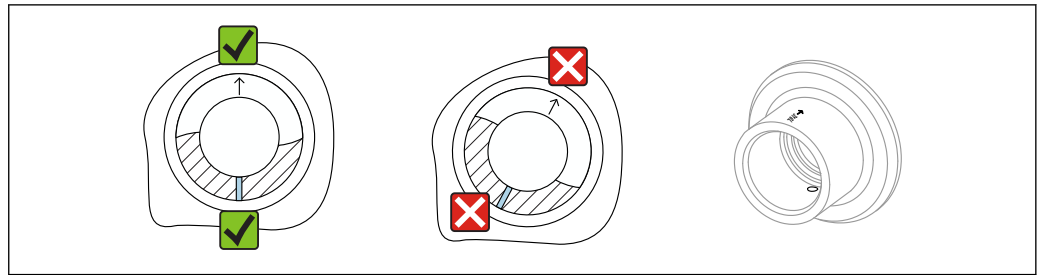


A0031874

10 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).

5.1.6 Weld-in adapter with leakage hole



11 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.

5.2 Mounting the measuring device

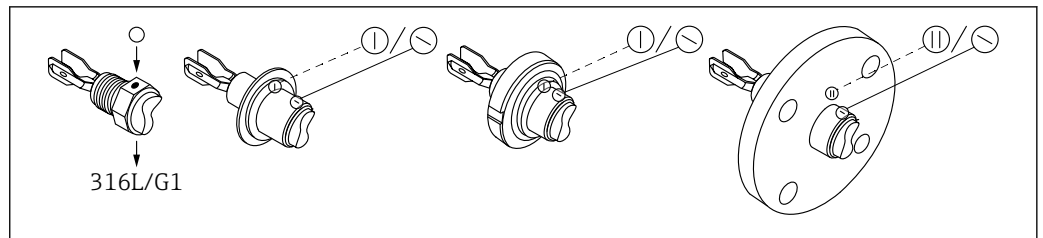
5.2.1 Required tools

- Open-ended wrench for sensor installation
- Screwdriver for electrical connection

5.2.2 Installation

Horizontal installation in vessels

Align the tuning fork with the marking



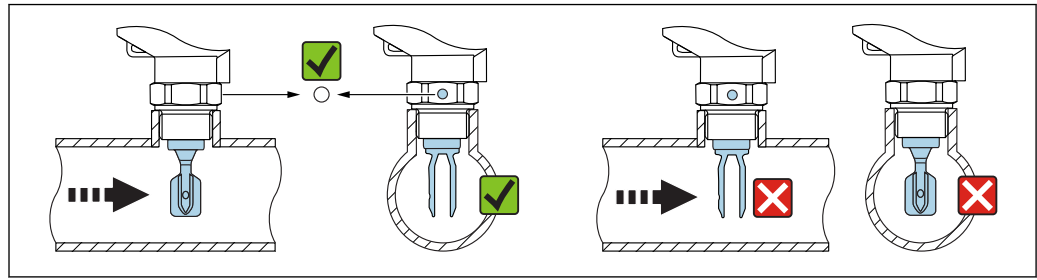
12 Marking to align the tuning fork

Use the marking to align the tuning fork in such a way that medium can run off easily and deposit buildup is avoided.

The following can be used as the marking:

- Material specification, thread description or circle on the hexagonal nut or on the weld-in adapter
- The II symbol on the back of the flange or Tri-Clamp

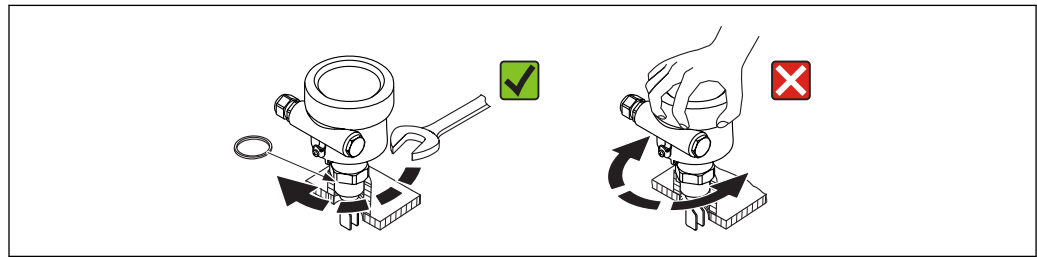
Installing in pipes



13 Marking and fork position

- Flow velocity up to 5 m/s with viscosity 1 mm²/s (cSt) and density 1 g/cm³ (SGU)
Check for correct functioning in the event of other process medium conditions
- The marking on the adapter points in the flow direction; the flow is thus not severely obstructed
- The marking can be identified while the device is installed

