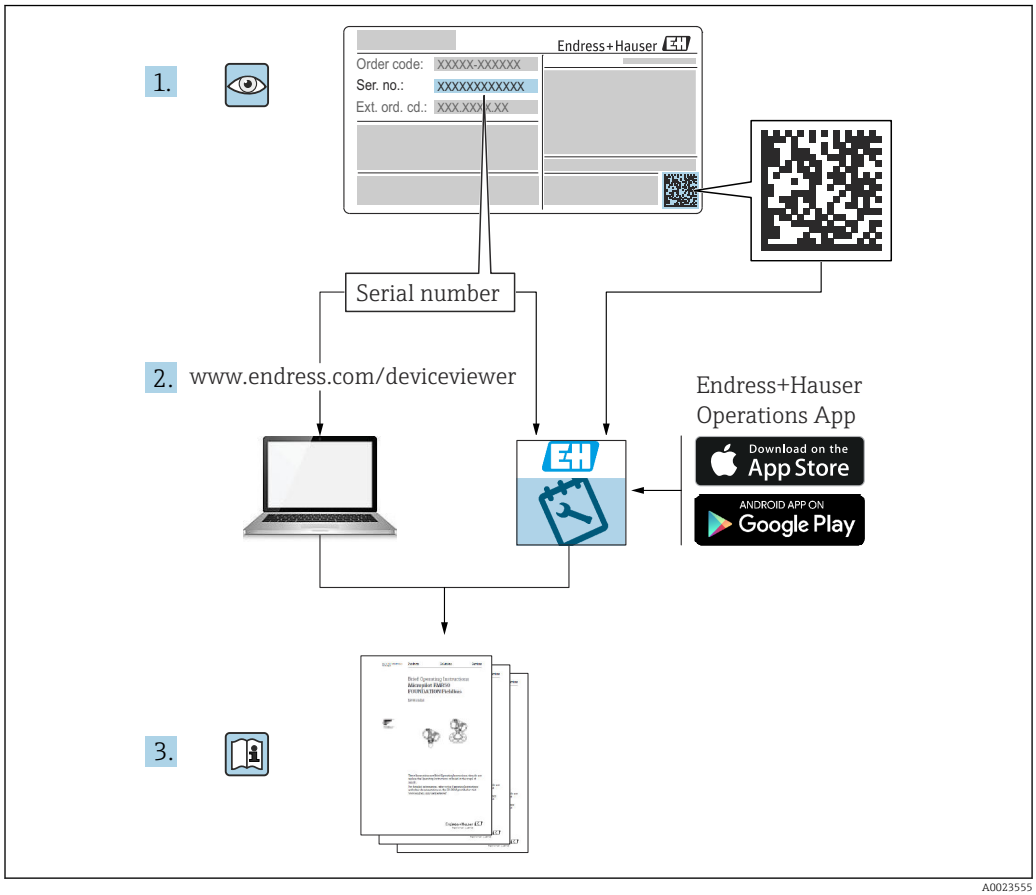
BA01893F/00/EN/06.25-00
71726571
2025-10-13

Valid from
01.01.zz (Device firmware)

Operating Instructions
Liquiphant FTL41

Vibronic
Level switch for liquids

Endress+Hauser
People for Process Automation



- Make sure the document is stored in a safe place such that it is always available when working on or with the device
- Avoid danger to individuals or the facility: read the "Basic safety instructions" section carefully, as well as all other safety instructions in the document that are specific to working procedures

The manufacturer reserves the right to modify technical data without prior notice. The Endress+Hauser sales organization will supply you with current information and updates to these instructions.

Table of contents

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 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.

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)

1.3 Documentation

For an overview of the scope of the associated Technical Documentation, refer to the following:
- *Device Viewer* (www.endress.com/deviceviewer): Enter the serial number from the nameplate
- *Endress+Hauser Operations app*: Enter serial number from nameplate or scan matrix code on nameplate.

1.4 Change history

V01.01.zz (01.2019)
- Valid for electronic inserts: FEL41, FEL44, FEL48
- Valid from documentation version: BA01893F/00/EN/01.19
- Changes: None; first version (original software)

2 Basic safety instructions

2.1 Requirements for the personnel

The personnel for installation, commissioning, diagnostics and maintenance must fulfill the following requirements:
- 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.

The operating personnel must fulfill the following requirements:
- Are instructed and authorized according to the requirements of the task by the facility's owner-operator.
- Follow the instructions in this manual.

2.2 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.

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

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.

2.5 Product safety

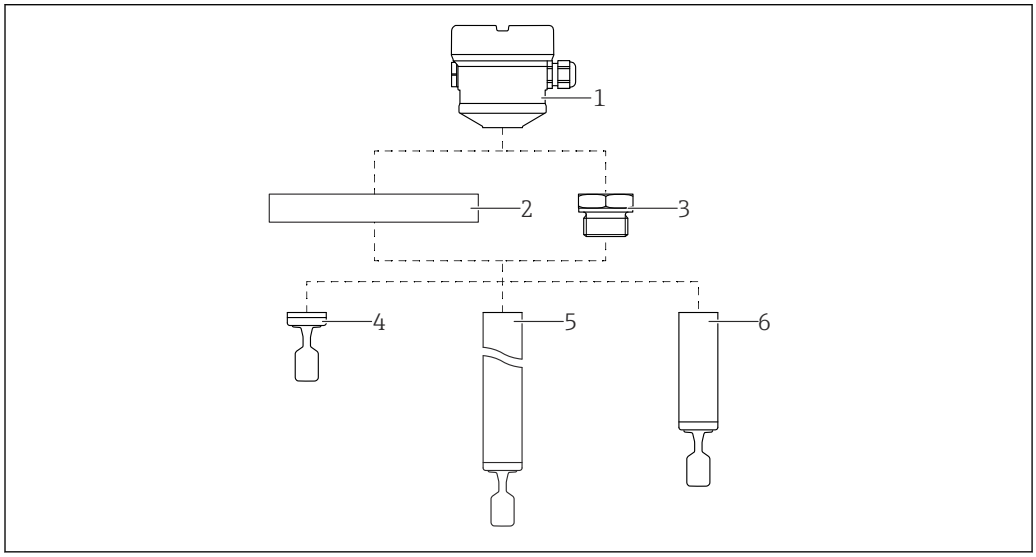
This state-of-the-art device is designed and tested in accordance with good engineering practice to meet operational safety standards. It left the factory in a condition in which it is safe to operate.

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 Product description

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

3.1 Product design



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

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

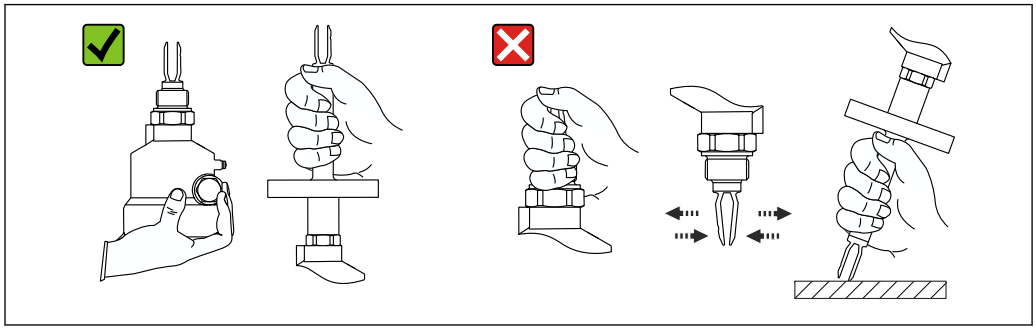
Use original packaging.

