

Brief Operating Instructions

Liquiphant FTL41

Vibronic
Level switch in liquids

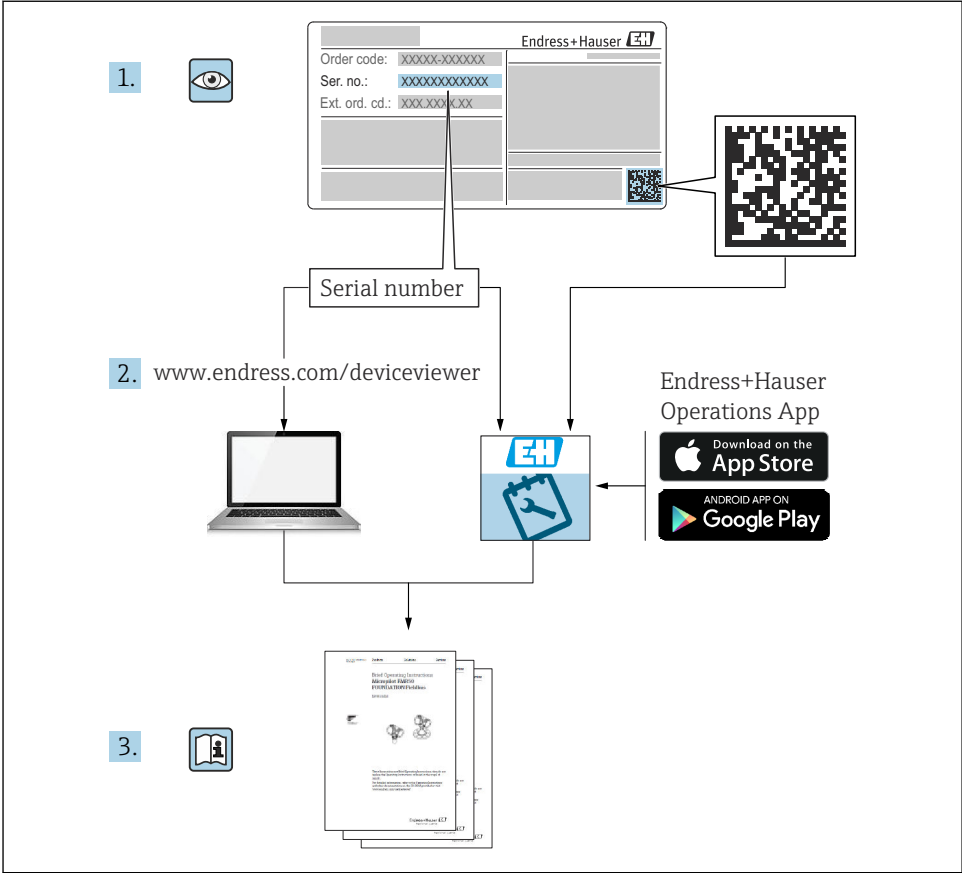


These Brief Operating Instructions are not a substitute for the Operating Instructions pertaining to the device. Detailed information can be found in the Operating Instructions and the additional documentation.

Available for all device versions via:

- Internet: www.endress.com/deviceviewer
- Smartphone/tablet: Endress+Hauser Operations app

1 Associated documentation



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2 Document information

2.1 Symbols

2.1.1 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 potentially dangerous situation. Failure to avoid this situation can result in serious or fatal injury.

 CAUTION

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

NOTICE

This symbol alerts you to a potentially harmful situation. Failure to avoid this situation can result in damage to the product or something in its vicinity.

2.1.2 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.

2.1.3 Tool symbols



Flat-blade screwdriver



Allen key



Open-ended wrench

2.1.4 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

2.1.5 Symbols in graphics

A, B, C ... View

1, 2, 3 ... Item numbers



Hazardous area



Safe area (non-hazardous area)

3 Basic safety instructions

3.1 Requirements for the personnel

The personnel must fulfill the following requirements for its tasks:

- ▶ Trained, qualified specialists must have a relevant qualification for this specific function and task.
- ▶ Are authorized by the plant owner/operator.
- ▶ Are familiar with federal/national regulations.
- ▶ Before starting work, read and understand the instructions in the manual and supplementary documentation as well as the certificates (depending on the application).
- ▶ Follow instructions and comply with basic conditions.

3.2 Intended use

The device described in this manual is intended only for the level measurement of liquids.

Do not exceed or drop below the relevant limit values for the device

 See the Technical Documentation

Incorrect use

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

Avoid mechanical damage:

- ▶ Do not touch or clean device surfaces with pointed or hard objects.

Clarification for borderline cases:

- ▶ For special media and fluids for cleaning, Endress+Hauser is glad to provide assistance in verifying the corrosion resistance of fluid-wetted materials, but does not accept any warranty or liability.

Residual risks

Due to the transfer of heat from the process and power dissipation within the electronics, the temperature of the housing may increase to up to 80 °C (176 °F) during operation. When in operation, the sensor can reach a temperature close to the medium temperature.

Danger of burns from contact with surfaces!

- ▶ In the event of elevated fluid temperatures, ensure protection against contact to prevent burns.

