

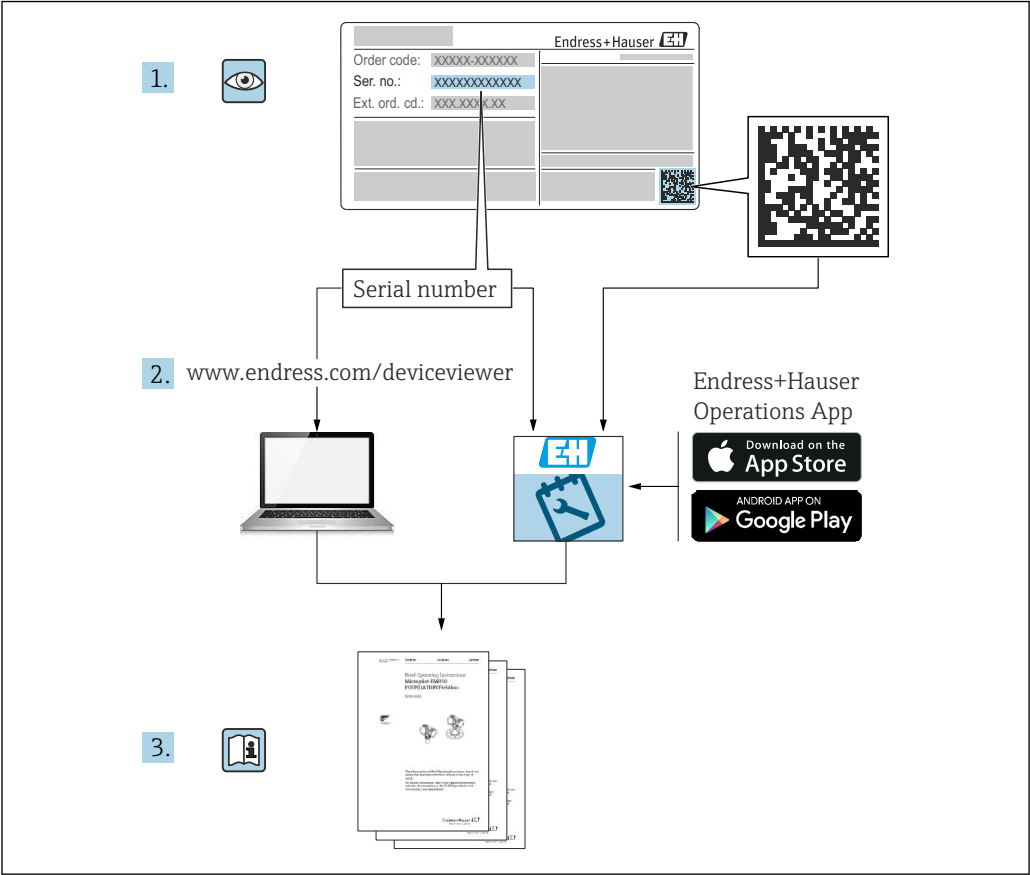
Operating Instructions

Liquiphant FTL41

Vibronic

Point level switch for liquids





A0023555

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1 About this document

1.1 Purpose of this document

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

1.2 Symbols

1.2.1 Safety symbols

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.

1.2.2 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.

1.2.3 Tool symbols

 Flat-blade screwdriver

 Allen key

 Open-ended wrench

1.2.4 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

1.2.5 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 Intended use

- Only use the device for liquids
- Improper use can pose hazards
- Ensure that the measuring device is free of defects while it is in operation
- Use the device only for media to which the wetted materials have an adequate level of resistance
- Do not exceed or drop below the relevant limit values for the device
 -  For more details, see the "Technical data" section
 -  See the Technical Documentation

2.2.1 Incorrect use

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

For requirements concerning functional safety in accordance with IEC 61508, the associated SIL documentation must be observed.

2.3 Workplace safety

For work on and with the device:

- ▶ Wear the required personal protective equipment according to federal/national regulations.

2.4 Operational safety

Risk of injury!

- ▶ Operate the device only if it is in proper technical condition, free from errors and faults.
- ▶ The operator is responsible for ensuring the interference-free operation of the device.

Modifications 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:

- ▶ Only perform repair work on the device if this is expressly permitted.
- ▶ Observe federal/national regulations pertaining to the repair of an electrical device.
- ▶ Use original spare parts and accessories from Endress+Hauser only.

Hazardous area

To eliminate danger to persons or the facility when the device is used in the hazardous area (e.g. explosion protection):

- ▶ Check the nameplate to verify whether the ordered device can be used for the intended purpose in the hazardous area.
- ▶ Observe the specifications in the separate supplementary documentation that is an integral part of this manual.

2.5 Product safety

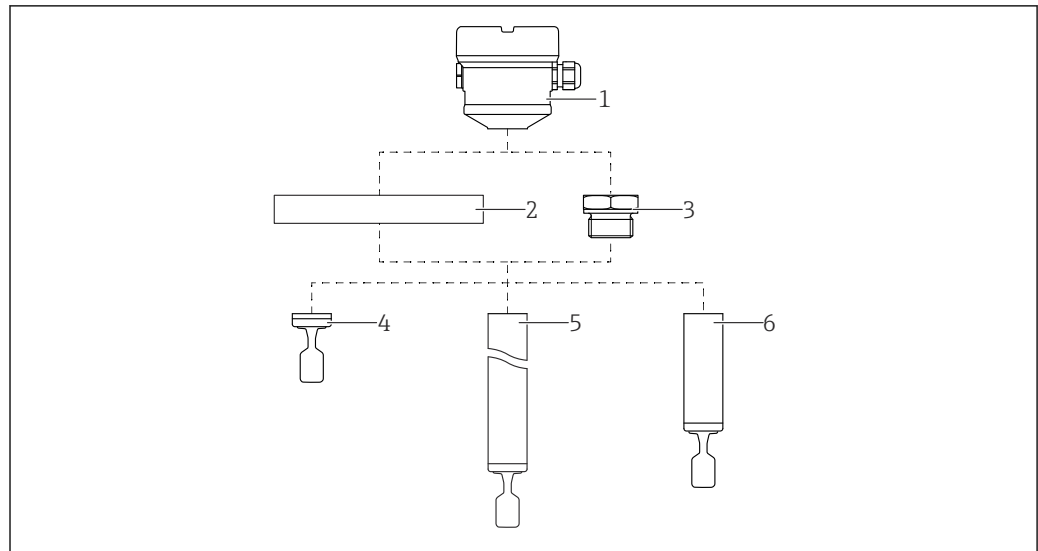
This device is designed in accordance with good engineering practice to meet state-of-the-art safety requirements, has been tested, and left the factory in a condition in which it is safe to operate.

It meets the 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

Point level switch for all liquids, for minimum or maximum detection in tanks, vessels and pipes.

3.1 Product design



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1 Product design


- 1 Housing with electronic insert and cover
- 2 Process connection flange (optional)
- 3 Process connection (optional)
- 4 Compact probe version with tuning fork
- 5 Pipe extension probe with tuning fork
- 6 Short tube version of probe with tuning fork

4 Incoming acceptance and product identification

4.1 Incoming acceptance

Check the following during incoming acceptance:

- ☐ Are the order codes on the delivery note and the product sticker identical?
- ☐ Are the goods undamaged?
- ☐ Do the data on the nameplate match the ordering information on the delivery note?
- ☐ If required (see nameplate): are the Safety Instructions e.g. XA provided?

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

4.2 Product identification

The device can be identified in the following ways:

- Nameplate specifications
- 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 scan the 2-D matrix code on the nameplate with the Endress+Hauser Operations app

4.2.1 Nameplate

The information that is required by law and is relevant to the device is shown on the nameplate, e.g.:

- Manufacturer identification
- Order number, extended order code, serial number
- Technical data, degree of protection
- Firmware version, hardware version
- Approval-related information, reference to Safety Instructions (XA)
- DataMatrix code (information about the device)

4.2.2 Electronic insert

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

4.2.3 Manufacturer address

Endress+Hauser SE+Co. KG
Hauptstraße 1
79689 Maulburg, Germany
Place of manufacture: See nameplate.