Storage temperature

−40 to +80 °C (−40 to +176 °F)

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



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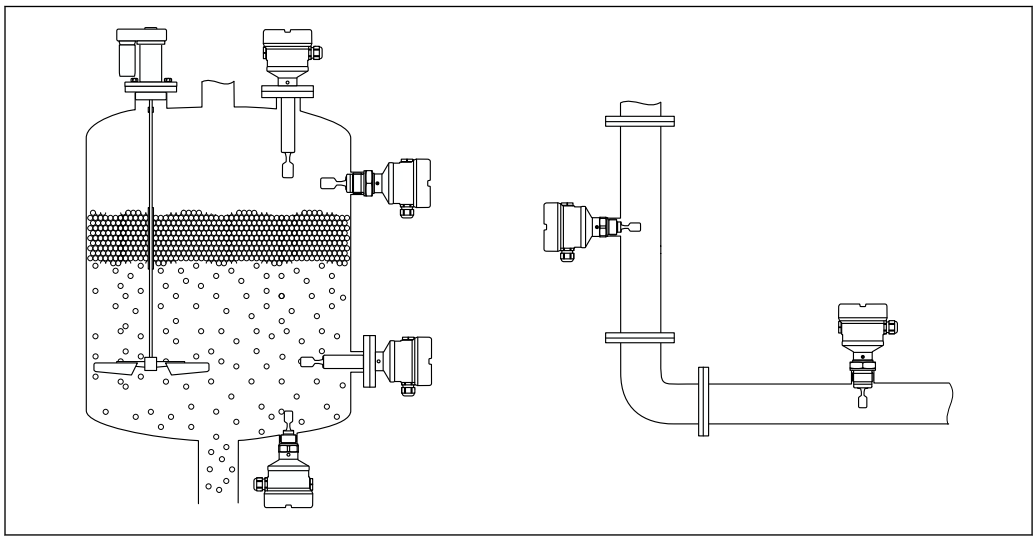
2 *Handling the device during transportation*

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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3 *Installation examples for a vessel, tank or pipe*

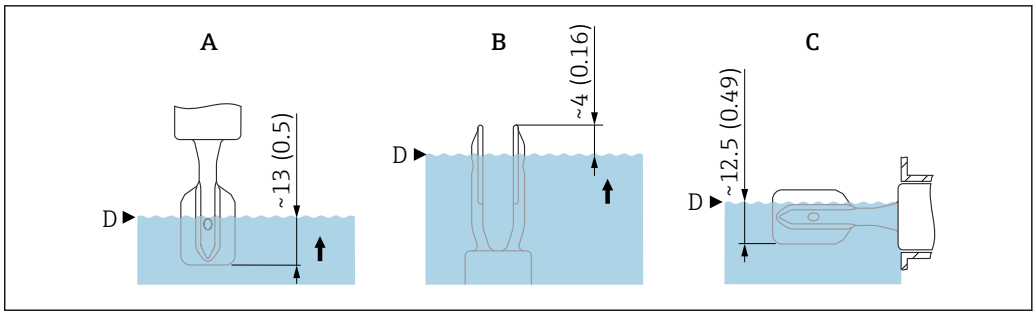
5.1 Installation requirements

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)

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



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

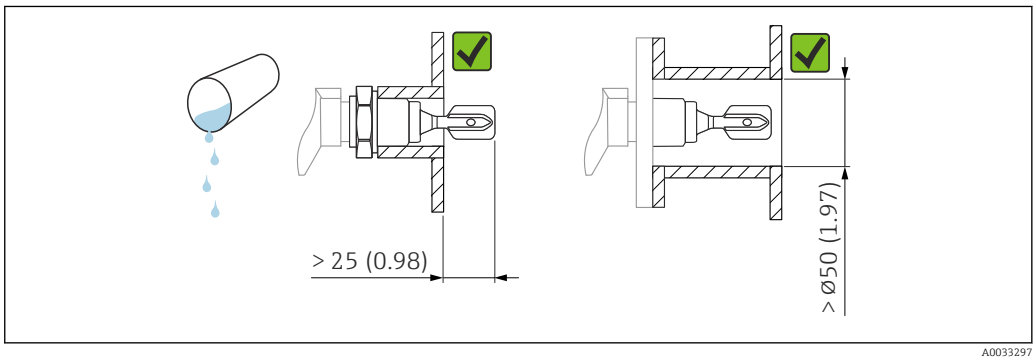
5.1.2 Take viscosity into consideration

Viscosity values
- Low viscosity : < 2 000 mPa·s
- High viscosity: > 2 000 to 10 000 mPa·s

Low viscosity

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

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



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

High viscosity

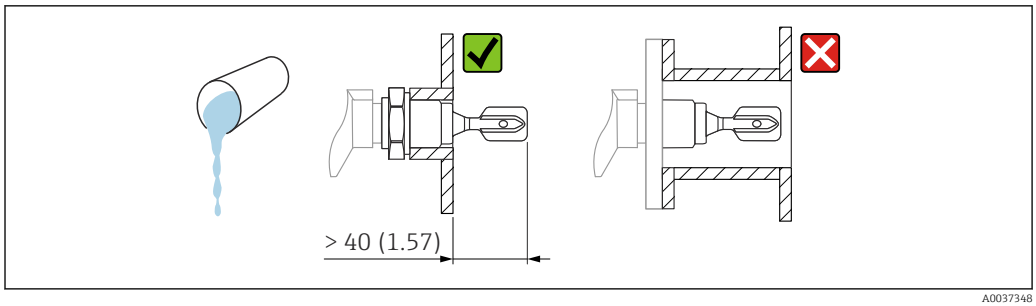
NOTICE

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: ≤ 10 000 mPa·s

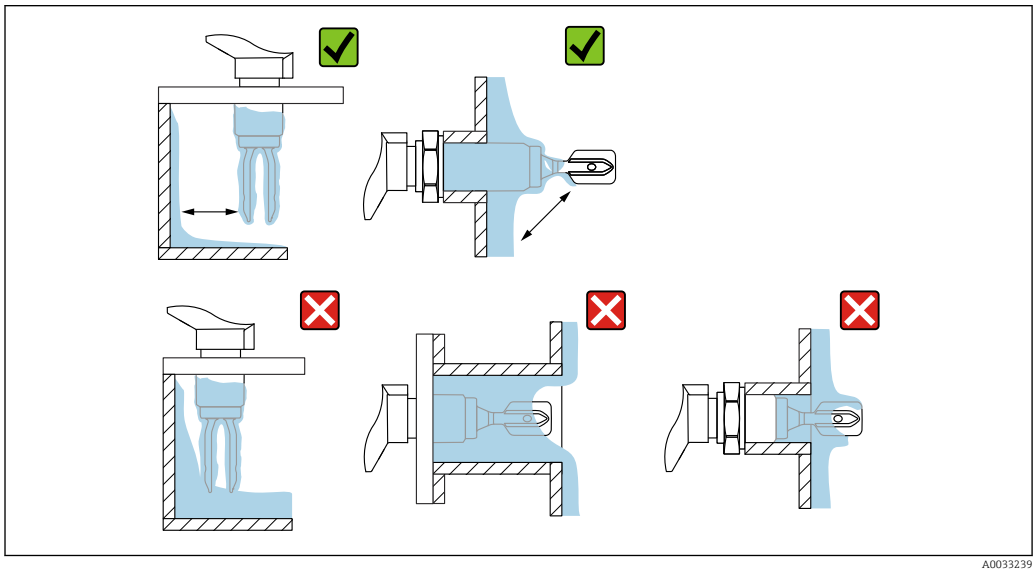
The tuning fork must be located outside the installation socket!



