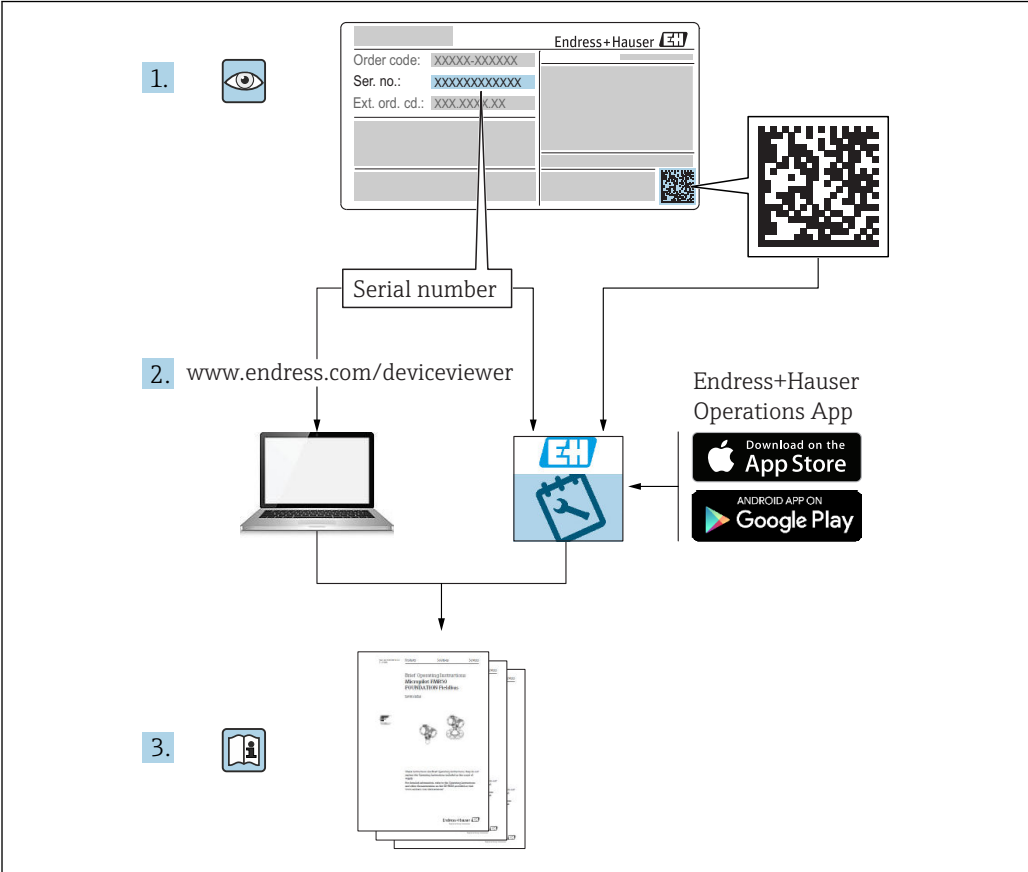


Operating Instructions

Liquiphant FTL51B

Vibronic
Limit switch for liquids





A0023555

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1 About this document

1.1 Symbols

1.1.1 Safety symbols

DANGER

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

WARNING

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


CAUTION

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

NOTICE

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

1.1.2 Electrical symbols

 Ground connection

Grounded clamp, which is grounded via a grounding system.

 Protective earth (PE)

Ground terminals, which must be grounded prior to establishing any other connections. The ground terminals are located on the inside and outside of the device.

1.1.3 Symbols for certain types of information

 Permitted


Procedures, processes or actions that are permitted.


 Forbidden

Procedures, processes or actions that are forbidden.

 Tip

Indicates additional information

 Reference to documentation

 Reference to another section


 1, 2, 3. Series of steps

1.1.4 Symbols in graphics

A, B, C ... View

1, 2, 3 ... Item numbers

 Hazardous area

 Safe area (non-hazardous area)

2 Basic safety instructions

2.1 Requirements for the personnel

The personnel must fulfill the following requirements to carry out the necessary tasks, e. g., commissioning and maintenance:

- ▶ Trained, qualified specialists must have a relevant qualification for the specific function and task
- ▶ Are authorized by the plant owner/operator
- ▶ Are familiar with federal/national regulations
- ▶ Must have read and understood the instructions in the manual and supplementary documentation
- ▶ Follow instructions and comply with conditions

2.2 Designated use

- Only use the measuring device as a limit switch for liquids
- Improper use can pose hazards
- Ensure that the measuring device is free of defects while it is in operation
- Use the measuring device only for media to which the process-wetted materials have an adequate level of resistance
- Do not exceed or drop below the limit values for the measuring device
☒ TI01403F/00/EN

2.2.1 Incorrect use

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

Residual risks

Due to heat transfer from the process, the temperature of the electronics housing and the assemblies contained therein may rise to 80 °C (176 °F) during operation.

Danger of burns from contact with surfaces!

- ▶ If necessary, ensure protection against contact to prevent burns.

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

2.3 Workplace safety

For work on and with the device:

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

2.4 Operational safety

Risk of injury!

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

Modifications to the device

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

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

Repair

To ensure continued operational safety and reliability:

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

2.5 Product safety

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

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

2.6 IT security

We only provide a warranty if the device is installed and used as described in the Operating Instructions. The device has safety mechanisms integrated to prevent users from inadvertently changing settings.

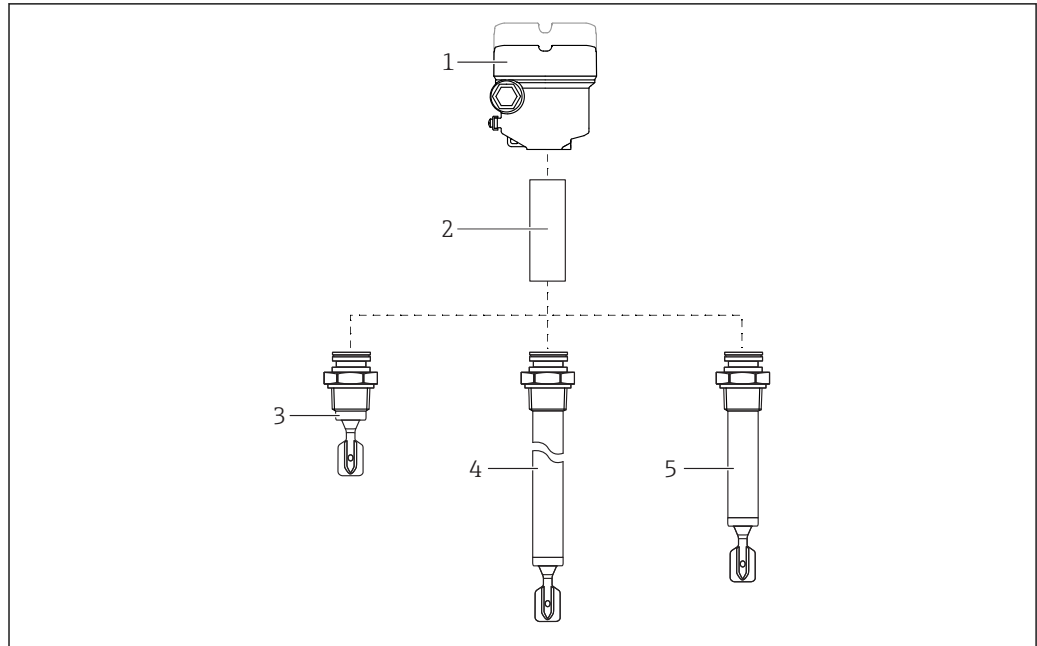
Provide additional protection for the device and data transfer to/from the device

- ▶ IT security measures defined in the plant owner/operator's own security policy must be implemented by plant owners/operators themselves.

3 Product description

Point level switch for minimum or maximum detection.


3.1 Product design



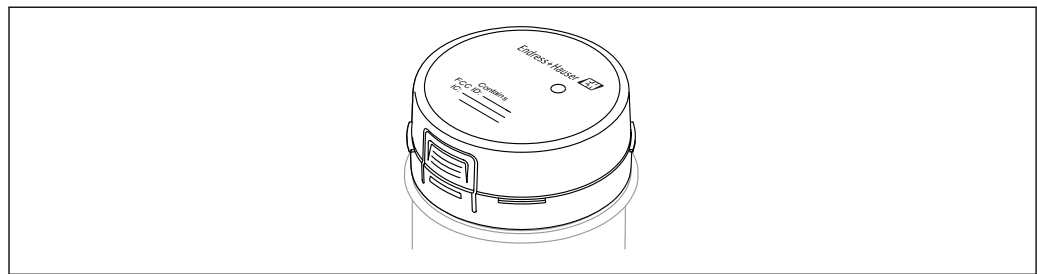
A0036953

 1 Product design


- 1 Housing with electronic insert and cover, optional Bluetooth module or LED module
- 2 Optional spacer (temperature spacer or pressure-tight feedthrough (second line of defense))
- 3 Compact probe design
- 4 Probe design with pipe extension
- 5 Probe design with short pipe

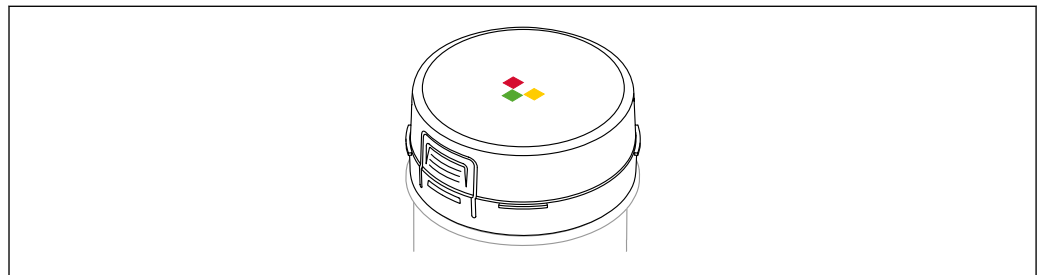
 Identify the electronic insert via the order code on the nameplate.

Optional: Bluetooth module VU121 or LED module VU120



A0039257

 2 Bluetooth module




A0039258

 3 LED module

4 Incoming acceptance and product identification

4.1 Incoming acceptance

Check the following during goods acceptance:

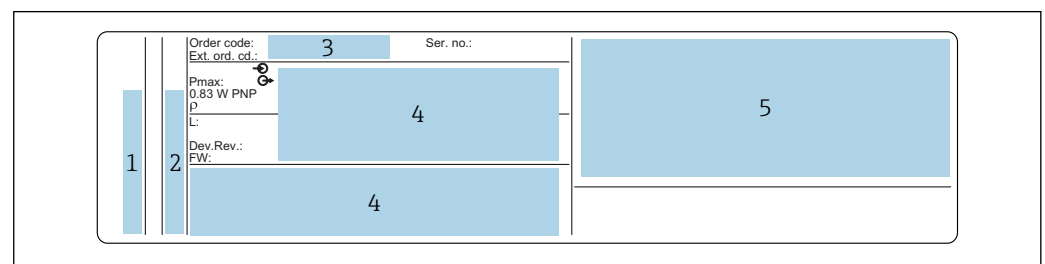
- Are the order codes on the delivery note and the product sticker identical?
 - Are the goods undamaged?
 - Do the nameplate data match the ordering information on the delivery note?
 - If required (see nameplate): Are the Safety Instructions, e. g. XA, provided?
 - Is the device properly secured?
-  If one of these conditions is not met, please contact the manufacturer's sales office.

4.2 Product identification

The measuring device can be identified in the following ways:

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

4.2.1 Nameplate



4 Nameplate specifications

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

4.2.2 Manufacturer address

Endress+Hauser SE+Co. KG
 Hauptstraße 1
 79689 Maulburg, Germany
 Address of the manufacturing plant: See nameplate.

4.3 Storage and transport

4.3.1 Storage conditions

Use original packaging.

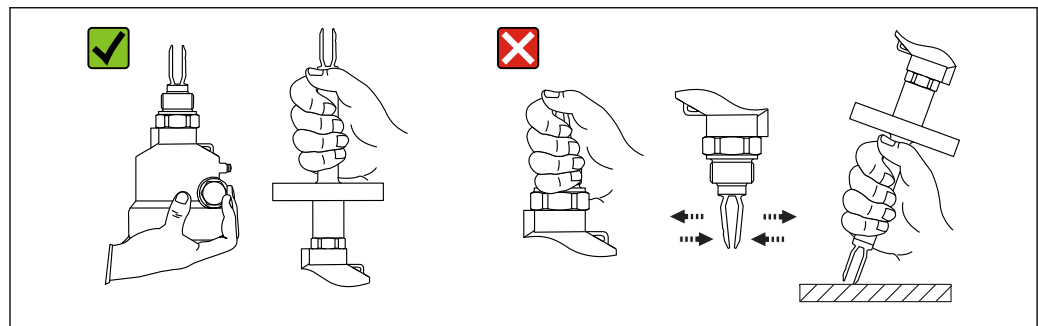
Storage temperature

-40 to +80 °C (-40 to +176 °F)

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

4.3.2 Transporting the device

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



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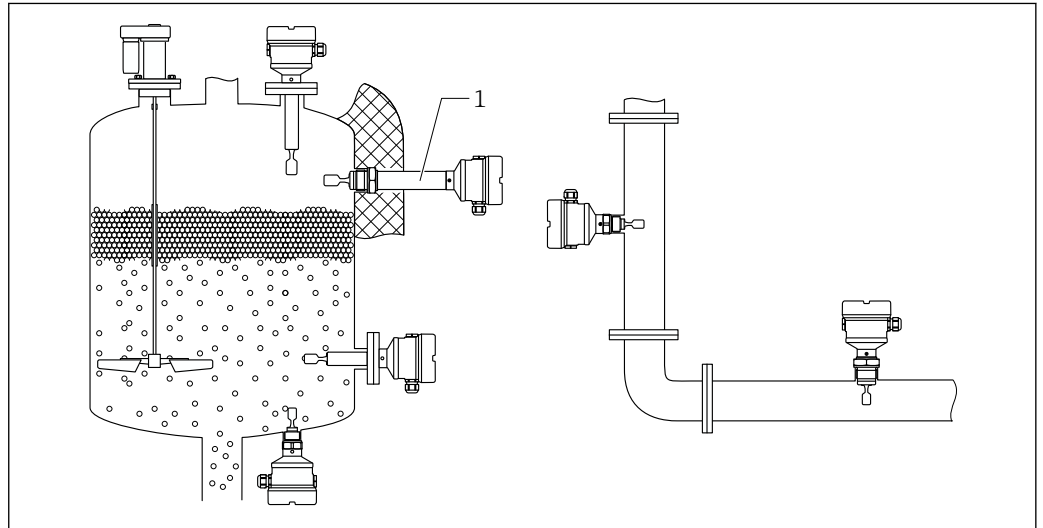
5 Handling the device during transportation

5 Installation

⚠ WARNING

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

► Only open the device in a dry environment!