4.3 Storage and transport

4.3.1 Storage conditions

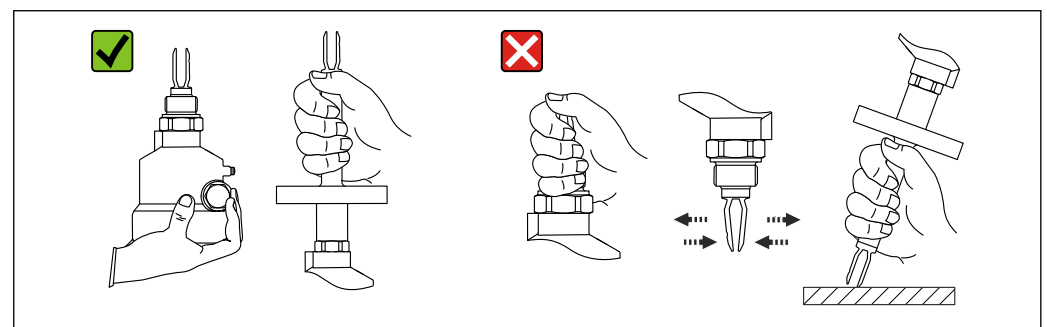
Use original packaging.

Storage temperature

–40 to +80 °C (–40 to +176 °F)

4.3.2 Transporting the device

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



 2 Handling the device during transportation

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5 Mounting

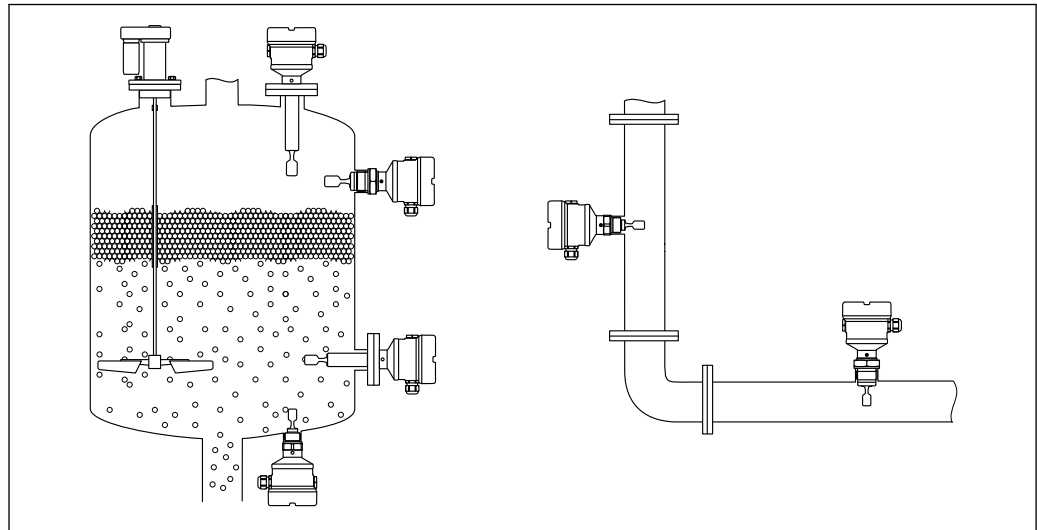
⚠ WARNING

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

► Only open the device in a dry environment!

Mounting instructions

- Any orientation for device with short pipe up to approx. 500 mm (19.7 in)
- Vertical orientation from above for device with long pipe
- Minimum distance between the fork tip and the tank wall or pipe wall: 10 mm (0.39 in)



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3 Installation examples for a vessel, tank or pipe

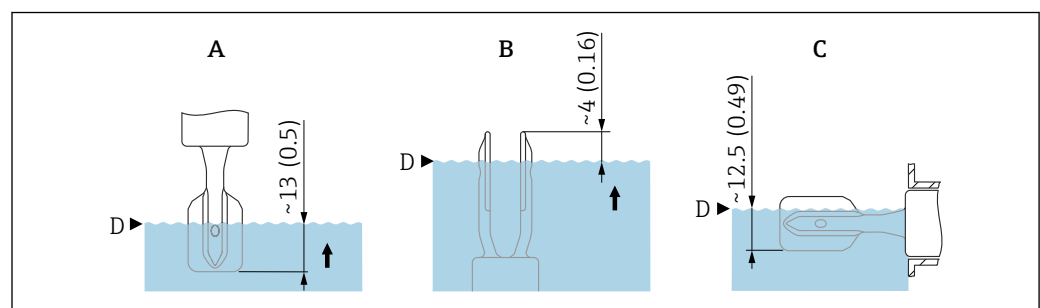
5.1 Mounting requirements

5.1.1 Take switch point into consideration

The following are typical switch points, depending on the orientation of the point level switch.

Water +23 °C (+73 °F)

i Minimum distance between the fork tip and the tank wall or pipe wall:
10 mm (0.39 in)



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4 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



Viscosity values

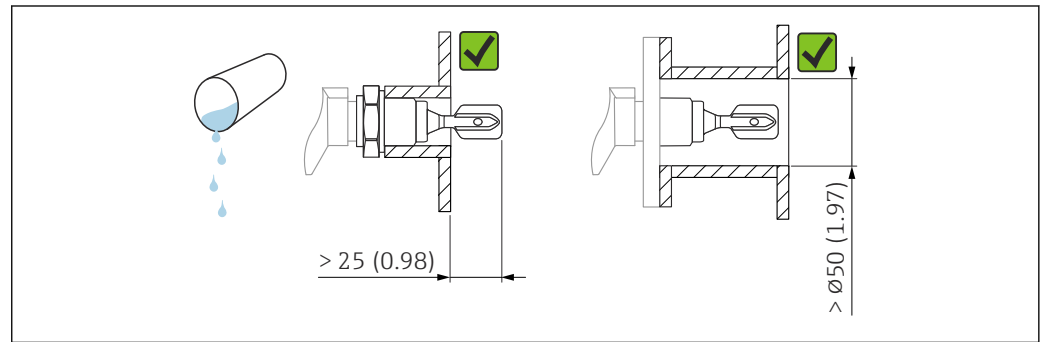
- Low viscosity : $< 2\,000\text{ mPa}\cdot\text{s}$
- High viscosity: $> 2\,000$ to $10\,000\text{ mPa}\cdot\text{s}$

Low viscosity



Low viscosity, e.g. water: $< 2\,000\text{ mPa}\cdot\text{s}$

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



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

High viscosity

NOTICE

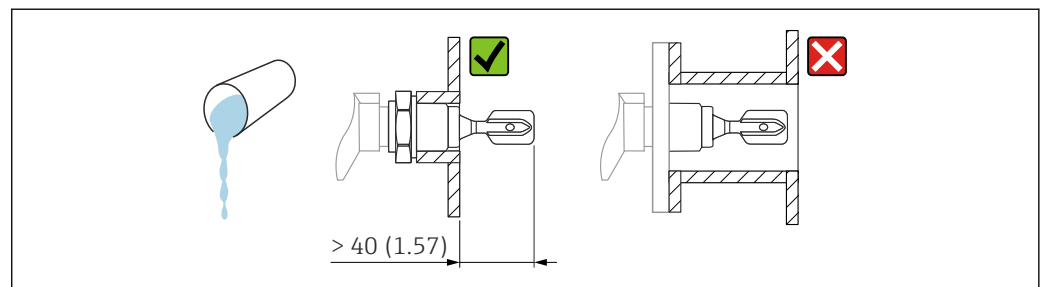
Highly viscous liquids may cause switching delays.

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



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

The tuning fork must be located outside the installation socket!