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

5.1.3 Avoid buildup

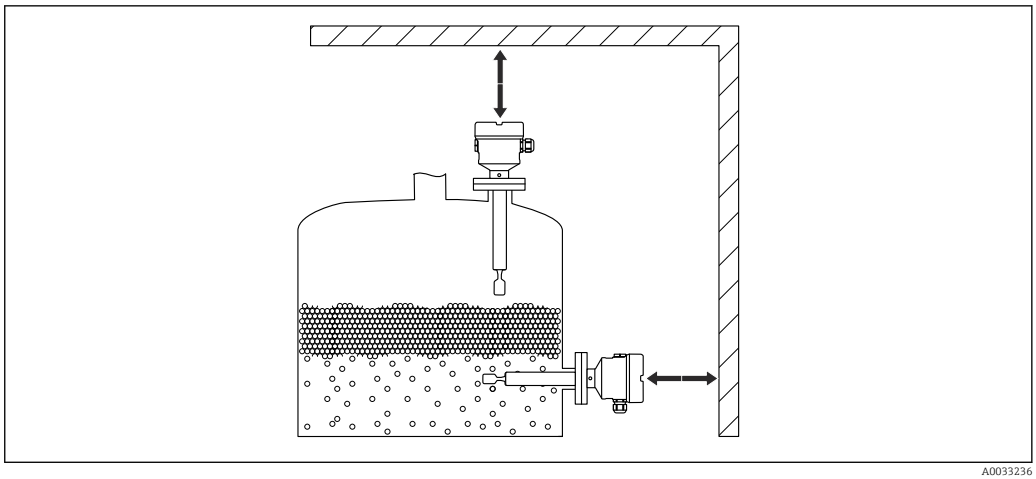
- Use short installation sockets to ensure that the tuning fork projects freely into the vessel
- Leave sufficient distance between the buildup expected on the tank wall and the tuning fork



7 *Installation examples for a highly viscous process medium*

5.1.4 Take clearance into consideration

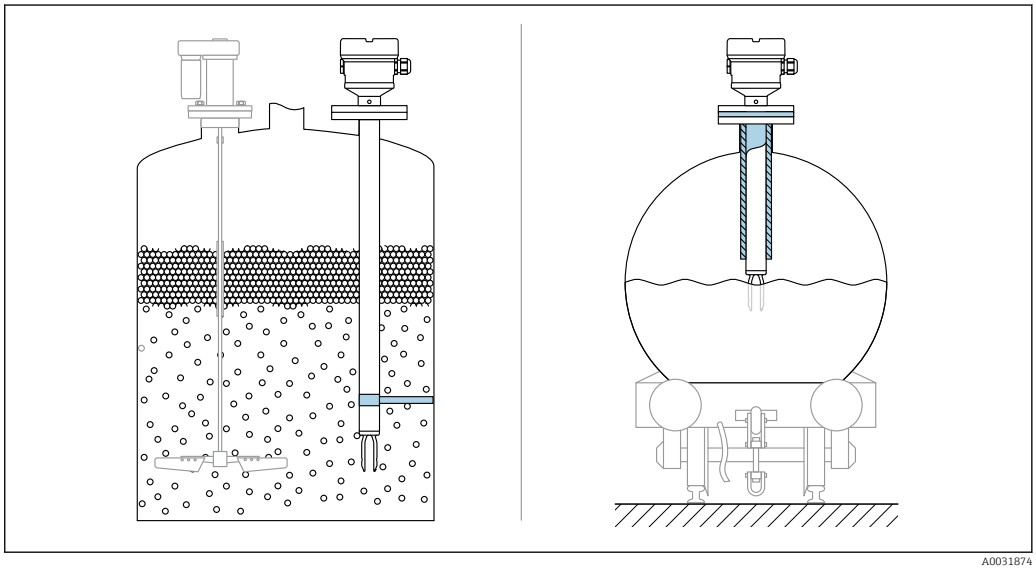
Allow sufficient space outside the tank for mounting, connection and settings involving the electronic insert.



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).

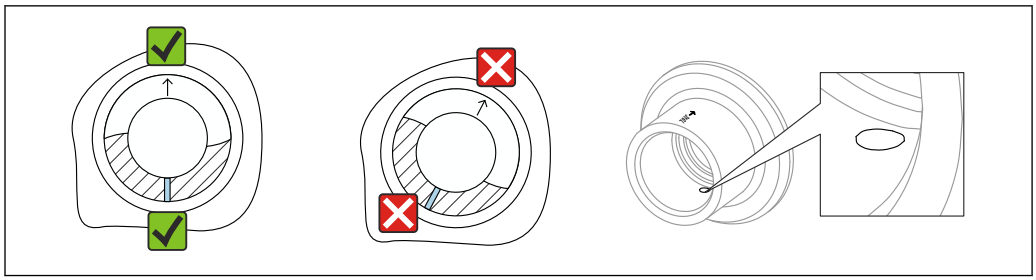


9 *Examples of support in the event of dynamic load*

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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10 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

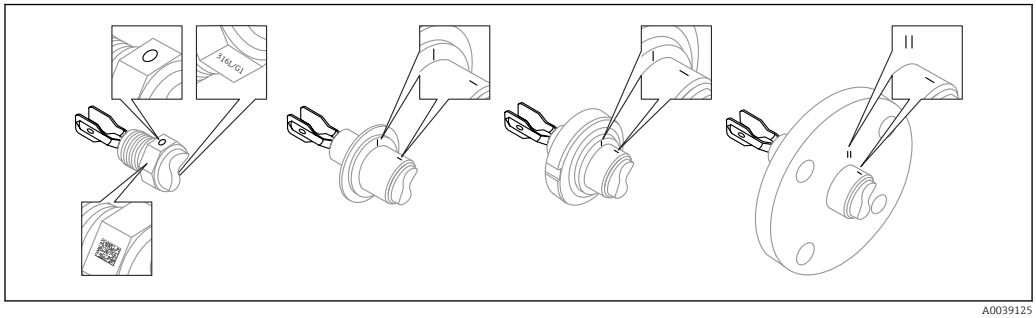
5.2.2 Installation procedure

Align the vibrating fork using the marking

The vibrating fork can be aligned using the marking in such a way that the medium drains off easily and buildup is avoided.

- Markings for threaded connections: Circle (material specification/thread designation opposite)
- Markings for flange or clamp connections: Line or double line

In addition, the threaded connections have a matrix code that is **not** used for alignment.



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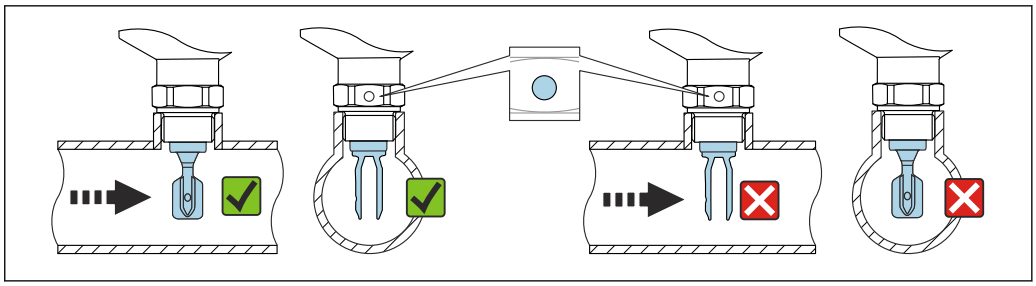
11 Position of the vibrating fork when installed horizontally in the vessel using the marking

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



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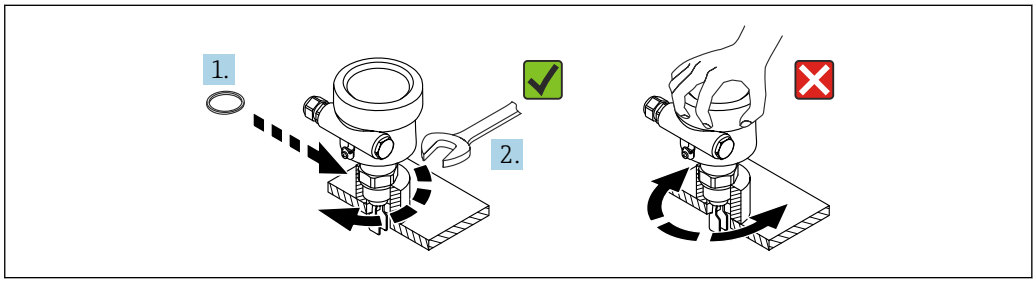
12 *Installation in pipes (take fork position and marking into consideration)*