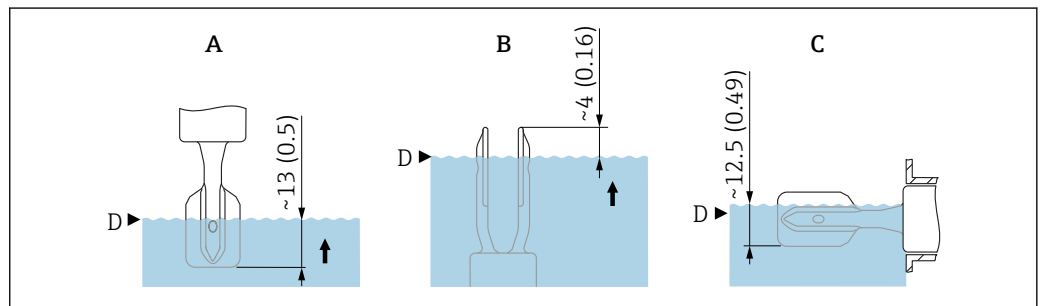
6 Installation in any position in a vessel, pipe or tank

1 Temperature spacer for tank with insulation and/or high process temperatures

5.1 Mounting conditions

5.1.1 Taking the switch point into consideration

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

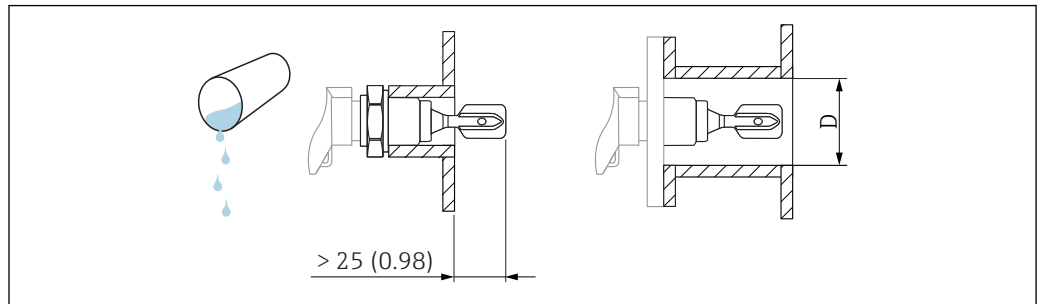


7 Typical switch points. Unit of measurement mm (in)

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

5.1.2 Take viscosity into consideration

Low viscosity



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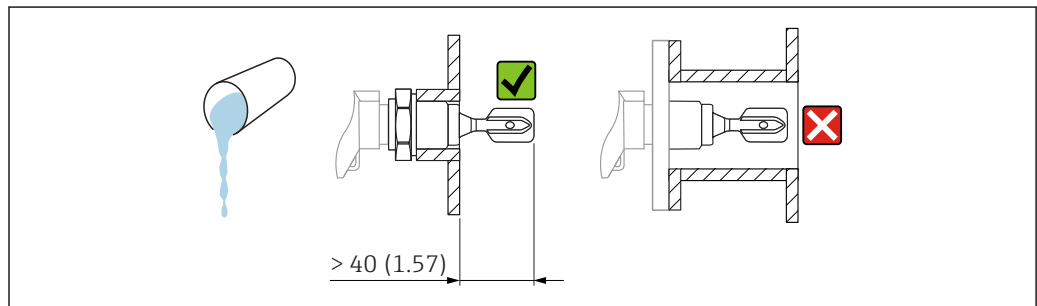
8 Installation example for low-viscosity liquids. Unit of measurement mm (in)

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

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

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

High viscosity



A0037348

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

NOTICE

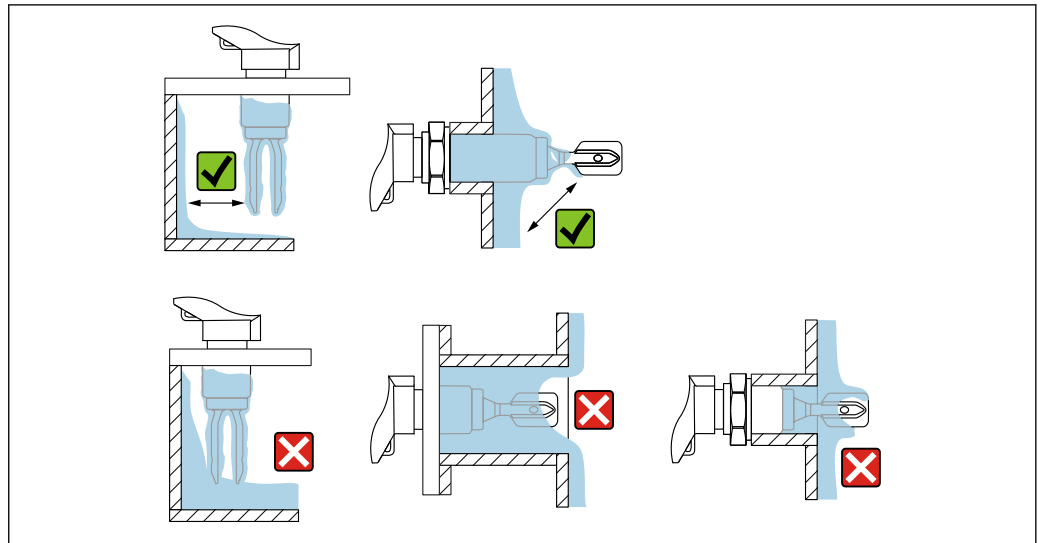
Highly viscous liquids may cause switching delays.

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

i High viscosity, e. g. viscous oils: < 10 000 mPa·s

The tuning fork must be located outside the installation socket!

5.1.3 Avoiding buildup

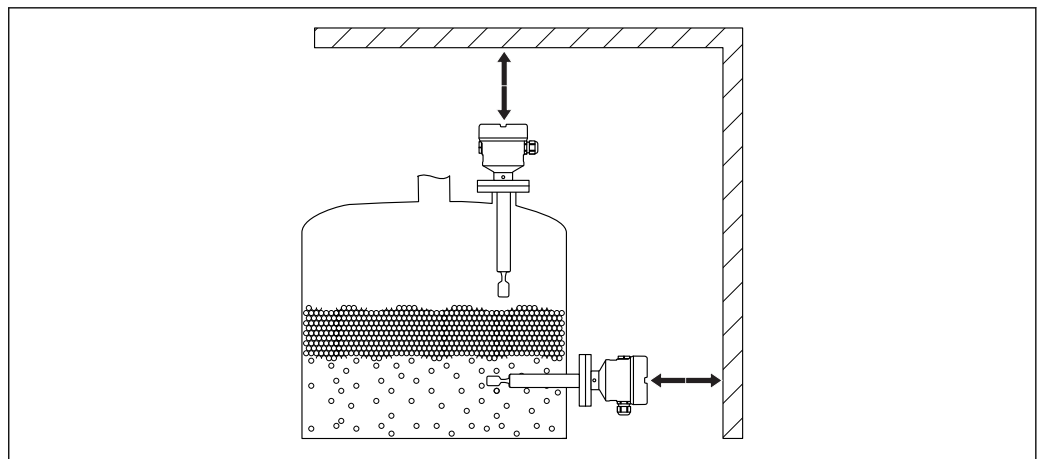


A0033239

10 Installation examples for a highly viscous process medium

- Use short installation sockets to ensure that the turning fork can project freely into the vessel.
- Install preferably flush-mounted on vessels or in pipes.
- Leave sufficient distance between the buildup expected on the tank wall and the tuning fork.

5.1.4 Take clearance into consideration

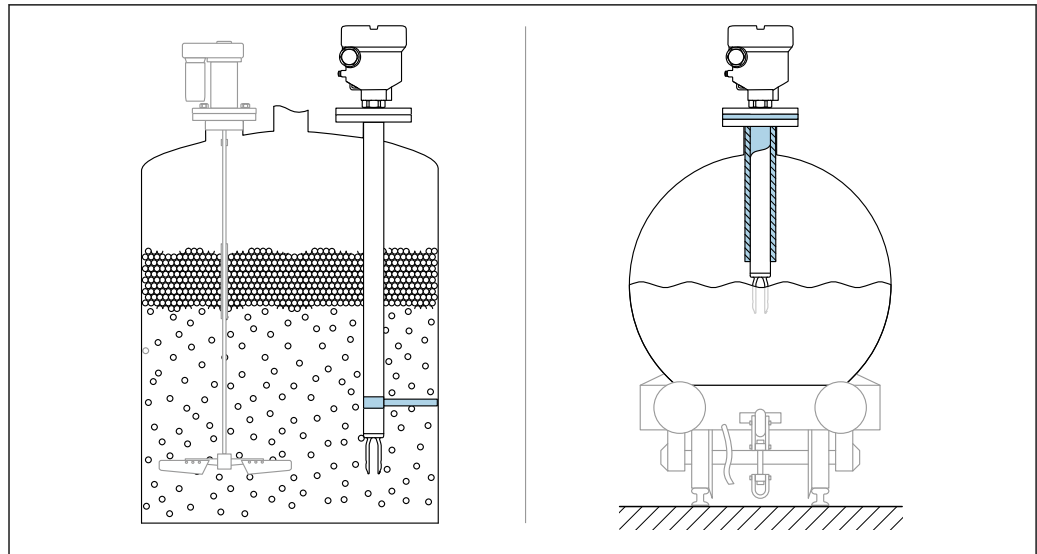


A0033236

11 Take clearance into consideration

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

5.1.5 Support the device

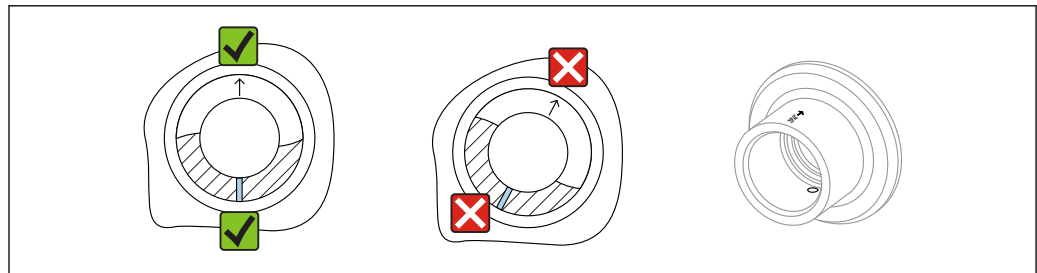


A0031874

12 Support in the event of dynamic load

Support the device in the event of severe dynamic load. Maximum lateral loading capacity of the pipe extensions and sensors: 75 Nm (55 lbf ft).

5.1.6 Weld-in adapter with leakage hole



A0039230

13 Weld-in adapter with leakage hole

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

5.2 Mounting the measuring device

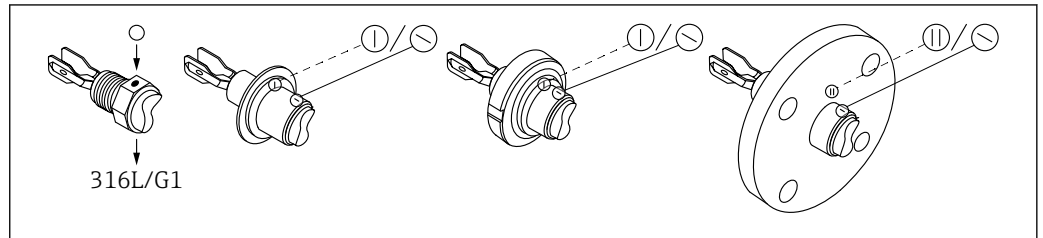
5.2.1 Required tools

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

5.2.2 Installation

Horizontal installation in vessels

Align the tuning fork with the marking



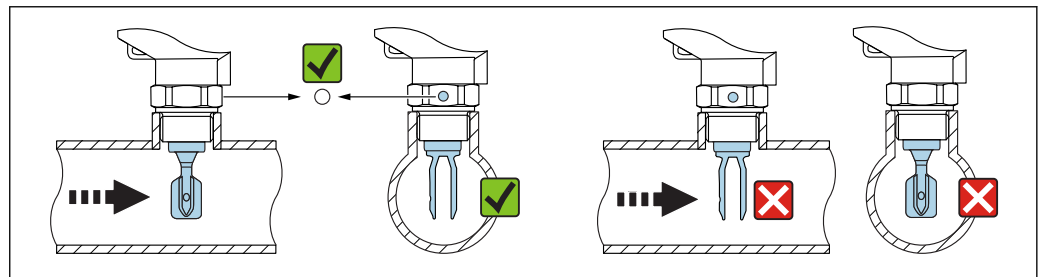
14 Marking to align the tuning fork

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

The following can be used as the marking:

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

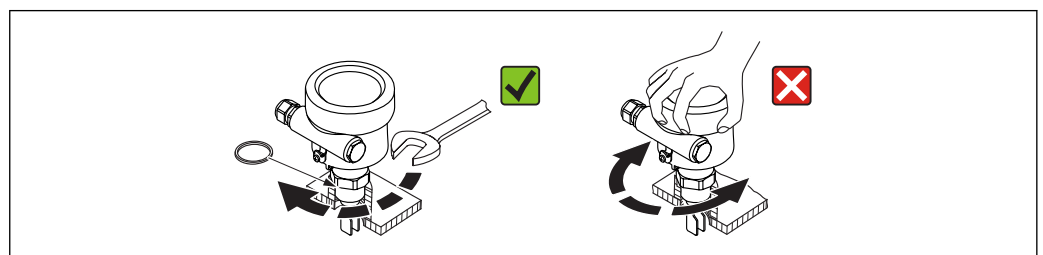
Installing in pipes



15 Marking and fork position

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

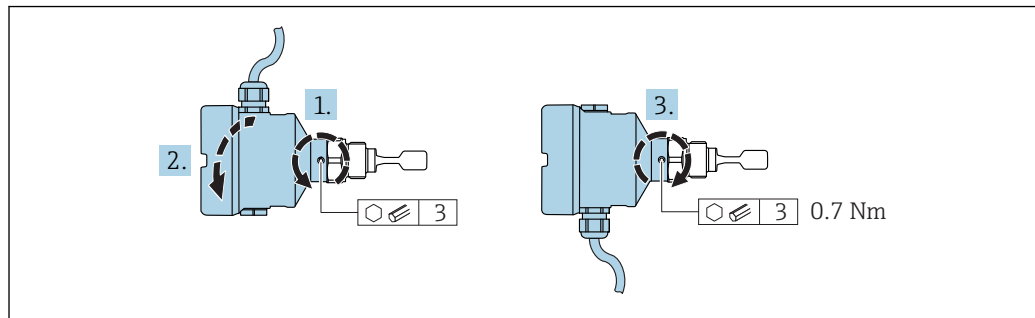
Screwing in the device



16 Screwing in the device

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

Aligning the cable entry



17 Housing with external locking screw

A0037347

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

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

5.3 Sliding sleeves

See the "Accessories" section.

5.4 Post-installation check

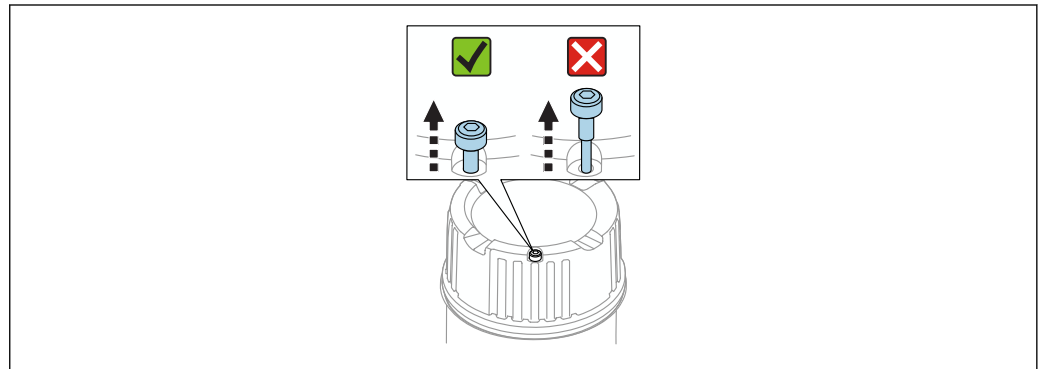
- Is the measuring device undamaged (visual inspection)?
 - Does the measuring device conform to the measuring point specifications?
- For example:
- Process temperature
 - Process pressure
 - Ambient temperature range
 - Measuring range
- Are the measuring point number and labeling correct (visual inspection)?
 - Is the measuring device adequately protected against precipitation and direct sunlight?
 - Is the device properly secured?

6 Electrical connection

6.1 Connection conditions

6.1.1 Cover with securing screw

i Covers with a securing screw are available for devices for use in hazardous areas. Do not release the screw fully.



18 Cover with securing screw

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 $\geq 35 V_{DC}$ or $\geq 16 V_{ACeff}$.

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

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

6.2 Connecting the measuring device

6.2.1 2-wire AC (electronic insert FEL61)

- Two-wire AC version
- Switches the load directly into the power supply circuit via an electronic switch; always connect in series with a load.
- Functional testing without level change
A functional test can be performed on the device using the test button on the electronic insert.

Supply voltage

$$U = 19 \text{ to } 253 V_{AC}$$

Residual voltage when switched through: maximum 12 V

i Pay attention to the following as per IEC/EN61010-1: Provide a suitable circuit breaker for the device, and limit the current to 1 A, e. g. by installing a 1 A fuse (slow-blow) in the line (not the neutral wire) of the supply circuit.

Power consumption

$$P \leq 2 \text{ VA}$$

Current consumption

Residual current when blocked: $I \leq 3.8 \text{ mA}$

The red LED flashes in the event of an overload or short-circuit. Check for an overload or short-circuit every 5 seconds. The test is deactivated after 60 seconds.

