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Brief Operating Instructions
Liquiphant FailSafe FTL80

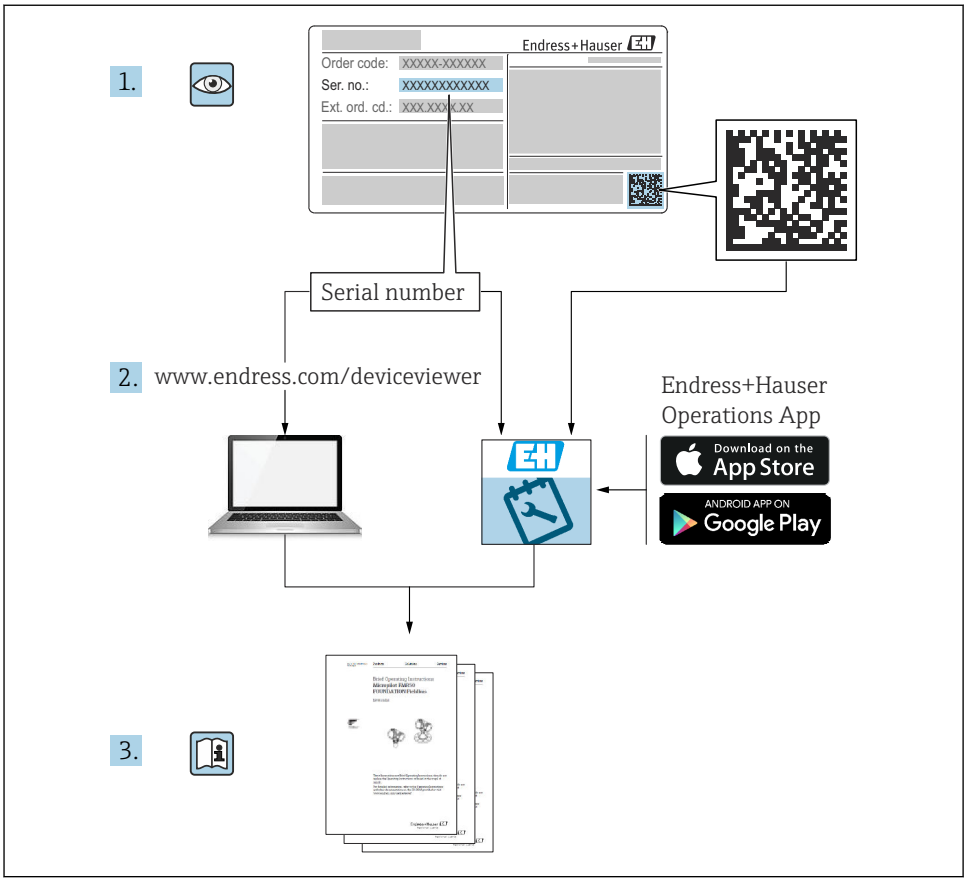
Vibronic
Compact level switch for liquids for failsafe overfill protection system

These are Brief Operating Instructions; they do not replace the Operating Instructions included in the scope of supply.
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

Endress+Hauser
People for Process Automation

1 Related documents



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2 About this document

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

1., 2., 3.
Series of steps

▶
Notice or individual step to be observed

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 Functional safety SIL

The Functional Safety Manual must be strictly observed for devices that are used in functional safety applications.

3.7 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 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

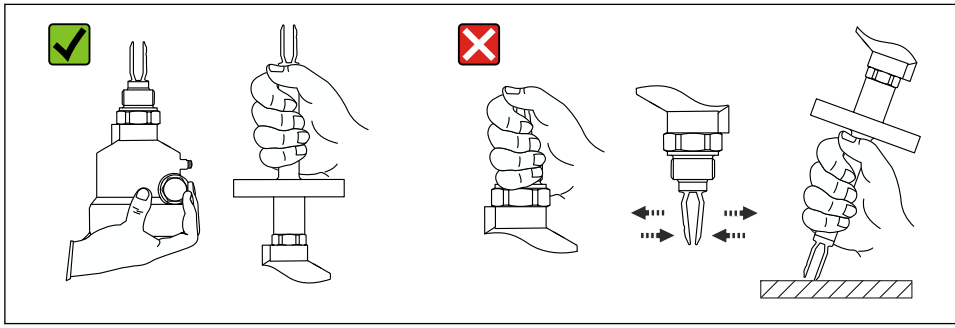
Use original packaging.

Storage temperature

−50 to +80 °C (−58 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, temperature spacer, flange or extension pipe
- Do not bend, shorten or extend the tuning fork



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1 Handling the device during transportation

5 Installation

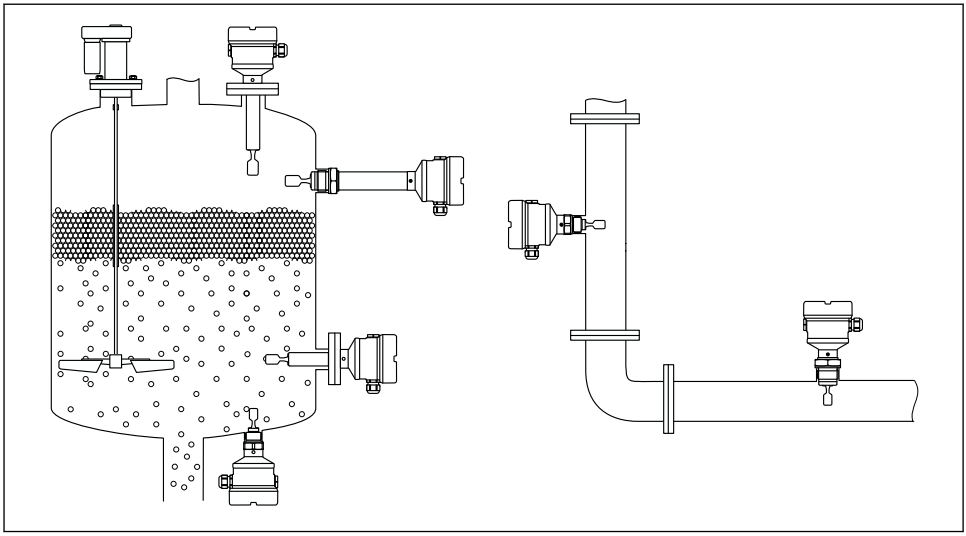
WARNING

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

► Only open the device in a dry environment!

