

Technical Information

Liquiphant FTL64

Vibronic



Point level switch for liquids in high-temperature applications

Application

- Point level switch for all liquids, for minimum or maximum detection in tanks, vessels and piping, even in hazardous areas
- Particularly suitable for high-temperature applications with up to 280 °C (536 °F)
- Tuning fork and process connection with highly corrosion-resistant Alloy C22 (2.4602) material and PFA-coated (conductive) version available for very aggressive media
- Process temperature range: -60 to +280 °C (-76 to +536 °F)
- Pressures up to 100 bar (1450 psi)
- Viscosities up to 10 000 mPa·s
- Ideal substitute for float switches; reliable function is not affected by flow, turbulence, air bubbles, foam, vibration, solids content or buildup.

Advantages

- Approved for safety systems with functional safety requirements up to SIL2/SIL3 in accordance with IEC 61508
- Maximum safety thanks to welded gas-tight feedthrough, even if sensor is damaged
- Functional safety: monitoring of the vibration frequency of the tuning fork
- Heartbeat Technology via the free iOS/Android SmartBlue app
- With *Bluetooth*® wireless technology

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About this document

Symbols

Safety symbols



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



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

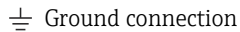


This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or medium injury.



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

Electrical symbols



Grounded clamp, which is grounded via a grounding system.



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.

Symbols for certain types of information



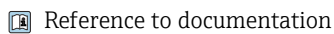
Procedures, processes or actions that are permitted.



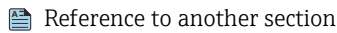
Procedures, processes or actions that are forbidden.



Indicates additional information



Reference to documentation



Reference to another section



Series of steps

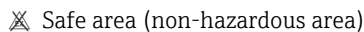
Symbols in graphics

A, B, C ... View

1, 2, 3 ... Item numbers



Hazardous area



Safe area (non-hazardous area)

Communication-specific symbols



Wireless data transmission between devices over a short distance.

Function and system design

point level detection

Maximum or minimum detection for liquids in tanks or pipes in all industries. Suitable for leakage monitoring, pump dry-running protection or overflow prevention, for example .

Specific versions are suitable for use in hazardous areas.

The point level switch differentiates between the "covered" and "not covered" conditions.

Depending on the MIN (minimum detection) or MAX (maximum detection) modes, there are two possibilities in each case: OK status and demand mode.

OK status

- In MIN mode, the fork is covered, e.g. Pump dry running protection
- In MAX mode, the fork is not covered e.g. overflow prevention

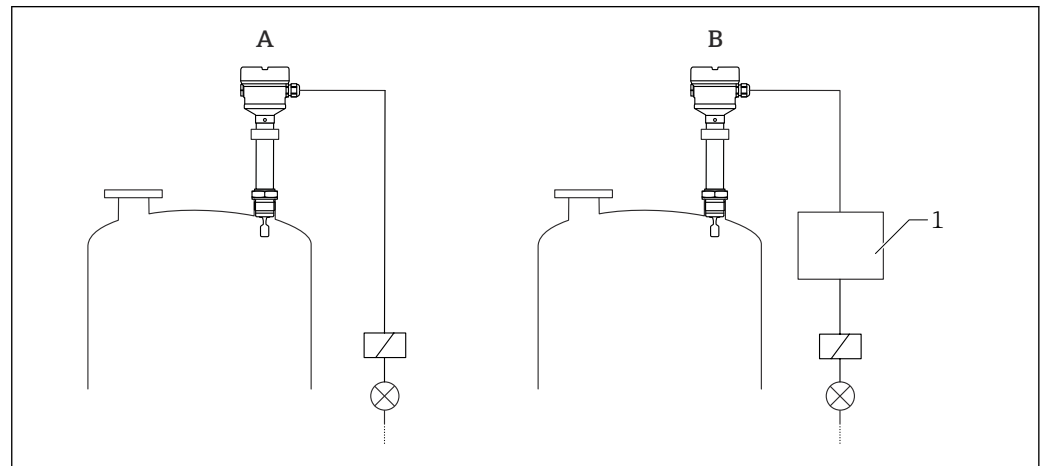
Demand mode

- In MIN mode, the fork is not covered e.g. pump dry running protection
- In MAX mode, the fork is covered e.g. overflow prevention

Measuring principle

The sensor's tuning fork vibrates at its intrinsic frequency. As soon as the liquid covers the tuning fork, the vibration frequency decreases. The change in frequency causes the point level switch to switch.

Measuring system



A0042328

1 Example of a measuring system

A Device for direct connection of a load

B Device for connection to a separate switching unit or PLC

1 Switching unit, PLC etc.

Dependability

Device-specific IT security

The device settings and the diagnostic data can be read out via Bluetooth. Device settings cannot be changed via Bluetooth.

Input

Measured variable

Level (point level), MAX or MIN safety

Measuring range

Depends on the installation location and the pipe extension ordered

Standard pipe extension up to 3 m (9.8 ft) and up to 6 m (20 ft) on request.

Output

Output and input variants	<p>Electronic inserts</p> <p>2-wire AC (FEL61)</p> <ul style="list-style-type: none"> ▪ Two-wire AC version ▪ Switches the load directly into the power supply circuit via an electronic switch <p>3-wire DC-PNP (FEL62)</p> <ul style="list-style-type: none"> ▪ Three-wire direct current version ▪ Switches the load via the transistor (PNP) and separate connection, e. g. in conjunction with programmable logical controllers (PLC) ▪ Ambient temperature $-60\text{ }^{\circ}\text{C}$ ($-76\text{ }^{\circ}\text{F}$), optionally available to order Low-temperature electronic inserts are marked LT <p>Universal current connection, relay output (FEL64)</p> <ul style="list-style-type: none"> ▪ Switches the loads via 2 floating change-over contacts ▪ Ambient temperature $-60\text{ }^{\circ}\text{C}$ ($-76\text{ }^{\circ}\text{F}$), optionally available to order Low-temperature electronic inserts are marked LT <p>Direct current connection, relay output (FEL64DC)</p> <ul style="list-style-type: none"> ▪ Switches the load via 2 potential-free changeover contacts ▪ Ambient temperature $-60\text{ }^{\circ}\text{C}$ ($-76\text{ }^{\circ}\text{F}$), optionally available to order Low-temperature electronic inserts are marked LT <p>PFM output (FEL67)</p> <ul style="list-style-type: none"> ▪ 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 $-50\text{ }^{\circ}\text{C}$ ($-58\text{ }^{\circ}\text{F}$), optionally available to order The low-temperature electronic inserts are marked LT <p>2-wire NAMUR $> 2.2\text{ mA}/< 1.0\text{ mA}$ (FEL68)</p> <ul style="list-style-type: none"> ▪ 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 $-50\text{ }^{\circ}\text{C}$ ($-58\text{ }^{\circ}\text{F}$), optionally available to order Low-temperature electronic inserts are marked LT
Output signal	<p>Switch output</p> <p>The following default switching delay times can be ordered for electronic inserts FEL61, FEL62, FEL64, FEL64DC, FEL67 and FEL68:</p> <ul style="list-style-type: none"> ▪ 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 ▪ 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 <p>COM interface</p> <p>For connecting to modules VU120 or VU121 (no modifying effect)</p> <p><i>Bluetooth® wireless technology (optional)</i></p> <p>The device has a Bluetooth® wireless technology interface. Device data and diagnostic data can be read out using the free "SmartBlue" app.</p>
Ex connection data	<p>See safety instructions (XA): All data relating to explosion protection are provided in separate Ex documentation and are available from the Downloads area of the Endress+Hauser website. The Ex documentation is supplied as standard with all devices approved for use in explosion hazardous areas.</p>

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)

Terminals

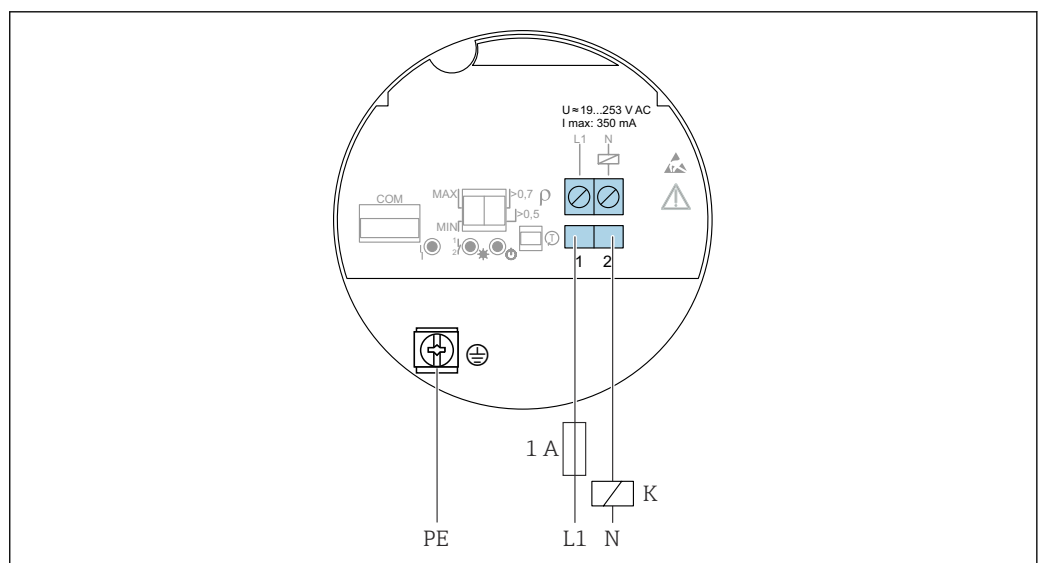
Terminals for cable cross-section up to 2.5 mm² (14 AWG). Use ferrules for the wires.

Overvoltage protection

Overvoltage category II

Terminal assignment

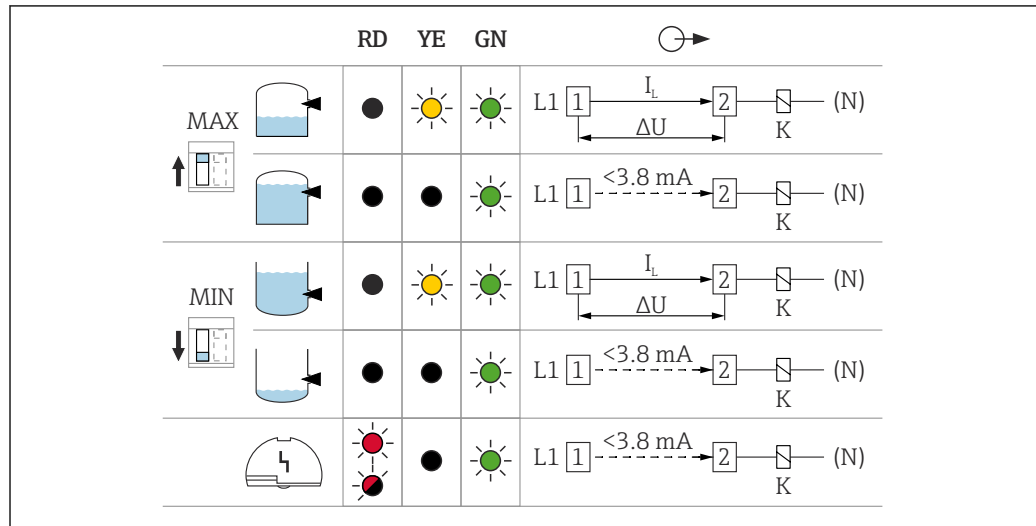
Always connect an external load. The electronic insert has integrated short-circuit protection.



2 2-wire AC, electronic insert FEL61

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Behavior of switch output and signaling

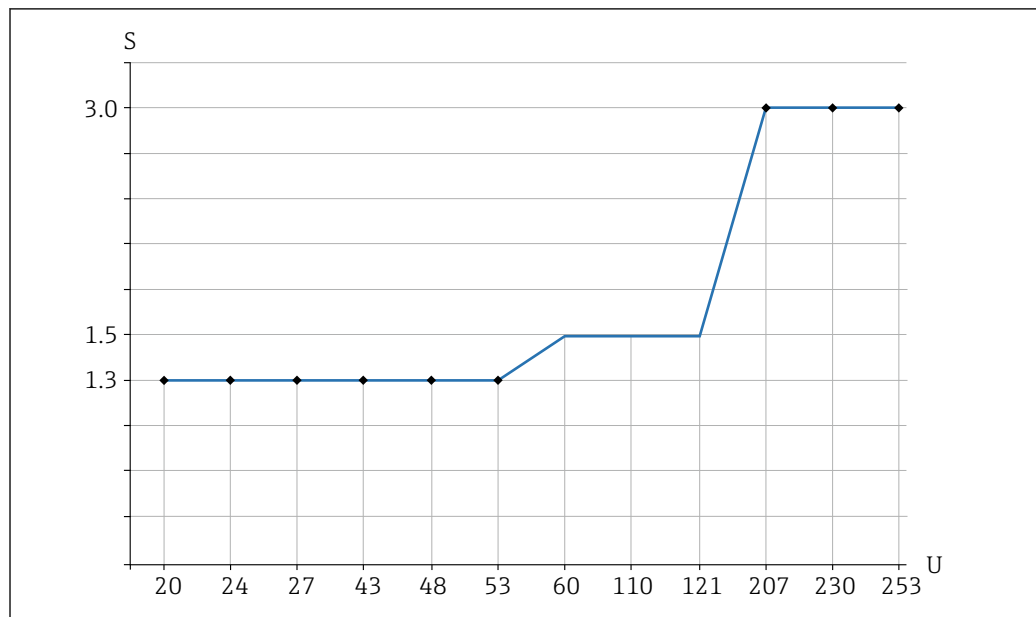


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3 Behavior of switch output and signaling, electronic insert FEL61

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

4 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

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.

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



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



Comply with the following according to 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 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. Check for an overload or short-circuit every 5 s.

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

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

Residual voltage

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

Behavior of output signal

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

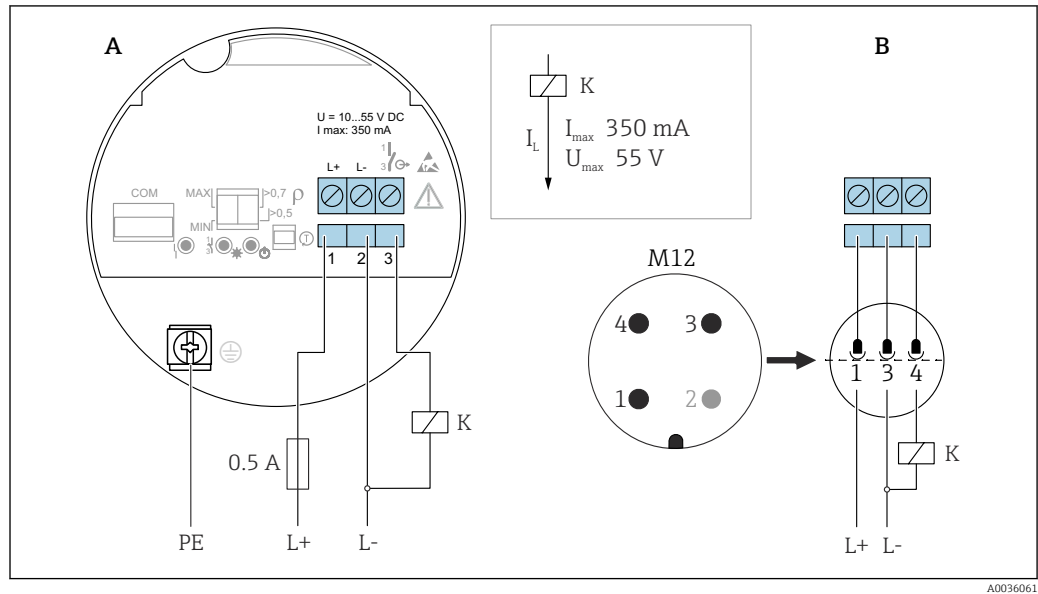
Terminals

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

Overvoltage protection

Overvoltage category I

Terminal assignment

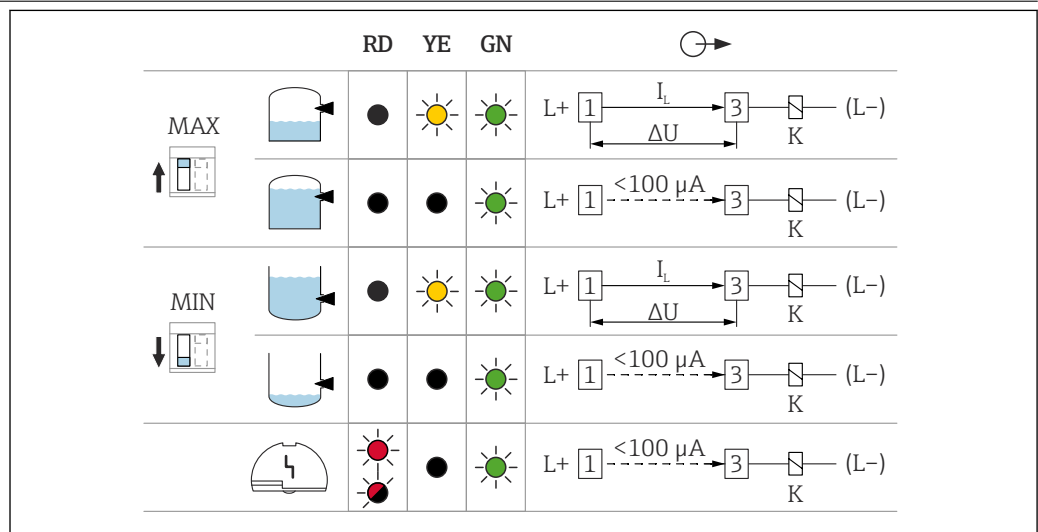


5 3-wire DC-PNP, electronic insert FEL62

A Connection wiring with terminals

B Connection wiring with M12 plug in housing according to EN61131-2 standard

Behavior of switch output and signaling



6 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



Universal current connection with relay output (electronic insert FEL64)

- Switches the loads via 2 potential-free change-over contacts
- 2 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.