Power output and load current

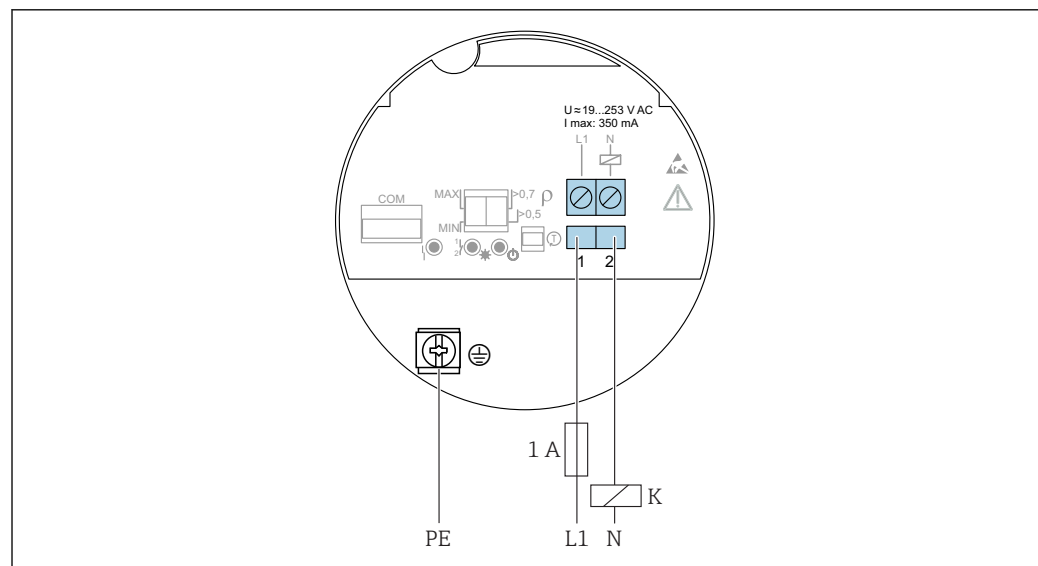
- Max 89 VA/253 V (350 mA); max 8.4 VA/24 V (350 mA)
- Min 2.5 VA/253 V (10 mA); min $\geq 0.5 \text{ VA/24 V}$ (20 mA)
- With overload and short-circuit protection.

Behavior of output signal

- OK status: load on (switched through)
- Demand mode: load off (blocked)
- Alarm: load off (blocked)

Terminal assignment

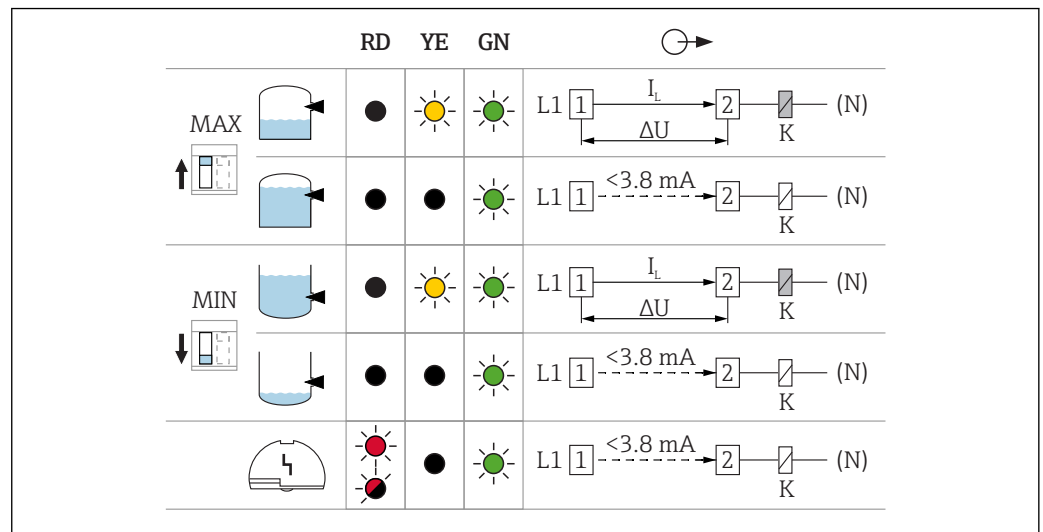
Always connect an external load. The electronic insert has integrated short-circuit protection.



A0036060

19 2-wire AC, electronic insert FEL61

Behavior of switch output and signaling



A0031901

20 Behavior of switch output and signaling, electronic insert FEL61

MAXDIP switch for setting MAX safety mode

MIN DIP switch for setting MIN safety mode

RD LED, red, for warning or alarm

YE LED, yellow, switch status

GN LED, green, operational status, device on

I_L Load current switched through

6.2.2 3-wire DC-PNP (electronic insert FEL62)

- Three-wire DC version
- Preferably in conjunction with programmable logic controllers (PLC), DI modules as per EN 61131-2. Positive signal at switch output of electronics module (PNP)
- Functional testing without level change
A functional test can be performed on the device using the test button on the electronic insert or using the test magnet with the housing closed.

Supply voltage



WARNING

Failure to use the prescribed power unit.

Risk of fatal injury due to electric shock!

- The FEL62 may only be powered by devices with safe galvanic isolation, as per IEC 61010-1.

$U = 10$ to 55 V_{DC}

- Pay attention to the following as per IEC/EN61010-1: Provide a suitable circuit breaker for the device, and limit the current to 500 mA, e. g. by installing a 0.5 A fuse (slow-blow) in the line (not the neutral wire) of the supply circuit.

Power consumption

$P \leq 0.5\text{ W}$

Current consumption

$I \leq 10\text{ mA}$ (without load)

The red LED flashes in the event of an overload or short-circuit.

Load current

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

Capacitance load

$C \leq 0.5 \text{ } \mu\text{F}$ at 55 V, $C \leq 1.0 \text{ } \mu\text{F}$ at 24 V

Residual current

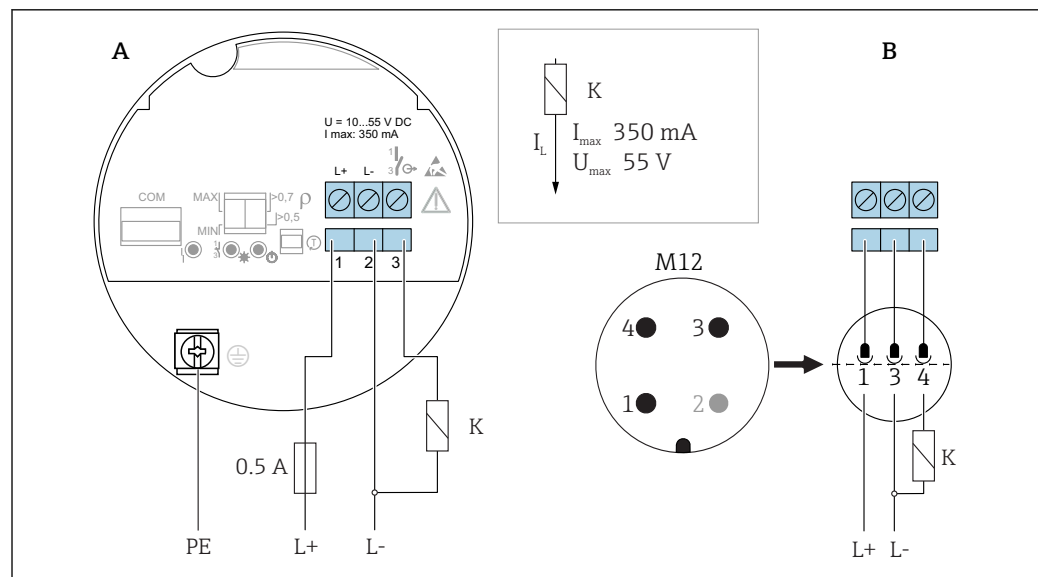
$I < 100 \text{ } \mu\text{A}$ (with transistor blocked)

Residual voltage

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

Behavior of output signal

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

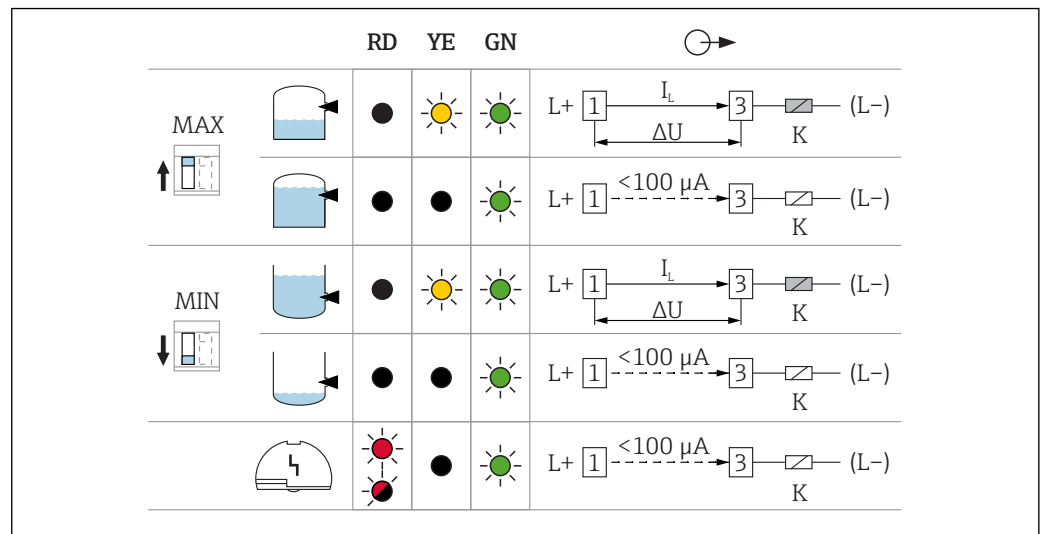
Terminal assignment

21 3-wire DC-PNP, electronic insert FEL62

A Connection wiring with terminals

B Connection wiring with M12 connector in housing as per EN61131-2 standard

Behavior of switch output and signaling



A0033508

22 Behavior of switch output and signaling, electronic insert FEL62

MAX DIP switch for setting MAX safety mode

MIN DIP switch for setting MIN safety mode

RD LED, red, for warning or alarm

YE LED, yellow, switch status

GN LED, green, operational status, device on

I_L Load current switched through

6.2.3 Universal current connection with relay output (electronic insert FEL64)

- Switches the loads via 2 potential-free changeover contacts
- Two galvanically isolated change-over contacts (DPDT), both change-over contacts switch simultaneously
- Functional testing without level change. A functional test can be performed on the device using the test button on the electronic insert or using the test magnet with the housing closed.

WARNING

In the event of an error, the electronic insert can exceed the limit temperature for touchable surfaces, resulting in a risk of burns.

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

Supply voltage

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

- Pay attention to the following as per IEC/EN61010-1: Provide a suitable circuit breaker for the device, and limit the current to 500 mA, e. g. by installing a 0.5 A fuse (slow-blow) in the line (not the neutral wire) of the supply circuit.

Power consumption

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

Connectable load

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

- $I_{AC} \leq 6 \text{ A}$ (Ex de 4 A), $U \sim \leq AC 253 \text{ V}$; $P \sim \leq 1500 \text{ VA}$, $\cos \varphi = 1$, $P \sim \leq 750 \text{ VA}$, $\cos \varphi > 0.7$
- $I_{DC} \leq 6 \text{ A}$ (Ex de 4 A) to DC 30 V, $I_{DC} \leq 0.2 \text{ A}$ to 125 V

According to IEC 61010: the sum of the voltages of the relay outputs and power supply ≤ 300 V

Preferably use electronic insert FEL62 DC PNP for low DC current loads, e. g. connection to a PLC.

Relay contact material: silver/nickel AgNi 90/10

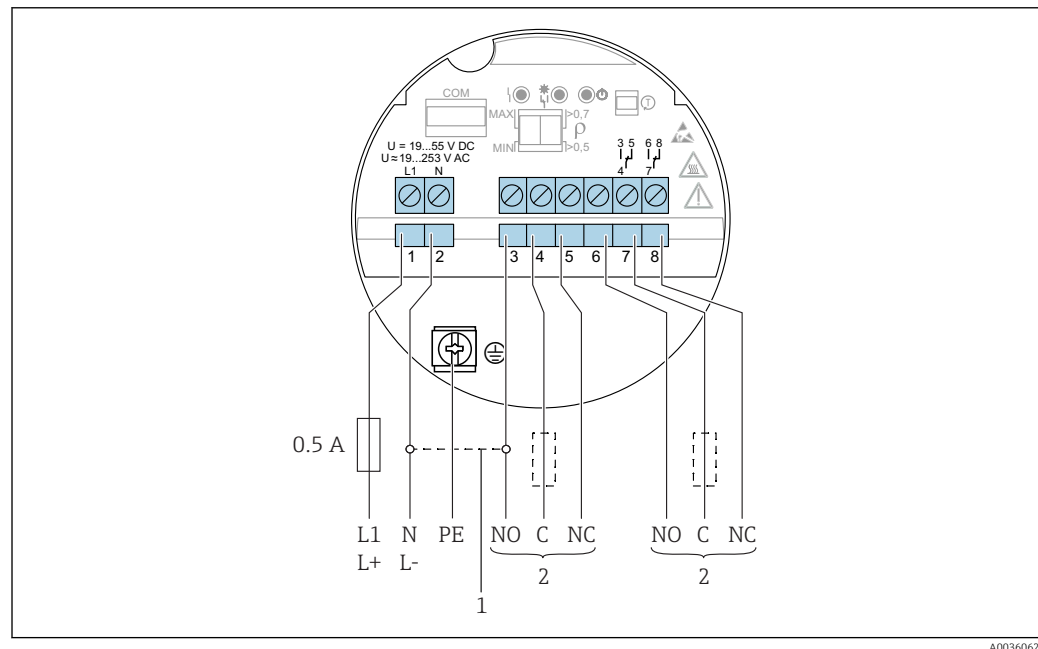
When connecting a device with high inductance, fit a spark suppressor to protect the relay contact. Depending on the connected load, a fine-wire fuse protects the relay contact in the event of a short-circuit.

Both relay contacts switch simultaneously.

Behavior of output signal

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




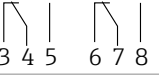

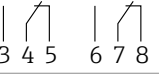


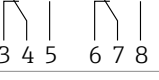

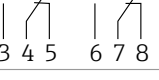

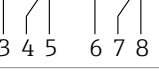
Terminal assignment



23 Universal current connection with relay output, electronic insert FEL64

- 1 When bridged, the relay output works using NPN logic.
- 2 Connectable load

Behavior of switch output and signaling

		RD	YE	GN	
MAX 		●	☀	☀	
		●	●	☀	
MIN 		●	☀	☀	
		●	●	☀	
		☀	●	☀	

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24 Behavior of switch output and signaling, electronic insert FEL64

MAX DIP switch for setting MAX safety mode

MIN DIP switch for setting MIN safety mode

RD LED, red, for alarm

YE LED, yellow, switch status


GN LED, green, operational status, device on

6.2.4 DC connection, relay output (electronic insert FEL64 DC)

- Switches the loads via 2 potential-free changeover contacts
- Two galvanically isolated change-over contacts (DPDT), both change-over contacts switch simultaneously
- Functional testing without level change. Functional testing of the entire device can be performed using the test button on the electronic insert or with the test magnet with the housing closed.

Supply voltage

$U = 9 \text{ to } 20 \text{ V}_{\text{DC}}$

-  Pay attention to the following as per IEC/EN61010-1: Provide a suitable circuit breaker for the device, and limit the current to 500 mA, e. g. by installing a 0.5 A fuse (slow-blow) in the power circuit.

Power consumption

$P < 1.0 \text{ W}$

Connectable load

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

- $I_{\text{AC}} \leq 6 \text{ A}$ (Ex de 4 A), $U_{\sim} \leq \text{AC } 253 \text{ V}$; $P_{\sim} \leq 1500 \text{ VA}$, $\cos \varphi = 1$, $P_{\sim} \leq 750 \text{ VA}$, $\cos \varphi > 0.7$
- $I_{\text{DC}} \leq 6 \text{ A}$ (Ex de 4 A) to DC 30 V, $I_{\text{DC}} \leq 0.2 \text{ A}$ to 125 V

According to IEC 61010: the sum of the voltages of the relay outputs and power supply $\leq 300 \text{ V}$

Preferably use electronic insert FEL62 DC PNP for low DC current loads, e. g. connection to a PLC.

