

# Technical Information

## Liquiphant FTL51B

Vibronic



### Point level switch for liquids

#### Application

- Point level switch for minimum or maximum detection in tanks, containers and piping with all types of liquids, even in hazardous areas
- Process temperature range: -50 to +150 °C (-58 to +302 °F)
- Pressures up to 100 bar (1 450 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
- No calibration needed: Quick, low-cost commissioning
- No mechanically moving parts: No maintenance, no wear, long operating life
- Functional safety: Monitoring of vibration frequency of the tuning fork
- Functional testing by means of test button on electronic insert
- Heartbeat Technology via free iOS/Android SmartBlue app
- Measuring device 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.

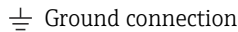


This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or medium injury.



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



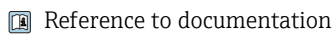
Permitted  
Procedures, processes or actions that are permitted.



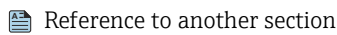
Forbidden  
Procedures, processes or actions that are forbidden.



Tip  
Indicates additional information



Reference to documentation



Reference to another section



1, 2, 3. Series of steps

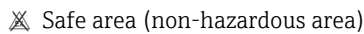
#### Symbols in graphics

**A, B, C ...** View

1, 2, 3 ... Item numbers



Hazardous area



Safe area (non-hazardous area)

## 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

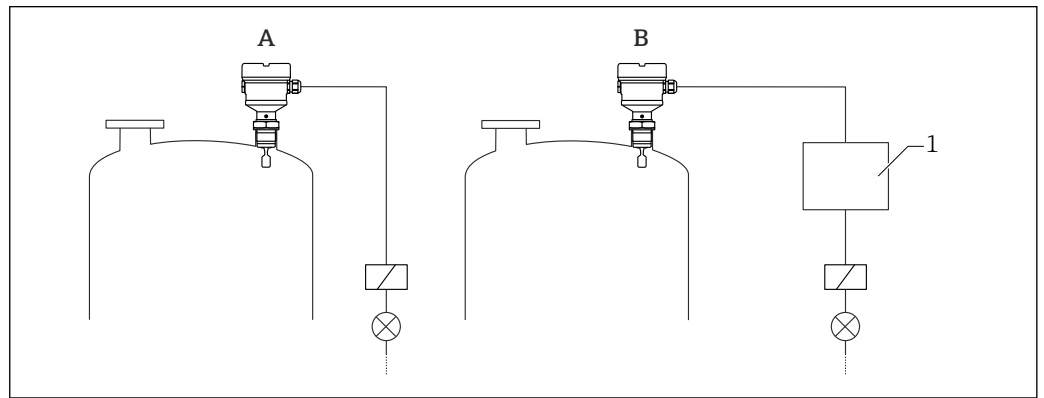
Demand mode

- 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



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  
Maximum sensor length 6 m (20 ft)

## Output

### Output and input variants

#### Electronic inserts

##### 2-wire AC (FEL61)

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

##### 3-wire DC-PNP (FEL62)

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

##### Universal current connection, relay output (FEL64)

- Switches the loads via 2 potential-free changeover contacts
- Ambient temperature  $-60\text{ °C}$  ( $-76\text{ °F}$ ), optionally available to order  
Low-temperature electronic inserts are marked LT

##### Direct current connection, relay output (FEL64DC)

- Switches the load via 2 potential-free changeover contacts
- Ambient temperature  $-60\text{ °C}$  ( $-76\text{ °F}$ ), optionally available to order  
Low-temperature electronic inserts are marked LT

##### PFM output (FEL67)

- For separate switching device (Nivotester FTL325P, FTL375P)
- PFM signal transmission; current pulses are superimposed on the power supply along the two-wire cabling
- Ambient temperature  $-50\text{ °C}$  ( $-58\text{ °F}$ ), optionally available to order  
The low-temperature electronic inserts are marked LT

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

- For separate switching device, e. g. Nivotester FTL325N
- Signal transmission H-L edge 2.2 to 3.8/0.4 to 1.0 mA as per IEC 60917-5-6 (NAMUR) on two-wire cable
- Ambient temperature  $-50\text{ °C}$  ( $-58\text{ °F}$ ), optionally available to order  
Low-temperature electronic inserts are marked LT

##### 2-wire density (FEL60D) for density measurement

Connection to Density Computer FML621



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

### Output signal

#### Switch output

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

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

#### COM interface

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

*Bluetooth® wireless technology (optional)*

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

### Ex connection data

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

## 2-wire AC (electronic insert FEL61)

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

### Supply voltage

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

Residual voltage when switched through: typically 12 V



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

### Power consumption

$S \leq 2 \text{ VA}$

### Current consumption

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

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

### Connectable load

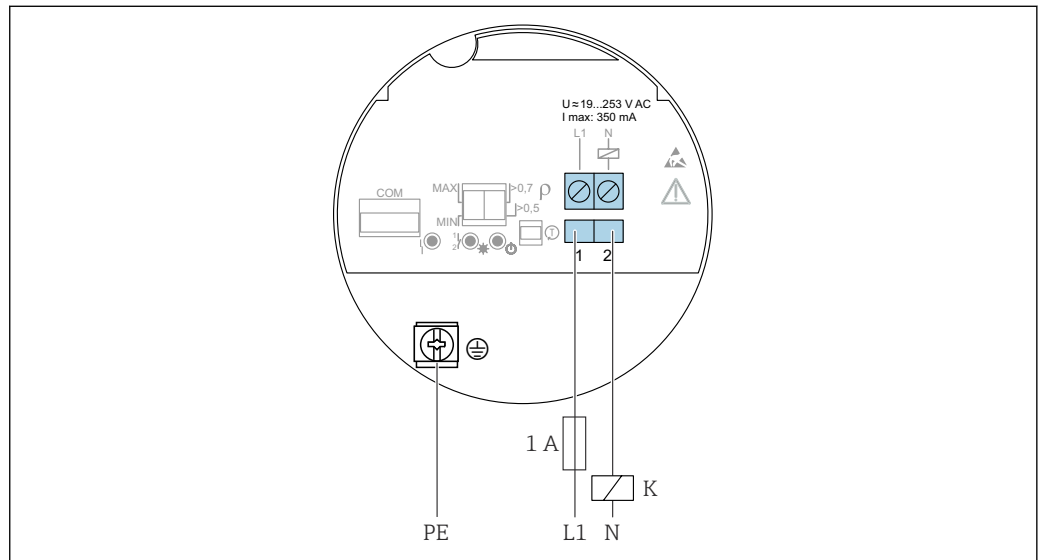
- Load with a minimum holding power/rated power of 2.5 VA at 253 V (10 mA) or 0.5 VA at 24 V (20 mA)
- Load with a maximum holding power/rated power of 89 VA at 253 V (350 mA) or 8.4 VA at 24 V (350 mA)
- With overload and short-circuit protection

### Behavior of output signal

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

### Terminal assignment

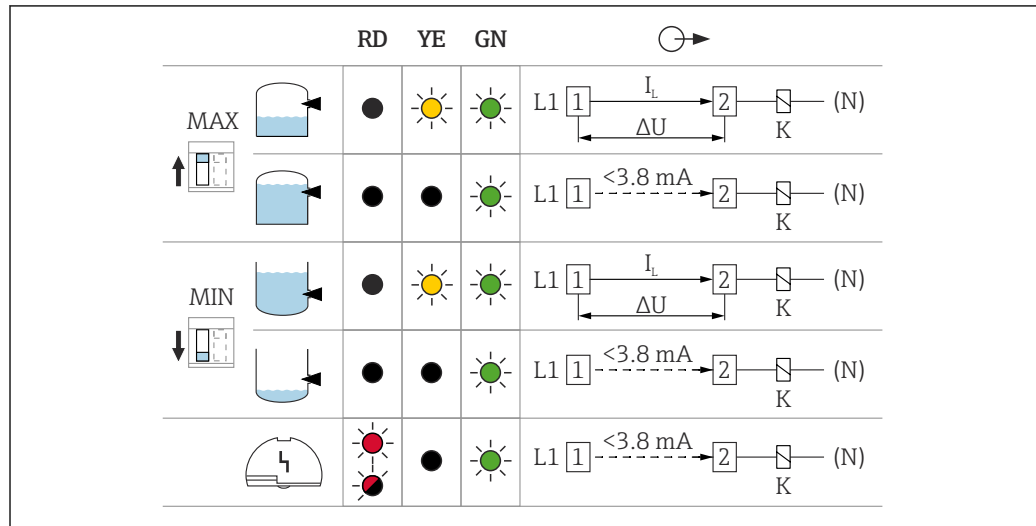
Always connect an external load. The electronic insert has integrated short-circuit protection.



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

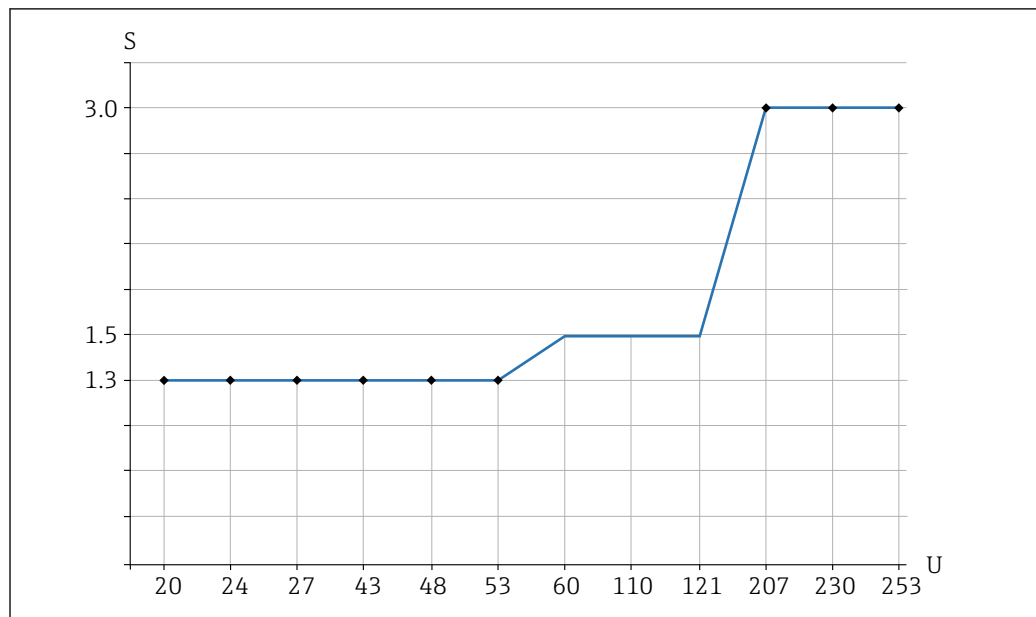
RD LED red for warning or alarm

YE LED yellow, switch status

GN LED green, operational status, device on

$I_L$  Load current switched through

## Selection tool for relays



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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**



**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.

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



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

**Power consumption**

$P \leq 0.5 \text{ W}$

**Current consumption**

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

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

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

**Residual current**

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

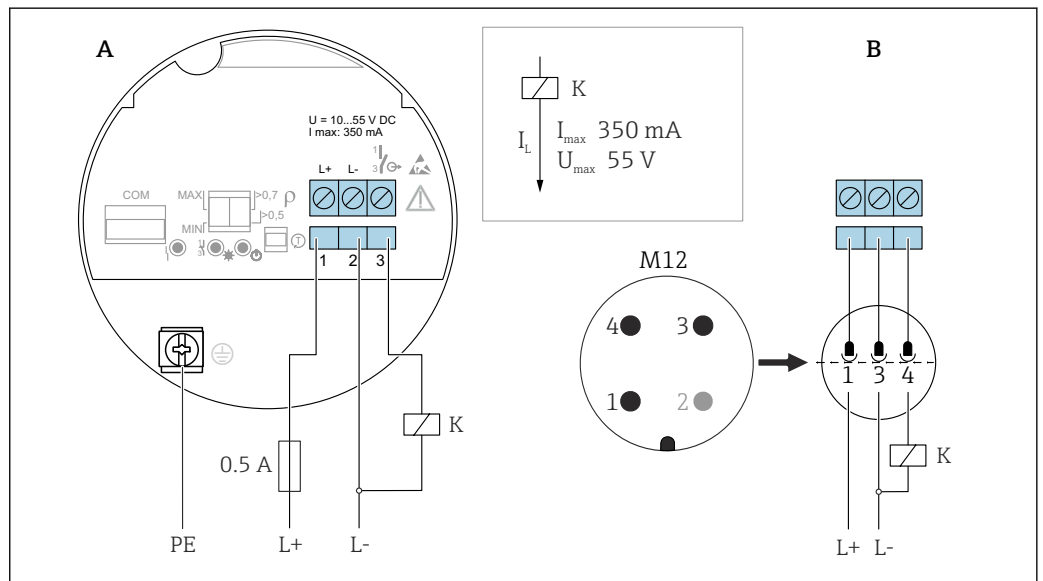
**Residual voltage**

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

**Behavior of output signal**

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

**Terminal assignment**

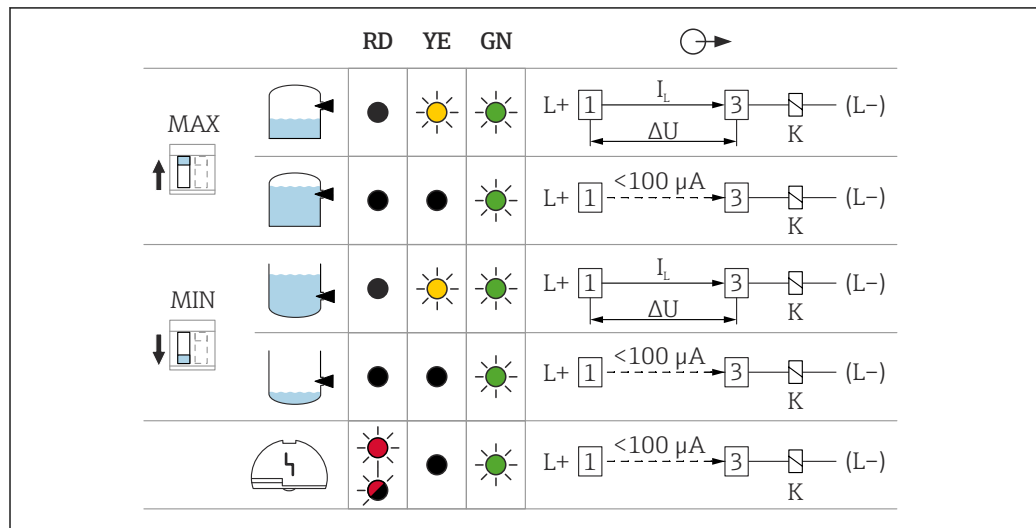


5 3-wire DC-PNP, electronic insert FEL62

A Connection wiring with terminals

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

## Behavior of switch output and signaling



A0033508

6 Behavior of switch output and signaling, electronic insert FEL62

MAXDIP switch for setting MAX safety mode

MIN DIP switch for setting MIN safety mode

RD LED red for warning or alarm

YE LED yellow, switch status

GN LED green, operational status, device on

$I_L$  Load current switched through

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

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

### WARNING

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

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

### Supply voltage

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

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

### Power consumption

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

### Connectable load

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

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

According to IEC 61010, the following applies: Total voltage from relay outputs and power supply  $\leq 300 \text{ V}$ .