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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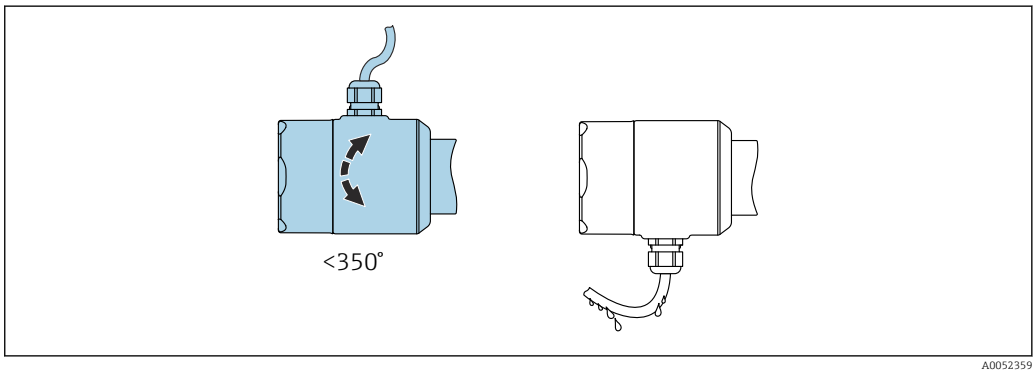
13 *Screwing in the device*

Aligning the cable entry

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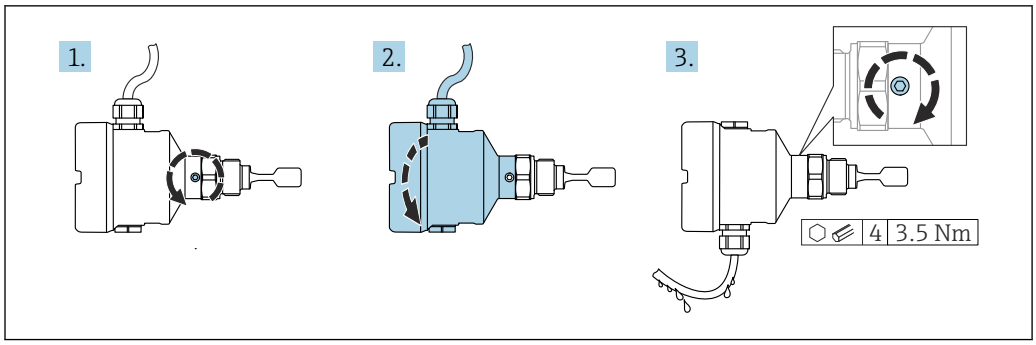
14 *Housing without set screw; form a drip loop on the cable.*

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.



15 *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.

5.3 Sliding sleeves

For more details, see the "Accessories" section.

Special Documentation SD02398F (Installation Instructions)

5.4 Post-mounting check

❑ Is the device undamaged (visual inspection)?

❑ Are the measuring point number and labeling correct (visual inspection)?

❑ Is the device adequately protected from precipitation and direct sunlight?

❑ Is the device properly secured?

❑ Does the device comply with the measuring point specifications?

For example:
- Process temperature
- Process pressure
- Ambient temperature
- Measuring range

6 Electrical connection

6.1 Required tool

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

6.2 Connecting requirements

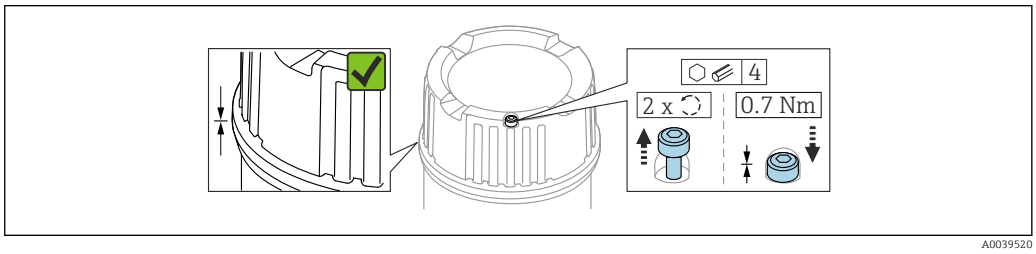
6.2.1 Cover with securing screw

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.



16 *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 ≥ 35 V_{DC} or ≥ 16 V_{AC}eff.

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

WARNING

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.

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

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 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

$P < 0.5$ W

Current consumption

$I \leq 10$ 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

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

Residual current

$I < 100$ µA (for blocked transistor)

Residual voltage

$U < 3$ V (for switched through transistor)

Behavior of output signal

- OK status: Switched through
- Demand mode: Blocked
- Alarm: Blocked

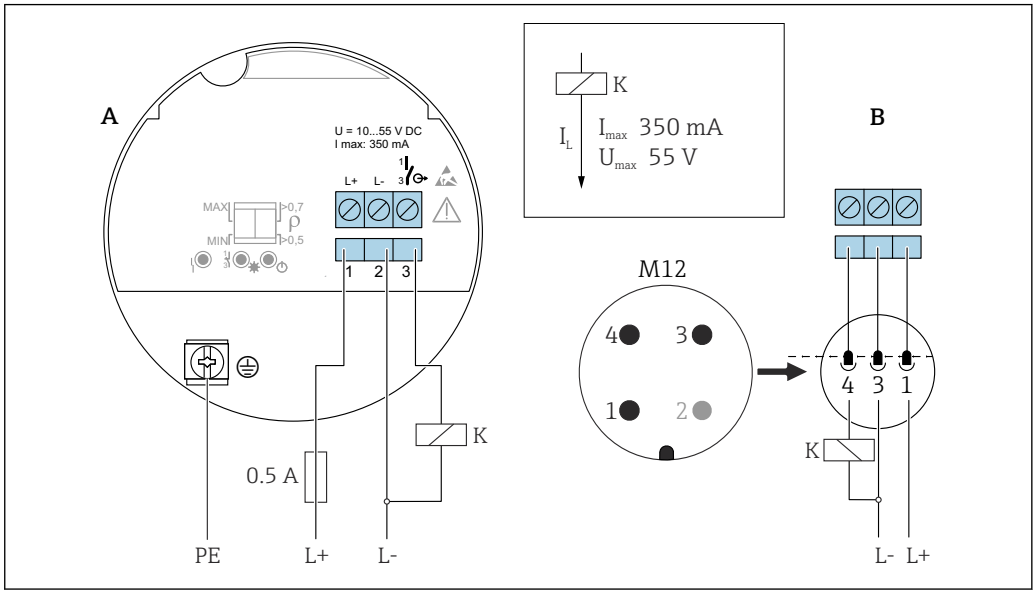
Terminals

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

Overvoltage protection

Overvoltage category I

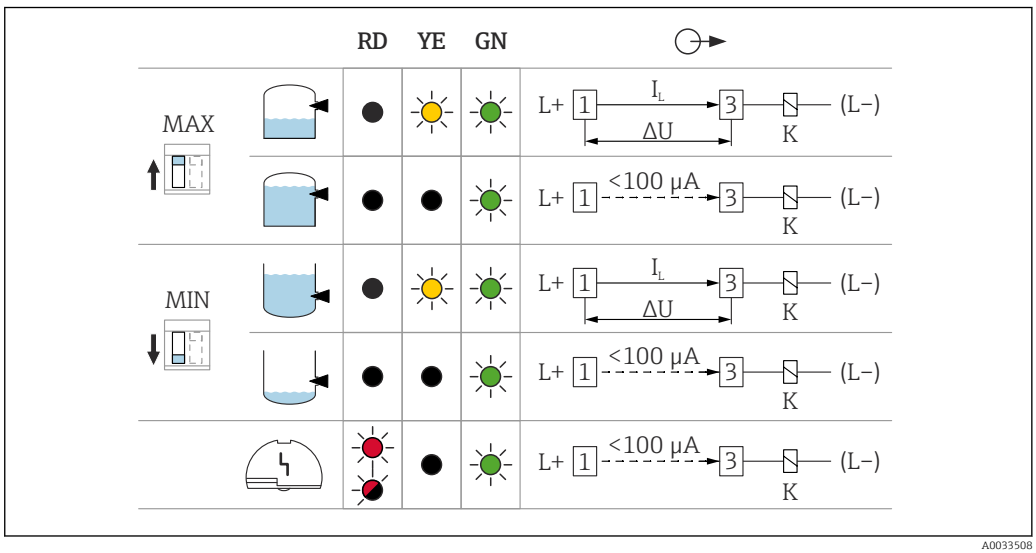
Terminal assignment



17 *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



18 *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 to 253 V_{AC}/19 to 55 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 VA, P < 1.3 W