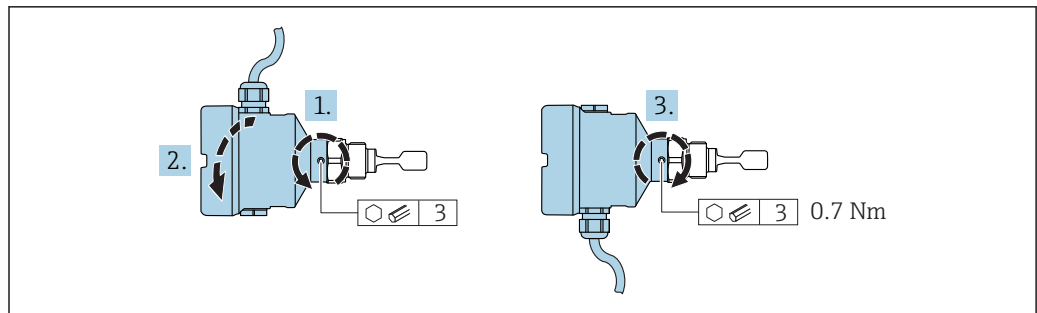
Screwing in the device



14 Screwing in the device

- Turn by the hex bolt only, 15 to 30 Nm (11 to 22 lbf ft)
- Do not turn at the housing!

Aligning the cable entry



15 Housing with external locking screw

i The locking screw is not tightened when the device is delivered.

1. Release the external locking screw.
2. Turn the housing, align the cable entry.
3. Tighten the external locking screw.

5.3 Sliding sleeves

 See the "Accessories" section.

5.4 Post-installation check

- Is the measuring device undamaged (visual inspection)?
- Does the measuring device conform to the measuring point specifications?

For example:

- Process temperature
- Process pressure
- Ambient temperature range
- Measuring range

- Are the measuring point number and labeling correct (visual inspection)?
- Is the measuring device adequately protected against precipitation and direct sunlight?
- Is the device properly secured?


6 Electrical connection

6.1 Connection conditions

6.1.1 Connecting protective earth (PE)

The protective earth conductor at the device must only be connected if the device's operating voltage is $\geq 35 V_{DC}$ or $\geq 16 V_{ACeff}$.

When the device is used in hazardous areas, it must always be included in the potential equalization of the system, irrespective of the operating voltage.

 The plastic housing is available with or without an external protective earth connection (PE).

6.2 Connecting the measuring device

6.2.1 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


WARNING

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.

$U = 10$ to $55 V_{DC}$

 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

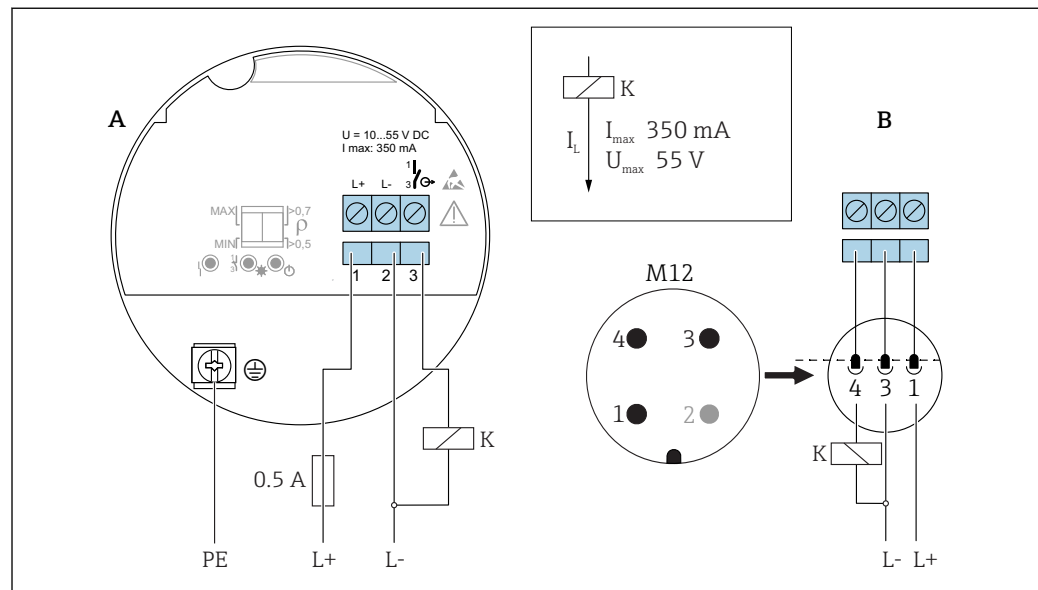
$$I < 100 \mu\text{A (for blocked transistor)}$$