Installation instructions

- Any orientation for compact version
- Minimum distance between the vibrating fork and the tank wall or pipe wall: 10 mm (0.39 in)



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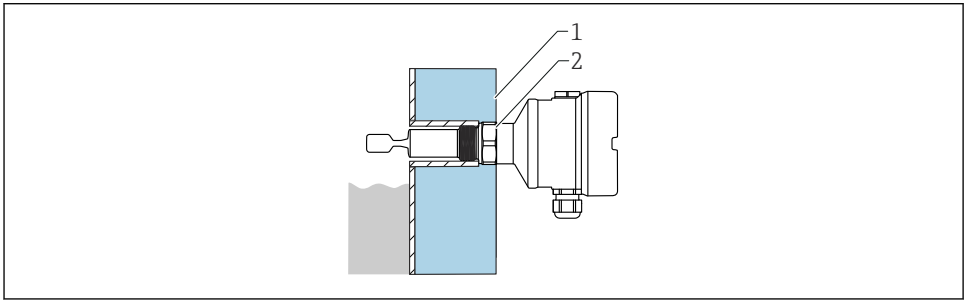
2 Installation examples for a vessel, tank or pipe

5.1 Installation requirements

5.1.1 Vessel with heat insulation

If process temperatures are high, the device should be included in the vessel insulation system to prevent the electronics from heating as a result of thermal radiation or convection. The insulation in this case should not be higher than the neck of the device.



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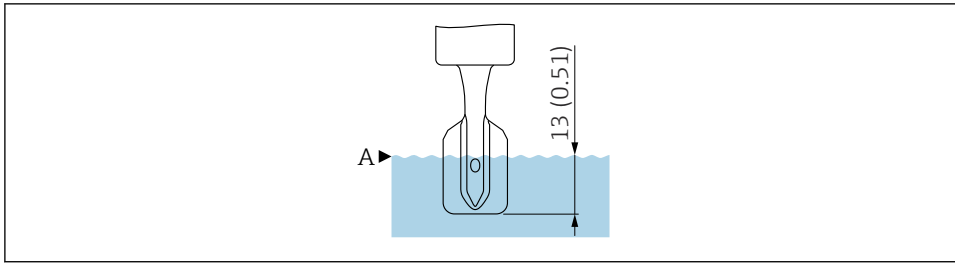
3 Example of a vessel with heat insulation

1 Vessel insulation
2 Insulation (up to the housing neck max.)

5.1.2 Taking the switch point into consideration

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



4 *Switch point at reference operating conditions. Unit of measurement mm (in)*

A Switch point

Technical data of the reference operating conditions; see Operating Instructions and Technical Information.

Outside the reference operating conditions, the switch point is in the area of the vibrating fork.

5.1.3 Viscosity depending on the mode of operation

With regard to the viscosity of the medium, the restrictions for applications involved in safety-related operation must be observed, as specified in the Functional Safety Manual.

Align the vibrating fork so that the narrow sides of the vibrating fork point upwards and downwards, allowing the liquid to drain off properly.

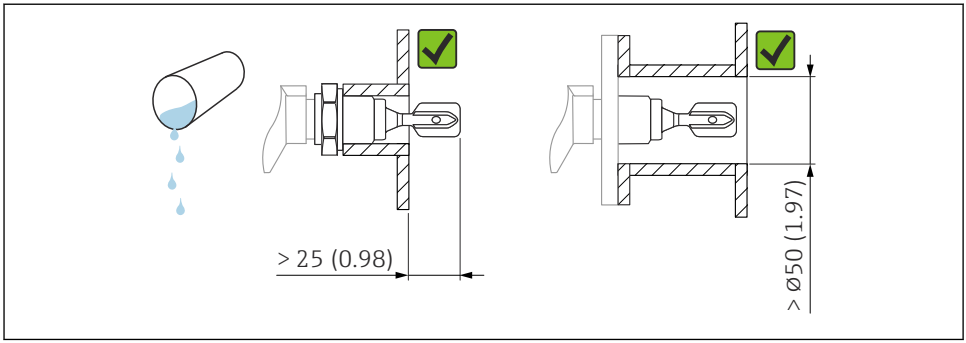
Maximum detection: ≤ 10 000 mPa·s

Minimum detection: ≤ 350 mPa·s

Minimum detection, high temperature 230 to 280 °C (450 to 536 °F): ≤ 100 mPa·s

Low viscosity

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



5 Example of installation for low-viscosity liquids. Unit of measurement mm (in)

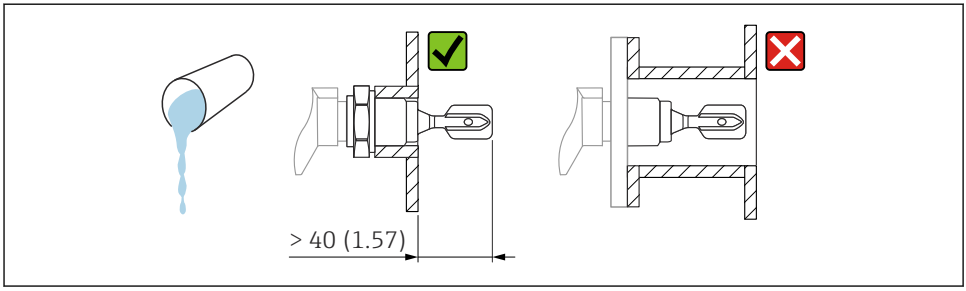
High viscosity

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!