Connectable load

Loads switched via two potential-free change-over contacts (DPDT)

- I_{AC} ≤ 6 A, U~ ≤ AC 253 V; P~ ≤ 1 500 VA, cos φ = 1, P~ ≤ 750 VA, cos φ > 0.7
- I_{DC} ≤ 6 Ato DC 30 V, I_{DC} ≤ 0.2 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 ≤ 300 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

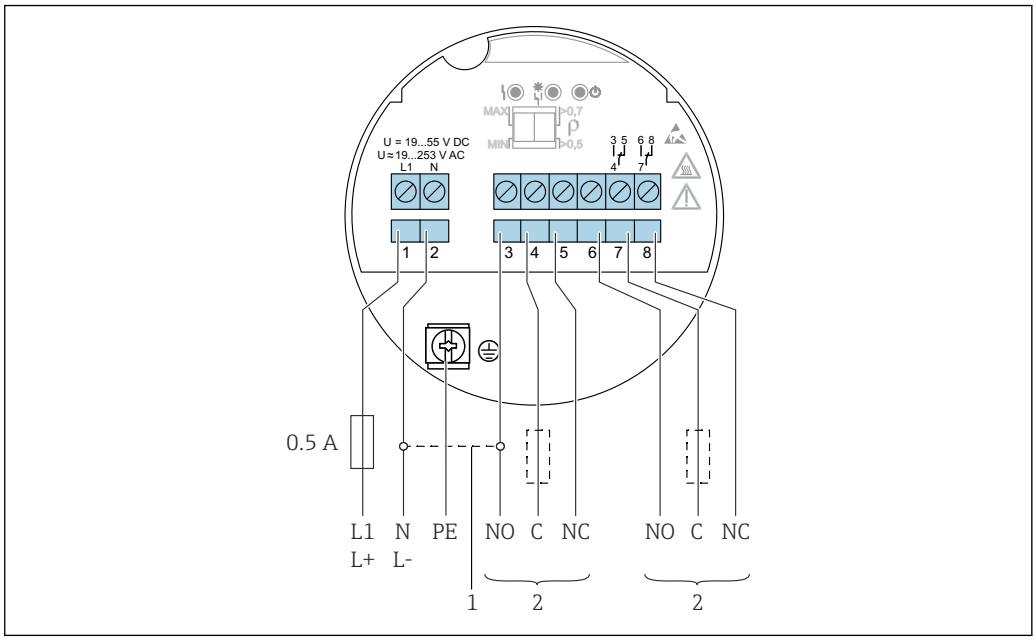
Terminals

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

Overvoltage protection

Overvoltage category II

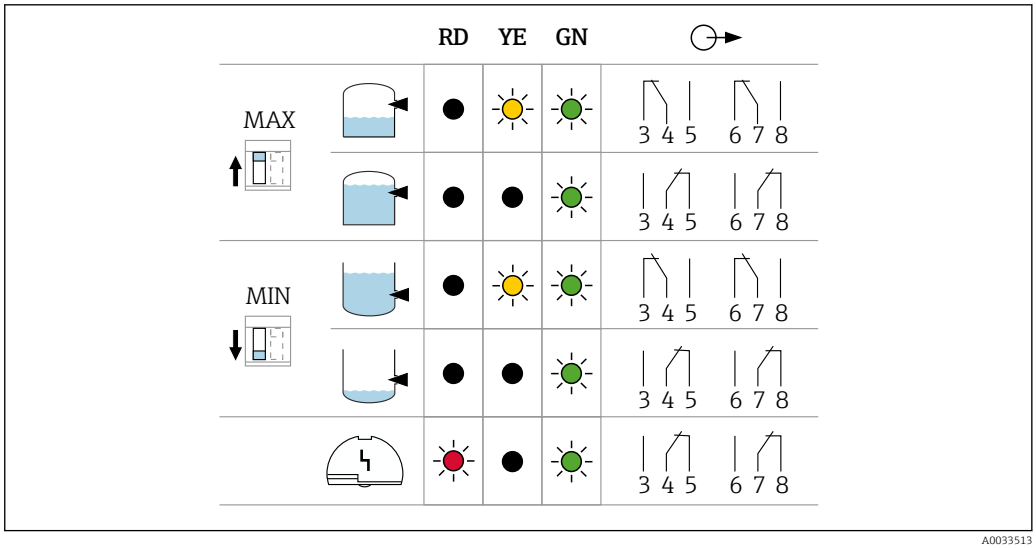
Terminal assignment



19 *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



20 *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 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 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