3.3 Workplace safety

For work on and with the device:

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

3.4 Operational safety

Damage to the device!

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

Modifications to the device

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

- ▶ If modifications are nevertheless required, consult 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 if the device ordered can be put to its intended use in the hazardous area.
- ▶ Observe the specifications in the separate supplementary documentation included as an integral part of these instructions.

3.5 Product safety

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

It meets general safety standards and legal requirements. It also complies with the EU directives listed in the device-specific EU declaration of conformity. The manufacturer confirms this by affixing the CE mark.

3.6 IT security

The manufacturer warranty is valid only if the product is installed and used as described in the Operating Instructions. The product is equipped with security mechanisms to protect it against any inadvertent changes to the settings.

IT security measures, which provide additional protection for the product and associated data transfer, must be implemented by the operators themselves in line with their security standards.

4 Incoming acceptance and product identification

4.1 Incoming acceptance

On receipt of the delivery:

1. Check the packaging for damage.
 - ↳ Report all damage immediately to the manufacturer.
Do not install damaged components.
2. Check the scope of delivery using the delivery note.
3. Compare the data on the nameplate with the order specifications on the delivery note.
4. Check the technical documentation and all other necessary documents, e.g. certificates, to ensure they are complete.



If one of the conditions is not satisfied, contact the manufacturer.

4.2 Product identification

The following options are available for identification of the device:

- Nameplate specifications
- Order code with breakdown of the device features on the delivery note
- Enter the serial numbers from the nameplates in *Device Viewer*
(www.endress.com/deviceviewer): all the information about the device is displayed.

4.2.1 Nameplate

Do you have the correct device?

The nameplate provides you with the following information on the device:

- Manufacturer identification, device designation
- Order code
- Extended order code
- Serial number
- Tag name (TAG) (optional)
- Technical values, e.g. supply voltage, current consumption, ambient temperature, communication-specific data (optional)
- Degree of protection
- Approvals with symbols
- Reference to Safety Instructions (XA) (optional)

- Compare the information on the nameplate with the order.

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)

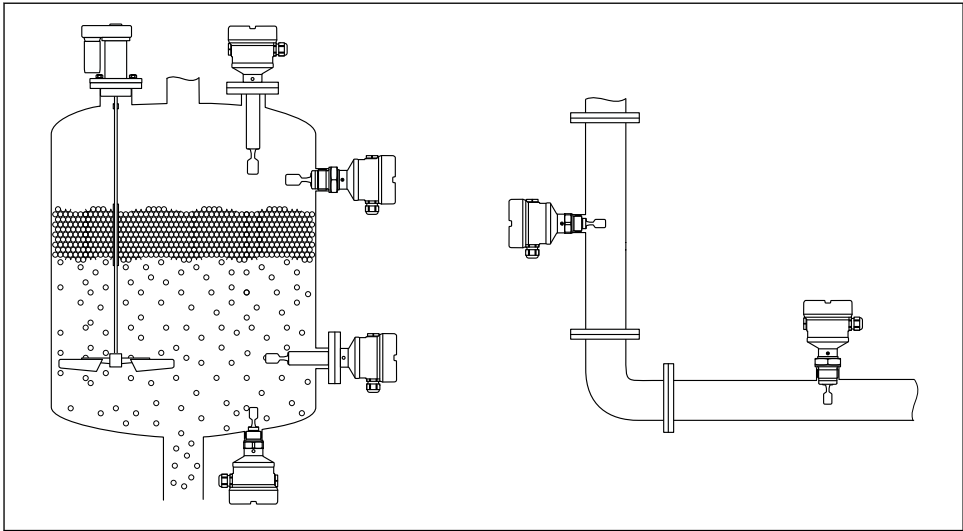
Transporting the device

- 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

5 Installation

Mounting instructions

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



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1 Installation examples for a vessel, tank or pipe

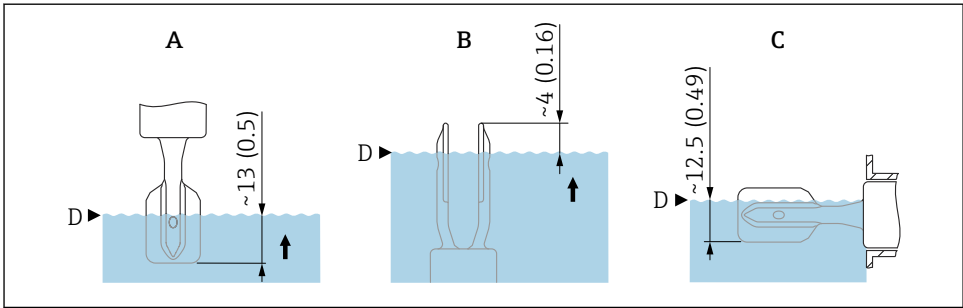
5.1 Installation requirements

5.1.1 Take switch point into consideration

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

Water +23 °C (+73 °F)

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



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2 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