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

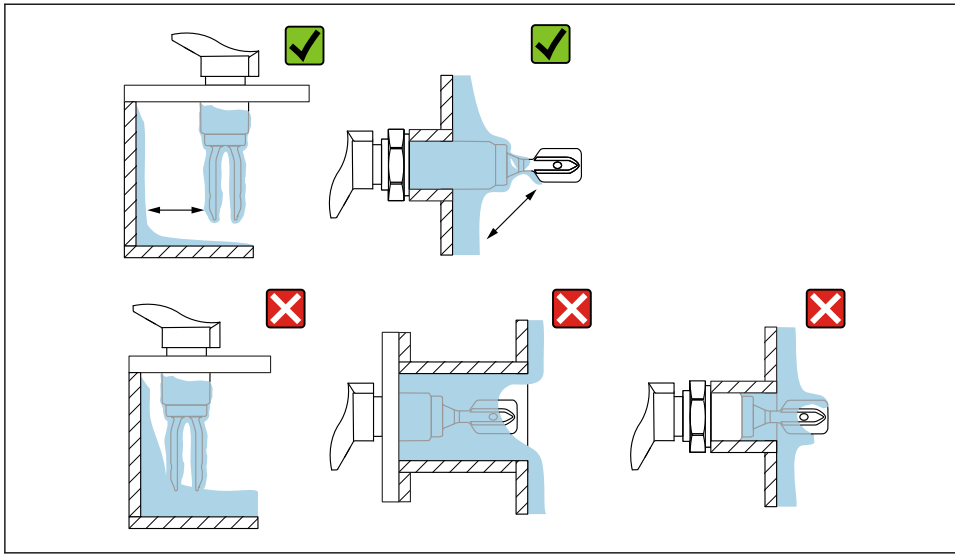
5.1.4 Preventing buildup

NOTICE

Buildup formation can restrict applications during safety-related operation.

- ► Refer to the Functional Safety Manual.

Ensure that there is sufficient distance between the expected buildup on the tank wall and the fork.



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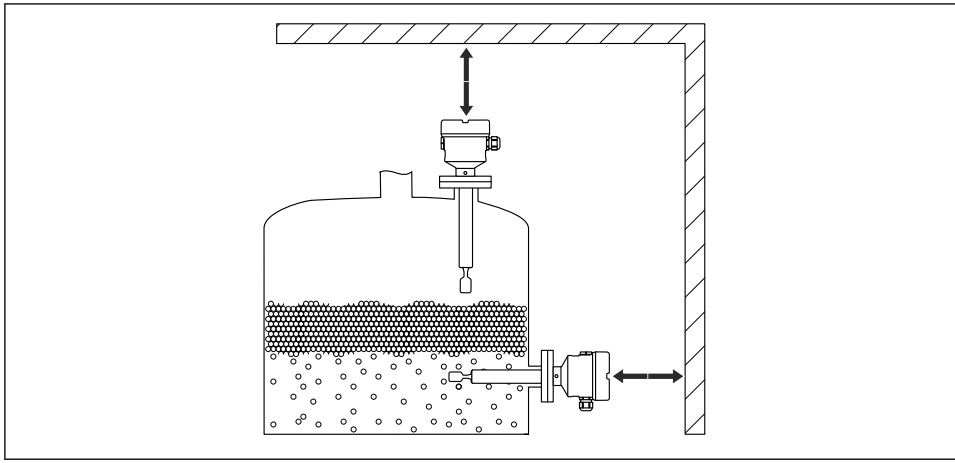
7 *Installation examples for a highly viscous process medium*

5.1.5 Take clearance into consideration



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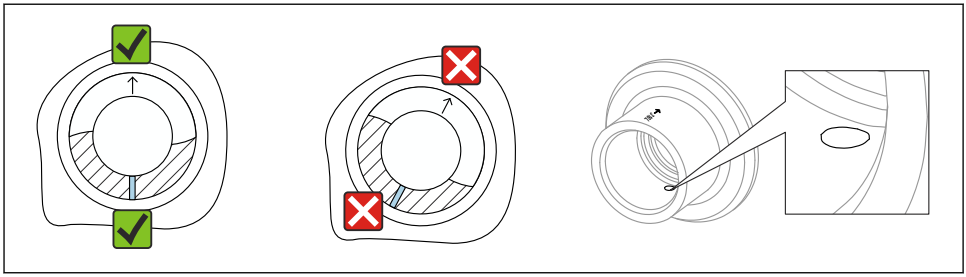
8 *Take clearance outside the tank into consideration*