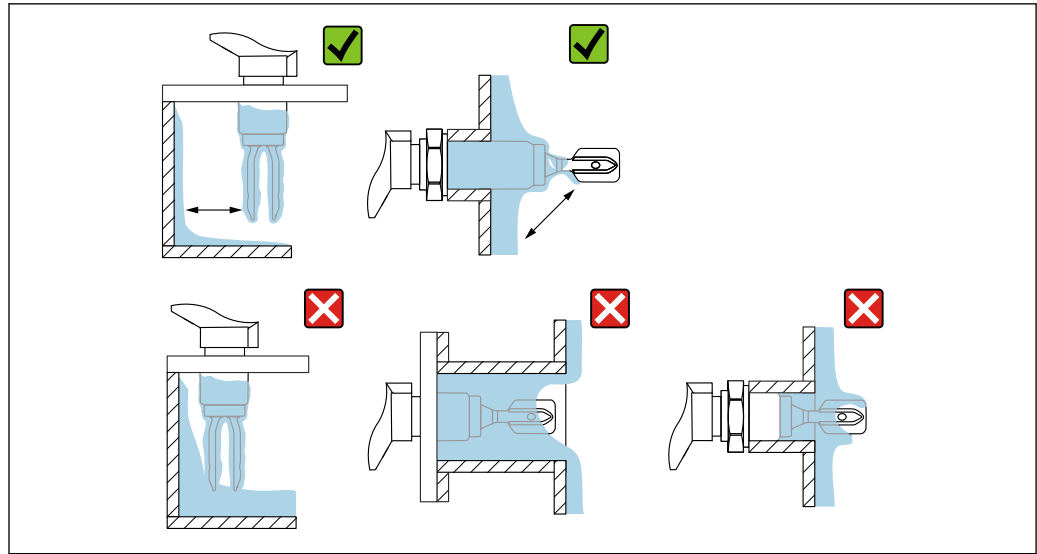


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6 Installation example for a highly viscous liquid. Unit of measurement mm (in)

5.1.3 Avoid buildup

- Use short installation sockets to ensure that the tuning fork projects freely into the vessel
- Leave sufficient distance between the buildup expected on the tank wall and the tuning fork

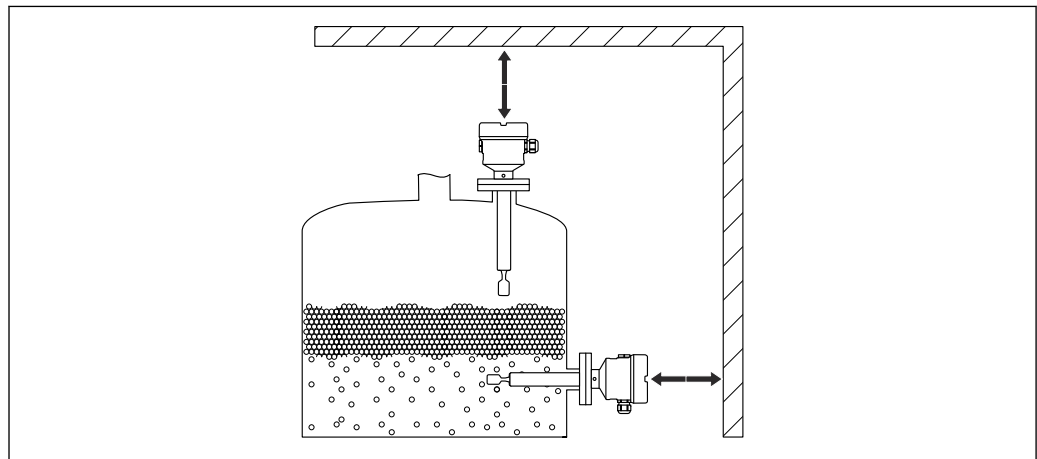


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7 Installation examples for a highly viscous process medium

5.1.4 Take clearance into consideration

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

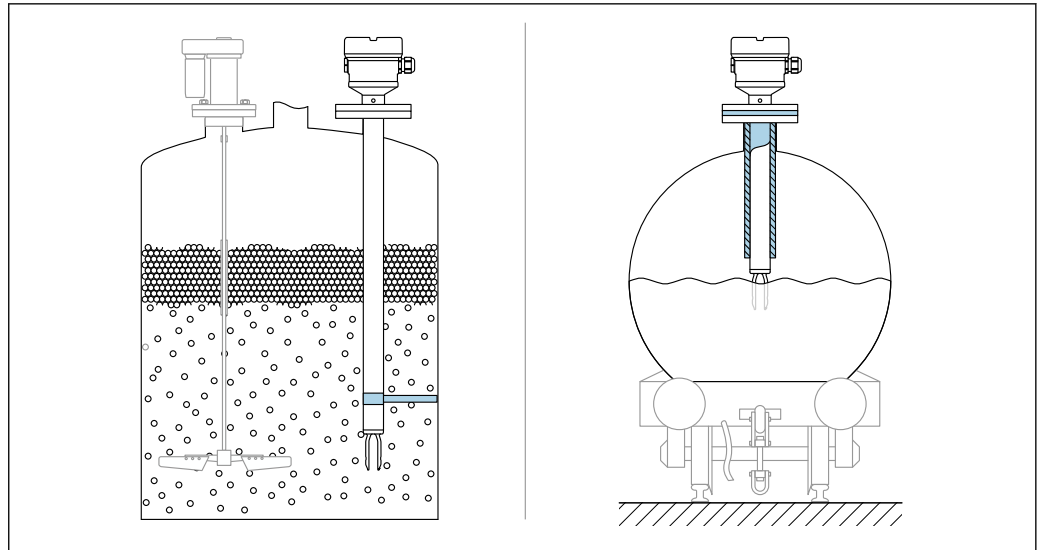


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8 Take clearance into consideration

5.1.5 Support the device

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).



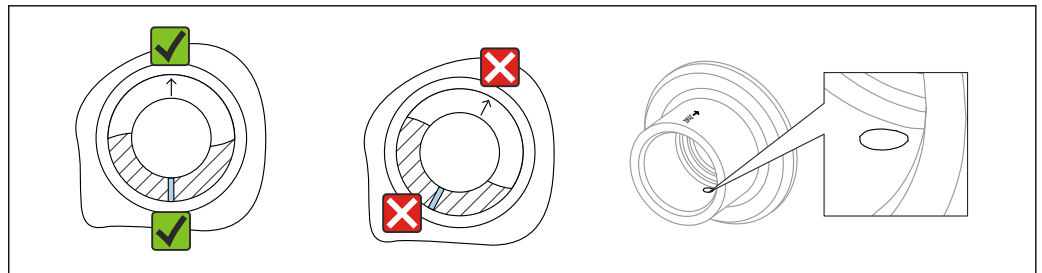
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9 Examples of support in the event of dynamic load

i Marine approval: In the case of pipe extensions or sensors longer than 1 600 mm, a support is needed at least every 1 600 mm.

5.1.6 Weld-in adapter with leakage hole

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



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10 Weld-in adapter with leakage hole

5.2 Mounting the device

5.2.1 Required tool

- Open-ended wrench for sensor installation
- Allen key for housing locking screw

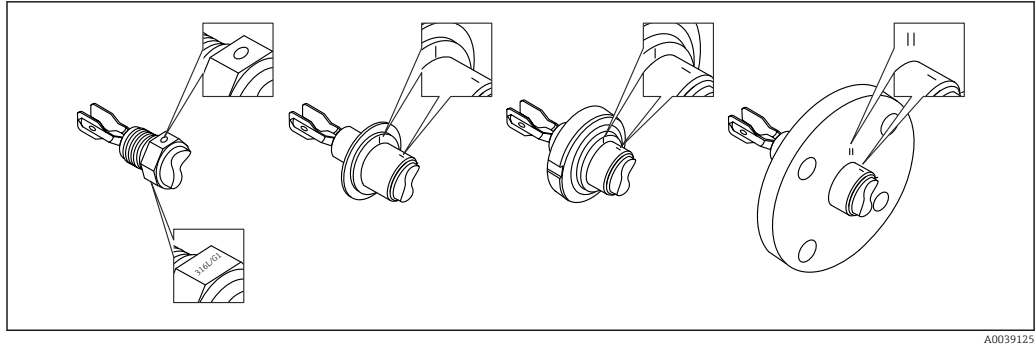
5.2.2 Installation

Align the tuning fork using the marking

The tuning fork can be aligned using the marking. Medium can thus run off easily and buildup is avoided.

Markings may include the following:

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

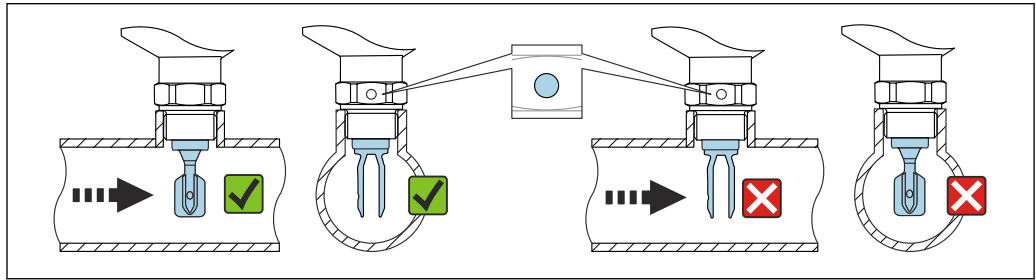


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11 Markings to align the tuning fork

Installing in pipes

- Flow velocity up to 5 m/s with a viscosity of 1 mPa·s and density of 1 g/cm³ (SGU).
Check for correct functioning 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 is pointing in the direction of flow.
- The marking is visible when installed.