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

Relay contact material: silver/nickel AgNi 90/10

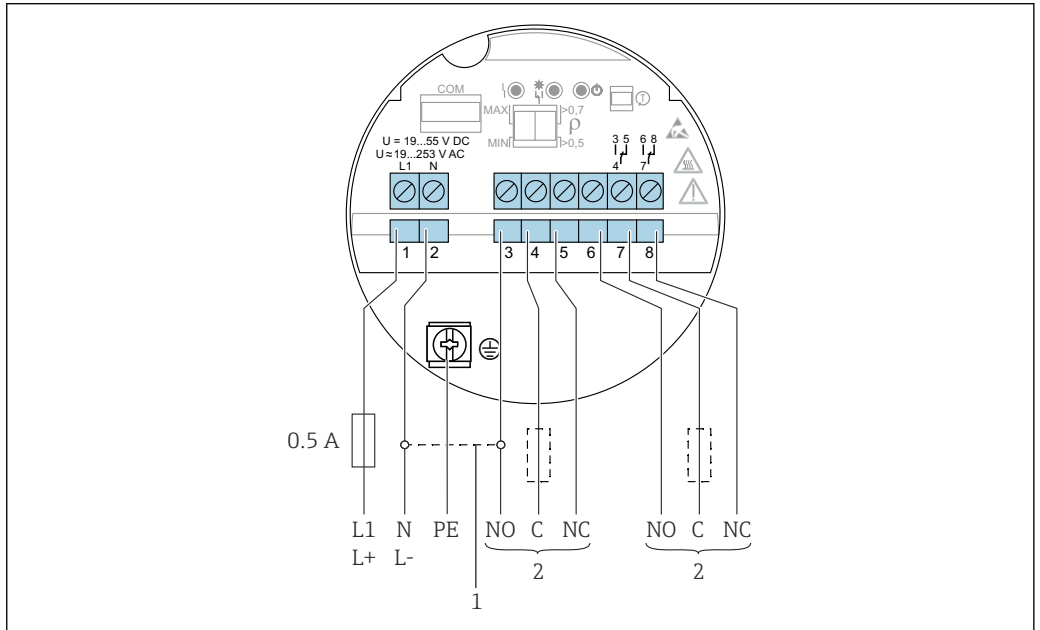
When connecting a device with high inductance, provide a spark suppressor to protect the relay contact. A fine-wire fuse (depending on the connected load) protects the relay contact in the event of a short-circuit.

Both relay contacts switch simultaneously.

**Behavior of output signal**

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

**Terminal assignment**

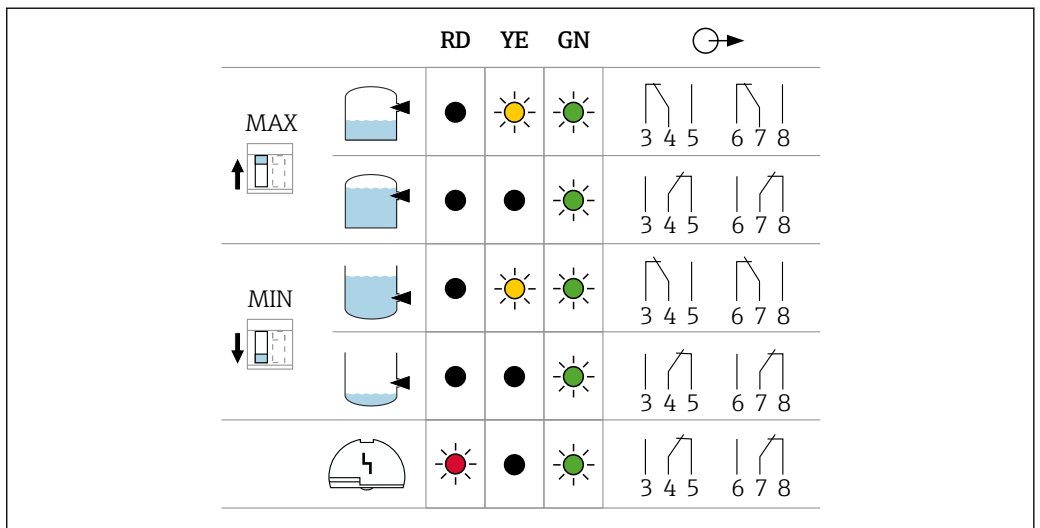


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7 Universal current connection with relay output, electronic insert FEL64

- 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

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

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

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

### Supply voltage

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

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

### Power consumption

$P < 1.0 \text{ W}$

### Connectable load

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

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

According to IEC 61010, the following applies: Total voltage from relay outputs and power supply  $\leq 300 \text{ V}$

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

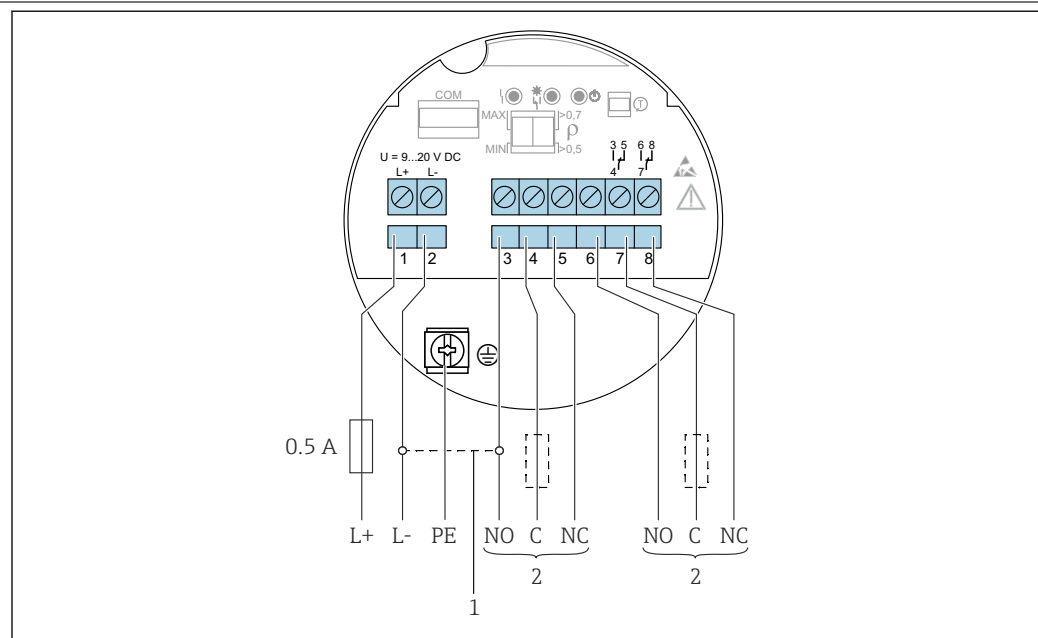
Relay contact material: silver/nickel AgNi 90/10


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

### Behavior of output signal

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



















### Terminal assignment




 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**

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

A003513

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

MAXDIP switch for setting MAX safety mode

MIN DIP switch for setting MIN safety mode

RD LED red for alarm

YE LED yellow, switch status

GN LED green, operational status, device on


## PFM output (electronic insert FEL67)

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

**Supply voltage**

U = 9.5 to 12.5 V<sub>DC</sub>

Reverse polarity protection

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

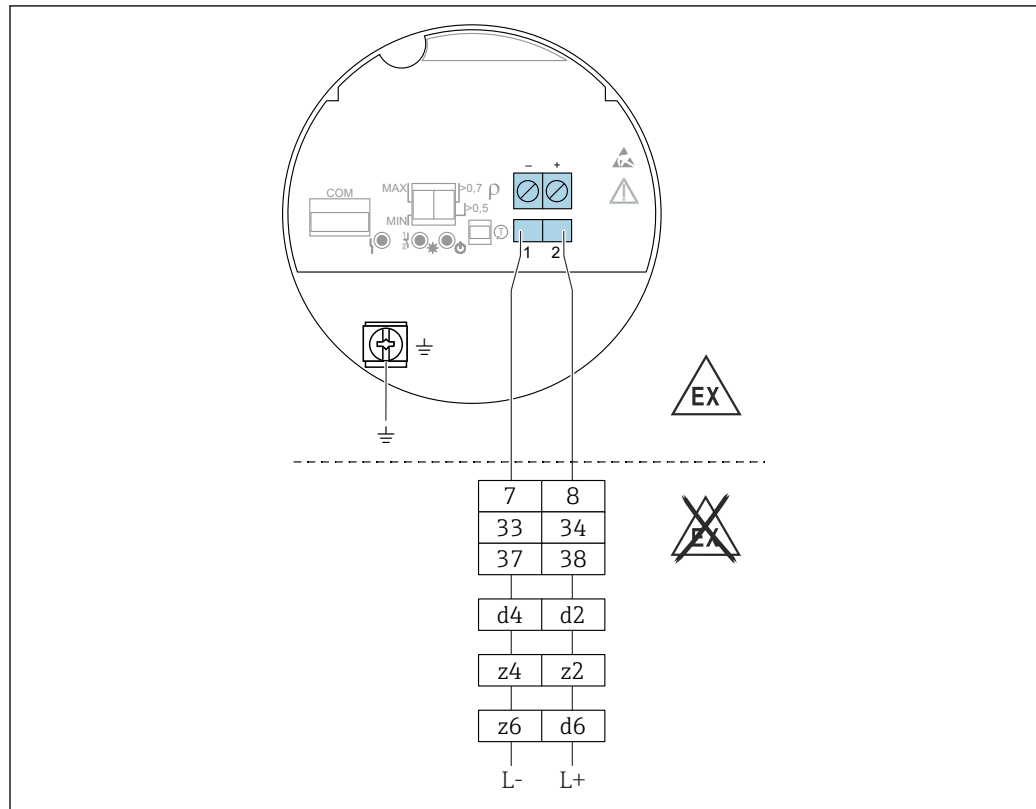
**Power consumption**

P ≤ 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

## Terminal assignment



11 PFM output, electronic insert FEL67

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

33/ 34: Nivotester FTL325P 3 CH input 2

37/ 38: Nivotester FTL325P 3 CH input 3

d4/ d2: Nivotester FTL375P input 1

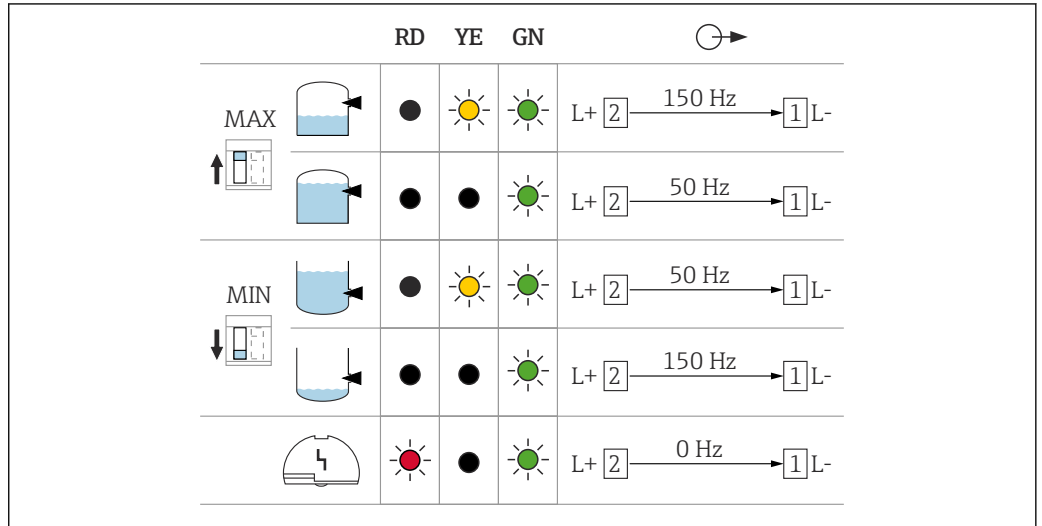
z4/ z2: Nivotester FTL375P input 2

z6/ d6: Nivotester FTL375P input 3

## Connection cable

- Maximum cable resistance: 25  $\Omega$  per core
- Maximum cable capacitance: < 100 nF
- Maximum cable length: 1 000 m (3 281 ft)

**Behavior of switch output and signaling**



A0037696

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

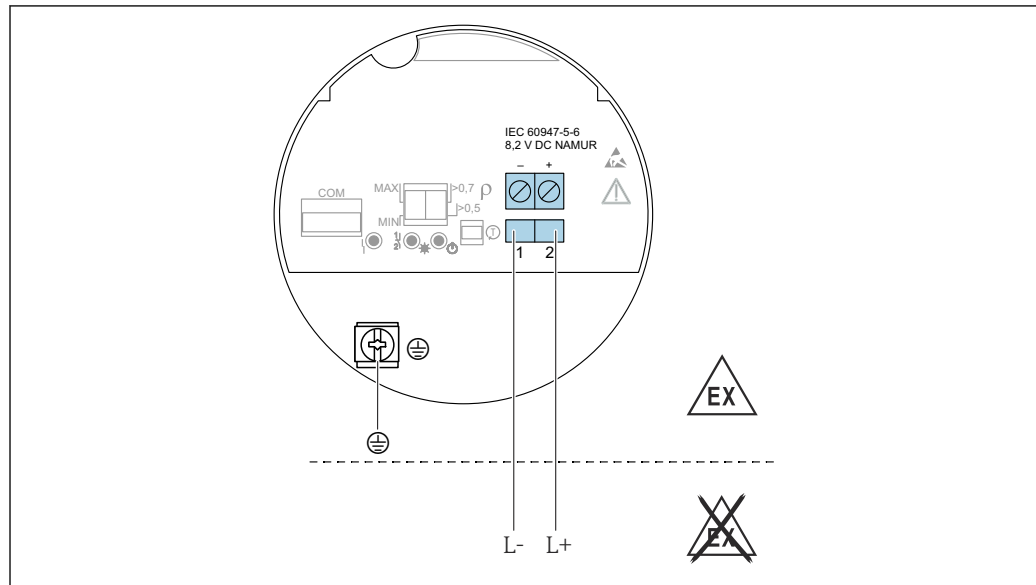
**i** The switches for MAX/MIN on the electronic insert and the FTL325P switching unit must be set according to the application. Only then is it possible to perform the functional test correctly.

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

- For connection to isolating amplifiers according to NAMUR (IEC 60947-5-6), e.g. Nivotester FTL325N from Endress+Hauser
- Signal transmission H-L edge 2.2 to 3.8 mA/0.4 to 1.0 mA as per IEC 60947-5-6 (NAMUR) on two-wire cabling
- Functional testing without level change. A functional test can be performed on the device using the test button on the electronic insert or using the test magnet (can be ordered as an option) with the housing closed.  
 The functional test can also be triggered by interrupting the supply voltage or activated directly from the Nivotester FTL325N.