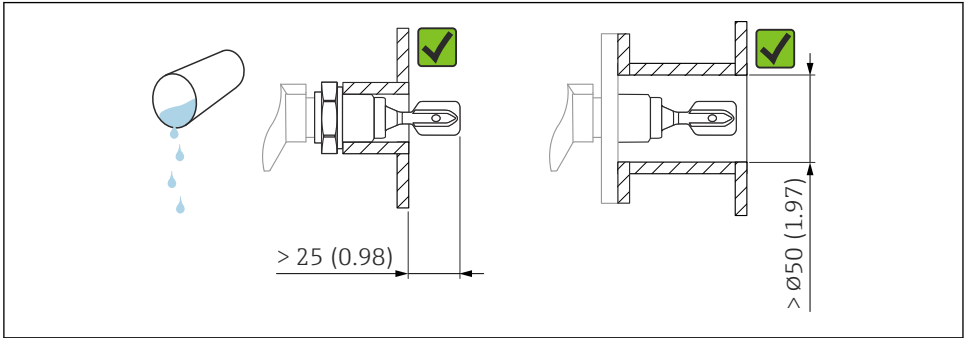
Viscosity values

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

Low viscosity



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



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

High viscosity

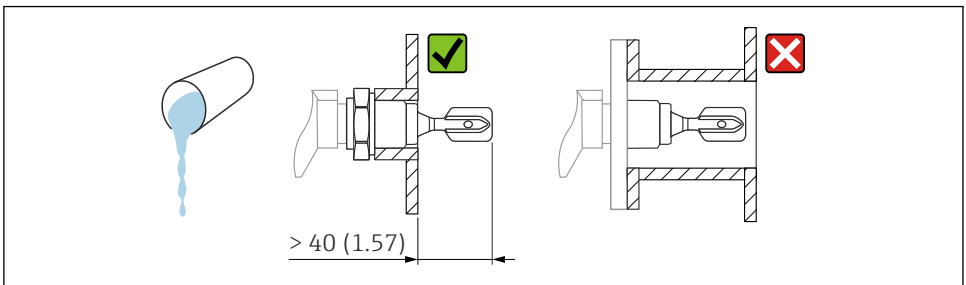
NOTICE

Highly viscous liquids may cause switching delays.

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



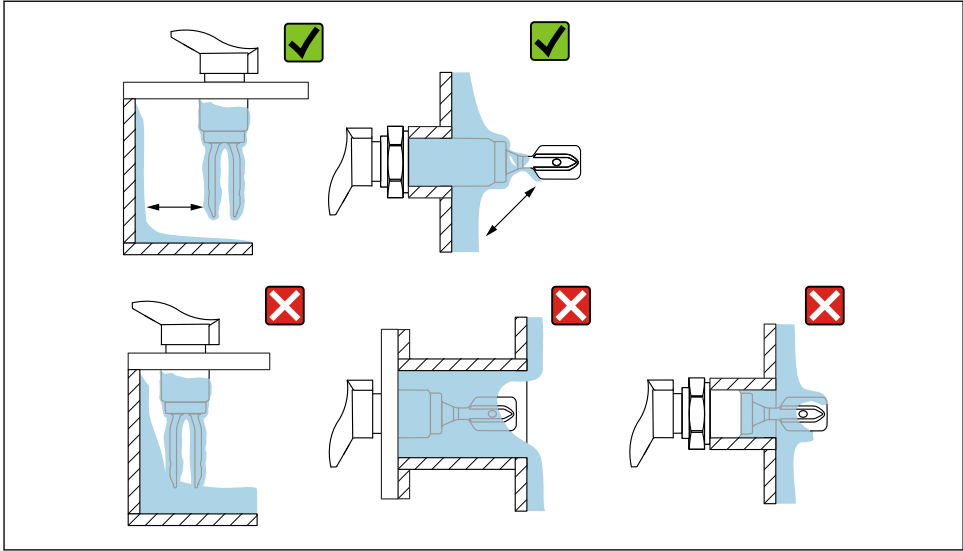
The tuning fork must be located outside the installation socket!



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

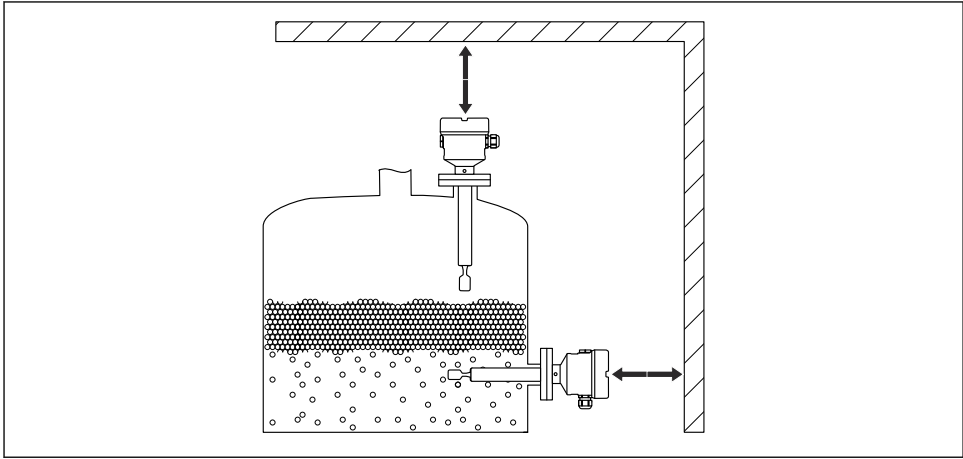
5.1.3 **Avoid buildup**



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5 *Installation examples for a highly viscous process medium*