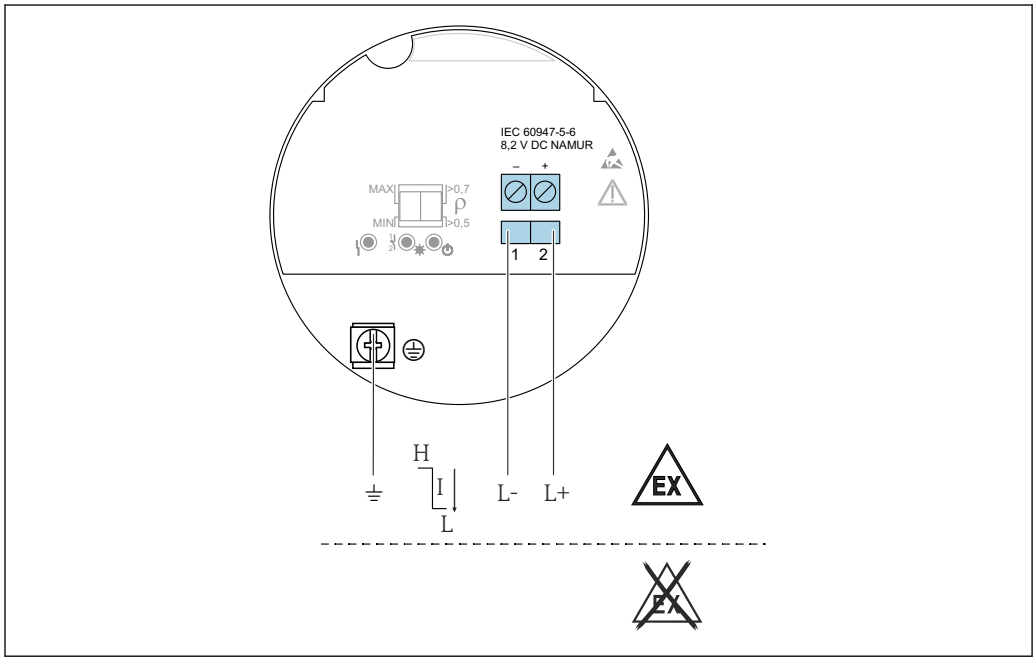
Terminals

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

Overvoltage protection

Overvoltage category I

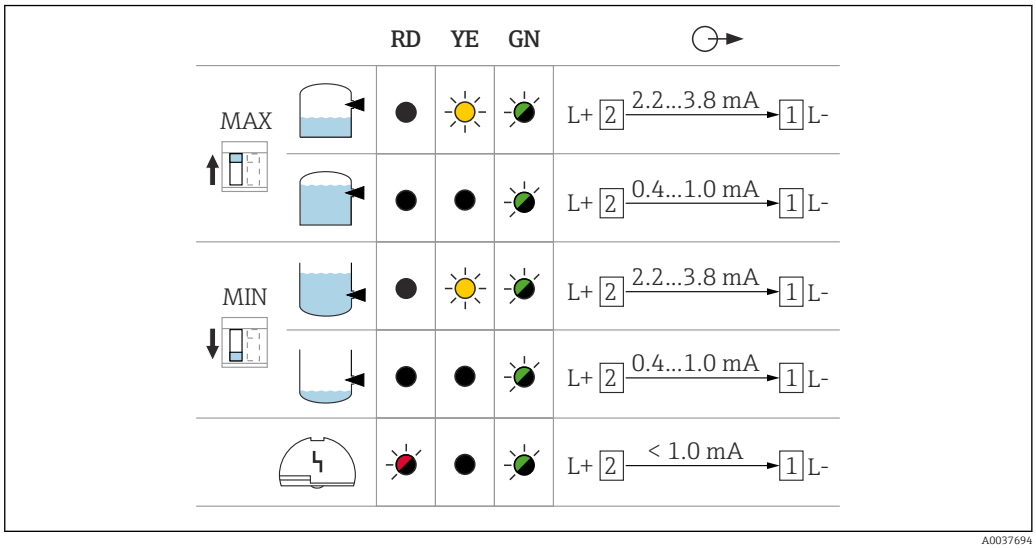
Terminal assignment



A0036058

21 2-wire NAMUR ≥ 2.2 mA/≤ 1.0 mA, electronic insert FEL48

Behavior of the switch output and signaling



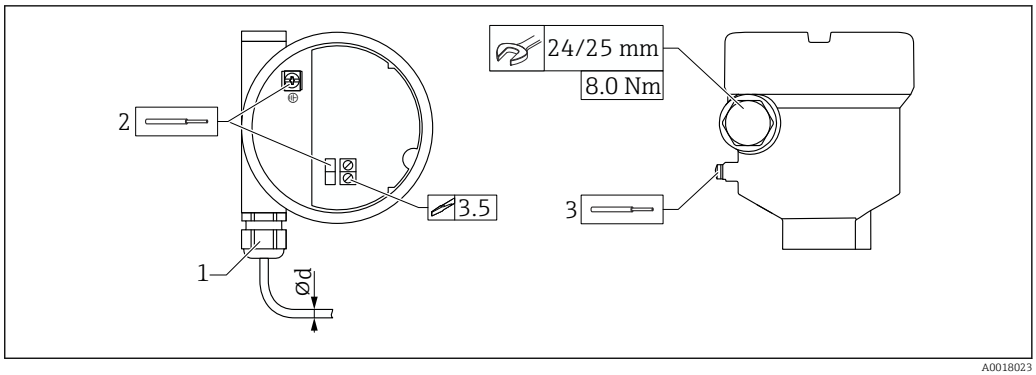
22 *FEL48 switching behavior and signaling*

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



23 *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)

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?

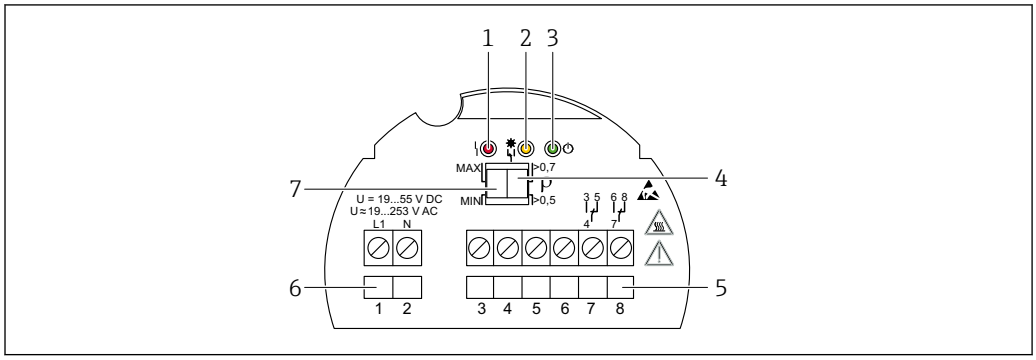
7 Operation options

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



24 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 Post-installation and function check

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

Post-mounting check

Post-connection check

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 currently available documentation 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 errors are for information purposes only and do not have a safety function. Depending on the diagnostic message, the device behaves in accordance with a warning or error.

The device behaves in accordance with NAMUR Recommendation NE 131 "NAMUR standard device requirements for field devices for standard applications".

9.1 Diagnostic information via LED

Green LED not lit
Possible cause: No power supply
Troubleshooting: Check the plug, cable and power supply

Red LED flashing
Possible cause: Overload or short-circuit in load circuit
Troubleshooting: Rectify the short-circuit
Reduce the maximum load current to below 350 mA

Red LED continuously lit
Possible cause: Internal sensor error or electronic fault
Troubleshooting: Replace the device

10 Maintenance

10.1 Maintenance tasks

No specific maintenance work is required.

10.1.1 Cleaning

Cleaning of surfaces not in contact with the medium

- Recommendation: Use a lint-free cloth that is either dry or slightly dampened using water.
- Do not use any sharp objects or aggressive cleaning agents that corrode the surfaces (displays, housing, for example) and seals.
- Do not use high-pressure steam.
- Observe the degree of protection of the device.

The cleaning agent used must be compatible with the materials of the device configuration. Do not use cleaning agents with concentrated mineral acids, bases or organic solvents.

Cleaning of surfaces in contact with the medium

Note the following for cleaning and sterilization in place (CIP/SIP):
- Use only cleaning agents to which the materials in contact with the medium are sufficiently resistant.
- Observe the permitted maximum medium temperature.

Cleaning the vibrating fork

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

- Clean the vibrating 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 Repairs to Ex-approved devices

WARNING

Incorrect repair can compromise electrical safety!
Explosion hazard!

- Only specialist personnel or the manufacturer's service team may carry out repairs on Ex-certified devices in accordance with national regulations.
- Relevant standards and national regulations on hazardous areas, safety instructions and certificates must be observed.
- Only use original spare parts from the manufacturer.
- 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 manufacturer's service team is permitted to modify a certified device and convert it to another certified version.

11.2 Spare parts

Product spare parts that are currently available can be found online at:
www.endress.com/onlinetools

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: https://www.endress.com
2. If returning the device, pack the device in such a way that it is reliably protected against impact and external influences. The original packaging provides the best protection.

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

The accessories currently available for the product can be selected at www.endress.com:

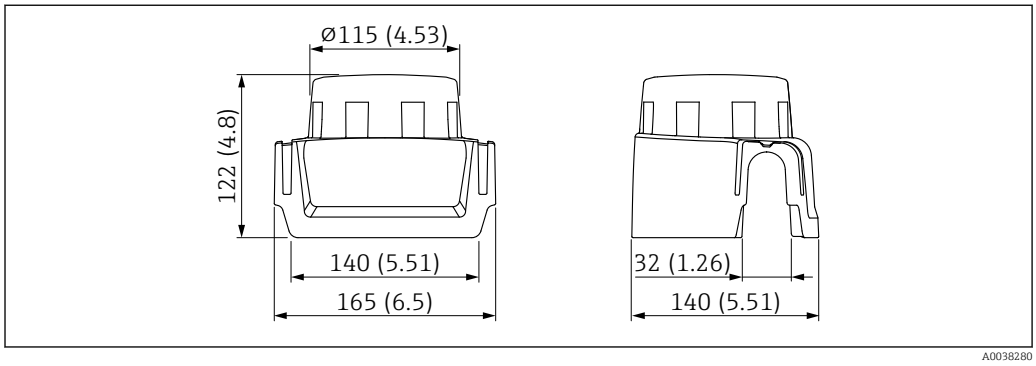
1. Select the product using the filters and search field.
2. Open the product page.
3. Select **Spare parts & Accessories**.