Residual voltage

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

Behavior output signal

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

Terminal assignment

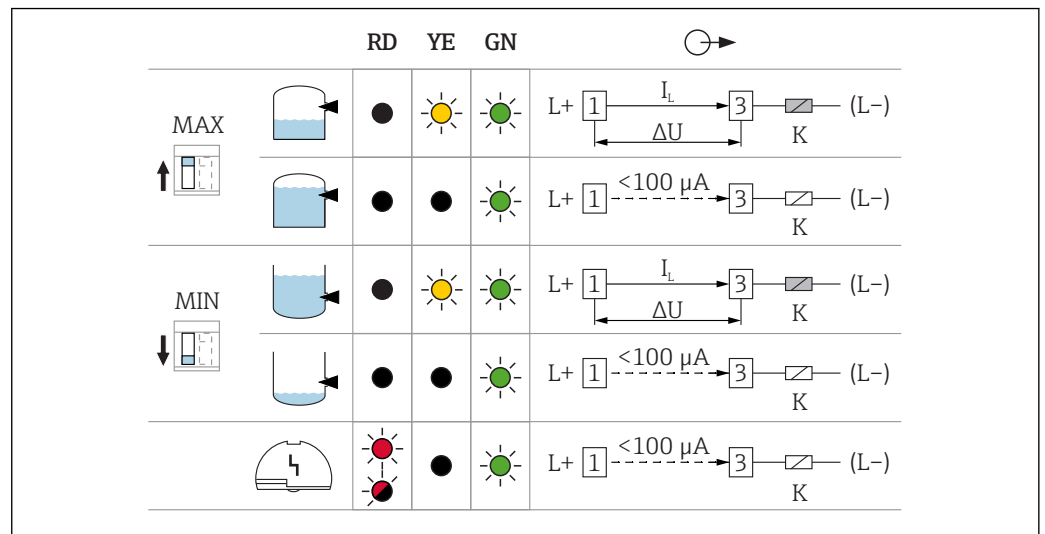
16 Terminal assignment FEL42

A Terminal assignment at electronic insert

B Terminal assignment on connector M12

A0036056

Behavior of the switch output and signaling



17 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

6.2.2 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

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

- 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

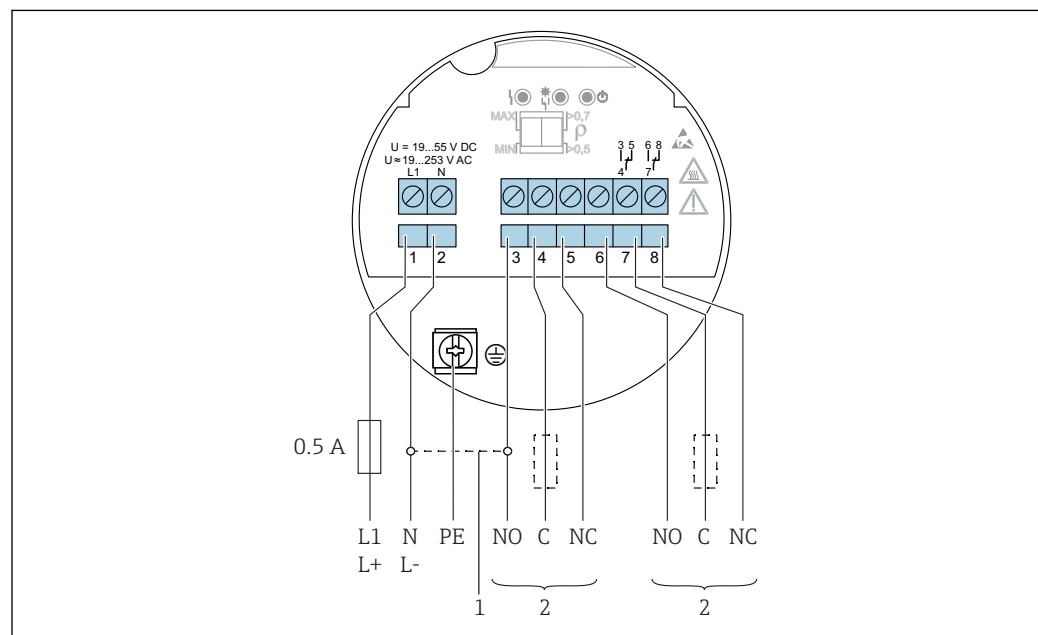
When connecting a device with high inductivity, provide spark quenching to protect the relay contact. A fine-wire fuse (depending on the connected load) protects the relay contact in the event of a short-circuit.

Both relay contacts switch simultaneously.

Behavior output signal

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






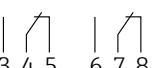


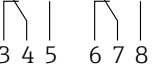

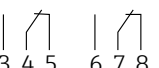

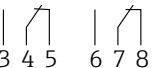
Terminal assignment




18 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  |  | ● | ☀ | ☀ |  |
| |  | ● | ● | ☀ |  |
|  | | ☀ | ● | ☀ |  |

A0033513

 19 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

6.2.3 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.

