

Operating Instructions

Liquiphant FTL62

Vibronic

Point level switch with highly corrosion-resistant coating 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)

1.1.5 Registered trademarks

Bluetooth®

The *Bluetooth*® word mark and logos are registered trademarks owned by the Bluetooth SIG, Inc. and any use of such marks by Endress+Hauser is under license. Other trademarks and trade names are those of their respective owners.

Apple®

Apple, the Apple logo, iPhone, and iPod touch are trademarks of Apple Inc., registered in the U.S. and other countries. App Store is a service mark of Apple Inc.

Android®

Android, Google Play and the Google Play logo are trademarks of Google Inc.

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 point level 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 overshoot or undershoot the relevant limit values of the measuring device 
TI01539F

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 EU directives listed in the device-specific EU 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

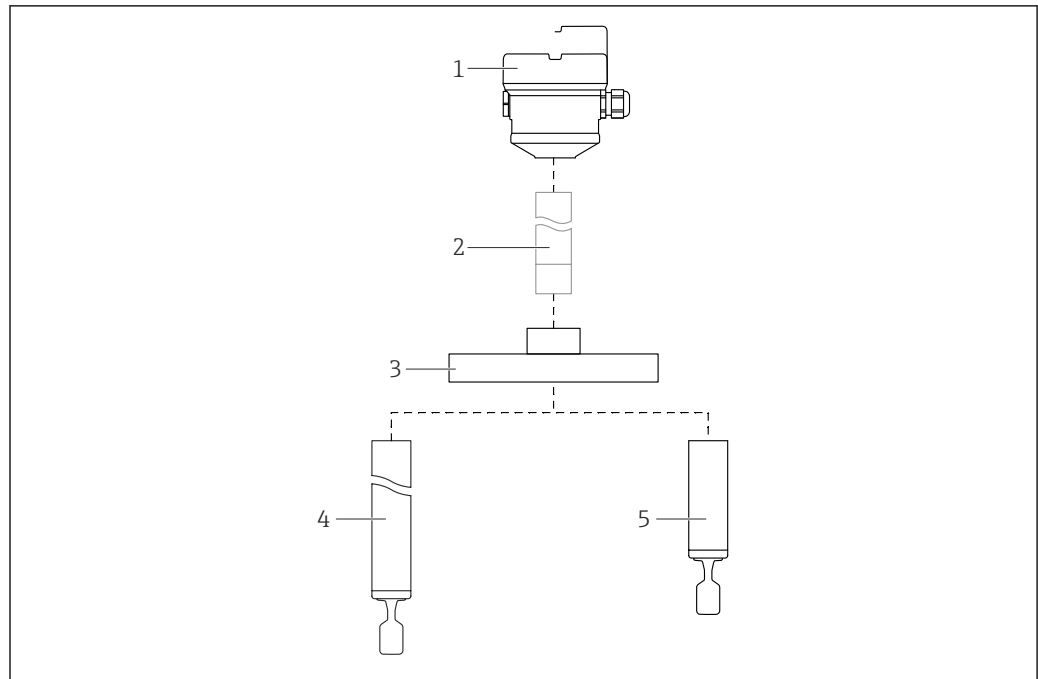
- ▶ IT security measures defined in the plant owner/operator's own security policy must be implemented by plant owners/operators themselves.

3 Product description

Point level switch for all liquids, for minimum or maximum detection in tanks, vessels and piping, even in hazardous areas.

Different coatings (plastic or enamel) offer a high degree of corrosion protection for applications in aggressive media.

3.1 Product design



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1 Product design

- 1 Housing with electronic insert and cover; Bluetooth module or LED module are optional
- 2 Temperature spacer, pressure-tight feedthrough (second line of defense), optional
- 3 Process connection flange
- 4 Probe design with pipe extension
- 5 Probe design with short pipe

 Flange, pipe extension and tuning fork are either plastic-coated or enamel-coated.
The electronic insert can be identified via the order code on the nameplate.

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?

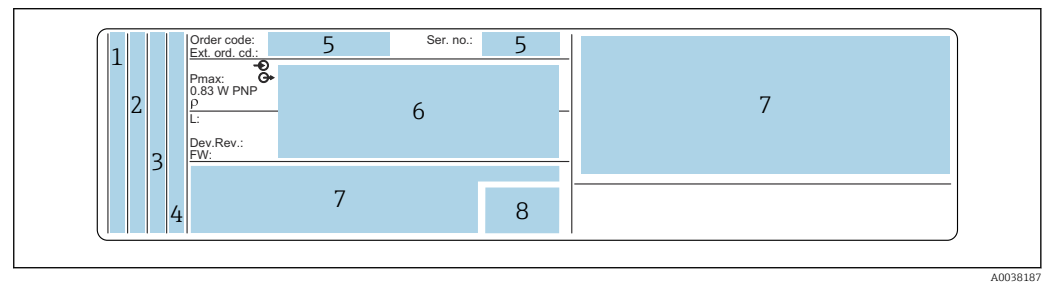
 If one of these conditions is not met, please contact the manufacturer's sales office.

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



 2 Nameplate specifications

- 1 Trademark (Endress+Hauser)
- 2 Trade name (Device name)
- 3 Manufacturer's address (Certificate holder)
- 4 Production location (Assembly plant)
- 5 Order number, extended order code, serial number
- 6 Technical data, reference to technical documentation
- 7 Approval-specific information
- 8 DataMatrix code (information about the device)

4.2.2 Manufacturer address

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

4.3 Storage and transport

4.3.1 Storage conditions

Use original packaging.

Storage temperature

−40 to +80 °C (−40 to +176 °F)
Optional: −50 °C (−58 °F), −60 °C (−76 °F)

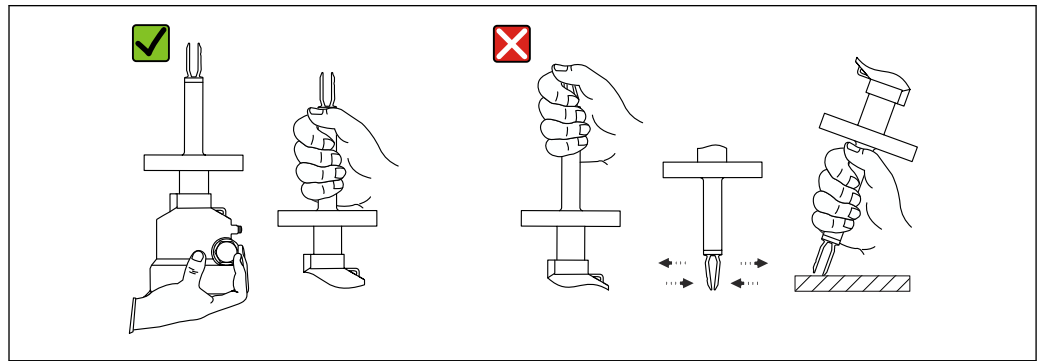
4.3.2 Transporting the device

NOTICE

Flange, pipe extension and tuning fork are either plastic-coated or enamel-coated. Scratches or impacts may cause damage to the coated surface of the device.

- ▶ Hold the device only by the housing, flange or extension pipe, protect coated surface appropriately.
- ▶ Transport the device to the measuring point in the original packaging.

Do not bend, shorten or extend the tuning fork



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3 Handling the device

5 Installation

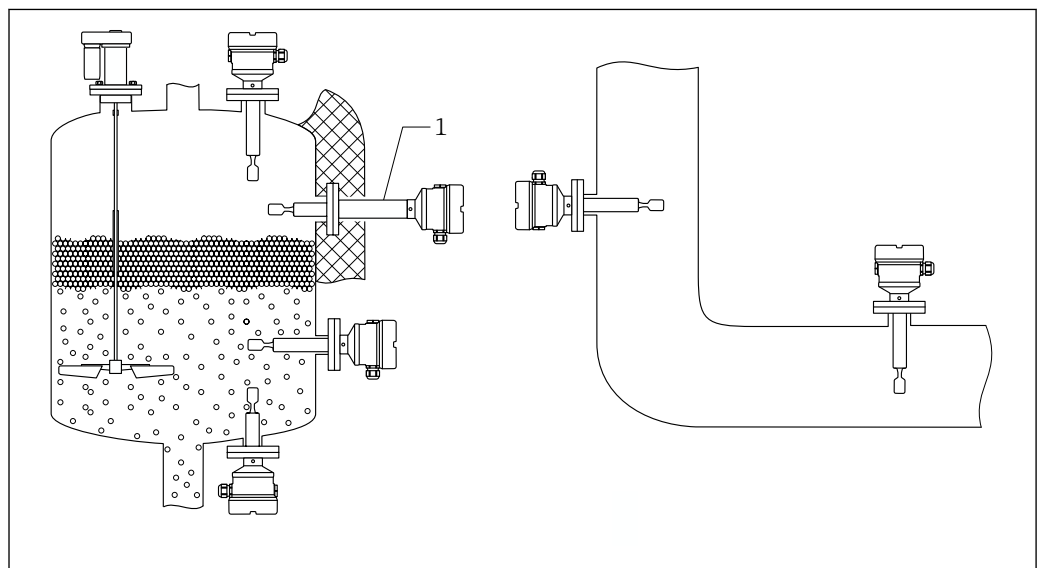
WARNING

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

- ▶ Only open the device in a dry environment!

Installation instructions

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



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4 Examples of installation in a vessel, pipe or tank

- 1 Temperature spacer/pressure-tight feedthrough (optional) for tank with insulation and/or high process temperatures

5.1 Installation conditions

NOTICE

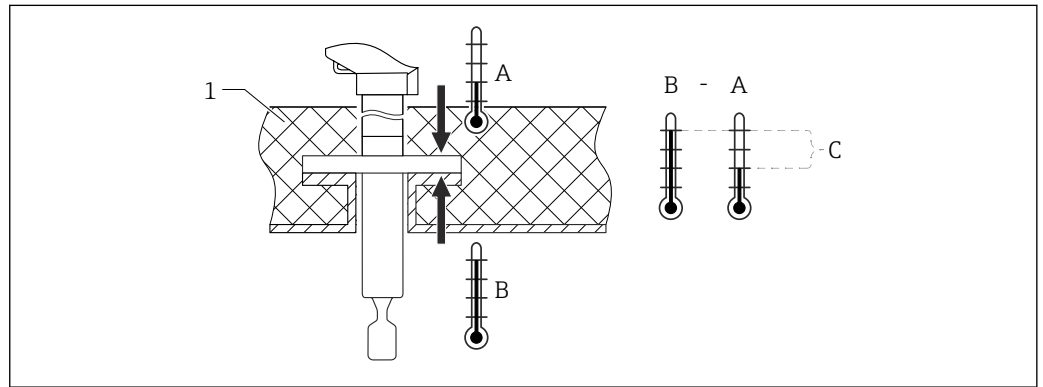
Scratches or impacts damage the coated surface of the device.

- Ensure the device is handled properly and professionally during all mounting work.

5.1.1 Pay attention to the temperature for devices with a PFA coating (conductive)

Difference in temperature between outer and inner side of flange must not exceed 60 °C (140 °F).

If necessary, use external insulation.



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5 Difference in temperature between outer and inner side of flange

1 Insulation

A Temperature of flange, outer side

B Temperature of flange, inner side, for ECTFE maximum 120 °C (248 °F)

C Difference in temperature for ECTFE, PFA maximum 60 °C (140 °F)

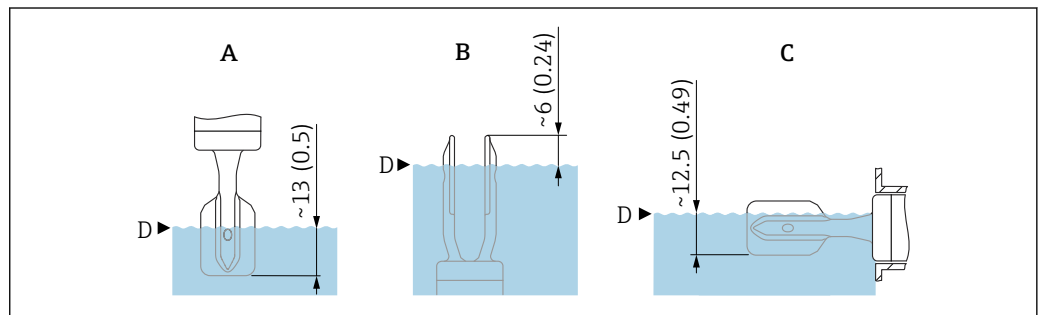
5.1.2 Take switch point into consideration

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

(Water +23 °C (+73 °F)).