<b>Supply voltage</b>	U = 8.2 V <sub>DC</sub>  <b>i</b> Observe the following as per IEC/EN61010-1: Provide a suitable circuit breaker for the device.
<b>Power consumption</b>	NAMUR IEC 60947-5-6
<b>Behavior of output signal</b>	<ul style="list-style-type: none"> <li>OK status: output current 2.2 to 3.8 mA</li> <li>Demand mode: output current 0.4 to 1.0 mA</li> <li>Alarm: output current &lt; 1.0 mA</li> </ul>

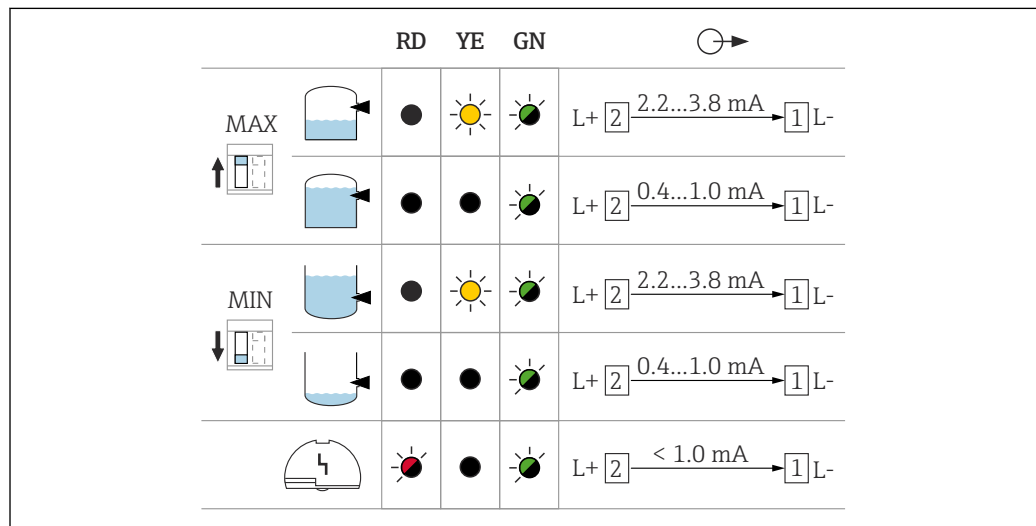
## Terminal assignment



A0036066

13 2-wire NAMUR  $\geq 2.2 \text{ mA} / \leq 1.0 \text{ mA}$ , electronic insert FEL68

## Behavior of switch output and signaling



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14 Behavior of switch output and signaling, electronic insert FEL68

MAX DIP switch for setting MAX safety mode

MIN DIP switch for setting MIN safety mode

RD LED red for alarm

YE LED yellow, switch status

GN LED green, operational status, device on

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

Ordering information in the Product Configurator:

- Order code for "Accessories", option NG "Prepared for Bluetooth"
- Order code for "Application package", option EL "Prepared for Heartbeat Verification + Monitoring"

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

Order options that must be selected together, or that are mutually exclusive, are automatically displayed in the Product Configurator.



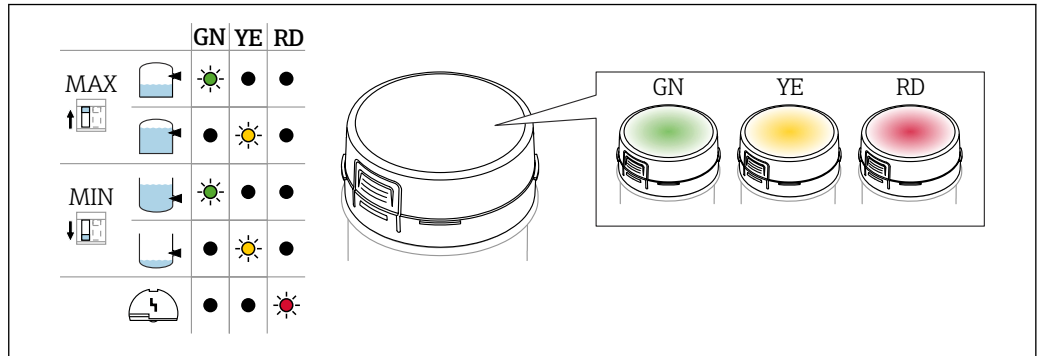
## LED module VU120 (optional)

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

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

**Current consumption**  $I_{\text{max}} = 0.4 \text{ A}$

### Signaling of operational status



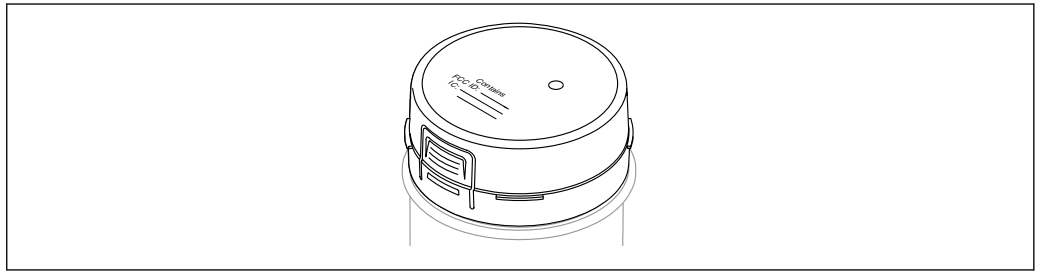
15 LED module, the LED lights up in green (GN), yellow (YE) or red (RD)

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. The documentation currently available can be found on the Endress+Hauser website: [www.endress.com](http://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](http://www.endress.com) → Downloads.

### Batteries

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

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

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

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

- For energy-related reasons, the Bluetooth module VU121 requires a special battery when operated with electronics insert FEL68 (2-wire NAMUR).
- The service life of the Bluetooth module without replacing the battery is at least 5 years with a maximum of 60 downloads of complete datasets (at ambient temperatures between 10 to 40 °C (50 to 104 °F)).

### 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](http://www.endress.com) → Downloads.

### Functions

 Additional details in the "Operability" section.

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## 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

 Additional details in the "Application packages" section.

## Performance characteristics

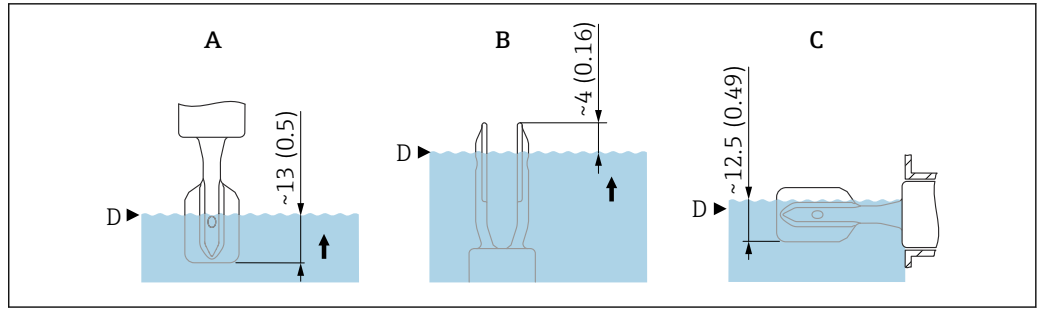
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### Reference operating conditions

- Ambient temperature: +23 °C (+73 °F)
- Process temperature: +23 °C (+73 °F)
- Density (water): 1 g/cm<sup>3</sup>
- Medium viscosity: 1 mPa·s
- Process pressure: ambient pressure/unpressurized
- Sensor installation: vertically from above
- Density selection switch: > 0.7 g/cm<sup>3</sup> (SGU)
- Switch direction of sensor: uncovered to covered

### Take switch point into consideration

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

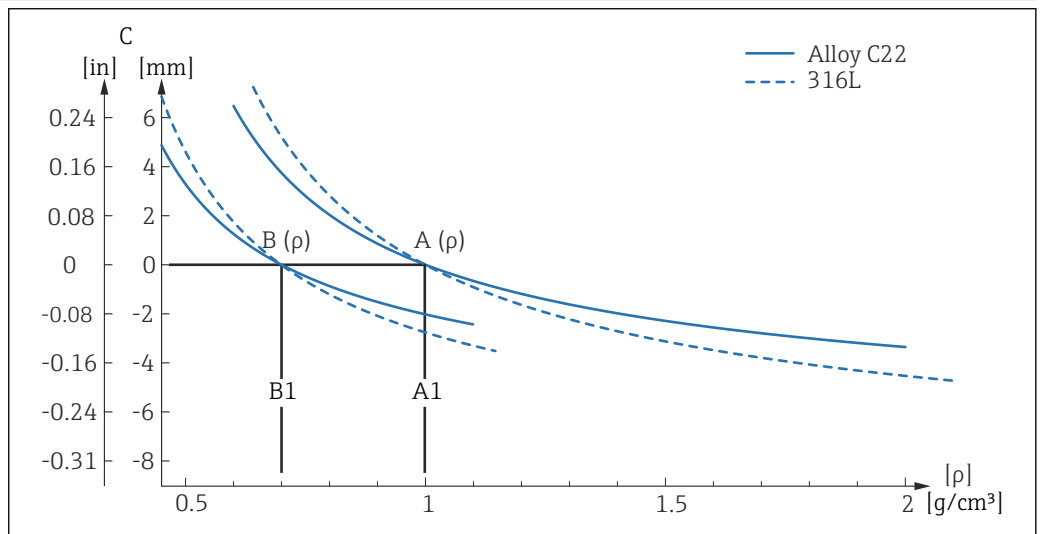


17 Typical switch points. Unit of measurement mm (in)

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

<b>Maximum measured error</b>	At reference operating conditions: max. $\pm 1$ mm (0.04 in)
<b>Hysteresis</b>	Typically 2.5 mm (0.1 in)
<b>Non-repeatability</b>	2 mm (0.08 in)
<b>Influence of the process temperature</b>	The switch point moves between +1.4 to -2.6 mm (+0.06 to -0.1 in) in the temperature range from -50 to +150 °C (-58 to +302 °F)
<b>Influence of the process pressure</b>	The switch point moves between 0 to 2.6 mm (0 to 0.1 in) in the pressure range from -1 to +64 bar (14.5 to 928 psi)

**Influence of the density of the process medium (at room temperature and normal pressure)**



18 Switch point deviation over density

- A Density switch setting ( $\rho > 0.7$ )
- A1 Reference operating condition  $\rho = 1 \text{ g/cm}^3$
- B Density switch setting ( $\rho > 0.5$ )
- B1 Reference operating condition  $\rho = 0.7 \text{ g/cm}^3$
- C Switch point deviation

Density setting

- TK<sub>typ</sub>, [mm/10 k]
  - $\rho > 0.7$ : -0.2
  - $\rho > 0.5$ : -0.2
- Pressure<sub>typ</sub>, [mm/10 bar]
  - $\rho > 0.7$ : -0.3
  - $\rho > 0.5$ : -0.4

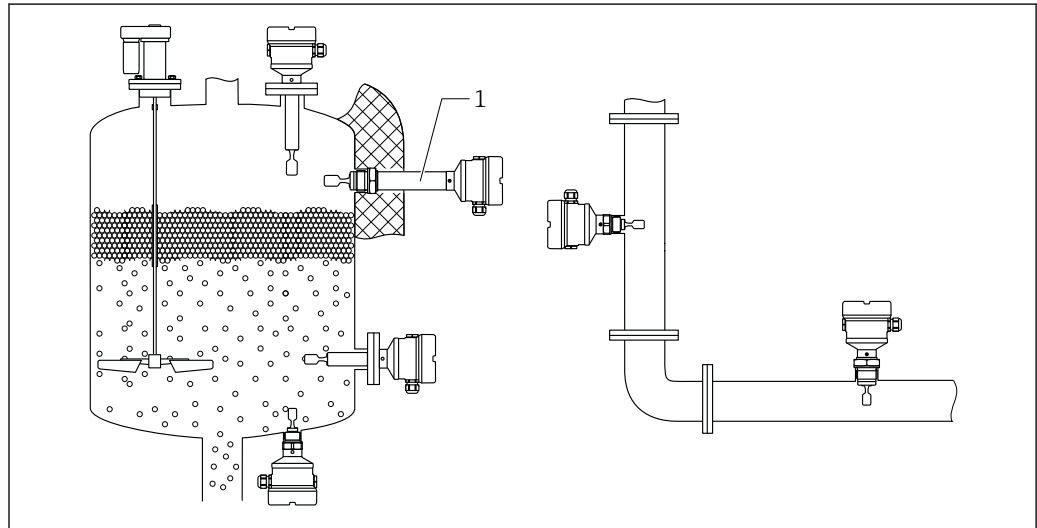
## Installation

**i** Open the device only in a dry environment!

### Mounting location, orientation

#### Mounting instructions

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



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

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

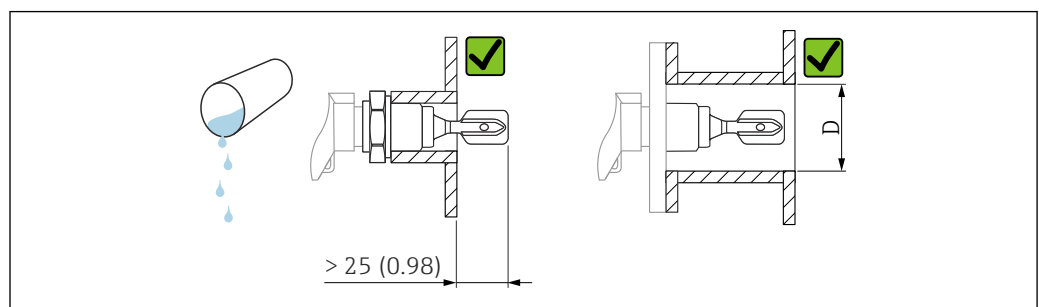
### Installation instructions

#### Take viscosity into consideration

##### Low viscosity

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

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



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

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

##### High viscosity

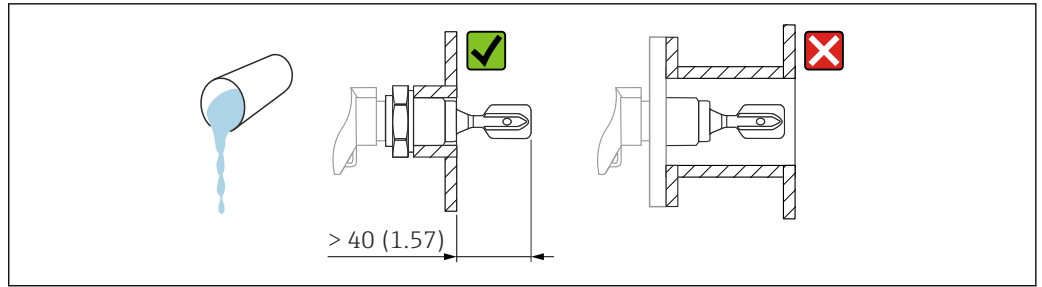
#### NOTICE

**Highly viscous liquids may cause switching delays.**

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

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

The tuning fork must be located outside the installation socket!

