

Technical Information

Liquicap FMI43

Capacitance level measurement

Level measurement in hygienic applications



Field of application

- Universally applicable, also for small vessels and tight installation conditions
- Very fast response times to changes in level, e.g. in filling plants
- Suitable for interface measurement
- For low relative permittivity media, e.g. oils, nitrogen, hydrogen
- Measuring range: 0.05 to 4 m (0.2 to 13 ft); > 4 m (13 ft) on request
- Process pressure range: Vacuum up to 100 bar (1 450 psi)
- Process temperature range: -80 to 200 °C (-112 to 392 °F)

Benefits

- Multi-frequency measuring technology to achieve high accuracy and reliable build-up compensation even under difficult conditions
- No adjustment necessary during commissioning (factory adjustment)
- Robust, FDA-compliant materials for maximum safety
- International Ex certificates, WHG (German Resources Act) overfill protection system, hygienic approvals
- Heartbeat Technology - continuous diagnostics, traceable in-situ device verification and predictive maintenance
- Bluetooth® wireless technology for commissioning, operation and maintenance
- CIP and SIP capability - Degree of protection: IP66/68/69

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About this document

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 potentially dangerous situation. Failure to avoid this situation can result in serious or fatal injury.



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



This symbol alerts you to a potentially harmful situation. Failure to avoid this situation can result in damage to the product or something in its vicinity.

Communication-specific symbols



Bluetooth® wireless technology
Wireless data transmission between devices over a short distance via radio technology.

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



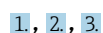
Reference to page



Reference to graphic



Notice or individual step to be observed



Series of steps



Result of a step

Symbols in graphics

1, 2, 3, ...
Item numbers

A, B, C, ...
Views

List of abbreviations

ϵ_r
Relative permittivity

PFA
Perfluoroalkoxy alkane

PTFE
Polytetrafluorethylene

PN
Nominal pressure

MWP
Maximum working pressure
The maximum working pressure is indicated on the nameplate.

PPE
Personal protective equipment

SELV
Safety Extra Low Voltage, protective extra-low voltage with safe electrical isolation

PELV

Protective Extra Low Voltage with protective earthing

DTM

Device Type Manager

Operating tool

The term "operating tool" is used in place of the following operating software:

- FieldCare / DeviceCare, for operation via HART communication, IO-Link communication and PC
- SmartBlue app for operation using an Android or iOS smartphone or tablet

PLC

Programmable logic controller (PLC)

Graphic conventions

- Installation, explosion and electrical connection drawings are presented in simplified format
- Devices, assemblies, components and dimensional drawings are presented in reduced-line format
- Dimensional drawings are not to-scale representations; the dimensions indicated are rounded off to 2 decimal places
- Unless otherwise described, flanges are presented with sealing surface form EN 1092-1; ASME B16.5, RF.

Function and system design

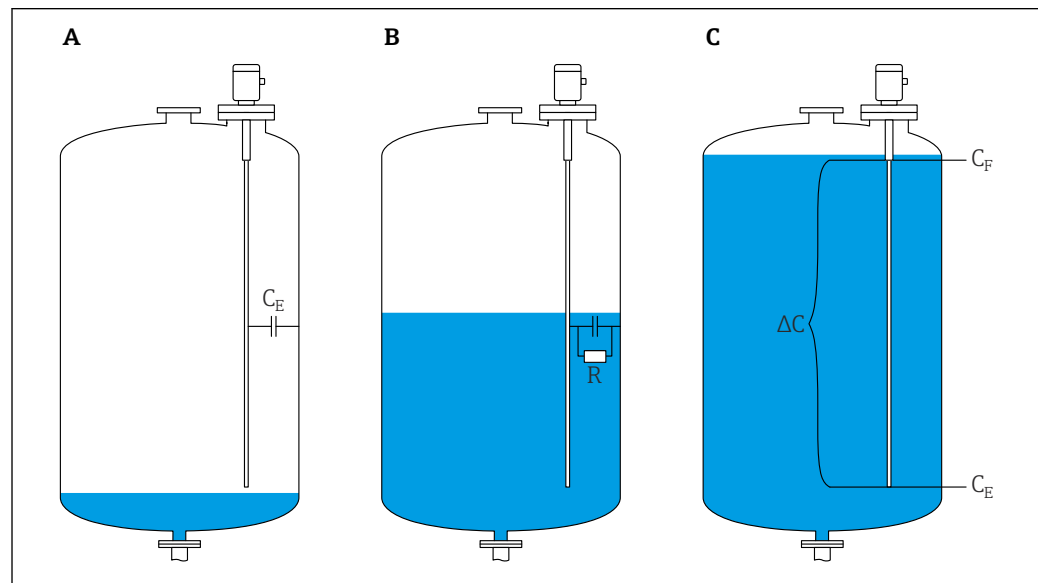
Measuring principle

Capacitance level measurement: Basic principles

Capacitance level measurement is based on the level-dependent capacitance of a capacitor. A capacitance probe forms the first electrode of this capacitor. The second electrode depends on the situation:

- The vessel wall (for conductive vessels)
- A ground tube
- A metal plate or a ground rod at the device's process connection

As the fill level increases, the capacitance will also increase.



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1 Capacitance level measurement with a rod probe with inactive length as an example

A Probe uncovered

B Probe partially covered

C Probe fully covered

R Resistance, depending on the level, vessel geometry and medium conductivity

C_F Capacitance full calibration (probe covered)

C_E Capacitance empty calibration (probe uncovered)

ΔC Change in capacitance (measuring span)

Phase-selective measurement

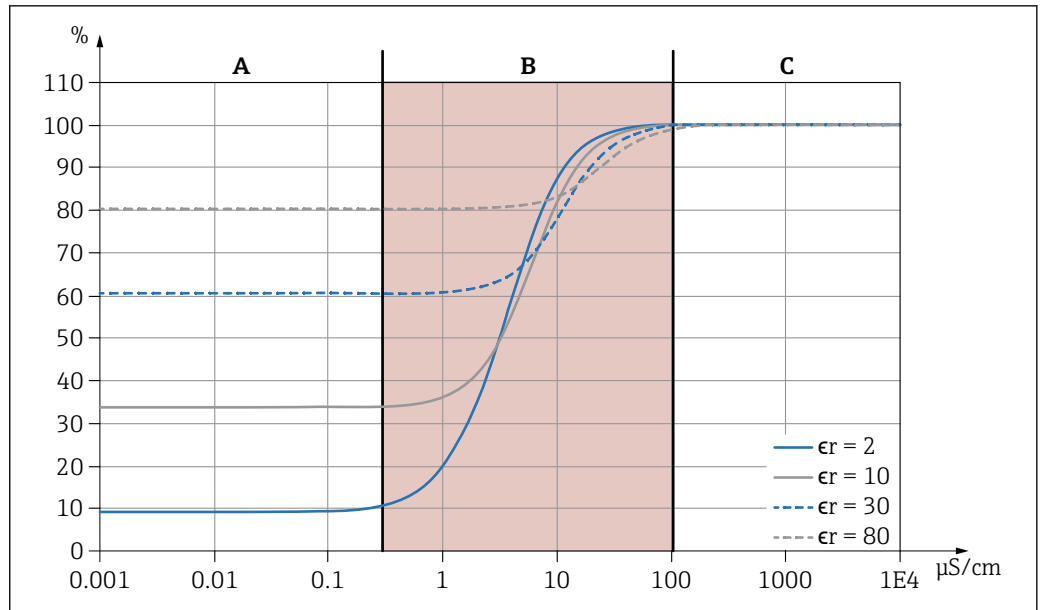
Unlike a simple capacitive method that only detects the total impedance, the device also evaluates the phase position of the measuring signal. This makes it possible to distinguish between the actual measured variable (level) and disruptive factors such as buildup and moisture.

Influence of the measuring frequency

A higher measuring frequency is less sensitive to buildup at the probe. This buildup is predominantly ohmic, while the medium has a frequency-selective capacitive behavior. At higher frequencies, the capacitance part predominates. This suppresses the effect of the buildup. The electronics automatically select the optimal measuring frequency including build-up behaviour and probe length (linearity).

S curve

Capacitive measuring technology distinguishes between electrically conductive media and non-conductive media with different permittivity. The S curve describes the transition from the behavior of conductive media to the behaviour of non-conductive media. The ranges for conductive or non-conductive media depend on the measuring frequency used. The following diagram shows a probe that is 100 % covered:



2 As an example, S curves are the result of a measuring frequency of 460 kHz and various relative permittivities (ϵ_r)

y axis: Level in %

x axis: Conductivity of the medium in $\mu\text{S}/\text{cm}$

A Non-conductive media

B Transition zone ("prohibited area")

C Conductive media

A: Non-conductive media

In the case of non-conductive media, e.g. oil, the measured capacitance consists of the capacitance of the probe insulation and the capacitance of the medium. The capacitance of the medium depends on the permittivity of the medium, the vessel geometry and the distance to the vessel wall. The influence of the vessel geometry is not required if a probe with a ground tube is used.