12.1 Weather protection cover, plastic, XW111

The weather protection cover can be ordered together with the device via the "Accessory enclosed" product structure.

It is used to protect against direct sunlight, precipitation and ice.

The plastic weather protection cover is suitable for the single compartment housing made of aluminum. The delivery includes the holder for direct mounting on the housing.



25 *Dimensions of weather protection cover, plastic, XW111. Unit of measurement mm (in)*

Material
Plastic

Accessory order code:
71438291

Special Documentation SD02423F

12.2 M12 socket

The M12 sockets listed are suitable for use in the temperature range −25 to +70 °C (−13 to +158 °F).

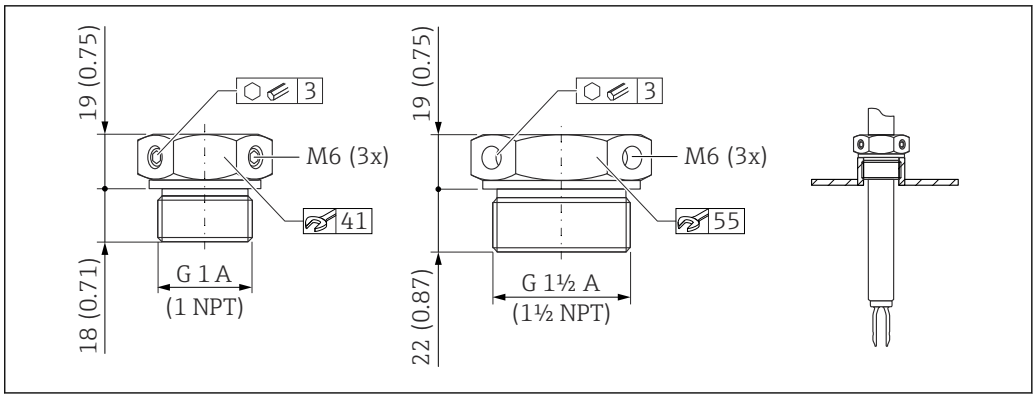
M12 socket IP69
- Terminated at one end
- Angled
- 5 m (16 ft) PVC cable (orange)
- Slotted nut 316L (1.4435)
- Body: PVC
- Order number: 52024216

M12 socket IP67
- Angled
- 5 m (16 ft) PVC cable (gray)
- Slotted nut Cu Sn/Ni
- Body: PUR
- Order number: 52010285

12.3 Sliding sleeves for unpressurized operation

Not suitable for use in explosive atmospheres.

Switch point, infinitely adjustable.



26 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

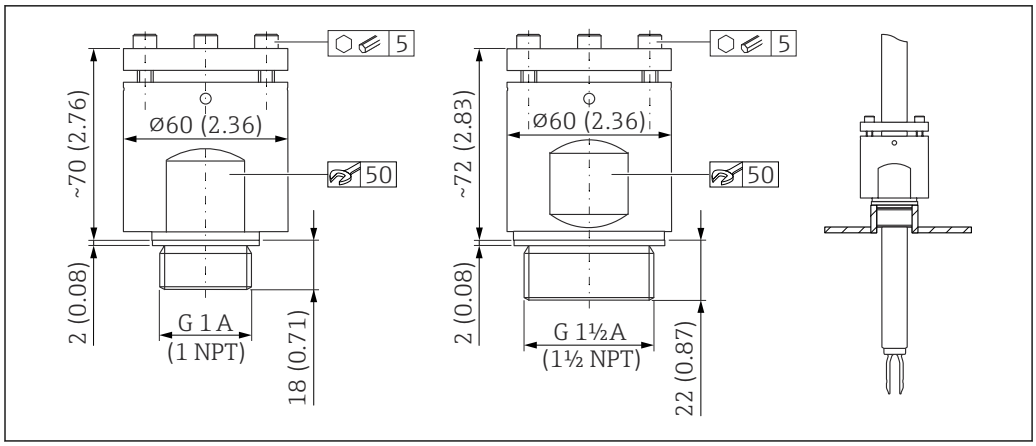
NPT 1½, ASME B 1.20.1
- Material: 1.4435 (AISI 316L)
- Weight: 0.54 kg (1.19 lb)
- Order number: 52003981
- Order number: 52011891, approval: with inspection certificate EN 10204 - 3.1 material

More detailed information and documentation are available:
- Product Configurator on the Endress+Hauser website www.endress.com
- Endress+Hauser Sales Organizationwww.addresses.endress.com

12.4 High pressure sliding sleeves

Suitable for use in explosive atmospheres.

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



27 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

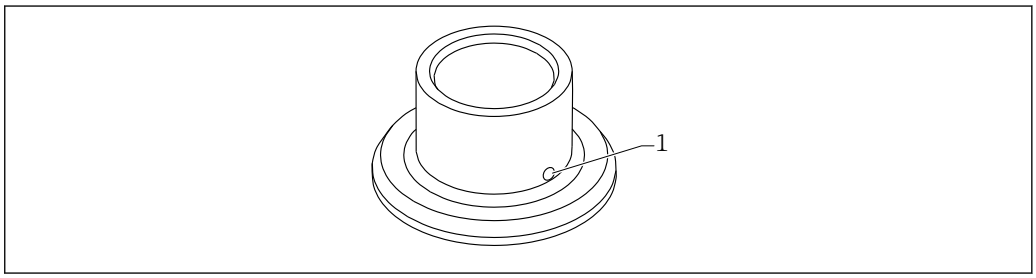
NPT 1½, ASME B 1.20.1
- Material: 1.4435 (AISI 316L)
- Weight: 1.32 kg (2.91 lb)
- Order number: 52003669
- Order number: 52011883, approval: with inspection certificate EN 10204 - 3.1 material

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

12.5 Weld-in adapter

Various weld-in adapters are available for installation in vessels or pipes. The adapters are optionally available with inspection certificate 3.1 EN 10204.



28 Weld-in adapter (sample view)

1 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.

- G 1, Ø53 mounting on the pipe
- G 1, Ø60 flush mount on the vessel
- G ¾, Ø55 flush mount
- G 1 sensor adjustable

For detailed information, see "Technical Information" TI00426F (Weld-in adapters, process adapters and flanges)

Available in the Downloads area of the Endress+Hauser website (www.endress.com/downloads).

13 Technical data

13.1 Input

13.1.1 Measured variable

The point level signal is triggered according to the operating mode (minimum or maximum detection) when the level exceeds or falls below the relevant point level.