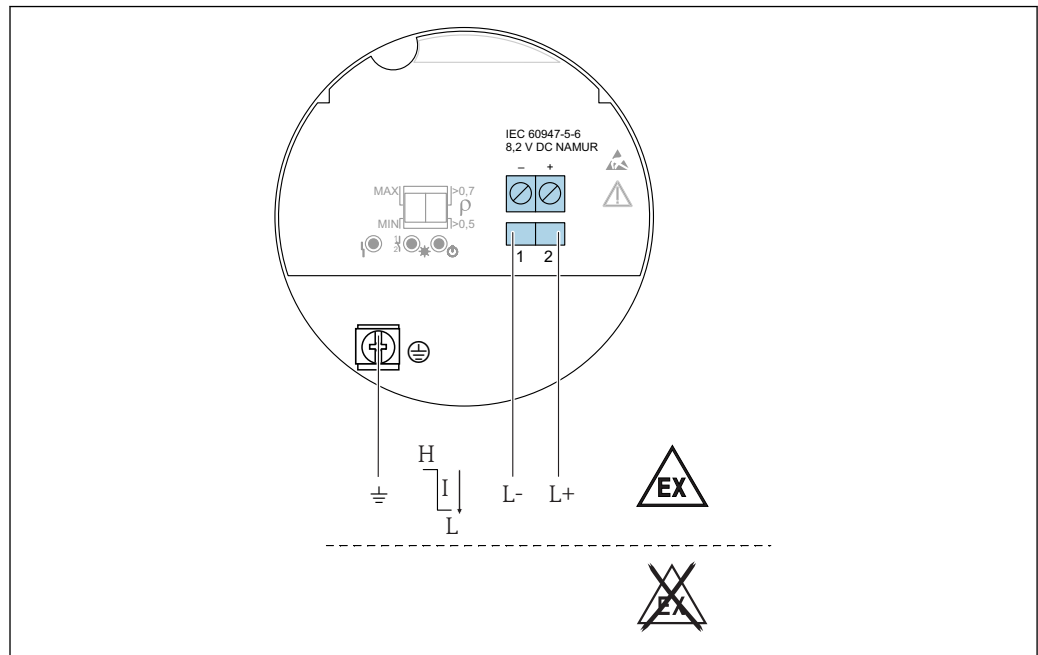
Power consumption

$P < 50 \text{ mW}$

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



A0036058

20 2-wire NAMUR > 2.2 mA / < 1.0 mA, electronic insert FEL48

Behavior of the switch output and signaling

| | | RD | YE | GN | ⊕ → |
|----------|--|----|----|----|---|
| MAX ↑ | | ● | ☀ | ● | L+ 2 $\xrightarrow{2.2...3.8\text{ mA}}$ 1 L- |
| | | ● | ● | ● | L+ 2 $\xrightarrow{0.4...1.0\text{ mA}}$ 1 L- |
| MIN ↓ | | ● | ☀ | ● | L+ 2 $\xrightarrow{2.2...3.8\text{ mA}}$ 1 L- |
| | | ● | ● | ● | L+ 2 $\xrightarrow{0.4...1.0\text{ mA}}$ 1 L- |
| | | ● | ● | ● | L+ 2 $\xrightarrow{< 1.0\text{ mA}}$ 1 L- |

A0037694

21 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

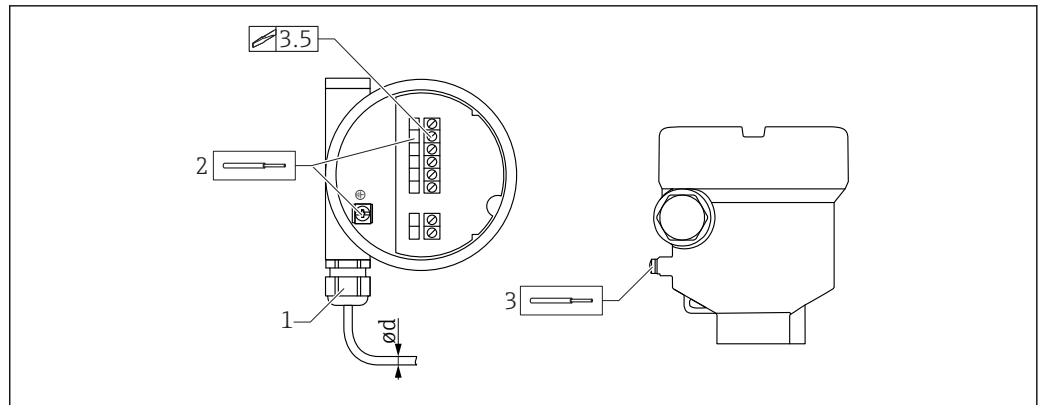
YE LED yellow switch status

GN LED green operational status, device on

6.2.4 Cable entry

Required tools

- Flat-blade screwdriver (0.6 x 3.5 mm) for terminals
- Torque spanner (8 Nm) for M20 cable gland