B: Transition range ("prohibited area") → **without automatic frequency adjustment**

It is not possible to take a reliable measurement in this range. Small changes in the conductivity cause a severe change in capacitance and therefore a measurement error at a constant level. This transition range depends on the measuring frequency.

C: Conductive media

From a certain conductivity, all the media run at the same capacitance at the same level (→ Graphic, Figure 2 → 100 $\mu\text{S}/\text{cm}$). The capacitance no longer depends on the medium, but rather on the thickness of the insulation. This means that the capacitance of the probe insulation is only determined in the covered area of the probe. The factory calibration is therefore valid for all these media. No additional adjustments are required. The conductivity from which this independence and therefore factory calibration are applicable depends on the measuring frequency, e.g.:

- 2 $\mu\text{S}/\text{cm}$ at a measuring frequency of 14 kHz
- 100 $\mu\text{S}/\text{cm}$ at a measuring frequency of 460 kHz

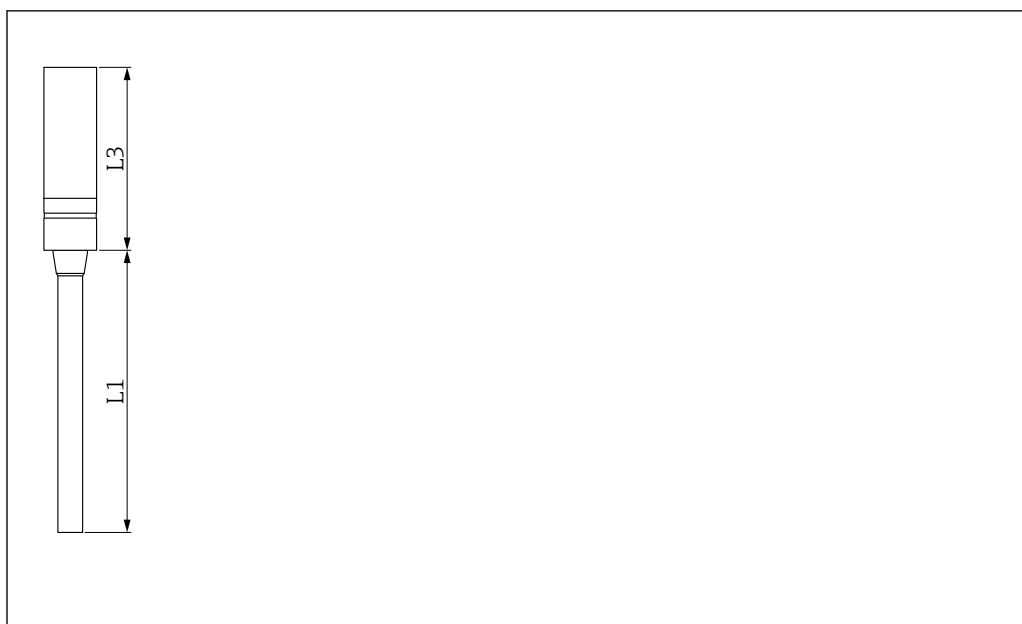
(→ Additional details in the "Measuring frequency and conductivity limits according to probe length" table)

Using multi-frequency measuring technology, the S curve can be shifted and automatically adapted to the medium.

Probe length and measuring frequency

The following lengths are significant for determining the probe length:

- Active length → L1
- Inactive length → L3
- Length of the connecting cable → L4



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3 Parts of probe length $L = L1 + L3$

A Rod probe with active length $L1$ and inactive length $L3$

For media with low relative permittivity (<4, e.g. oil), the next highest measuring frequency can be selected without restriction. If the measuring frequency is set too high, the linearity of the measurement gets worse. Example: A probe length of 16 m (52 ft) must not exceed a frequency of 115 kHz to ensure a linearity <1 %.

The following values are conservative:

Measuring frequency and conductivity limits according to probe length

Probe lengths m (ft)	Maximum measuring frequency kHz	Factory calibration valid From conductivity > $\mu\text{S}/\text{cm}$
0 to 0.5 m (0 to 1.6 ft)	3 680	500
0 to 1 m (0 to 3.3 ft)	1 840	320
0 to 1.5 m (0 to 4.9 ft)	1 228	240
0 to 2 m (0 to 6.6 ft)	920	180
0 to 3 m (0 to 9.8 ft)	614	120
0 to 4 m (0 to 13 ft)	460	90
0 to 6 m (0 to 20 ft)	307	60
0 to 8 m (0 to 26 ft)	230	45
0 to 12 m (0 to 39 ft)	154	30
0 to 16 m (0 to 52 ft)	115	25
0 to 24 m (0 to 79 ft)	77	15
0 to 32 m (0 to 105 ft)	58	12
0 to 48 m (0 to 157 ft)	38	7

Probe lengths m (ft)	Maximum measuring frequency kHz	Factory calibration valid From conductivity > $\mu\text{S}/\text{cm}$
>0 to 48 m (0 to 157 ft)	19	3
>0 to 48 m (0 to 157 ft)	14	1.5

More information on relative permittivity is available in the downloads area of the Endress+Hauser website:

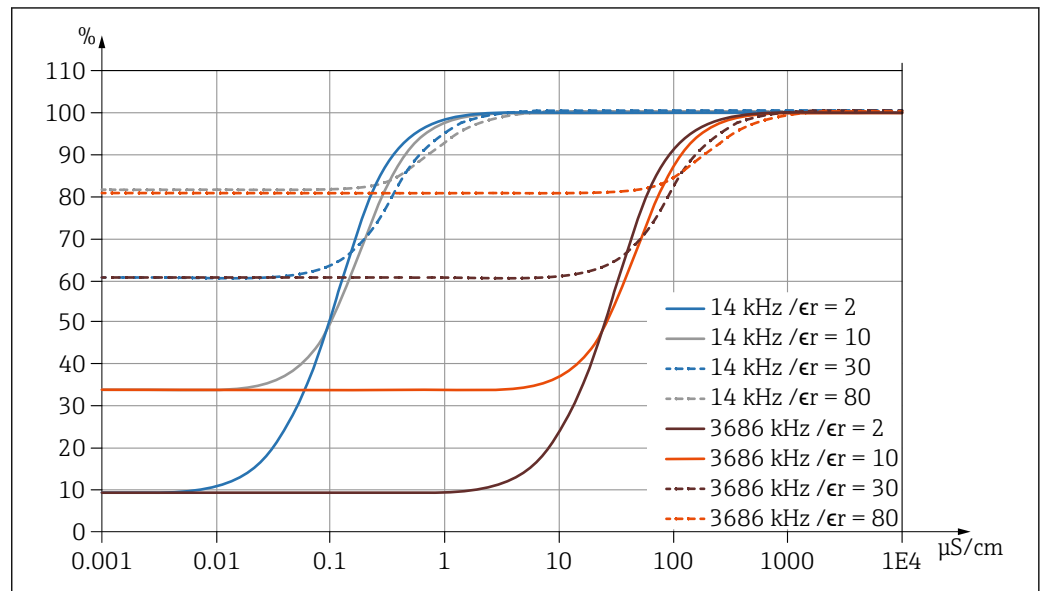
- Endress+Hauser dielectric constant (DC value) – Compendium (CP01076F)
- "DC Values App" from Endress+Hauser (available for Android and iOS)

Multi-frequency measuring technology

Using the multi-frequency measuring technology (14 kHz to 3.7 MHz, 15 levels), the measuring frequency can be optimally set to build-up behavior, S curve and probe length. Depending on the boundary conditions, the frequency range in which a measuring frequency works reliably or critically moves.

Frequency optimization via the "Commissioning" wizard

The **Commissioning** wizard guides you step-by-step to the optimal measuring frequency and takes all relevant influence quantities into account. Selecting the right frequency reliably prevents the transition range ("prohibited range").



4 Example S curves with automatically determined measuring frequency outside the transition range

y axis: Level in %

x axis: Conductivity of the medium in $\mu\text{S}/\text{cm}$

The S curve is affected by the measuring frequency selected.

Automatic measurement frequency selection

The electronics automatically determine the optimal measuring frequency via the **Commissioning** wizard. Two key influencing variables are taken into consideration in this case:

1. Probe length

The maximum usable measuring frequency is limited by the probe length.