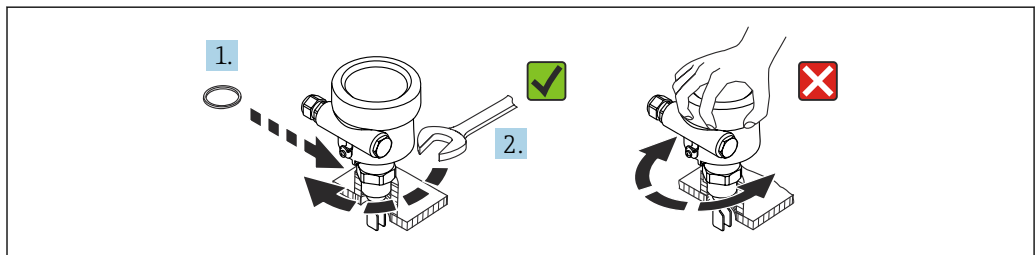


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12 Installation in pipes (take fork position and marking into consideration)

Screwing in the device

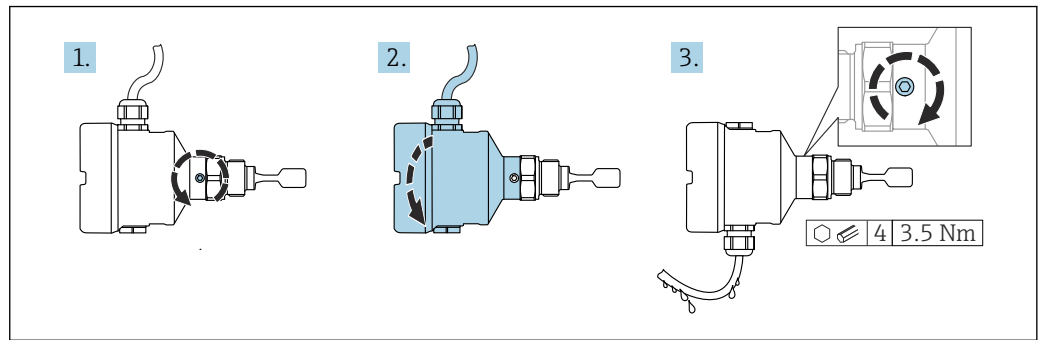
- Turn by the hex bolt only, 15 to 30 Nm (11 to 22 lbf ft)
- Do not turn at the housing!



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13 Screwing in the device

Aligning the cable entry




14 Housing with external locking screw and drip loop

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

1. Loosen the external locking screw (maximum 1.5 turns).
2. Turn the housing, align the cable entry.
 - ↳ Avoid moisture in the housing, provide a loop to allow moisture to drain off.
3. Tighten the external locking screw.

5.3 Sliding sleeves

 For more details, see the "Accessories" section.

5.4 Post-mounting check

- ☐ Is the device undamaged (visual inspection)?
- ☐ Does the measuring device meet the measuring point specifications?

For example:

 - Process temperature
 - Process pressure
 - Ambient temperature
 - Measuring range
- ☐ Are the measuring point number and labeling correct (visual inspection)?
- ☐ Is the device adequately protected from wet conditions and direct sunlight?
- ☐ Is the device properly secured?

6 Electrical connection

6.1 Required tool

- Screwdriver for electrical connection
- Allen key for screw of cover lock

6.2 Connecting requirements

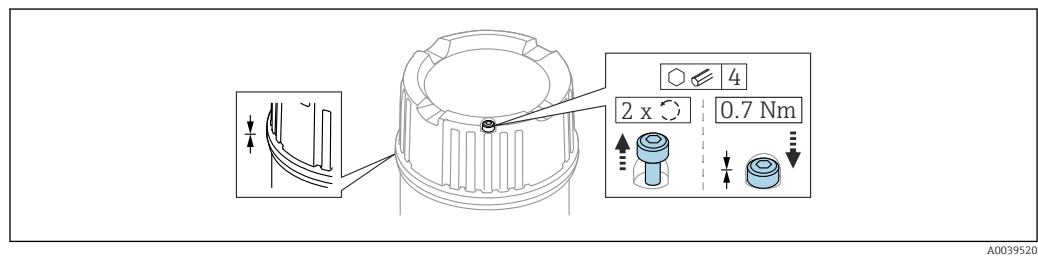
6.2.1 Cover with securing screw

In the case of devices for use in the hazardous area with a certain type of protection, the cover is sealed by a securing screw.

NOTICE

If the securing screw is not positioned correctly, the cover cannot provide secure sealing.

- ▶ Open the cover: slacken the screw of the cover lock with a maximum of 2 turns so that the screw does not fall out. Fit the cover and check the cover seal.
- ▶ Close the cover: screw the cover securely onto the housing, making sure that the securing screw is positioned correctly. There should not be any gap between the cover and housing.



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15 Cover with securing screw

6.2.2 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.

- i** The plastic housing is available with or without an external protective earth connection (PE). If the operating voltage of the electronic insert is $< 35 V$, the plastic housing has no external protective earth connection.

6.3 Connecting the device

i Housing thread

The thread of the electronics and connection compartment is coated with lubricant varnish.

- ✗** Avoid additional lubrication.

6.3.1 3-wire DC-PNP (electronic insert FEL42)

- Three-wire DC version
- Switches the load via the transistor (PNP) and separate connection, e.g. in conjunction with programmable logic controllers (PLC), DI modules according to 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.

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



Comply with the following according to IEC/EN61010-1: provide a suitable circuit breaker for the device and limit the current to 500 mA, e.g. by installing 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 5 s.

Load current

$$I \leq 350 \text{ mA with overload and short-circuit protection}$$

Residual current

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

Residual voltage

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

Behavior of output signal

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

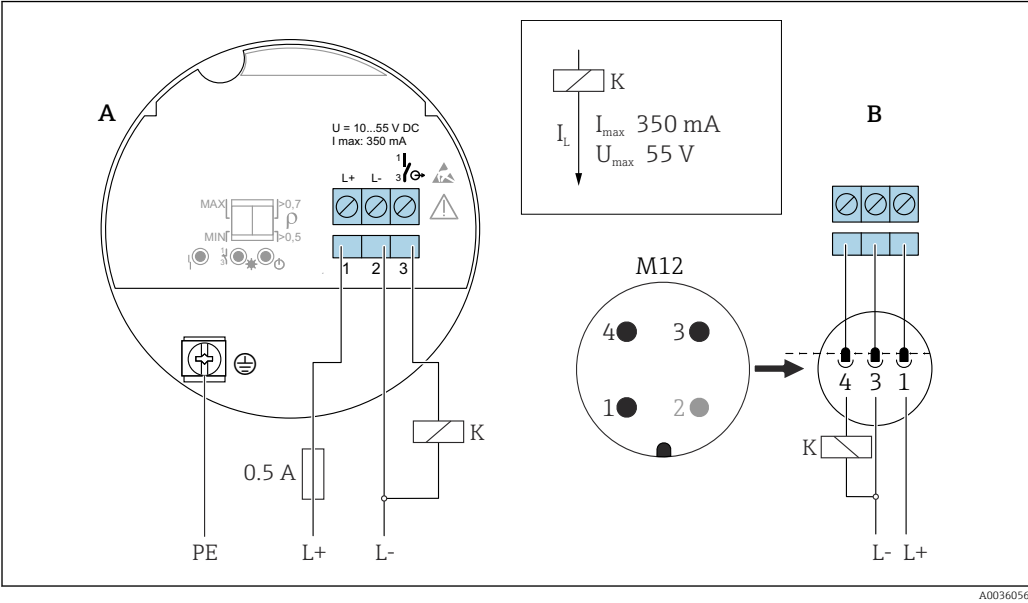
Terminals

Terminals for cable cross-section up to 2.5 mm^2 (14 AWG). Use ferrules for the wires.