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

Plastic-coated tuning fork



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6 Typical switch points, plastic-coated tuning fork. Unit of measurement mm (in)

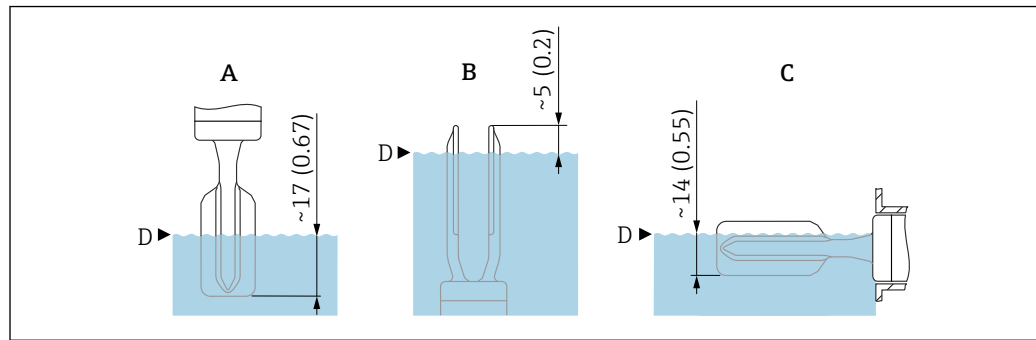
A Installation from above

B Installation from below

C Installation from the side

D Switch point

Enamel-coated tuning fork



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7 Typical switch points, enamel-coated tuning fork. Unit of measurement mm (in)

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

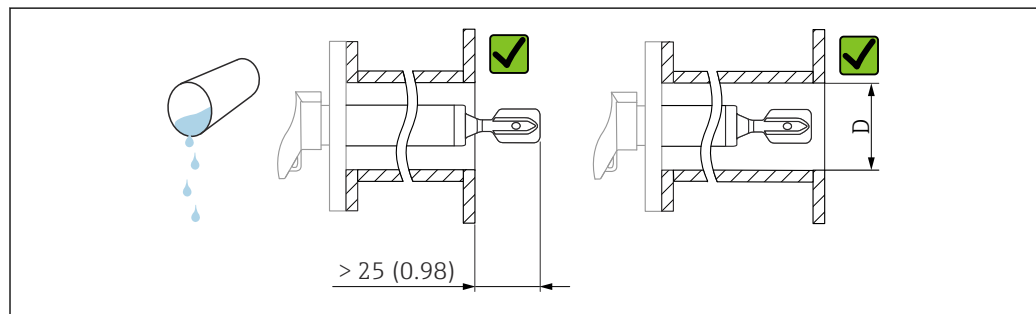
5.1.3 Take viscosity into consideration

Low viscosity



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

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



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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)

High viscosity



NOTICE

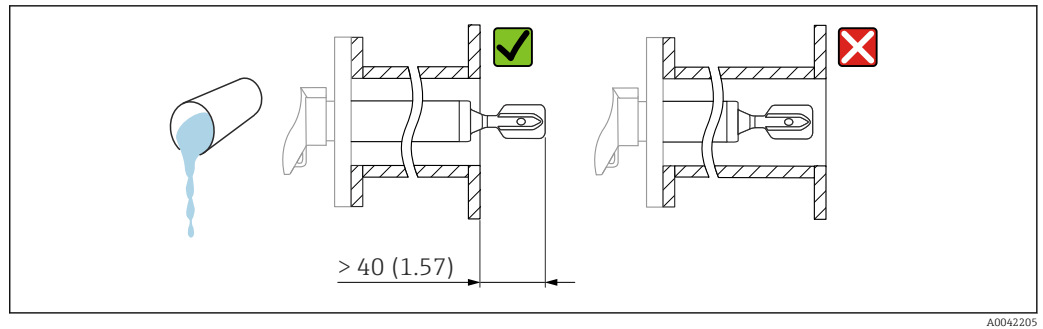
Highly viscous liquids may cause switching delays.

- 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

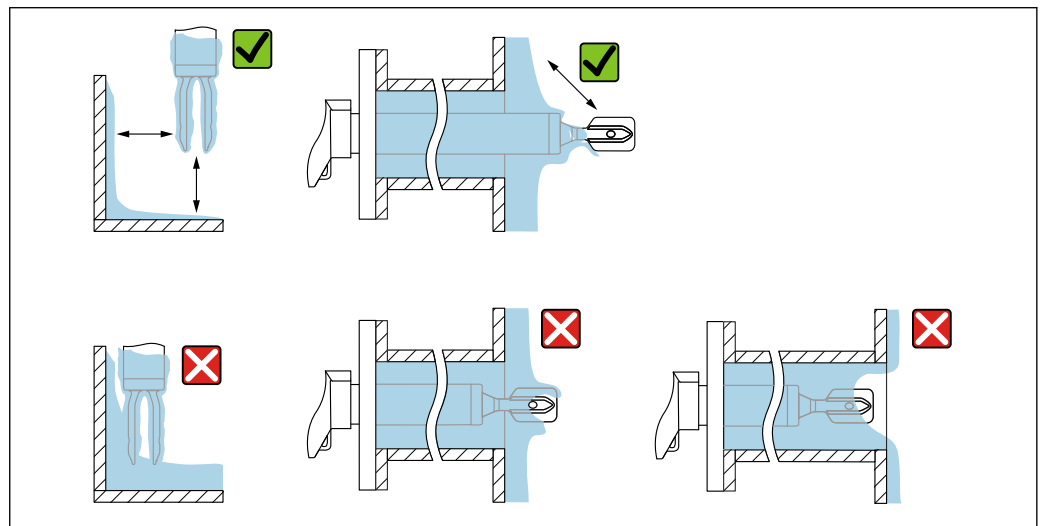
The tuning fork must be located outside the installation socket!



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

5.1.4 Avoid buildup

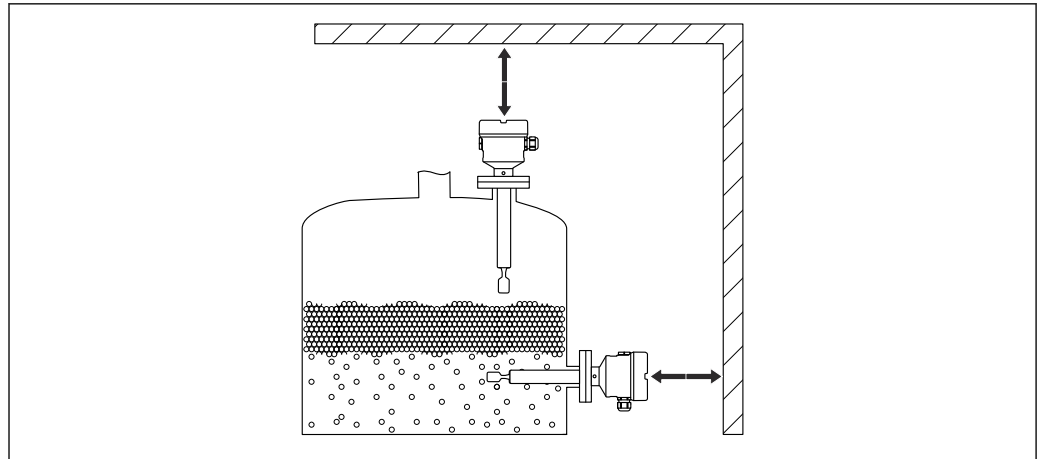
- Use short installation sockets to ensure that the turning fork can project freely into the vessel
- Install preferably flush mount on vessels or in pipes
- Leave sufficient distance between the buildup expected on the tank wall and the tuning fork



10 Installation examples for a highly viscous process medium

5.1.5 Take clearance into consideration

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



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11 Take clearance into consideration

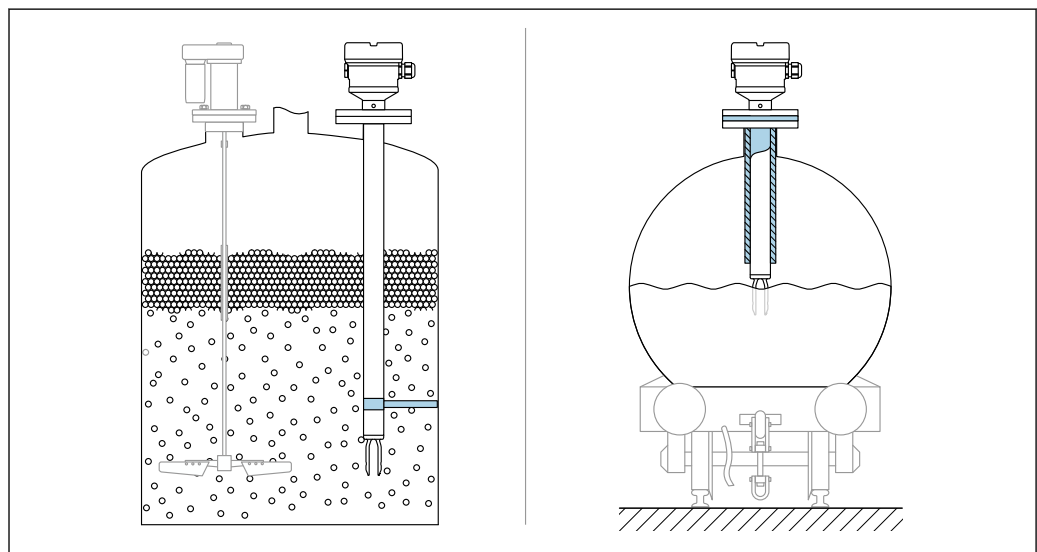
5.1.6 Support the device

NOTICE

If the device is supported incorrectly, shocks and vibrations can damage the coated surface.

- ▶ Only use a support in conjunction with ECTFE or PFA plastic coating.
- ▶ Use suitable supports only.

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



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12 Examples of support in the event of dynamic load

5.2 Mounting the measuring device

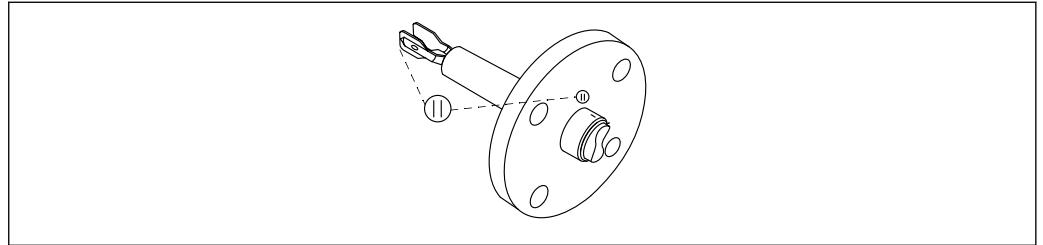
5.2.1 Required tool

Screwdriver for electrical connection

5.2.2 Installation

Align the tuning fork with the marking

The tuning fork can be aligned with the help of the marking (II symbol) on the rear of the flange. Medium can thus run off easily and buildup is avoided.

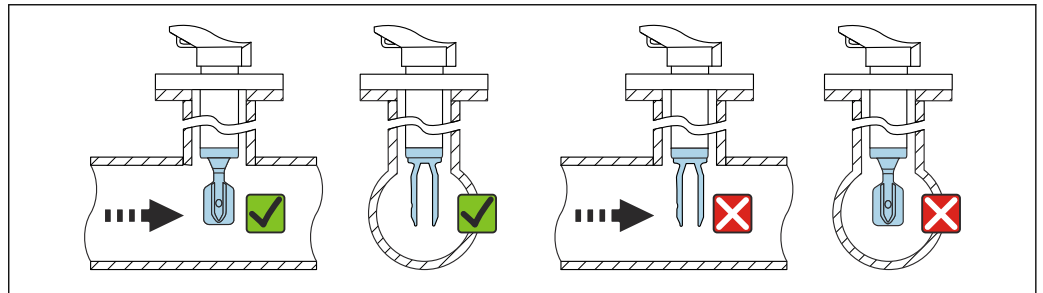


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13 Marking on flange to align the tuning fork

Installing in pipes

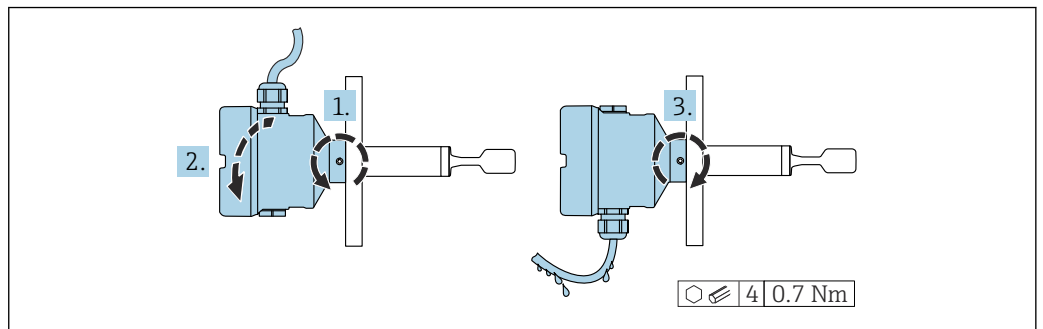
- Flow velocity up to 5 m/s with viscosity 1 mPa·s and density 1 g/cm³ (SGU).
Check for correct functioning in the event of other process medium conditions.
- The flow will not be significantly impeded if the tuning fork is correctly aligned and the marking is pointing in the direction of flow.
- The marking is visible when installed.