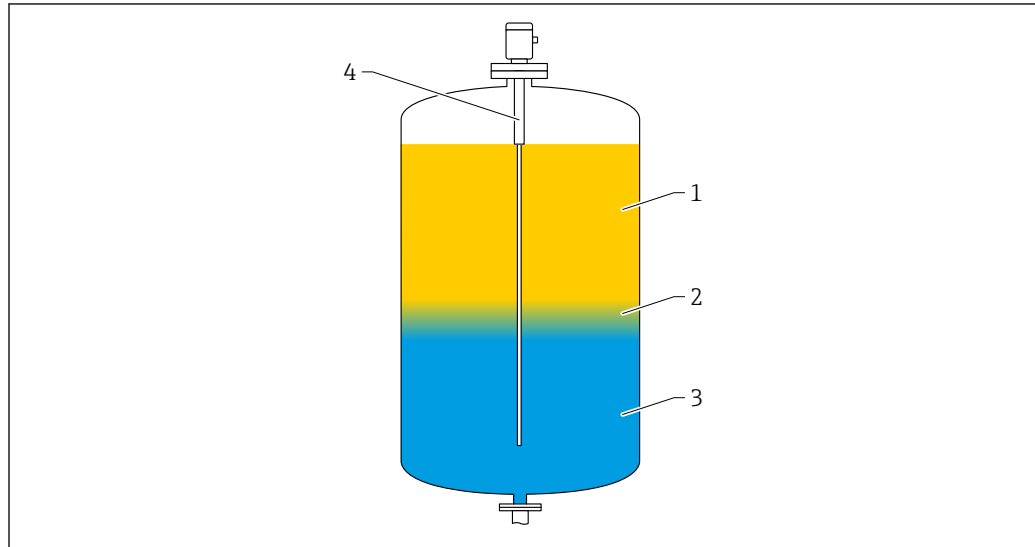
2. Conductivity and relative permittivity of the medium

Ideally, the measuring frequency should be in the "conductivity-independent range" (→ Figure 2, range C, factory calibration remains valid). If this is not possible, a measuring frequency is selected in the "conductivity-dependent range", which requires recalibration or is converted directly for probes with a ground tube.

Interface measurement between two media

For a reliable interface measurement, one of the media has to be electrically conductive (→ Figure 2, range A) and the other non-conductive (→ Figure 2, range C).

The empty calibration is performed at a level of 100 % with the non-conductive medium (e.g. oil). The full calibration is performed at a level of 100 % with the conductive medium (e.g. water). The position of the interface or emulsion layer can then be recorded reliably. To avoid measurement errors, the upper medium must completely cover the probe. Alternatively, it must be kept at a constant level during the measurement.



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5 Interface (emulsion) between non-conductive and conductive medium

- 1 Non-conductive medium, e.g. oil
- 2 Interface (emulsion)
- 3 Conductive medium, e.g. water
- 4 Inactive length

Measurement behavior and stability

Fast response time:

There is a minimum response time of 40 ms between a change in level and the signal output. This means that the measuring system is also suitable for use in dynamic filling and process applications.

High resolution:

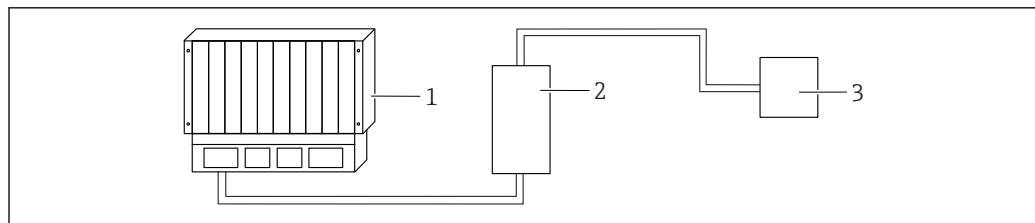
The measurement system records very low changes in capacitance accurately and stably. It is therefore particularly suitable for media with a low relative permittivity and minimum change in capacitance, e.g. oil or hydrogen.

Inactive length:

Probes with an inactive length reduce the effect of condensate in the nozzle. Measurement errors caused by local condensation are thus effectively avoided.

Measuring system

A complete measuring system consists of:



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- 1 PLC (programmable logic controller)
- 2 IO-Link: IO-Link master
- 3 Device

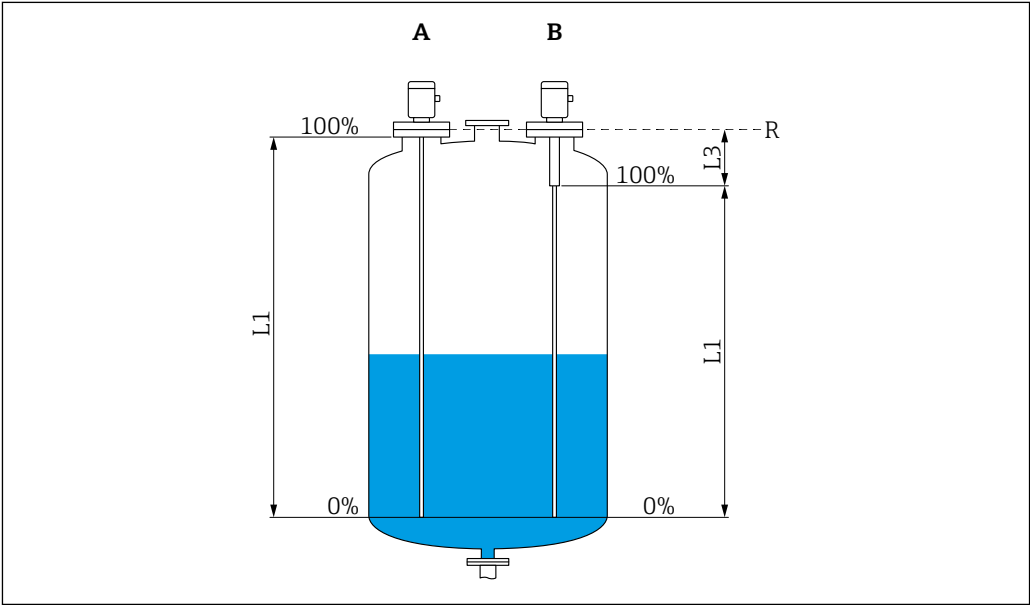
Communication and data processing

- IO-Link: Digital communication protocol IO-Link, 3-wire
- Bluetooth® wireless technology (optional)

Dependability	IT security The manufacturer warranty is valid only if the product is installed and used as described in the Operating Instructions. The product features security mechanisms to protect it against any inadvertent changes to the settings. Security measures, which provide additional protection for the product and associated data transfer, must be implemented by the operators themselves in line with their security standards. Device-specific IT security The device offers specific functions to support protective measures by the operator. These functions can be configured by the user and guarantee greater in-operation safety if used correctly. An overview of the most important functions is provided in the following section: Access code to change user role (applies to operation via display, Bluetooth® wireless technology or FieldCare, DeviceCare, asset management tools (e.g. AMS, PDM)
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Input

Measured variable	Continuous measurement of capacitance between the capacitance probe and vessel wall or ground tube. The change in capacitance depends on the level of the medium: ■ Covered probe → high capacitance ■ Probe not covered → low capacitance
Measuring range	When installing in a nozzle, use inactive length (L3) to avoid measurement errors. ■ Measuring range: 0 to 6 000 pF ■ Recommended measuring span ΔC: 25 to 6 000 pF ■ Possible measuring span ΔC: 2 to 6 000 pF ■ Multi-frequency: 14.4 to 3 680 kHz Available probe lengths: ■ Rod probes 2 m (6.6 ft) Up to 6 m (20 ft) on request ■ Rope probes 4 m (13 ft) > 4 m (13 ft) on request



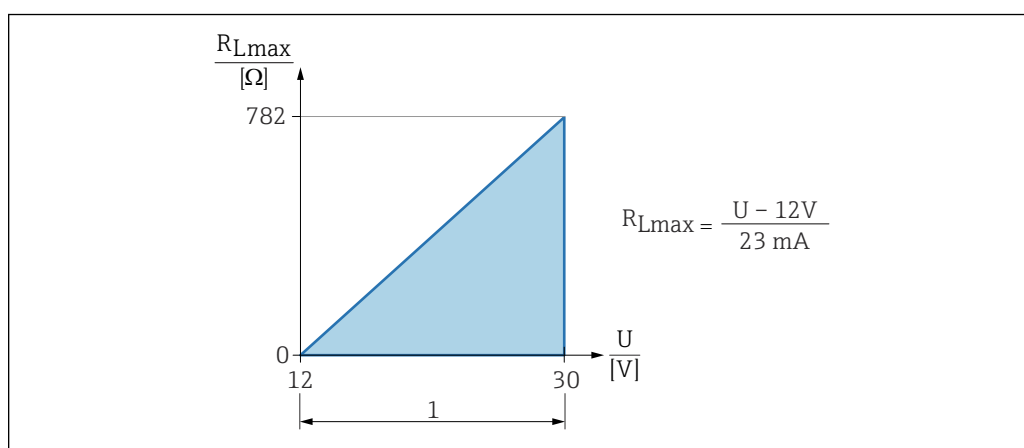
6 Measuring range of rod probe. Unit of measurement mm (in)

A Rod probe
B Rod probe with inactive length
L1 Active length, measuring range can be individually set
L3 Inactive length
R Reference area (= sealing surface of the process connection)

Output

4–20 mA/IO-Link

Supply voltage	A suitable circuit breaker must be provided for the device in accordance with IEC 61010-1. Protective circuits against reverse polarity, HF interference and overvoltage peaks are integrated in the device. $U = \text{DC } 12 \text{ to } 30 \text{ V}$ on a DC power unit IO-Link communication is guaranteed only if the supply voltage is at least 18 V. The power unit must be tested to ensure it meets safety requirements (e.g. PELV, SELV, Class 2) and must comply with the relevant protocol specifications.
Power consumption	Non-hazardous area: To meet device safety specifications according to the IEC 61010 standard, the installation must ensure that the maximum current is limited to 500 mA.
Equipotential bonding	If necessary, establish potential equalization using the process connection or the grounding clamp supplied by the customer.
Failure signal	Current output Signal on alarm in accordance with NAMUR recommendation NE 43. ■ Max. alarm: can be set from 21.5 to 23 mA ■ Min. alarm: < 3.6 mA (factory setting) Onsite display and operating tool via digital communication Status signal (according to NAMUR Recommendation NE 107): Plain text display Switch output (DC-PNP) Failure signal: OFF (quiescent current safety)
Load	For the current output, the following applies: In order to guarantee sufficient terminal voltage, a maximum load resistance R_L (including line resistance) must not be exceeded, depending on the supply voltage U of the supply unit.