5.1.4 **Take clearance into consideration**

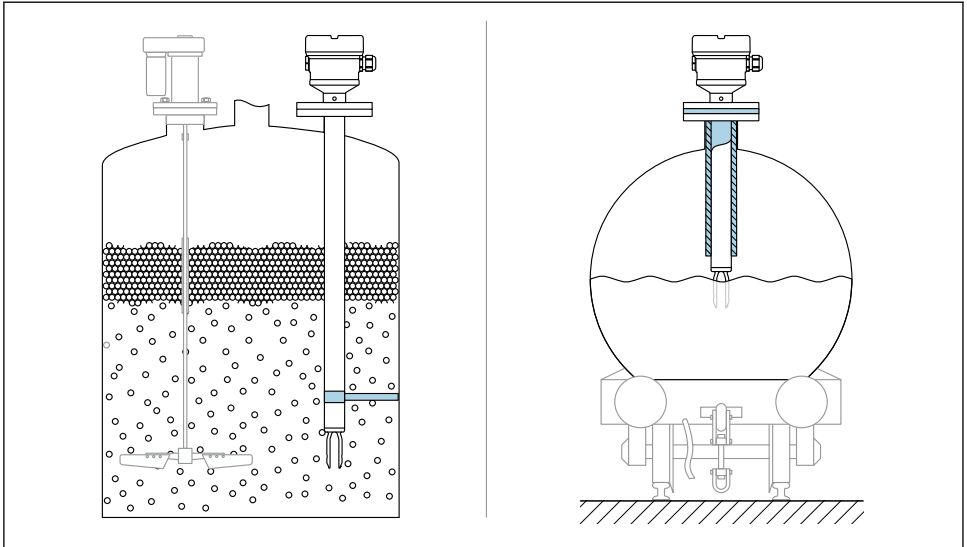


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6 *Take clearance outside the tank into consideration*

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).



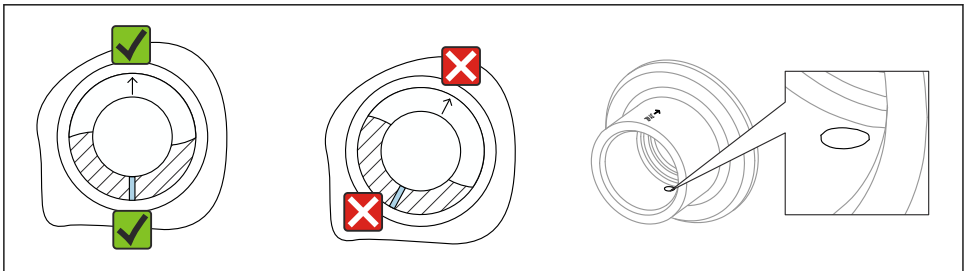
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 7 Examples of support in the event of dynamic load

 **Marine approval:** In the case of pipe extensions or sensors longer than 1 600 mm (63 in), a support is needed at least every 1 600 mm (63 in).

5.1.6 Weld-in adapter with leakage hole

Position the weld-in adapter so that the leakage hole points downwards. This allows any leakage to be detected at an early stage, as the escaping medium becomes visible.



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 8 Weld-in adapter with leakage hole

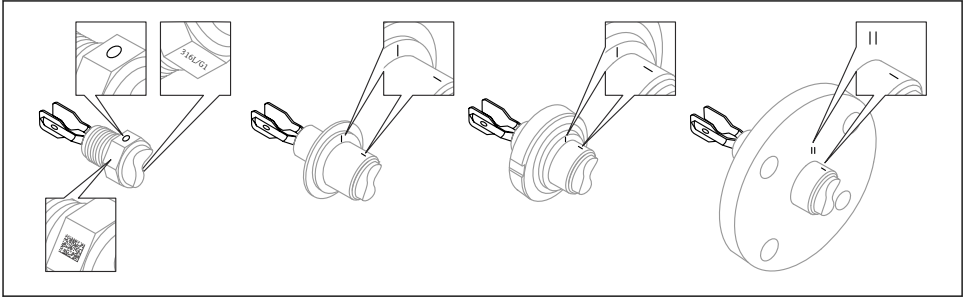
5.2 Installing the device

5.2.1 Required tool

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

5.2.2 Installation procedure

Aligning the vibrating fork using the marking



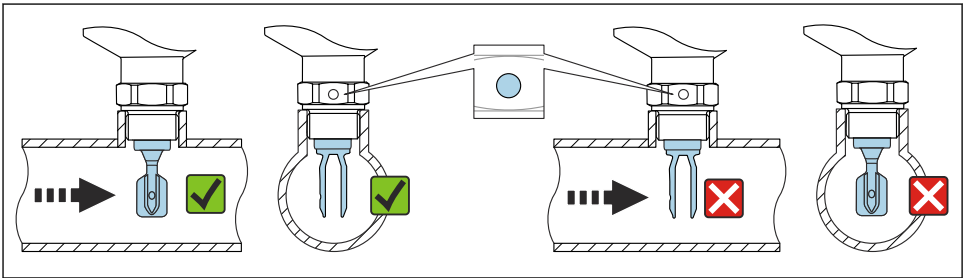
9 Position of the vibrating fork when installed horizontally in the vessel using the marking

Installing the device in piping

- Flow velocity up to 5 m/s with a viscosity of 1 mPa·s and density of 1 g/cm³ (62.4 lb/ft³) (SGU).