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14 Installation in pipes

Aligning the cable entry



A0042214

15 Housing with external locking screw

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

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

3. Tighten the external locking screw.

5.3 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

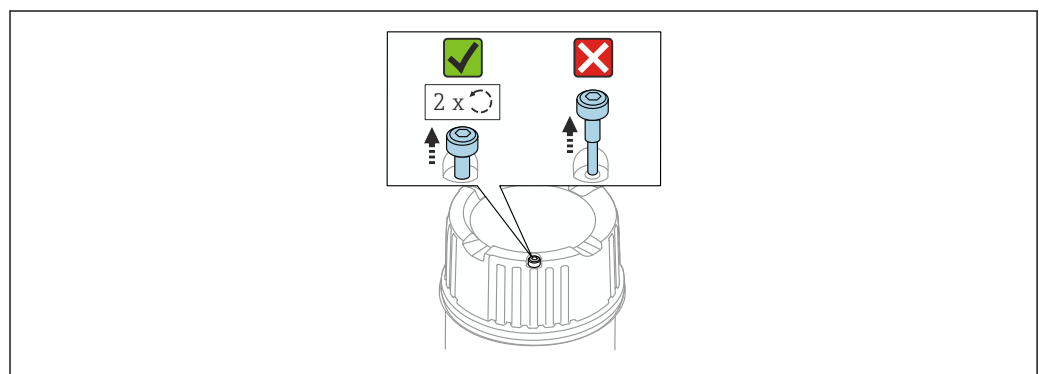
6.1.1 Cover with securing screw

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

NOTICE

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

- Before unscrewing the cover, make sure that the securing screw does not protrude too far over the edge of the cover. Loosen the securing screw with a maximum of 2 turns.
- Pay attention to the position of the securing screw when screwing the cover closed.



A0039520

16 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 $\geq 35 \text{ V}_{\text{DC}}$ or $\geq 16 \text{ V}_{\text{ACeff}}$.

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

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

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

$U = 19\text{ to }253\text{ V}_{AC}, 50\text{ Hz}/60\text{ Hz}$

Residual voltage when switched through: typically 12 V

-  Observe 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 phase (not the neutral conductor) of the supply circuit.

Power consumption

$S \leq 2\text{ VA}$

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 s . The test is deactivated after 60 s .

Connectable load

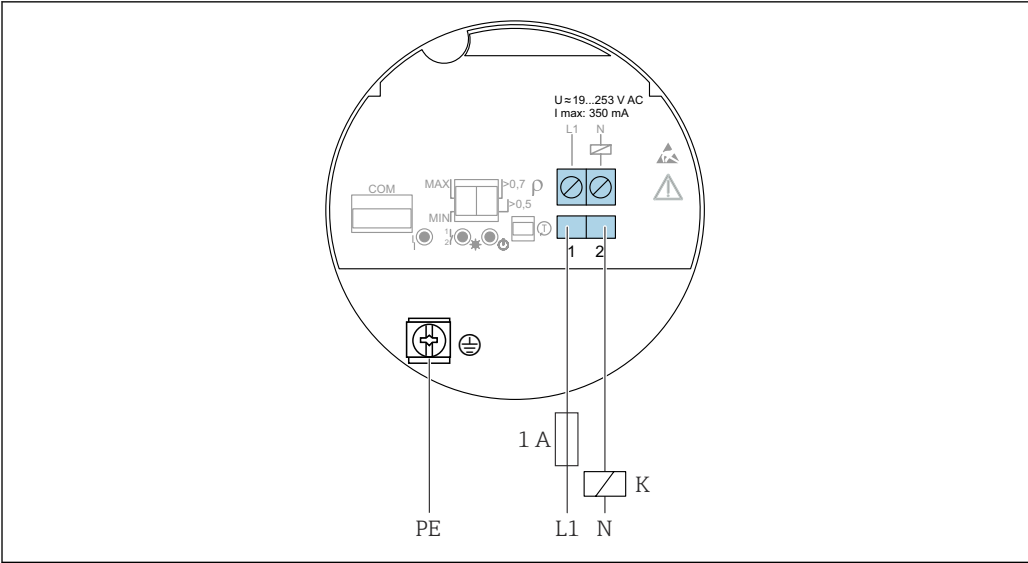
- Load with a minimum holding power/rated power of 2.5 VA at 253 V (10 mA) or 0.5 VA at 24 V (20 mA)
- Load with a maximum holding power/rated power of 89 VA at 253 V (350 mA) or 8.4 VA at 24 V (350 mA)
- With overload and short-circuit protection

Behavior of output signal

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

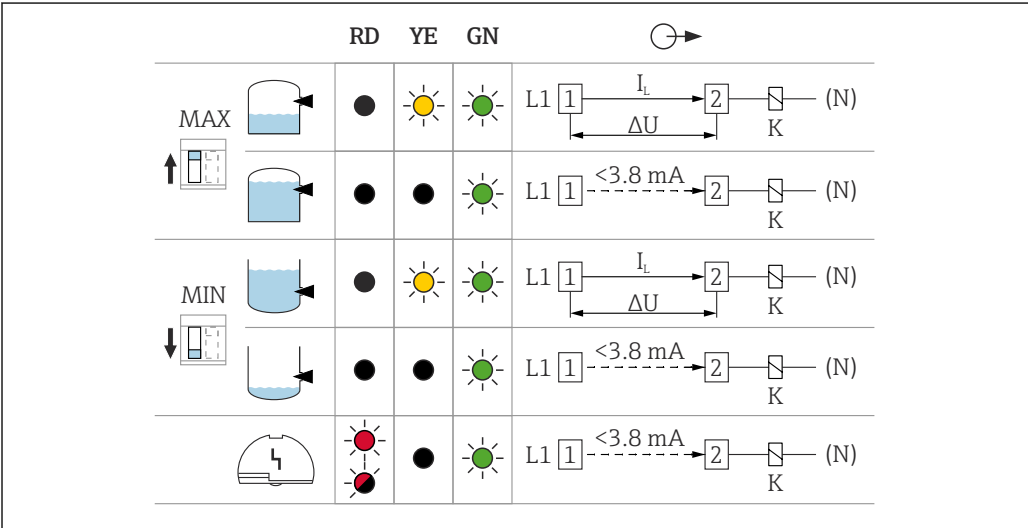
Terminal assignment

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



17 2-wire AC, electronic insert FEL61

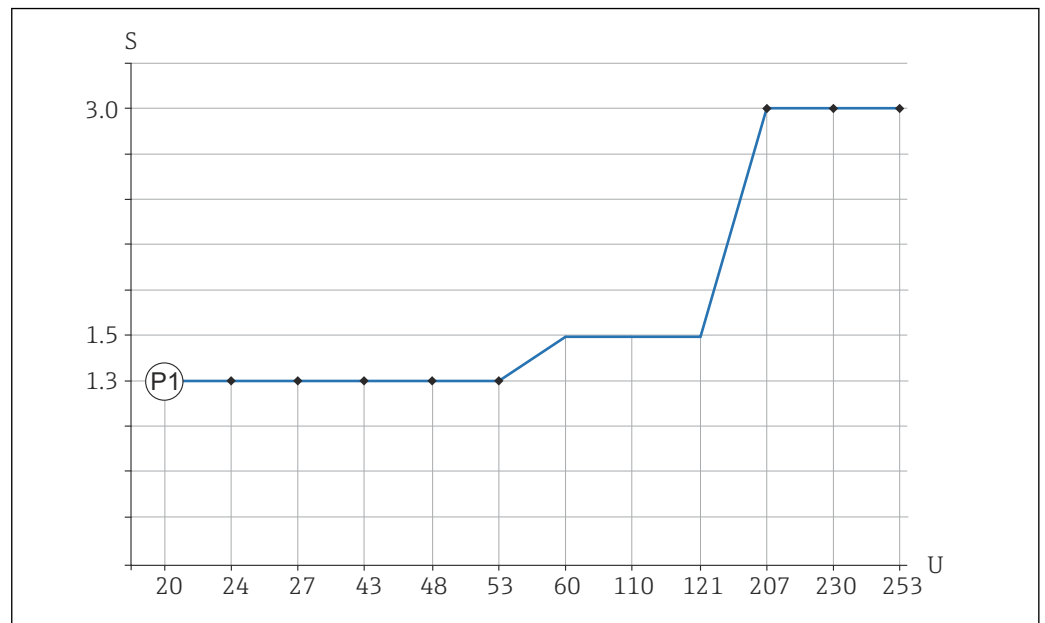
Behavior of switch output and signaling



18 Behavior of switch output and signaling, electronic insert FEL61

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

Selection tool for relays



A0042052

19 Recommended minimum holding power/rated power for load

S Holding power/rated power in [VA]

U Operating voltage in [V]

AC mode

- Operating voltage: 24 V, 50 Hz/60 Hz
- Holding power/rated power: > 0.5 VA, < 8.4 VA
- Operating voltage: 110 V, 50 Hz/60 Hz
- Holding power/rated power: > 1.1 VA, < 38.5 VA
- Operating voltage: 230 V, 50 Hz/60 Hz
- Holding power/rated power: > 2.3 VA, < 80.5 VA

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 (can be ordered as an option) with the housing closed.

Supply voltage

⚠ WARNING

Failure to use the prescribed power unit.

Risk of potentially life-threatening electric shock!

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

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



Observe 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 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

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

Residual current

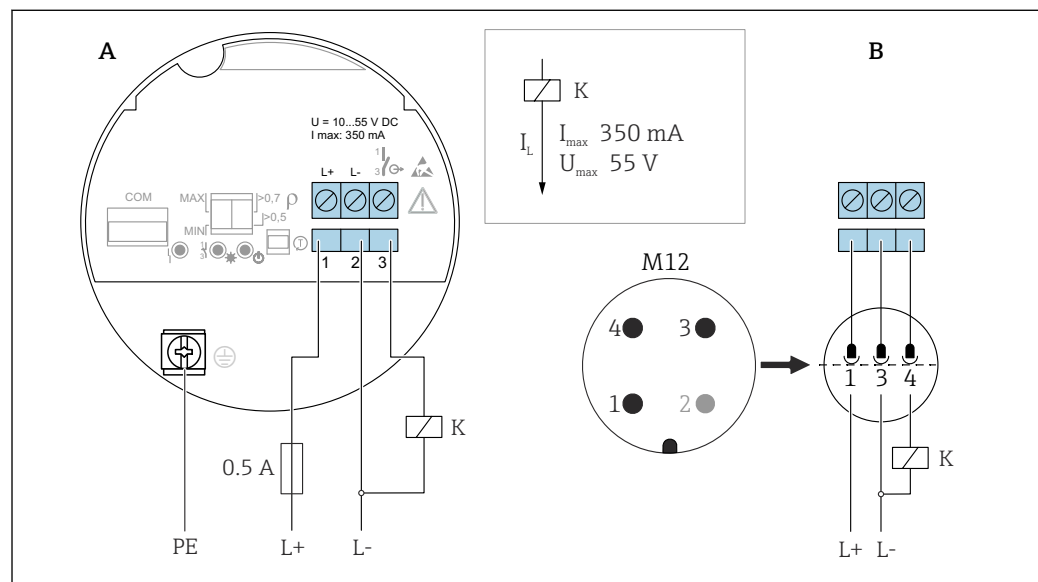
$$I < 100 \text{ } \mu\text{A (for blocked transistor)}$$