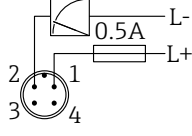


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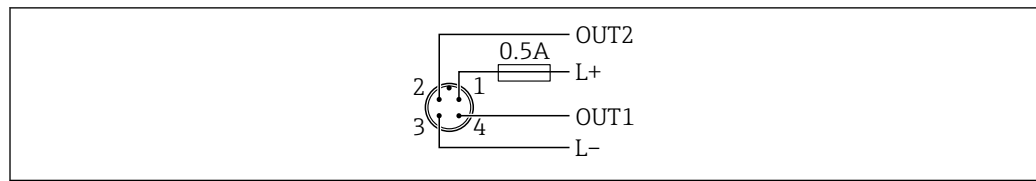
1 Power supply 12 to 30 V
 U Supply voltage

If load is too high:

- Failure current is indicated and error message is displayed (indication: MIN alarm current)
- Periodic checking to establish if it is possible to quit fault state

Damping	Damping affects all continuous outputs. Factory setting: 1 s (can be configured from 0 to 1 200 s in increments of 0.1 seconds)
Protocol-specific data	■ Manufacturer ID: 17(0x0011) ■ Device type: 0x91DC ■ Device revision: 0x01 ■ IO-Link version: IO-Link V1.1 ■ IO-Link process data profile: SSP4.3.1
Breaking capacity	■ Switch status ON: $I_a \leq 200 \text{ mA}^{2)}$; Switch status OFF: $I_a < 0.1 \text{ mA}^{3)}$ ■ Switch cycles: $> 1 \cdot 10^7$ ■ Voltage drop PNP: $\leq 2 \text{ V}$ ■ Overload protection: Automatic load testing of switching current; ■ Max. capacitive load: 1 μF at max. supply voltage (without resistive load) ■ Periodic disconnection from protective circuit in the event of overcurrent ($f = 1 \text{ Hz}$)
Overvoltage protection	The device meets the IEC 61326-1 product standard (Table 2 Industrial environment). Depending on the type of connection (DC power supply, input line, output line), different test levels are used to prevent transient overvoltages (IEC 61000-4-5 Surge) in accordance with IEC EN 61326-1: Test level for DC power supply lines and IO lines: 1 000 V wire to ground. Overvoltage category In accordance with IEC 61010-1, the device is intended for use in networks with overvoltage protection category II.
Terminal assignment	2-wire (4–20 mA analog output)  1 Supply voltage L+, brown wire (BN) 2 Supply voltage L- (OUT2), white wire (WH) Analog output: 4 to 20 mA proportional to capacitance

- 2) If the "1 x PNP + 4 to 20 mA" outputs are used at the same time, the switch output OUT1 can be loaded with up to 100 mA load current over the entire temperature range. The switching current may be up to 200 mA up to an ambient temperature of 50 °C (122 °F) and up to a process temperature of 85 °C (185 °F). If the "1 x PNP" or "2 x PNP" configuration is used, the switch outputs can be loaded with a total of up to 200 mA over the entire temperature range.
- 3) Different for switch output OUT2, for switch status OFF: $I_a < 3.6 \text{ mA}$ and $U_a < 2 \text{ V}$ and for switch status ON: voltage drop PNP: $\leq 2.5 \text{ V}$

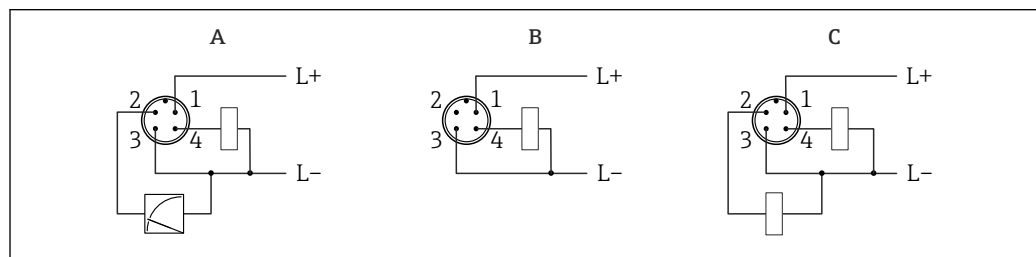
3-wire or 4-wire

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- 1 Supply voltage L+, brown wire (BN)
- 2 Switch or analog output (OUT2), white wire (WH)
- 3 Supply voltage L-, blue wire (BU)
- 4 Switch output or IO-Link output (OUT1), black wire (BK)

Analog output: 4 to 20 mA proportional to capacitance

If the device detects an IO-Link master at OUT1, the output is used for digital IO-Link communication. If not, then OUT1 is automatically configured as a switch output (SIO mode).

Connection examples

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- A 1 x PNP switch and analog output
- B 1 x PNP switch output (current output must be deactivated. If the current output has not been deactivated, a message appears. In the case of local display: Fault is displayed. In the case of LED indicator: Operating status LED permanently red), default setting
- C 2 x PNP switch output (set second output to switch output)

Analog output: 4 to 20 mA proportional to capacitance

Available device plugs**M12 plug**

For further information, see the "Device-specific accessories" section

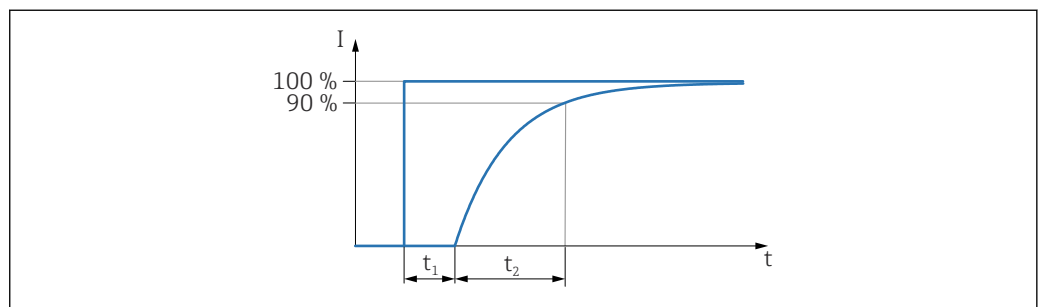
Performance characteristics**Response time**

Order code for output: 4–20 mA/IO-Link
Specification V1.1

Reference operating conditions

- As per IEC 62828-1
- Ambient temperature T_A = constant, in the range: 21 to 33 °C (70 to 91 °F)
- Humidity ϕ = constant, in the range of: 5 to 80 % RH $\pm$ 5 %
- Atmospheric pressure p_U = constant, in the range of: 860 to 1060 mbar (12.47 to 15.37 psi)
- Supply voltage: DC 24 V $\pm$ 2.4 V
- Medium: Water with a conductivity > 100 μ S/cm
- Measuring frequency: 230
- Length of probe (PFA): 1 m (3.3 ft)

Maximum measurement error	■ Linearity deviation : <1 % (in water, in relation to reference operating conditions) ■ Non-linearity for limit point setting (linearity) as per EN 61298-2: ≤ 0.5 % ■ Non-repeatability (reproducibility) as per EN 61298-2: ≤ 0.1 %
Temperature dependency	■ Probe rod : < 0.1% / K ■ Probe rope: < 0.1% / K
Pressure dependency	■ Probe rod: ~ 0.2%/bar ■ Probe rope : < 0.1%/bar
Factory calibration	Empty calibration (0 %) and full calibration (100 %) ■ Rod probe < 2 m (6.6 ft) : ≤ 5 mm (0.2 in) (calibration with water) ■ Rod probe > 2 m (6.6 ft) and rope probes: Typically ≤ 2 % (theoretical calibration) Recalibration is necessary in the following cases: ■ With a distance between the probe and the vessel wall < 250 mm (9.84 in) (influence on empty calibration) ■ If used in media <2 μS/cm (influence on full calibration)
Resolution	Current output: < 1 μA
Influence of process pressure	In the case of fully insulated probes in conductive liquids: < 10% in relation to the current measured value
Reaction time	The reaction behaviour is described using the step response in accordance with IEC 62828-1. According to IEC 62828-1, the step response time is the time following an abrupt change in the input signal up until the changed output signal has adopted 90 % of the steady-state value for the first time. Damping can be configured. Dead time, time constant Shows the dead time and time constant as per IEC 62828-1:



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t_1 Dead time
 t_2 Time constant

Step response time = Dead time (t_1) + time constant T90

Dynamic behavior, current output

Order code for output: 4-20 mA/IO-Link

- Dead time (t_1): maximum 40 ms
- Time constant T90: Maximum 60 ms (damping = 0 s)

Dynamic behavior of switch output

Switching delay:

- Factory setting: 1 s, symmetrical
 - OUT1 = DC-PNP; high active (MIN)
 - OUT2 = OFF
- Can be configured via operating tools: 0.04 to 60.00 s in steps of 0.02 s

Warm-up time

The warm-up time (in accordance with IEC 62828-1) indicates the time required for the device to reach its maximum accuracy or performance after the supply voltage is energized.