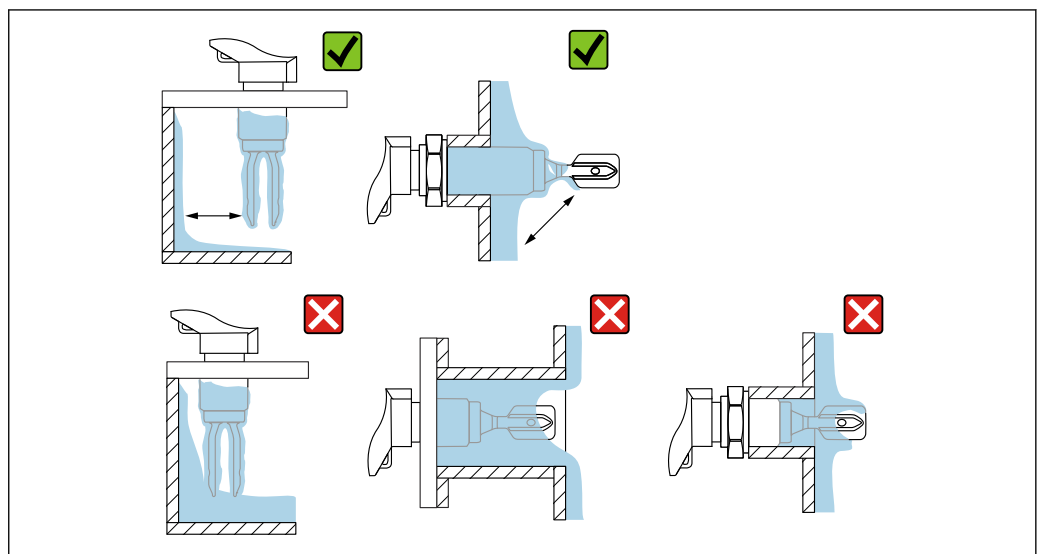


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21 Installation example for a highly viscous liquid. Unit of measurement mm (in)

**Avoid buildup**

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

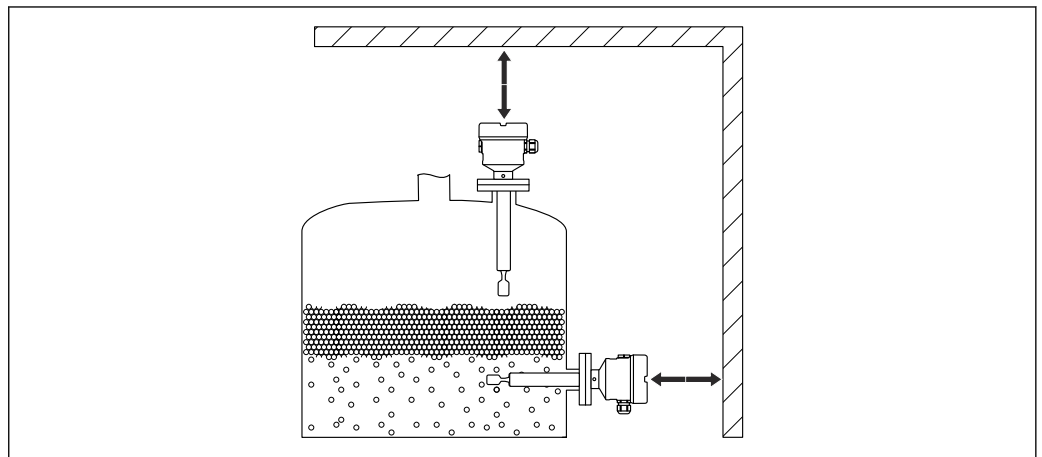


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22 Installation examples for a highly viscous process medium

**Take clearance into consideration**

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



A0033236

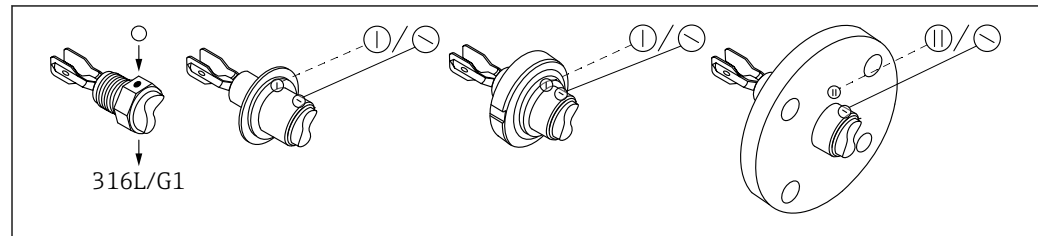
23 Take clearance into consideration

### Align the tuning fork with the marking

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

Markings may include the following:

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



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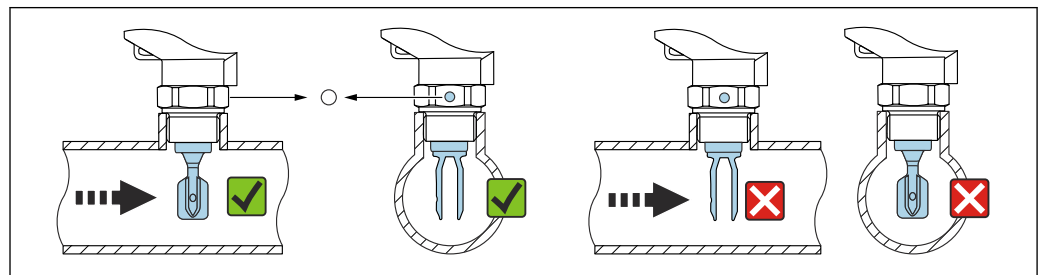
24 Markings to align the tuning fork

### Installing in pipes

Flow velocity up to 5 m/s with viscosity 1 mPa·s and density 1 g/cm<sup>3</sup> (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 on the adapter is pointing in the direction of flow.

The marking is visible when installed.



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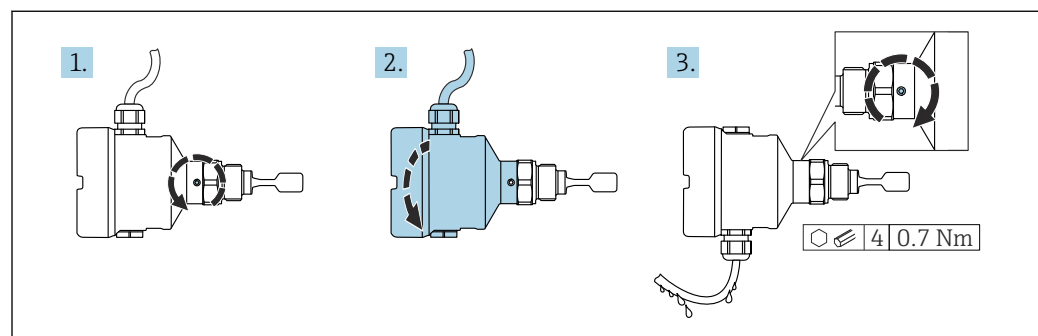
25 Installation in pipes

### Sliding sleeves

Additional details in the "Accessories" section.

### Aligning the cable entry

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



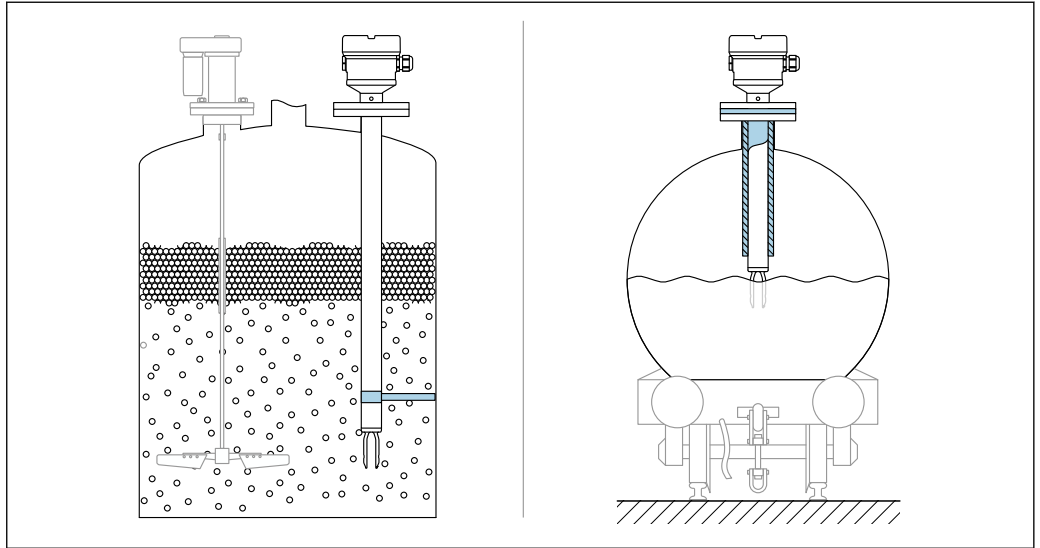
A0037347

26 Housing with external locking screw

**Special mounting instructions**

**Support the device**

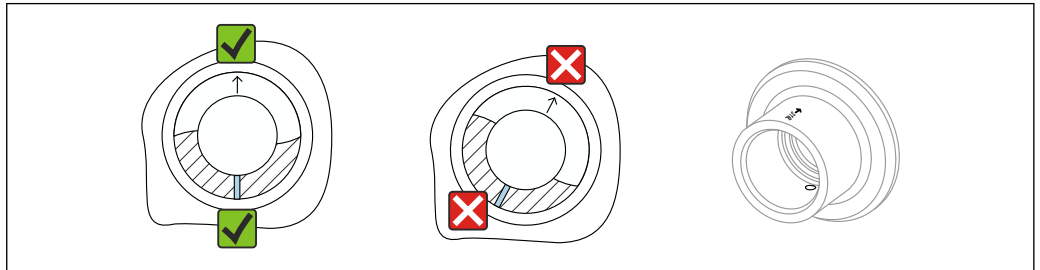
Support the device in the event of severe dynamic load. Maximum lateral loading capacity of the pipe extensions and sensors: 75 Nm (55 lbf ft).



27 Examples of support in the event of dynamic load

**Weld-in adapter with leakage hole**

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



28 Weld-in adapter with leakage hole

**Environment**

**Ambient temperature range** -40 to +70 °C (-40 to +158 °F)

**⚠ WARNING**

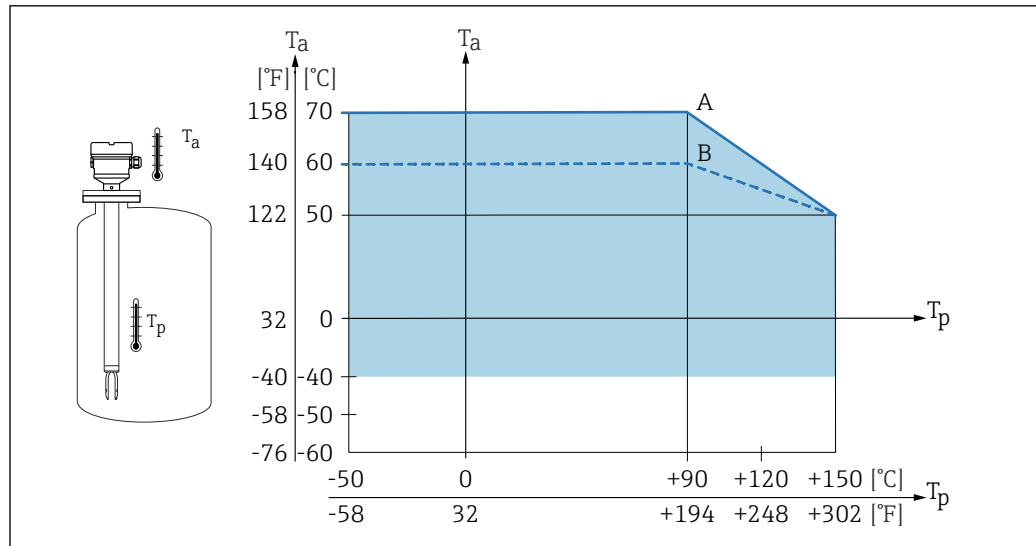
**Permitted connection voltage exceeded!**

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

Optional  
-60 °C (-76 °F) or -50 °C (-58 °F)

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

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



A0045128

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

A Device without LED module; at process temperature and FEL64  $T_p > 90^\circ\text{C}$ , max. load current 4 A

B Device with LED module; at process temperature and FEL64  $T_p > 90^\circ\text{C}$ , max. load current 2 A

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

A:  $70^\circ\text{C}$  ( $158^\circ\text{F}$ )

B:  $60^\circ\text{C}$  ( $140^\circ\text{F}$ )

Ordering information, optionally available

- Ambient temperature  $-60^\circ\text{C}$  ( $-76^\circ\text{F}$ )  
Product Configurator, order code for "Test, Certificate, Declaration" option "JT"
- Ambient temperature  $-50^\circ\text{C}$  ( $-58^\circ\text{F}$ )  
Product Configurator, order code for "Test, Certificate, Declaration" option "JL"

Low-temperature electronic inserts are marked LT.

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

Outdoor operation in strong sunlight:

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

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

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

**Operating altitude** As per IEC 61010-1 Ed.3:  

- Up to 2 000 m (6 600 ft) above sea level
- Can be extended to 3 000 m (9 800 ft) above sea level if overvoltage protection is used

**Climate class** As per IEC 60068-2-38 test Z/AD


**Degree of protection** In accordance with DIN EN 60529, NEMA 250



**IP66/IP68 NEMA 4X/6P**



Types of housing:

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

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


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

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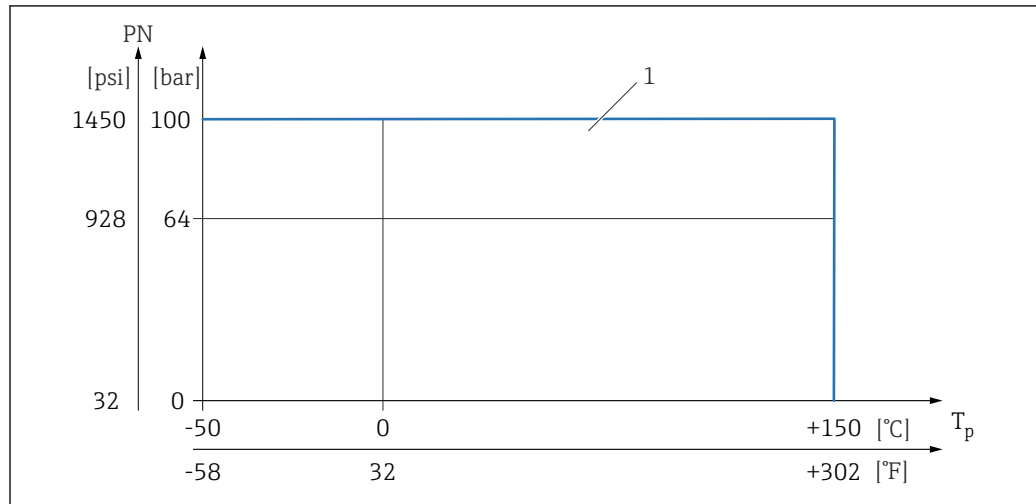
<b>Vibration resistance</b>	As per IEC60068-2-64-2009 $a(\text{RMS}) = 50 \text{ m/s}^2$ , $f = 5 \text{ to } 2\,000 \text{ Hz}$ , $t = 3 \text{ axes} \times 2 \text{ h}$ For increased oscillations or vibrations, the additional option of order code "Application" option "B" 100 bar (1 450 psi) process pressure is recommended.
<b>Shock resistance</b>	In accordance with IEC60068-2-27-2008: $300 \text{ m/s}^2 [= 30 g_n] + 18 \text{ ms}$ $g_n$ : standard acceleration of gravity
<b>Mechanical stress</b>	Support the device in the event of severe dynamic load. Maximum lateral loading capacity of the pipe extensions and sensors: 75 Nm (55 lbf ft).  Additional details in the "Support the device" section.
<b>Electromagnetic compatibility</b>	<ul style="list-style-type: none"> <li>■ Electromagnetic compatibility as per EN 61326 series and NAMUR recommendation EMC (NE21)</li> <li>■ The requirements of EN 61326-3-1 for the safety function (SIL) are fulfilled</li> </ul>  Details are available in the supplementary Functional Safety Manual.