Check for correct functioning in the event of other process medium conditions.

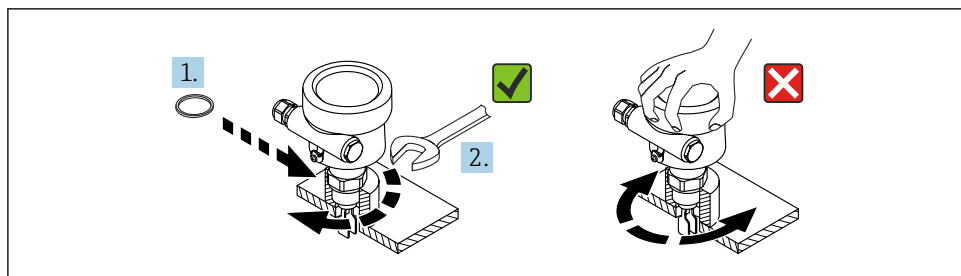
- The flow will not be significantly impeded if the tuning fork is correctly aligned and the marking is pointing in the direction of flow.
- The marking is visible when installed



10 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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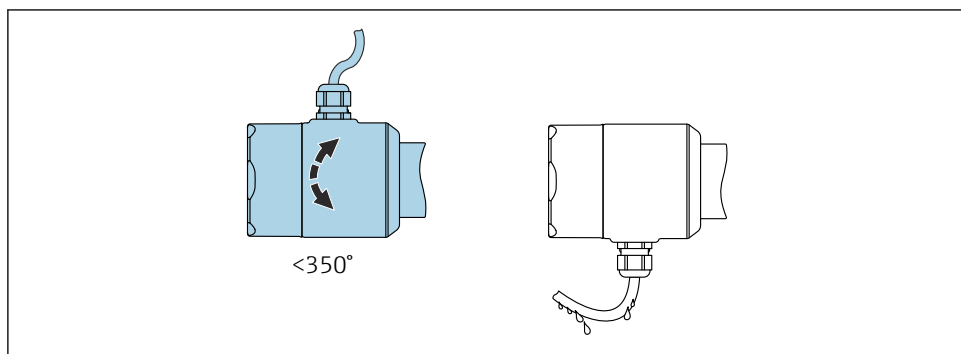
 11 Screwing in the device

Aligning the cable entry

All housings can be aligned. Forming a drip loop on the cable prevents moisture from entering the housing.

Housing without set screw

The device housing can be rotated up to 350°.



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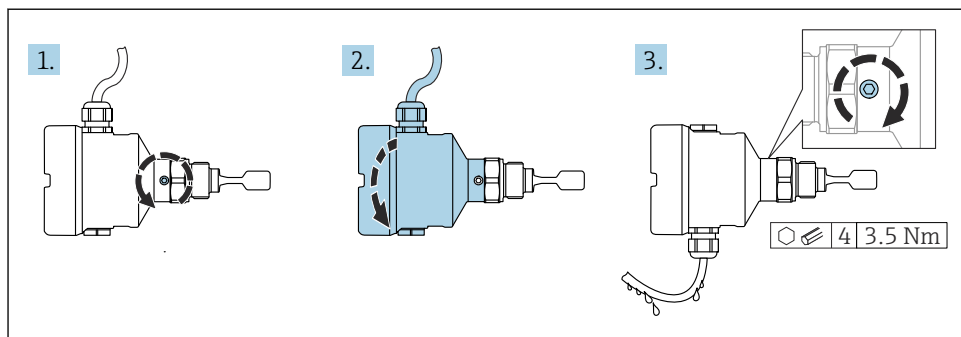
 12 Housing without set screw; form a drip loop on the cable.

Housing with locking screw



In the case of housings with locking screw:

- The housing can be turned and the cable aligned by loosening the locking screw. A cable loop for draining prevents moisture in the housing.
- The locking screw is not tightened when the device is delivered.



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13 Housing with external locking screw; form a drip loop on the cable

1. Loosen the external locking screw (maximum 1.5 turns).
2. Turn the housing and align the cable entry.
3. Tighten the external locking screw.

Turning the housing

The housing can be rotated up to 380° by loosening the locking screw.

NOTICE

The housing cannot be unscrewed fully.

- ▶ Loosen the external locking screw by a maximum of 1.5 turns. If the screw is unscrewed too much or completely (beyond the screw anchor point), small parts (counter disk) can become loose and fall out.
- ▶ Tighten the securing screw (hexagon socket 4 mm (0.16 in)) with maximum 3.5 Nm (2.58 lbf ft) ± 0.3 Nm (± 0.22 lbf ft).