Warm-up time: ≤ 10 s

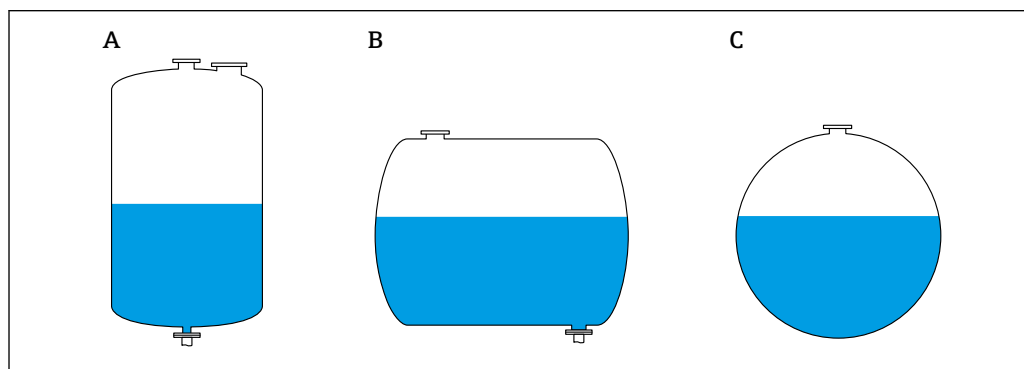
Installation

Installation location

Vessel types

The probes can be installed in a variety of vessel types:

- In conductive vessels
- In non-conductive vessels



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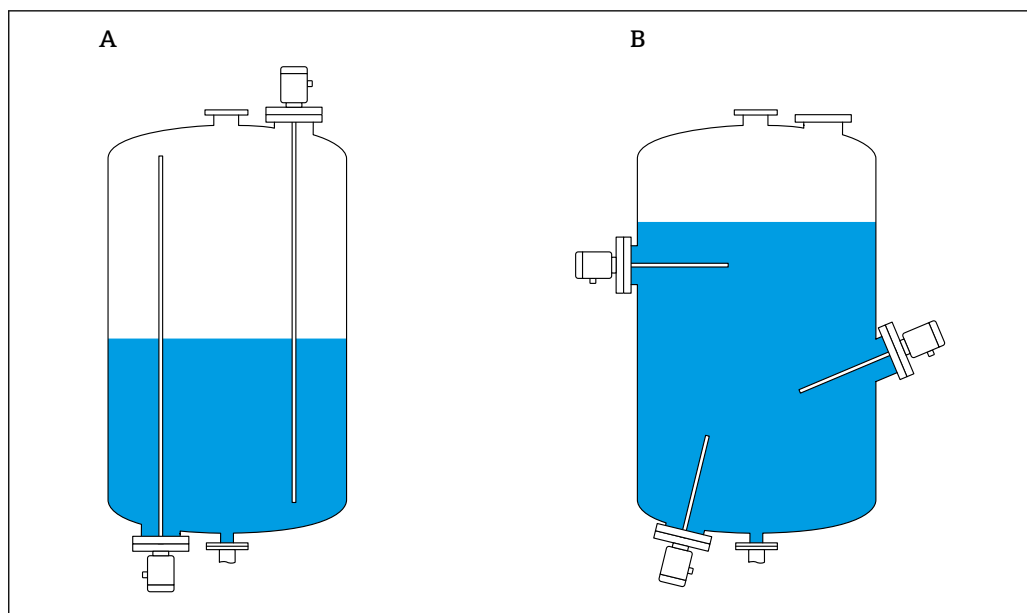
 8 Examples of vessel type

- A Upright, cylindrical tank
- B Horizontal, cylindrical tank
- C Spherical/tube tank

Orientation

Rod probe

Installation from above, from below or from the side



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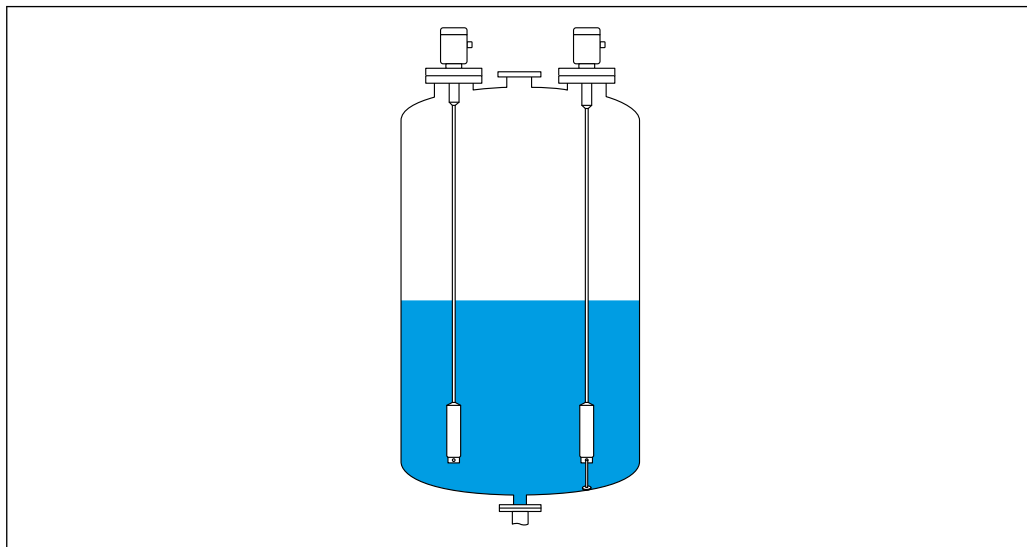
9 Orientation of rod probe

A Installation from above or below

B Installation from the side

Rope probe

Installation from above



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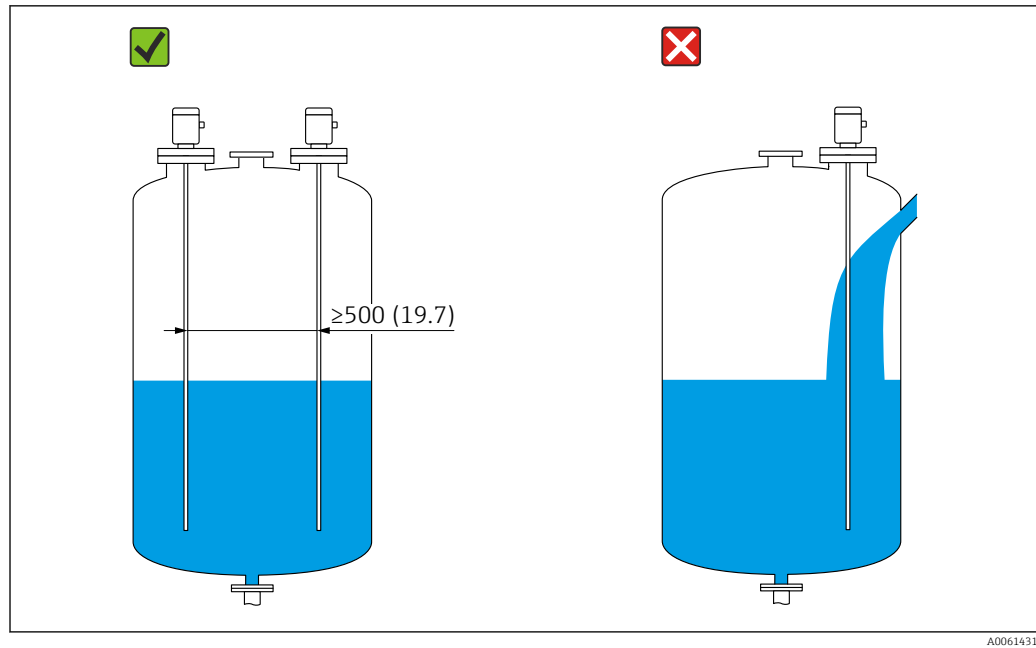
10 Orientation of rope probe

Installation instructions

- The sealing element used must be suitable for continuous operation at the maximum permissible operating temperature
- Comply with approval-related requirements for attachments
- Devices with CAN/US approvals are intended for indoor use
- Devices are suitable for use in wet environments in accordance with IEC 61010-1