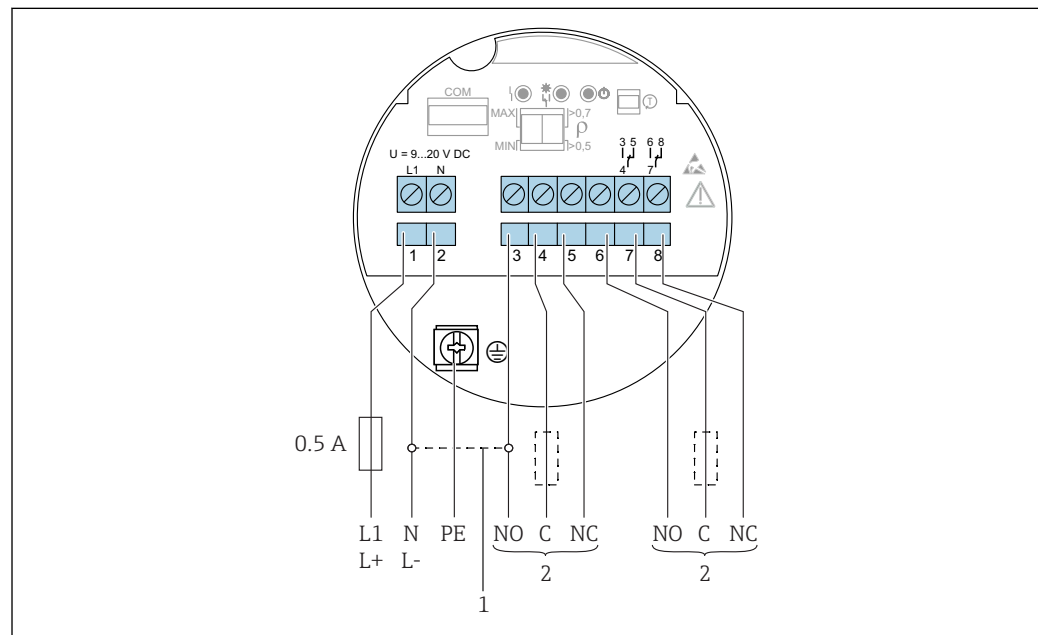
Relay contact material: silver/nickel AgNi 90/10

When connecting a device with high inductance, fit a spark suppressor to protect the relay contact. Depending on the connected load, a fine-wire fuse protects the relay contact in the event of a short-circuit.

Behavior of output signal

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







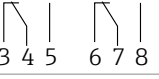




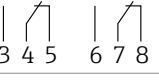





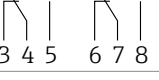




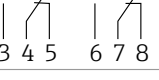




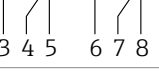
Terminal assignment



25 DC connection with relay output, electronic insert FEL64 DC

- 1 When bridged, the relay output works using NPN logic.
- 2 Connectable load

Behavior of switch output and signaling

		RD	YE	GN	
MAX 					
					
MIN 					
					
					

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26 Behavior of switch output and signaling, electronic insert FEL64 DC

MAX DIP switch for setting MAX safety mode

MIN DIP switch for setting MIN safety mode

RD LED, red, for alarm

YE LED, yellow, switch status

GN LED, green, operational status, device on

6.2.5 PFM output (electronic insert FEL67)

- For connecting to the Nivotester FTL325P and FTL375P switching units from Endress +Hauser
- PFM signal transmission; pulse frequency modulation, superimposed on the power supply along the two-wire cabling
- Functional testing without level change:
 - A functional test can be performed on the device using the test button on the electronic insert.
 - The functional test can also be prompted by disconnecting the supply voltage or triggered directly by the Nivotester FTL325P and FTL375P switching unit.

Supply voltage

$U = 9.5 \text{ to } 12.5 \text{ V}_{DC}$

 Pay attention to the following as per IEC/EN61010-1: Provide a suitable circuit breaker for the device.

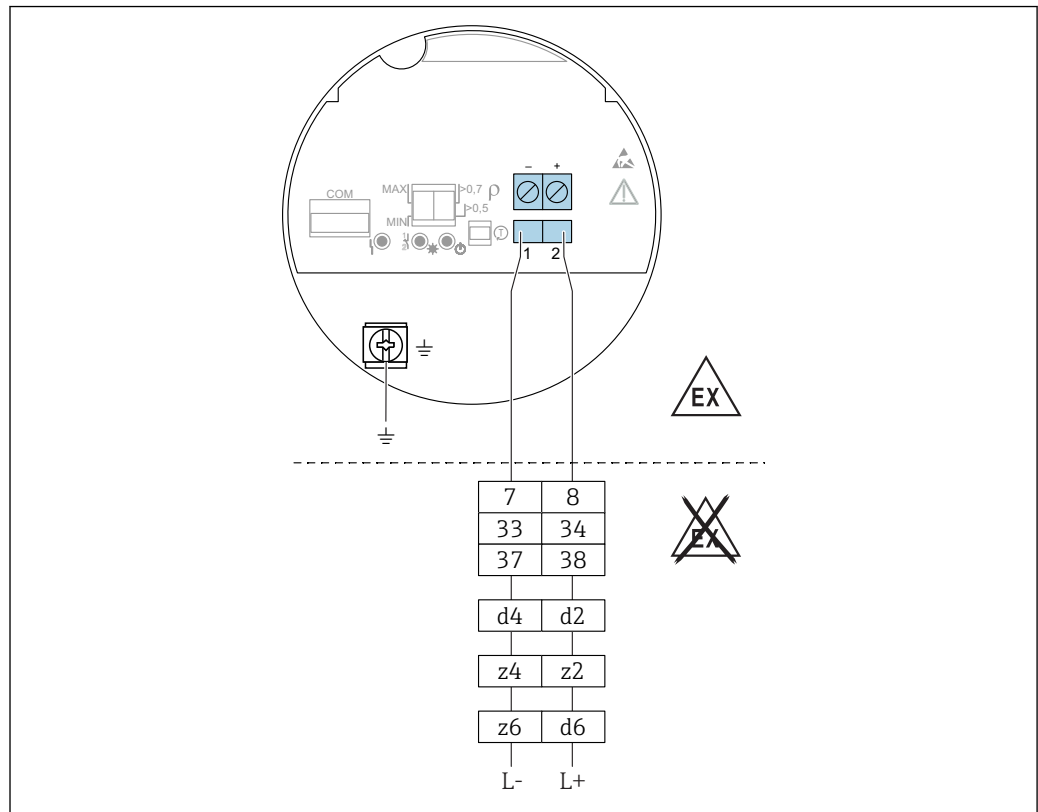
Power consumption

$P \leq 150 \text{ mW}$ with Nivotester FTL325P or FTL375P

Behavior of output signal

- OK status: MAX mode 150 Hz, MIN mode 50 Hz
- Demand mode: MAX mode 50 Hz, MIN mode 150 Hz
- Alarm: MAX/MIN mode 0 Hz

Terminal assignment



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■ 27 PFM output, electronic insert FEL67

7/ 8: Nivotester FTL325P 1 CH, FTL325P 3 CH input 1

33/ 34: Nivotester FTL325P 3 CH input 2

37/ 38: Nivotester FTL325P 3 CH input 3

d4/ d2: Nivotester FTL375P input 1

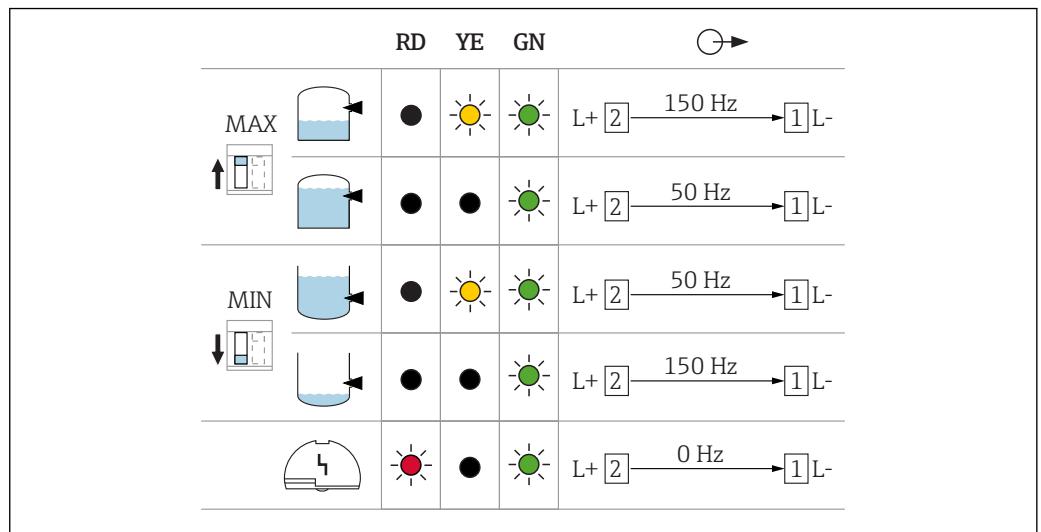
z4/ z2: Nivotester FTL375P input 2

z6/ d6: Nivotester FTL375P input 3

Connection cable

- Maximum cable resistance: 25 Ω per core
- Maximum cable capacitance: < 100 nF
- Maximum cable length: 1000 m (3281 ft)

Behavior of switch output and signaling



A0037696

28 Switching behaviour and signaling, electronic insert FEL67

MAX DIP switch for setting MAX safety mode

MIN DIP switch for setting MIN safety mode

RD LED, red, for alarm

YE LED, yellow, switch status

GN LED, green, operational status, device on

i The MAX/MIN switch must be set in accordance with the application. Only then is it possible to perform the functional test correctly.

6.2.6 2-wire NAMUR > 2.2 mA / < 1.0 mA (electronic insert FEL68)

- For connecting to isolating amplifier as per NAMUR (IEC 60947-5-6), e.g. the Nivotester FTL325N from Endress+Hauser
- Signal transmission H-L edge 2.2 to 3.8 mA / 0.4 to 3.8 mA as per IEC 60947-5-6 (NAMUR) on two-wire cable
- Functional testing without level change. A functional test can be performed on the device using the test button on the electronic insert or using the test magnet with the housing closed.
The functional test can also be triggered by interrupting the supply voltage or activated directly from the Nivotester FTL325N.

Supply voltage

$$U = 8.2 V_{DC}$$

i Pay attention to the following as per IEC/EN61010-1: Provide a suitable circuit breaker for the device.

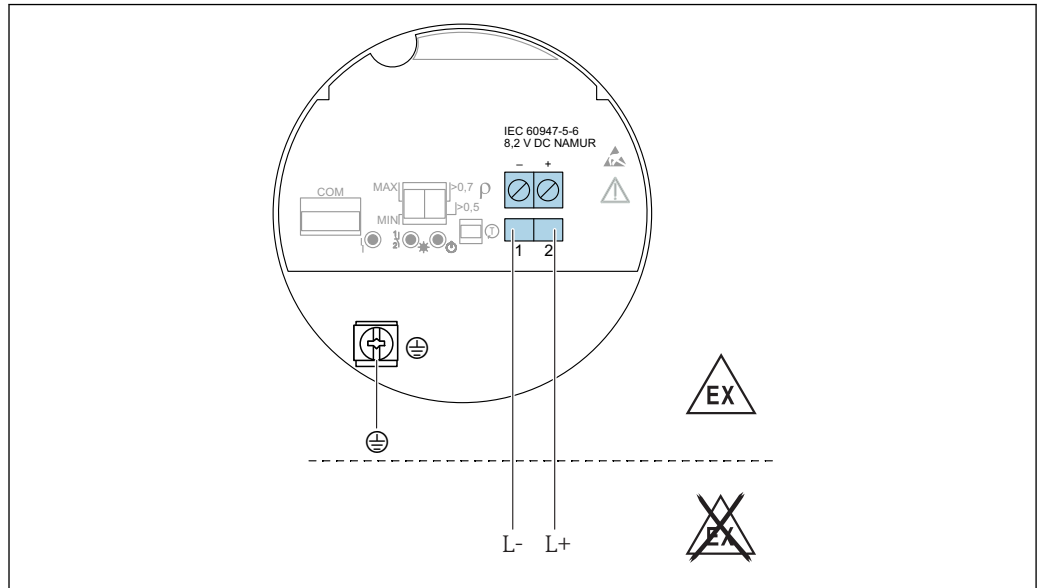
Power consumption

NAMUR IEC 60947-5-6

Behavior of output signal

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

Terminal assignment



A0036066

29 2-wire NAMUR > 2.2 mA / < 1.0 mA, electronic insert FEL68

Behavior of switch output and signaling

		RD	YE	GN	⌚
MAX ↑		●	☀	●	L+ 2 → 2.2...3.8 mA → 1 L-
		●	●	●	L+ 2 → 0.4...1.0 mA → 1 L-
MIN ↓		●	☀	●	L+ 2 → 2.2...3.8 mA → 1 L-
		●	●	●	L+ 2 → 0.4...1.0 mA → 1 L-
		●	●	●	L+ 2 → < 1.0 mA → 1 L-

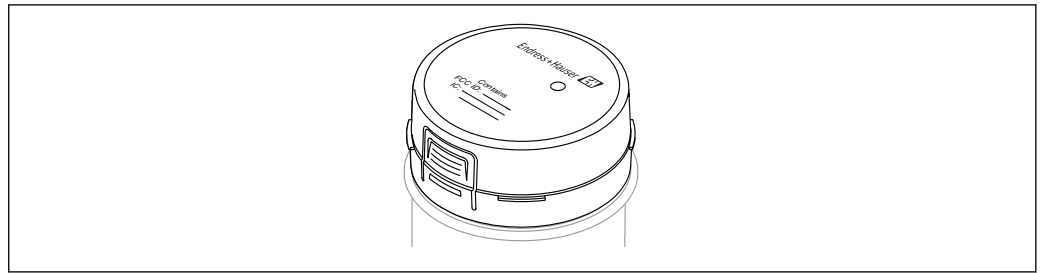
A0037694

30 Behavior of switch output and signaling, electronic insert FEL68

- MAX DIP switch for setting MAX safety mode
- MIN DIP switch for setting MIN safety mode
- RD LED, red, for alarm
- YE LED, yellow, switch status
- GN LED, green, operational status, device on

i When using the device with the electronic insert FEL68 (2-wire NAMUR), the Bluetooth module must be ordered separately, including the required battery. Product Configurator, order code for "Accessory mounted", option NG "Prepared for Heartbeat Verification + Monitoring + Bluetooth".

6.2.7 Bluetooth module VU121 (optional)



A0039257

31 Bluetooth module VU121

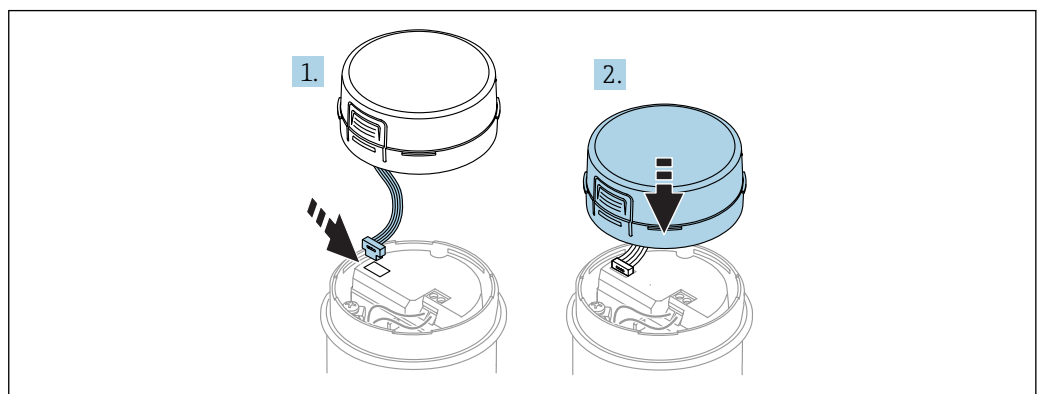
- The Bluetooth module can be connected via the COM interface to the following electronic inserts: FEL61, FEL62, FEL64, FEL64 DC, FEL67, FEL68 (2-wire NAMUR).
- The Bluetooth module with battery is suitable for use in hazardous areas.
- For energy-related reasons, the Bluetooth module requires a special battery when operated with the 2-wire NAMUR electronics.

i When using the device with the electronic insert FEL68 (2-wire NAMUR), the Bluetooth module must be ordered separately, including the required battery. Product Configurator, order code for "Accessory mounted", option NG "Prepared for Heartbeat Verification + Monitoring + Bluetooth".