Closing the housing covers

NOTICE

Thread and housing cover damaged from dirt and fouling!

- ▶ Remove dirt (e.g. sand) on the thread of the covers and housing.
- ▶ If you continue to encounter resistance when closing the cover, check the thread again for fouling.



Housing thread

The threads of the electronics and connection compartment can be coated with an anti-friction coating.

The following applies for all housing materials:

Do not lubricate the housing threads.

6 Electrical connection

6.1 Required tool

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

6.2 Connecting requirements

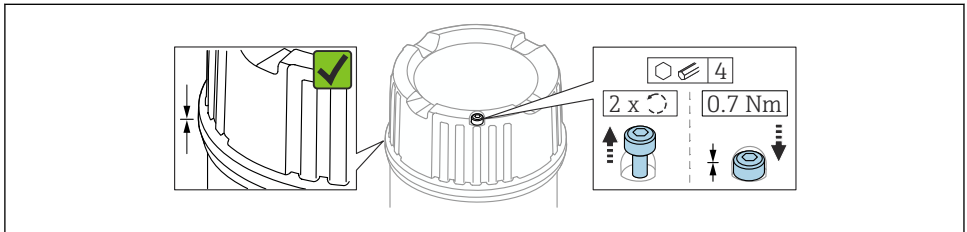
6.2.1 Cover with securing screw

The cover is locked by a securing screw in devices for use in hazardous areas with certain explosion protection.

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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 14 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.



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



Housing thread

The threads of the electronics and connection compartment can be coated with an anti-friction coating.

The following applies for all housing materials:

Do not lubricate the housing threads.

6.3.1 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 according to EN 61131-2

Supply voltage



Failure to use the prescribed power supply unit.

Risk of potentially life-threatening electric shock!

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

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



The device must be powered by a voltage supply categorized as "CLASS 2" or "SELV".



Comply with the following according to IEC 61010-1: 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

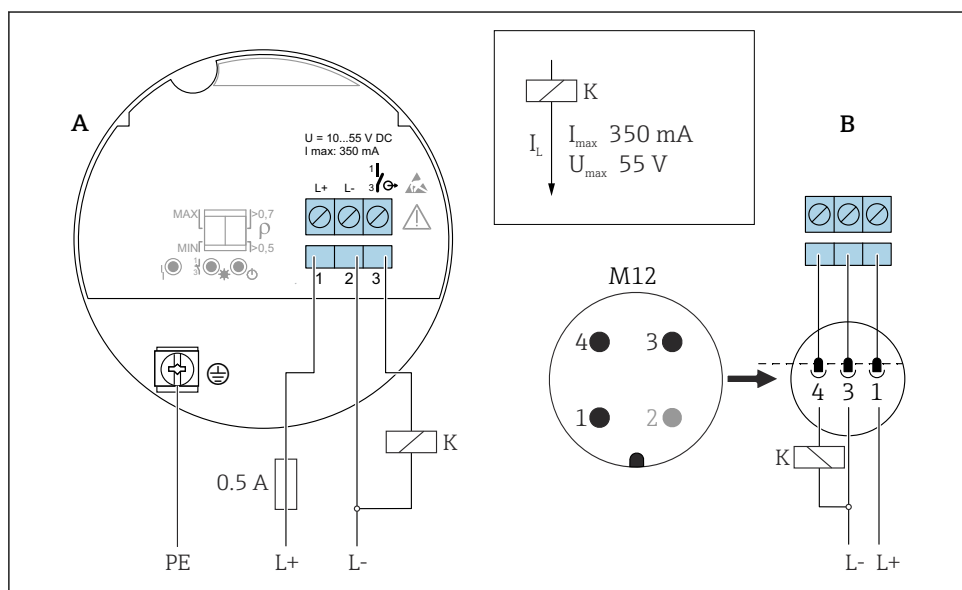
Terminals

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

Overvoltage protection

Overvoltage category I

Terminal assignment



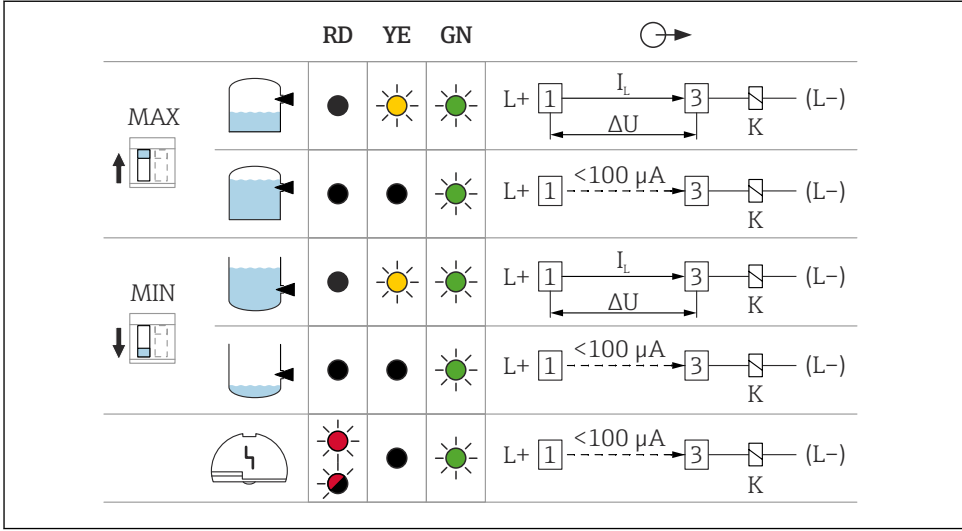
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15 Terminal assignment FEL42