Rod probes

- A low-impedance connection between the device and the vessel is required in conductive vessels
- Do not install the probe in the area of the filling stream
- It is not allowed for the probe to come into contact with the vessel wall
- Maintain a minimum distance of 500 mm (19.7 in) between multiple probes installed side by side
- In the event of a strong lateral load, use a rod probe with a ground tube (on request)

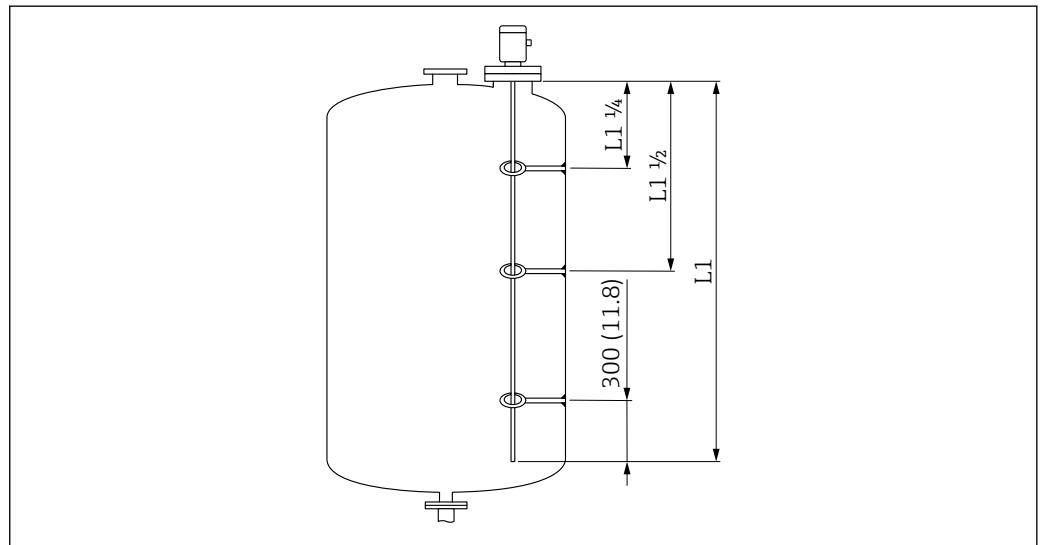


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11 Installation instructions for rod probe. Unit of measurement mm (in)

Securing rod probes

Conductive or non-conductive support can be provided for fully insulated rod probes with a length of ≥ 1 m (3.3 ft).



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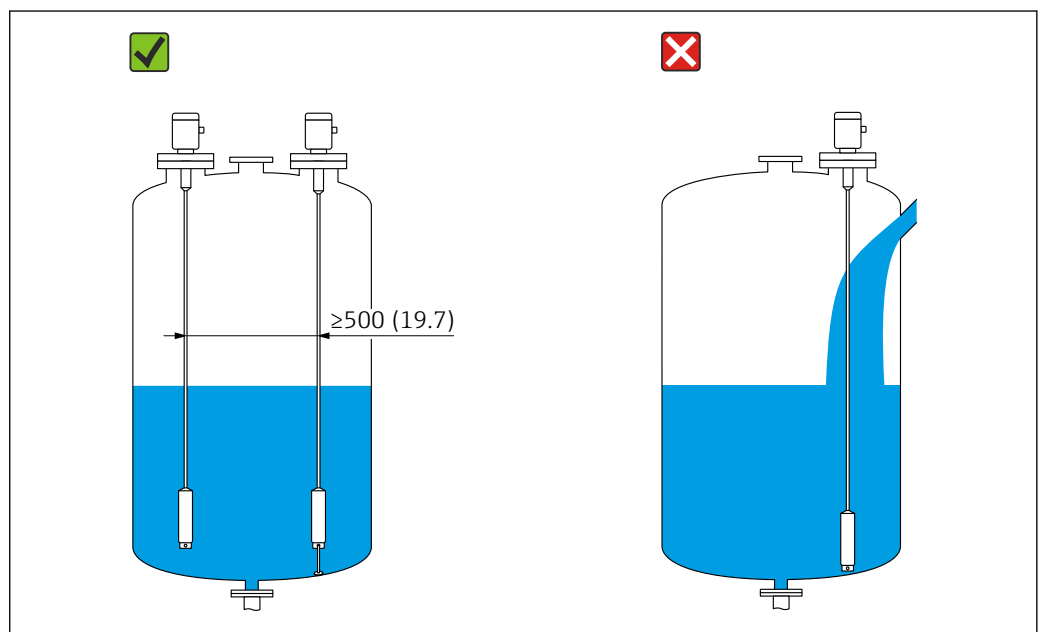
12 Example of how to support a probe rod. Unit of measurement mm (in)

Example for probe interpolation points with length $L1 = 2$ m (6.6 ft)

- $\frac{1}{4} \times L1 = 0.5$ m (1.6 ft)
- $\frac{1}{2} \times L1 = 1$ m (3.3 ft)
- Measured from the end of the probe rod = 300 mm (11.8 in)

Rope probe

- A low-impedance connection between the device and the vessel is required in conductive vessels (e.g. via the process connection)
- Do not install the probe in the area of the filling stream
- It is not allowed for the probe to come into contact with the vessel wall. If necessary, the probe weight must be secured in the vessel
- Maintain a minimum distance of 500 mm (19.7 in) between multiple probes installed side by side



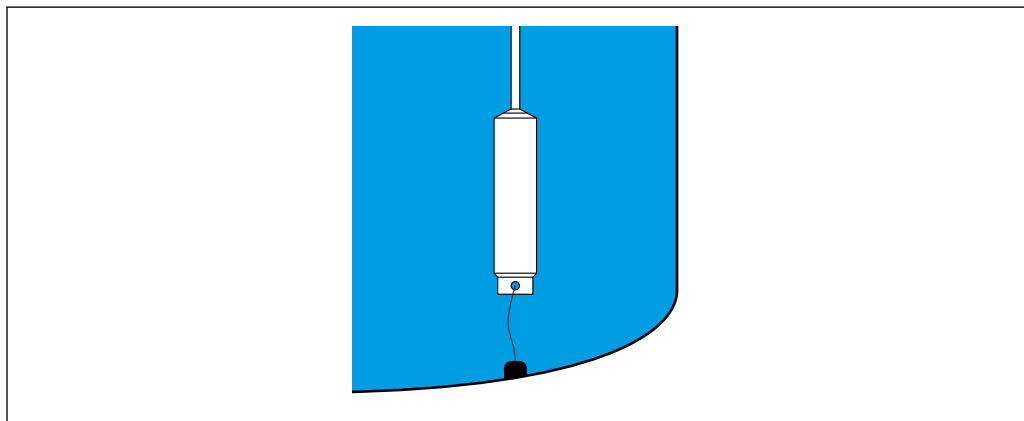
A0061432

13 Installation instructions for rope probe. Unit of measurement mm (in)

Probe weight

If the probe comes into contact with the silo wall or other components in the tank, the end of the probe must also be secured. The probe weight has an anchor hook for this purpose. The anchorage can be conductive or be insulated against the tank wall.

Maximum pulling force 200 N (44.96 lbf)



A0061674

Rope shortening kit

A rope shortening kit can be ordered as an accessory.



For additional information, see Special Documentation SD03578F.

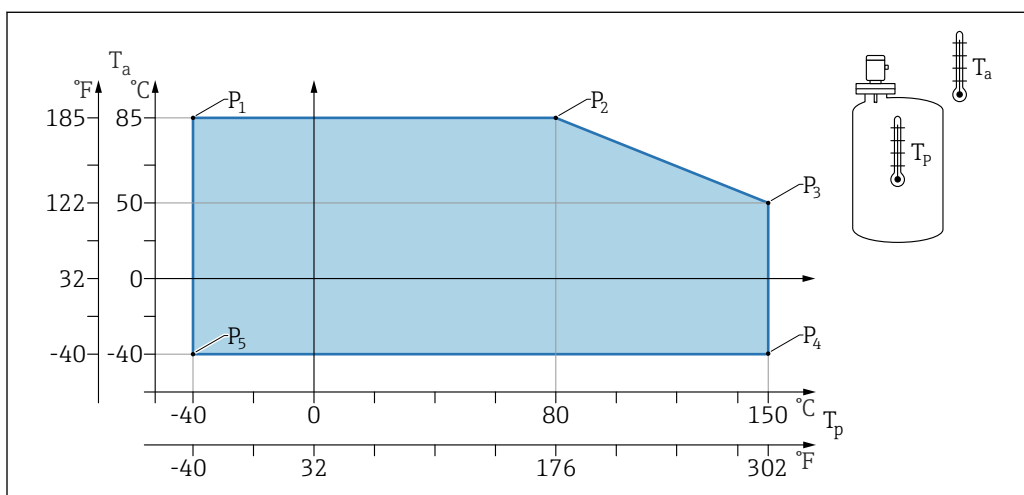
Environment

Ambient temperature range -40 to 85 °C (-40 to 185 °F)

The permitted ambient temperature is reduced at higher process temperatures.