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 two potential-free change-over contacts

2-wire NAMUR > 2.2 mA/< 1.0 mA (FEL48)
- For separate switching unit
- Signal transmission H-L edge 2.2 to 3.8 mA/0.4 to 1.0 mA as per IEC 60947-5-6 (NAMUR) on two-wire cable

13.2.2 Output signal

Switching output

Preset switching delay times can be ordered:
- 0.5 s when the vibrating fork is covered and 1.0 s when the vibrating fork is uncovered (factory setting)
- 0.25 s when the vibrating fork is covered and 0.25 s when the vibrating fork is uncovered
- 1.5 s when the vibrating fork is covered and 1.5 s when the vibrating fork is uncovered
- 5.0 s when the vibrating fork is covered and 5.0 s when the vibrating fork is uncovered

13.2.3 Ex connection data

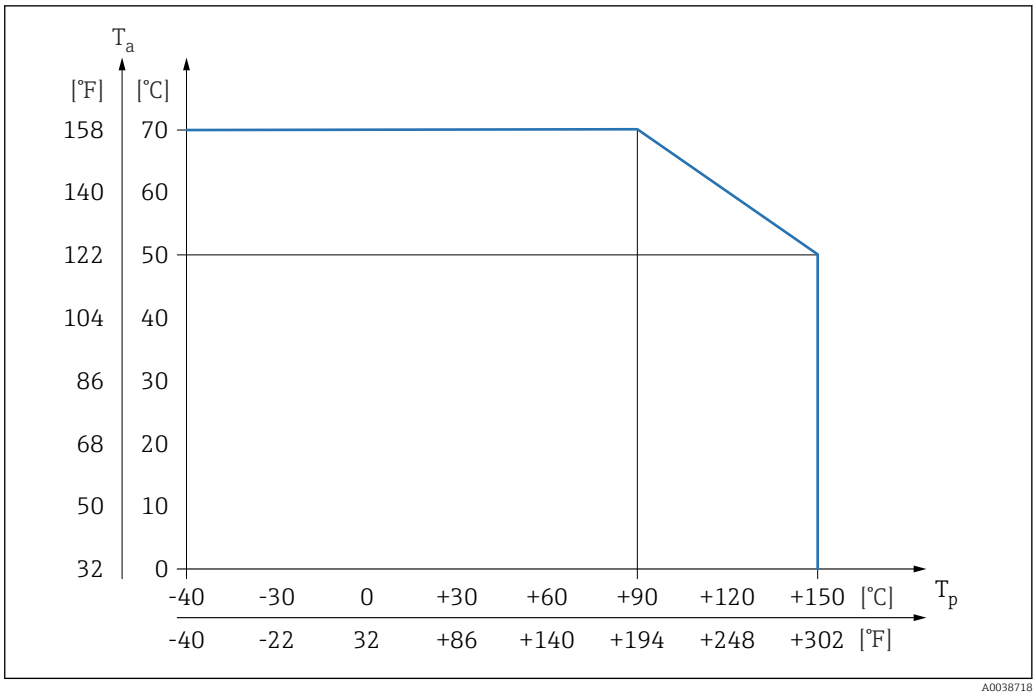
See safety instructions (XA): All data relating to explosion protection are provided in separate Ex documentation and are available from the Downloads area of the Endress+Hauser website. The Ex documentation is supplied as standard with all devices approved for use in explosion hazardous areas.

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 to North America.



29 *For FEL44 and process temperature 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 protective 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

Testing according to IEC 60529 and NEMA 250

IP68 test condition: 1.83 m H_2O for 24 h

Housing
See cable entries

Cable entries
- M20 coupling, plastic, IP66/68 NEMA Type 4X/6P
- M20 coupling, nickel-plated brass, IP66/68 NEMA Type 4X/6P
- G ½ thread, NPT ½, NPT ¾ IP66/68 NEMA Type 4X/6P

Degree of protection for M12 plug
- When housing is closed and connection cable is plugged in: IP66/67 NEMA Type 4X
- When housing is open or connection cable is not plugged in: IP20, NEMA Type 1

NOTICE

M12 plug: Loss of IP protection class due to incorrect installation!
- ▶ The degree of protection only applies if the connecting cable used is plugged in and screwed tight.
- ▶ The degree of protection only applies if the connecting cable used is specified according to IP67 NEMA Type 4X.

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

13.3.7 Vibration resistance

As per IEC60068-2-64-2008
a(RMS) = 50 m/s^2, f = 5 to 2 000 Hz , t = 3 axes x 2 h

13.3.8 Shock resistance

As per IEC 60068-2-27-2008: 300 m/s^2 [= 30 g_n] + 18 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 Pollution degree

Pollution degree 2

13.3.11 Electromagnetic compatibility (EMC)

- Electromagnetic compatibility as per the EN 61326 series and NAMUR Recommendation EMC (NE 21)
  Interference immunity according to Table 2 (Industrial), interference radiation according to Group 1 Class B
- Fulfills the requirements of EN 61326-3-1

For more details, refer to the EU Declaration of Conformity.

13.4 Process

13.4.1 Process temperature range

−40 to +150 °C (−40 to +302 °F)

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

13.4.2 Thermal shock

≤ 120 K/s

13.4.3 Process pressure range

PN: 40 bar (580 psi)

The maximum pressure for the device depends on the lowest-rated element with regard to pressure.

Components are: process connection, optional mounting parts, or accessories.

WARNING

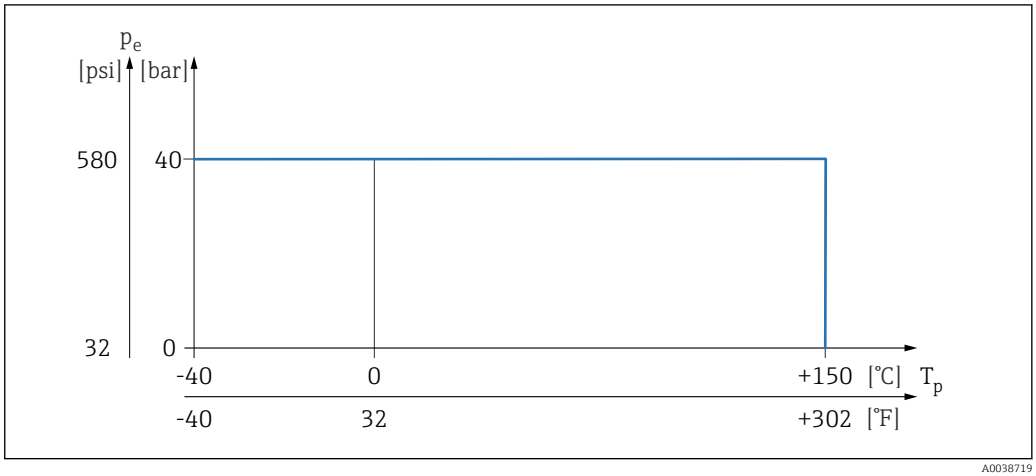
Incorrect design or use of the device may lead to bursting parts!
This may result in severe, possibly irreversible injury to persons and environmental hazards.

- Only operate the device within the specified limits for the components!
- MWP (maximum working pressure): The maximum working pressure is specified on the nameplate. This value refers to a reference temperature of +20 °C (+68 °F) and may be applied to the device for an unlimited time. Observe the temperature dependency of the maximum working pressure. For higher temperatures, refer to the following standards for the permitted pressure values for flanges:EN 1092-1 (materials 1.4435 and 1.4404 are identical with regard to their stability/temperature property and are grouped together in under 13E0 in EN 1092-1 Tab. 18; the chemical composition of the two materials can be identical), ASME B 16.5a, JIS B 2220 (the latest version of the standard applies in each case).
- The Pressure Equipment Directive (2014/68/EU) uses the abbreviation "PS". The abbreviation "PS" corresponds to the maximum working pressure of the device.
- MWP data that deviate from this are provided in the relevant sections of the Technical Information.

The lowest value from the derating curves of the device and of the selected flange applies in each case.

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*

13.4.4 Overpressure limit

PN = 40 bar (580 psi): overpressure limit = 1.5 · 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 g/cm³ (43.7 lb/ft³)
Switch position > 0.7 g/cm³ (43.7 lb/ft³), order configuration

Liquids with density 0.5 g/cm³ (31.2 lb/ft³)
Switch position > 0.5 g/cm³ (31.2 lb/ft³), can be configured via DIP switch

Liquids with density > 0.4 g/cm³ (25.0 lb/ft³)
- Optionally available to order
- 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 (25.0 lb/ft³)/ density setting.

13.4.8 Solids contents

Ø ≤ 5 mm (0.2 in)

13.5 Additional technical data

Technical Information TI01402F.
Current Technical Information: Endress+Hauser website: www.endress.com → Downloads.

www.addresses.endress.com

Endress+Hauser

People for Process Automation