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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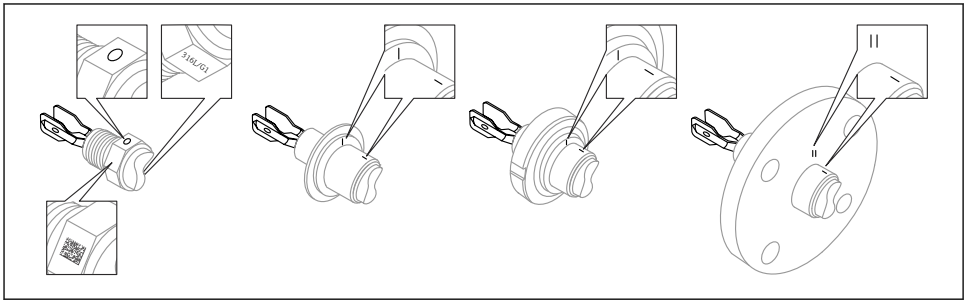
9 Weld-in adapter with leakage hole

5.2 Installing the device

5.2.1 Required tools

- Screw driver
- Open-ended wrench for sensor installation : SW32 or SW41
- Allen key for housing locking screw

5.2.2 Aligning the vibrating fork using the marking



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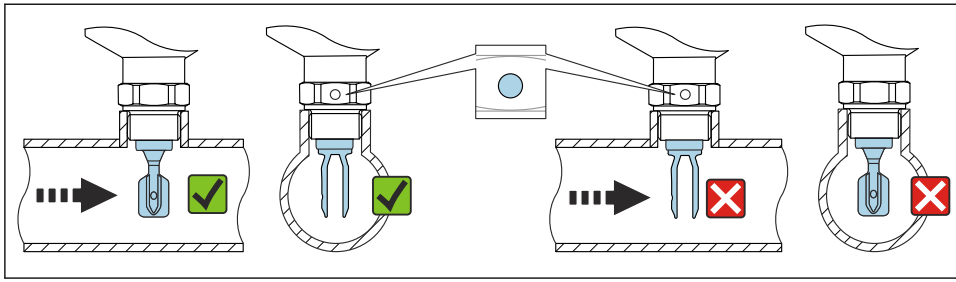
10 Position of the vibrating fork when installed horizontally in the vessel using the marking

5.2.3 Installing the device in piping

- Flow velocity up to 5 m/s with viscosity 1 mPa·s and density 1 g/cm³ (62.4 lb/ft³). Check for correct functioning in the event of other process medium conditions.
- If the vibrating fork is correctly aligned and the marking is pointing in the flow direction, the flow will not be significantly obstructed.
- The marking is visible when installed.
- Pipe diameter: ≥ 50 mm (2 in)



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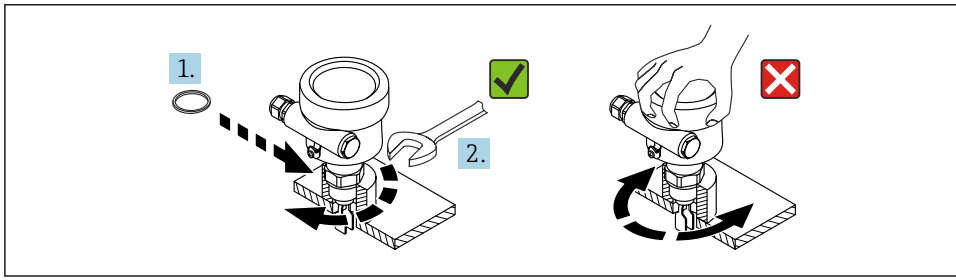
11 *Installation in pipes (take fork position and marking into consideration)*

5.2.4 Screwing in the device

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



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12 *Screwing in the device*

5.2.5 Aligning the cable entry

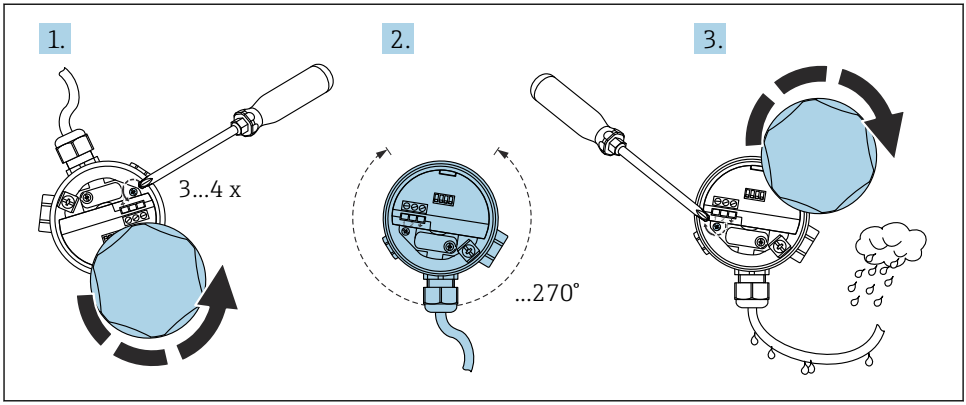
All housings can be aligned. Forming a drip loop on the cable prevents moisture from entering the housing.

Housing with locking screw (316L (F27) and 316L hygienic (F15))

The housing can be aligned using a locking screw.

Aligning the housing:

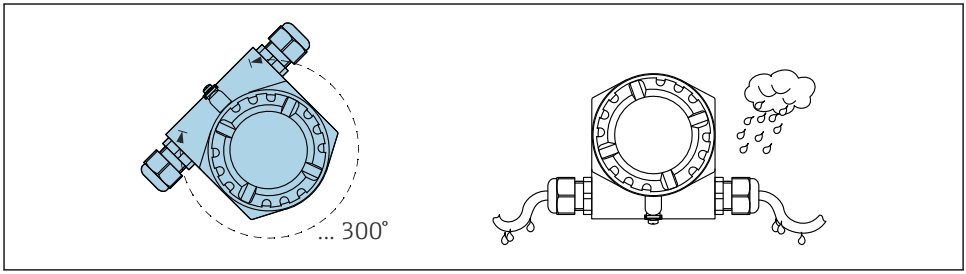
1. Open the housing cover and loosen the locking screw (3-4 rotations).
2. Rotate the housing into the correct position.
3. Tighten the locking screw with maximum 0.9 Nm and close the housing cover.