Residual voltage

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

Behavior of output signal

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

Terminal assignment

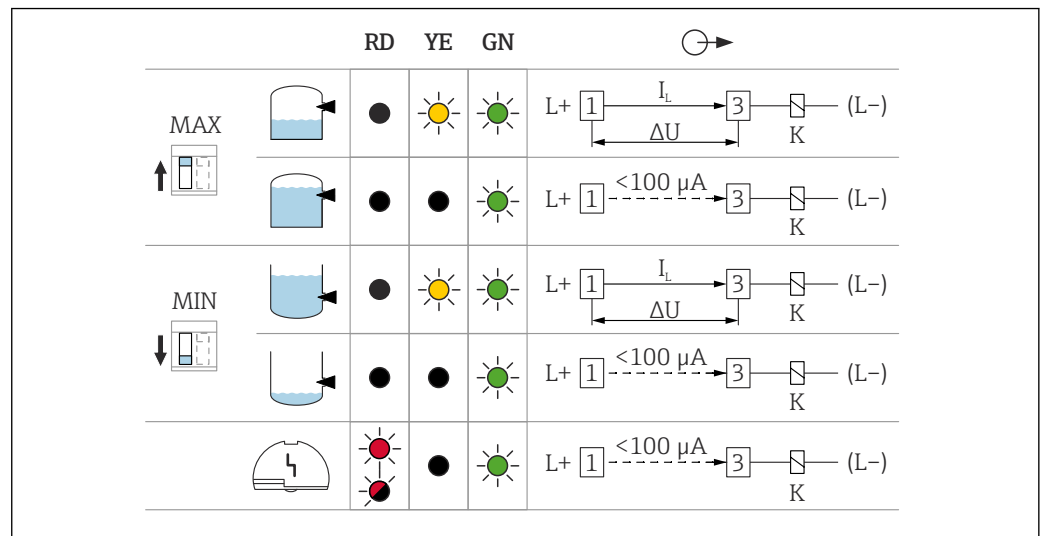
A0036061

20 3-wire DC-PNP, electronic insert FEL62

A Connection wiring with terminals

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

Behavior of switch output and signaling



A0033508

21 Behavior of switch output and signaling, electronic insert FEL62

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

6.2.3 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 (can be ordered as an option) with the housing closed.

WARNING

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

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

Supply voltage

$U = 19 \text{ to } 253 \text{ V}_{AC}, 50 \text{ Hz}/60 \text{ Hz}/19 \text{ to } 55 \text{ V}_{DC}$

- Observe 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 phase (not the neutral conductor) of the supply circuit.

Power consumption

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

Connectable load

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

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

According to IEC 61010, the following applies: Total voltage from relay outputs and power supply ≤ 300 V.

Use electronic insert FEL62 DC PNP for small DC load currents, e. g. for connection to a PLC.

Relay contact material: silver/nickel AgNi 90/10

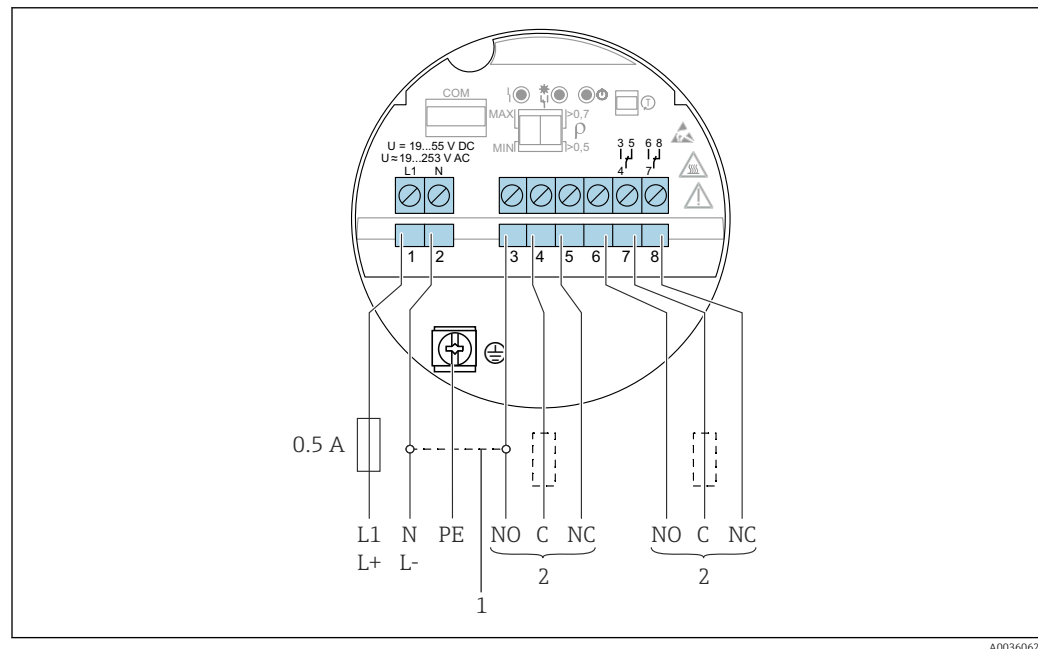
When connecting a device with high inductance, provide a spark suppressor to protect the relay contact. A fine-wire fuse (depending on the connected load) protects the relay contact in the event of a short-circuit.

Both relay contacts switch simultaneously.

Behavior of output signal

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

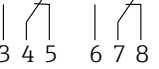
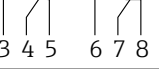
Terminal assignment



22 Universal current connection with relay output, electronic insert FEL64

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

Behavior of switch output and signaling

		RD	YE	GN	
MAX 					
					
MIN 					
					
					

A0033513

23 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 (can be ordered as an option) with the housing closed.

Supply voltage

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



Observe 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 supply 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 following applies: Total voltage from 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.

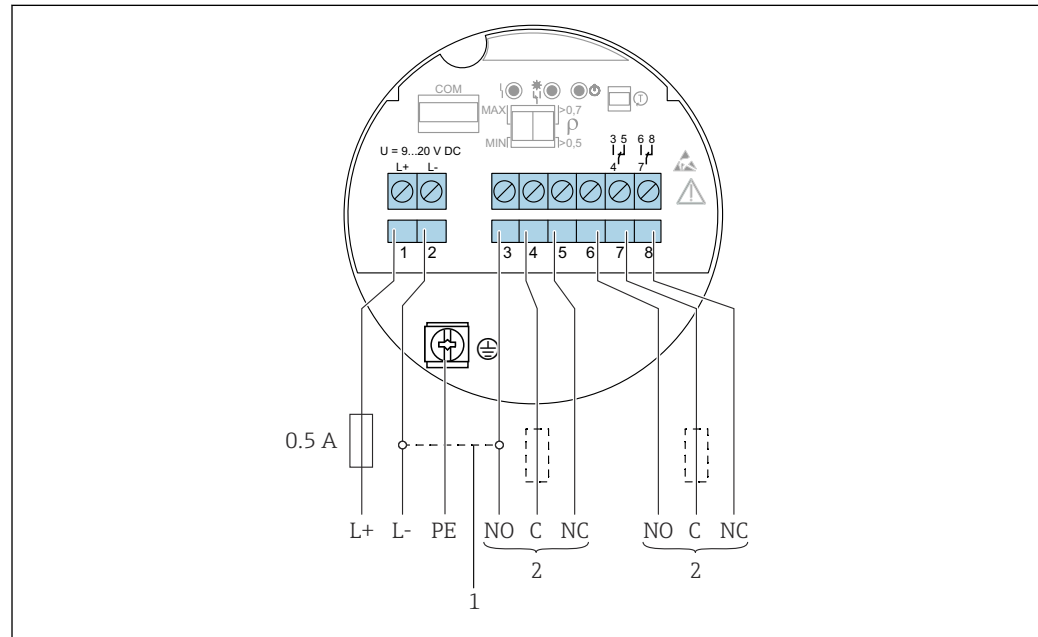
Relay contact material: silver/nickel AgNi 90/10

When connecting a device with high inductance, provide spark quenching 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.

Behavior of output signal

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

Terminal assignment

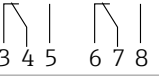
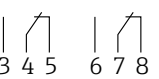
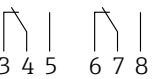
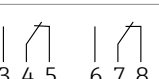
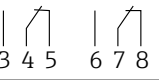


A0037685

24 DC connection with relay output, electronic insert FEL64 DC

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

Behavior of switch output and signaling

		RD	YE	GN	
MAX 					
					
MIN 					
					
					

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25 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

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

Reverse polarity protection



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

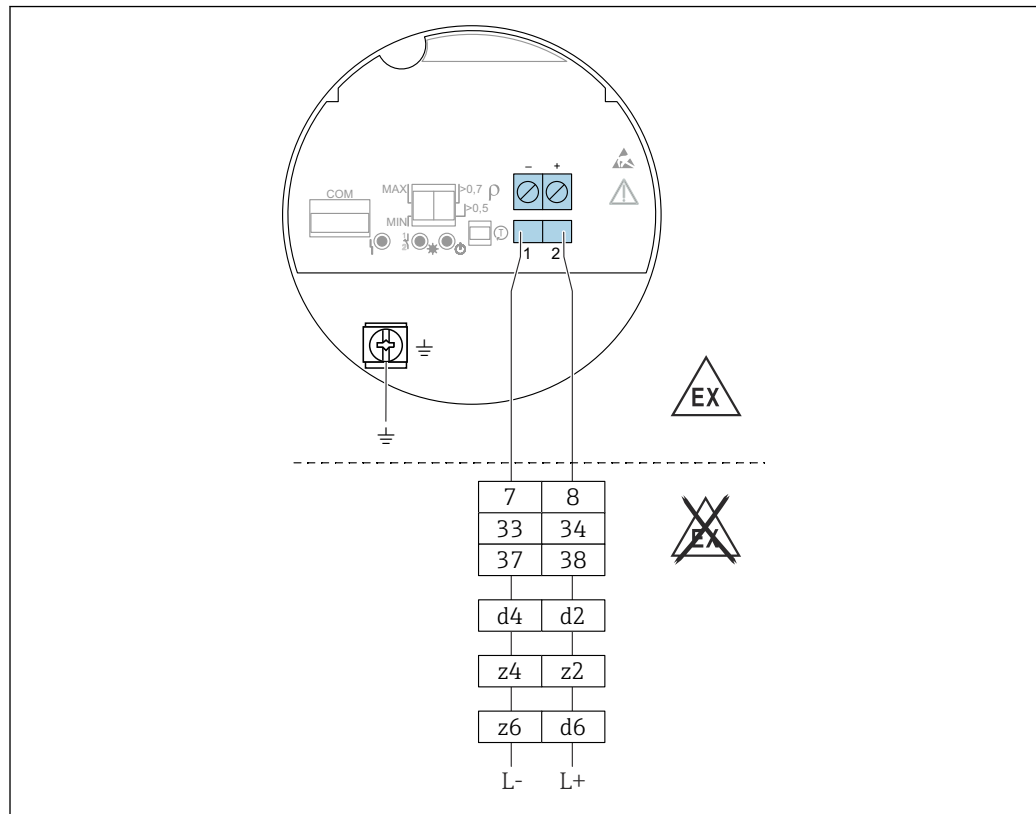
Power consumption

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

Behavior of output signal

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

Terminal assignment



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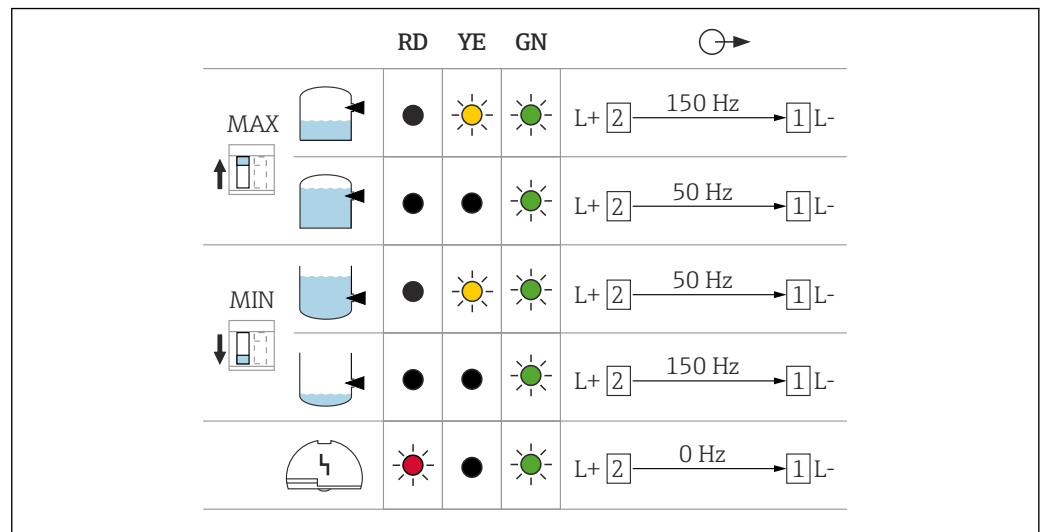
26 PFM output, electronic insert FEL67

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 (3 281 ft)

Behavior of switch output and signaling



27 Switching behavior and signaling, electronic insert FEL67

MAXDIP 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 switches for MAX/MIN on the electronic insert and the FTL325P switching unit must be set according to 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 connection to the isolating switch repeater as per NAMUR (IEC 60947-5-6), e. g. Nivotester FTL325N from Endress+Hauser
- Signal transmission H-L edge 2.2 to 3.8 mA/0.4 to 1.0 mA as per IEC 60947-5-6 (NAMUR) on two-wire cabling
- 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 (can be ordered as an option) 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 Observe the following as per IEC/EN61010-1: Provide a suitable circuit breaker for the device.