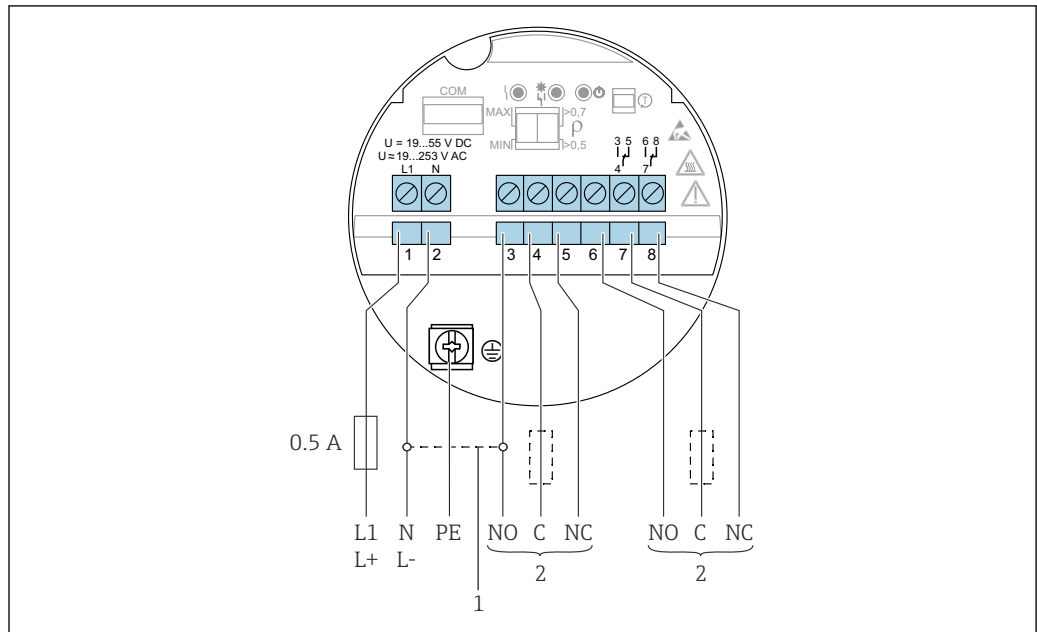
WARNING

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	<p>$U = 19 \text{ to } 253 \text{ V}_{AC}, 50 \text{ Hz}/60 \text{ Hz} / 19 \text{ to } 55 \text{ V}_{DC}$</p> <p> Comply with the following according to 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 supply circuit.</p>
Power consumption	$S < 25 \text{ VA}, P < 1.3 \text{ W}$
Connectable load	<p>Loads switched via 2 potential-free changeover contacts (DPDT)</p> <ul style="list-style-type: none"> ▪ $I_{AC} \leq 6 \text{ A}, U \sim \leq AC 253 \text{ V}; P \sim \leq 1500 \text{ VA}, \cos \varphi = 1, P \sim \leq 750 \text{ VA}, \cos \varphi > 0.7$ ▪ $I_{DC} \leq 6 \text{ A to DC } 30 \text{ V}, I_{DC} \leq 0.2 \text{ A to } 125 \text{ V}$ <p> Additional restrictions for the connectable load depend on the selected approval. Pay attention to the information in the Safety Instructions (XA).</p> <p>According to IEC 61010, the following applies: total voltage from relay outputs and power supply $\leq 300 \text{ V}$.</p> <p>Use electronic insert FEL62 DC PNP for small DC load currents, e.g. for connection to a PLC.</p> <p>Relay contact material: silver/nickel AgNi 90/10</p> <p>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.</p> <p>Both relay contacts switch simultaneously.</p>
Behavior of output signal	<ul style="list-style-type: none"> ▪ OK status: relay energized ▪ Demand mode: relay de-energized ▪ Alarm: relay de-energized
Terminals	Terminals for cable cross-section up to 2.5 mm^2 (14 AWG). Use ferrules for the wires.
Overvoltage protection	Overvoltage category II

Terminal assignment

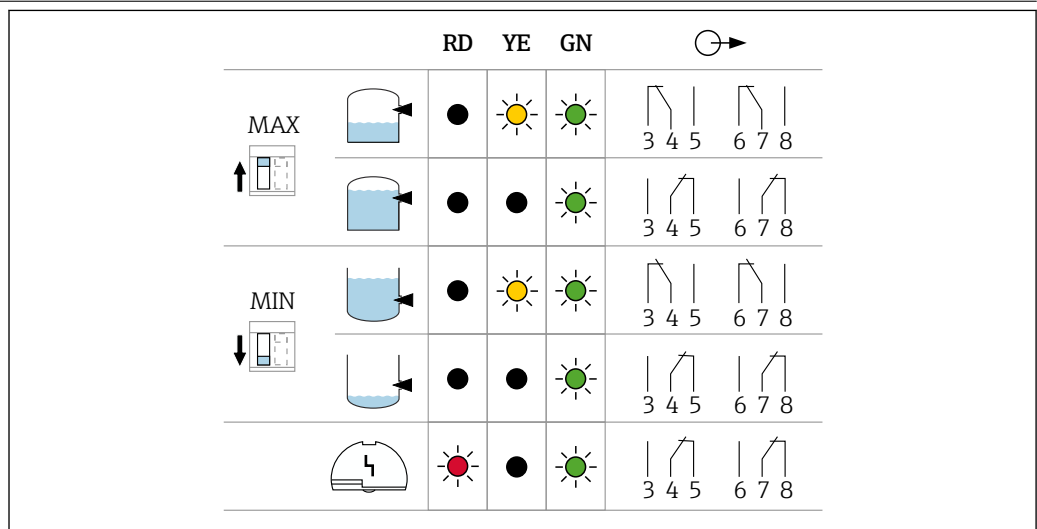


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7 Universal current connection with relay output, electronic insert FEL64

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

Behavior of switch output and signaling






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8 Behavior of switch output and signaling, electronic insert FEL64

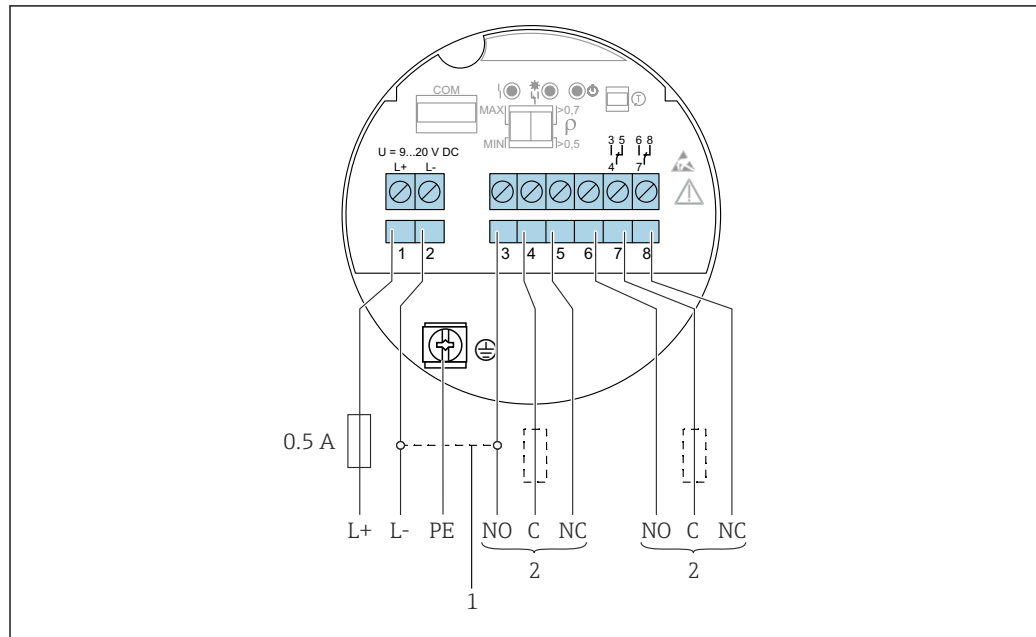
- MAX DIP switch for setting MAX safety mode
- MIN DIP switch for setting MIN safety mode
- RD LED red for alarm
- YE LED yellow, switch status
- GN LED green, operational status, device on

DC connection, relay output (electronic insert FEL64 DC)

- Switches the loads via 2 potential-free change-over contacts
- 2 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	<p>$U = 9 \text{ to } 20 \text{ V}_{\text{DC}}$</p> <p> The device must be powered by a voltage supply categorized as "CLASS 2" or "SELV".</p> <p> Comply with the following according to 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 supply circuit.</p>
Power consumption	$P < 1.0 \text{ W}$
Connectable load	<p>Loads switched via 2 potential-free change-over contacts (DPDT)</p> <ul style="list-style-type: none"> ▪ $I_{\text{AC}} \leq 6 \text{ A}$, $U \sim \leq \text{AC } 253 \text{ V}$; $P \sim \leq 1500 \text{ VA}$, $\cos \varphi = 1$, $P \sim \leq 750 \text{ VA}$, $\cos \varphi > 0.7$ ▪ $I_{\text{DC}} \leq 6 \text{ A}$ to DC 30 V, $I_{\text{DC}} \leq 0.2 \text{ A}$ to 125 V <p> Additional restrictions for the connectable load depend on the selected approval. Pay attention to the information in the Safety Instructions (XA).</p> <p>According to IEC 61010, the following applies: Total voltage from relay outputs and power supply $\leq 300 \text{ V}$</p> <p>Electronic insert FEL62 DC PNP preferred for small DC load currents, e.g. connection to a PLC.</p> <p>Relay contact material: silver/nickel AgNi 90/10</p> <p>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.</p>
Behavior of output signal	<ul style="list-style-type: none"> ▪ OK status: relay energized ▪ Demand mode: relay de-energized ▪ Alarm: relay de-energized
Terminals	Terminals for cable cross-section up to 2.5 mm^2 (14 AWG). Use ferrules for the wires.
Overvoltage protection	Overvoltage category I

Terminal assignment

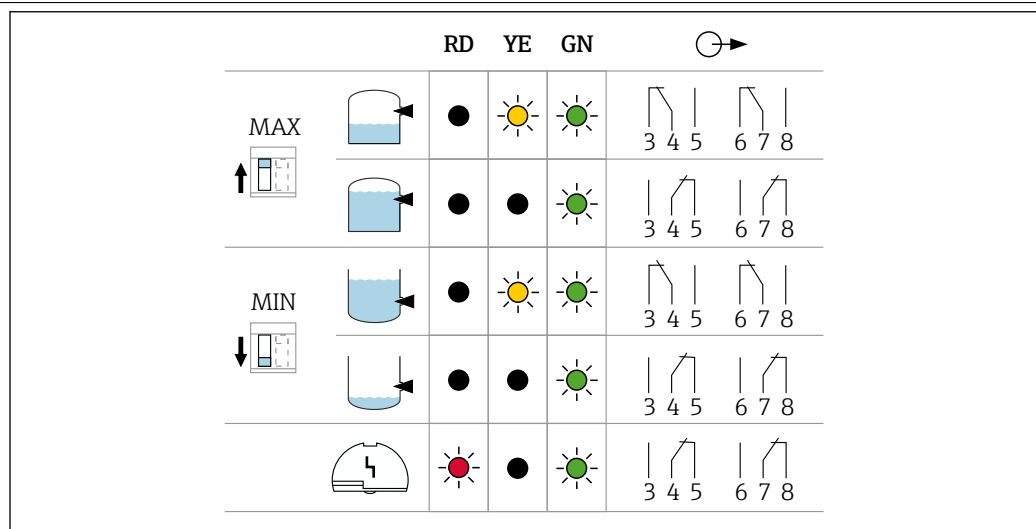


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9 DC connection with relay output, electronic insert FEL64 DC

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

Behavior of switch output and signaling



A0033513

10 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

PFM output (electronic insert FEL67)

- For connection to Endress+Hauser Nivotester switching units FTL325P and FTL375P
- 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

$U = 9.5$ to $12.5 V_{DC}$



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



Comply with the following according to IEC/EN61010-1: provide a suitable circuit breaker for the device.

Power consumption

$P \leq 150$ 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

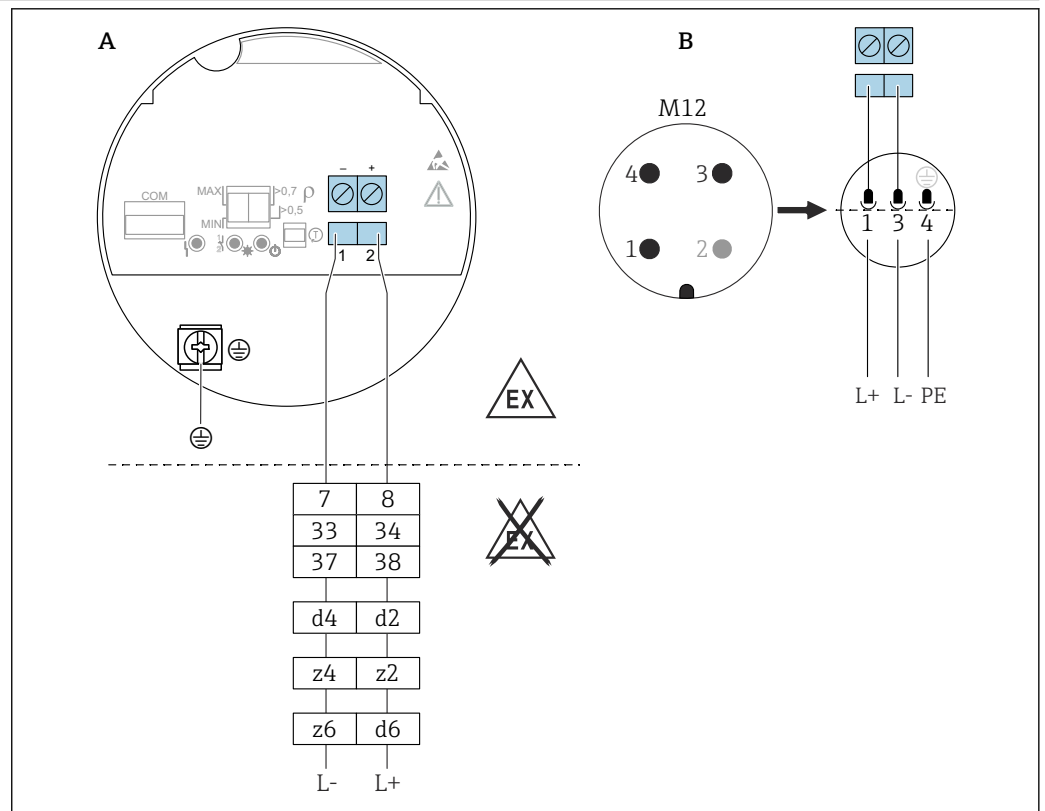
Terminals

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

Overvoltage protection

Overvoltage category I

Terminal assignment



11 PFM output, electronic insert FEL67

A Connection wiring with terminals

B Connection wiring with M12 plug in housing according to EN61131-2 standard

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

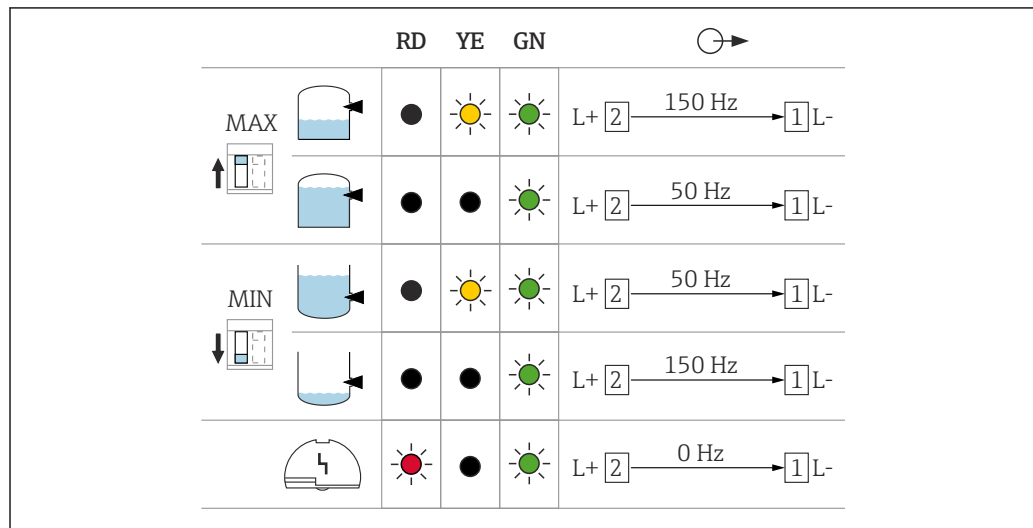
z4/ z2: Nivotester FTL375P input 2

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



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12 Switching behavior 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 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.

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

- To connect to isolating amplifiers according to NAMUR (IEC 60947-5-6), e.g. Nivotester FTL325N from Endress+Hauser
- To connect to isolating amplifiers of third-party suppliers according to NAMUR (IEC 60947-5-6), a permanent power supply for the electronic insert FEL68 must be ensured
- Signal transmission H-L edge 2.2 to 3.8 mA/0.4 to 1.0 mA according to NAMUR (IEC 60947-5-6) on two-wire cabling
- 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

$U = 8.2 V_{DC} \pm 20\%$

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

i Comply with the following according to IEC/EN61010-1: provide a suitable circuit breaker for the device.