Batteries

- i** The battery is categorized as dangerous goods when transported by air and may not be installed in the device when shipped.
- i** Replacement batteries can be purchased from a specialist retailer. Only the following types of AA 3.6 V lithium batteries made by the manufacturers listed below are suitable as replacement batteries:
- SAFT LS14500
 - TADIRAN SL-360/s
 - XENOENERGY XL-060F

Connecting the module

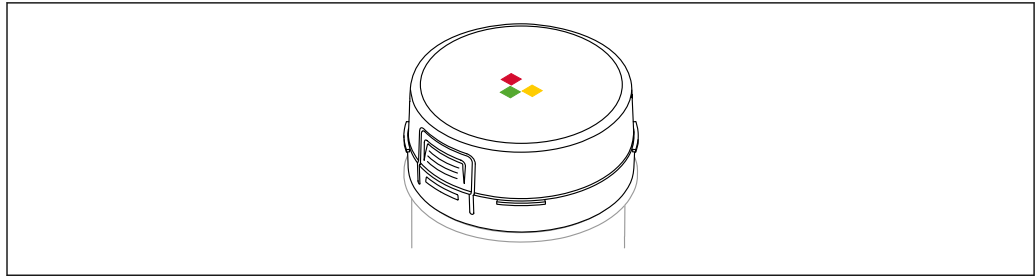


A0039242

32 Connecting the module

Connect the Bluetooth module with the COM interface in the electronic insert.

6.2.8 LED module VU120 (optional)



A0039258

33 LED module

The bright LED display indicates the switch status or the alarm condition and can be connected to the following electronic inserts: FEL62, FEL64, FEL64DC

Supply voltage

$$U = 12 \text{ to } 55 \text{ V}_{\text{DC}}, 19 \text{ to } 253 \text{ V}_{\text{AC}}$$

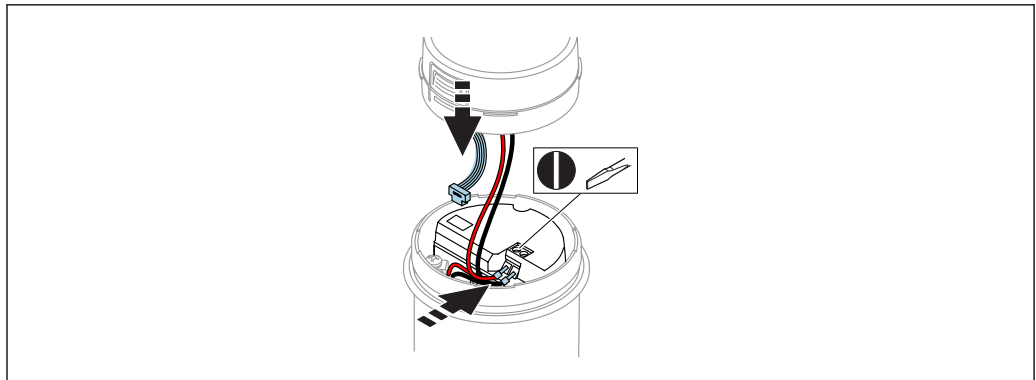
Power consumption

$$U \leq 0.7 \text{ W}, < 6 \text{ VA}$$

Current consumption

$$I_{\text{max}} = 0.4 \text{ A}$$

Connecting the module



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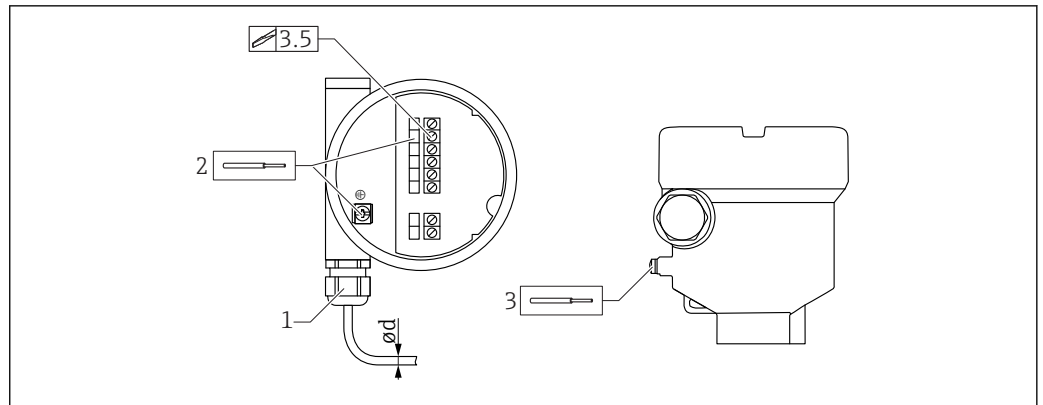
34 Connecting the LED module

1. Attach the connecting cable of the LED module to the connecting cables of the supply voltage. Use the wire end ferrules supplied.
2. Connect the wire end ferrules to the terminals of the measuring device.
3. Connect the LED module with the COM interface in the electronic insert.

6.2.9 Cable entry

Required tools

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



A0018023

35 Cable entry, electronic insert

1 M20 cable gland

2 Conductor cross-section, 2.5 mm² maximum (AWG14)

3 Conductor cross-section, 4.0 mm² maximum (AWG12)

ød Nickel-plated brass 7 to 10.5 mm (0.28 to 0.41 in)

ød Plastic 5 to 10 mm (0.2 to 0.38 in)

ød Stainless steel 7 to 12 mm (0.28 to 0.47 in)

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

6.3 Post-connection check

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

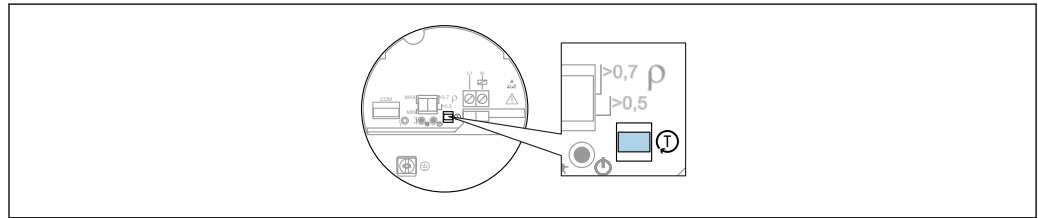
7 Operation options

7.1 Overview of operation options

7.1.1 Operating concept

- Operation with button and DIP switches on the electronic insert
- Display with optional Bluetooth module and SmartBlue (app) via Bluetooth® wireless technology
- Indication of switching status and operational status with optional LED module (lights visible from the outside)
 - For plastic housing and aluminum housing (standard and Ex d) in conjunction with the DC-PNP and relay electronics
 - Ordering information: Product Configurator, order code for "Display; operation" option "B"

7.1.2 Functional test using the button on the electronic insert



A0037132

36 Position of button for functional test

i The functional test must be performed when the device status is OK.
Status OK: MAX safety and sensor free or MIN safety and sensor covered.

- Press the test button for at least 1 second (FEL61/62/64/64DC/67/68 electronic inserts)
- The output changes to the safety-oriented state - the functional test of the device takes place
- Test duration at least 10 s or until the button is released if the button is pressed for > 10 s
- The device returns to normal operation if the internal test is successful

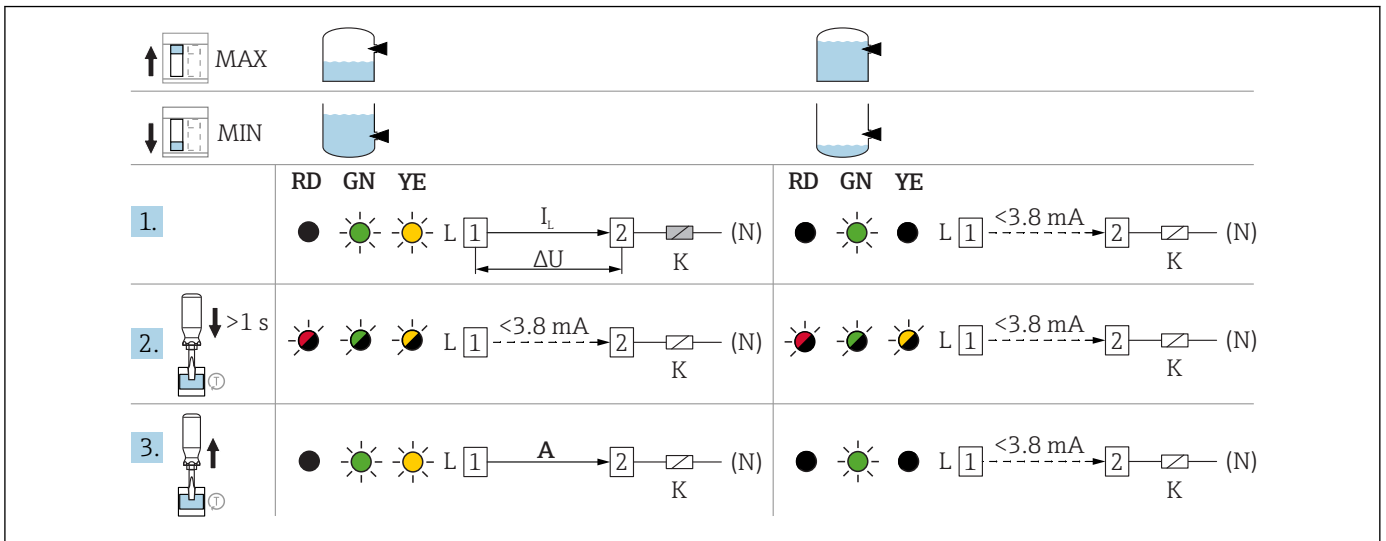
The LEDs flash one after another as a chaser light during the functional test.

If the housing cannot be opened during operation due to explosion protection requirements, e. g., EX d/XP), the functional test can also be performed from the outside using the test magnet (FEL62, FEL64 DC, FEL68). The functional test of the PFM electronics (FEL67) and NAMUR electronics (FEL68) can be started at the Nivotester FTL325P/N.

i Pay attention to the information in the Safety Manual for proof testing safety equipment in accordance with SIL or WHG (German Water Resources Act).

1. Make sure no undesired switching processes are triggered!
2. Press the button "T" on the electronic insert for at least 1 s (e. g., with a screwdriver).
 - ↳ The output changes from the OK status to demand mode.

FEL61 switching behavior and signaling

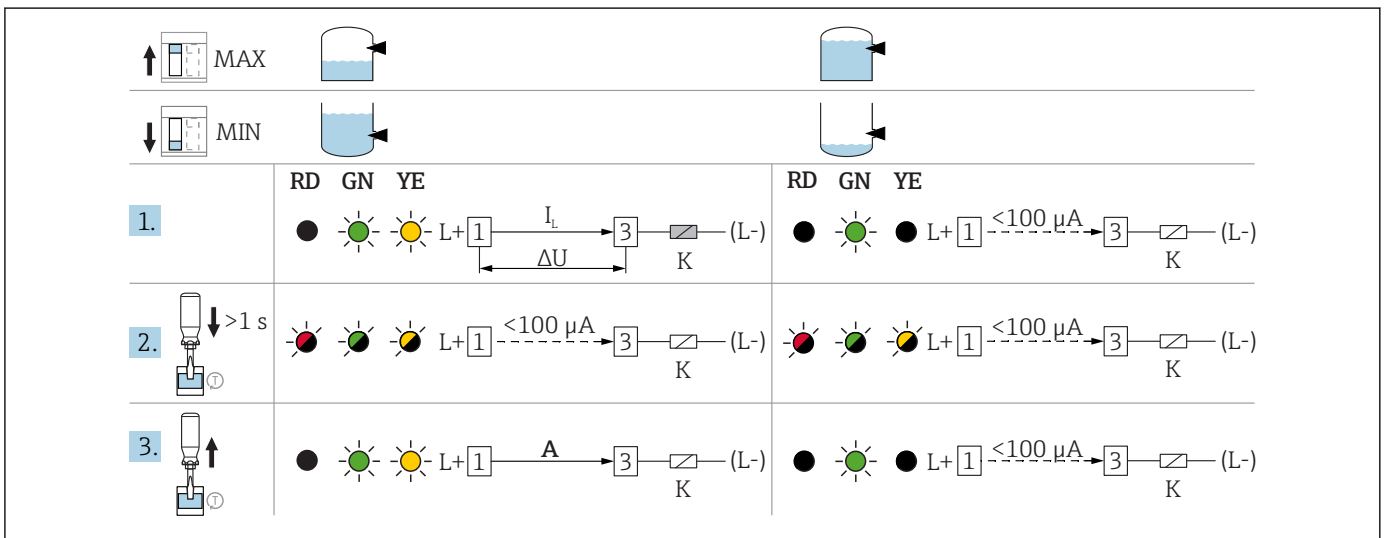


A0039210

37 FEL61 switching behavior and signaling

A After the test button is pressed, the load is switched off for at least 10 seconds ($I < 3.8\text{ mA}$) even if the button is pressed for < 10 seconds. If the button is pressed for > 10 seconds, the load remains switched off ($I < 3.8\text{ mA}$) until the test button is released. The load is then switched on again.

FEL62 switching behaviour and signaling

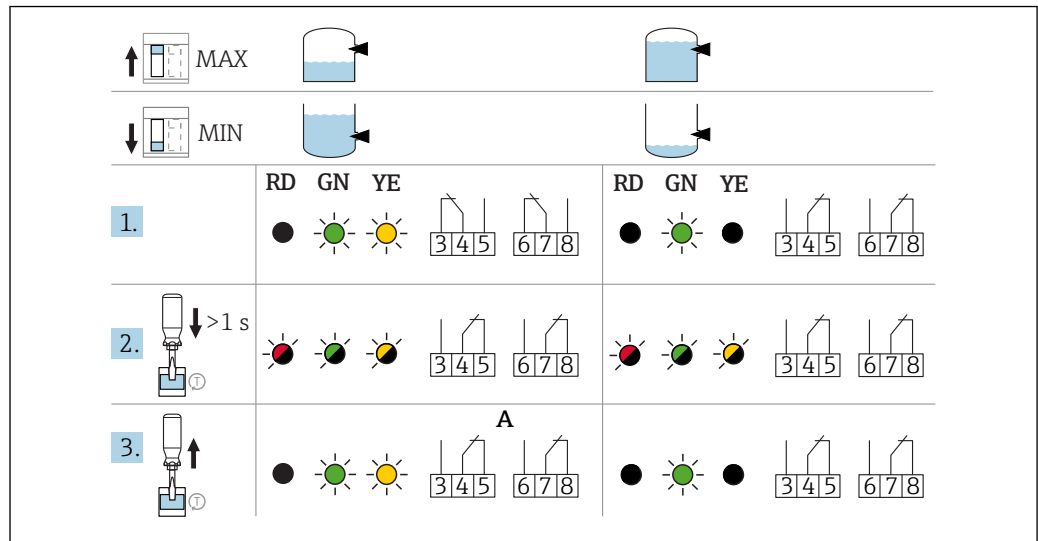


A0039211

38 FEL62 switching behaviour and signaling

A After the test button is pressed, the DC-PNP output is switched off for at least 10 seconds ($I < 100\text{ }\mu\text{A}$) even if the button is pressed for < 10 seconds. If the button is pressed for > 10 seconds, the DC-PNP output remains switched off ($I < 100\text{ }\mu\text{A}$) until the test button is released. The DC-PNP output is then switched on again.