## Process

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<b>Process temperature range</b>	-50 to +150 °C (-58 to +302 °F) Pay attention to the pressure and temperature dependence,  additional details in the "Sensor process pressure range" section
<b>Thermal shock</b>	$\leq 120 \text{ K/s}$

## Process pressure range



A0038268

30 Process temperature FTL51B

- 1 Permitted pressure rating if the "100 bar (1 450 psi)" option is selected. For exceptions, see the "Process connections" section. Canadian CRN approval: The maximum permissible process pressure is limited to 90 bar (1 305 psi) only in connection with the CRN approval. More details on the maximum pressure values are available in the download area of the product page under "www.endress.com".

**WARNING**

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

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

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

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

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

**Process pressure range of the sensors**

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

**Test pressure**

**Gauge pressure**

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

The instrument function is limited during the pressure test.

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

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**Density**

**Liquids with density > 0.7 g/cm<sup>3</sup>**

Switch position > 0.7 g/cm<sup>3</sup> (as-delivered state)

**Liquids with density 0.5 to 0.8 g/cm<sup>3</sup>**

Switch position > 0.5 g/cm<sup>3</sup> (can be configured via DIP switch)

**Optionally available to order: Liquids with density > 0.4 g/cm<sup>3</sup> or > 0.5 g/cm<sup>3</sup> (not for devices with SIL approval)**

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

---

**Pressure tightness**

Up to vacuum



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

## Mechanical construction

**i** For the dimensions, see the Product Configurator: [www.endress.com](http://www.endress.com)

Search for product → click "Configuration" to the right of the product image → after configuration click "CAD"

The following dimensions are rounded values. For this reason, they may deviate slightly from the dimensions given on [www.endress.com](http://www.endress.com).

### Design, dimensions

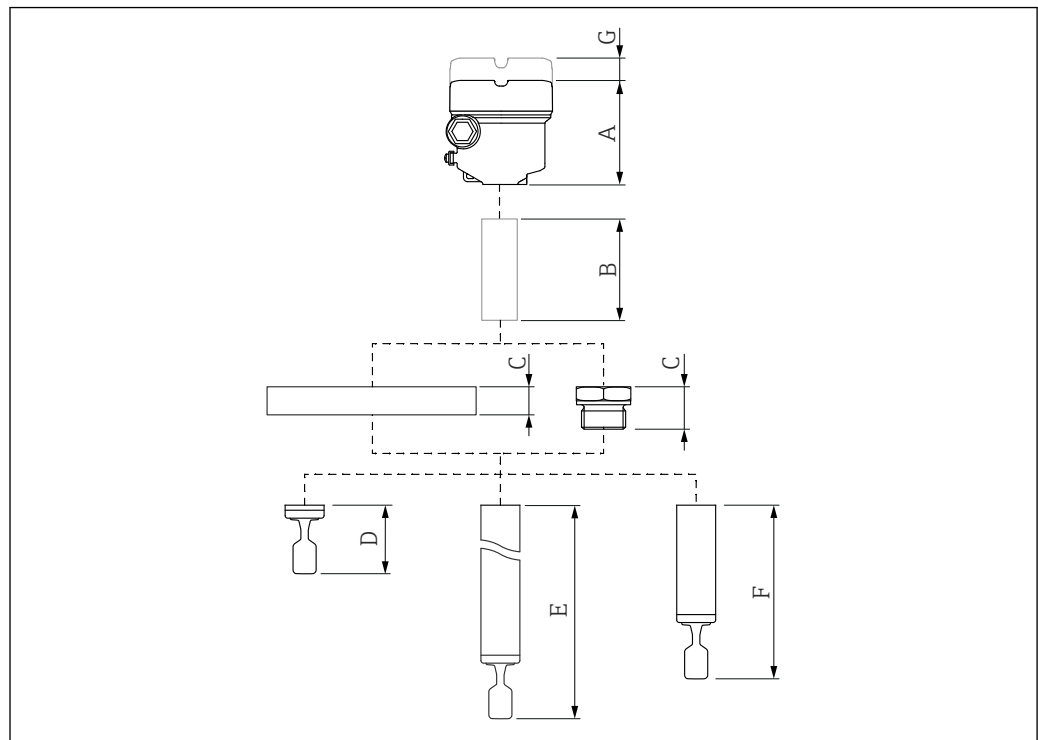
#### Device height

The device height is calculated from the following components:

- Housing including cover
- Temperature spacer and/or pressure-tight feedthrough (second line of defense), optional
- Pipe extension, short pipe or compact version
- 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 into consideration the installation distance (space that is used to install the device)



A0036841

**31** Components for determining the height of the device

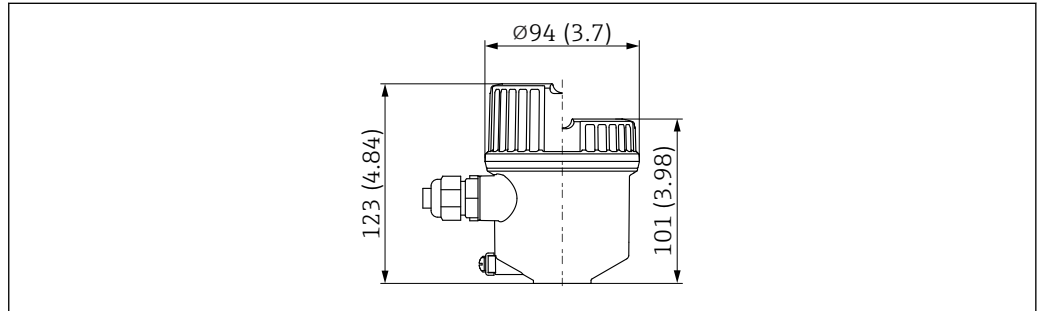
- A Housing including cover
- B Temperature spacer, pressure-tight feedthrough (optional), details in the Product Configurator, depending on the process connection, up to 60 mm (2.36 in). For details, see Product Configurator.
- C Process connection, flange or thread
- D Tuning fork
- E Pipe extension
- F Short pipe
- G Installation clearance

**Housing and cover**

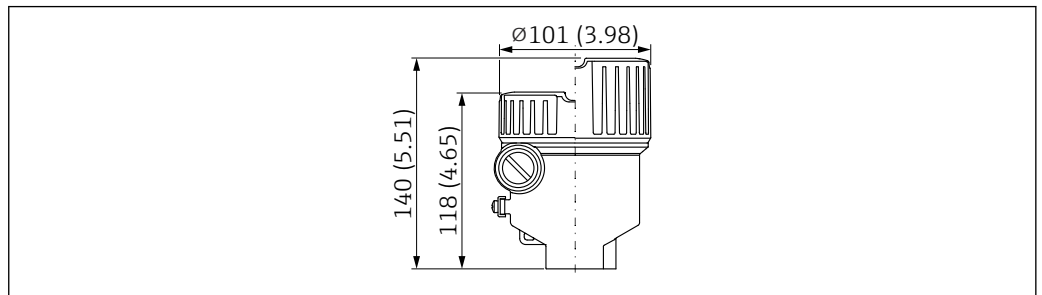
All housings can be aligned. The locking screw on metal housings can be used to secure the alignment of the housing.

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

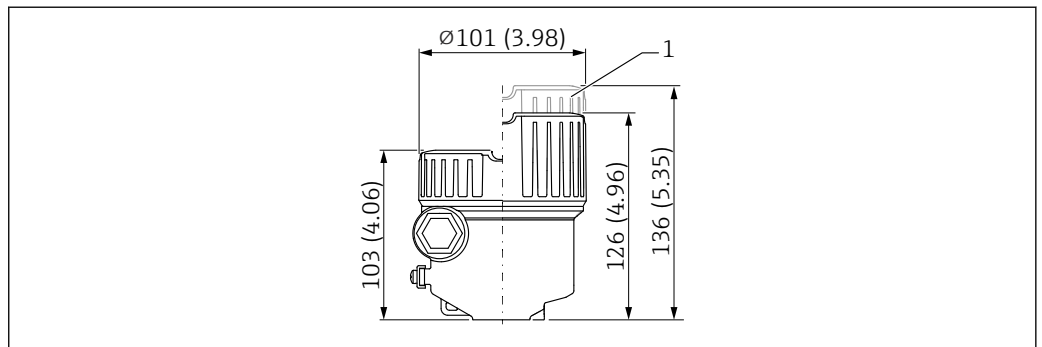
*Dimensions of housing and cover*



32 Single compartment; plastic; Product Configurator: order code for "Housing; material", option A. Unit of measurement mm (in)

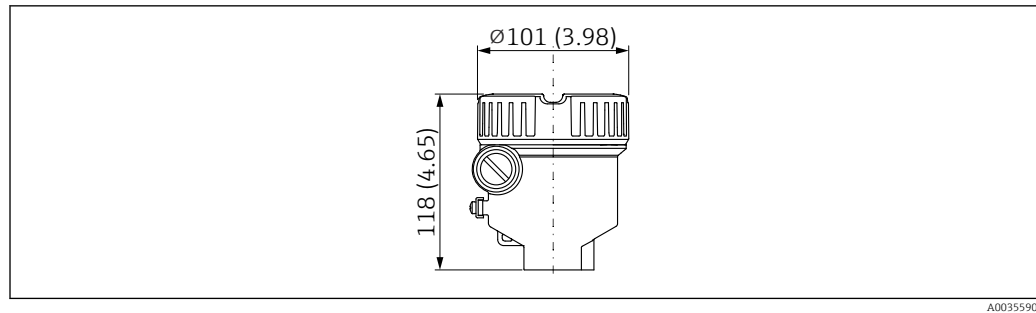


33 Single compartment; aluminum, coated; with Ex d/XP approval; Product Configurator: order code for "Housing; material", option B. Unit of measurement mm (in)

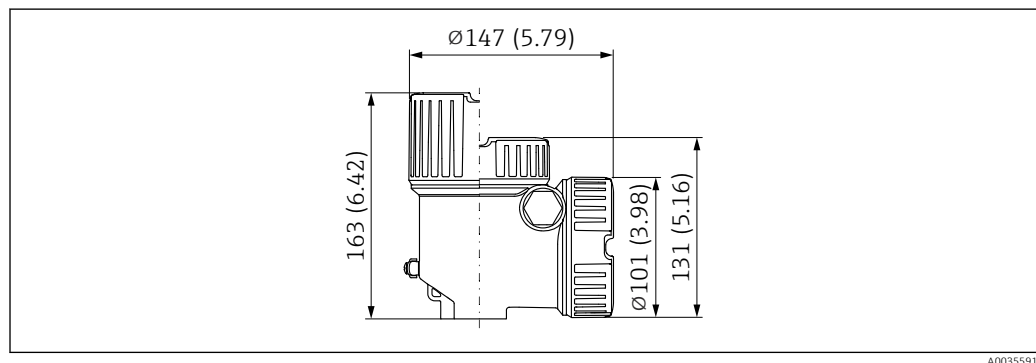


34 Single compartment; aluminum, coated; Product Configurator: order code for "Housing; material", option B. Unit of measurement mm (in)

1 Cover for Ex ec approval



■ 35 Single compartment 316L, cast; with Ex d/XP approval also; Product Configurator: order code for "Housing; material", option C. Unit of measurement mm (in)



■ 36 Dual compartment, L-shaped; aluminum, coated; with Ex d/XP approval also; Product Configurator: order code for "Housing; material", option M. Unit of measurement mm (in)

#### Ground terminal

- Ground terminal inside the housing, max. conductor cross-section 2.5 mm<sup>2</sup> (14 AWG)
- Ground terminal outside the housing, max. conductor cross-section 4 mm<sup>2</sup> (12 AWG)
- If safety extra-low voltage is used to supply power to electronic inserts, do not connect protective ground

#### 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)

The scope of delivery comprises:

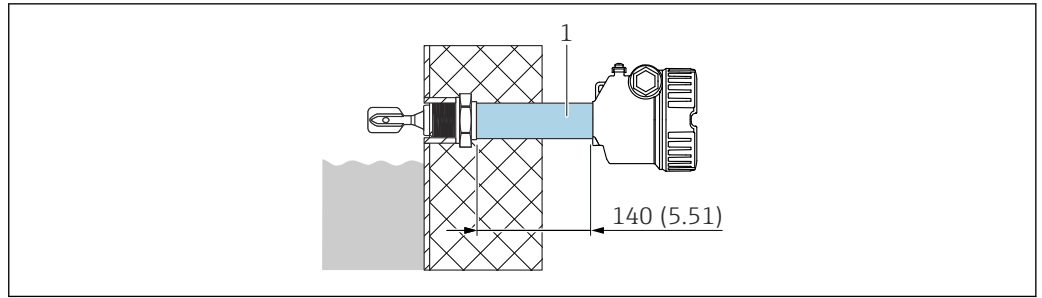
- 1 cable gland installed
- 1 cable gland sealed with dummy plug

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

Exceptions: With Ex d/XP, only threaded entries are permitted.

#### Temperature spacer, pressure-tight feedthrough (optional)

Provides sealed insulation for the vessel and a normal ambient temperature for the housing




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Unit of measurement mm (in)

1 Temperature spacer or pressure-tight feedthrough

Product Configurator, order code for "Sensor design":

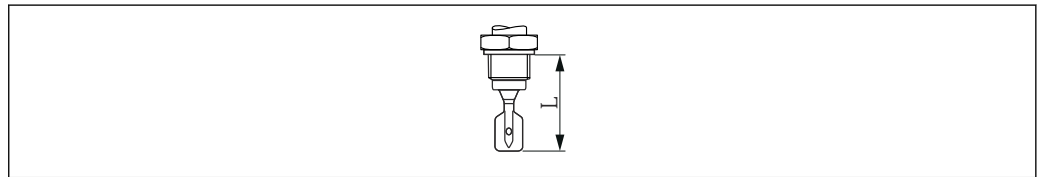
- Option "MR" for temperature spacer
- Option "MS" for pressure-tight feedthrough (second line of defense)  
In the event of damage to the sensor, protects the housing from exposure to vessel pressures up to 100 bar (1 450 psi).

 The "Pressure-tight feedthrough" option can only be selected in conjunction with the "Temperature spacer" option.