Overvoltage protection

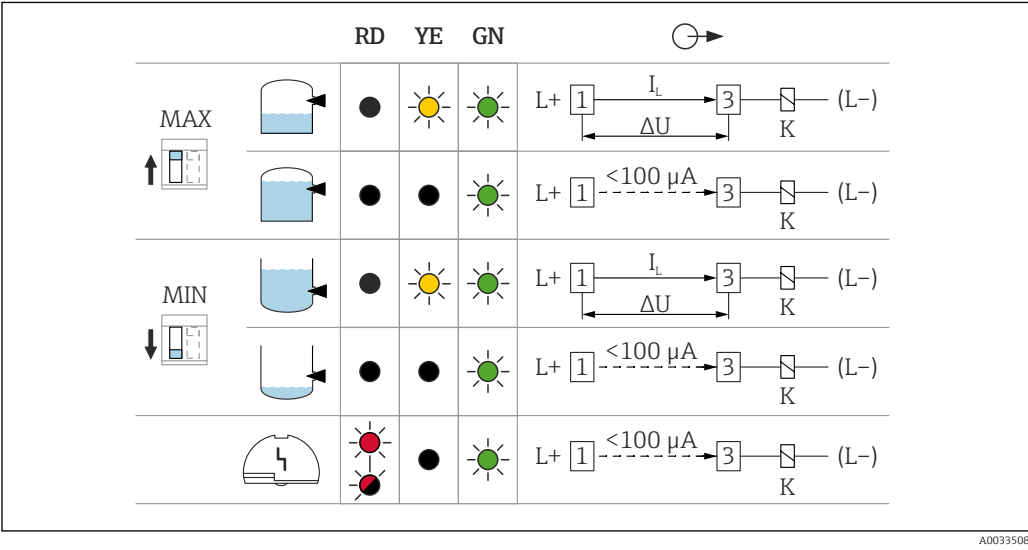
Overvoltage category II

Terminal assignment



16 Terminal assignment FEL42
A Terminal assignment at electronic insert
B Terminal assignment at M12 plug according to EN61131-2 standard

Behavior of the switch output and signaling



17 FEL42 switching behavior, signaling LED
MAX DIP 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

6.3.2 Universal current connection with relay output (electronic insert FEL44)

- Switches the loads via 2 potential-free change-over contacts
- 2 separate change-over contacts (DPDT)

⚠ WARNING

An error at the electronic insert can cause the permitted temperature for touch-safe surfaces to be exceeded. This presents a risk of burns.

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

Supply voltage

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



Comply with the following according to IEC/EN61010-1: provide a suitable circuit breaker for the device and limit the current to 500 mA, e.g. by installing a 0.5 A fuse (slow-blow) in the power supply circuit.

Power consumption

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

Connectable load

Loads switched via 2 potential-free changeover contacts (DPDT)

- $I_{AC} \leq 6 \text{ A}$ (Ex de 4 A), $U \sim \leq AC 253 \text{ V}$; $P \sim \leq 1\,500 \text{ VA}$, $\cos \varphi = 1$, $P \sim \leq 750 \text{ VA}$, $\cos \varphi > 0.7$
- $I_{DC} \leq 6 \text{ A}$ (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 $\leq 300 \text{ V}$.

Use electronic insert FEL42 DC PNP 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 inductance, provide a spark suppressor 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 of output signal

- OK status: relay energized
- Demand mode: relay de-energized
- Alarm: relay de-energized

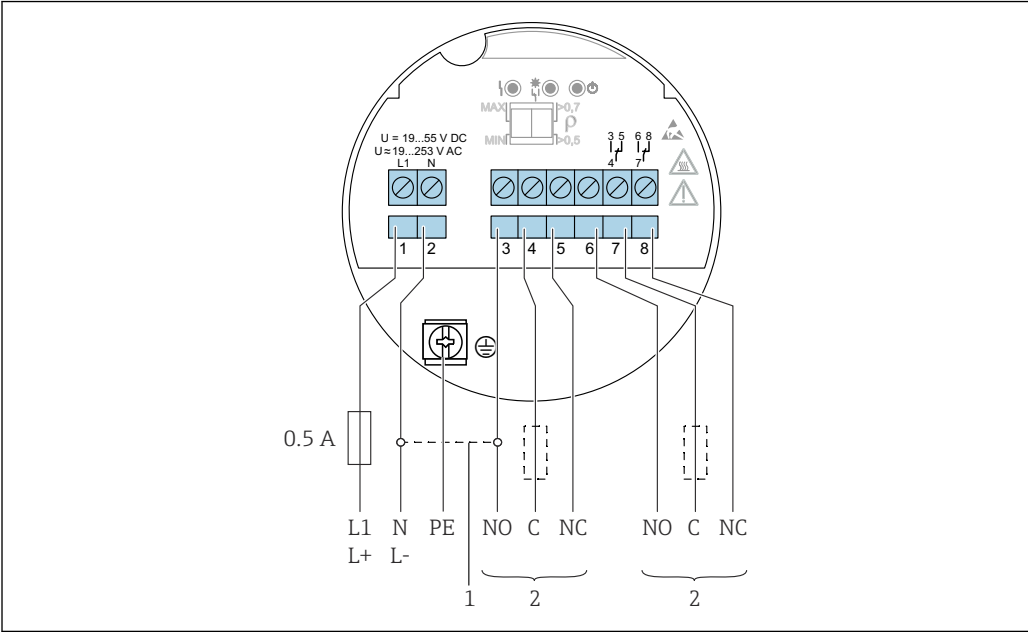
Terminals

Terminals for cable cross-section up to 2.5 mm^2 (14 AWG). Use ferrules for the wires.

Overvoltage protection

Overvoltage category II

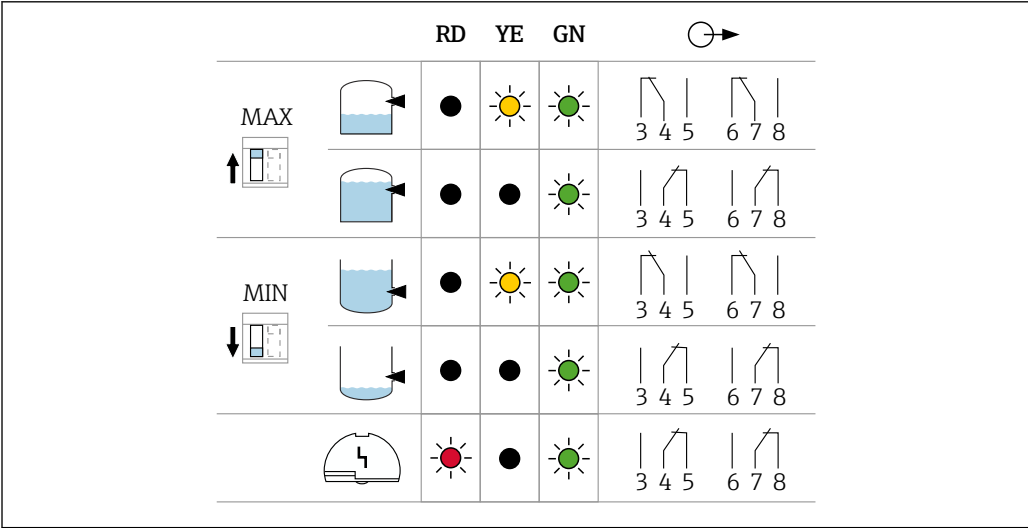
Terminal assignment



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



19 FEL44 switching behavior, signaling LED

- 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

6.3.3 2-wire NAMUR $> 2.2 \text{ mA}/< 1.0 \text{ mA}$ (electronic insert FEL48)

- To connect to isolating amplifiers according to NAMUR (IEC 60947-5-6), e.g. Nivotester FTL325N from Endress+Hauser
- To connect to isolating amplifiers of third-party suppliers according to NAMUR (IEC 60947-5-6), a permanent power supply for the electronic insert FEL48 must be ensured
- Signal transmission H-L edge 2.2 to $3.8 \text{ mA}/0.4$ to 1.0 mA according to NAMUR (IEC 60947-5-6) on two-wire cabling

Supply voltage

$$U = 8.2 \text{ V}_{\text{DC}}$$

-  Comply with the following according to 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