FEL64, FEL64DC switching behavior and signaling



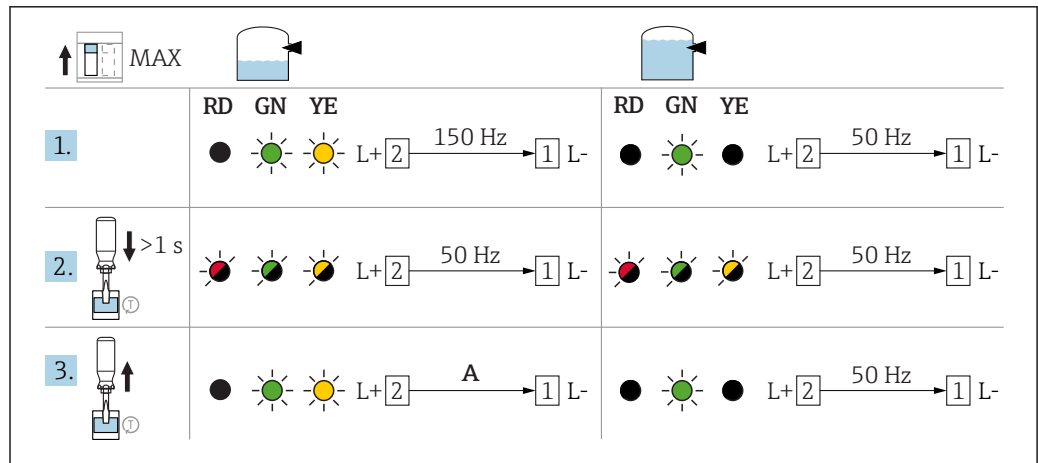
A0039212

39 FEL64, FEL64DC switching behavior and signaling

A After the test button is pressed, the relay is de-energized for at least 10 seconds even if the button is pressed for < 10 seconds. If the test button is pressed for > 10 seconds, the relay remains de-energized until the test button is released. The relay is then energized again.

FEL67 switching behaviour and signaling

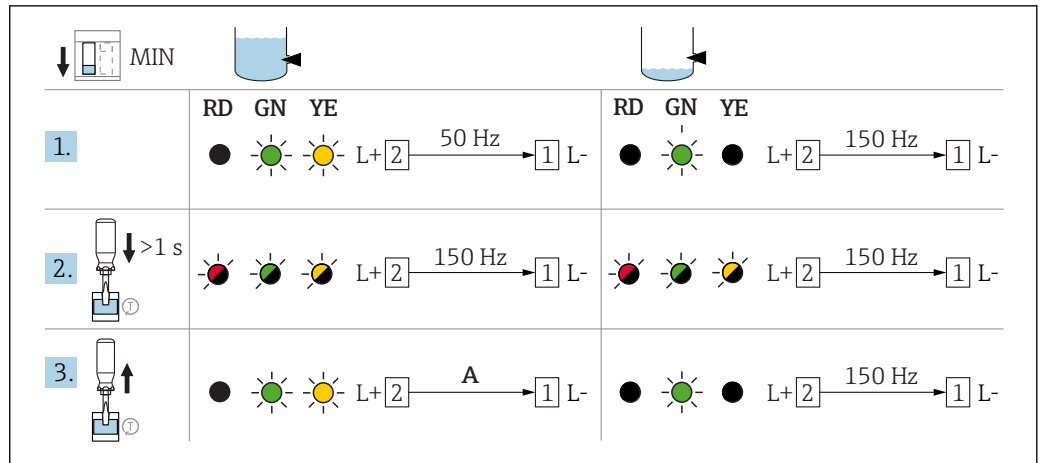
i A distinction must be made between MAX and MIN operating modes in the case of the FEL67 electronic insert!



A0039213

40 FEL67 MAX switching behaviour and signaling

A After the test button is pressed, the output frequency is switched off for at least 10 seconds, 50 Hz, even if the button is pressed for < 10 seconds. If the button is pressed for > 10 seconds, the output frequency remains at 50 Hz until the test button is released. The output frequency then returns to 150 Hz once again.



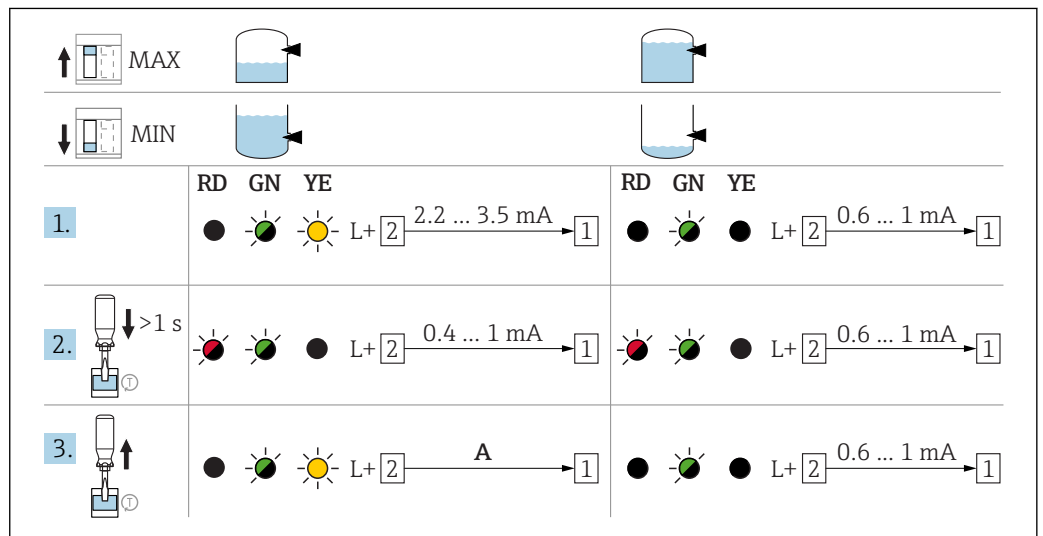
A0039214

41 FEL67 MIN switching behaviour and signaling

A After the test button is pressed, the output frequency is switched off for at least 10 seconds, 150 Hz, even if the button is pressed for < 10 seconds. If the button is pressed for > 10 seconds, the output frequency remains at 150 Hz until the test button is released. The output frequency then returns to 50 Hz once again.

i The PFM frequency cannot be measured on site. It is therefore recommended to proof test the functionality at the Nivotester FTL325P/FTL375P.

FEL68 switching behaviour and signaling



A0039543

42 NAMUR electronics switching behaviour and signaling

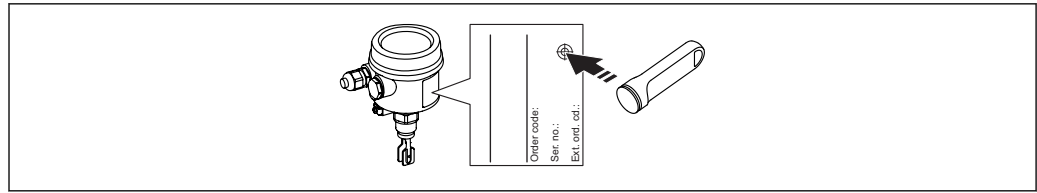
A After the test button is pressed, the current is 0.6 to 1 mA for at least 10 seconds even if the button is pressed for < 10 seconds. If the button is pressed for > 10 seconds, the current remains at 0.6 to 1 mA until the test button is released. The current then returns to 2.2 to 3.5 mA.

7.1.3 Functional test of the electronic switch with a test magnet

Perform functional test of the electronic switch without opening the device

- Hold the test magnet against the marking on the nameplate on the outside
- Simulation is possible in the case of the FEL62, FEL64, FEL64DC, FEL68 electronic inserts

The functional test with the test magnet acts in the same way as pressing the test button on the electronic insert.

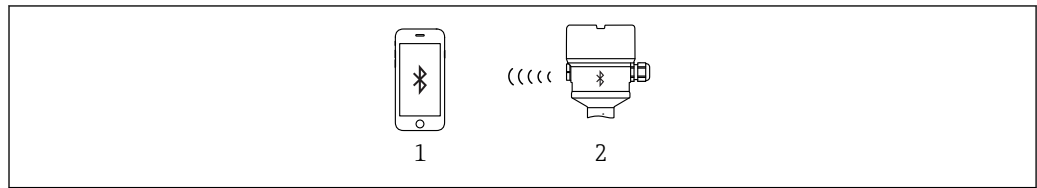


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43 Functional test with test magnet

7.1.4 Heartbeat diagnostics and verification with Bluetooth® wireless technology

Access via Bluetooth® wireless technology



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44 Remote operation via Bluetooth® wireless technology

- 1 Smartphone or tablet with SmartBlue (app)
- 2 Device with optional Bluetooth module

Bluetooth module VU121 (optional)

Functions

- Connection via COM interface: Bluetooth module for device diagnostics via a smartphone app or tablet app
- Display the battery status via app when used with electronic insert FEL68 (NAMUR)
- User guidance (wizard) for SIL/WHG proof testing
- Visible in the livelist 10 seconds after the Bluetooth search commences
- Data can be read from the Bluetooth module 60 seconds after the supply voltage is switched on
- Display of the current vibration frequency and the switching state of the device

The yellow LED flashes when the Bluetooth module is connected to another Bluetooth device, e. g. mobile phone.

Heartbeat Technology

Heartbeat Technology module

Heartbeat Diagnostics

Continuously monitors and evaluates the device status and process conditions. Generates diagnostic messages when certain events occur and provides troubleshooting measures in accordance with NAMUR NE 107.

Heartbeat Verification

Performs a verification of the current device status upon request and generates a Heartbeat Technology verification report showing the result of the verification.

Heartbeat Monitoring

Continuously provides device and/or process data for an external system. Analysis of this data forms the basis for process optimization and predictive maintenance.

Technical data

- Approval: intrinsically safe Ex ia, IS or ec/ic
- NAMUR electronics (electronic insert FEL68):
For energy-related reasons, the Bluetooth module VU121 requires a special battery when operated with the 2-wire NAMUR electronics. The service life of the Bluetooth module without replacing the battery is at least 5 years with a maximum of 60 downloads of complete datasets (at ambient temperatures between 10 to 40 °C (50 to 104 °F)).
- Maximum free-field range 50 m (165 ft)
- Operation radius with intervisibility 10 m (33 ft) around the device



For documentation on radio approvals, see the Endress+Hauser website:
www.endress.com → Downloads.

7.2 LED module VU120 (optional)

The LED module lights up very brightly and can be easily identified from a distance. It can be connected to the following electronic inserts: FEL62, FEL64, FEL64 DC

Depending on either the MAX/MIN setting, the sensor status can be identified from the LEDs; displayed in the colors green, yellow and red.

The three colors of the LEDs flash one after another as a chaser light during the functional test.

7.2.1 Configuration and sensor status

LED shows a green light

- MAX, sensor status: Not covered
- MIN, sensor status: Covered

LED shows a yellow light

- MAX, sensor status: Covered
- MIN, sensor status: Not covered

LED shows a red light

Alarm

LED flashes red

- Warning
- FEL62 overload/short-circuit or no communication

The three colors of the LEDs flash one after another as a chaser light during the functional test.

8 Commissioning

8.1 Function check

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

- "Post-installation check" checklist → 16
- "Post-connection check" checklist → 31

8.2 Switching on the measuring device

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

FEL61, FEL62, FEL64, FEL64DC electronic inserts: The output is in the correct state for a maximum of 3 seconds after the device is switched on.

NAMUR FEL68 and PFM FEL67 electronic inserts: A functional test is always carried out when the device is switched on. The output is in the correct state after a maximum of 10 seconds.

8.3 Establishing a connection via SmartBlue (app)

8.3.1 SmartBlue (app)

Requirements

Device requirements

Commissioning via SmartBlue is only possible if a Bluetooth module is installed in the device.

System requirements

SmartBlue is available as a download from the Google Play Store for Android devices and from the iTunes Store for iOS devices

- iOS devices: iPhone 4S or higher from iOS9.0; iPad2 or higher from iOS9.0; iPod Touch 5th generation or higher from iOS9.0
- Devices with Android: from Android 4.4 KitKat and *Bluetooth*® 4.0

Initial password

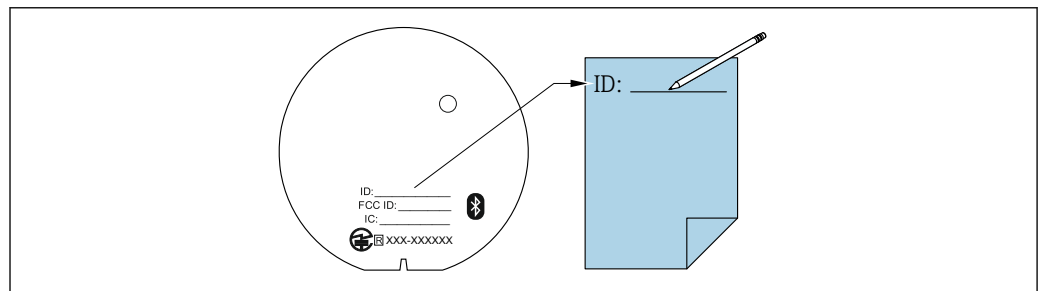
The ID number (serial number) on the nameplate of the Bluetooth module is used as the initial password when establishing the connection for the first time.

i It is important to note the following if the Bluetooth module is removed from one device and installed in another device: all log-in data are only stored in the Bluetooth module and not in the device. This also applies to the password changed by the user.

Preparatory steps

Note down the ID number of the Bluetooth module. The ID number on the nameplate of the Bluetooth module is used as the initial password when establishing the connection for the first time.

The high cover with the window must be used for devices that are operated with the Bluetooth module.



A0039040

Establishing a connection via SmartBlue (app)


1. Scan the QR code or enter "SmartBlue" in the search field.




 45 [Download link](#)

2. Start SmartBlue.
3. Select device from livelist displayed.
4. Log-in:
 - ↳ User name: admin
 - Password: ID number on the Bluetooth module

5. Tap the icons for more information.

 After logging in for the first time, change the password!

Saving PDF reports

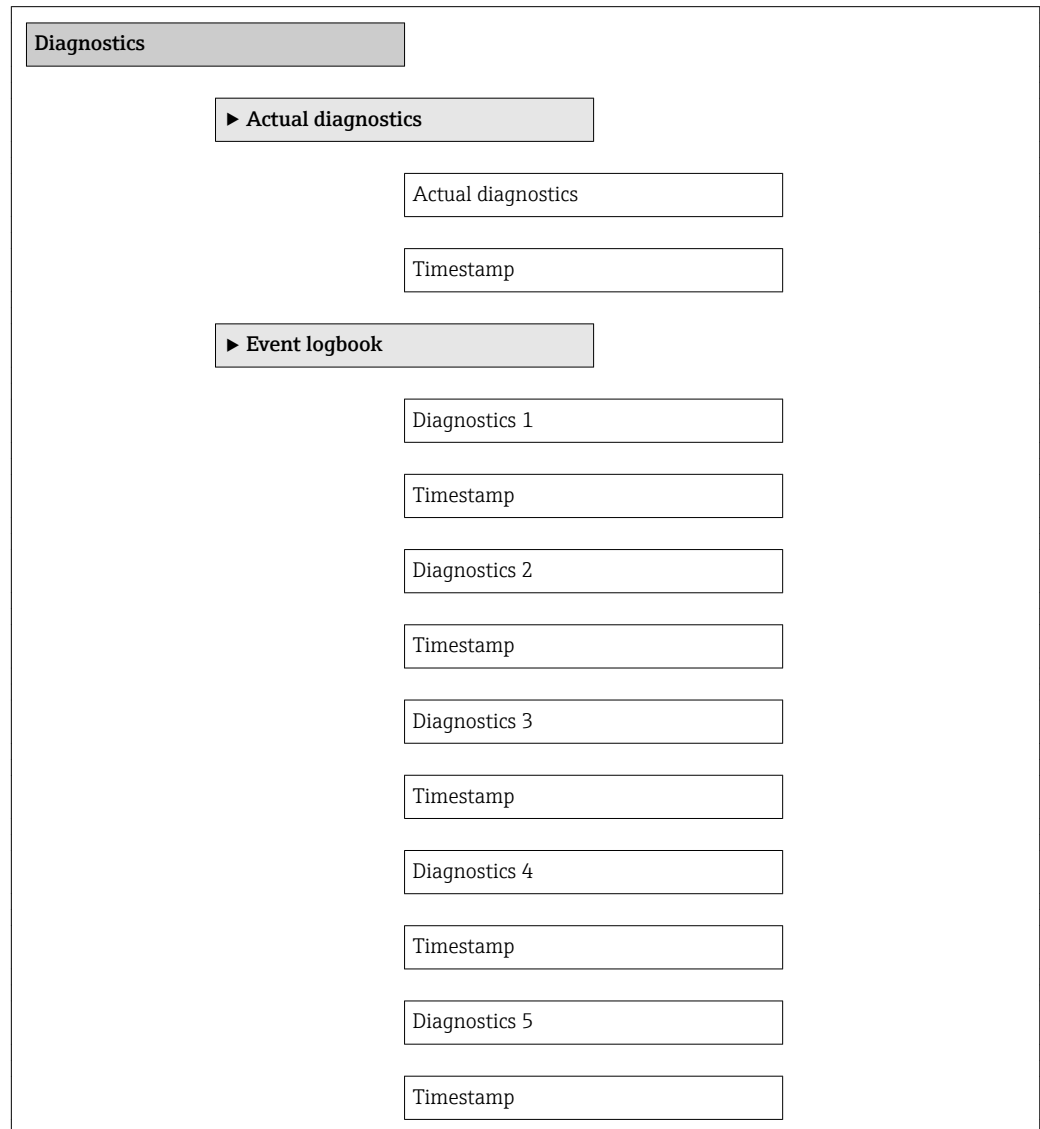
 The PDF reports generated in the SmartBlue app are not automatically saved and must therefore be actively saved on the smartphone or tablet.