### Probe design

#### Compact

- Material: 316L or Alloy C
- Sensor length L: depends on process connection  
See "Process connections" section: thread G, ASME B1.20.3 MNPT, EN10226 R, Tri-Clamp



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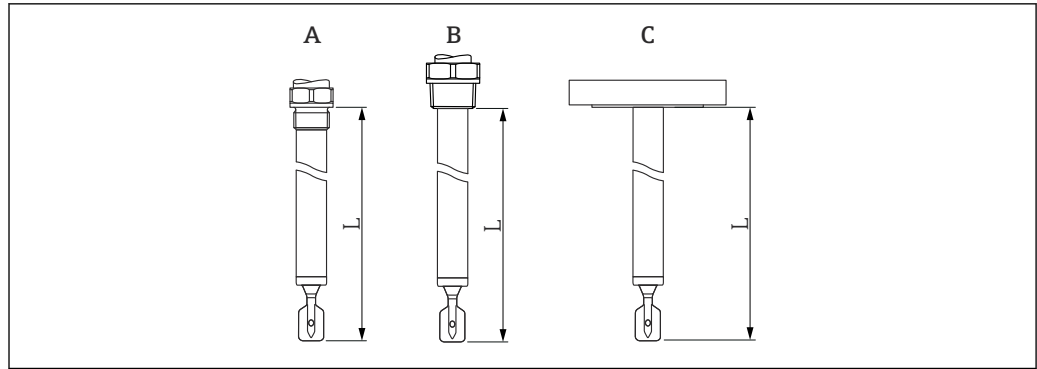
 37 Probe design: compact, sensor length L

#### Short pipe

- Material: 316L, sensor length L: depends on process connection
- Material: Alloy C, sensor length L: depends on process connection
  - Flange = 115 mm (4.53 in)
  - Thread G 3/4 = 115 mm (4.53 in)
  - Thread G 1 = 118 mm (4.65 in)
  - Thread NPT, R = 99 mm (3.9 in)
  - Tri-Clamp = 115 mm (4.53 in)

#### Pipe extension

- Material: 316L, sensor length L: 117 to 6 000 mm (4.7 to 236 in)
- Material: Alloy C, sensor lengths L: 148 to 3 000 mm (5.9 to 118 in)

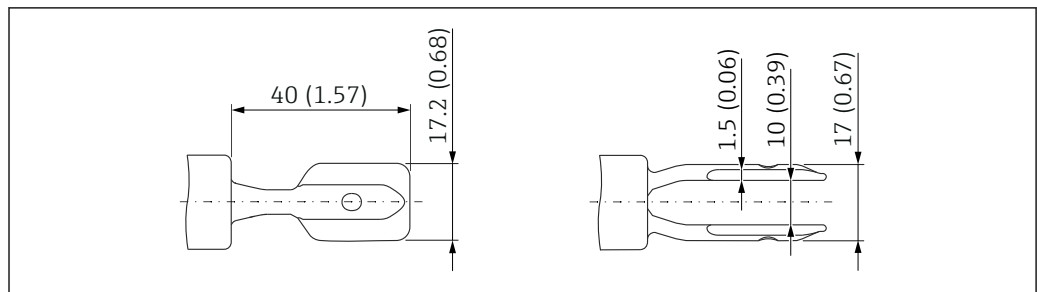


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38 Probe designs: pipe extension, short pipe, sensor length L

- A G 3/4, G 1
- B NPT 3/4, NPT 1, R 3/4, R 1
- C Flange, Tri-Clamp

### Tuning fork



A0038269

39 Tuning fork. Unit of measurement mm (in)

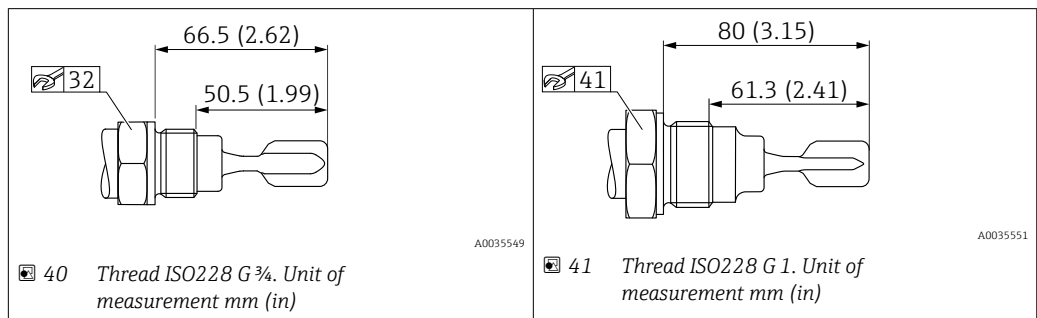
### Process connections

Thread ISO228 G for installing in weld-in adapter

G 3/4, G 1 suitable for installing in weld-in adapter

- Material: 316L
- Pressure rating, temperature: ≤ 40 bar (580 psi), ≤ 100 °C (212 °F)
- Pressure rating, temperature: ≤ 25 bar (363 psi), ≤ 150 °C (302 °F)
- Weight: 0.2 kg (0.44 lb)
- Accessory: weld-in adapter

**i** The weld-in adapter is not included in the scope of delivery.



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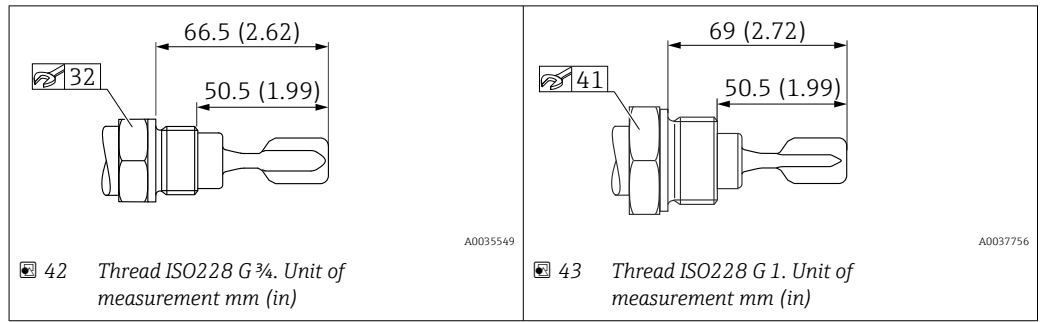
A0035551

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

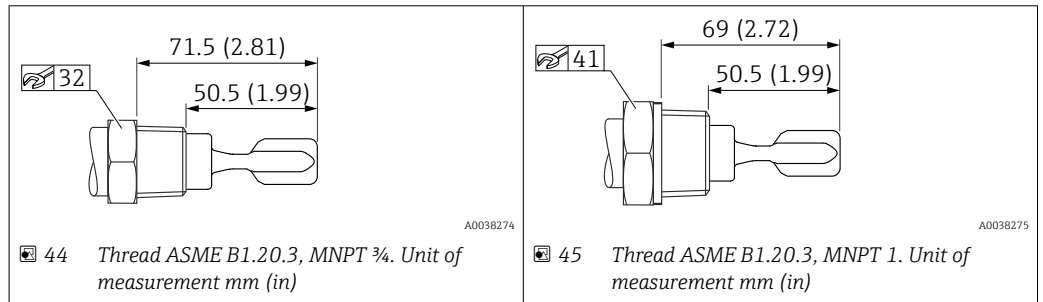
41 Thread ISO228 G 1. Unit of measurement mm (in)



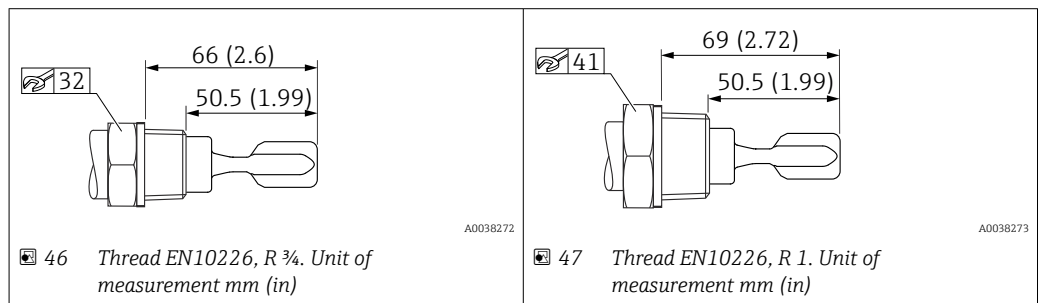
Thread ISO228 G with flat seal



Thread ASME B1.20.3, MNPT



Thread EN10226, R

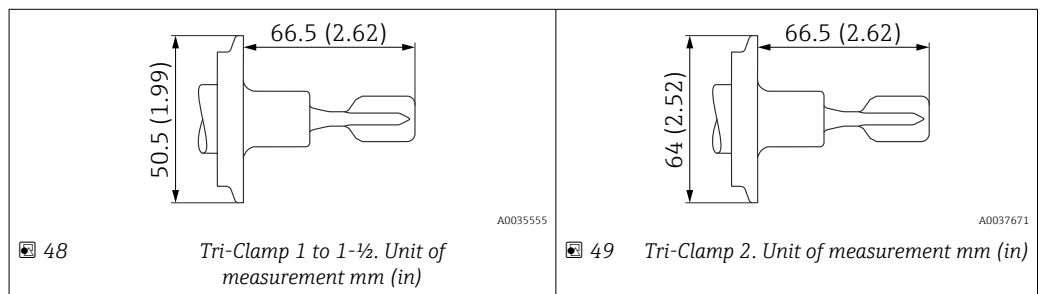


Tri-Clamp

Version ISO2852 DN25-38 (1 to 1-½), DIN32676 DN25-40

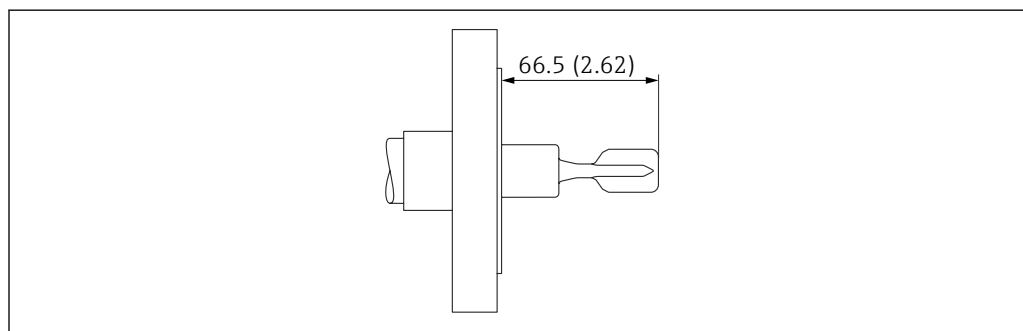
- Material: 316L
- Pressure rating: ≤ 25 bar (363 psi)
- Temperature: ≤ 150 °C (302 °F)
- Weight: 0.1 kg (0.22 lb)

**i** The maximum temperature and the maximum pressure are dependent on the clamping ring and the seal used. The lowest value applies in each case.



*Sensor dimensions in the case of flanges*

AlloyC22-plated flanges are available for higher chemical resistance.  
The flange carrier material is made of 316L and is welded to an AlloyC22 disk.



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

*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 1-¼"	316/316L	1.2 kg (2.65 lb)
Cl.150	NPS 2"	316/316L	2.4 kg (5.29 lb)
Cl.150	NPS 2"	AlloyC22>316/316L	2.4 kg (5.29 lb)
Cl.150	NPS 1-½"	316/316L	1.5 kg (3.31 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 1-¼"	316/316L	2.0 kg (4.41 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 3"	316/316L	6.8 kg (14.99 lb)
Cl.300	NPS 3"	AlloyC22>316/316L	6.8 kg (14.99 lb)
Cl.300	NPS 4"	316/316L	11.5 kg (25.6 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)

*ASME B16.5 flanges, FF*

Pressure rating	Type	Material	Weight
Cl.150	NPS 1"	316/316L	1.0 kg (2.21 lb)1 (2.21)
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)

*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 4"	316/316L	11.5 kg (25.6 lb)

Pressure rating	Type	Material	Weight
Cl.600	NPS 2"	316/316L	4.2 kg (9.26 lb)
Cl.600	NPS 3"	316/316L	6.2 kg (13.67 lb)

*EN flanges EN 1092-1, A*

Pressure rating	Type	Material	Weight
PN6	DN32	316L (1.4404)	1.2 kg (2.65 lb)
PN6	DN40	316L (1.4404)	1.4 kg (3.09 lb)
PN6	DN50	316L (1.4404)	1.6 kg (3.53 lb)
PN10/16	DN80	316L (1.4404)	4.8 kg (10.58 lb)
PN10/16	DN100	316L (1.4404)	5.6 kg (12.35 lb)
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)
PN40	DN50	316L (1.4404)	3.2 kg (7.06 lb)
PN100	DN50	316L (1.4404)	5.5 kg (12.13 lb)

*EN flanges EN 1092-1, B1*

Pressure rating	Type	Material	Weight
PN6	DN32	316L (1.4404)	1.2 kg (2.65 lb)
PN6	DN50	316L (1.4404)	1.6 kg (3.53 lb)
PN6	DN50	AlloyC22>316L	1.6 kg (3.53 lb)
PN10/16	DN100	316L (1.4404)	5.6 kg (12.35 lb)
PN10/16	DN100	AlloyC22>316L	5.6 kg (12.35 lb)
PN25/40	DN25	316L (1.4404)	1.4 kg (3.09 lb)
PN25/40	DN25	AlloyC22>316L	1.4 kg (3.09 lb)
PN25/40	DN50	316L (1.4404)	3.2 kg (7.06 lb)
PN25/40	DN50	AlloyC22>316L	3.2 kg (7.06 lb)
PN25/40	DN80	316L (1.4404)	5.9 kg (13.01 lb)
PN25/40	DN80	AlloyC22>316L	5.2 kg (11.47 lb)
PN100	DN50	316L (1.4404)	5.5 kg (12.13 lb)

*EN flanges EN 1092-1, C*

Type	Material	Pressure rating	Weight
DN32	316L (1.4404)	PN6	1.2 kg (2.65 lb)
DN50	316L (1.4404)	PN25/40	3.2 kg (7.06 lb)

*EN flanges EN 1092-1, D*

Type	Material	Pressure rating	Weight
DN32	316L (1.4404)	PN6	1.2 kg (2.65 lb)
DN50	316L (1.4404)	PN25/40	3.2 kg (7.06 lb)

*EN flanges EN 1092-1, E*

Type	Material	Pressure rating	Weight
DN32	316L (1.4404)	PN6	1.2 kg (2.65 lb)
DN50	316L (1.4404)	PN25/40	3.2 kg (7.06 lb)

*JIS flanges B2220*

Pressure rating	Type	Material	Weight
10K	10K 25A	316L (1.4404)	1.3 kg (2.87 lb)
10K	10K 40A	316L (1.4404)	1.5 kg (3.31 lb)
10K	10K 50A	316L (1.4404)	1.7 kg (3.75 lb)
10K	10K 50A	AlloyC22>316L	1.7 kg (3.75 lb)
10K	10K 80A	316L (1.4404)	2.2 kg (4.85 lb)
10K	10K 100A	316L (1.4404)	2.8 kg (6.17 lb)

*Process connection, sealing surface*

- Thread ISO228, G
- Thread ASME, MNPT
- Thread EN10226, R
- Tri-Clamp ISO2852
- 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)

**Weight****Basic weight: 0.65 kg (1.43 lb)**

The basic weight comprises:

- Sensor (compact)
- Electronic insert
- Housing: single compartment, plastic with cover
- Thread, G ¾"



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

**In addition to the basic weight:****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 with LED module or Bluetooth module with high cover: 0.38 kg (0.84 lb)
- 316L cast: 1.21 kg (2.67 lb)
- Dual compartment, L-shaped; aluminum, coated: 1.22 kg (2.69 lb)  
optional with LED module or Bluetooth module with high cover: 0.38 kg (0.84 lb)