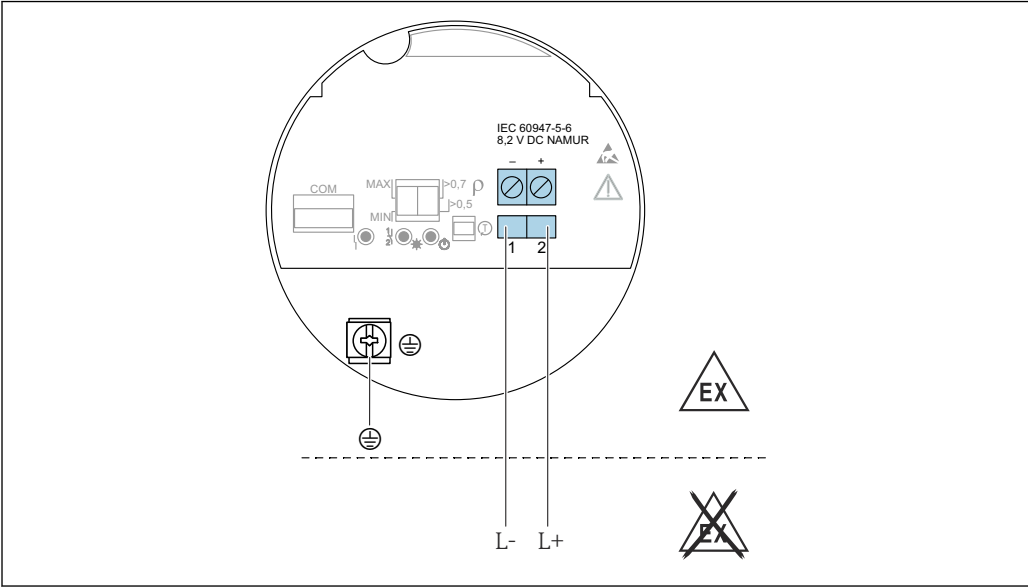
Power consumption

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 < 1.0 mA

Terminal assignment



28 2-wire NAMUR $\geq 2.2 \text{ mA} / \leq 1.0 \text{ mA}$, electronic insert FEL68

Behavior of switch output and signaling

		RD	YE	GN	
MAX					$L+ \begin{matrix} \boxed{2} \end{matrix} \xrightarrow{2.2 \dots 3.8 \text{ mA}} \begin{matrix} \boxed{1} \end{matrix} L-$
					$L+ \begin{matrix} \boxed{2} \end{matrix} \xrightarrow{0.4 \dots 1.0 \text{ mA}} \begin{matrix} \boxed{1} \end{matrix} L-$
MIN					$L+ \begin{matrix} \boxed{2} \end{matrix} \xrightarrow{2.2 \dots 3.8 \text{ mA}} \begin{matrix} \boxed{1} \end{matrix} L-$
					$L+ \begin{matrix} \boxed{2} \end{matrix} \xrightarrow{0.4 \dots 1.0 \text{ mA}} \begin{matrix} \boxed{1} \end{matrix} L-$
					$L+ \begin{matrix} \boxed{2} \end{matrix} \xrightarrow{< 1.0 \text{ mA}} \begin{matrix} \boxed{1} \end{matrix} L-$

29 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

The Bluetooth module must be ordered separately, including the required battery, for use in conjunction with electronic insert FEL68 (2-wire NAMUR).

6.2.7 LED module VU120 (optional)

Supply voltage

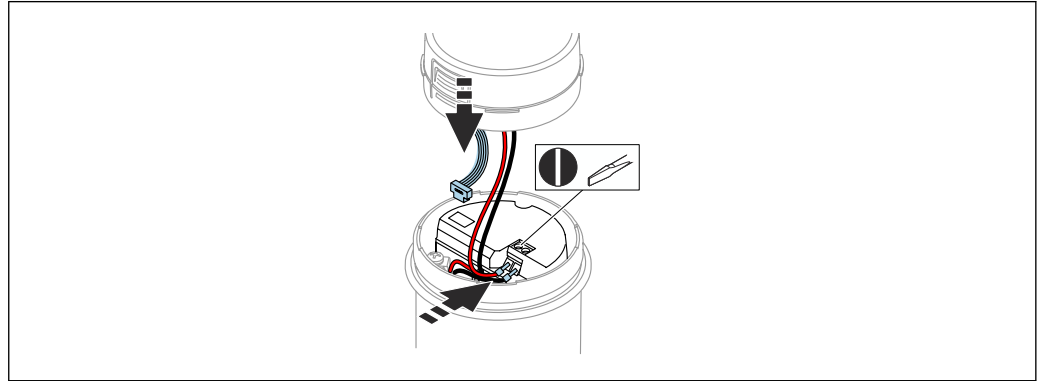
$U = 12 \text{ to } 55 \text{ V}_{DC}$,
 $U = 19 \text{ to } 253 \text{ V}_{AC}$, 50 Hz/60 Hz

Power consumption

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

Current consumption

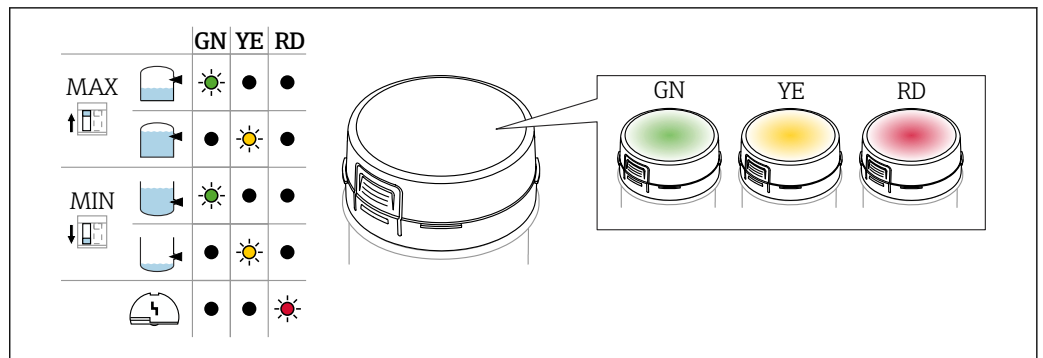
$$I_{\max} = 0.4 \text{ A}$$

Connecting the LED module

A0033542

30 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.

Operational status signaling

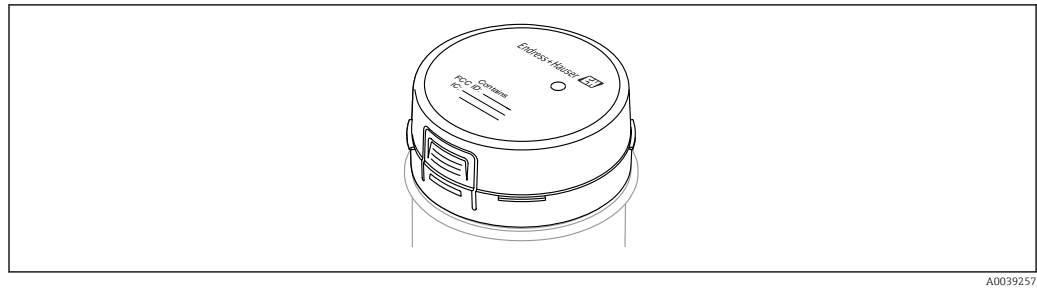
A0039258

31 LED module, the LED lights up in green (GN), yellow (YE) or red (RD)

A brightly lit LED indicates the operational status (switch status or alarm status). The LED module can be connected to the following electronic inserts: FEL62, FEL64, FEL64DC.

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

6.2.8 Bluetooth module VU121 (optional)



32 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 is only available in conjunction with the Heartbeat Verification + Monitoring application package.
- The Bluetooth module with battery is suitable for use in hazardous areas.
- The Bluetooth module must be ordered separately, including the required battery, for use in conjunction with electronic insert FEL68 (2-wire NAMUR).

Batteries

i The battery is categorized as dangerous goods when transported by air and may not be installed in the device when shipped.

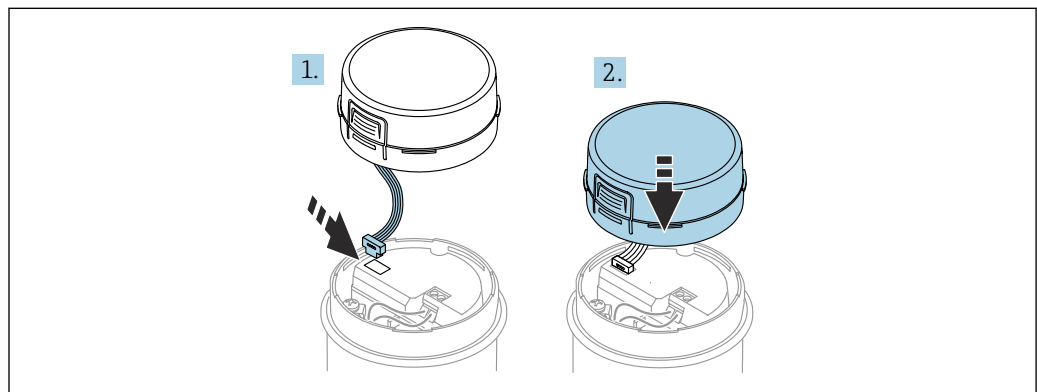
i Replacement batteries can be purchased from a specialist retailer. Only the following types of AA 3.6 V lithium batteries made by the manufacturers listed below are suitable as replacement batteries:

- SAFT LS14500
- TADIRAN SL-360/s
- XENOENERGY XL-060F

Special battery in conjunction with electronic insert FEL68 (2-wire NAMUR)

- For energy-related reasons, the Bluetooth module VU121 requires a special battery when operated with electronics insert FEL68 (2-wire NAMUR).
- 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)).