9 Operation

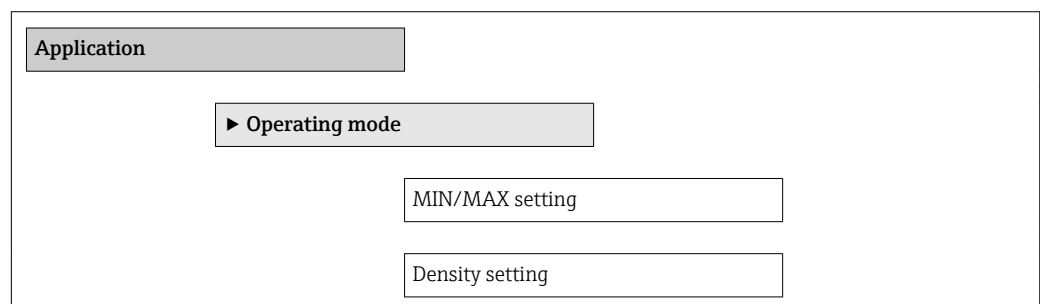
9.1 Diagnostics menu

The following data can be read out via the optional Bluetooth module and the associated Endress+Hauser SmartBlue app.

9.1.1 "Diagnostics" menu



9.1.2 "Application" menu



Switching delay uncovered to covered
Switching delay covered to uncovered
► Output
Digital Output-Status

9.1.3 "System" menu

System
Electronic type
► Bluetooth configuration
BLE HW revision
► Information
Device tag
Serial number
Firmware version
Device name
Order code
Manufacturer
Manufacturer ID
ENP version
Operating time
Number of system starts
Time stamp of last proof test
Date of last proof test
Frequency at delivery status
Current frequency

Upper alarm frequency
Upper warning frequency
Lower alarm frequency
Battery status
Temperature
Min. electronics temperature
Max. electronics temperature

9.2 Heartbeat Verification

The "Heartbeat Verification" module contains the Heartbeat Verification wizard which carries out the verification of the current device status and creates the Heartbeat Technology verification report:

- The wizard can be used via the SmartBlue app.
- The wizard takes the user through the entire process of creating the verification report.
- Displays the operating hours counter and the temperature drag indicator.
- If the vibration frequency of the fork increases, a corrosion warning appears.
- The order configuration of the air's vibration frequency is shown on the verification report. An increased vibration frequency indicates corrosion. A reduced vibration frequency signals deposits or that the medium is covering the sensor. Deviations between the current vibration frequency and the vibration frequency upon delivery can be caused by the process temperature and process pressure.

9.3 Recurrent testing for SIL/WHG (German Water Resources Act) devices ¹⁾

The "SIL Prooftest", "WHG Prooftest" and "SIL/WHG Prooftest" modules contain a wizard for recurrent testing. This is required at appropriate intervals for the following applications: SIL (IEC61508/IEC61511), WHG (German Water Resources Act):

- The wizard can be used via the SmartBlue app.
- The wizard takes the user through the entire process of creating the verification report.
- The verification report can be saved as a PDF file.

10 Diagnostics and troubleshooting

The device indicates warnings and faults via Bluetooth in the SmartBlue app and via the LEDs on the electronic insert. All the device warnings and faults are for information purposes only and do not have a safety function. The faults diagnosed by the device are displayed in the SmartBlue app in accordance with NE107. Depending on the diagnostic message, the device behaves as per a warning or fault condition.

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

1) Only available for devices with SIL or WHG approval

If using NAMUR electronics, change or insert the battery in the Bluetooth module.

10.1 Diagnostic information via light emitting diodes

10.1.1 LED at electronic insert

LED green not lit

Possible cause: No power supply

Troubleshooting: Check plug, cable and power supply

LED flashes red

Possible cause: Overload or short-circuit in load circuit

Troubleshooting: Clear the short-circuit

Reduce maximum load current to below 350 mA

LED red continuously lit

Possible cause: Internal sensor error or electronic fault

Troubleshooting: Replace device

10.1.2 SmartBlue

Device is not visible in the live list

Possible cause: No Bluetooth connection available

The device is already connected to another smartphone or tablet

No cable is connected to the Bluetooth module

Troubleshooting:

- Connect the Bluetooth module to the COM interface
- Enable Bluetooth function on smartphone or tablet
- If using NAMUR electronics, change or insert the battery in the Bluetooth module

Device is visible in the live list but cannot be accessed via SmartBlue

- Possible cause on Android end device

Troubleshooting:

- Check whether the location function is enabled for the app
- Check whether the location function for the app was approved the first time
- GPS or positioning function must be activated for certain Android versions in conjunction with Bluetooth®
- Activate GPS, close the app fully and restart, enable the positioning function for the app

- Possible cause on Apple end device

Troubleshooting:

- Log in as normal
- Enter the user name: admin
- Enter initial password (serial number of Bluetooth module), paying attention to lower/upper case

Login via SmartBlue not possible

Possible cause: Device is being put into operation for the first time

Troubleshooting: Enter initial password (ID number of Bluetooth module) and change it, paying attention to lower/upper case.

No communication with device via SmartBlue

- Possible cause: Incorrect password entered
Troubleshooting: Enter correct password
- Possible cause: Forgotten password
Troubleshooting: Contact Endress+Hauser Service

11 Maintenance

No special maintenance work is required.

11.1 Maintenance tasks

11.1.1 Cleaning

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

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


12 Repair

12.1 General information

12.1.1 Repair concept

Endress+Hauser repair concept

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

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

12.1.2 Repair of Ex-certified devices

WARNING


Limitation of electrical safety due to incorrect connection!

Risk of explosion!

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

12.2 Spare parts

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

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

12.3 Return

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

12.4 Disposal



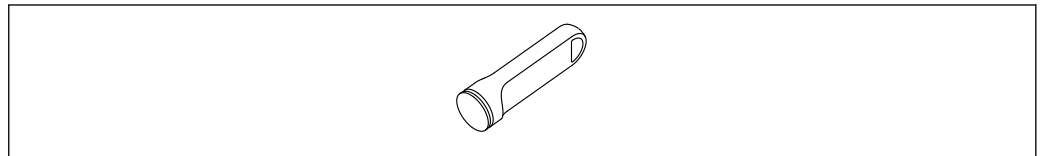
If required by the Directive 2012/19/EU on waste electrical and electronic equipment (WEEE), our products are marked with the depicted symbol in order to minimize the disposal of WEEE as unsorted municipal waste. Such products may not be disposed of as unsorted municipal waste and can be returned to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

13 Accessories

13.1 Device-specific accessories

13.1.1 Test magnet

Order number: 71437508

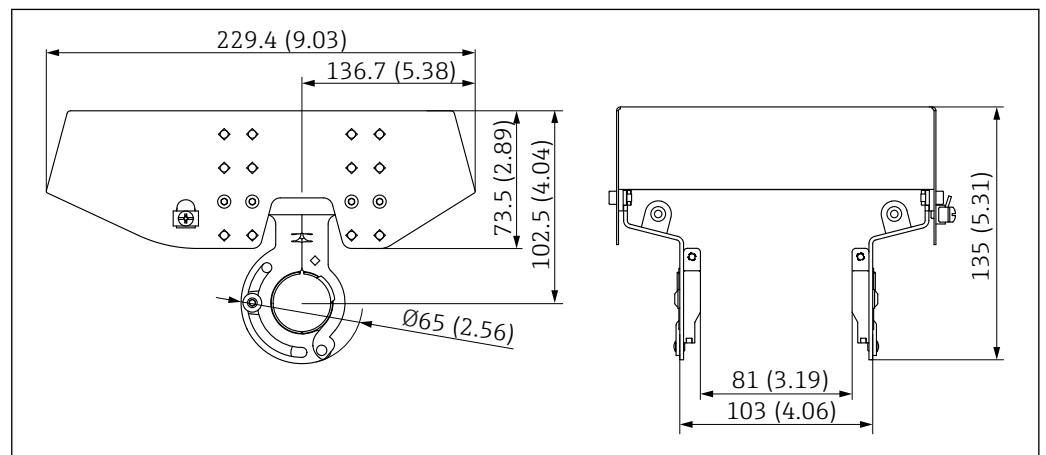


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46 Test magnet

13.1.2 Weather protection cover for dual-compartment housing, aluminum

- Material: stainless steel 316L
- Order number: 71438303

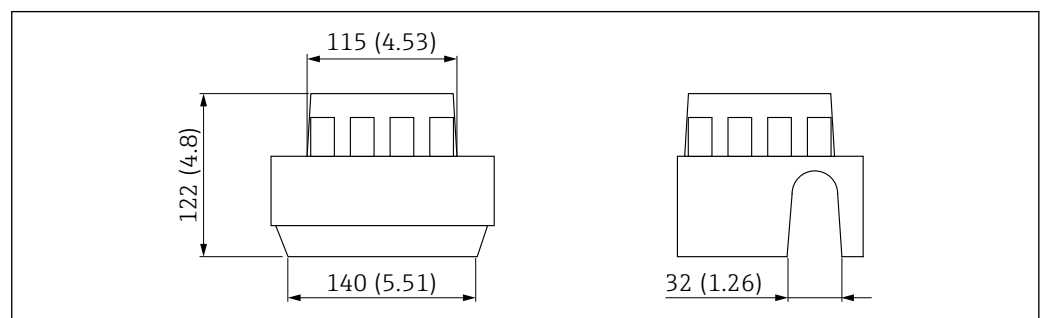


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47 Weather protection cover for dual-compartment housing, aluminum. Unit of measurement mm (in)

13.1.3 Weather protection cover for single-compartment housing, metal

- Material: plastic
- Order number: 71438291



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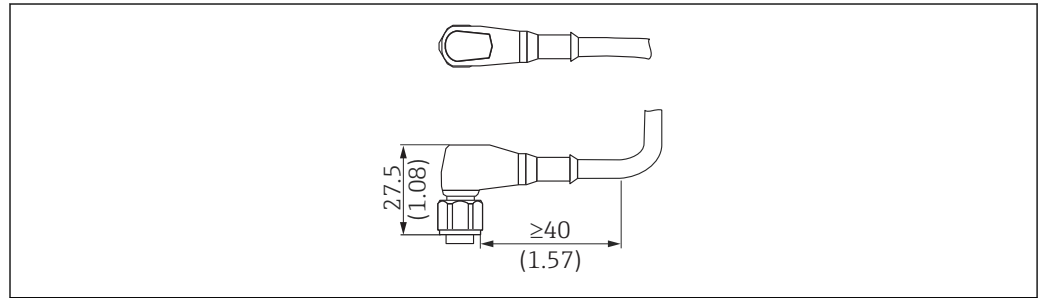
48 Weather protection cover for single-compartment housing, metal. Unit of measurement mm (in)

13.1.4 Plug-in jack

i The plug-in jacks listed are suitable for use in the temperature range -25 to $+70$ °C (-13 to $+158$ °F).

Plug-in jack M12 IP69

- Terminated at one end
- Elbowed 90°
- 5 m (16 ft) PVC cable (orange)
- Slotted nut 316L (1.4435)
- Body: PVC (orange)
- Order number: 52024216

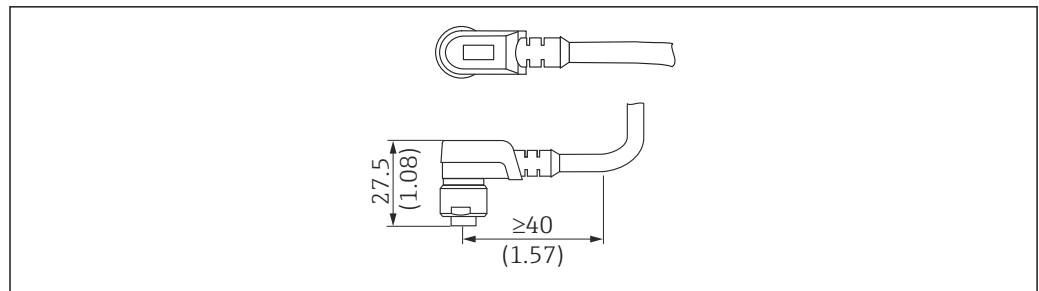


A0023713

49 Plug-in jack M12 IP69. Unit of measurement mm (in)

Plug-in jack M12 IP67

- Elbowed 90°
- 5 m (16 ft) PVC cable (gray)
- Slotted nut Cu Sn/Ni
- Body: PUR (blue)
- Order number: 52010285



A0022292

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

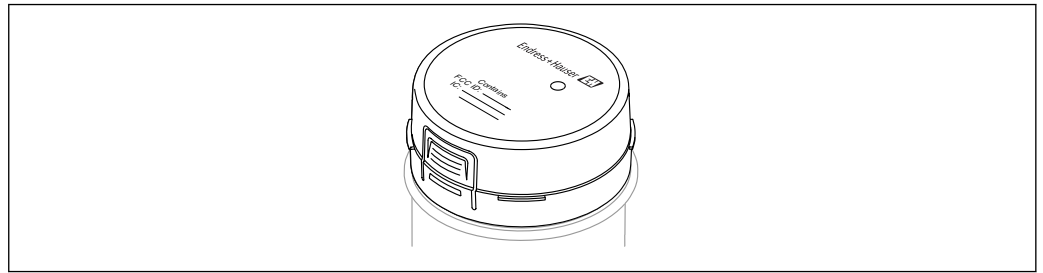
13.1.5 Additional modules

i If the Liquiphant is retrofitted with the Bluetooth module or the LED module, it is also necessary to order a tall housing cover with sight glass. The cover depends on the housing and approval of the device.

More detailed information is available:

- Product Configurator on the Endress+Hauser webpage: www.endress.com
- Endress+Hauser Sales Center www.addresses.endress.com

Bluetooth module VU121 (optional)



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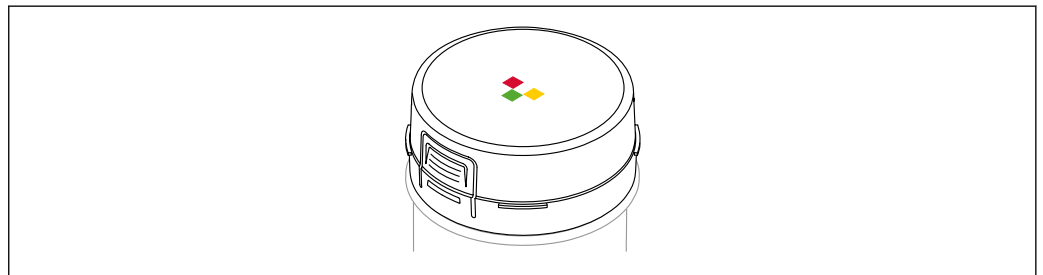
51 Bluetooth module VU121

The Bluetooth module can be connected to the following electronic inserts via the COM interface: FEL61, FEL62, FEL64, FEL64DC, FEL67, FEL68 (NAMUR 2-wire).