The following information only takes functional aspects into consideration. Additional restrictions may apply for certified device versions.

Version 150 °C (302 °F)

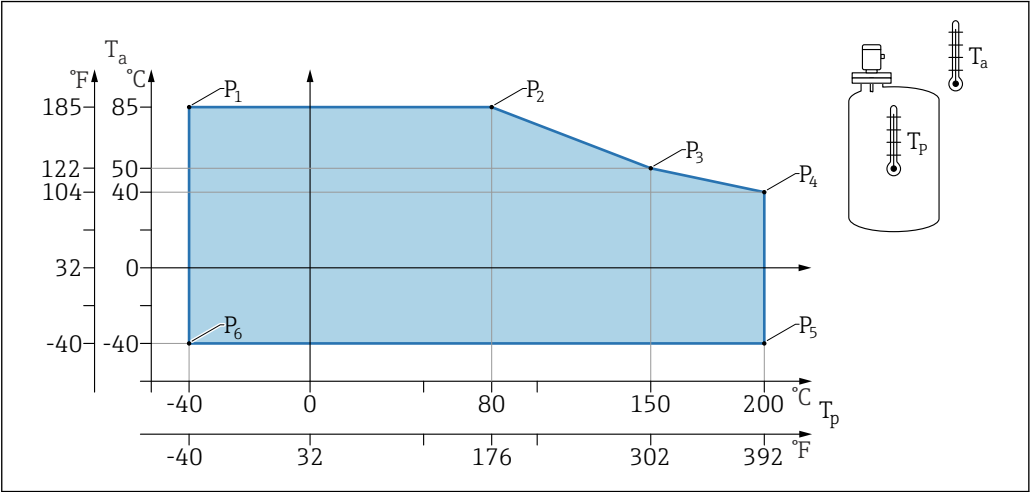


A0061957

14 Version 150 °C (302 °F), ambient temperature T_a depending on the process temperature T_p

P	T _p	T _a
P1	-40 °C (-40 °F)	85 °C (185 °F)
P2	80 °C (176 °F)	85 °C (185 °F)
P3	150 °C (302 °F)	50 °C (122 °F)
P4	150 °C (302 °F)	-40 °C (-40 °F)
P5	-40 °C (-40 °F)	-40 °C (-40 °F)

Version 200 °C (392 °F)

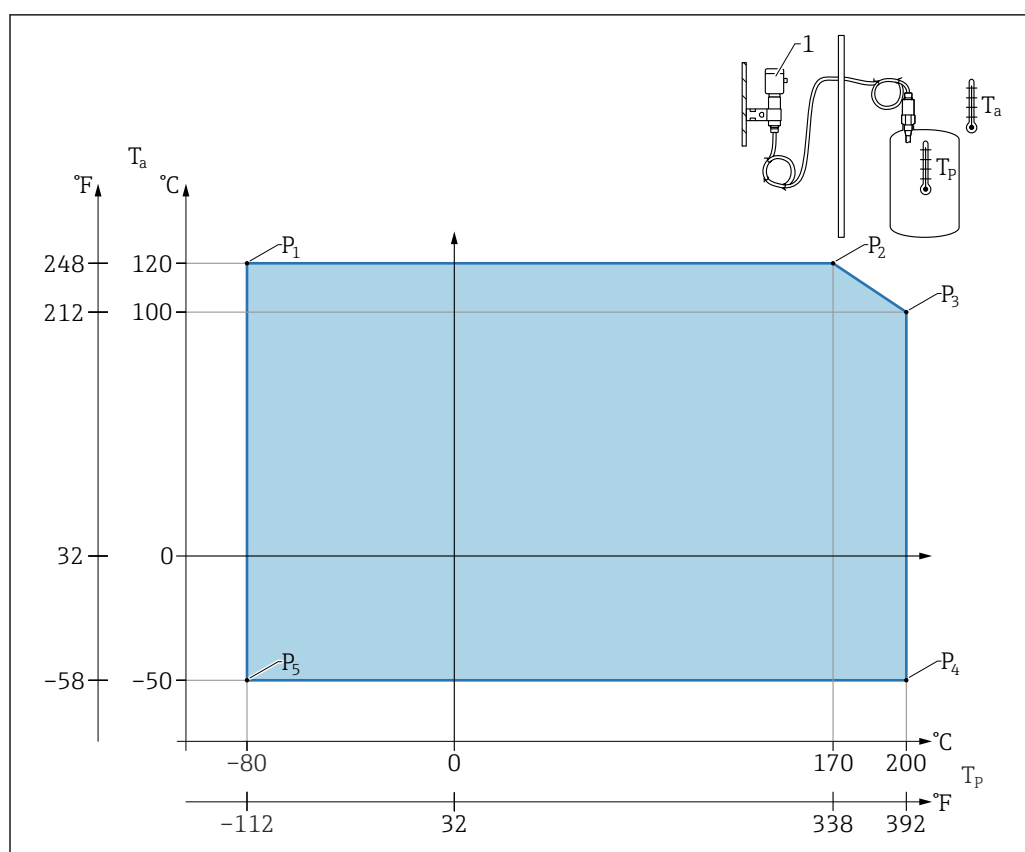


15 Version 200 °C (392 °F), ambient temperature T_a depending on the process temperature T_p

At a process temperature of $T_p = -80$ °C (-112 °F), the permitted ambient temperature is limited to $T_a = -25$ to 70 °C (-4 to 158 °F).

P	T _p	T _a
P1	-40 °C (-40 °F)	85 °C (185 °F)
P2	80 °C (176 °F)	85 °C (185 °F)
P3	150 °C (302 °F)	50 °C (122 °F)
P4	200 °C (392 °F)	40 °C (77 °F)
P5	200 °C (392 °F)	-40 °C (-40 °F)
P6	-40 °C (-40 °F)	-40 °C (-40 °F)

Sensor, remote



A0061975

16 Sensor, remote

 T_a Ambient temperature T_p Process temperature

1 The permitted ambient temperature at the device with remote sensor is the same as indicated for the compact housing.

P	T_p	T_a
P1	-80 °C (-1 °F)	120 °C (1 °F)
P2	170 °C (1 °F)	120 °C (1 °F)
P3	200 °C (392 °F)	100 °C (1 °F)
P4	200 °C (392 °F)	-50 °C (-1 °F)
P5	-80 °C (-1 °F)	-50 °C (-1 °F)

Storage temperature -40 to 85 °C (-40 to 185 °F)

Operating altitude Up to 5 000 m (16 404 ft) above sea level.

Climate class According to IEC 60068-2-38 test Z/AD (relative humidity 4 to 100 %).

Degree of protection Test as per IEC 60529/EN 60529 and NEMA 250-2014
For mounted M12 connecting cable: IP66/68/69, NEMA type 4X/6P
(IP68: (1.83 mH₂O for 24 h))

Pollution degree Pollution degree 2 in accordance with IEC 61010-1.

Vibration resistance	■ Stochastic noise (random sweep) as per IEC 60068-2-64 Case 2 ■ Guaranteed for 5 to 2 000 Hz: $1.25 \text{ (m/s}^2\text{)}^2\text{/Hz}$, ~ 5 g The vibration resistance has been tested for a probe length of 0.5 m (1.6 ft). With sinusoidal oscillations, increased mechanical stress can occur as a result of the resonance effects. Additional mechanical support is required for longer probes.
Shock resistance	■ Test standard: IEC 60068-2-27 Case 2 ■ Shock resistance: 30 g (18 ms) in all 3 axes Shock resistance has been verified for a probe length of 0.5 m (1.6 ft). Additional mechanical support is required for longer probes.
Electromagnetic compatibility (EMC)	■ Electromagnetic compatibility as per IEC 61326 series and NAMUR recommendation EMC (NE21) ■ Maximum deviation under interference influence: < 0.5 % For more details refer to the EU Declaration of Conformity.