22 Cable entry, electronic insert

- 1 M20 cable gland
- 2 Conductor cross-section, 2.5 mm² maximum (AWG14)
- 3 Conductor cross-section, 4.0 mm² maximum (AWG12)
- ød Nickel-plated brass 7 to 10.5 mm (0.28 to 0.41 in)
- ød Plastic 5 to 10 mm (0.2 to 0.38 in)
- ød Stainless steel 7 to 12 mm (0.28 to 0.47 in)

Secure the cable gland and tighten the union nut of the cable gland, 8 Nm (5.9 lbf ft) torque. Screw the enclosed cable glands into the housing with a torque of 3.75 Nm (2.76 lbf ft).

6.3 Post-connection check

- Is the device or cable undamaged (visual inspection)?
- Do the cables used comply with the requirements?
- Do the mounted cables have adequate strain relief?
- Are the cable glands mounted and firmly tightened?
- Does the supply voltage match the specifications on the nameplate?
- No reverse polarity, is terminal assignment correct?
- If supply voltage is present, is the green LED lit?
- Are all the housing covers installed and tightened?
- Optional: Is the cover with securing screw tightened?

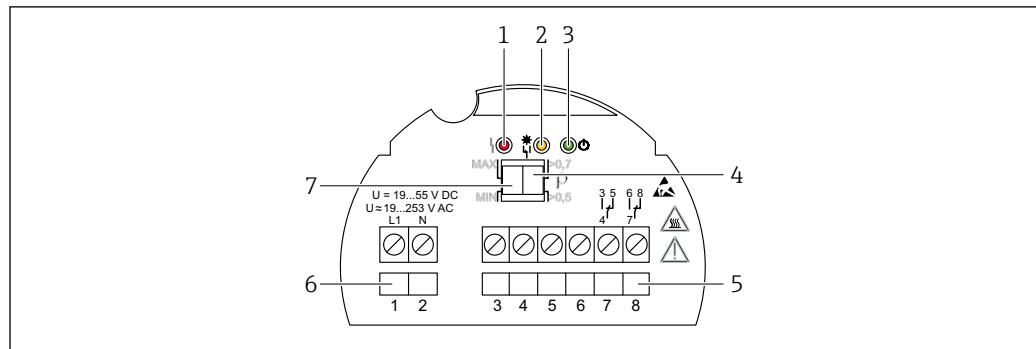
7 Operation options

7.1 Overview of operation options

7.1.1 Operation concept

Operation with DIP switches on the electronic insert

7.1.2 Elements on the electronic insert



23 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

8 Commissioning

8.1 Function check

Before commissioning the measuring point, check whether the post-installation and post-connection checks have been performed:

- "Post-installation check" checklist → 15
- "Post-connection check" checklist → 21

8.2 Powering up the measuring device

During the power-up time, the device output is in the safety-oriented state, or in the alarm state if available.

The output will be in the correct state max. three seconds after powering up the device.

9 Diagnostics and troubleshooting

The device indicates warnings and errors via the LEDs on the electronic insert. All the device warnings and faults are for information purposes only and do not have a safety function. Depending on the diagnostic message, the device behaves as per a warning or fault condition.

The device behaves in accordance with NAMUR Recommendation NE131 "NAMUR standard device requirements for field devices for standard applications".

9.1 LED at electronic insert

LED green not lit

Possible cause: No power supply

Troubleshooting: Check plug, cable and power supply

LED flashes red

Possible cause: Overload or short-circuit in load circuit

Troubleshooting: Clear the short-circuit

Reduce maximum load current to below 350 mA

LED red continuously lit

Possible cause: Internal sensor error or electronic fault

Troubleshooting: Replace device

10 Maintenance

No special maintenance work is required.

10.1 Maintenance tasks

10.1.1 Cleaning

It is not permitted to use the device with abrasive media. Material abrasion on the tuning fork can result in the device malfunctioning.

- Clean the tuning fork as necessary
- Cleaning is also possible in the installed state, e. g. CIP Cleaning in Place and SIP Sterilization in Place

11 Repair

11.1 General information

11.1.1 Repair concept

Endress+Hauser repair concept

- Measuring devices have a modular design
- Customers can carry out repairs

 For more information on service and spare parts, please contact your Endress+Hauser sales representative.