- Bluetooth module with battery for use in conjunction with NAMUR electronics FEL68 electronic insert
Order number: 71437381
- Bluetooth module without battery for use in conjunction with FEL61, FEL62, FEL64, FEL64DC and FEL67 electronic inserts
Order number: 71437383

i When using the device with the electronic insert FEL68 (2-wire NAMUR), the Bluetooth module must be ordered separately, including the required battery.
Product Configurator, order code for "Accessory mounted", option NG "Prepared for Heartbeat Verification + Monitoring + Bluetooth".

LED module VU120 (optional)



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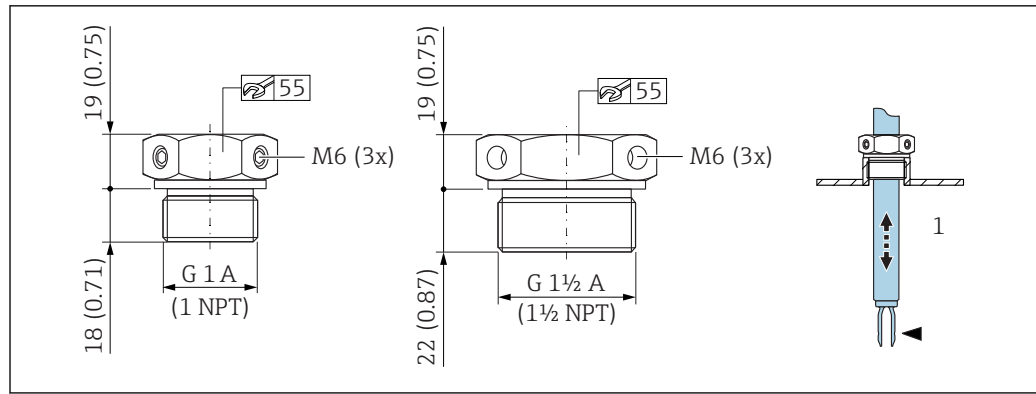
52 LED module

The bright LED display indicates the switch status or the alarm condition and can be connected to the following electronic inserts: FEL62, FEL64, FEL64DC

Order number: 71437382

13.1.6 Sliding sleeves for unpressurized operation

Switch point, infinitely adjustable.



53 Sliding sleeves for unpressurized operation. Unit of measurement mm (in)

1 $p_e = 0 \text{ bar (0 psi)}$

G 1, DIN ISO 228/1

- Material: 1.4435 (AISI 316L)
- Weight: 0.21 kg (0.46 lb)
- Order number: 52003978
- Order number: 52011888, approval: with inspection certificate EN 10204 - 3.1 material

NPT 1, ASME B 1.20.1

- Material: 1.4435 (AISI 316L)
- Weight: 0.21 kg (0.46 lb)
- Order number: 52003979
- Order number: 52011889, approval: with inspection certificate EN 10204 - 3.1 material

G 1½, DIN ISO 228/1

- 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

13.1.7 High pressure sliding sleeves

- Switch point, infinitely adjustable
- For use in hazardous areas,
- Seal package made of graphite
- For G 1, G 1½: seal included in delivery

14 Technical data

14.1 Input

14.1.1 Measured variable

Level (point level), MAX or MIN safety

14.1.2 Measuring range

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

14.2 Output

14.2.1 Output and input variants

Electronic inserts

2-wire AC (FEL61)

- Two-wire AC version
- Switches the load directly into the power supply circuit via an electronic switch.

3-wire DC-PNP (FEL62)

- Three-wire DC version
- Switches the load via the transistor (PNP) and separate connection, e. g. in conjunction with programmable logical controllers (PLC)
- Ambient temperature -60 °C (-76 °F), optionally available for order
Low-temperature electronic inserts are marked LT.

Universal current connection, relay output (FEL64)

- Switches the loads via 2 potential-free changeover contacts
- Ambient temperature -60 °C (-76 °F), optionally available for order
Low-temperature electronic inserts are marked LT.

Direct current connection, relay output (FEL64DC)

- Switches the load via 2 potential-free changeover contacts
- Ambient temperature -60 °C (-76 °F), optionally available for order
Low-temperature electronic inserts are marked LT.

PFM output (FEL67)

- For separate switching device (Nivotester FTL325P, FTL375P)
- PFM signal transmission; current pulses are superimposed on the power supply along the two-wire cabling
- Ambient temperature -52 °C (-62 °F), optionally available for order
The low-temperature electronic inserts are marked LT

2-wire NAMUR $> 2.2\text{ mA}/< 1.0\text{ mA}$ (FEL68)

- For separate switching device, e. g. Nivotester FTL325N
- Signal transmission H-L edge 2.2 to 3.8/0.4 to 1.0 mA as per IEC 60917-5-6 (NAMUR) on two-wire cable
- Ambient temperature -52 °C (-62 °F), optionally available for order
Low-temperature electronic inserts are marked LT.

2-wire density (FEL60D) for density measurement

Connection to Density Computer FML621



For more information, see the Technical Information for density measuring technology.

14.2.2 Output signal

Switch output

Preset switching times can be ordered. The following ranges can be ordered for point level switches without communication (AC two-wire, relays, DC-PNP, PFM, NAMUR):

- 0.5 seconds when the fork is covered and 1.0 seconds when it is uncovered (factory setting)
- 0.25 seconds when the fork is covered and 0.25 seconds when it is uncovered (fastest setting)
- 1.5 seconds when the fork is covered and 1.5 seconds when it is uncovered
- 5 seconds when the fork is covered and 5 seconds when it is uncovered

COM interface

For connecting to modules VU120 or VU121 (no modifying effect)

Bluetooth® wireless technology (optional)

The device has a Bluetooth® wireless technology interface. Device data and diagnostic data can be read out using the free "SmartBlue" app.

14.2.3 Ex connection data

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

14.3 Environment

14.3.1 Ambient temperature range

-40 to +70 °C (-40 to +158 °F)

WARNING

Permitted connection voltage exceeded!

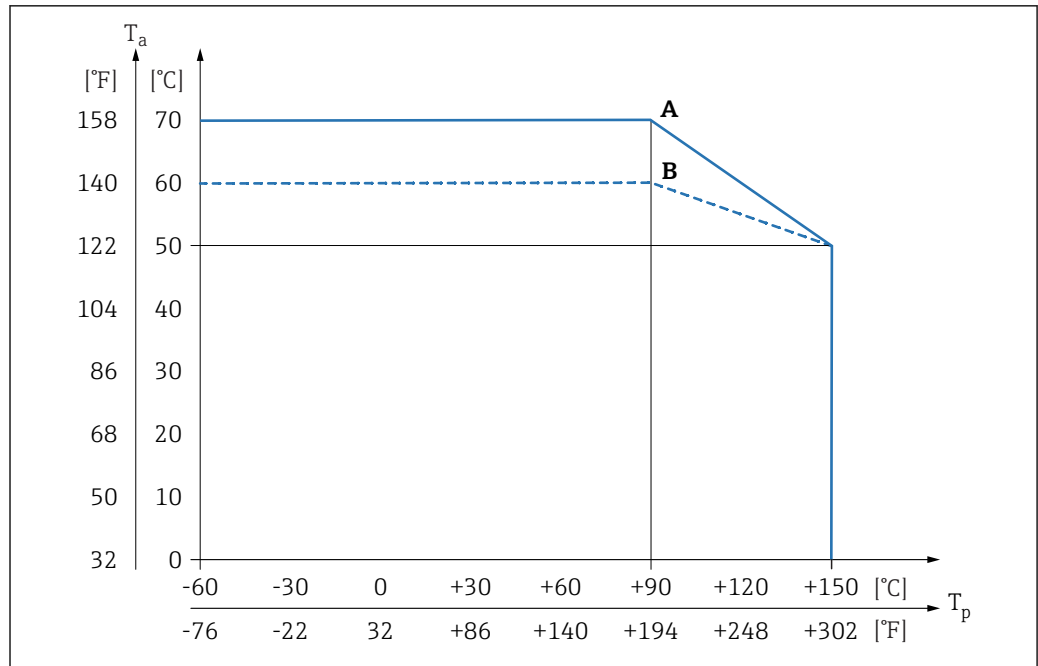
- ▶ For electrical safety reasons, the maximum connection voltage for all electronic inserts at ambient temperatures below -40 °C (-40 °F) is limited to a maximum of 35 V DC.

Optional

-60 °C (-76 °F) or -52 °C (-62 °F)

In the hazardous area, the permitted ambient temperature can be limited depending on the zones and gas groups. Pay attention to the information in the Ex documentation (XA).

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



A0037923

55 Permitted ambient temperature T_a at the housing as a function of the process temperature T_p in the vessel:

- A Device without LED module; at process temperature $T_p > 90^\circ$, with FEL64 and max. load current 4 A
- B Device with LED module; at process temperature and FEL64 $T_p > 90^\circ$ max. load current 2 A

For devices with a temperature spacer, the following ambient temperatures apply across the entire process temperature range:

- A: 70 °C
- B: 60 °C

Ordering information:

- Product Configurator, order code for "output", option "1"
Ambient temperature -60 °C (-76 °F), optionally available for order
- Product Configurator, order code for "output", option "2"
Ambient temperature -52 °C (-62 °F), optionally available for order.

Low-temperature electronic inserts are marked LT.

- i** ■ Bluetooth module (non-Ex): -40 to +85 °C (-40 to +185 °F)
- Bluetooth module (Ex ia): -40 to +65 °C (-40 to +149 °F), T4
- LED module: -40 to +60 °C (-40 to +140 °F)

Outdoor operation in strong sunlight:

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

14.3.2 Storage temperature

-40 to +80 °C (-40 to +176 °F)
optional: -52 °C (-62 °F), -60 °C (-76 °F)

14.3.3 Humidity

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

14.3.4 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

14.3.5 Climate class

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

14.3.6 Degree of protection

For housing with electrical connection

M20 coupling, plastic

- Single-chamber, plastic: IP66/67 NEMA type 4X
- Single-chamber and dual-chamber, aluminum: IP66/68 NEMA type 4X/6P
- Single-chamber 316L, cast: IP66/68 NEMA type 4X/6P

M20 coupling, nickel-plated brass

Single-chamber and dual-chamber, aluminum: IP66/68 NEMA type 4X/6P

M20 coupling, 316L

- Single-chamber and dual-chamber, aluminum: IP66/68 NEMA type 4X/6P
- Single-chamber 316L, cast: IP66/68 NEMA type 4X/6P

Thread M20

- Single-chamber, plastic: IP66/67 NEMA type 4X
- Single-chamber and dual-chamber, aluminum: IP66/68 NEMA type 4X/6P
- Single-chamber 316L, cast: IP66/68 NEMA type 4X/6P

Thread G ½

- Single-chamber, plastic: IP66/67 NEMA type 4X
- Single-chamber and dual-chamber, aluminum: IP66/68 NEMA type 4X/6P
- Single-chamber 316L, cast: IP66/68 NEMA type 4X/6P

Thread NPT ½

- Single-chamber, plastic: IP66/67 NEMA type 4X
- Single-chamber 316L, cast: IP66/68 NEMA type 4X/6P

Thread NPT ¾

- Single-chamber and dual-chamber, aluminum: IP66/68 NEMA type 4X/6P
- Single-chamber 316L, cast: IP66/68 NEMA type 4X/6P

M12 plug

- Single-chamber, plastic: IP66/67 NEMA type 4X
- Single-chamber, aluminum: IP66/67 NEMA type 4X
- Single-chamber 316L, cast: IP66/67 NEMA type 4X

14.3.7 Vibration resistance

As per IEC60068-2-64-2009

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

For increased oscillations or vibrations, the additional option of order code "Application" option "B" 100 bar (1 450 psi) process pressure is recommended.

14.3.8 Shock resistance

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

14.3.9 Mechanical load

Lateral loading capacity

📖 Special mounting instructions

14.3.10 Electromagnetic compatibility

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

Details are available in the supplementary Functional Safety Manual.

14.4 Process

14.4.1 Process temperature range

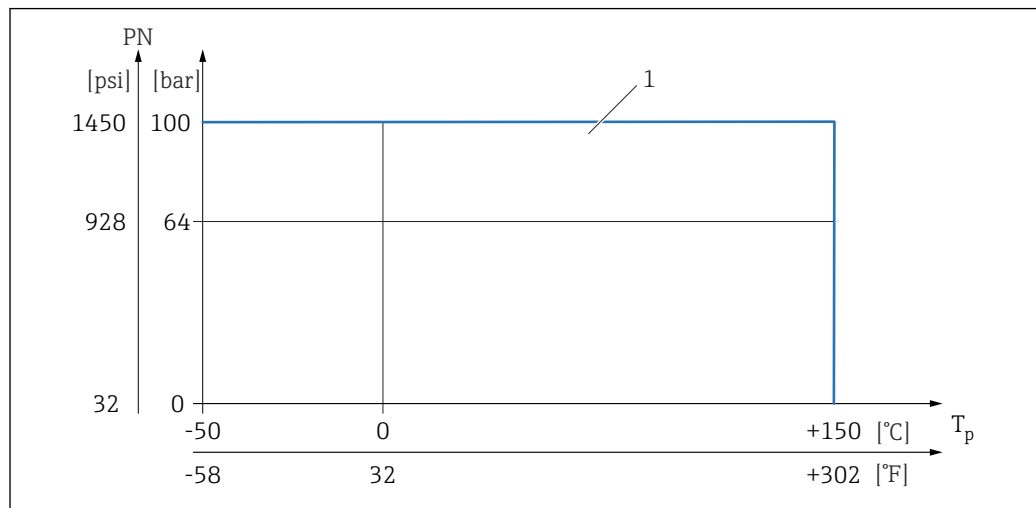
-50 to +150 °C (-58 to +302 °F)

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

14.4.2 Thermal shock

≤ 120 K/s

14.4.3 Process pressure range



📖 56 Process temperature FTL51B

1 Permitted pressure rating if the "100 bar (1450 psi)" option is selected. For exceptions, see the "Process connections" section. Canadian CRN approval: more details on the maximum pressure values are available in the download area of the product page under "www.endress.com".

⚠ WARNING

The maximum pressure for the measuring device is dependent on the lowest-rated element, with regard to pressure, of the selected components. This means that it is necessary to pay attention to the process connection as well as the sensor.

- ▶ For pressure specifications, see the "Mechanical construction" section.
- ▶ The measuring device must be operated only within the specified limits!
- ▶ The Pressure Equipment Directive (2014/68/EU) uses the abbreviation "PS". The abbreviation "PS" corresponds to the MWP (maximum working pressure) of the measuring device.

Permitted pressure values for flanges at higher temperatures can be found in the following standards:

- pR EN 1092-1: 2005 With regard to its stability-temperature property, the material 1.4435 is identical to 1.4404, which is classed as 13E0 in EN 1092-1 Tab. 18. The chemical composition of the two materials can be identical.
- ASME B 16.5
- JIS B 2220

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

Process pressure range of the sensors

- PN: 64 bar (928 psi) at max. 150 °C (302 °F)
Ordering information: Product Configurator, order code for "Application" option "A"
- PN: 100 bar (1 450 psi) at max. 150 °C (302 °F)
Ordering information: Product Configurator, order code for "Application" option "B"

14.4.4 Test pressure**Gauge pressure**

- PN = 64 bar (928 psi): test pressure = 1.5 · PN maximum 100 bar (1 450 psi) depending on process connection selected
- Membrane burst pressure at 200 bar (2 900 psi)
- PN = 100 bar (1 450 psi): test pressure = 1.5 · PN maximum 150 bar (2 175 psi) depending on process connection selected
- Membrane burst pressure at 400 bar (5 800 psi)

The instrument function is limited during the pressure test.

The mechanical integrity is guaranteed at pressures up to 1.5 times the process nominal pressure (PN).

14.4.5 Density

- Switch position > 0.7 g/cm³ = order configuration
Standard setting for liquids with a density > 0.7 g/cm³
- Switch position > 0.5 g/cm³ = can be configured via DIP switch
For liquids with a density > 0.5 g/cm³ to < 0.8 g/cm³
- Order option: 0.4 g/cm³ (not for devices with SIL)
For liquids with a density > 0.4 g/cm³ and density < 0.6 g/cm³
If this option has been selected, the density setting is always set to 0.4 g/cm³. This setting can no longer be altered.

14.4.6 Pressure tightness

Up to vacuum

 In vacuum evaporation systems, the density of the liquids can drop to a very low value: select density setting 0.4.

14.5 Additional technical data

See Technical Documentation TI01403F/00/EN.

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