**Temperature spacer**

0.6 kg (1.32 lb)

**Pressure-tight feedthrough**

0.7 kg (1.54 lb)

**Pipe extension**

- 1000 mm: 0.9 kg (1.98 lb)
- 100 in: 2.3 kg (5.07 lb)


**Process connections**

See "Process connections" section

**Plastic protective cover**

0.2 kg (0.44 lb)

**Materials****Materials in contact with process**

- Process connection: 316L (1.4404 or 1.4435)
- Pipe extension: 316L (1.4404 or 1.4435)
- Flat seal for process connection G  $\frac{3}{4}$  or G 1: fiber-reinforced elastomer seal, asbestos-free as per DIN 7603
- For flanges,  "Mechanical construction" section
- Flange plating: Alloy C22 (2.4602)
- Tuning fork: 316L (1.4435), optional (Alloy C22)

**Seals**

Seal included in delivery:

Metrical threads G  $\frac{3}{4}$ , G 1 standard, flat seal as per DIN7603

Seal not included in delivery:

- Tri-Clamp
- Flanges
- R and NPT thread
- Metrical threads G  $\frac{3}{4}$ , G 1 for installation in weld-in adapter

**Materials not in contact with process****Plastic housing**

- Housing: PBT/PC
- Dummy cover: PBT/PC
- Transparent cover: PBT/PC or PA12
- 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
- Adapter as substitute for cable glands: 316L
- Nameplate: plastic foil
- TAG sign: plastic film, metal, or provided by customer

**Aluminum housing, coated**

- Housing: EN AC 44300 aluminum
- Dummy cover: EN AC 44300 aluminum
- Cover with sight glass: EN AC 44300 aluminum, PC Lexan 943A synthetic glass  
Cover with viewing window made of polycarbonate, optionally available to order. For Ex d applications, the sight glass is made from borosilicate.
- Cover seal materials: HNBR
- Cover seal materials: FVMQ (in low-temperature version only)
- Nameplate: plastic foil
- TAG sign: plastic film, stainless steel, or provided by customer
- M20 cable glands: select material (stainless steel, nickel-plated brass, polyamide)

**Stainless steel housing**

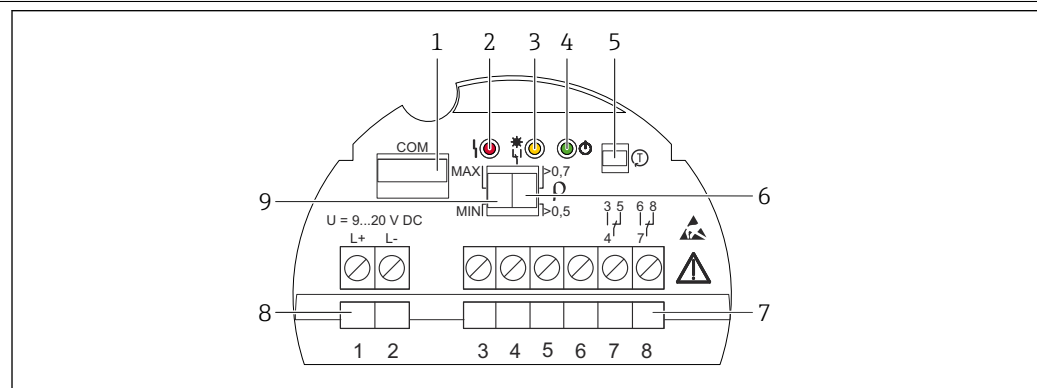
- Housing: stainless steel AISI 316L (1.4409)
- Cover: AISI 316L (1.4409)
- Cover seal materials: FVMQ (in low temperature version only)
- Cover seal materials: HNBR
- Nameplate: stainless steel 316L
- TAG sign: plastic film, stainless steel, or provided by customer
- M20 cable glands: select material (stainless steel, nickel-plated brass, polyamide)

**Surface roughness**

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

**Operability****Operating concept**

- Operation with button and DIP switches on the electronic insert
- Display with optional Bluetooth module and SmartBlue (app) via Bluetooth® wireless technology
- Indication of operational status (switch status or alarm status) with optional LED module (lights visible from the outside)
  - For plastic housing and aluminum housing (standard and Ex d) in conjunction with the DC-PNP (electronic insert FEL62) and relay electronics (electronic inserts FEL64, FEL64DC)
  - Ordering information: Product Configurator, order code for "Display; operation" option "B"

**Elements on the electronic insert**

51 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

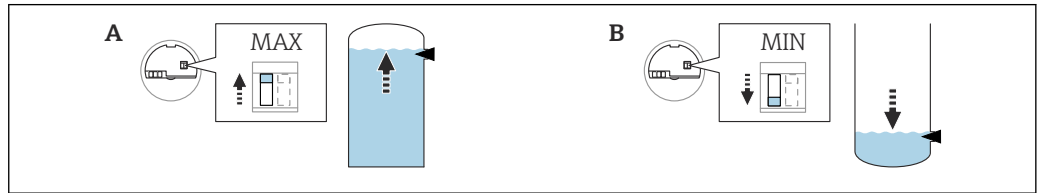
**Terminals**

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

Local operation

Operation at electronic insert

MAX/MIN fail-safe mode



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52 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 overfill 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



A0033471

53 Switch position on the electronic insert for density

Liquids with density > 0.7 g/cm<sup>3</sup>

Switch position > 0.7 g/cm<sup>3</sup> (as-delivered state)

Liquids with density 0.5 to 0.8 g/cm<sup>3</sup>

Switch position > 0.5 g/cm<sup>3</sup> (can be configured via DIP switch)

Optionally available to order: liquids with density > 0.4 g/cm<sup>3</sup> or > 0.5 g/cm<sup>3</sup> (not for devices with SIL approval)

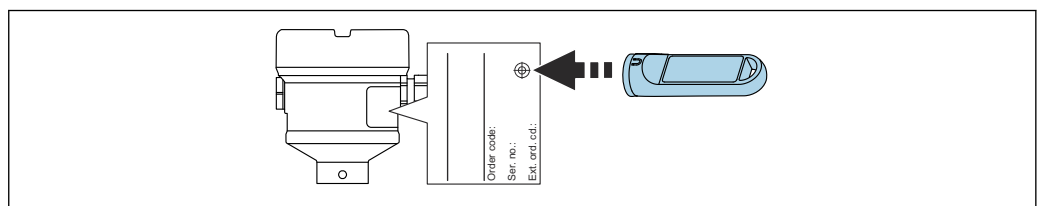
Fixed value that cannot be edited. The function of the DIP switch is interrupted.

Functional test of the electronic switch with a test magnet

The test magnet can be ordered as an option; Product Configurator: order code for "Enclosed accessories", option R6 "Test magnet".

Possible for the following electronic inserts: FEL62, FEL64, FEL64DC, FEL68.

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.

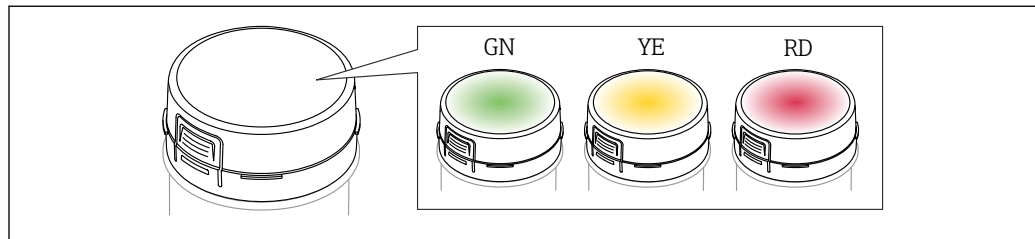


A0033419

54 Functional test with test magnet

**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.



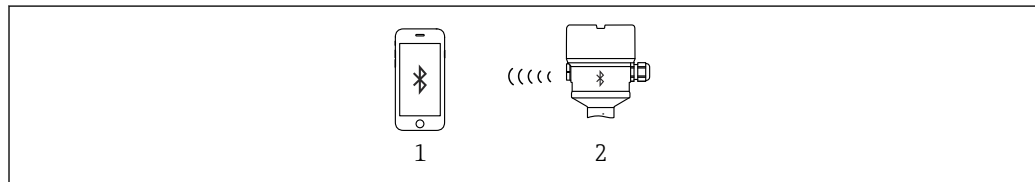
A0043925

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

Additional information → 17 and in the Accessories section

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

Access via Bluetooth® wireless technology



A0033411

56 Remote operation via Bluetooth® wireless technology

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

Bluetooth module VU121 (optional)

Functions

- Connection via COM interface: Bluetooth module for device diagnostics via a smartphone app or tablet app
- Display the battery status via app when used with electronic insert FEL68 (NAMUR)
- User guidance (wizard) for SIL/WHG proof testing
- Visible in the livelist 10 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 vibration frequency and the switching state of the device

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

Heartbeat Technology

Additional details 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 test**

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

 The certificates, approvals and other documentation currently available can be accessed as follows:  
Endress+Hauser website: [www.endress.com](http://www.endress.com) → 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-Tick 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 are labelled with the RCM- Tick marking on the name plate.



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.

 Ex temperature class: T1 to T6  
If using type of protection Ex i and electronic insert FEL68 (NAMUR) and the Bluetooth module in addition (battery required): T4 to T1.


#### Explosion-protected smartphones and tablets

If used in hazardous areas, mobile end devices with an Ex approval must be used.

### Overfill protection


Before mounting the device, observe the documentation from the WHG approvals (German Federal Water Act).

Approved for overfill protection and leakage detection.

 Ordering information: Product Configurator, order code for "Additional approval", option "LD"

### Functional safety

The Liquiphant has been developed according to the IEC 61508 standard. The device is suitable for overfill prevention and dry-running protection up to SIL 2 (SIL 3 with homogeneous redundancy). For a detailed description of the safety functions with the Liquiphant, settings and functional safety data, see the "Functional Safety Manual" on the Endress+Hauser website: [www.endress.com](http://www.endress.com) → Downloads.

 Ordering information: Product Configurator, order code for "Additional approval", option "LA"  
Subsequent confirmation of usability according to IEC 61508 is not possible.

**Marine approvals**

- ABS (American Bureau of Shipping), option "LF"
- LR (Lloyd's Register) marine approval, option "LG"
- BV (Bureau Veritas) marine approval, option "LH", → pending
- GL (Germanischer Lloyd)/DNV (Det Norske Veritas), option "LJ"



Ordering information: Product Configurator, order code for "Additional approval", for option see items listed.

**Radio approval**

Further information and the documentation currently available can be found on the Endress+Hauser website: [www.endress.com](http://www.endress.com) → Downloads.

**CRN approval**

Versions with a CRN approval (Canadian Registration Number) are listed in the corresponding registration documents. CRN-approved devices are marked with a registration number.

Any restrictions regarding the maximum process pressure values are listed on the CRN certificate.



Ordering information: Product Configurator, order code for "Additional approval", option "LS"

**Inspection certificates****Test, certificate, declaration**

The following documents can be ordered:

- Inspection certificate 3.1, EN10204 (material certificate, wetted parts)
- NACE MRO175 / ISO 15156 (wetted parts), declaration
- NACE MRO103 / ISO 17945 (wetted parts), declaration
- AD 2000 (wetted parts), declaration, excluding cast parts
- ASME B31.3 Process Piping, declaration
- Pressure test, internal procedure, test report
- Helium leak test, internal procedure, test report
- Material identification check (PMI), internal procedure (wetted parts), test report
- Penetrant testing AD2000-HP5-3(PT), wetted/pressurized metal parts, inspection certificate
- Penetrant testing ISO23277-1 (PT), wetted/pressurized metal parts, inspection certificate
- Penetrant testing ASME VIII-1 (PT), wetted/pressurized metal parts, inspection certificate
- Welding documentation, wetted/pressurized seams



Ordering information: Product Configurator, order code for "Additional approval", option "LS"



The documentation currently available can be found on the Endress+Hauser- website: [www.endress.com](http://www.endress.com) → Downloads or using the serial number of the device under Online Tools in the Device Viewer.

**Service**

- Cleaned of oil+grease (wetted)
- PWIS-free (paint-wetting impairment substances)
- Switching delay setting to be spec.
- Setting for MIN safety mode
- Default density setting > 0.4 g/cm<sup>3</sup>
- Default density setting > 0.5 g/cm<sup>3</sup>

*Hard-copy product documentation*

Hard-copy versions of the test reports, declarations and inspection certificates can also be order via order code 570 "Service", option I7 "Hard-copy product documentation". The documents are then provided with the device upon delivery.


**Pressure Equipment Directive****Pressure equipment with allowable pressure ≤ 200 bar (2 900 psi)**

Pressure instruments with a flange and threaded boss that do not have a pressurized housing do not fall within the scope of the Pressure Equipment Directive, irrespective of the maximum allowable pressure.


*Reasons:*

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".

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.

<b>Process seal as per ANSI/ISA 12.27.01</b>	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.
	 Aluminum, stainless steel and plastic housing are approved as single-seal devices.
<b>China RoHS symbol</b>	China RoHS 1, law SJ/T 11363-2006: The measuring system complies with the substance restrictions of the Restriction on Hazardous Substances Directive (RoHS).
<b>RoHS</b>	The measuring system complies with the substance restrictions of the Restriction on Hazardous Substances Directive 2011/65/EU (RoHS 2).
<b>Additional certification</b>	<p><b>EAC conformity</b></p> <p>The measuring system meets the legal requirements of the applicable EAC guidelines. These are listed in the corresponding EAC Declaration of Conformity together with the standards applied.</p> <p>The manufacturer confirms successful testing of the device by affixing to it the EAC mark.</p>
<b>ASME B 31.3</b>	Design and materials in accordance with ASME B31.3. 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.

## Ordering information

<b>Ordering information</b>	Detailed ordering information is available from your nearest sales organization <a href="http://www.addresses.endress.com">www.addresses.endress.com</a> or in the Product Configurator under <a href="http://www.endress.com">www.endress.com</a> :
	<ol style="list-style-type: none"> <li>1. Click Corporate</li> <li>2. Select the country</li> <li>3. Click Products</li> <li>4. Select the product using the filters and search field</li> <li>5. Open the product page</li> </ol>
	The Configuration button opens the Product Configurator.
	<p> <b>Product Configurator - the tool for individual product configuration</b></p> <ul style="list-style-type: none"> <li>■ Up-to-the-minute configuration data</li> <li>■ Depending on the device: Direct input of measuring point-specific information such as measuring range or operating language</li> <li>■ Automatic verification of exclusion criteria</li> <li>■ Automatic creation of the order code and its breakdown in PDF or Excel output format</li> <li>■ Ability to order directly in the Endress+Hauser Online Shop</li> </ul>

<b>TAG</b>	<p><b>Measuring point (TAG)</b></p> <p>The device can be ordered with a tag name.</p>
	<p><b>Position of the tag marking</b></p> <p>Choose from the following in the additional specification:</p> <ul style="list-style-type: none"> <li>■ Tag plate, stainless steel</li> <li>■ Plastic film</li> <li>■ Supplied label/plate</li> <li>■ RFID TAG</li> <li>■ RFID TAG + tag plate stainless steel</li> <li>■ RFID TAG + plastic film</li> <li>■ RFID TAG + supplied label/plate</li> </ul>

**Definition of the tag name**

Specify in the additional specification:

3 lines containing up to 18 characters each

The specified tag name appears on the selected label and/or on the RFID TAG.