Connecting the Bluetooth module

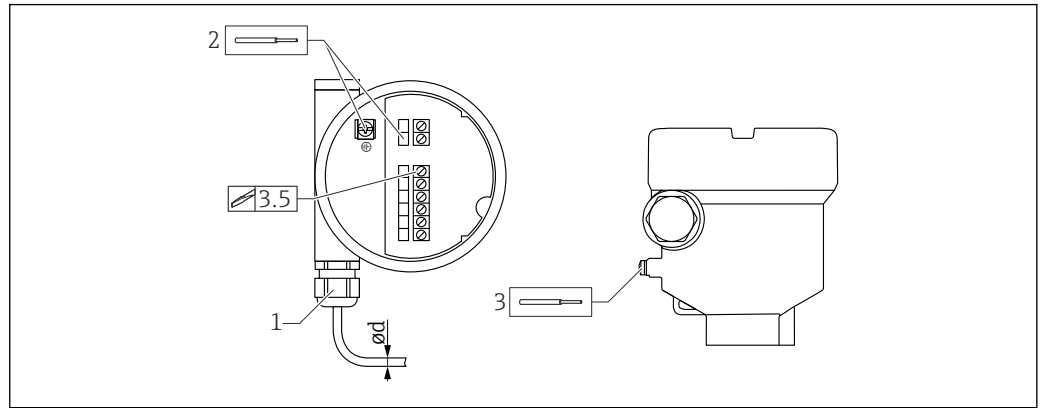


33 Connecting the Bluetooth module

6.2.9 Connecting the cables

Required tool

- Flat-blade screwdriver (0.6 mm x 3.5 mm) for terminals
- Torque wrench



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

- 1 M20 coupling (with cable entry), example
 - 2 Maximum conductor cross-section 2.5 mm² (AWG 14), ground terminal inside the housing + terminals on the electronics
 - 3 Maximum conductor cross-section 4.0 mm² (AWG 12), ground terminal outside the housing (example of plastic housing with external protective ground connection (PE))
- 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)

i Pay attention to the following when using the M20 coupling

Following cable entry:

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

6.3 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 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

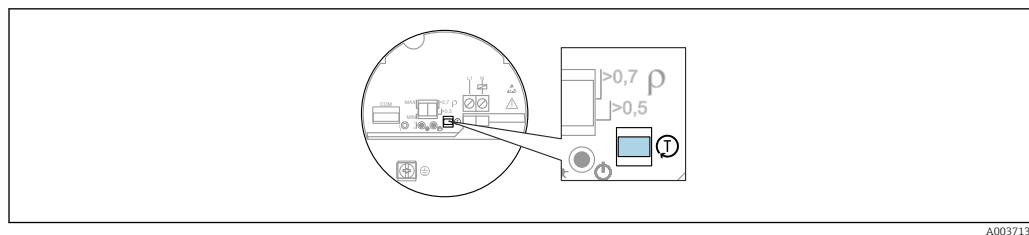
7.1 Overview of operation options

7.1.1 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 operational status (switch status or alarm 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 (electronic insert FEL62) and relay electronics (electronic inserts FEL64, FEL64DC)
 - Ordering information: Product Configurator, order code for "Display; operation" option "B"

7.1.2 Functional test using the button on the electronic insert

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



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35 Position of button for functional test

- Press the test button for at least 1 s (electronic inserts FEL61/62/64/64DC/67/68)
- 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

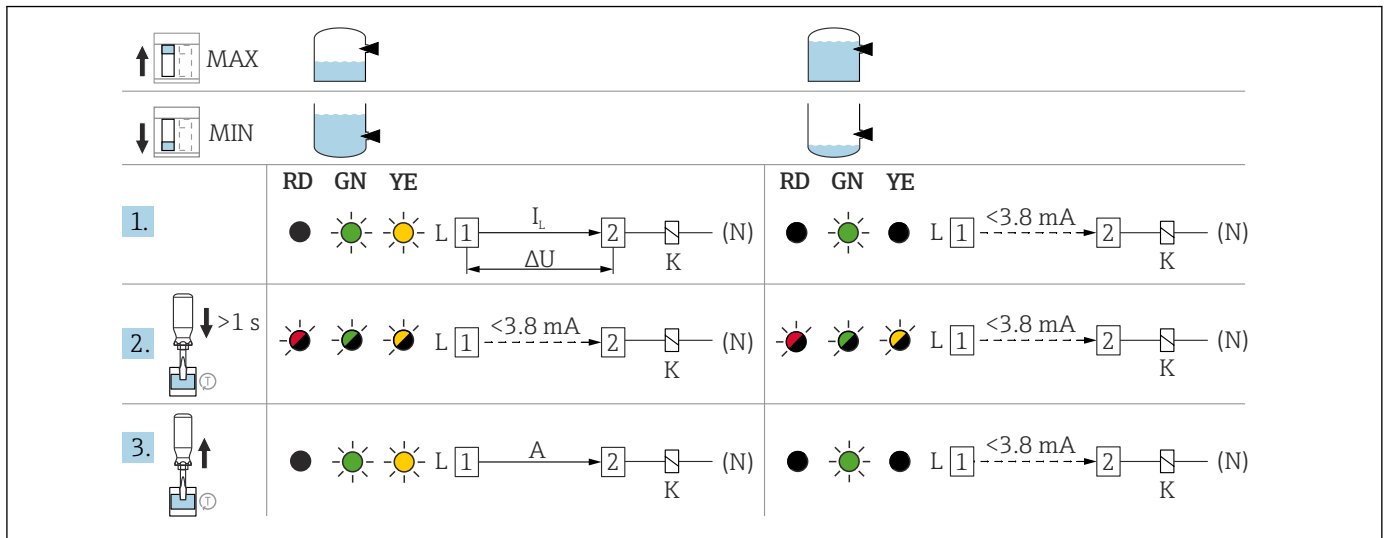
The LEDs flash one after another as a chaser light during the functional test.

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, which can be ordered as an option (FEL62, FEL64, FEL64DC, 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

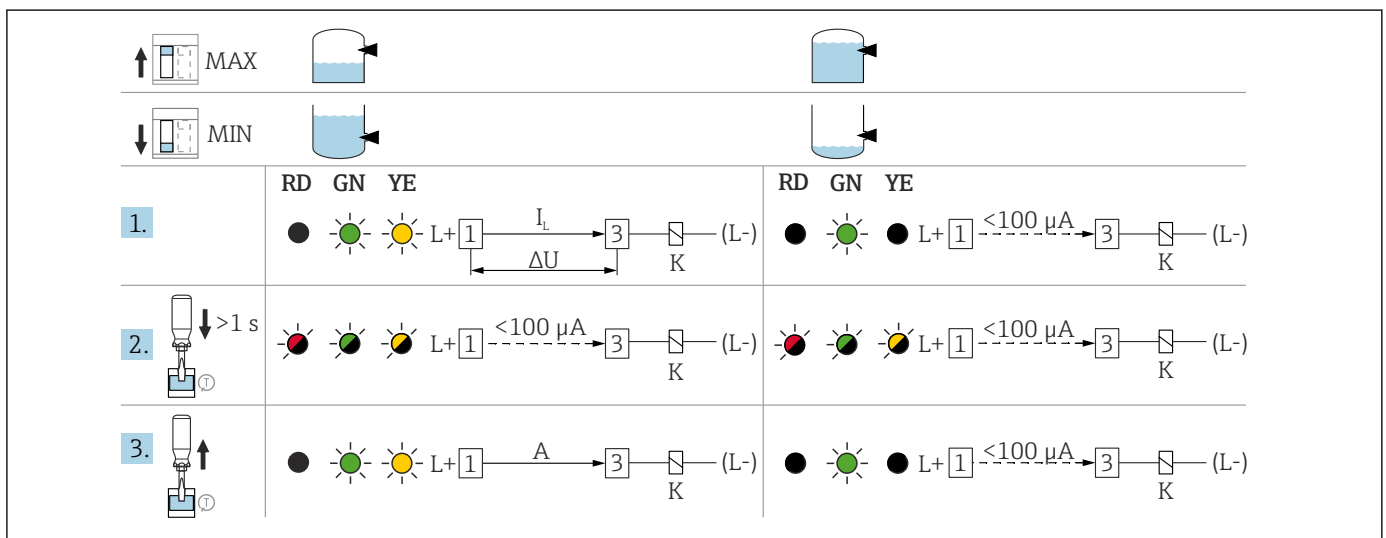


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36 FEL61 switching behavior and signaling

A After the test button is pressed, the load is switched off for at least 10 s ($I < 3.8 \text{ mA}$) even if the button is pressed for $< 10 \text{ s}$. If the button is pressed for $> 10 \text{ s}$, 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 behavior and signaling