Power consumption

NAMUR IEC 60947-5-6

< 6 mW with $I < 1 \text{ mA}$; < 38 mW with $I = 3.5 \text{ mA}$

Connection data interface

NAMUR IEC 60947-5-6

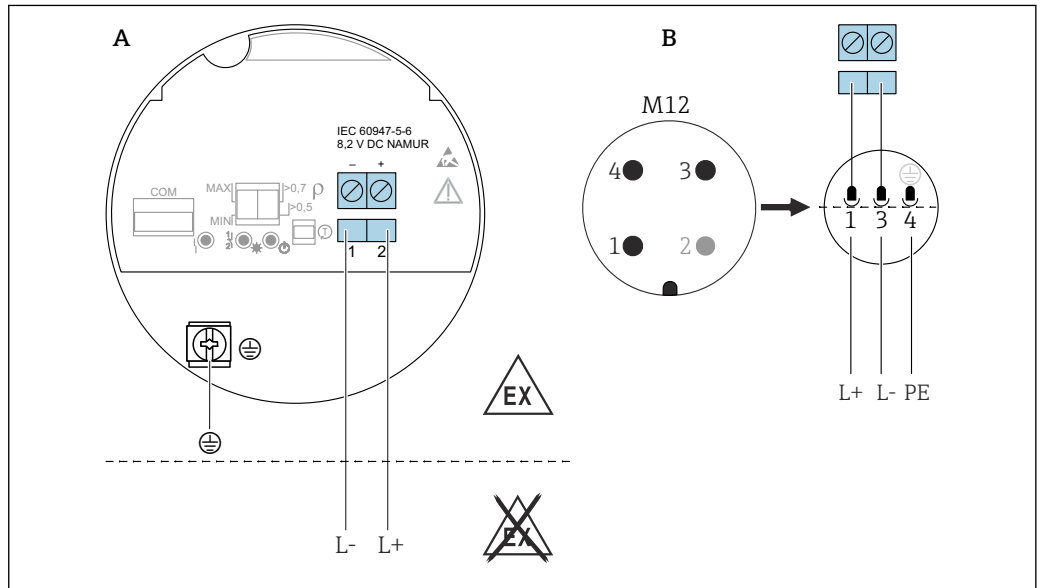
Behavior of output signal

- 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

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

Overvoltage protection Overvoltage category I

Terminal assignment

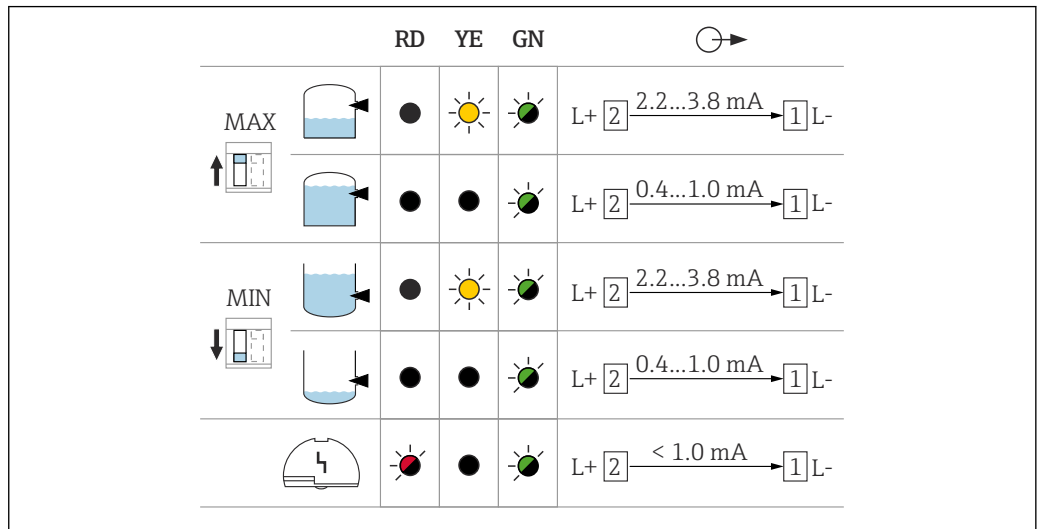


13 2-wire NAMUR ≥ 2.2 mA/≤ 1.0 mA, electronic insert FEL68

A Connection wiring with terminals

B Connection wiring with M12 plug in housing according to EN61131-2 standard

Behavior of switch output and signaling



14 Behavior of switch output and signaling, electronic insert FEL68

MAXDIP switch for setting MAX safety mode

MIN DIP switch for setting MIN safety mode

RD Red LED for alarm

YE Yellow LED, switch status

GN Green LED, operational status, device on

Electronic insert FEL68 with Bluetooth module

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

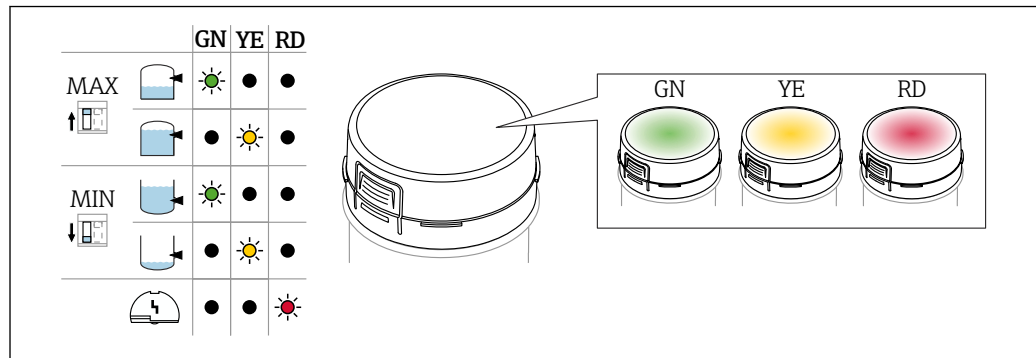
i The following versions can be optionally selected in the Product Configurator:
 Application package: Heartbeat Verification + Monitoring for NAMUR output
 Accessory mounted: Bluetooth for NAMUR output

The order number of the **Bluetooth module, including the required battery**, are subsequently displayed in the Product Configurator.

LED module VU120 (optional)

Supply voltage	U = 12 to 55 V _{DC} , U = 19 to 253 V _{AC} , 50 Hz/60 Hz
Power consumption	P ≤ 0.7 W, S < 6 VA
Current consumption	I _{max} = 0.4 A

Signaling of operational status



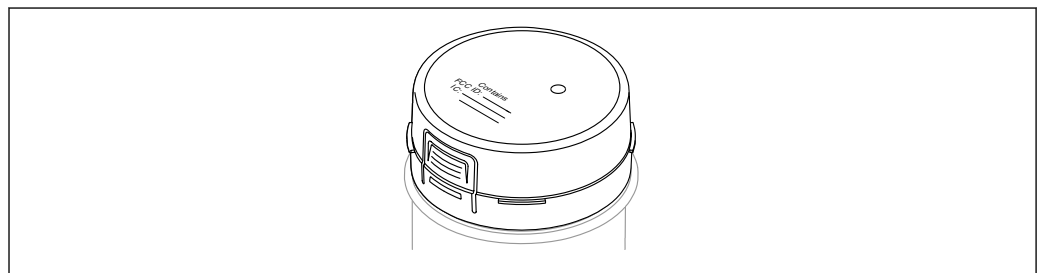
15 LED module, the LED lights up in green (GN), yellow (YE) or red (RD)

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.

See the accompanying Operating Instructions for more detailed information on connection and the switching states. Documentation currently available on the Endress+Hauser- website: www.endress.com → Downloads.

Bluetooth module and Heartbeat Technology

Bluetooth module VU121 (optional)




16 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).

For additional information about the connection, see the Operating Instructions for the device. Documentation currently available on the Endress+Hauser- website: www.endress.com → Downloads.

Batteries - use and handling

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

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

Replacement batteries can be purchased from a specialist retailer.

Replacement batteries

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

Isolation lug in battery compartment

NOTICE

Removal of grounding lug causes battery to discharge prematurely

Removing the grounding lug from the battery compartment of the Bluetooth module causes the battery to discharge prematurely, regardless of the sensor power supply.

- ▶ As long as the sensors are in storage, the grounding lug must remain in the battery compartment of the Bluetooth module.

Operating life

- If the batteries are empty, Bluetooth connection is no longer possible.
- At ambient temperatures from +10 to +40 °C (+50 to +104 °F), 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.

Requirement: The sensor is 99 % in the "good" state (demand requires increased power consumption)

The battery life is based on a scenario where the sensor is connected and powered.

Replacing the battery

- ▶ Before replacing the battery, the Bluetooth module must be disconnected from electronic insert FEL68.
 - ↳ Only then will the battery status display be detected correctly.

Approvals

The Bluetooth module is approved for use in the following types of protection for devices: Ex i, Ex d, Ex e or Ex t. The temperature class of the device is limited to T4 to T1 if the Bluetooth module is used in type of protection Ex i /IS in conjunction with electronic insert FEL68 (2-wire NAMUR) and the required battery in the Bluetooth module.

Additional technical data

- Free-field range: 50 m (165 ft) max.
- Operation radius with intervisibility around the device: 10 m (33 ft)

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

Heartbeat Technology

Heartbeat Technology module

The software package consists of 3 modules. These three modules combined check, evaluate and monitor device functionality and process conditions.



- Heartbeat Diagnostics
- Heartbeat Verification
- Heartbeat Monitoring

Performance characteristics

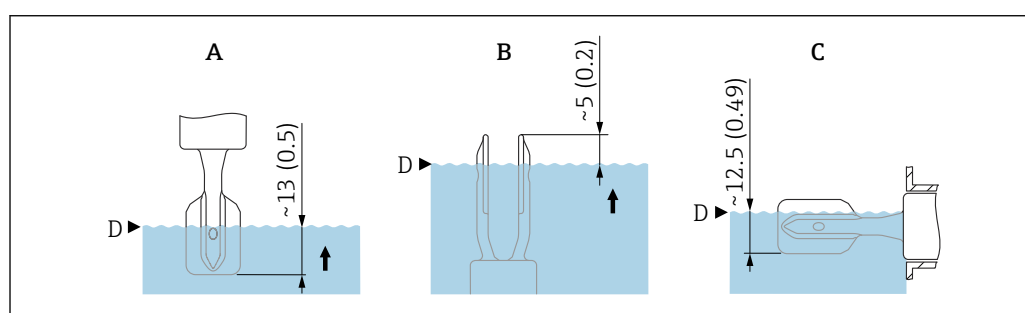
Reference operating conditions

- Ambient temperature: +23 °C (+73 °F)
- Process temperature: +23 °C (+73 °F) ±5 °C (9 °F)
- Density (water): 1 g/cm³ (62.4 lb/ft³)
- Medium viscosity: 1 mPa·s
- Process pressure: unpressurized
- Sensor installation: vertically from above
- Density selection switch: > 0.7 g/cm³ (43.7 lb/ft³) (SGU)
- Switch direction of sensor: uncovered to covered

Take switch point into consideration

The following are typical switch points, depending on the orientation of the point level switch
Water +23 °C (+73 °F)

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



A0044069

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

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

Maximum measured error

At reference operating conditions: max. ± 1 mm (0.04 in) at switch point

Hysteresis

Typically 2.5 mm (0.1 in)

Non-repeatability

0.5 mm (0.02 in)

Influence of the process temperature

The switch point moves from +1.4 to -5.5 mm (+0.06 to -0.22 in) in the temperature range of -60 to +280 °C (-76 to +536 °F)

Influence of the process pressure

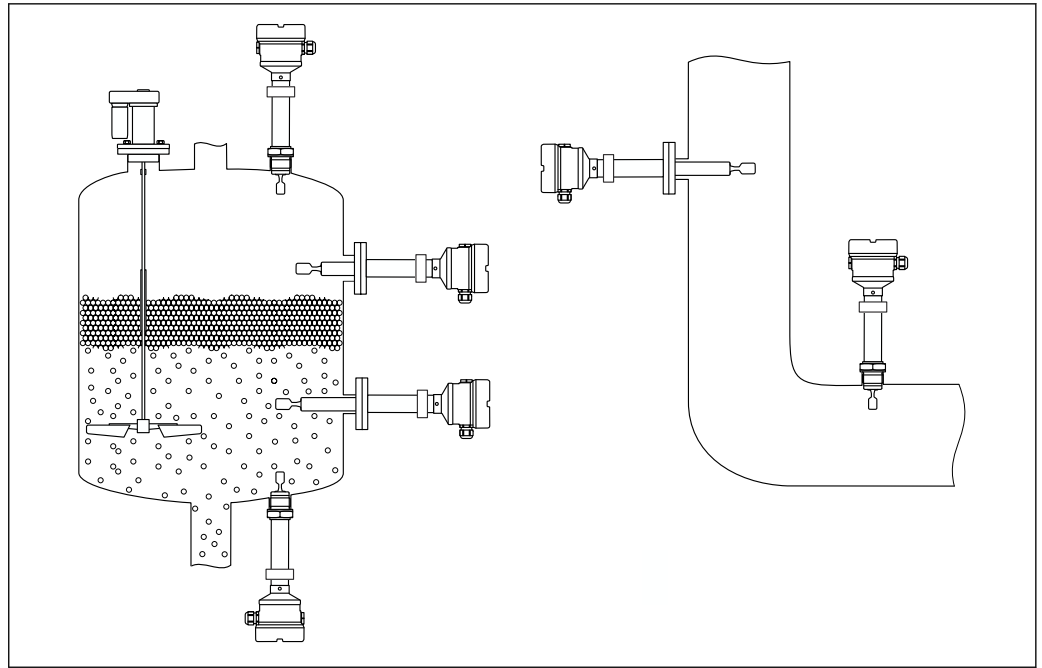
The switch point moves from 0 to -3.9 mm (0 to -0.15 in) in the pressure range of -1 to +100 bar (-14.5 to +1450 psi)

Mounting

Mounting location, orientation

Mounting instructions

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



A0042329

18 Installation examples for a vessel, tank or pipe

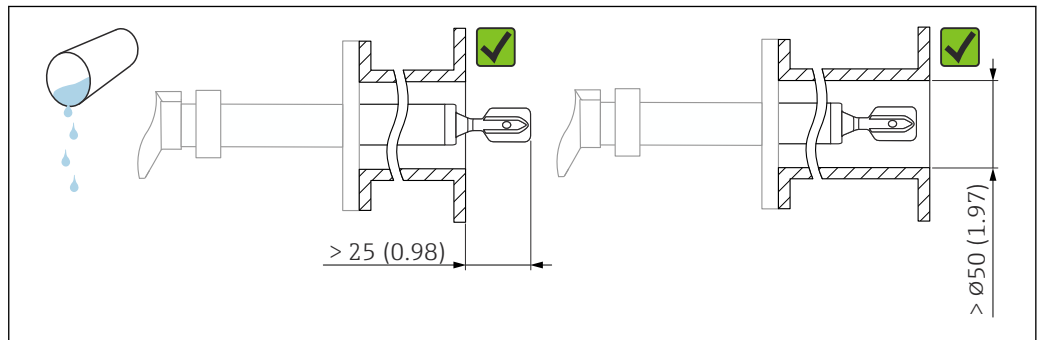
Installation instructions

Take viscosity into consideration

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

Low viscosity

- i** Low viscosity, e.g. water: < 2 000 mPa·s
It is permitted to position the tuning fork within the installation socket.



A0042333

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

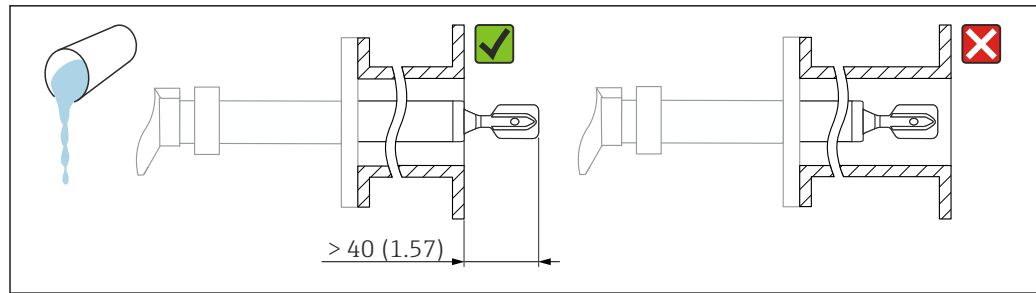
High viscosity

NOTICE

Highly viscous liquids may cause switching delays.

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

- i** High viscosity, e.g. viscous oils: ≤ 10 000 mPa·s
The tuning fork must be located outside the installation socket!