**Presentation in the SmartBlue app**

The first 32 characters of the tag name

The tag name can always be changed specifically for the measuring point via Bluetooth.

## Application packages



Ordering information in the Product Configurator:

- Order code for "Application package", option EH "Heartbeat Verification + Monitoring" can only be selected in conjunction with optional Bluetooth module:  
Order code for "Accessory mounted", option "NF"
- In conjunction with electronic insert FEL68 (2-wire NAMUR):  
Order code for "Application package", option EL "Prepared for Heartbeat Verification + Monitoring"  
The Bluetooth module, including the required battery, must be ordered separately in this case:  
Order code for "Accessories", option NG "Prepared for Bluetooth".

Order options that must be selected together, or that are mutually exclusive, are automatically displayed in the Product Configurator.

**Heartbeat Technology module****Heartbeat Diagnostics**

Continuously monitor and analyze the device status and process conditions. Generate diagnostic messages with corrective measures in accordance with NAMUR NE 107 when certain events occur.

**Heartbeat Verification**

Performs on-demand verification of the current device status and generates the Heartbeat Technology verification report, which shows the result of the verification.

**Heartbeat Monitoring**

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

**Heartbeat Verification**

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

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

**Proof-testing for SIL/WHG devices**

Only available for devices with SIL or WHG approval

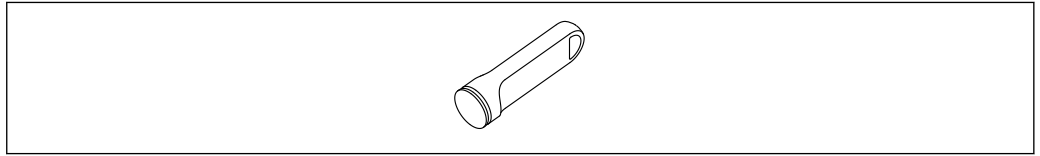
The "SIL Prooftest", "WHG Prooftest" or "SIL/WHG Prooftest" module includes a wizard for the proof-testing that is required at appropriate intervals for the following applications: SIL (IEC61508/IEC61511), WHG (German Federal Water Act):

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

## Accessories

### Test magnet

Order number: 71437508

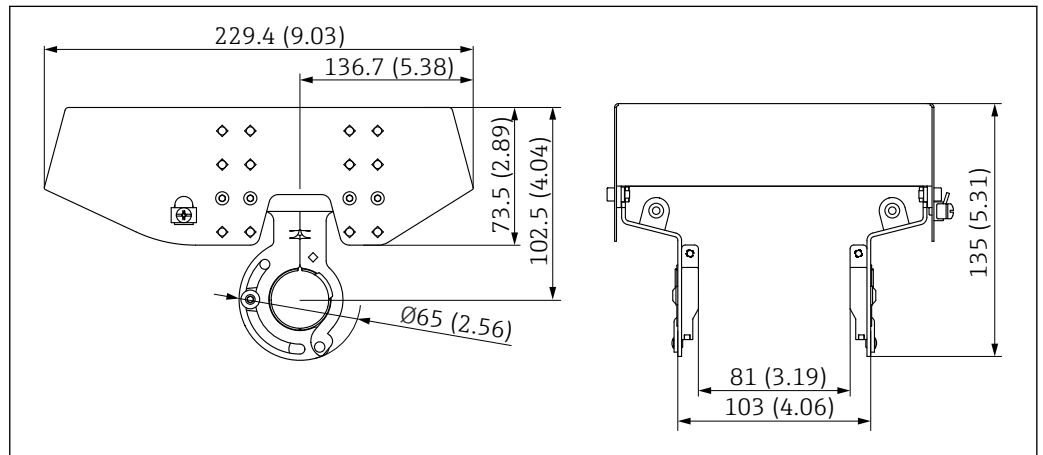


A0039209

57 Test magnet

### Weather protection cover for dual-compartment housing, aluminum

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

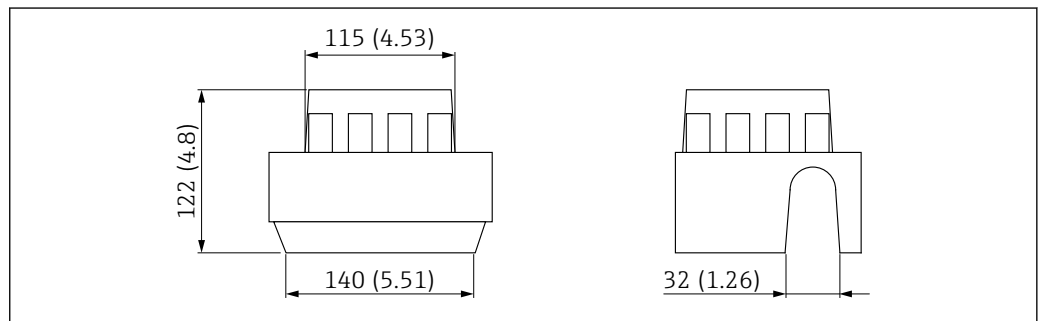


A0039231

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

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

- Material: plastic
- Order number: 71438291



A0039280

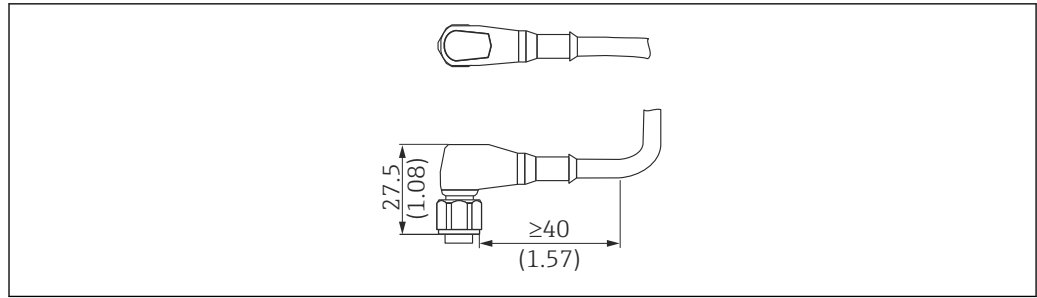
59 Protective cover for single compartment housing, aluminum or 316L. Unit of measurement mm (in)

### Plug-in jack

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

#### Plug-in jack M12 IP69

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

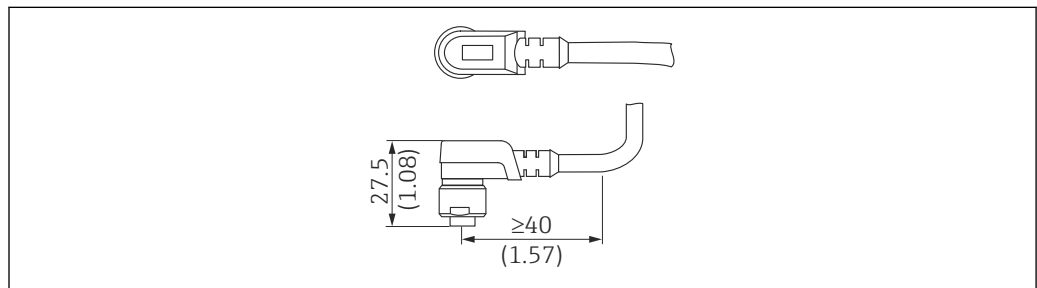


A0023713

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

#### Plug-in jack M12 IP67

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



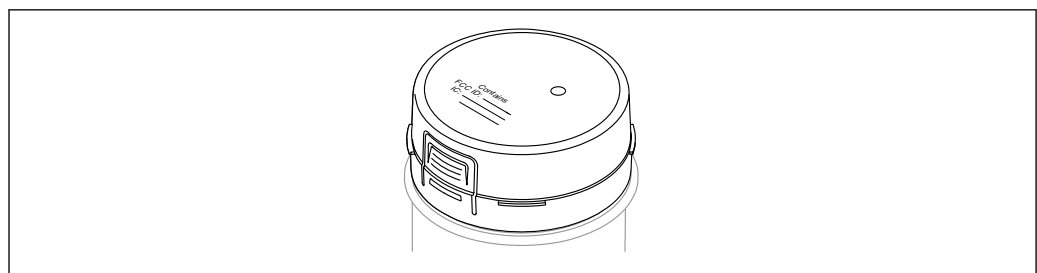
A0022292

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

#### 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

62 Bluetooth module VU121

More detailed information and documentation are available:

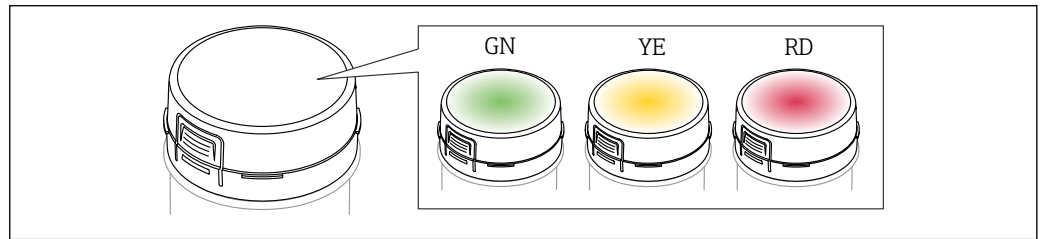
- Product Configurator on the Endress+Hauser website [www.endress.com](http://www.endress.com)
- Endress+Hauser sales organization [www.addresses.endress.com](http://www.addresses.endress.com)

**i** A tall cover is required (transparent plastic cover or aluminum cover with sight glass) when using or retrofitting the Bluetooth module. Use with the Bluetooth module is not possible for the single compartment housing, 316L cast. 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



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

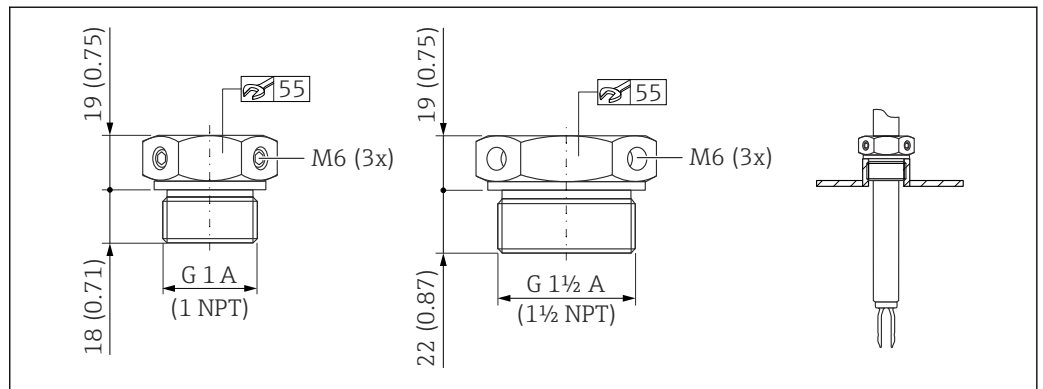
More detailed information and documentation are available:

- Product Configurator on the Endress+Hauser website [www.endress.com](http://www.endress.com)
- Endress+Hauser sales organization [www.addresses.endress.com](http://www.addresses.endress.com)

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

**Sliding sleeves for unpressurized operation**

Switch point, infinitely adjustable.



64 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 1 1/2, 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

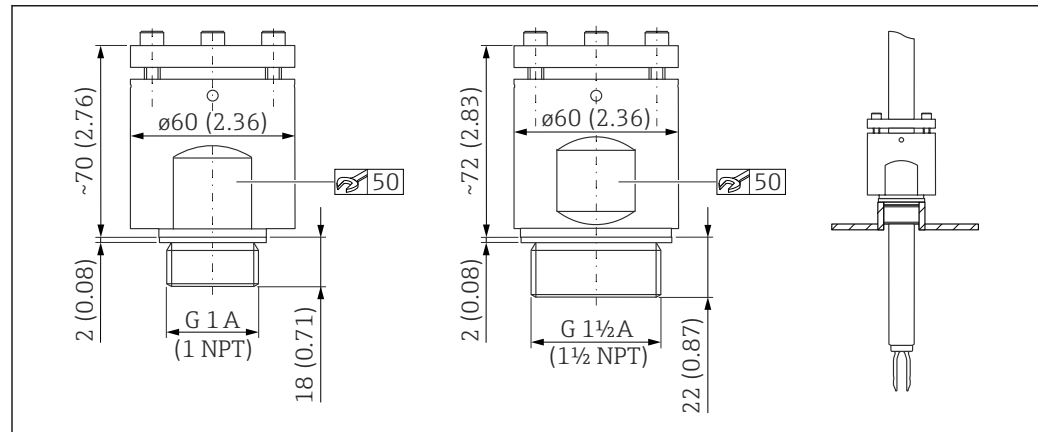
NPT 1 1/2, ASME B 1.20.1

- 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

- i More detailed information and documentation are available:
  - Product Configurator on the Endress+Hauser website [www.endress.com](http://www.endress.com)
  - Endress+Hauser sales organization [www.addresses.endress.com](http://www.addresses.endress.com)

### High pressure sliding sleeves

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



A0037667

i 65 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: AlloyC22
- Weight: 1.13 kg (2.49 lb)
- Approval: with inspection certificate EN 10204 - 3.1 material
- Order number: 71118691

#### NPT 1, ASME B 1.20.1

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

#### NPT 1, ASME B 1.20.1

- Material: AlloyC22
- Weight: 1.13 kg (2.49 lb)
- Approval: with inspection certificate EN 10204 - 3.1 material
- Order number: 71118694

#### G 1½, DIN ISO 228/1

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

#### G 1½, DIN ISO 228/1

- Material: AlloyC22
- Weight: 1.32 kg (2.91 lb)
- Approval: with inspection certificate EN 10204 - 3.1 material
- Order number: 71118693




NPT 1½, ASME B 1.20.1

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


NPT 1½, ASME B 1.20.1

- Material: AlloyC22
- Weight: 1.32 kg (2.91 lb)
- Approval: with inspection certificate EN 10204 - 3.1 material
- Order number: 71118695

 More detailed information and documentation are available:

- Product Configurator on the Endress+Hauser website [www.endress.com](http://www.endress.com)
- Endress+Hauser sales organization [www.addresses.endress.com](http://www.addresses.endress.com)

## Supplementary documentation

 The certificates, approvals and other documentation currently available can be accessed as follows:  
Endress+Hauser website: [www.endress.com](http://www.endress.com) → Downloads.

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### Special Documentation

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

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### Supplementary device-dependent documentation

#### Document type: Operating Instructions (BA)

Installation and initial commissioning – contains all functions in the operating menu that are required for a typical measuring task. Functions beyond this scope are not included.  
BA01894F

#### Document type: Brief Operating Instructions (KA)

Quick guide to the first measured value – includes all essential information from the incoming acceptance to the electrical connection.  
KA01429F

#### Document type: Safety Instructions, certificates

Depending on the approval, Safety Instructions are also supplied with the device, e. g. XA. This documentation is an integral part of the Operating Instructions.  
The nameplate indicates the Safety Instructions (XA) that are relevant to the device.

## Registered trademarks

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