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

Housing without locking screw (plastic (F16), aluminum (F13, F17, T13))

The housing can be rotated up to 300 °.



14 *Housing without set screw; form a drip loop on the cable*

5.2.6 Sealing the housing

NOTICE

Risk of device damage due to moisture inside the housing!

The O-ring seal on the housing cover can be destroyed by mineral oil-based grease. This can allow moisture to enter the housing.

- ▶ Use only an approved lubricant such as Syntheso Glep 1 for the O-ring seal on the housing cover.

NOTICE

Risk of device damage due to moisture inside the housing!

An improperly closed housing cover or incorrectly sealed cable entries can allow moisture to enter the housing.

- ▶ Always ensure that the housing cover and cable entries are tightly closed.

5.2.7 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

NOTICE

- ▶ Comply with national standards and regulations!

6.1 Connecting requirements

6.1.1 Required tool

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

6.1.2 Connecting protective earth (PE)

The protective earth conductor at the device must only be connected if the device's operating voltage is ≥ AC 35 V or ≥ DC 16 V.

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.

6.2 Connecting the device

6.2.1 Power supply

- Nominal supply voltage: DC 24 V
- Supply voltage range: DC 12 to 30 V
- Power consumption: < 660 mW
- Reverse polarity protection: yes

6.2.2 Connectable load

R = (U - 12 V) / 22 mA

U = Supply voltage range: DC 12 to 30 V

6.2.3 Galvanic isolation

▶ Ensure galvanic isolation between the sensor and power supply.

NOTICE

▶ The device must be connected to a power supply that provides sufficient isolation for the operating voltage.

6.2.4 Overvoltage protection

Overvoltage category II (DIN EN 60664-1 VDE 0110-1)

6.2.5 Pollution degree

Pollution degree 2 (IEC 60664-1 and IEC 61010-1)

6.2.6 Mode of operation

The mode of operation (minimum detection or maximum detection) is selected via the connection coding on the electronic insert.

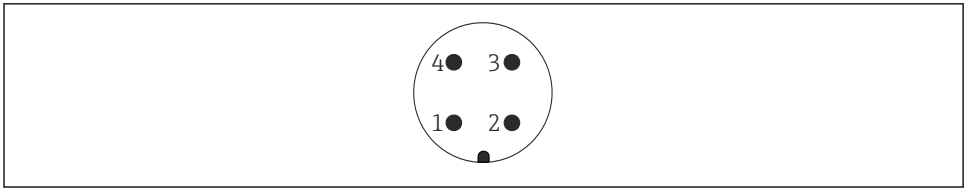
MAX = maximum detection:
- The output switches in a safety-oriented manner when the probe is covered (demand mode)
- Used, for example, for overflow protection systems
- Jamming of the vibrating fork leads to a "covered" signal (demand mode)

MIN = minimum detection:
- The output switches in a safety-oriented manner when the probe is free (demand mode)
- Used, for example, for dry-run protection
- Foam is not detected

6.2.7 Connection via M12 plug connector

For maximum detection mode of operation with an M12 plug connector, it is not necessary to open the housing for connection purposes.

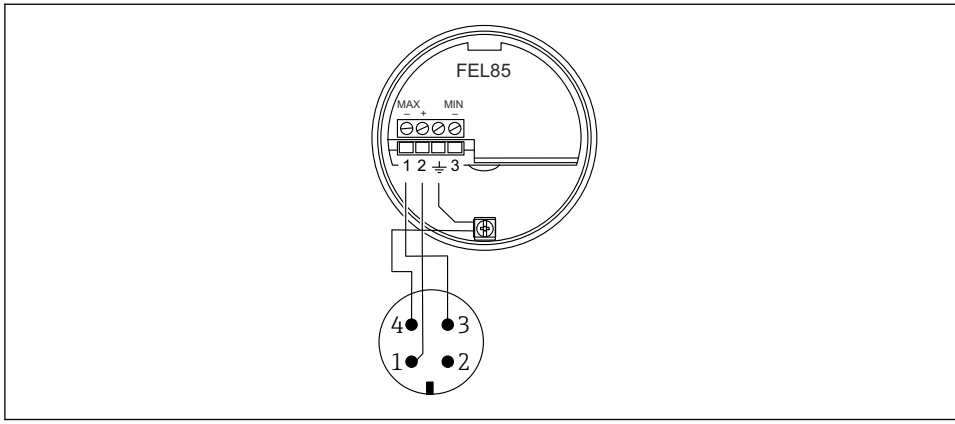
M12 plug



15 M12 plug, pin assignment

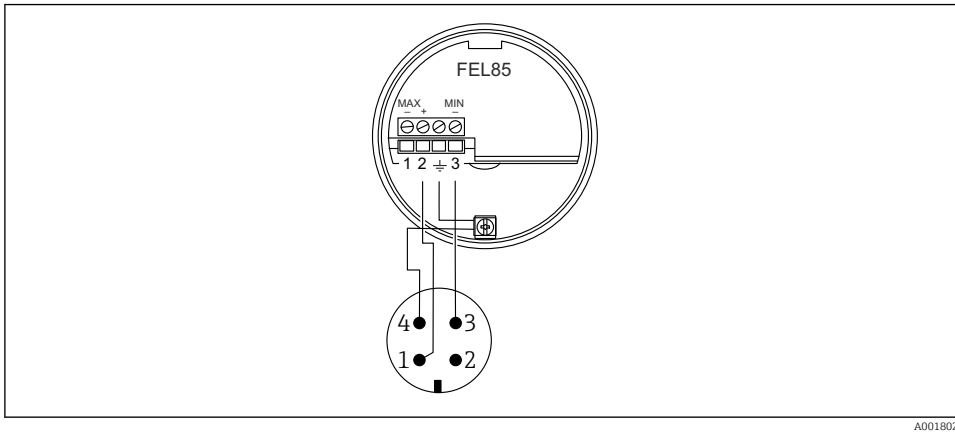
1 Signal +
2 Not used
3 Signal –
4 Ground