A Terminal assignment at electronic insert

B Terminal assignment at M12 plug according to EN61131-2 standard

Behavior of the switch output and signaling



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16 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 two potential-free change-over contacts
- Two 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 61010-1: 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 two potential-free change-over contacts (DPDT)

- $I_{AC} \leq 6 \text{ A}$, $U \sim \leq \text{AC } 253 \text{ V}$; $P \sim \leq 1\,500 \text{ VA}$, $\cos \varphi = 1$, $P \sim \leq 750 \text{ VA}$, $\cos \varphi > 0.7$
- $I_{DC} \leq 6 \text{ A}$ to DC 30 V, $I_{DC} \leq 0.2 \text{ A}$ to 125 V



Additional restrictions for the connectable load depend on the selected approval. Pay attention to the information in the Safety Instructions (XA).

According to IEC 61010, the following applies: Total voltage from relay outputs and auxiliary 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 quenching unit 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

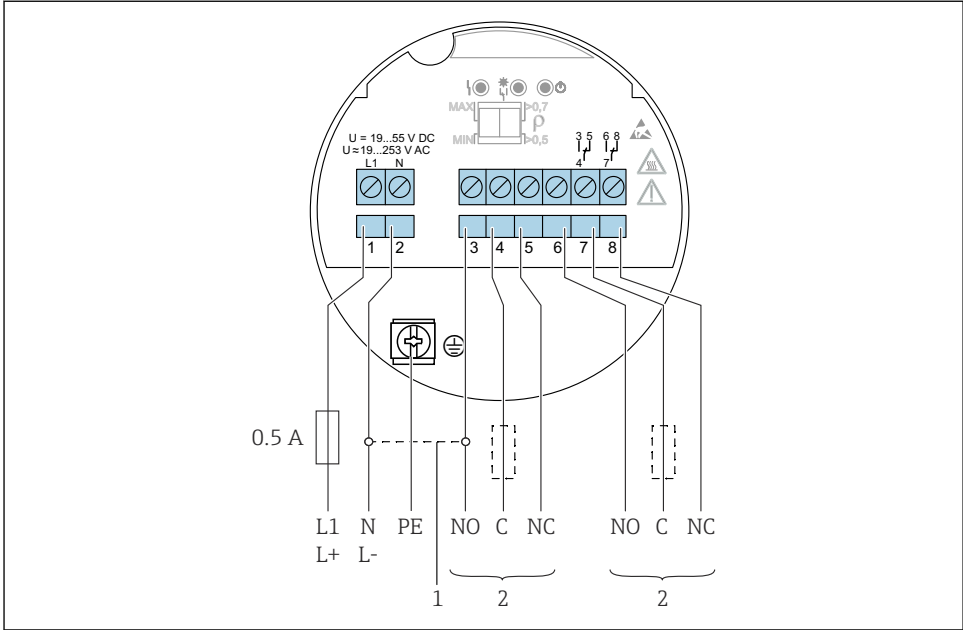
Terminals

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

Overvoltage protection

Overvoltage category II

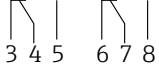
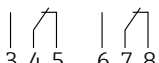
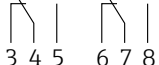
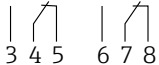
Terminal assignment



17 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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18 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

6.3.3 2-wire NAMUR > 2.2 mA/< 1.0 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 electronic insert FEL48 must be ensured
- Signal transmission H-L edge 2.2 to 3.8 mA/0.4 to 1.0 mA according to NAMUR (IEC 60947-5-6) on two-wire cabling

Supply voltage

$$U = 8.2 V_{DC}$$



The device must be powered by a voltage supply categorized as "CLASS 2" or "SELV".



Comply with the following according to IEC 61010-1: Provide a suitable circuit breaker for the device.