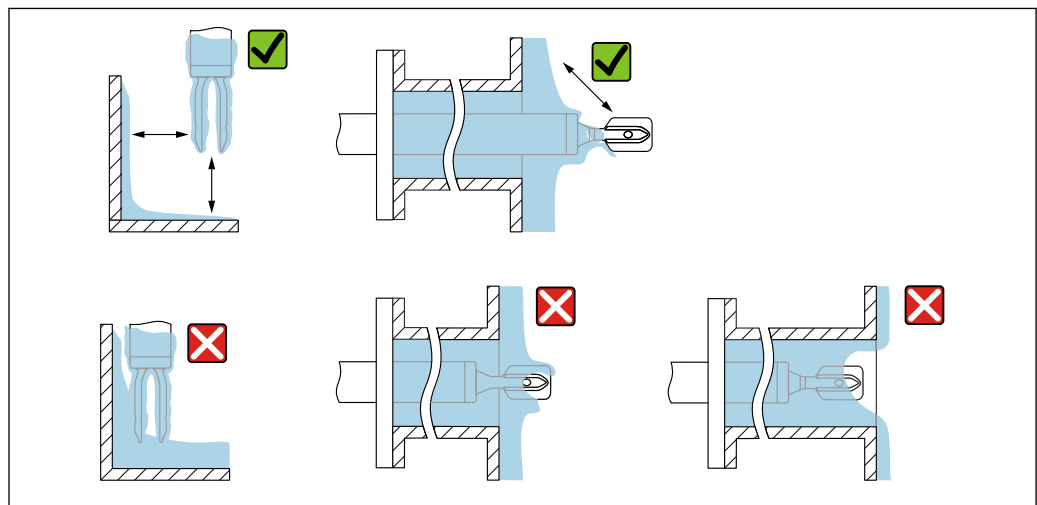


A0042335

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

Avoid buildup

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

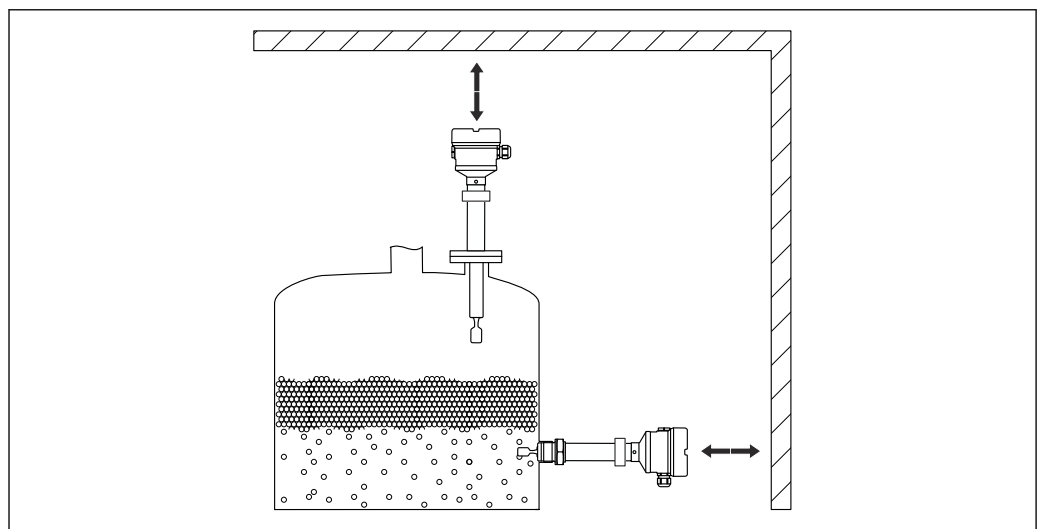


A0042345

21 Installation examples for a highly viscous process medium

Take clearance into consideration

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



A0042340

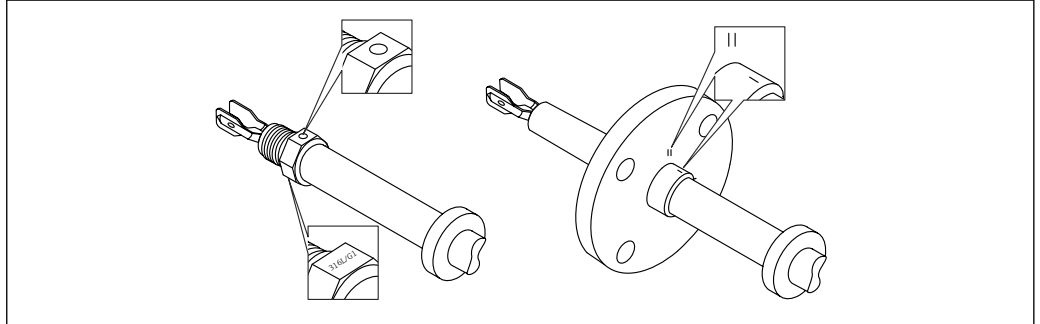
22 Take clearance into consideration

Aligning the tuning fork using the marking

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

Markings are identified on the process connection by:

Material specification, thread designation, circle, line or double line

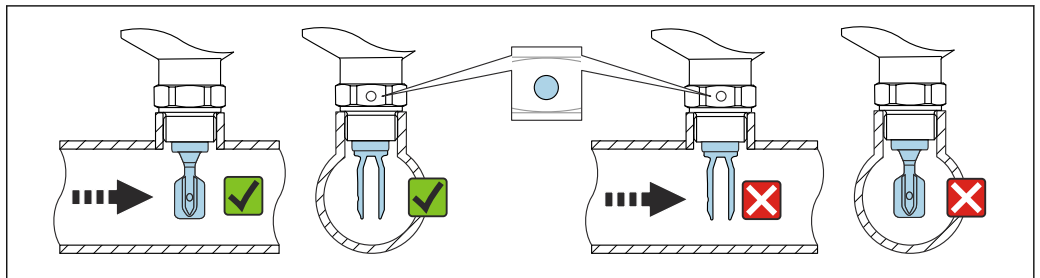


23 Position of the tuning fork when installed horizontally in the vessel using the marking

A0042348

Installing the device in piping

- Flow velocity up to 5 m/s with a viscosity of 1 mPa·s and density of 1 g/cm³ (62.4 lb/ft³) (SGU). Check for correct functioning in the event of other process medium conditions.
- The flow will not be significantly impeded if the tuning fork is correctly aligned and the marking is pointing in the direction of flow.
- The marking is visible when installed



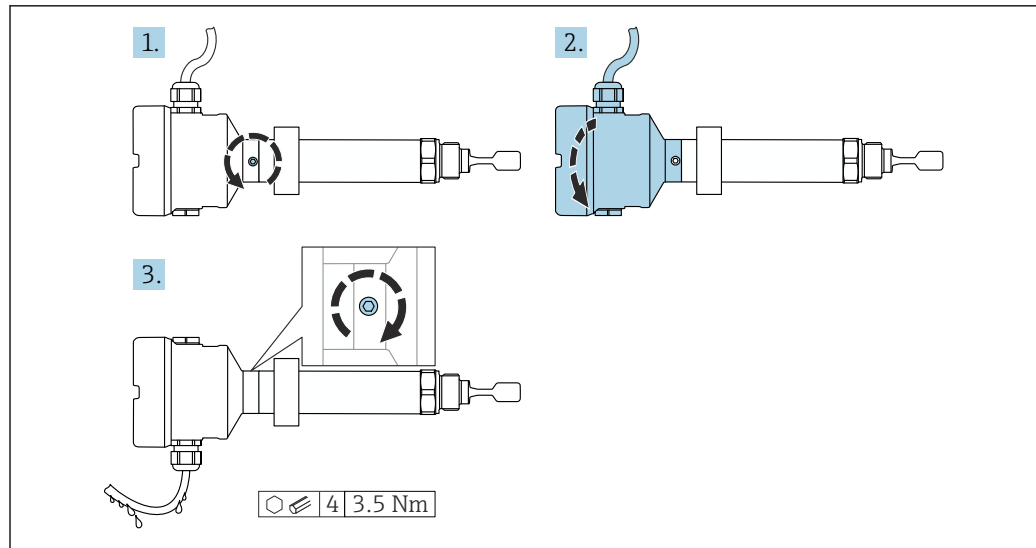
24 Installation in pipes (take fork position and marking into consideration)

A0034851

Aligning the cable entry

- i** Housings with locking screw:
 - The housing can be turned and the cable aligned by turning the locking screw.
 - The locking screw is not tightened when the device is delivered.

Housing with locking screw: The housing can be turned and the cable aligned by turning the locking screw.



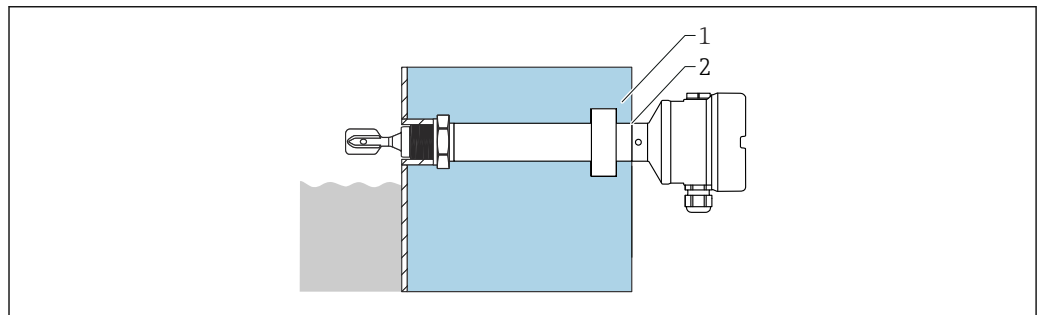
A0042355

25 Housing with external locking screw and drip loop

Special mounting instructions

Vessel with heat insulation

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



A0050991

26 Vessel with heat insulation

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

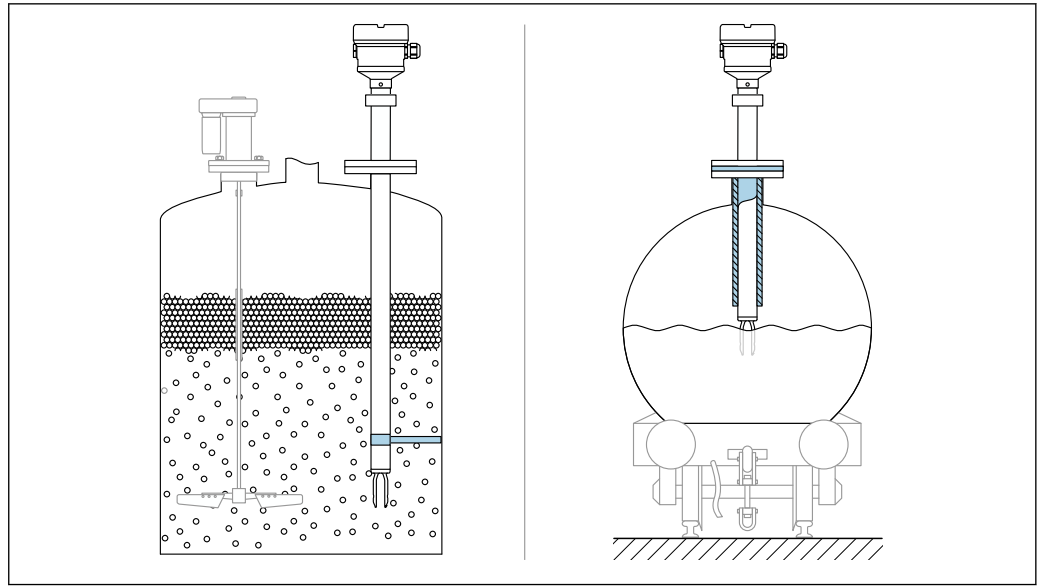
Support the device

NOTICE

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

- ▶ 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).



27 Examples of support in the event of dynamic load

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

Sliding sleeves

A For more details, see the "Accessories" section.

Environment

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.

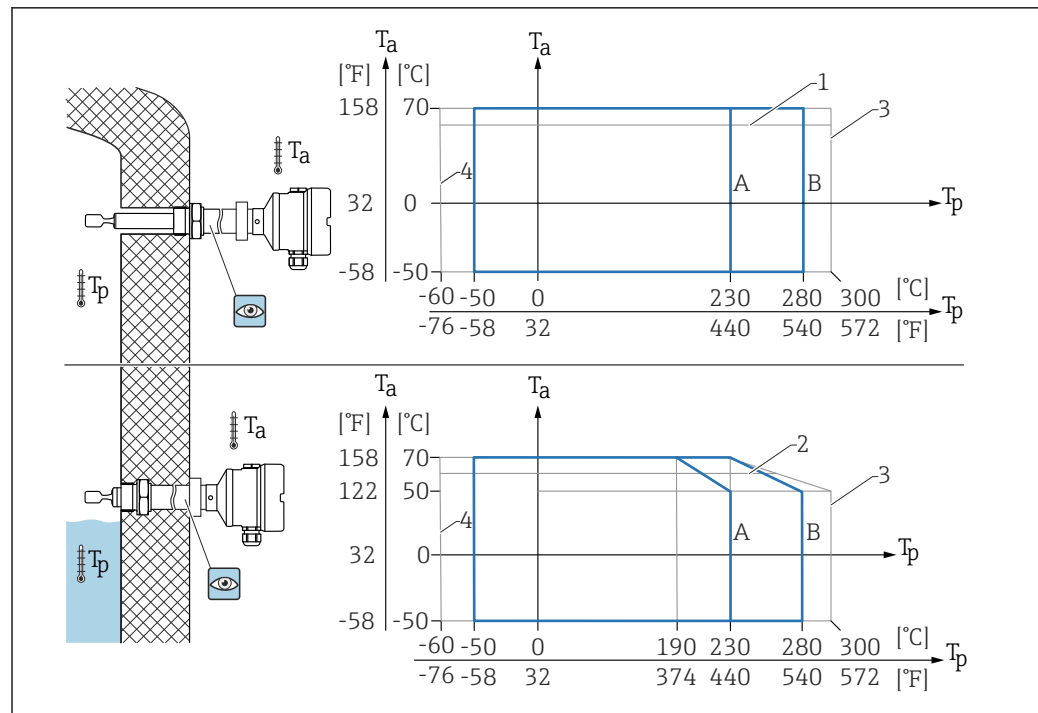
-40 to +70 °C (-40 to +158 °F)

Optionally available to order:

- -50 °C (-58 °F) with restricted operating life and performance
- -60 °C (-76 °F) with restricted operating life and performance
- i** Below -50 °C (-58 °F): devices can be permanently damaged

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

Low-temperature electronic inserts are marked LT.



A0037923

■ 28 Permitted ambient temperature T_a at the housing as a function of the process temperature T_p in the vessel

A 230 °C (446 °F) sensor

B 280 °C (536 °F) sensor

1 Exceptions for electronic insert FEL64:

Without LED module: Relay current = 6 A, T_a max. = 60 °C (140 °F);

Relay current = 4 A, T_a max. = 65 °C (149 °F)

With LED module: T_a max. -10 K

2 Exceptions for electronic insert FEL64:

Without LED module: Relay current = 6 A, T_a max. = 65 °C (149 °F);

Relay current = 4 A, T_a max. = 70 °C (158 °F)

With LED module: T_a max. -10 K

3 Max. 50 h on cumulative basis

4 Only for ATEX and CSA certificates



Low temperatures are not possible for SIL

Bluetooth module:

■ -50 °C (-58 °F) for non-Ex, Ex ia and Ex d

■ -60 °C (-76 °F) for non-Ex

LED module:

■ -50 °C (-58 °F) for non-Ex, Ex ia and Ex d

■ -60 °C (-76 °F) for non-Ex

Outdoor operation in strong sunlight:

■ Mount the device in a shaded location

■ Avoid direct sunlight, particularly in warmer climatic regions

■ Use a protective cover, can be ordered as an accessory

Hazardous area

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




Storage temperature

-40 to +80 °C (-40 to +176 °F)



Optional: -50 °C (-58 °F), -60 °C (-76 °F)




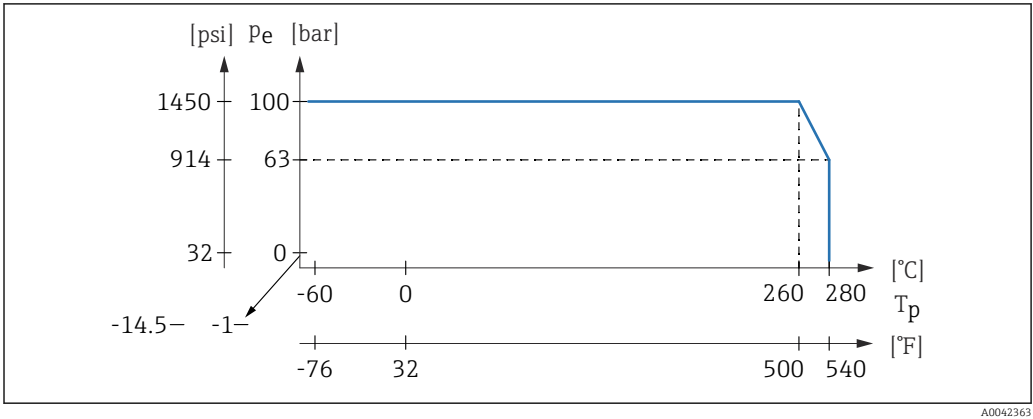
Humidity

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

Operating altitude	As per IEC 61010-1 Ed.3: <ul style="list-style-type: none"> 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
Climate class	As per IEC 60068-2-38 test Z/AD
Degree of protection	Testing according to IEC 60529 and NEMA 250 IP68 test condition: 1.83 m H ₂ O for 24 h Housing See cable entries Cable entries <ul style="list-style-type: none"> M20 threaded joint, plastic, IP66/68 NEMA Type 4X/6P M20 threaded joint, nickel-plated brass, IP66/68 NEMA Type 4X/6P M20 threaded joint, 316L, IP66/68 NEMA Type 4X/6P M20 thread, IP66/68 NEMA Type 4X/6P G ½ thread, NPT ½, NPT ¾ IP66/68 NEMA Type 4X/6P Degree of protection for M12 plug <ul style="list-style-type: none"> When housing is closed and connecting cable is plugged in: IP66/67 NEMA Type 4X When housing is open or connecting cable is not plugged in: IP20, NEMA Type 1 <p>NOTICE</p> <p>M12 plug: Loss of IP protection class due to incorrect installation!</p> <ul style="list-style-type: none"> The degree of protection only applies if the connecting cable used is plugged in and screwed tight. The degree of protection only applies if the connecting cable used is specified according to IP67 NEMA Type 4X. <p> If the "M12 plug" option is selected as the electrical connection, IP66/67 NEMA Type 4X applies for all housing types.</p>
Vibration resistance	As per IEC60068-2-64-2008 a(RMS) = 50 m/s ² , f = 5 to 2 000 Hz, t = 3 axes x 2 h
Shock resistance	In accordance with IEC60068-2-27-2008: 300 m/s ² [= 30 g _n] + 18 ms g _n : standard acceleration of gravity
Mechanical load	Support the device in the event of severe dynamic load. Maximum lateral loading capacity of the pipe extensions and sensors: 75 Nm (55 lbf ft).  For more details, see the "Supporting the device" section.
Pollution degree	Pollution degree 2
Electromagnetic compatibility (EMC)	<ul style="list-style-type: none"> Electromagnetic compatibility as per EN 61326 series and NAMUR recommendation EMC (NE21) With regard to the safety function (SIL), the requirements of EN 61326-3-x are satisfied <p> For more details, refer to the EU Declaration of Conformity.</p>

Process

Process temperature range	<ul style="list-style-type: none"> -60 to +230 °C (-76 to +446 °F) -60 to +280 °C (-76 to +536 °F)/to 300 °C (572 °F) for max. 50 h on cumulative basis -50 to +230 °C (-58 to +446 °F) with PFA coating (conductive) <p> The device can be ordered for use in very aggressive media with a highly corrosion-resistant PFA coating. At medium temperatures up to ≥ 150 °C (302 °F), pay attention to the chemical durability and the increasing risk of damage to the coating from diffusion.</p> <p>Observe pressure and temperature dependency,  see the "Process pressure range of the sensors" section.</p>
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Medium conditions	<p>The service life of the device can be impacted in applications where increased hydrogen diffusion through the metallic membrane can be expected.</p> <p>Typical conditions from which hydrogen diffusion is relevant:</p> <ul style="list-style-type: none"> ■ Temperature: > 180 °C (356 °F) ■ Increasing process pressures accelerate hydrogen diffusion
Thermal shock	<p>Without restrictions within the process temperature range.</p> <p> With PFA coating (conductive): ≤ 120 K/s</p>
Process pressure range	<p>⚠ WARNING</p> <p>The maximum pressure for the device depends on the lowest-rated element, with regard to pressure, of the selected component. This means that it is necessary to pay attention to the process connection as well as the sensor.</p> <ul style="list-style-type: none"> ▶ Pressure specifications,  Technical Information, "Mechanical construction" section. ▶ Only operate the device 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 device. <p>Refer to the following standards for the permitted pressure values of the flanges at higher temperatures:</p> <ul style="list-style-type: none"> ■ pR EN 1092-1: 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 <p>In each case, the lowest value from the derating curves of the device and the selected flange applies.</p> <p> Devices with CRN approval: maximum 90 bar (1 305 psi) for devices with a pipe extension. Information on the Endress+Hauser website: www.endress.com → Downloads.</p>
Process pressure range of the sensors	
 <p>The graph plots process pressure (Pe) against process temperature (Tp). The left y-axis shows pressure in psi (0, 32, 914, 1450) and bar (0, -1, 63, 100). The bottom x-axis shows temperature in °C (-60, 0, 260, 280) and °F (-76, 32, 500, 540). The curve is constant at 100 bar (1450 psi) until 260 °C (500 °F), then derates linearly to 63 bar (914 psi) at 280 °C (536 °F), and drops to 0 bar (-14.5 °C / -1 °F) at 280 °C (536 °F).</p>	
<p>Ordering information: Product Configurator, feature "Application":</p> <ul style="list-style-type: none"> ■ PN: max. 100 bar (1 450 psi) max. 230 °C (446 °F) ■ PN: max. 100 bar (1 450 psi) max. 280 °C (536 °F) ■ With PFA coating (conductive): max. 40 bar (580 psi) max. 230 °C (446 °F) 	
Overpressure limit	<ul style="list-style-type: none"> ■ Overpressure limit = 1.5 · PN Maximum 100 bar (1 450 psi) at 230 °C (446 °F) and 280 °C (536 °F) ■ Membrane burst pressure at 200 bar (2 900 psi) <p>The device function is limited during the pressure test.</p> <p>Mechanical integrity is guaranteed up to 1.5 times the process nominal pressure PN.</p>
Density	<p>Liquids with density > 0.7 g/cm³ (43.7 lb/ft³) Switch position > 0.7 g/cm³ (43.7 lb/ft³), order configuration</p>

Liquids with density 0.5 g/cm³ (31.2 lb/ft³)

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

Liquids with density > 0.4 g/cm³ (25.0 lb/ft³)

- Optionally available to order
- SIL for defined media and process parameters on request
- Fixed value that cannot be edited

The function of the DIP switch is interrupted



For information on medium differentiation/density detection: Documentation Liquiphant density (FEL60D) with density computer FML621 (Endress+Hauser website www.endress.com → Downloads)

Viscosity ≤ 10 000 mPa·s

Pressure tightness Up to vacuum



In vacuum evaporation plants, select the 0.4 g/cm³ (25.0 lb/ft³) / density setting.