FEL85 Maximum detection mode of operation (factory setting)



16 Terminal assignment with M12 connector, maximum detection mode of operation

FEL85 Minimum detection mode of operation



17 Terminal assignment with M12 connector, minimum detection mode of operation

6.2.8 Connecting the cable

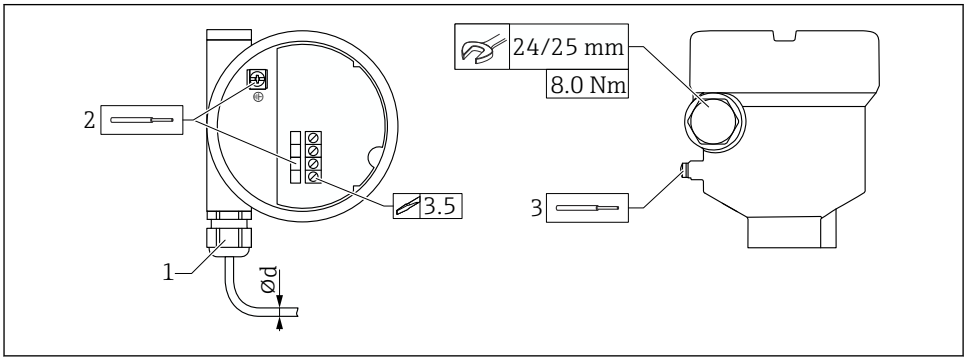
Required tools

- 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

Cable specification

The electronic inserts can be connected with commercially available instrument cables. If using shielded cables, it is recommended to connect the shielding on both sides for best results (if potential equalization is available).

Cable: maximum 25 Ω per conductor and 100 nF (typically 1 000 m (3 281 ft)).



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

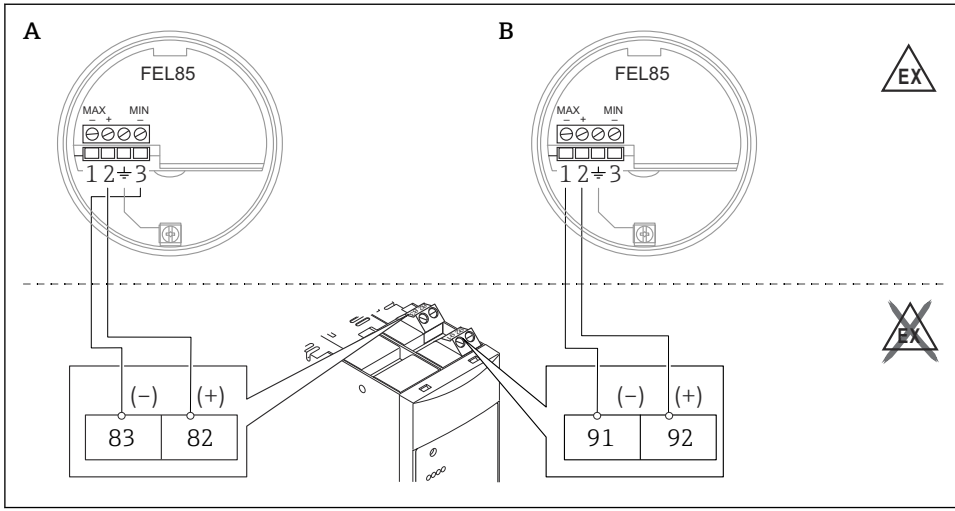
1 M20 coupling (with cable entry)
2 Maximum conductor cross-section 2.5 mm² (AWG14), ground terminal inside the housing + terminals on the electronics
3 Maximum conductor cross-section 4.0 mm² (AWG12), ground terminal outside the housing
Ød Cable gland, plastic 5 to 10 mm (0.2 to 0.38 in)
Cable gland, nickel-plated brass7 to 10.5 mm (0.28 to 0.41 in)
Cable gland, stainless steel7 to 12 mm (0.28 to 0.47 in)

Pay attention to the following when using the M20 coupling

After inserting the cable:

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

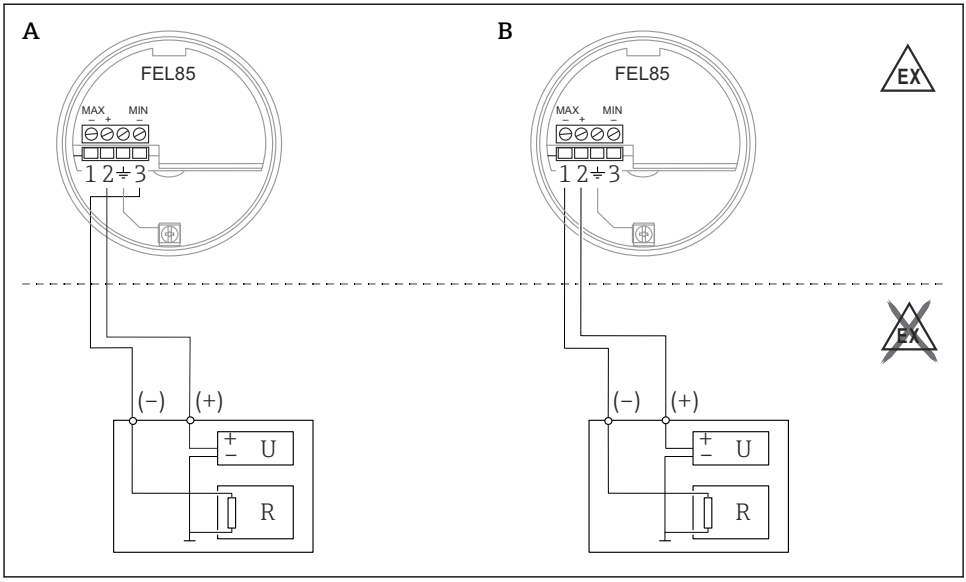
6.2.9 Connection to the Nivotester FailSafe FTL825



A Minimum detection (dry-run protection)
B Maximum detection (overfill protection system)

6.2.10 Connecting to control systems

The device is suitable for connection to a programmable logic controller (PLC), a safety PLC (SPLC) or AI Modules via a 4 to 20 mA signal according to EN 61131-2 and NE06, NE043.



19 *Connecting to a PLC*

A Minimum detection (dry-run protection)
B Maximum detection (overfill protection system)
U Nominal supply voltage DC 24 V
R Resistance

When in OK status, the current output is in the range of 12 to 20 mA. Two different current ranges are used:

- Minimum detection: 17.5 to 19.5 mA
- Maximum detection: 12.5 to 14.5 mA

The current output is in the range of 4 to 12 mA in demand mode. Two different current ranges are used:
- Minimum detection: 8.0 to 10.0 mA
- Maximum detection: 5.0 to 7.0 mA

LIVE signal:
- Changes by 1 mA every 2 000 ms
- Ensures that the sensor is connected correctly
- Can be monitored by the PLC
- Enables identification of faults in downstream components (e.g., PLC)

- To achieve SIL3, the current values must be monitored during integration into a PLC. A current value outside the OK status current range is invalid (demand mode).
- For SIL1 or SIL2 applications, it is sufficient to program a current threshold of 12 mA.
  - Demand mode: < 12 mA
  - OK status: > 12 mA

Device behavior in case of fault (alarm and warning)

In the event of a fault the current output is in the range below 3.6 mA. Short-circuits are an exception: in this case, the current output is in the range above 21 mA. For alarm monitoring, the logic unit must be able to detect both HI alarms (≥ 21.0 mA) and LO alarms (≤ 3.6 mA). No distinction is made between an alarm and a warning.

6.3 Ensuring the degree of protection

Tested in accordance with EN 60529 and NEMA 250

Housing

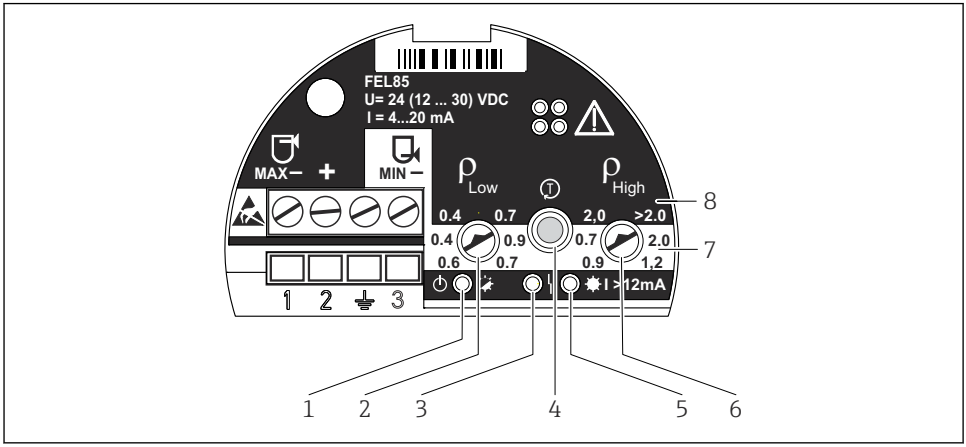
- Plastic (F16):
  IP66/67/NEMA Type 4X enclosure
- 316L, hygienic (F15):
  IP66/67/NEMA Type 4X enclosure
- 316L (F27):
  IP66/68/NEMA Type 4X/6P enclosure
- Aluminium (F17):
  IP66/67/NEMA Type 4X enclosure
- Aluminium (F13):
  IP66/68/NEMA Type 4X/6P enclosure
- Aluminum (T13) with separate terminal compartment (Ex d):
  IP66/68/NEMA Type 4X/6P enclosure

7 Operation options

7.1 Operation concept

- Operation with button and rotary switches on the electronic insert
- Configuration of minimum or maximum detection via connection wiring
- Density range adjustment via two rotary switches, confirmation via test button

7.2 Elements on the electronic insert



1 *Green LED, operation; initialization (lit), normal operation (flashes), fault (off or flashes alternately with red LED)*
2 *Density ρ_{Low} (rotary switch); Adjusts the lower density range limit*
3 *Red LED, fault; sensor error (lit permanently), operating error and electronic insert fault (flashing)*
4 *Test button; used to confirm configuration changes and activate proof testing*
5 *Yellow LED, current output; MAX (free) lit (13.5 mA), MIN (covered) lit (18.5 mA)*
6 *Density ρ_{High} (rotary switch); Adjusts the upper density range limit*
7 *MIN; white background indicates the adjustable density range in minimum detection mode*
8 *MAX; black background indicates the adjustable density range in maximum detection mode*

8 Commissioning

- The minimum detection or maximum detection mode of operation is configured via the connection wiring.
- The device is not operational in its delivery state. The density range must be set for commissioning. Otherwise, the device starts with an error message.