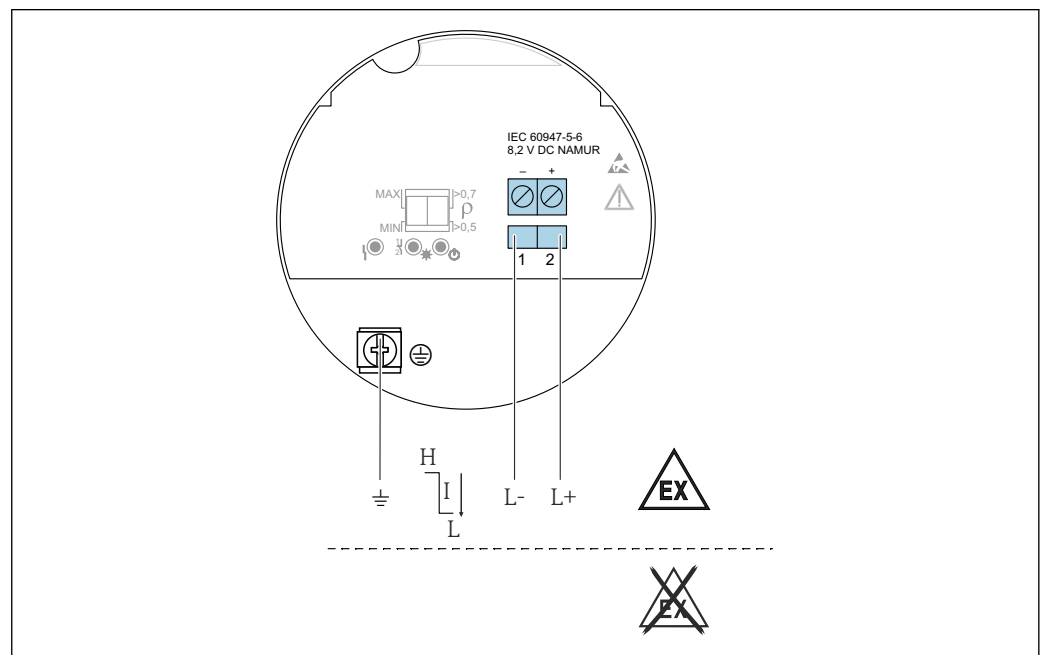
Terminals


Terminals for cable cross-section up to 2.5 mm^2 (14 AWG). Use ferrules for the wires.

Overvoltage protection

Overvoltage category II

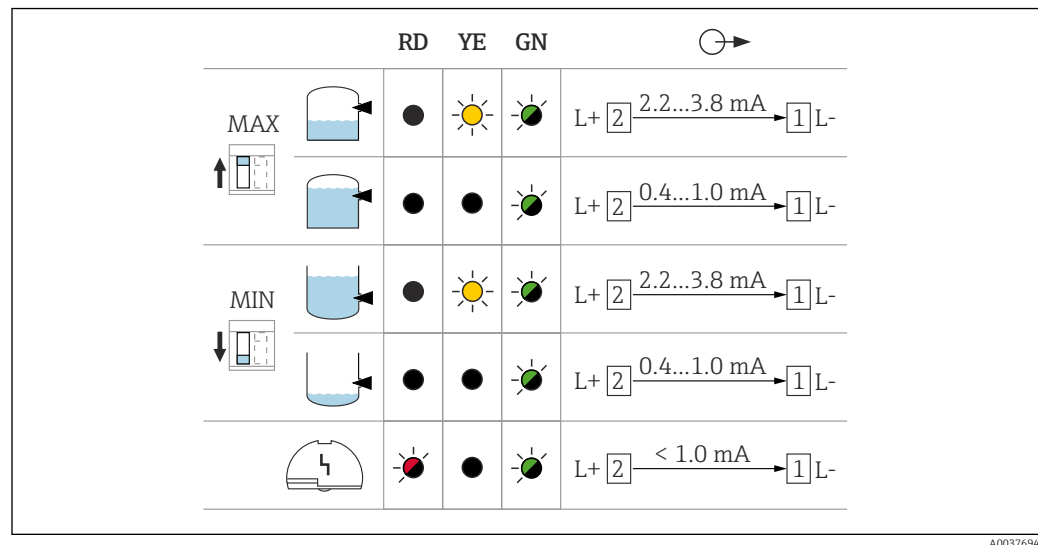
Terminal assignment



 20 2-wire NAMUR $\geq 2.2 \text{ mA}/\leq 1.0 \text{ mA}$, electronic insert FEL48

A0036058

Behavior of the switch output and signaling



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

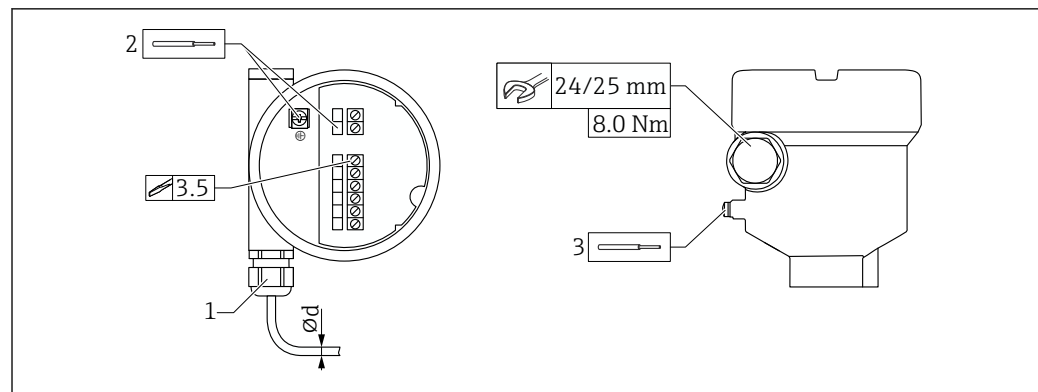
YE LED yellow, switch status

GN LED green, operational status, device on

6.3.4 Connecting the cables

Required tools

- Flat-blade screwdriver (0.6 mm x 3.5 mm) for terminals
- Suitable tool with width across flats AF24/25 (8 Nm (5.9 lbf ft)) for M20 cable gland



A0018023

22 Example of coupling with cable entry, electronic insert with terminals

- 1 M20 coupling (with cable entry), example
 - 2 Conductor cross-section maximum 2.5 mm^2 (AWG14), ground terminal on inside in housing + terminals on the electronics
 - 3 Conductor cross-section maximum 4.0 mm^2 (AWG12), ground terminal on outside of the housing (example: plastic housing with outer protective ground connection (PE))
- \varnothing d Nickel-plated brass 7 to 10.5 mm (0.28 to 0.41 in)
 \varnothing d Plastic 5 to 10 mm (0.2 to 0.38 in)
 \varnothing d Stainless steel 7 to 12 mm (0.28 to 0.47 in)

Pay attention to the following when using the M20 coupling

Following cable entry:

- Counter-tighten the coupling
- Tighten the union nut of the coupling with 8 Nm (5.9 lbf ft)
- Screw the enclosed coupling into the housing with 3.75 Nm (2.76 lbf ft)

6.4 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 information 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 tightened with securing screw?

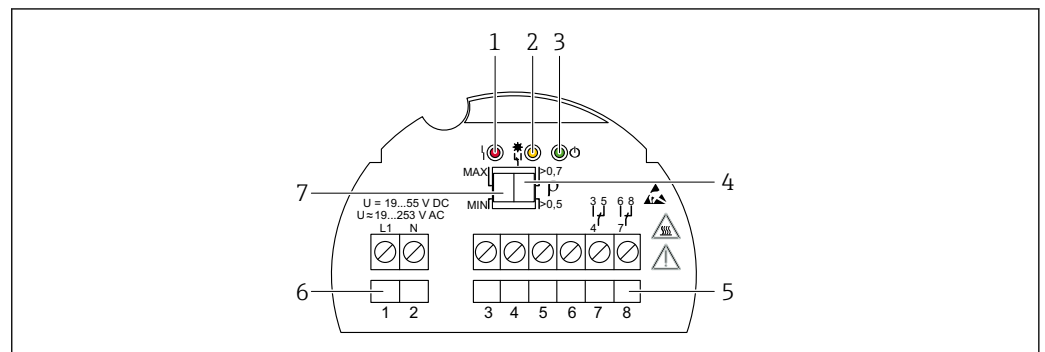
7 Operation options

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 of 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-mounting and post-connection checks have been performed:

-  Checklist in "Post-mounting check" section
-  Checklist in "Post-connection check" section

8.2 Switching on the device

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

The output is in the correct state after a maximum of 3 s following device power-up.

8.3 Further information



Further information and the documentation currently available can be found on the Endress+Hauser website: www.endress.com → Downloads.

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 on electronic insert

Green LED not lit

Possible cause: No power supply

Troubleshooting: Check plug, cable and power supply

LED flashing red

Possible cause: Overload or short-circuit in load circuit

Troubleshooting: Clear the short-circuit

Reduce maximum load current to below 350 mA

Red LED continuously lit

Possible cause: Internal sensor error or electronic fault

Troubleshooting: Replace device

9.2 Firmware history

V01.01.zz (01.2019)

- Valid for electronic inserts: FEL41, FEL44, FEL48
- Valid from documentation version: BA01893F/00/EN/01.19
- Changes: none; 1st version (original software)

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 notes

11.1.1 Repair concept

Endress+Hauser repair concept

- The 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


Incorrect repair can affect electrical safety!