Solids contents Ø ≤ 5 mm (0.2 in)

Mechanical construction

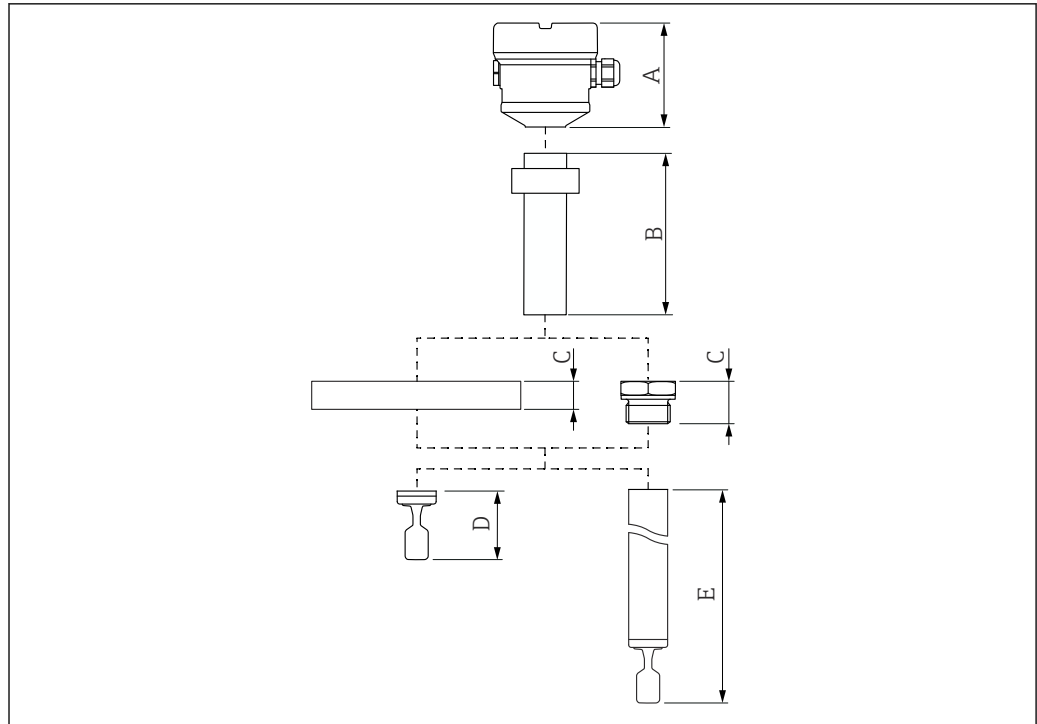
Design, dimensions**Device height**

The device height consists of the following components:

- Housing including cover
- Temperature spacer with gas-tight glass feedthrough (second line of defense)
- Compact version or pipe extension
- Process connection

The individual heights of the components can be found in the following sections:

- Determine the height of the device and add the individual heights
- Take the installation clearance into consideration (space that is needed to install the device)



A0042418

29 Components to determine the device height

- A Housing including cover
- B Temperature spacer with gas-tight glass feedthrough → 2 lengths available, depending on the process temperature
- C Process connection
- D Probe design: compact version with tuning fork
- E Probe design: pipe extension with tuning fork

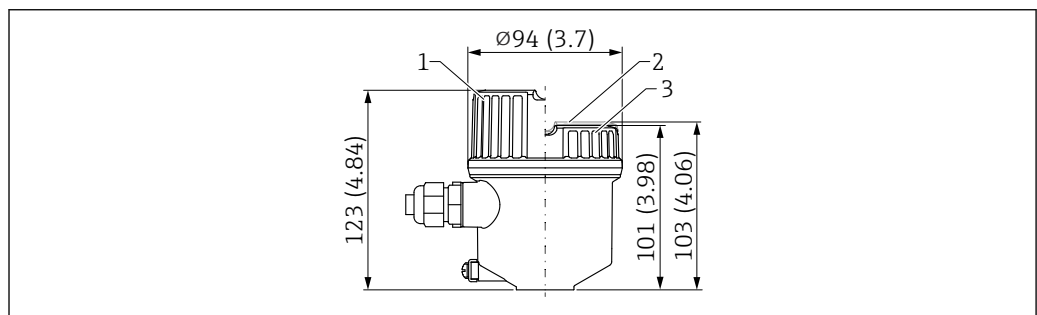
Dimensions

Housing and cover

All housings can be aligned. The housing alignment can be fixed on housings with a locking screw.

Devices with a Bluetooth or LED module require a tall cover (transparent plastic cover or cover with sight glass). The Bluetooth or LED module cannot be used in conjunction with the 316L single compartment housing.

Single compartment housing, plastic

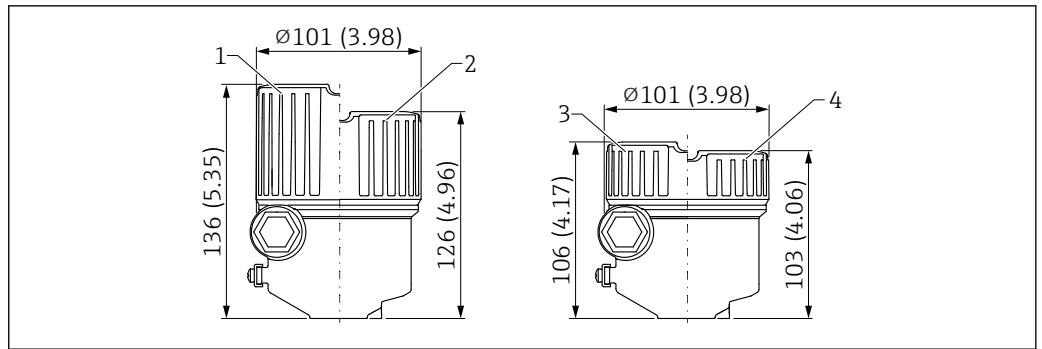


A0035911

30 Dimensions of single compartment housing, plastic. Unit of measurement mm (in)

- 1 Height with plastic cover (transparent)
- 2 Height with cover with plastic sight glass (optional)
- 3 Height with cover without sight glass

Single compartment housing, aluminium, coated

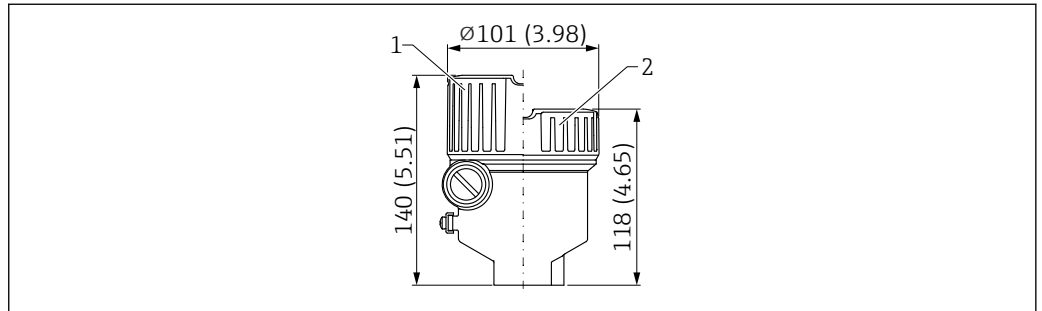


A0039402

31 Dimensions of single compartment housing, aluminum, coated. Unit of measurement mm (in)

- 1 Height with cover with sight glass made of glass for Ex ec approval
- 2 Height with cover with plastic sight glass
- 3 Height with cover without sight glass
- 4 Height with cover with plastic sight glass (optional)

Single compartment housing, aluminum, coated (Ex d/XP, dust ignition-proof)

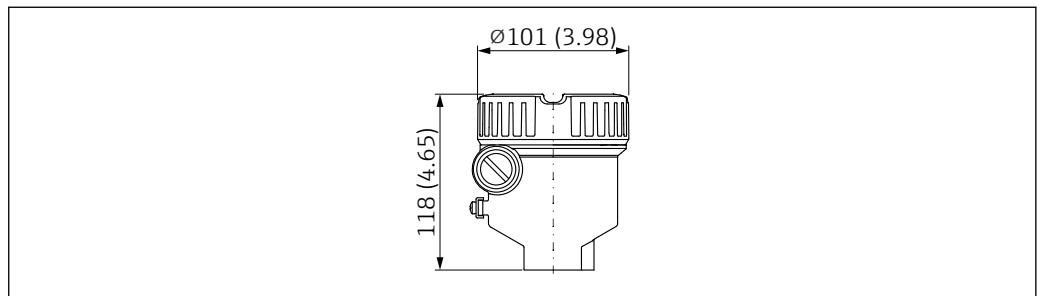


A0039401

32 Dimensions of single compartment housing, aluminum, coated; with Ex d/XP, dust ignition-proof. Unit of measurement mm (in)

- 1 Height with cover with sight glass made of glass
- 2 Height with cover without sight glass

Single compartment housing, 316L

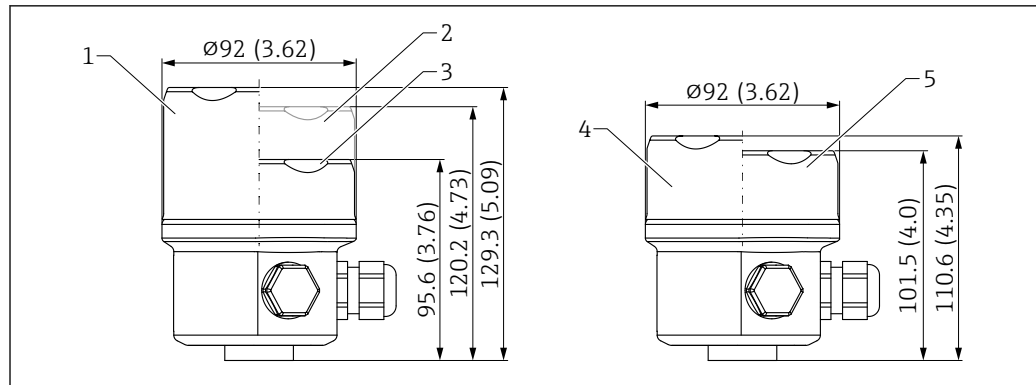


A0052845

33 Dimensions of single compartment 316L housing; with Ex d/XP also, dust ignition-proof; cover without sight glass. Unit of measurement mm (in)

316L single compartment housing, hygienic

- i** The housing with ground terminal and cover with cover lock are required for use in hazardous areas with a certain type of protection.

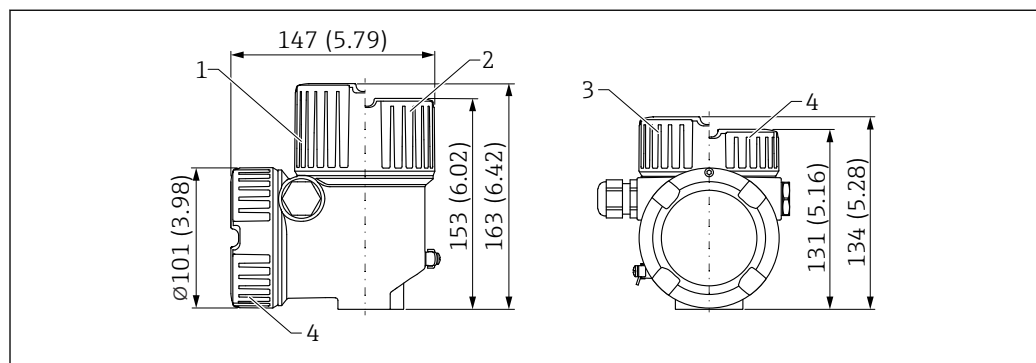


A0050817

34 Dimensions of single compartment housing, 316L, hygienic. Unit of measurement mm (in)

- 1 Height with cover with sight glass made of glass
- 2 Height with cover with plastic sight glass
- 3 Height with cover without sight glass
- 4 Height with cover with sight glass made of glass (optional)
- 5 Height with cover with plastic sight glass (optional)

Dual compartment housing, L-shaped, aluminum, coated



A0035591

35 Dimensions of dual compartment housing, L-shaped, aluminum, coated; also with Ex d/XP, dust ignition-proof. Unit of measurement mm (in)

- 1 Height with cover with sight glass made of glass
- 2 Height with cover with plastic sight glass
- 3 Height with cover with plastic sight glass (optional)
- 4 Height with cover without sight glass

Ground terminal

- Ground terminal inside the housing, max. conductor cross-section 2.5 mm² (14 AWG)
- Ground terminal outside on the housing, max. conductor cross-section 4 mm² (12 AWG)

Cable glands

Cable diameter:

- Plastic: Ø5 to 10 mm (0.2 to 0.38 in)
- Nickel-plated brass: Ø7 to 10.5 mm (0.28 to 0.41 in)
- Stainless steel: Ø7 to 12 mm (0.28 to 0.47 in)

i The scope of delivery comprises:

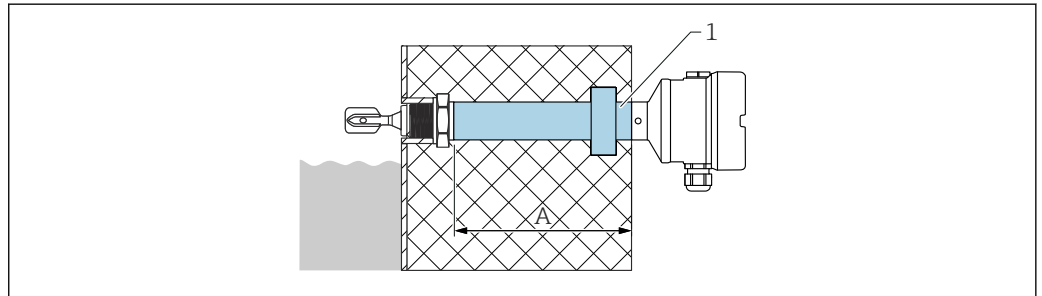
- 1 cable gland installed
- 1 cable gland sealed with dummy plug

A second cable gland (not mounted) is also included in the scope of delivery of the relay electronics.

Exceptions: For Ex d/XP, dust ignition-proof, only threaded insertions are permitted.

Temperature spacer

- Provides sealed insulation for the vessel and a normal ambient temperature for the housing.
- If the sensor is damaged, protects the housing from vessel pressures up to 100 bar (1 450 psi)



A0042352

36 Temperature spacer with gas-tight glass feedthrough

- 1 Temperature spacer with pressure-tight glass feedthrough with maximum insulation length
- A 2 lengths available depending on the process temperature

Product Configurator, "Application" feature:

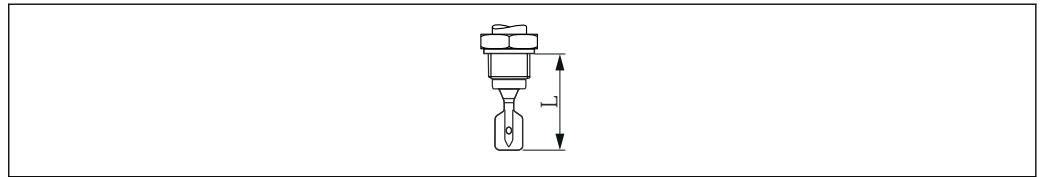
- 230 °C (446 °F): approx. 160 mm (6.3 in)
- 280 °C (536 °F): approx. 200 mm (7.87 in)
- PFA (conductive) 230 °C (446 °F): approx. 160 mm (6.3 in)

Probe design

Compact version

Sensor length L: depends on process connection

For further details, see the "Process connections" section.