11.1.2 Repair of Ex-certified devices

WARNING


Limitation of electrical safety due to incorrect connection!

Risk of explosion!

- ▶ Only specialist personnel or the Endress+Hauser service team may carry out repairs on Ex-certified devices.
- ▶ Relevant standards and national regulations on hazardous areas, safety instructions and certificates must be observed.
- ▶ Use only original Endress+Hauser spare parts.
- ▶ Please note the device designation on the nameplate. Only identical parts may be used as replacements.
- ▶ Carry out repairs according to the instructions. On completion of repair work, carry out the routine test specified for the device.
- ▶ Only the Endress+Hauser service team is permitted to modify a certified device and convert it to another certified version.
- ▶ All repairs and modifications must be documented.

11.2 Spare parts

- Some replaceable measuring device components are identified by means of a spare part nameplate. This contains information about the spare part.
- All the spare parts for the measuring device along with the order code are listed in the *W@M Device Viewer* (www.endress.com/deviceviewer) and can be ordered. If available, users can also download the associated Installation Instructions.

 Measuring device serial number or QR code:
Located on the device and spare part nameplate.

11.3 Return

The measuring device must be returned if the wrong device has been ordered or delivered. As an ISO-certified company and also due to legal regulations, Endress+Hauser is obliged to follow certain procedures when handling any returned products that have been in contact with medium. To ensure safe, swift and professional device returns, please refer to the procedure and conditions for returning devices provided on the Endress+Hauser website at <http://www.endress.com/support/return-material>

11.4 Disposal



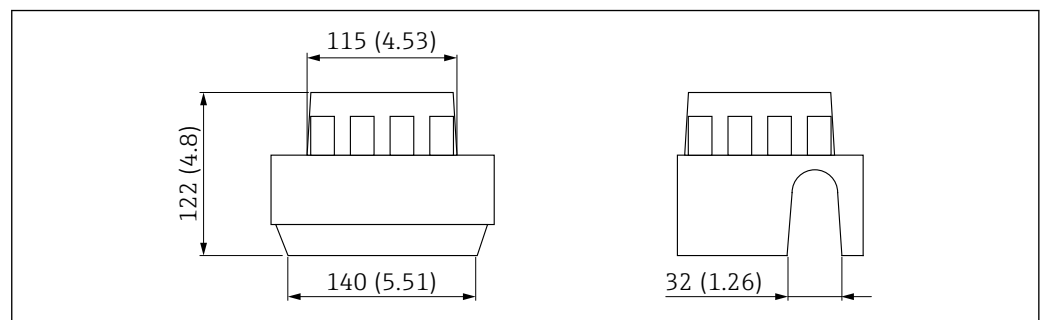
If required by the Directive 2012/19/EU on waste electrical and electronic equipment (WEEE), our products are marked with the depicted symbol in order to minimize the disposal of WEEE as unsorted municipal waste. Such products may not be disposed of as unsorted municipal waste and can be returned to Endress+Hauser for disposal at conditions stipulated in our General Terms and Conditions or as individually agreed.

12 Accessories

12.1 Device-specific accessories

12.1.1 Weather protection cover for single-compartment housing, metal

- Material: plastic
- Order number: 71438291



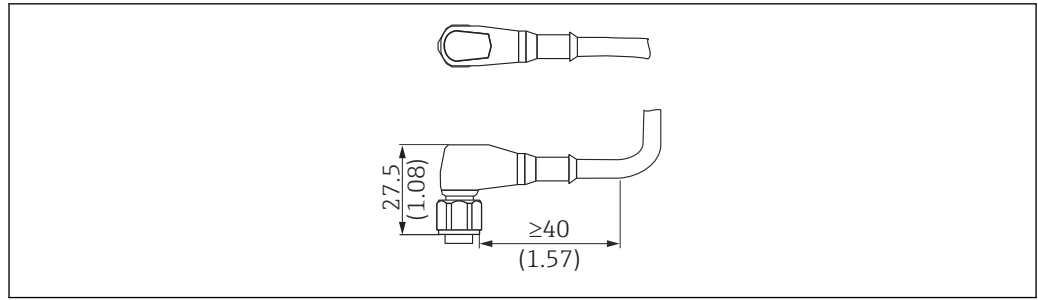
24 Weather protection cover for single-compartment housing, metal. Unit of measurement mm (in)