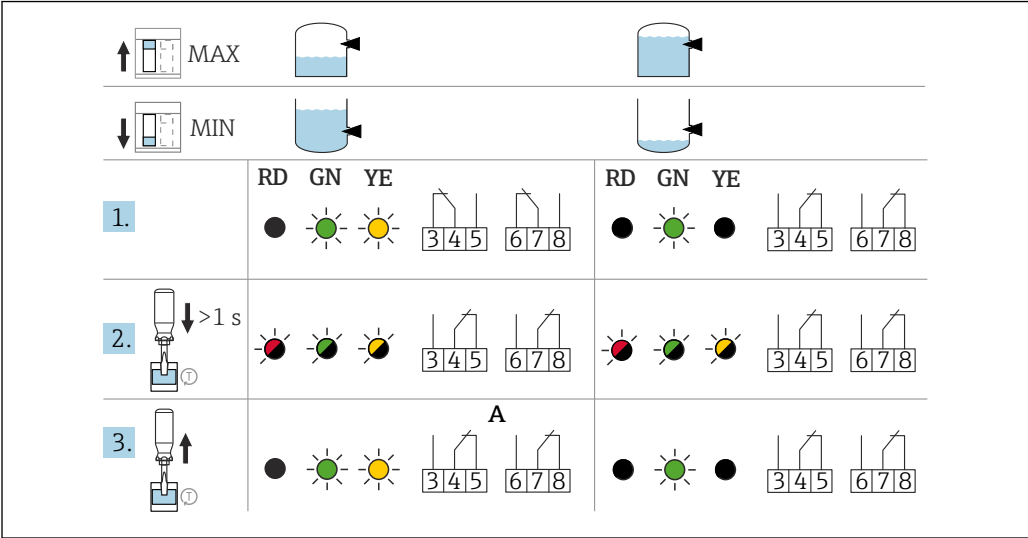


A0039211

37 FEL62 switching behavior and signaling

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

FEL64, FEL64DC switching behavior and signaling

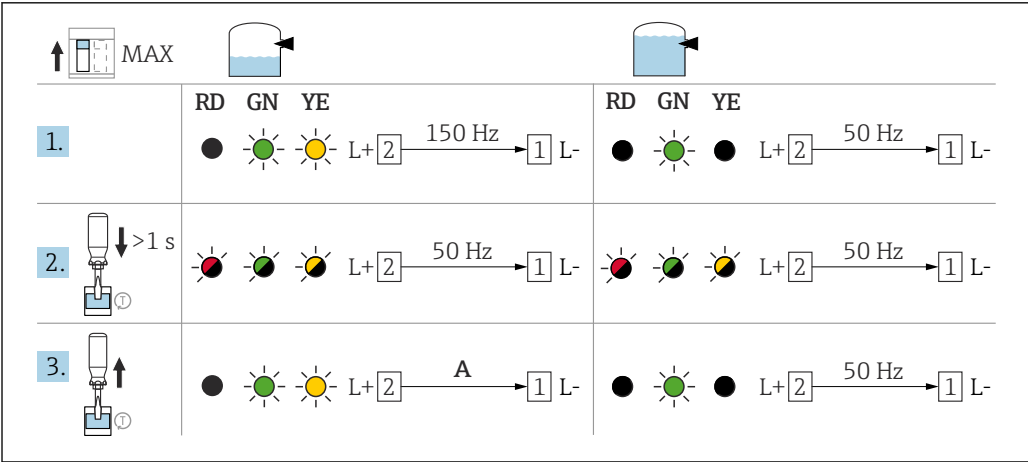


38 FEL64, FEL64DC switching behavior and signaling

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

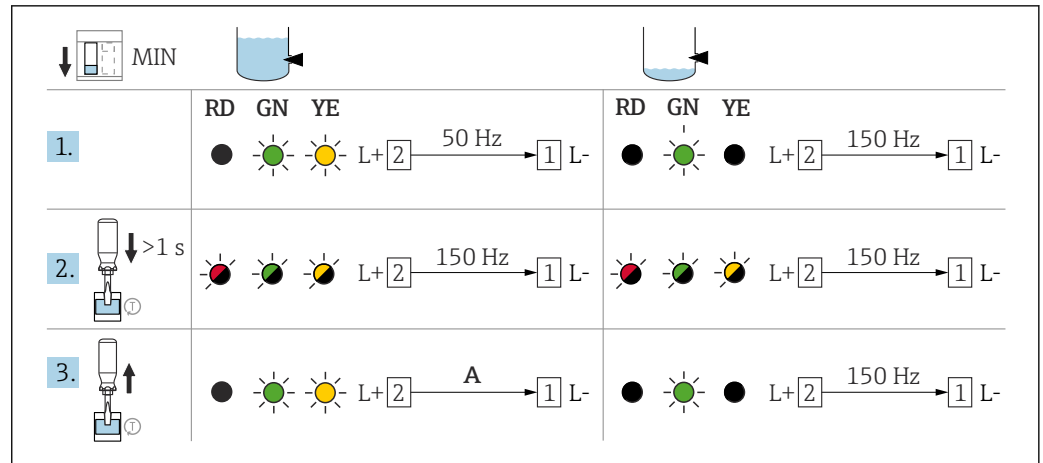
FEL67 switching behavior and signaling

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



39 FEL67 MAX switching behavior and signaling

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



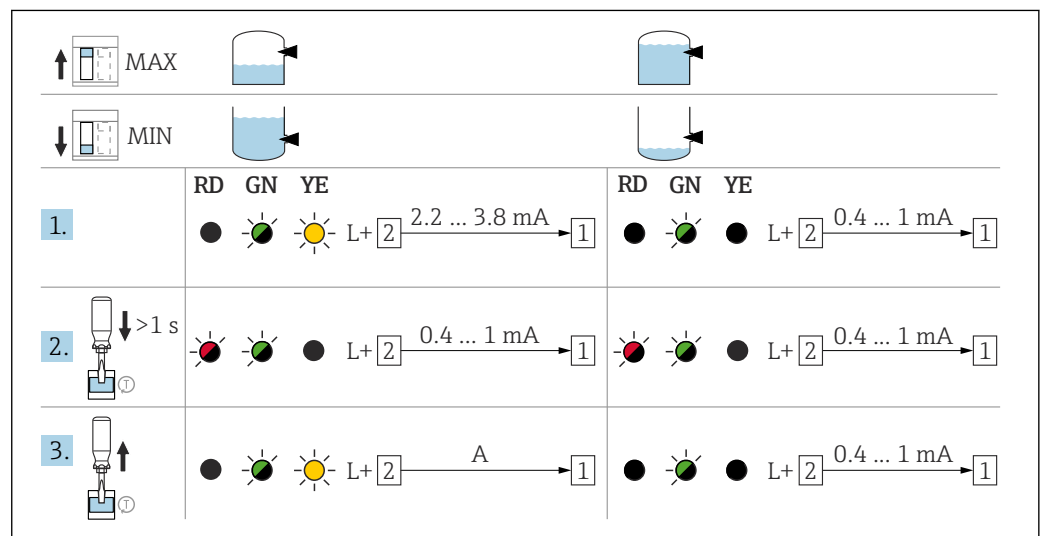
A0039214

40 FEL67 MIN switching behavior and signaling

A After the test button is pressed, the output frequency is switched off for at least 10 s 150 Hz, even if the button is pressed for < 10 s. If the button is pressed for > 10 s, 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 behavior and signaling



A0039343

41 NAMUR electronics switching behavior and signaling

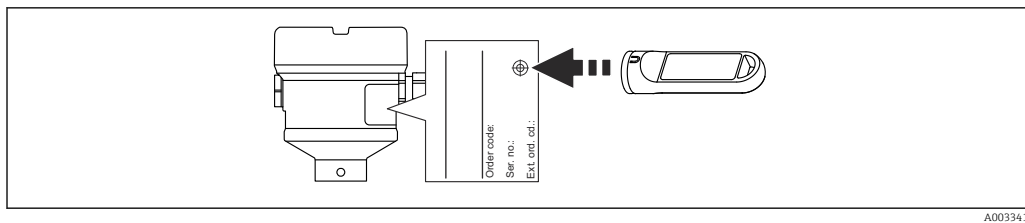
A After the test button is pressed, the current is 0.4 to 1 mA for at least 10 s even if the button is pressed for < 10 s. If the button is pressed for > 10 s, the current remains at 0.4 to 1 mA until the test button is released. The current then returns to 2.2 to 3.8 mA.

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 the functional test using the test button on the electronic insert.

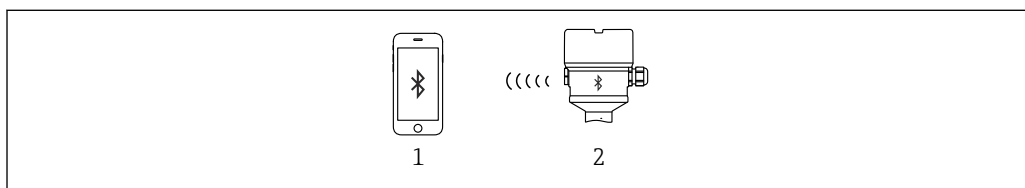


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42 Functional test with test magnet

7.1.4 Heartbeat diagnosis and verification with Bluetooth® wireless technology

Access via Bluetooth® wireless technology



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43 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.

7.2 LED module VU120 (optional)

Depending on the MAX/MIN setting, an LED indicates the operational status (switch status or alarm status) in green, yellow and red. The LED lights up very brightly and can be easily identified from a distance.

Connection to the following electronic inserts: FEL62, FEL64, FEL64 DC.

 For more detailed information, see "Electrical connection" section.

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 safety-oriented state, or in the alarm state if available:

- For electronic insert FEL61, the output will be in the correct state for a maximum of 4 s after powering up the device.
- For electronic inserts FEL62, FEL64, FEL64DC, the output will be in the correct state for a maximum of 3 s after powering up the device.
- For electronic inserts FEL68 NAMUR and FEL67 PFM, a functional test is always performed upon powering up the device. The output is in the correct state after a maximum of 10 s.

8.3 Establishing a connection via SmartBlue (app)

8.3.1 Requirements

Device requirements

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

System requirements

The SmartBlue App is available for download for mobile smartphone or tablet devices in the Google Play Store for Android, and in the App Store for iOS.

- iOS devices: iPhone 5S or higher from iOS11; iPad 5th Generation or higher from iOS11; iPod Touch 6th Generation or higher from iOS11
- Devices with Android: from Android 6.0 and *Bluetooth*® 4.0

Initial password

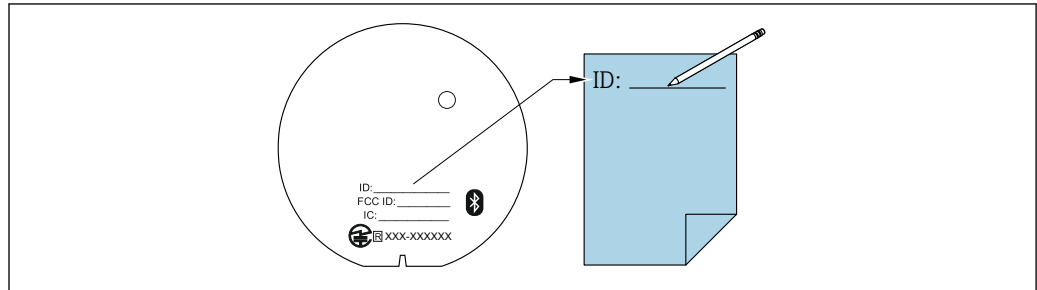
The ID number on the nameplate of the Bluetooth module is used as the initial password when establishing the connection for the first time.

 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.

8.3.2 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.

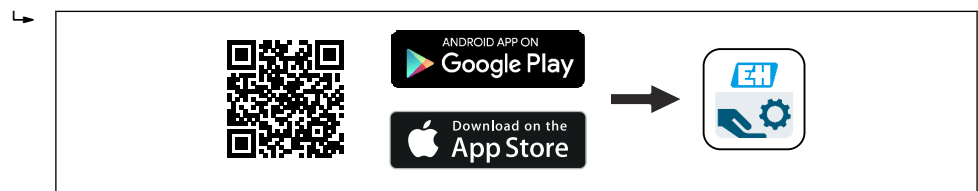
The high cover with the window must be used for devices that are operated with the Bluetooth module.



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8.3.3 Establishing a connection via SmartBlue (app)

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



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 44 [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

Settings and information concerning diagnostics as well as help for troubleshooting

Diagnostics

▶ Active diagnostics

Actual diagnostics

Timestamp

▶ Diagnostic list

Diagnostics 1

Timestamp

Diagnostics 2

Timestamp

Diagnostics 3

Timestamp

Diagnostics 4

Timestamp

Diagnostics 5

Timestamp

9.1.2 "Application" menu

Functions for detailed process adaptation to integrate the device optimally into your application

Application

► Operating mode

MIN/MAX setting

Density setting

Switching delay uncovered to covered

Switching delay covered to uncovered

► Output

Output state

9.1.3 "System" menu

System settings concerning device management, user administration or safety

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 proof test
Frequency at delivery status
Current frequency
Upper alarm frequency
Upper warning frequency
Lower alarm frequency
Battery status
Electronics temperature
Minimum electronics temperature
Maximum electronics temperature

9.2 Heartbeat Verification

The "Heartbeat Verification" module includes the Heartbeat Verification wizard, which performs a verification of the current device condition and generates the Heartbeat Technology verification report:

- The wizard can be used via the SmartBlue app.
- The wizard guides the user through the entire process of generating the verification report.
- The operating hours counter and minimum/maximum temperature indicator (peakhold) are displayed.
- If the vibration frequency of the fork increases, a corrosion warning appears.
- The order configuration of the oscillation frequency in air is indicated in the verification report. An increased oscillation frequency indicates the presence of corrosion. A reduced oscillation frequency indicates that there is buildup present or that the sensor is covered by the medium. Deviations in the oscillation frequency compared to the oscillation frequency on delivery may occur due to the process temperature and process pressure.

9.3 Proof testing for SIL/WHG devices ¹⁾

The "SIL Prooftest", "WHG Prooftest" module or "SIL/WHG Prooftest" module includes a wizard for the proof testing that is required at appropriate intervals for the following applications: SIL (IEC61508/), WHG (German Federal Water Act):

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

¹⁾ Available only for devices with SIL or WHG approval

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".

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

No LED is lit (only applies for FEL61)

Possible cause: load current > 3.8 mA in the blocked state

Troubleshooting: replace electronics

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.
- ▶ 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), 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 Endress+Hauser for disposal under the applicable conditions.

12.5 Battery disposal

- The end user is legally obliged to return used batteries
- The end user can return old batteries or electronic assemblies containing these batteries free of charge to Endress+Hauser

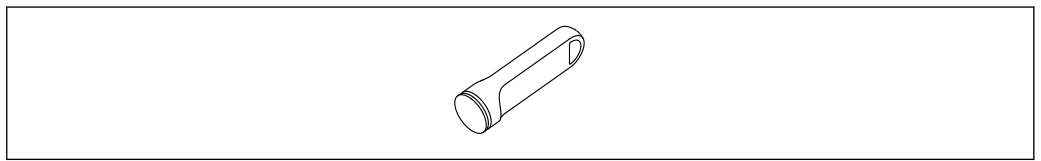


In accordance with German law regulating the use of batteries (BattG §28 Para 1 Number 3), this symbol is used to denote electronic assemblies that must not be disposed of as household waste.

13 Accessories

13.1 Test magnet

Order number: 71437508

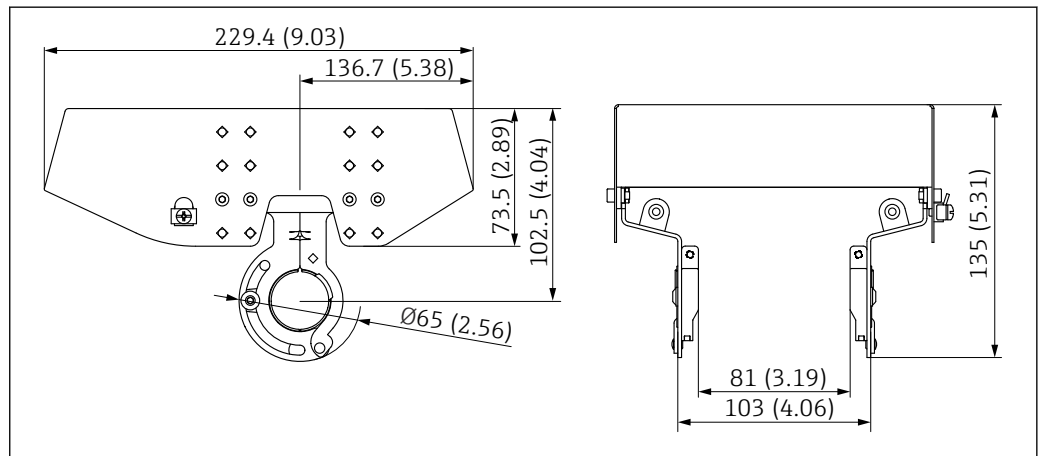


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45 Test magnet

13.2 Weather protection cover for dual-compartment housing, aluminum

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

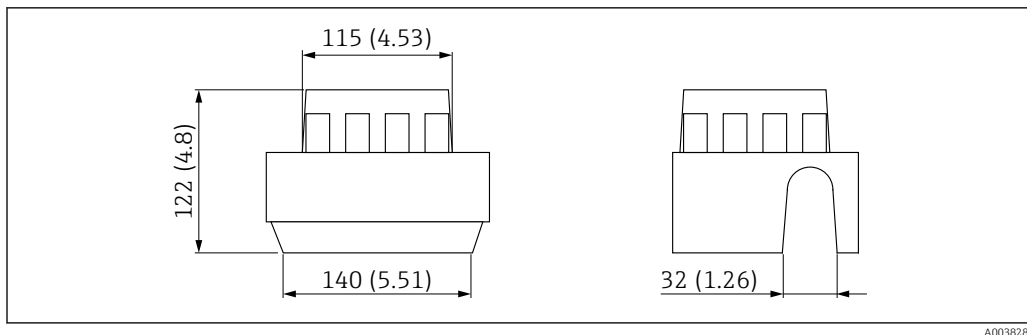


A0039231

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

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

- Material: plastic
- Order number: 71438291



A0038280

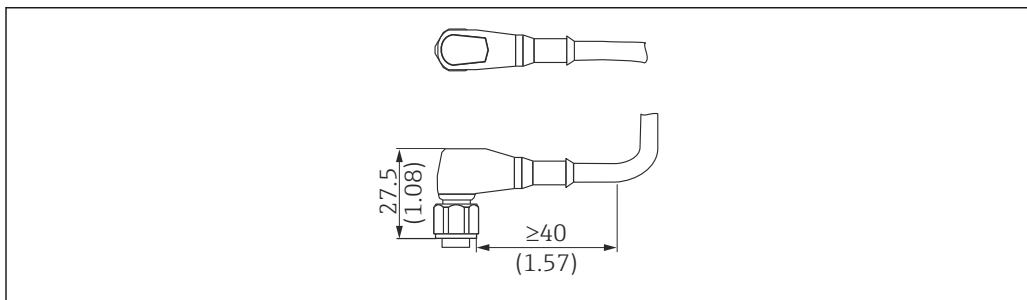
47 Protective cover for single compartment housing, aluminum or 316L. Unit of measurement mm (in)