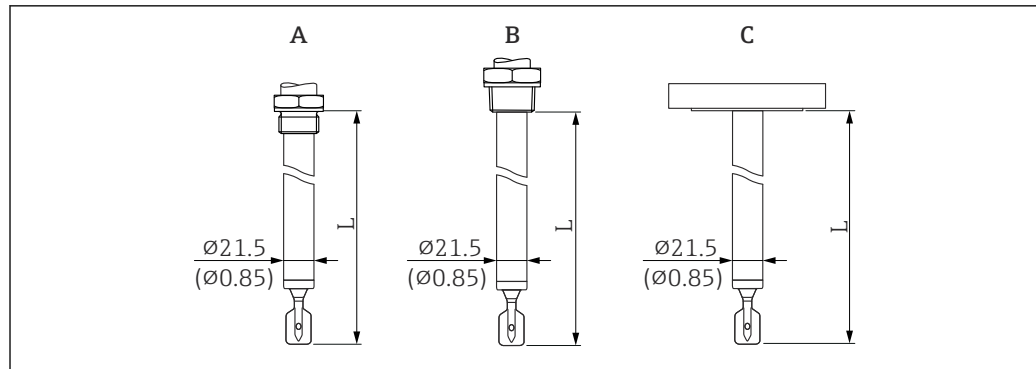


A0042435

37 Probe design: compact version, sensor length L

Pipe extension

- Material: 316L, sensor length L: 148 to 3 000 mm (5.83 to 118.11 in)
- Material: Alloy C22, sensor lengths L: 148 to 3 000 mm (5.83 to 118.11 in)
- Material: 316L substrate material coated with PFA (conductive), sensor lengths L: 148 to 3 000 mm (5.83 to 118.11 in)
- Only available with flange as a process connection.
- Length tolerances L: < 1 m (3.3 ft) = -5 mm (-0.2 in), 1 to 3 m (3.3 to 9.8 ft) = -10 mm (-0.39 in)

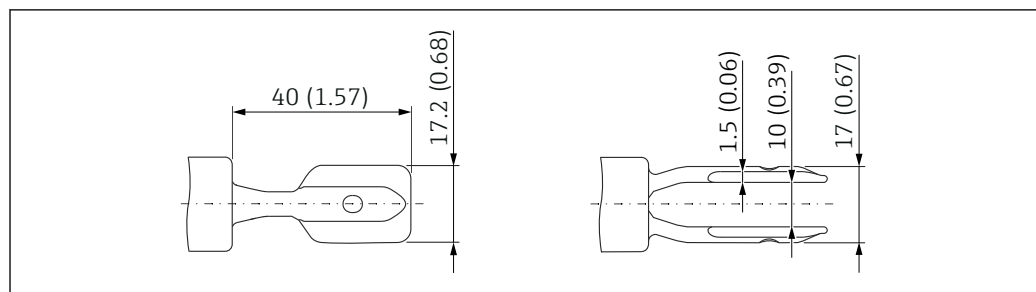


A0042431

38 Pipe extension (sensor length L). Unit of measurement mm (in)

- A $G \frac{3}{4}, G 1$
 B $NPT \frac{3}{4}, NPT 1, R \frac{3}{4}, R 1$
 C Flange

Tuning fork



A0038269

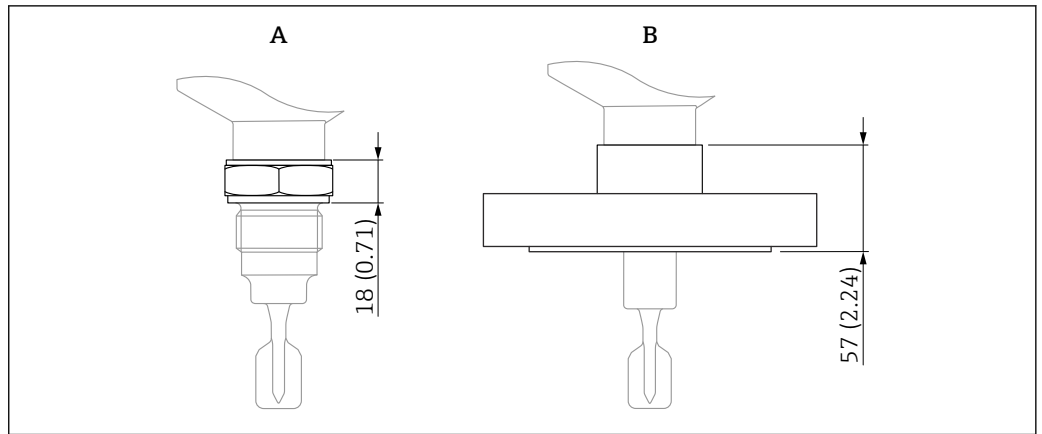
39 Tuning fork. Unit of measurement mm (in)

Process connections

Process connection, sealing surface

- Thread ISO228, G
- Thread ASME B1.20.1, NPT
- Thread EN10226, R
- Flange ASME B16.5, RF (Raised Face)
- Flange ASME B16.5, FF (Flat Face)
- Flange ASME B16.5, RTJ (Ring Type Joint)
- Flange EN1092-1, Form A
- Flange EN1092-1, Form B1
- Flange EN1092-1, Form C
- Flange EN1092-1, Form D
- Flange EN1092-1, Form E
- Flange JIS B2220, RF (Raised Face)
- Flange HG/T20592, RF (Raised Face)
- Flange HG/T20615, RF (Raised Face)
- Flange HG/T20615, RJ (Ring Joint)

Height of process connection



A0046798

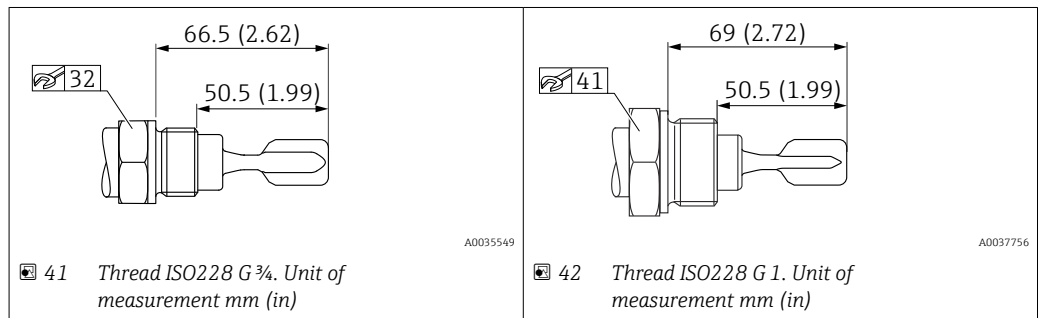
40 Maximum height specification for the process connections

- A Process connection with threaded connection
- B Process connection with flange

Thread ISO228 G

G 3/4, G 1

- Material: 316L
- Pressure rating: ≤ 100 bar (1 450 psi)
- Temperature: ≤ 280 °C (536 °F)
- Weight G 3/4: 0.2 kg (0.44 lb)
- Weight G 1: 0.33 kg (0.73 lb)



A0035549

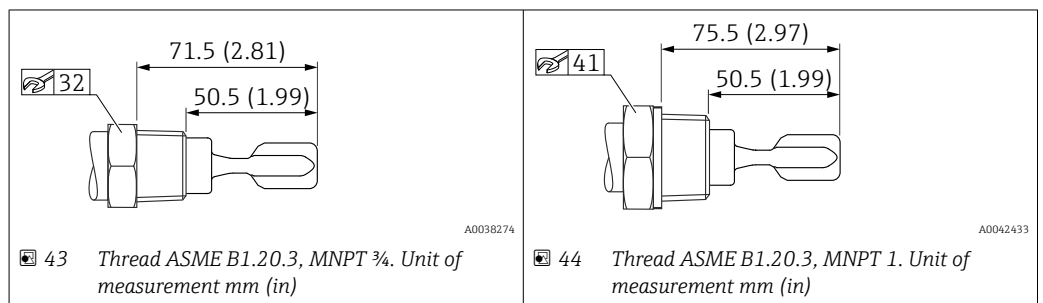
A0037756

41 Thread ISO228 G 3/4. Unit of measurement mm (in)

42 Thread ISO228 G 1. Unit of measurement mm (in)

Thread ASME B1.20.3, MNPT

- Material: 316L
- Pressure rating: ≤ 100 bar (1 450 psi)
- Temperature: ≤ 280 °C (536 °F)
- Weight: 0.3 kg (0.66 lb)



A0038274

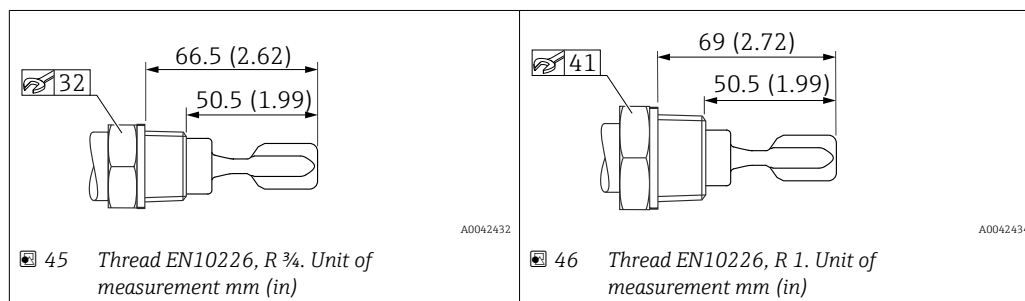
A0042433

43 Thread ASME B1.20.3, MNPT 3/4. Unit of measurement mm (in)

44 Thread ASME B1.20.3, MNPT 1. Unit of measurement mm (in)

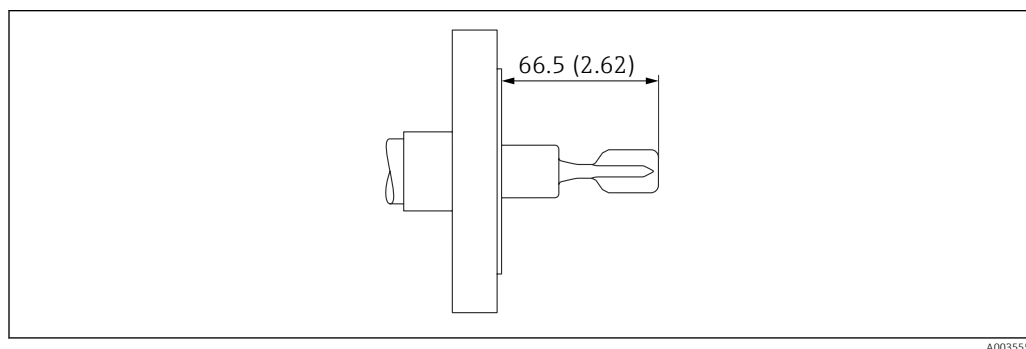
Thread EN10226, R

- Material: 316L
- Pressure rating: ≤ 100 bar (1 450 psi)
- Temperature: ≤ 280 °C (536 °F)
- Weight: 0.3 kg (0.66 lb)



Flanges

AlloyC22-plated flanges are available for higher chemical resistance.
The flange carrier material is made of 1.4462 and is welded to an AlloyC22 disk.



47 Example with flange. Unit of measurement mm (in)

i In the event of high temperatures: pay attention to the pressure loading capacity of the flange depending on the temperature!

ASME B16.5 flanges, RF

Pressure rating	Type	Material	Weight
Cl.150	NPS 1"	316/316L	1.0 kg (2.21 lb)
Cl.150	NPS 1- $\frac{1}{2}$ "	316/316L	1.5 kg (3.31 lb)
Cl.150	NPS 2"	316/316L	2.4 kg (5.29 lb)
Cl.150	NPS 2"	Alloy C22>1.4462	2.4 kg (5.29 lb)
Cl.150	NPS 3"	316/316L	4.9 kg (10.8 lb)
Cl.150	NPS 4"	316/316L	7.0 kg (15.44 lb)
Cl.300	NPS 1- $\frac{1}{2}$ "	316/316L	2.7 kg (5.95 lb)
Cl.300	NPS 2"	316/316L	3.2 kg (7.06 lb)
Cl.300	NPS 2"	Alloy C22>1.4462	3.2 kg (7.06 lb)
Cl.300	NPS 3"	316/316L	6.8 kg (14.99 lb)
Cl.300	NPS 4"	316/316L	11.5 kg (25.6 lb)
Cl.600	NPS 2"	Alloy C22>1.4462	6.8 kg (14.99 lb)
Cl.600	NPS 2"	316/316L	4.2 kg (9.26 lb)

Pressure rating	Type	Material	Weight
Cl.600	NPS 3"	316/316L	6.8 kg (14.99 lb)
Cl.600	NPS 4"	316/316L	17.3 kg (38.15 lb)

ASME B16.5 flanges, FF

Pressure rating	Type	Material	Weight
Cl.150	NPS 1"	316/316L	1.0 kg (2.21 lb)
Cl.150	NPS 2"	316/316L	2.4 kg (5.29 lb)
Cl.300	NPS 1-½"	316/316L	2.7 kg (5.95 lb)
Cl.300	NPS 2"	316/316L	3.2 kg (7.06 lb)
Cl.300	NPS 4"	316/316L	11.5 kg (25.36 lb)
Cl. 600	NPS 2"	Alloy C22>1.4462	4.2 kg (9.26 lb)
Cl. 600	NPS 2"	316/316L	4.2 kg (9.26 lb)
Cl. 600	NPS 3"	316/316L	6.8 kg (14.99 lb)
Cl. 600	NPS 4"	316/316L	17.3 kg (38.15 lb)

ASME B16.5 flanges, RTJ

Pressure rating	Type	Material	Weight
Cl.300	NPS 2"	316/316L	3.2 kg (7.06 lb)
Cl.300	NPS 3"	316/316L	6.8 kg (14.99 lb)
Cl.300	NPS 4"	316/316L	11.5 kg (25.36 lb)
Cl.600	NPS 2"	316/316L	17.3 kg (38.15 lb)

EN flanges EN 1092-1, A

Pressure rating	Type	Material	Weight
PN25/40	DN25	316L (1.4404)	1.3 kg (2.87 lb)
PN25/40	DN32	316L (1.4404)	2.0 kg (4.41 lb)
PN25/40	DN40	316L (1.4404)	2.4 kg (5.29 lb)
PN25/40	DN50	316L (1.4404)	3.2 kg (7.06 lb)
PN25/40	DN65	316L (1.4404)	4.3 kg (9.48 lb)
PN25/40	DN80	316L (1.4404)	5.9 kg (13.01 lb)
PN25/40	DN100	316L (1.4404)	7.5 kg (16.54 lb)
PN100	DN50	316L (1.4404)	5.5 kg (12.13 lb)

EN flanges EN 1092-1, B1

Pressure rating	Type	Material	Weight
PN10/16	DN50	316L (1.4404)	2.5 kg (5.51 lb)
PN10/16	DN80	316L (1.4404)	4.8 kg (10.58 lb)
PN10/16	DN100	316L (1.4404)	5.2 kg (11.47 lb)
PN25/40	DN25	Alloy C22>1.4462	1.4 kg (3.09 lb)
PN25/40	DN25	316L (1.4404)	1.4 kg (3.09 lb)

Pressure rating	Type	Material	Weight
PN25/40	DN50	Alloy C22>1.4462	3.2 kg (7.06 lb)
PN25/40	DN50	316L (1.4404)	3.2 kg (7.06 lb)
PN25/40	DN80	316L (1.4404)	5.9 kg (13.01 lb)
PN25/40	DN80	Alloy C22>316L	5.2 kg (11.47 lb)
PN63	DN50	316L (1.4404)	4.5 kg (9.92 lb)

EN flanges EN 1092-1, E

Type	Material	Pressure rating	Weight
DN50	316L (1.4404)	PN25/40	3.2 kg (7.06 lb)

JIS flanges B2220

Pressure rating	Type	Material	Weight
20K	20K 50A	316L (1.4404)	1.9 kg (4.19 lb)

Coating material and layer thickness

The maximum diameter \varnothing depends on the coating material.

PFA (Edlon™), PFA (RubyRed®), PFA (conductive)

- Lower limit: 0.45 mm (0.02 in)
- Upper limit: 1.6 mm (0.06 in)
- Maximum diameter: \varnothing 24.6 mm (0.97 in)

Properties and benefits of coatings**PFA (perfluoroalkoxy)**

- Properties similar to PTFE (polytetrafluoroethylene) and FEP (perfluoroethylenepropylene)
- Also known as Teflon®-PFA
- Very good chemical and corrosion resistance
- High abrasion performance
- Good non-stick and sliding properties
- High temperature stability
- Ideal for use in the chemical and pharmaceutical industry

Weight**Basic weight: 1.35 kg (2.98 lb)**

The basic weight comprises:

- Sensor design: compact version/pipe extension
- Electronic insert
- Housing: single compartment, plastic with cover
- Thread, G 3/4"



Differences in weight result from the housing, LED or Bluetooth module (incl. tall cover).