Power consumption

$$P < 50 \text{ mW}$$

Behavior of output signal

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

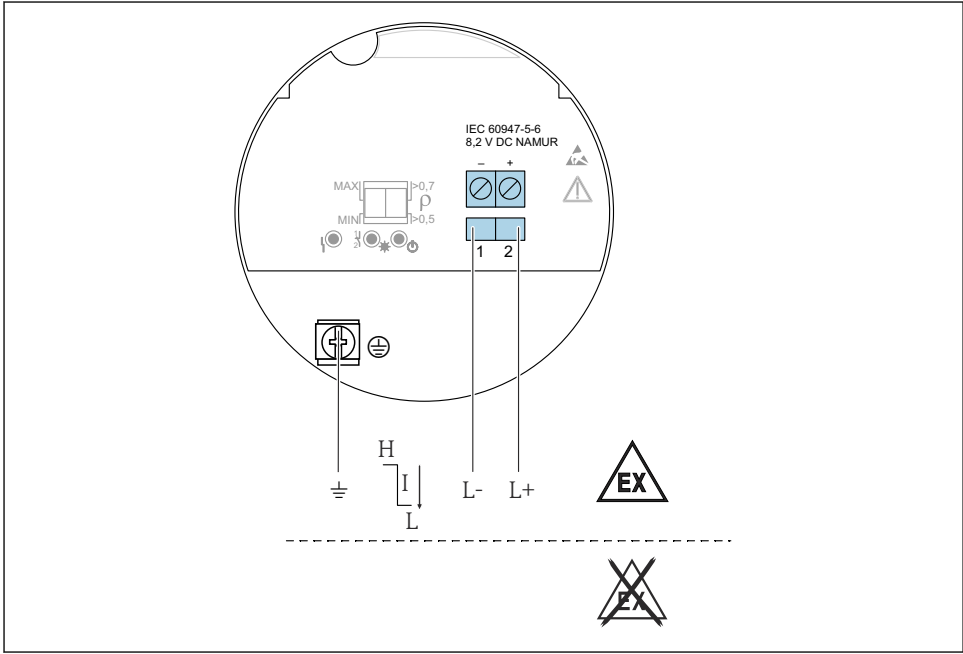
Terminals

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

Overvoltage protection

Overvoltage category I

Terminal assignment



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19 2-wire NAMUR $\geq 2.2 \text{ mA} / \leq 1.0 \text{ mA}$, electronic insert FEL48

Behavior of the switch output and signaling

		RD	YE	GN	
 MAX					L+  $2.2...3.8\text{ mA}$  L-
					L+  $0.4...1.0\text{ mA}$  L-
 MIN					L+  $2.2...3.8\text{ mA}$  L-
					L+  $0.4...1.0\text{ mA}$  L-
					L+  $< 1.0\text{ mA}$  L-

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 20 FEL48 switching behavior and signaling

MAXDIP switch for setting the MAX safety

MIN DIP switch for setting the MIN safety

RD LED red for alarm

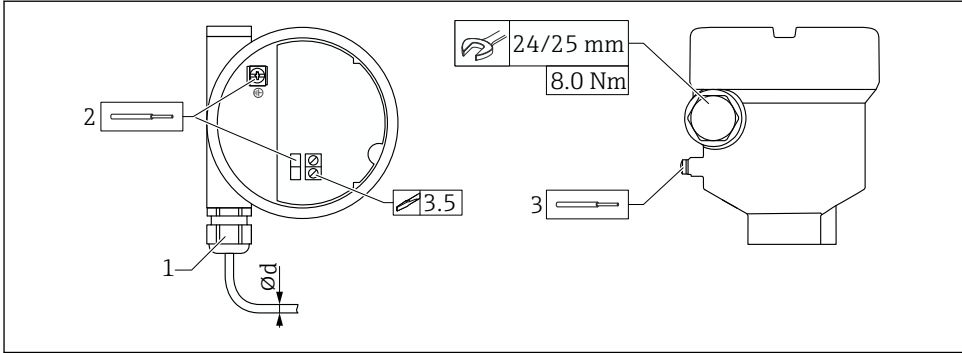
YE LED yellow, switch status

GN LED green, operational status, device on

6.3.4 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



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

- 1 M20 coupling (with cable entry), example
 - 2 Conductor cross-section maximum 2.5 mm² (AWG14), ground terminal on inside in housing + terminals on the electronics
 - 3 Conductor cross-section maximum 4.0 mm² (AWG12), ground terminal on outside of the housing (example: plastic housing with outer protective ground connection (PE))
- Ød Nickel-plated brass 7 to 10.5 mm (0.28 to 0.41 in),
 Plastic 5 to 10 mm (0.2 to 0.38 in),
 Stainless steel 7 to 12 mm (0.28 to 0.47 in)

i 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)

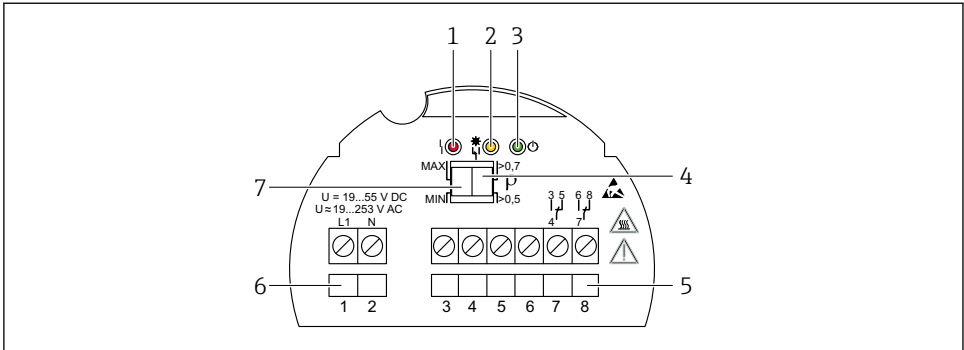
7 Operation options

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



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 22 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

See Operating Instructions.

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.



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