12.1.2 Plug-in jack

i 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

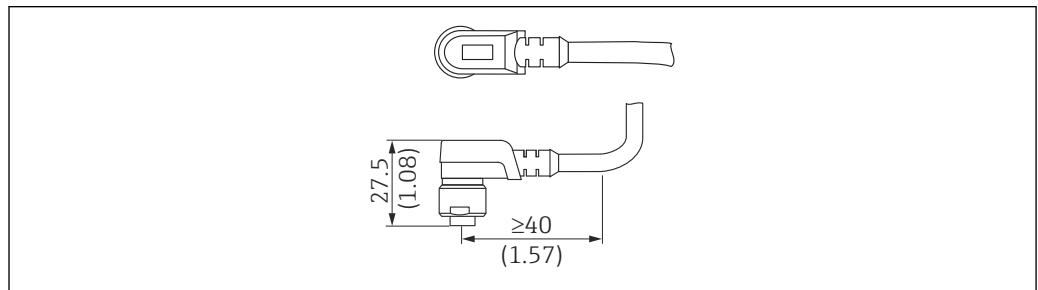


A0023713

25 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

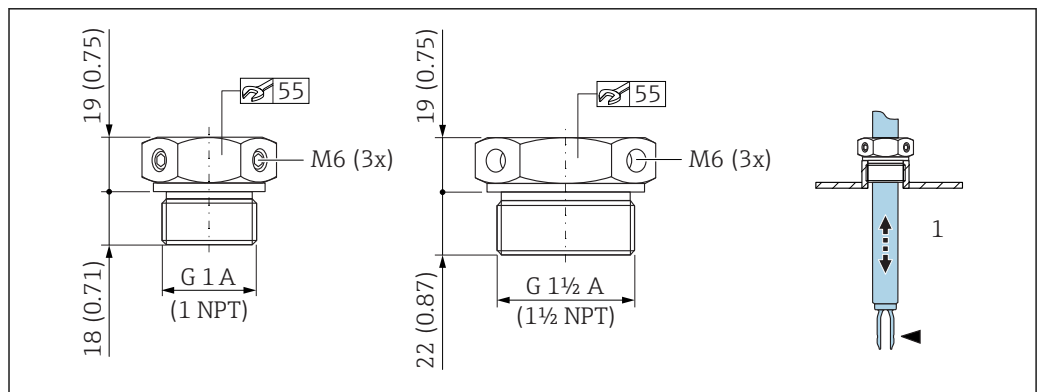


A002292

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

12.2 Sliding sleeves for unpressurized operation

Switch point, infinitely adjustable.



A0037666

27 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/I

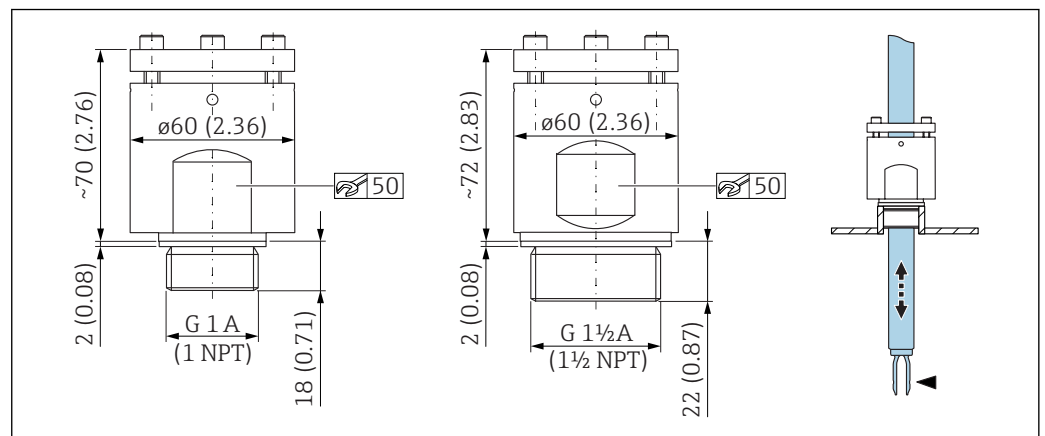
- Material: 1.4435 (AISI 316L)
- Weight: 0.54 kg (1.19 lb)
- Order number: 52003980
- Order number: 52011890, approval: with inspection certificate EN 10204 - 3.1 material

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

12.3 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



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

G 1, DIN ISO 228/I

- 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/I

- 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

13 Technical data

13.1 Input

13.1.1 Measured variable

Level (point level), MAX or MIN safety

13.1.2 Measuring range

Depends on the installation location and the pipe extension ordered
Maximum sensor length 6 m (20 ft)

13.2 Output

13.2.1 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

13.2.2 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

13.2.3 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.