13.4 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

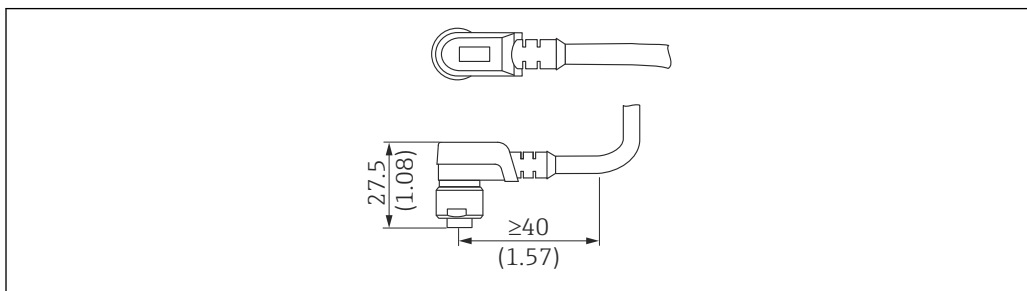


A0023713

48 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



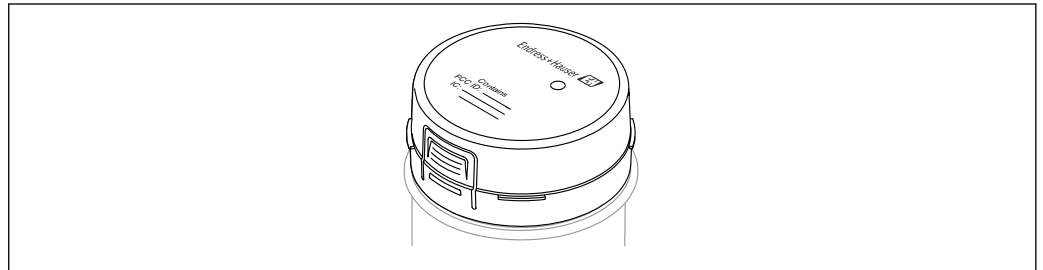
A0022292

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

13.5 Bluetooth module VU121 (optional)

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 without battery for use in conjunction with electronic inserts FEL61, FEL62, FEL64, FEL64DC and FEL67
Order number: 71437383
- Bluetooth module with battery for use in conjunction with electronic insert FEL68 (2-wire NAMUR)
Order number: 71437381



A0039257

50 Bluetooth module VU121

More detailed information is available:

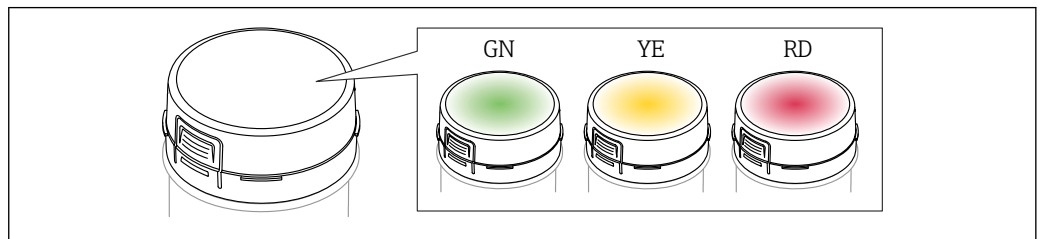
- Product Configurator on the Endress+Hauser web page: www.endress.com
- Endress+Hauser Sales Center www.addresses.endress.com

i A tall cover is required (transparent plastic cover or aluminum cover with sight glass) when using or retrofitting the Bluetooth module. The Bluetooth module cannot be used in conjunction with the single compartment 316L housing, cast. The cover depends on the housing and approval of the device.

13.6 LED module VU120 (optional)

A brightly lit LED indicates the operational status (switch status or alarm status). The LED module can be connected to the following electronic inserts: FEL62, FEL64, FEL64DC.

Order number: 71437382



A0043925

51 LED module, the LED lights up in green (GN), yellow (YE) or red (RD)

More detailed information is available:

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

i A tall cover is required (transparent plastic cover or aluminum cover with sight glass) when using or retrofitting the Bluetooth module. Use of the Bluetooth module is not possible in conjunction with the single compartment 316L housing, cast. The cover depends on the housing and approval of the device.

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

Sensor length:

- With plastic coating, maximum 3 m (9.8 ft)
- With enamel coating, maximum 1.2 m (3.9 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 to 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 to 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 to 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 -50°C (-58°F), optionally available to 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 -50°C (-58°F), optionally available to 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**

The following default switching delay times can be ordered for electronic inserts FEL61, FEL62, FEL64, FEL64DC, FEL67 and FEL68:

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

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**
⚠ 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.

-40 to $+70^{\circ}\text{C}$ (-40 to $+158^{\circ}\text{F}$)

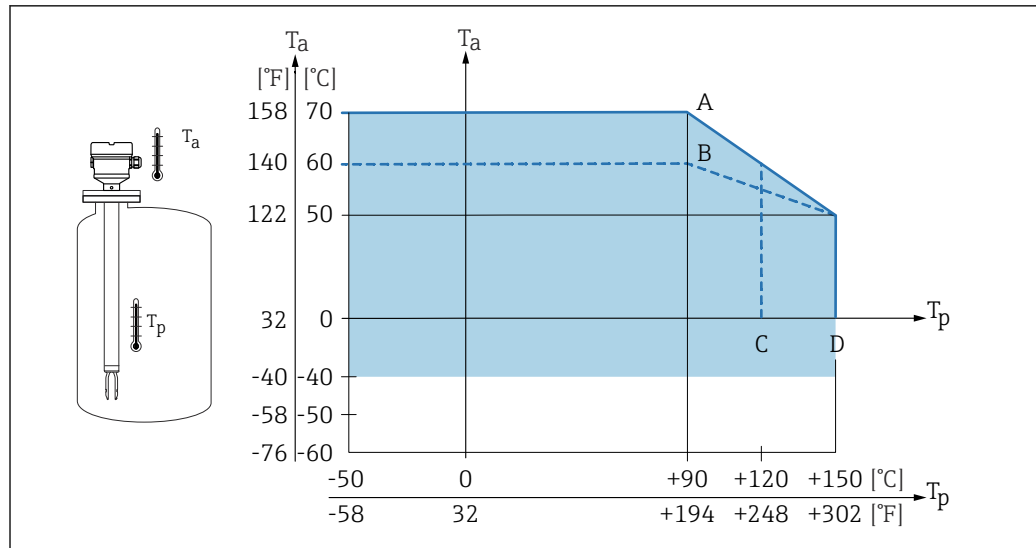
Optionally available to order:

- -60°C (-76°F)
Product Configurator, order code for "Test, Certificate, Declaration" option "JT"
- -50°C (-58°F)
Product Configurator, order code for "Test, Certificate, Declaration" option "JL"

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); for North America, "indoor use" applies.

Low-temperature electronic inserts are marked LT.



52 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 and FEL64 $T_p > 90^\circ\text{C}$ (194°F), max. load current 4 A
- B Device with LED module; at process temperature and FEL64 $T_p > 90^\circ\text{C}$ (194°F), max. load current 2 A
- C ECTFE-coated
- D PFA- or enamel-coated

- Bluetooth module (non-Ex): -40 to $+85^\circ\text{C}$ (-40 to $+185^\circ\text{F}$)
- Bluetooth module (Ex ia): -40 to $+65^\circ\text{C}$ (-40 to $+149^\circ\text{F}$), T4
- LED module: -40 to $+60^\circ\text{C}$ (-40 to $+140^\circ\text{F}$)

Outdoor operation in strong sunlight:

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

14.3.2 Storage temperature

-40 to $+80^\circ\text{C}$ (-40 to $+176^\circ\text{F}$)
Optional: -50°C (-58°F), -60°C (-76°F)

14.3.3 Humidity

Operation 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

In accordance with DIN EN 60529, NEMA 250

IP66/IP68 NEMA 4x/6P

Types of housing:

- Single compartment; plastic
- Single compartment; aluminum, coated; Ex d/XP
- Single compartment; 316L, cast; Ex d/XP
- Dual compartment L-shaped, aluminum, coated; Ex d/XP



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

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

14.3.7 Vibration resistance

As per IEC60068-2-64-2009

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

14.3.8 Shock resistance

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

g_n : standard acceleration of gravity

14.3.9 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).

Additional details in the "Support the device" section.

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**

- ECTFE: $-50 \text{ to } +120 \text{ }^\circ\text{C}$ ($-58 \text{ to } +248 \text{ }^\circ\text{F}$)
- PFA: $-50 \text{ to } +150 \text{ }^\circ\text{C}$ ($-58 \text{ to } +302 \text{ }^\circ\text{F}$)
- Enamel: $-50 \text{ to } +150 \text{ }^\circ\text{C}$ ($-58 \text{ to } +302 \text{ }^\circ\text{F}$)

Pay attention to the pressure and temperature dependency. Additional details in the "Process pressure range" section.

14.4.2 Thermal shock

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

14.4.3 Process pressure range

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.

The following data apply over the entire temperature range. Pay attention to exceptions for flange process connections!

- ECTFE, PFA: -1 to 40 bar (-14.5 to 580 psi)
- Enamel: max. -1 to 25 bar (-14.5 to 363 psi)

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

- 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

In each case, the lowest value from the derating curves of the device and the selected flange applies.

Canadian CRN approval: more details on the maximum pressure values are available in the download area of the product page under "www.endress.com".

14.4.4 Test pressure

Test pressure = $1.5 \cdot PN$

- ECTFE, PFA: $PN = 40$ bar (580 psi)
Enamel: $PN = 25$ bar (362.5 psi)
- Membrane burst pressure at 200 bar (2 900 psi)

The device 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 State of aggregation

Liquid

14.4.6 Density

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

Switch position $> 0.7 \text{ g/cm}^3$ (order configuration)

Liquids with density 0.5 to 0.8 g/cm^3

Switch position $> 0.5 \text{ g/cm}^3$ (can be configured via DIP switch)

Optionally available to order: Liquids with density $> 0.4 \text{ g/cm}^3$ (not for devices with SIL approval)

Fixed value that cannot be edited. The function of the DIP switch is interrupted.

Order code for "Service", option "Default density setting $> 0.4 \text{ g/cm}^3$ "

14.4.7 Viscosity

≤ 10 000 mPa·s

14.4.8 Pressure shocks

≤ 20 bar/s (290 psi/s)

14.4.9 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.

14.4.10 Solids contents

∅ ≤ 5 mm (0.2 in)

14.4.11 Lateral loading capacity

≤ 75 Nm

14.5 Additional technical data

Technical Documentation TI01539F.

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