Explosion Hazard!

- ▶ 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.
- ▶ 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 device components are identified by 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.

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

11.3 Return

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

1. Refer to the web page for information:
<http://www.endress.com/support/return-material>
 ↳ Select the region.
2. Return the device if repairs or a factory calibration are required, or if the wrong device was ordered or delivered.

11.4 Disposal



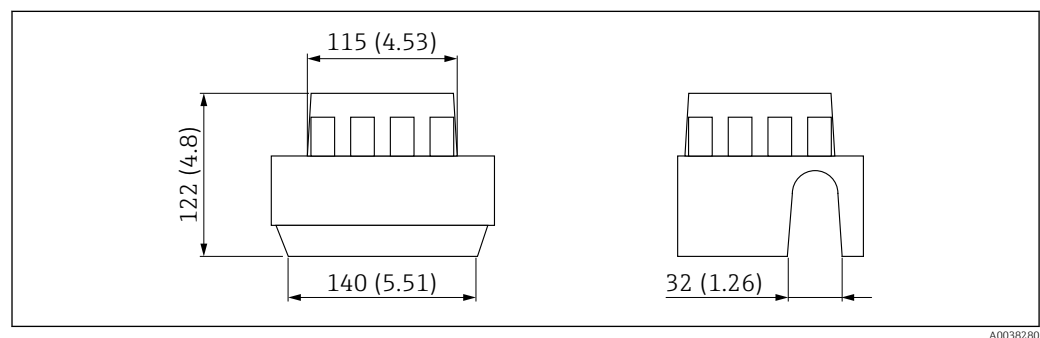
If required by the Directive 2012/19/EU on waste electrical and electronic equipment (WEEE), the product is marked with the depicted symbol in order to minimize the disposal of WEEE as unsorted municipal waste. Do not dispose of products bearing this marking as unsorted municipal waste. Instead, return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

12 Accessories

12.1 Device-specific accessories

12.1.1 Protective cover for single compartment housing, aluminum or 316L

- Material: plastic
- Order number: 71438291



24 Protective cover for single compartment housing, aluminum or 316L. Unit of measurement mm (in)

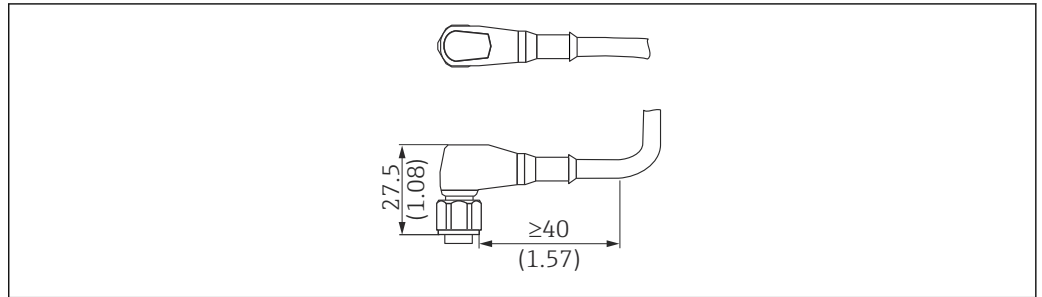
12.1.2 Plug-in jack

- 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

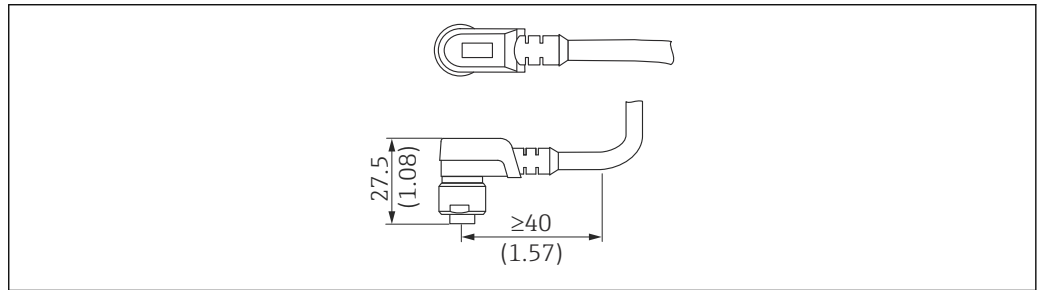


A0023713

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 (black)
- Order number: 52010285



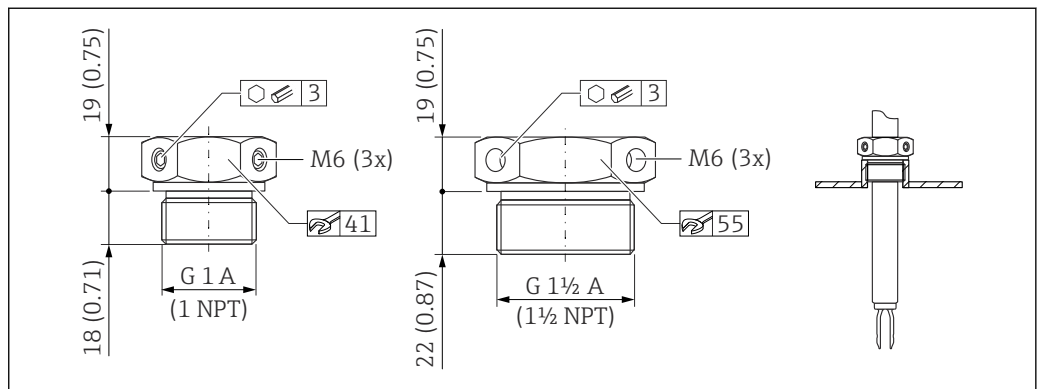
A0022292

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

12.2 Sliding sleeves for unpressurized operation

i Not suitable for use in explosive atmospheres.

Switch point, infinitely adjustable.



A0037666

27 Sliding sleeves for unpressurized operation $p_e = 0$ bar (0 psi). Unit of measurement mm (in)

G 1, DIN ISO 228/I

- 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

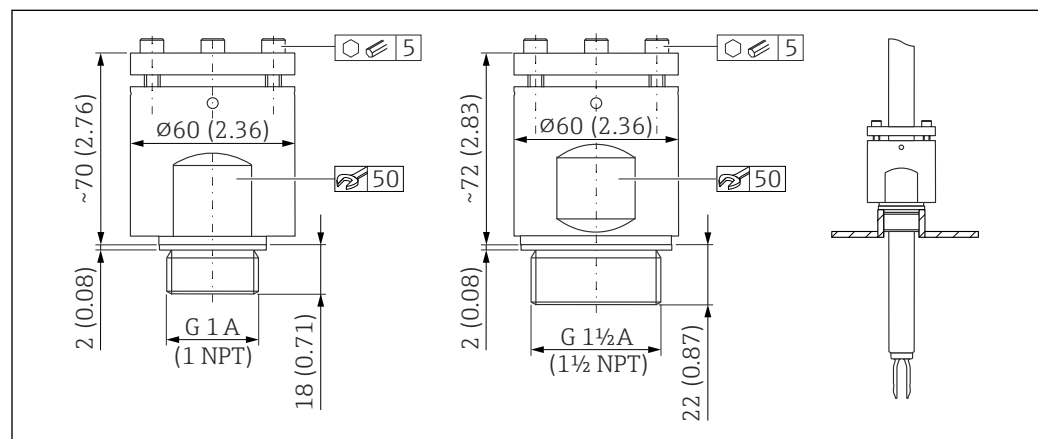
- Material: 1.4435 (AISI 316L)
- Weight: 0.54 kg (1.19 lb)
- Order number: 52003981
- Order number: 52011891, approval: with inspection certificate EN 10204 - 3.1 material

 More detailed information and documentation are available:

- Product Configurator on the Endress+Hauser website www.endress.com
- Endress+Hauser sales organization www.addresses.endress.com

12.3 High pressure sliding sleeves

- Switch point, infinitely adjustable
- Use in explosive atmospheres
- Seal package made of graphite
- Graphite seal available as spare part 71078875
- For G 1, G 1½: seal is included in the delivery



A0037667

 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
- Order number: 71118693

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

 More detailed information and documentation are available:

- Product Configurator on the Endress+Hauser website www.endress.com
- Endress+Hauser sales organization www.addresses.endress.com

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 potential-free changeover 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 mA / 0.4 to 1.0 mA as per IEC 60947-5-6 (NAMUR) on two-wire cabling

13.2.2 Output signal

Switch output

Preset switching delay times for the point level switches can be ordered for the following areas:

- 0.5 s when the tuning fork is covered and 1.0 s when it is uncovered (factory setting)
- 0.25 s when the tuning fork is covered and 0.25 s when it is uncovered (fastest configuration)
- 1.5 s when the tuning fork is covered and 1.5 s when it is uncovered
- 5.0 s when the tuning fork is covered and 5.0 s when it is uncovered

13.2.3 Ex connection data

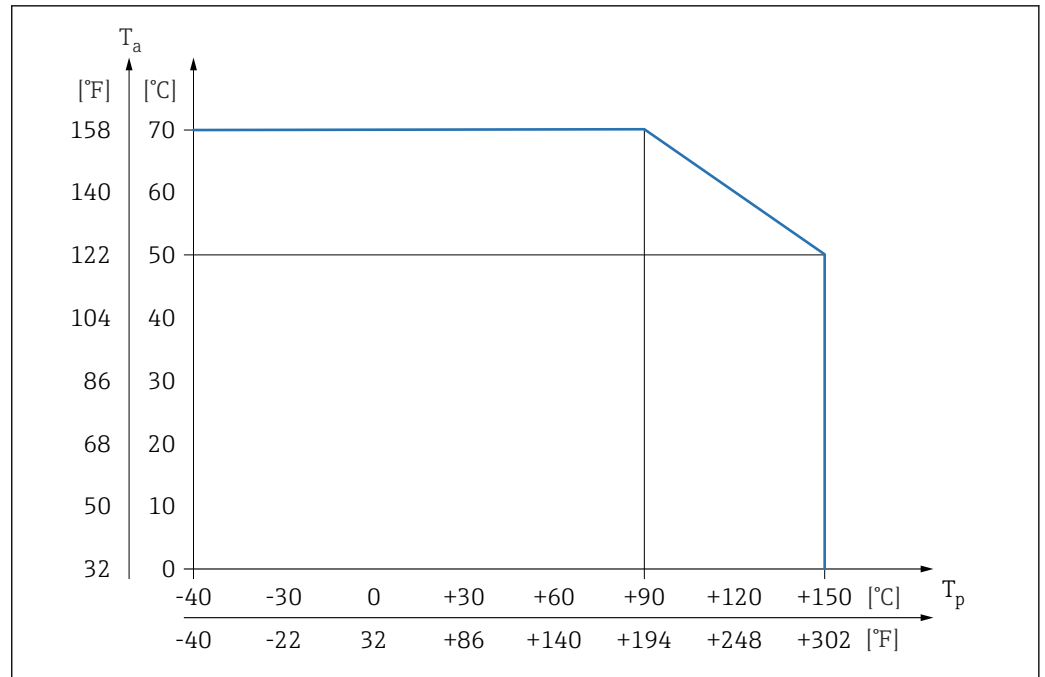
See safety instructions (XA): All data relating to explosion protection are provided in separate Ex documentation and are available from the Downloads Area of the Endress+Hauser-website. The Ex documentation is supplied as standard with all Ex devices.

13.3 Environment

13.3.1 Ambient temperature range

−40 to +70 °C (−40 to +158 °F)

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



A0038718

29 At process temperature and FEL44 $T_p > 90$ °C max. load current 4 A

If operating outdoors in strong sunlight:

- Mount the device in a shaded location
- Avoid direct sunlight, particularly in warmer climatic regions
- Use a weather protection cover, can be ordered as an accessory

Hazardous area

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).

13.3.2 Storage temperature

-40 to +80 °C (-40 to +176 °F)

13.3.3 Humidity

Operation 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


In accordance with DIN EN 60529, NEMA 250

IP66/IP68 NEMA 4X/6P

Types of housing:

- Single compartment; plastic
- Single compartment; aluminum, coated
- Single compartment; aluminum, coated; Ex d/XP

 If the "M12 plug" option is selected as the electrical connection, **IP66/67 NEMA TYPE 4X** applies for all housing types.

 Ordering information: Select the required option in the order code for "Electrical connection". Exclusion criteria are taken into account automatically.

13.3.7 Vibration resistance

As per IEC60068-2-64-2008

$a(\text{RMS}) = 50 \text{ m/s}^2$, $f = 5 \text{ to } 2\,000 \text{ Hz}$, $t = 3 \text{ axes} \times 2 \text{ h}$

13.3.8 Shock resistance

In accordance with IEC60068-2-27-2008: $300 \text{ m/s}^2 [= 30 g_n] + 18 \text{ ms}$

g_n : standard acceleration of gravity

13.3.9 Mechanical 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).

 For more details, see the "Supporting the device" section.

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**

$-40 \text{ to } +150 \text{ }^\circ\text{C}$ ($-40 \text{ to } +302 \text{ }^\circ\text{F}$)

Observe pressure and temperature dependency,  see the "Process pressure range of the sensors" section.

13.4.2 Thermal shock

$\leq 120 \text{ K/s}$

13.4.3 Process pressure range

⚠ WARNING

The maximum pressure for the device depends on the lowest-rated element, with regard to pressure, of the selected component. 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.
- ▶ Only operate the device 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 device.

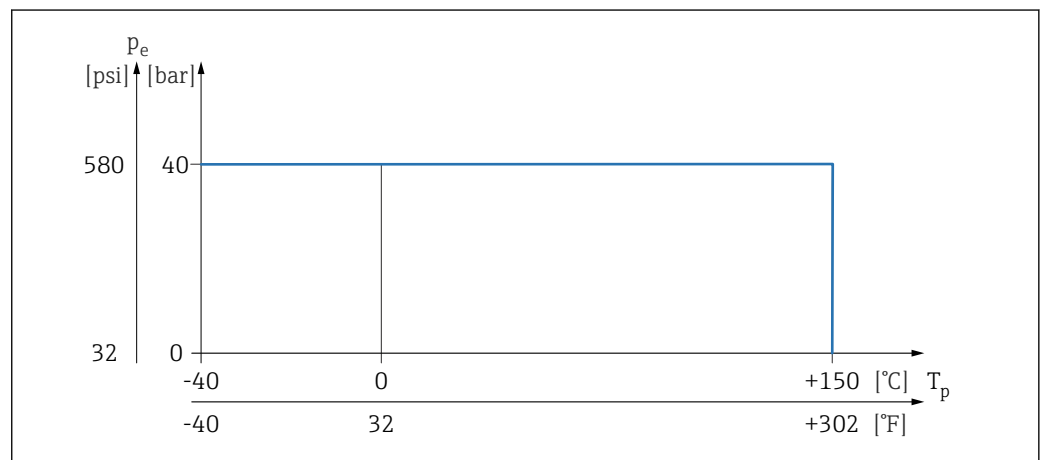
Refer to the following standards for the permitted pressure values of the flanges at higher temperatures:

- pR EN 1092-1: 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.

i Canadian CRN approval: more details about the maximum pressure values are available in the download area of the product page under: www.endress.com → Downloads.

Process pressure range of the sensors



30 Process temperature FTL41

A0038719

PN: 40 bar (580 psi)

13.4.4 Test pressure

PN = 40 bar (580 psi): test pressure = $1.5 \cdot \text{PN}$ maximum 60 bar (870 psi) depending on the selected process connection

The device function is limited during the pressure test.

Mechanical integrity is guaranteed up to 1.5 times the process nominal pressure PN.

13.4.5 Density

Liquids with density $> 0.7 \text{ g/cm}^3$

Switch position $> 0.7 \text{ g/cm}^3$ (as-delivered state)

Liquids with density 0.5 g/cm³

Switch position > 0.5 g/cm³ (can be set via DIP switch)

Optionally available: liquids with density > 0.4 g/cm³

- Optionally available, not suitable for SIL applications
- Fixed value that cannot be edited.

The function of the DIP switch is interrupted.

13.4.6 Viscosity

≤ 10 000 mPa·s

13.4.7 Pressure tightness

Up to vacuum



In vacuum evaporation plants, select the 0.4 g/cm³ density setting.

13.4.8 Solids contents

∅ ≤ 5 mm (0.2 in)

13.5 Additional technical data

Technical Information TI01402F.

Current Technical Information: Endress+Hauser website: www.endress.com → Downloads.



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