Bluetooth module

0.1 kg (0.22 lb)

LED module

0.1 kg (0.22 lb)

Housing

- Single compartment; aluminum, coated: 0.8 kg (1.76 lb)
optional LED module or Bluetooth module with a tall cover: 0.38 kg (0.84 lb)
- Single compartment; 316L: 2.1 kg (4.63 lb)
- Single compartment; 316L, hygienic: 0.45 kg (0.99 lb)
optional LED module or Bluetooth module with a tall cover: 0.38 kg (0.84 lb)
- Dual compartment, L-shaped; aluminum, coated: 1.22 kg (2.69 lb)
optional LED module or Bluetooth module with a tall cover: 0.38 kg (0.84 lb)

Gas-tight feedthrough

0.2 kg (0.44 lb)

Pipe extension

- 1 000 mm: 0.9 kg (1.98 lb)
- 50 in: 1.15 kg (2.54 lb)

Process connection

See "Process connections" section

Protective cover, plastic

0.2 kg (0.44 lb)

Protective cover, 316L

0.93 kg (2.05 lb)

Materials**Materials in contact with process***Process connection and pipe extension*

316L (1.4435 or 1.4404)

- Optional Alloy C22 (2.4602)
- Optional PFA coating (conductive)
- G $\frac{3}{4}$, G 1 according to DIN ISO 228/I, flat seal according to DIN 7603, at installation location
- R $\frac{3}{4}$, R 1 according to DIN 2999 Part 1
- $\frac{3}{4}$ -14 NPT, 1 - 1 $\frac{1}{2}$ NPT according to ANSI B 1.20.1

Tuning fork

S31803 (1.4462)

- Optional Alloy C22 (2.4602)
- Optional PFA coating (conductive)

Flanges

- 316L (1.4404)
 - Optional PFA coating (conductive)
 - Flange plating: Alloy C22
- Flanges (standard specifications → Product Configurator)
 - according to EN/DIN from DN 25
 - according to ANSI B16.5 from 1"
 - according to JIS B 2220 (RF)

Materials not in contact with process*Plastic housing*

- Housing: PBT/PC
- Dummy cover: PBT/PC
- Transparent cover: PA12
- Cover with sight glass: PBT/PC and PC
- Cover seal: EPDM
- Potential equalization: 316L
- Seal under potential equalization: EPDM
- Plug: PBT-GF30-FR
- M20 cable gland: PA
- Seal on plug and cable gland: EPDM
- Threaded adapter as substitute for cable glands: PA66-GF30
- Nameplate: plastic foil
- TAG plate: plastic foil, metal or provided by customer

Aluminum housing, coated

- Housing: aluminum EN AC 43400
- Dummy cover: aluminum EN AC 43400
- Cover with sight glass: aluminum EN AC 43400, PC Lexan 943A synthetic glass
 - Cover with polycarbonate sight glass, optionally available to order
 - In the case of Ex d, the sight glass is made of borosilicate
- Cover seal materials: HNBR
- Cover seal materials: FVMQ (only for low temperature version)

- Plug: aluminum
Plastic (PBT-GF30-FR) in Ex-free, Ex i or IS combination with cable gland, plastic, M20 thread or G ½ thread
- Nameplate: plastic foil
- TAG plate: plastic foil, stainless steel or provided by the customer
- M20 cable glands: select material (stainless steel, nickel-plated brass, polyamide)

Stainless steel housing, 316L

- Housing: stainless steel AISI 316L (1.4409)
Stainless steel (ASTM A351 : CF3M (cast equivalent to AISI 316L material)/DIN EN 10213 : 1.4409)
- Dummy cover: stainless steel AISI 316L (1.4409)
- Plug: stainless steel
- Cover seal materials: FVMQ (only for low temperature version)
- Cover seal materials: HNBR
- Nameplate: stainless steel housing labeled directly
- TAG plate: plastic foil, stainless steel or provided by the customer
- M20 cable glands: select material (stainless steel, nickel-plated brass, polyamide)

Stainless steel housing, 316L, hygienic

- Housing: stainless steel AISI 316L (1.4404)
- Dummy cover: stainless steel AISI 316L (1.4404)
- Cover with polycarbonate sight glass optionally available. For dust ignition-proof applications, the sight glass is made of borosilicate.
- Cover seal materials: VMQ
- Plug: stainless steel or plastic
 - Plastic (PBT-GF30-FR) in Ex-free, Ex i or IS combination with cable gland, plastic, M20 thread or G ½ thread
 - Stainless steel for cable glands made of stainless steel or nickel or for Ex t, Ex ia IIIC
- Nameplate: stainless steel housing labeled directly
- TAG plate: plastic foil, stainless steel or provided by the customer
- M20 cable glands: select material (stainless steel, nickel-plated brass, polyamide)

Surface roughness

The surface roughness of the surface in contact with the process is $Ra \leq 3.2 \mu\text{m}$ (126 μin).

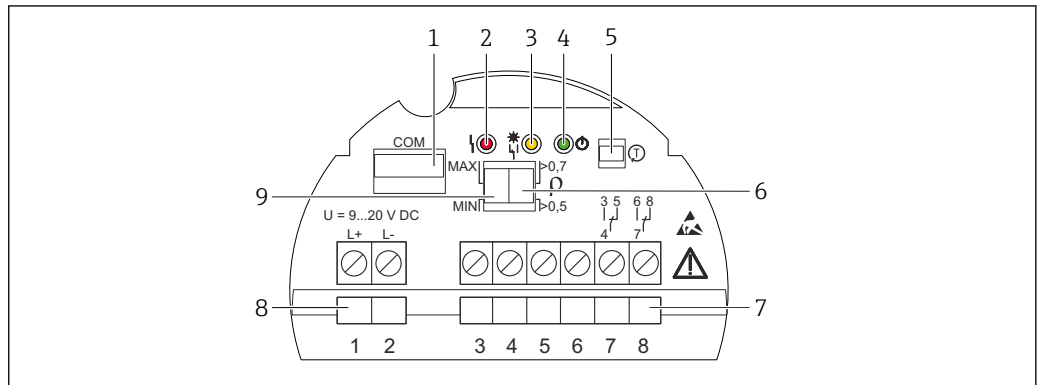
User interface

Operation 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 (signal lights visible from the outside)
- Observe approvals for plastic housing, aluminum housing and stainless steel housing in hygienic applications (combined with DC-PNP (electronic insert FEL62) and relay electronics (electronic inserts FEL64, FEL64DC))

Onsite operation

Elements on the electronic insert

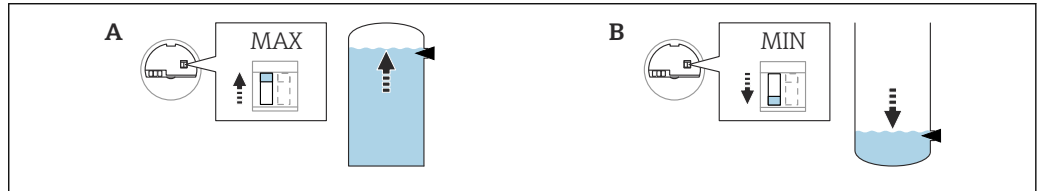


48 Example of electronic insert FEL64DC

- 1 COM interface for additional modules (LED module, Bluetooth module)
- 2 LED, red, for warning or alarm
- 3 LED, yellow, switch status
- 4 LED, green, operational status (device is on)
- 5 Test button, activates functional test
- 6 DIP switch for setting density 0.7 or 0.5
- 7 Terminals (3 to 8), relay contact
- 8 Terminals (1 to 2), power supply
- 9 DIP switch for configuring MAX/MIN safety mode

Operation at electronic insert

MAX/MIN fail-safe mode

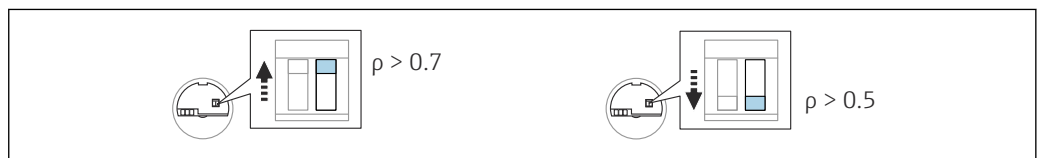


49 Switch position on the electronic insert for fail-safe mode MAX/MIN

- A MAX (maximum fail-safe mode)
- B MIN (minimum fail-safe mode)

- Minimum/maximum quiescent current safety can be switched at the electronic insert
- MAX = Maximum safety: When the tuning fork is covered, the output switches in the direction of demand. Use this for overflow prevention, for example.
- MIN = Minimum safety: When the tuning fork is uncovered, the output switches in the direction of demand. Use this for dry-running protection of pumps, for example.

Density switchover



50 Switch position on the electronic insert for density

Liquids with density > 0.7 g/cm³ (43.7 lb/ft³)

Switch position > 0.7 g/cm³ (43.7 lb/ft³), order configuration

Liquids with density 0.5 g/cm³ (31.2 lb/ft³)

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

Liquids with density > 0.4 g/cm³ (25.0 lb/ft³)

- Optionally available to order
- SIL for defined media and process parameters on request
- Fixed value that cannot be edited

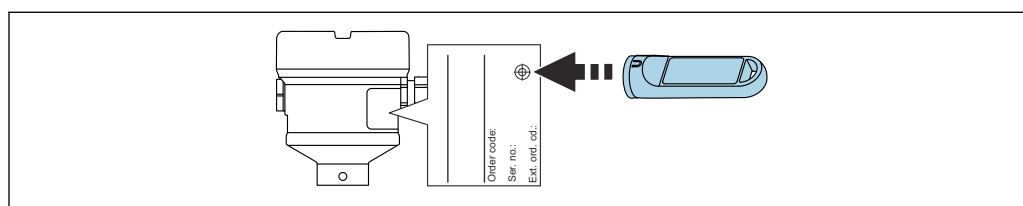
The function of the DIP switch is interrupted

i For information on medium differentiation/density detection: Documentation Liquiphant density (FEL60D) with density computer FML621 (Endress+Hauser website www.endress.com → Downloads)

Functional test of the electronic switch with a test magnet

The functional test with the test magnet can be performed without opening the device. To perform the test, hold the test magnet against the marking on the nameplate of the housing. The functional test with the test magnet acts in the same way as the functional test using the test button on the electronic insert.

The functional test can be applied for the following electronic inserts: FEL62, FEL64, FEL64DC, FEL68.



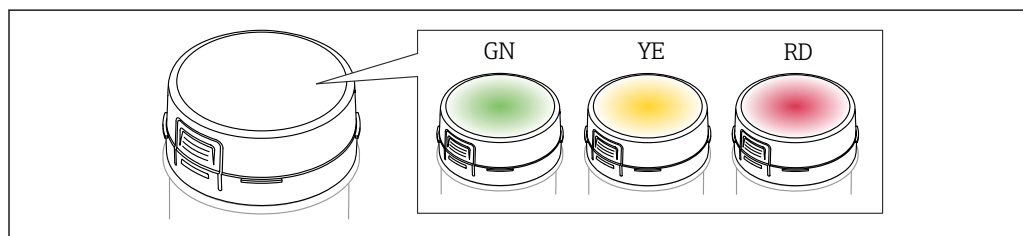
A0033419

51 Functional test with test magnet

i Product Configurator: the test magnet is optionally available.

Local display**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.



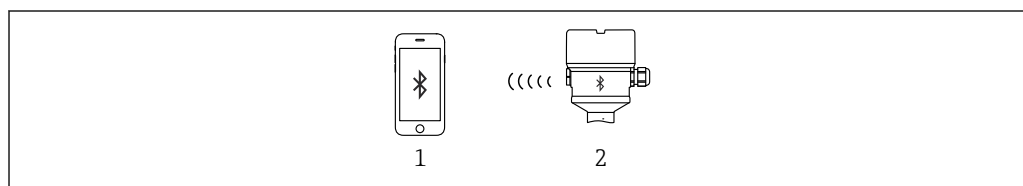
A0043925

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

Additional information → **18** and in the "Accessories" section

Remote operation**Heartbeat diagnostics and verification with Bluetooth® wireless technology**

Access via Bluetooth® wireless technology



A0033411

53 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)
- Guidance via the **SIL/WHG Prooftest** wizard
- Visible in the livelist 10 s seconds after the Bluetooth search commences
- Data can be read from the Bluetooth module 60 s after the supply voltage is switched on
- Display of the current oscillation frequency and the switch status of the device

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

Heartbeat Technology

 Additional information in the "Application packages" section.

Diagnostic information

Heartbeat Technology

The electronics module and the tuning fork are checked using Heartbeat Technology, and a verification of the Liquiphant is performed. The switch output is not changed during this test. The test can be performed at any time and does not influence the switch output in the safety circuit. In the case of proof-testing, the SmartBlue app supports users in every step of the test. The switch output is also switched during this test. During the proof-test, alternative monitoring measures must be taken to ensure process safety.

Proof testing

During the proof test, the SmartBlue app provides support for each individual stage of the test (proof-test wizard). The switch output is also switched during this test. During the proof test, alternative monitoring measures must be taken to ensure process safety.

Evaluation of the vibration frequency

If the vibration frequency exceeds the upper warning frequency, a warning is displayed. A warning is activated when the fork becomes corroded, for example. The switch output remains in the current state. The warning is displayed in the SmartBlue app and output in the Heartbeat Technology protocol. When a warning occurs, it is necessary to check the Liquiphant sensor.

The current oscillation frequency must be in the range between the upper and lower alarm frequency. If the current oscillation frequency is above the upper alarm frequency or below the lower alarm frequency, an alarm is output. The output switches to the safety-oriented state.

Certificates and approvals

Current certificates and approvals for the product are available at www.endress.com on the relevant product page:

1. Select the product using the filters and search field.
2. Open the product page.
3. Select **Downloads**.

CE mark








The measuring system meets the legal requirements of the applicable EU Directives. These are listed in the corresponding EU Declaration of Conformity together with the standards applied. Endress+Hauser confirms successful testing of the device by affixing to it the CE mark.



RCM marking

The supplied product or measuring system meets the ACMA (Australian Communications and Media Authority) requirements for network integrity, interoperability, performance characteristics as well as health and safety regulations. Here, especially the regulatory arrangements for electromagnetic compatibility are met. The products bear the RCM marking on the nameplate.



A0029561

Ex approval	All data relating to explosion protection are provided in separate Ex documentation and are available from the Downloads Area. The Ex documentation is supplied as standard with all Ex devices.
	<p> Ex temperature class: T1 to T6</p> <p>If using type of protection Ex i and electronic insert FEL68 (NAMUR) and the Bluetooth module in addition (battery required): T4 to T1.</p>
	<p>Explosion-protected smartphones and tablets</p> <p>If used in hazardous areas, mobile end devices with an Ex approval must be used.</p>
Overfill protection	<p>Before mounting the device, observe the documentation from the WHG approvals (German Federal Water Act).</p> <p>Approved for overfill protection and leakage detection.</p>
	<p> Product Configurator: feature "Additional approval"</p>
Corrosion test	Corrosion test
	<p>Standards and test methods:</p> <ul style="list-style-type: none"> ▪ 316L: ASTM A262 Practice E and ISO 3651-2 Method A ▪ Alloy C22 and Alloy C276: ASTM G28 Practice A and ISO 3651-2 Method C ▪ 22Cr duplex, 25Cr duplex: ASTM G48 Practice A or ISO 17781 and ISO 3651-2 Method C <p>The corrosion test is confirmed for all wetted and pressure-bearing parts.</p> <p>A 3.1 material certificate must be ordered as confirmation of the test.</p>
	<p>Additional information</p> <p> Difference in wetted materials between the tuning fork and pipe extension:</p> <ul style="list-style-type: none"> ▪ Tuning fork: S31803 (1.4462) ▪ Pipe extension: 316L (1.4435) <p>With regard to the different materials of the tuning fork and pipe extension, the corrosion test is based on the material of the pipe extension 316L (1.4435).</p>
Functional safety	<p>The Liquiphant has been developed according to the IEC 61508 standard. The device is suitable for overfill protection and dry-running protection up to SIL 2 (SIL 3 with homogeneous redundancy). A detailed description of the safety functions with Liquiphant, settings and functional safety data are provided in the "Functional Safety Manual" on the Endress+Hauser website: www.endress.com → Downloads.</p> <p> Product Configurator: feature "Additional approval"</p> <p>Subsequent confirmation of usability according to IEC 61508 is not possible.</p>
Marine approvals	<p> Product Configurator: feature "Additional approval"</p>
Radio approval	<p> Further information and currently available documentation can be found on the Endress+Hauser website: www.endress.com → Downloads.</p>
CRN approval	<p>Versions with a CRN approval (Canadian Registration Number) are listed in the corresponding registration documents. CRN-approved devices are marked with a registration number.</p> <p>Any restrictions regarding the maximum process pressure values are listed on the CRN certificate.</p> <p> Product Configurator: feature "Additional approval"</p>

Service	<ul style="list-style-type: none"> ■ Cleaned of oil+grease (wetted) ■ ANSI Safety Red coating, housing cover ■ Switching delay setting to be spec. ■ Setting for MIN safety mode ■ Default density setting > 0.4 g/cm³ (25.0 lb/ft³) ■ Default density setting > 0.5 g/cm³ (31.2 lb/ft³) ■ Bluetooth communication is disabled on delivery
Test, certificate, declaration	<ul style="list-style-type: none"> ■ Inspection certificate 3.1, EN10204 (material certificate, wetted parts) ■ NACE MR0175/ISO 15156 (wetted parts), declaration ■ NACE MR0103/ISO 17945 (wetted parts), declaration ■ AD 2000 (wetted parts), declaration, excluding cast parts ■ ASME B31.3 process piping, declaration ■ ASME B31.1 process piping, declaration ■ Pressure test, internal procedure, test report ■ Helium leak test, internal procedure, test report ■ PMI test, internal procedure (wetted parts), test report ■ Penetrant testing AD2000-HP5-3 (PT), wetted/pressurized metallic parts, test report ■ Penetrant testing ISO23277-1 (PT), wetted/pressurized metallic parts, test report ■ Penetrant testing ASME VIII-1 (PT), wetted/pressurized metallic parts, test report ■ Welding documentation, wetted/pressurized seams, declaration/ISO/ASME Welding documentation consisting of: <ul style="list-style-type: none"> ■ Welding drawings ■ WPQR (Welding Procedure Qualification Record) according to ISO 14613/ISO14614 or ASME Sect. IX ■ WPS (Welding Procedure Specifications) ■ WQR (Welder Qualification Record) <p> Documentation currently available on the Endress+Hauser website: www.endress.com → Downloads or with the serial number of the device under Online Tools in the Device Viewer.</p>
Pressure Equipment Directive	<p>Pressure equipment with permitted pressure ≤ 200 bar (2 900 psi)</p> <p>Pressure instruments with a process connection that does not have a pressurized housing do not fall within the scope of the Pressure Equipment Directive, irrespective of the maximum allowable pressure.</p> <p><i>Reasons:</i></p> <p>According to Article 2, point 5 of EU Directive 2014/68/EU, pressure accessories are defined as "devices with an operational function and having pressure-bearing housings".</p> <p>If a pressure instrument does not have a pressure-bearing housing (no identifiable pressure chamber of its own), there is no pressure accessory present within the meaning of the Directive.</p>
Process seal as per ANSI/ISA 12.27.01	<p>North American practice for the installation of process seals. In accordance with ANSI/ISA 12.27.01, Endress+Hauser devices are designed as either single seal or dual seal devices with a warning message. This allows the user to waive the use of - and save the cost of installing - an external secondary process seal in the protective conduit as required in ANSI/NFPA 70 (NEC) and CSA 22.1 (CEC). These instruments comply with the North American installation practice and provide a very safe and cost-saving installation for pressurized applications with hazardous fluids. More information is provided in the Safety Instructions (XA) for the relevant device.</p> <p> The following housings are approved as single seal devices:</p> <ul style="list-style-type: none"> ■ Single compartment, aluminum ■ Single compartment, stainless steel 316L ■ Single compartment, stainless steel 316L, hygienic ■ Single compartment, plastic
China RoHS symbol	<p>China RoHS 1, Law SJ/T 11363-2006: The measuring system complies with the substance restrictions of the Directive on the Restriction of the Use of Certain Hazardous Substances (RoHS).</p>
RoHS	<p>The measuring system meets the substance restrictions of the Directive on the Restriction of the Use of Certain Hazardous Substances 2011/65/EU (RoHS 2) and the Delegated Directive (EU) 2015/863 (RoHS 3).</p>

EAC conformity	The measuring system meets the legal requirements of the applicable EAC guidelines. These are listed in the corresponding EAC Declaration of Conformity along with the standards applied. The manufacturer confirms successful testing of the device by affixing to it the EAC mark.
ASME B 31.3/31.1	Design and materials in accordance with ASME B31.3/31.1. The welds are through-penetration welded and meet the requirements of the ASME Boiler and Pressure Vessel Code, Section IX and EN ISO 15614-1.