For applications requiring functional safety in accordance with IEC 61508 (SIL), refer to the Functional Safety Manual.

8.1 Function check

See Operating Instructions.

8.2 Setting the density range

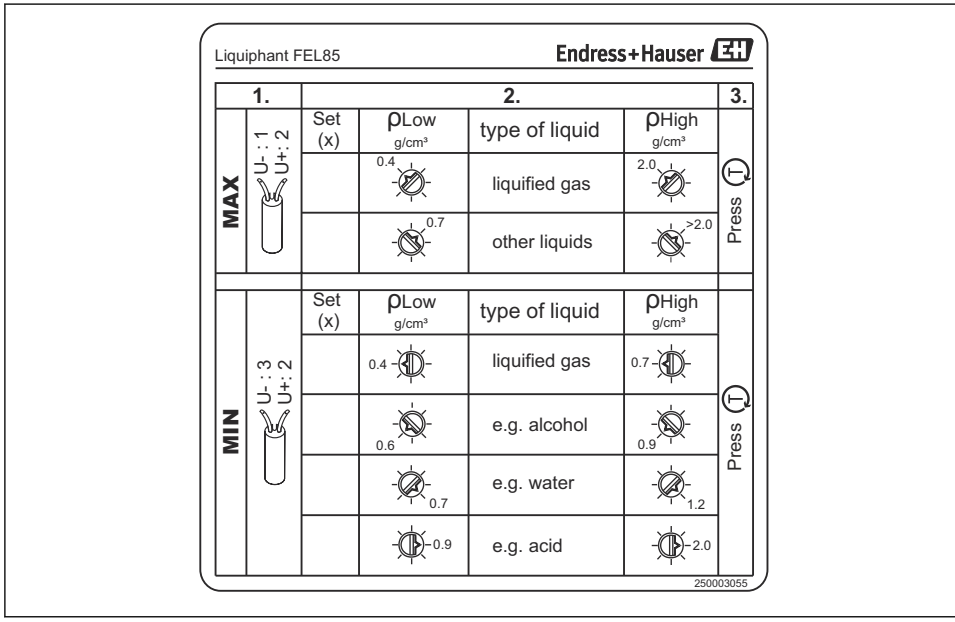
▶ Select the density ranges for low and high densities based on the media group (e.g. liquefied gas, alcohol, aqueous solutions, acid) on the device; see Operating Instructions.

If the rotary switches are not aligned parallel to each other, no valid density range is selected. The red LED flashes alternately with the green LED.

8.2.1 Sensor pass

The sensor pass is a plug-in card located inside the device housing.

1. Mark the selected density range on the sensor pass.
2. Store the sensor pass inside the housing.



20 *Figure: sensor pass*

8.3 Confirming configuration

Configuration confirmation is required. It can be performed in two ways:
- Press the test button on the device.
- Disconnect the device from the supply voltage (restart).

8.4 Proof testing

- Only start the function test in the OK status
- For applications involved in safety-related operation, refer to the Functional Safety Manual

The test button can be used to simulate the demand current. The output is set so that the currents 6 mA (demand for maximum detection) or 9 mA (demand for minimum detection) are displayed.

Carry out the proof test:

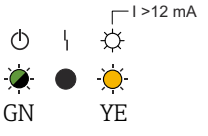
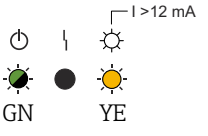
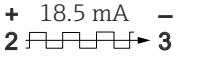
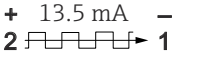
1. Press the test button
   ↳ A limit alarm is triggered (Maximum detection = 6 mA or Minimum detection = 9 mA)
2. Release the test button.
   ↳ System restarts with ≤ 3.6 mA, followed by normal operation

For the proof testing sequence, see the Operating Instructions and Functional Safety Manual.

8.5 Switching on the device

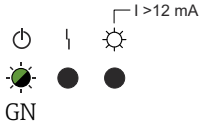
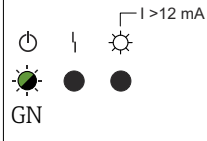
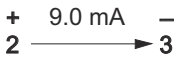
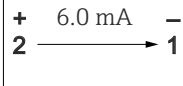
When the power connection is switched on, the output is in a fault signal state. The device is ready for operation after a maximum of 4 s.

8.5.1 Behavior of switch output and signaling in OK status

MIN	MAX
	
21 LED signaling ☼= on ●= off ✳ = flashes	*22 LED signaling* ☼= on ●= off ✳ = flashes
	
23 Output signal	*24 Output signal*

A permanent LIVE signal (frequency 0.25 Hz, amplitude ±0.5 mA) is superimposed on the output signal in the OK status.

8.5.2 Behavior of the switch output and signaling in demand mode

MIN	MAX
 25 *LED signaling* ●= off ☼ = flashes	 26 *LED signaling* ●= off ☼ = flashes
 27 *Output signal*	 28 *Output signal*

8.6 Status of the outputs in the event of an error

In the event of an error, the output current I is < 3.6 mA (failure current in accordance with NAMUR NE43).

For troubleshooting and fault resolution, see the Operating Instructions.

8.7 Further information

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

www.addresses.endress.com

Endress+Hauser

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