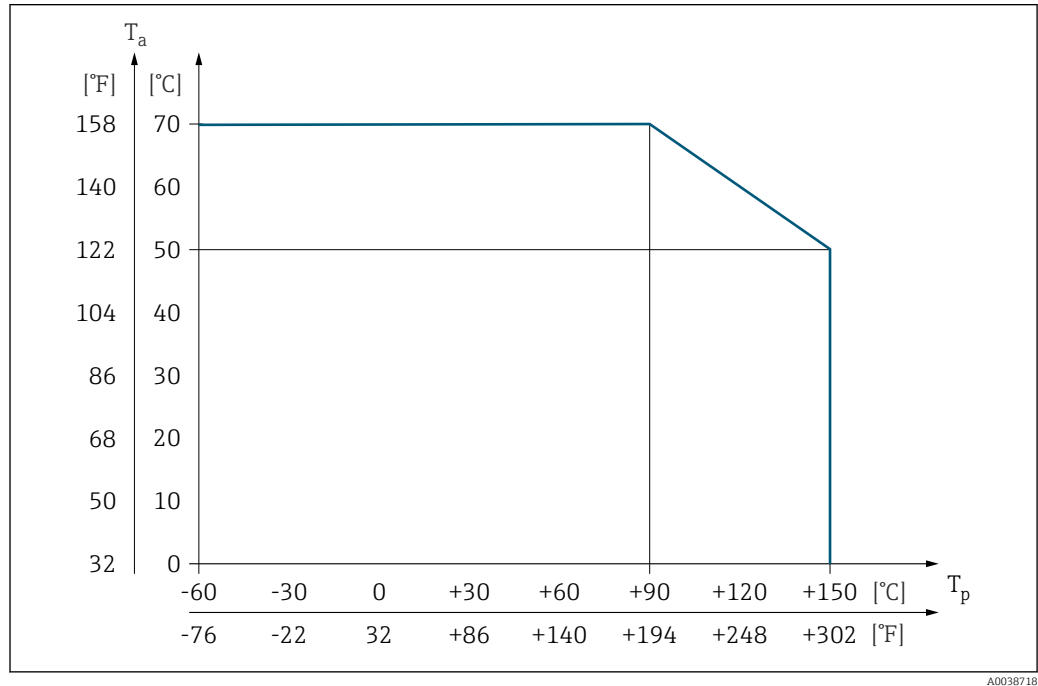
13.3 Environment

13.3.1 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.



29 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

13.3.2 Storage temperature

-40 to +80 °C (-40 to +176 °F)

optional: -52 °C (-62 °F), -60 °C (-76 °F)

13.3.3 Humidity

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

13.3.4 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

13.3.5 Climate class

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

13.3.6 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

13.3.7 Vibration resistance

As per IEC60068-2-64-2009


$a(\text{RMS}) = 50 \text{ m/s}^2$, $f = 5 \text{ to } 2000 \text{ Hz}$, $t = 3 \text{ axes} \times 2 \text{ h}$

13.3.8 Shock resistance

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

13.3.9 Mechanical load

Lateral loading capacity

 Special mounting instructions

13.3.10 Electromagnetic compatibility

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

13.4 Process

13.4.1 Process temperature range

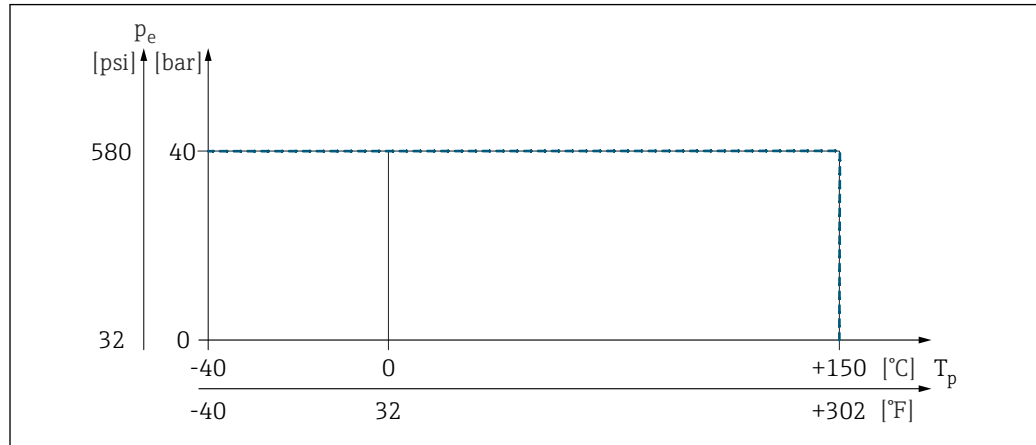
Pay attention to the pressure and temperature dependence (see the "Sensor process pressure range" section)

-40 to +150 °C (-40 to +302 °F)

13.4.2 Thermal shock

≤ 120 K/s

13.4.3 Process pressure range



A0038719

30 Process temperature FTL41

⚠ 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)

13.4.4 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.

13.4.5 Density


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

13.4.6 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.

13.5 Additional technical data

-  Latest technical information: Endress+Hauser website: www.endress.com → Downloads.



www.addresses.endress.com