Order information

Detailed ordering information is available from your nearest sales organization www.addresses.endress.com or in the Product Configurator at www.endress.com:

1. Select the product using the filters and search field.
2. Open the product page.
3. Select **Configuration**.



Product Configurator - the tool for individual product configuration

- Up-to-the-minute configuration data
- Depending on the device: Direct input of measuring point-specific information such as measuring range or operating language
- Automatic verification of exclusion criteria
- Automatic creation of the order code and its breakdown in PDF or Excel output format
- Ability to order directly in the Endress+Hauser Online Shop

TAG	<p>Measuring point (tag)</p> <p>The device can be ordered with a tag name.</p> <p>Location of tag name</p> <p>Select in the additional specification:</p> <ul style="list-style-type: none"> ▪ Stainless steel tag plate ▪ Paper adhesive label ▪ Tag provided by the customer ▪ RFID tag ▪ RFID tag + stainless steel tag plate ▪ RFID tag + paper adhesive label ▪ RFID tag + tag provided by the customer ▪ IEC 61406 stainless steel tag ▪ IEC 61406 stainless steel tag + NFC tag ▪ IEC 61406 stainless steel tag, stainless steel tag ▪ IEC 61406 stainless steel tag + NFC, stainless steel tag ▪ IEC 61406 stainless steel tag, plate supplied ▪ IEC 61406 stainless steel tag + NFC, plate supplied <p>Definition of tag name</p> <p>Specify in the additional specification: 3 lines of maximum 18 characters each The specified tag name appears on the selected plate and/or on the RFID tag.</p> <p>Visualization in SmartBlue app</p> <p>The first 32 characters of the tag name The tag name can always be changed specifically for the measuring point via Bluetooth.</p>
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Test reports, declarations and inspection certificates	All test reports, declarations and inspection certificates are provided electronically in the <i>Device Viewer</i> : Enter the serial number from the nameplate (www.endress.com/deviceviewer)
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Product documentation on paper

Test reports, declarations and inspection certificates in hard copy can optionally be ordered with feature 570 "Service", Version I7 "Product documentation on paper". The documents are then provided with the device upon delivery.

Application packages

 The following versions can be optionally selected in the Product Configurator:

- Heartbeat Verification + Monitoring application package
Can only be selected in conjunction with optional Bluetooth module
- Accessories installed: Bluetooth

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

- Application package: Heartbeat Verification + Monitoring for NAMUR output
Can only be selected in conjunction with Bluetooth module for NAMUR output
- Accessory mounted: Bluetooth for NAMUR output

Heartbeat Technology module

Heartbeat Diagnostics

Continuously monitors and assesses the device condition 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 condition on demand and generates the Heartbeat Technology verification report showing the verification result.

Heartbeat Monitoring


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

Heartbeat Verification

The "Heartbeat Verification" module contains the **Heartbeat Verification** wizard, which verifies the current instrument health and creates the Heartbeat Technology verification report:

- The wizard can be used via the SmartBlue app.
- The wizard guides the user through the entire process for creating the verification report.
- The operating hours counter and minimum/maximum temperature indicator (peakhold) are displayed.
- In the event of an increase in the oscillation frequency of the fork, a corrosion warning will appear.
- The as-delivered state of the oscillation frequency in air is indicated on the verification report. A high oscillation frequency is an indicator of corrosion. A lower oscillation frequency indicates buildup or a sensor covered by the medium. Deviations of the oscillation frequency from the oscillation frequency in the as-delivered state can be caused by the process temperature and process pressure.

Proof testing for SIL/WHG devices

 The proof test is only available for devices with SIL or WHG approval.

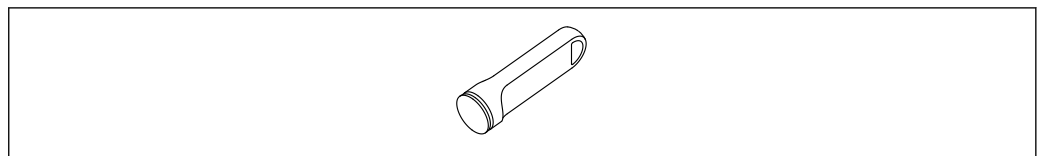
The "SIL Proof test" module, the "WHG Proof test" module or the "SIL/WHG Proof test" module contains a **SIL/WHG Prooftest** wizard, which must be performed at appropriate intervals in the following applications: SIL (IEC61508/IEC61511), WHG (German Water Resources Act (Gesetz zur Ordnung des Wasserhaushalts)):

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

Accessories

Test magnet

Order number: 71437508

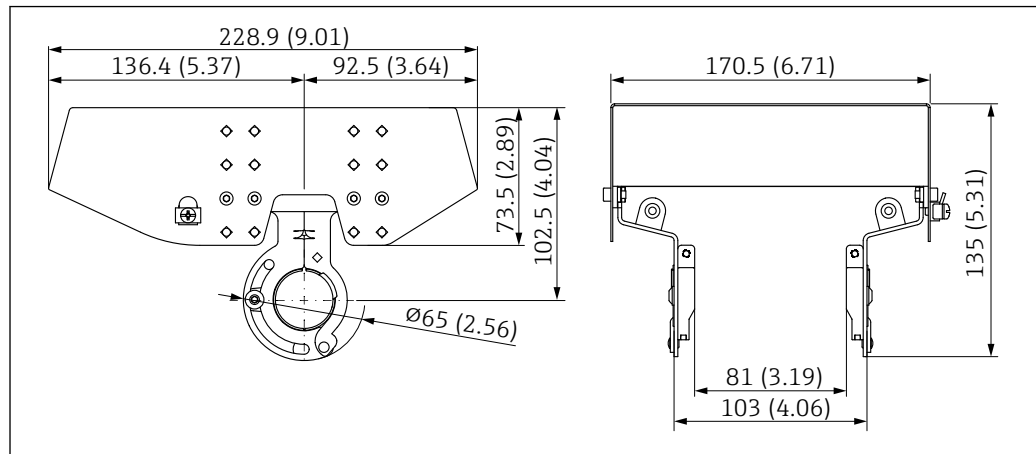


 54 Test magnet

A0039209

Protective cover for aluminum dual compartment housing

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

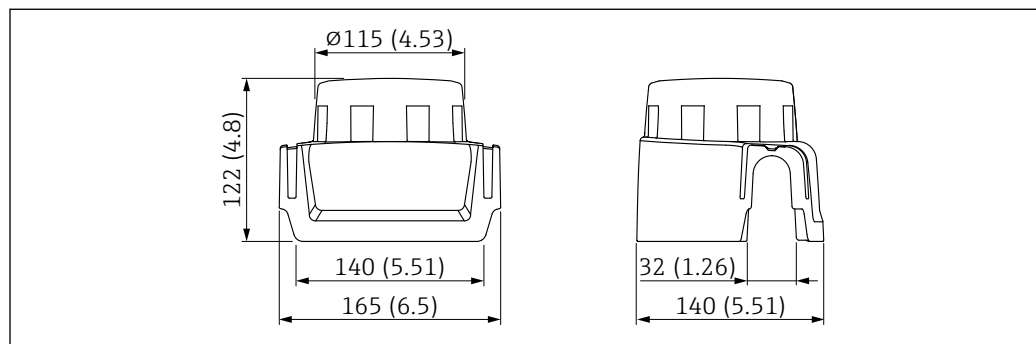


A0039231

55 Protective cover for aluminum dual compartment housing. Unit of measurement mm (in)

Protective cover for single compartment housing, aluminum or 316L

- Material: plastic
- Order number: 71438291



A0038280

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

M12 socket

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

M12 socket IP69

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

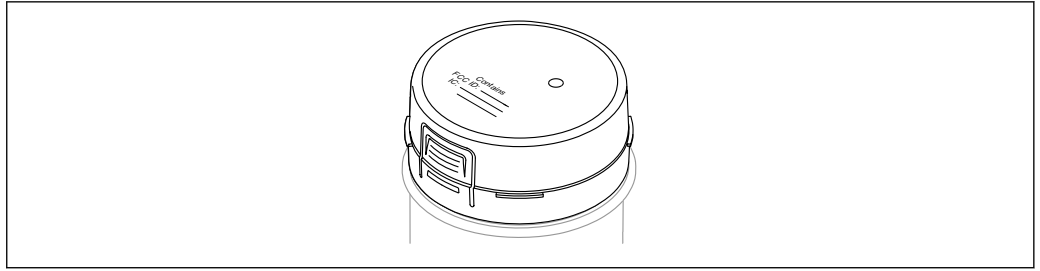
M12 socket IP67

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

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 (2-wire NAMUR).

- 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

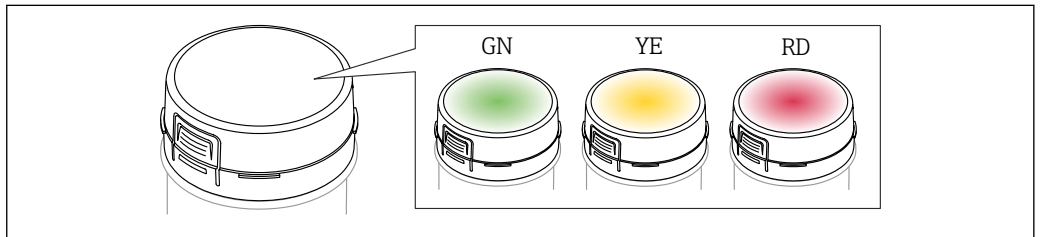
57 Bluetooth module VU121

- i More detailed information and documentation are available:
 - Product Configurator on the Endress+Hauser website www.endress.com
 - Endress+Hauser sales organization www.addresses.endress.com
- i A tall cover is required (transparent plastic cover/cover with sight glass 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 3 16L housing. The cover depends on the housing and approval of the device.

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

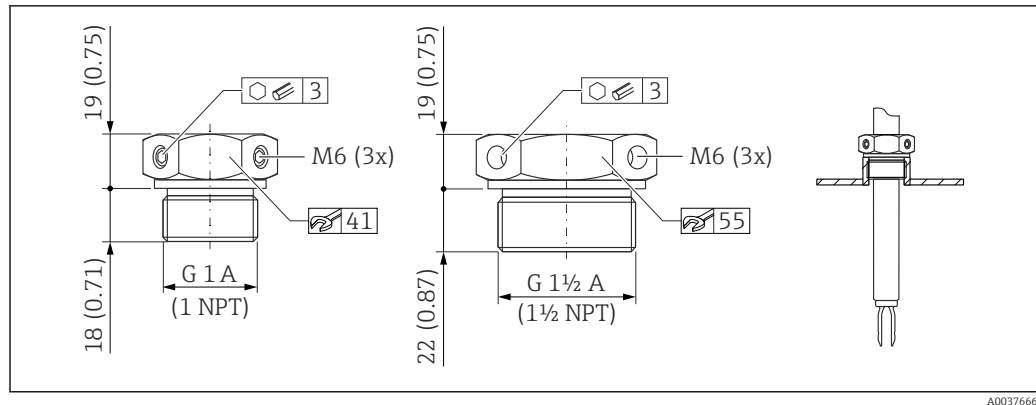
58 LED module, the LED lights up in green (GN), yellow (YE) or red (RD)

- i More detailed information and documentation are available:
 - Product Configurator on the Endress+Hauser website www.endress.com
 - Endress+Hauser sales organization www.addresses.endress.com
- i A tall cover is required (transparent plastic cover/cover with sight glass or aluminum cover with sight glass) for using and retrofitting the LED module. The LED module cannot be used in conjunction with the single compartment 3 16L housing. The cover depends on the housing and approval of the device.

Sliding sleeves for unpressurized operation

- i Not suitable for devices with PFA (conductive) coating.
- i Not suitable for use in explosive atmospheres.

Switch point, infinitely adjustable.



59 Sliding sleeves for unpressurized operation $p_e = 0$ bar (0 psi). Unit of measurement mm (in)

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

More detailed information and documentation are available:

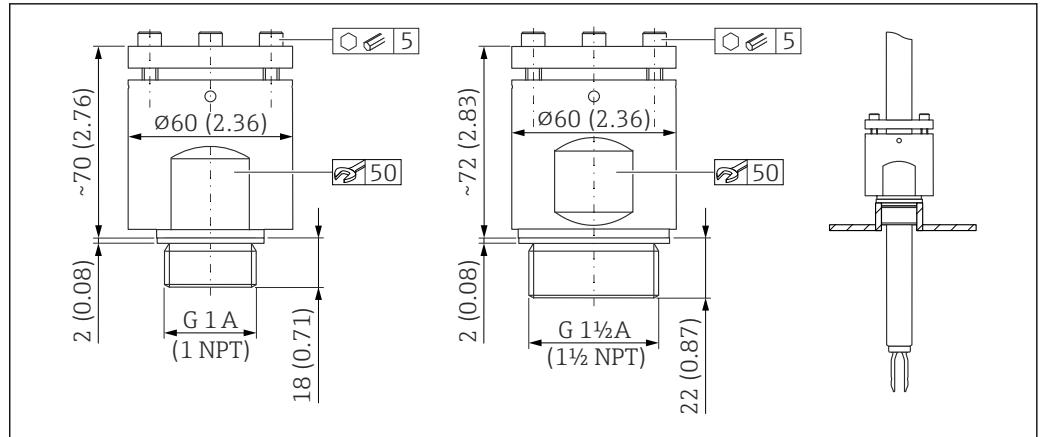
- Product Configurator on the Endress+Hauser website www.endress.com
- Endress+Hauser sales organization www.addresses.endress.com

High pressure sliding sleeves

i Suitable for use in explosive atmospheres.

i Not suitable for devices with PFA (conductive) coating.

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



60 High pressure sliding sleeves. Unit of measurement mm (in)

G 1, DIN ISO 228/1

- Material: 1.4435 (AISI 316L)
- Weight: 1.13 kg (2.49 lb)
- Order number: 52003663
- Order number: 52011880, approval: with inspection certificate EN 10204 - 3.1 material

G 1, DIN ISO 228/1

- Material: Alloy C22
- Weight: 1.13 kg (2.49 lb)
- Approval: with inspection certificate EN 10204 - 3.1 material
- Order number: 71118691

NPT 1, ASME B 1.20.1

- Material: 1.4435 (AISI 316L)
- Weight: 1.13 kg (2.49 lb)
- Order number: 52003667
- Order number: 52011881, approval: with inspection certificate EN 10204 - 3.1 material

NPT 1, ASME B 1.20.1

- Material: Alloy C22
- Weight: 1.13 kg (2.49 lb)
- Approval: with inspection certificate EN 10204 - 3.1 material
- Order number: 71118694

G 1½, DIN ISO 228/1

- Material: 1.4435 (AISI 316L)
- Weight: 1.32 kg (2.91 lb)
- Order number: 52003665
- Order number: 52011882, approval: with inspection certificate EN 10204 - 3.1 material

G 1½, DIN ISO 228/1

- Material: Alloy C22
- Weight: 1.32 kg (2.91 lb)
- Approval: with inspection certificate EN 10204 - 3.1 material

NPT 1½, ASME B 1.20.1

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

NPT 1½, ASME B 1.20.1

- Material: Alloy C22
- Weight: 1.32 kg (2.91 lb)
- Approval: with inspection certificate EN 10204 - 3.1 material
- Order number: 71118695

More detailed information and documentation are available:

- Product Configurator on the Endress+Hauser website www.endress.com
- Endress+Hauser sales organization www.addresses.endress.com

Documentation



For an overview of the scope of the associated Technical Documentation, refer to the following:

- *Device Viewer* (www.endress.com/deviceviewer): Enter the serial number from the nameplate
- *Endress+Hauser Operations app*: Enter serial number from nameplate or scan matrix code on nameplate.

Standard documentation

Document type: Operating Instructions (BA)

The Operating Instructions contain all the information that is required in various phases of the life cycle of the device: from product identification, incoming acceptance and storage, to mounting, connection, operation and commissioning through to troubleshooting, maintenance and disposal. BA02037F

Document type: Brief Operating Instructions (KA)

Quick guide to obtaining the first measured value – the Brief Operating Instructions contain all the essential information from incoming acceptance to initial commissioning. KA01480F

Document type: Safety Instructions, certificates

Depending on the approval, safety instructions for electrical equipment in hazardous areas are also supplied with the device. They are an integral part of the Operating Instructions. Information on the Safety Instructions (XA) that are relevant for the device is provided on the nameplate.

Supplementary device-dependent documentation

Additional documents are supplied depending on the device version ordered: Always comply strictly with the instructions in the supplementary documentation. The supplementary documentation is an integral part of the device documentation.

Special Documentation

- SD02662F: Heartbeat Verification + Monitoring application package
- SD02389F: Bluetooth module VU121, radio approval
- SD02398F: Sliding sleeve for Liquiphant (installation instructions)
- SD01622P: Weld-in adapter (installation instructions)
- TI00426F: Weld-in adapters, process adapters and flanges (overview)

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