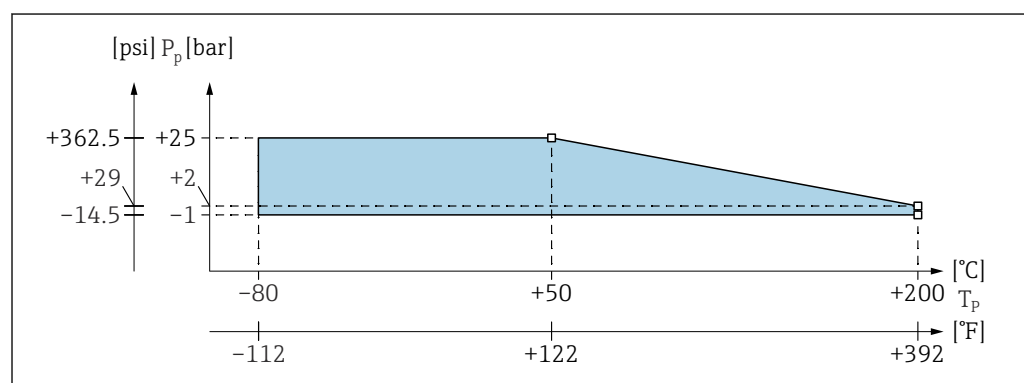
Process

Process temperature range	■ -80 to 150 °C (-112 to 302 °F) ■ -80 to 200 °C (-112 to 392 °F) Pay attention to the pressure and temperature dependency.
Process pressure range	Pressure specifications The maximum pressure for the device depends on the lowest-rated element with regard to pressure. Components are: process connection, optional mounting parts, or accessories. ⚠ WARNING Incorrect design or use of the device may lead to bursting parts! This may result in severe, possibly irreversible injury to persons and environmental hazards. ▶ Only operate the device within the specified limits for the components! ▶ MWP (maximum working pressure): The maximum working pressure is specified on the nameplate. This value refers to a reference temperature of 20 °C (68 °F) and may be present at the device for an unlimited time. Note temperature dependency of MWP. For higher temperatures, refer to the following standards for the permitted pressure values for flanges: EN 1092-1 (materials 1.4435 and 1.4404 are identical with regard to their stability/temperature property and are grouped together in under 13E0 in EN 1092-1 Tab. 18. The chemical composition of the two materials can be identical), ASME B 16.5a, JIS B 2220 (the latest version of the standard applies in each case). ▶ The Pressure Equipment Directive (2014/68/EU) uses the abbreviation "PS". The abbreviation "PS" corresponds to the maximum working pressure (MWP) of the device ▶ MWP data that deviate from this is provided in the relevant sections of the Technical Information.
Process pressure limits	The permitted process pressure limits depend on the used process connection and the valid pressure/temperature derating curves. For further information, see the Technical Information, "Mechanical construction" section, process connections. Refer to the following standards for the permitted pressure values for higher temperatures: ■ EN 1092-1: 2005 Table, Appendix G2 With regard to its resistance and temperature property, the material 1.4435 is identical to 1.4404 (AISI 316L) which is grouped under 13E0 in EN 1092-1 Tab. 18. The chemical composition of the two materials can be identical. ■ ASME B 16.5a - 1998 Tab. 2-2.2 F316 ■ ASME B 16.5a - 1998 Tab. 2.3.8 N10276 ■ JIS B 2220

Pressure/temperature ratings

For process connections:

- Thread G $\frac{1}{2}$, G $\frac{3}{4}$, G1, flanges <DN50, <ASME B16.5 NPS 2" , < JIS 10K (10 mm rod)
- Thread G $\frac{3}{4}$, G1, flanges <DN50, <ASME B16.5 NPS 2" , < JIS 10K (16 mm rod)



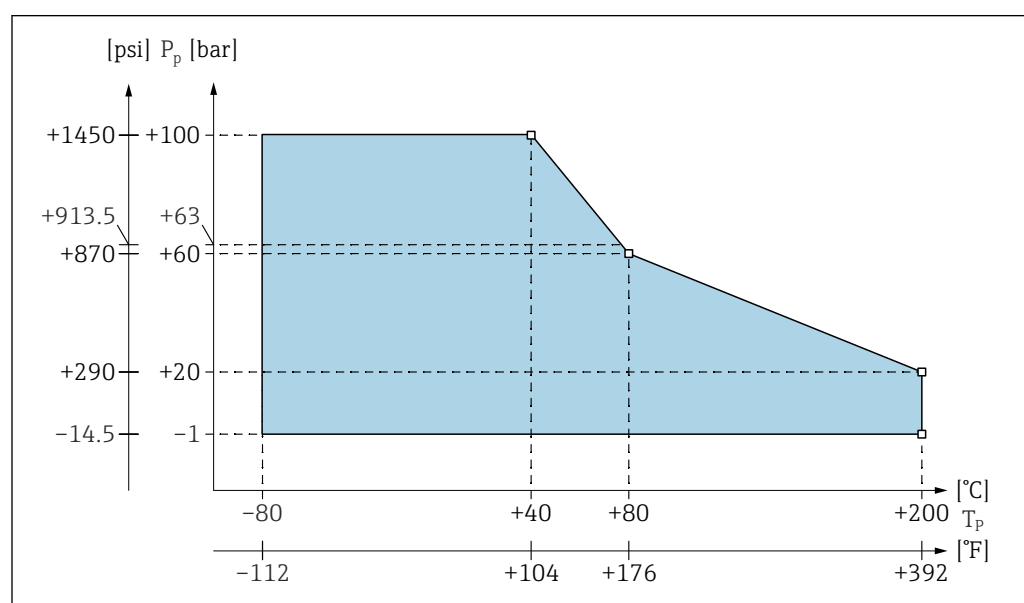
A0043640

P_p Process pressure

T_p Process temperature

For process connections:

Thread G1 $\frac{1}{2}$, flanges $\geq$ DN50, $\geq$ ASME B16.5 NPS 2", $\geq$ JIS 10 K (16 mm rod)



A0043641

P_p Process pressure

T_p Process temperature

63 Process pressure for probes with an inactive length

Mechanical construction

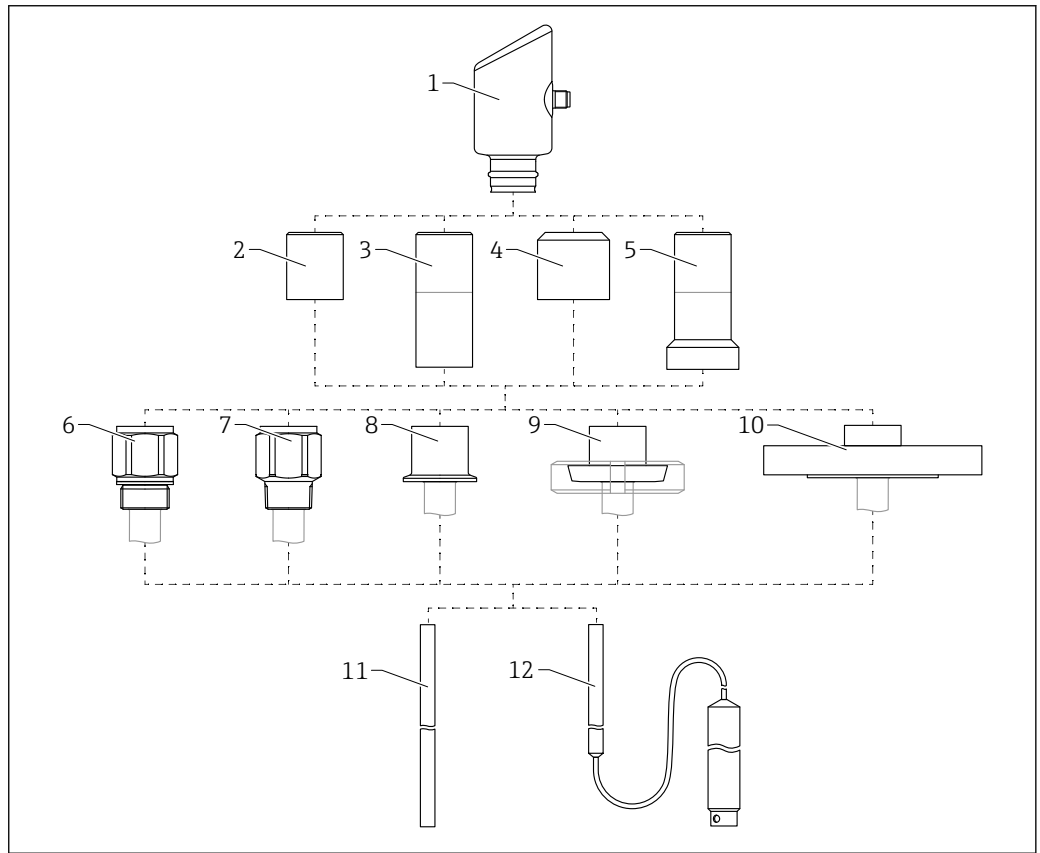
The following dimensions are rounded values. As a result, there may be deviations from the specifications in the Product Configurator at www.endress.com.

To view CAD data:

1. Enter www.endress.com in your web browser
2. Search for the device
3. Select the **Configuration** button
4. Configure the device

5. Select the CAD drawings button

Design and dimensions



A0062476

 17 Product design with sample process connections

- 1 Housing
- 2 Housing adapter: Probe $\varnothing 10$ mm, T_p max. 150 °C (302 °F)
- 3 Housing adapter: Probe $\varnothing 10$ mm, T_p max. 200 °C (392 °F)
- 4 Housing adapter: Probe $\varnothing 16$ mm, T_p max. 150 °C (302 °F)
- 5 Housing adapter: Probe $\varnothing 16$ mm, T_p max. 200 °C (392 °F)
- 6 Process connection: Thread ISO 228, G
- 7 Process connection: Thread ASME B1.20.1, NPT
- 8 Process connection: Tri-Clamp ISO 2852, NA-CONNECT compatible
- 9 Process connection: DIN 11851 compression fitting
- 10 Process connection: Flange EN 1092-1; ASME B16.5
- 11 Rod probe
- 12 Rope probe

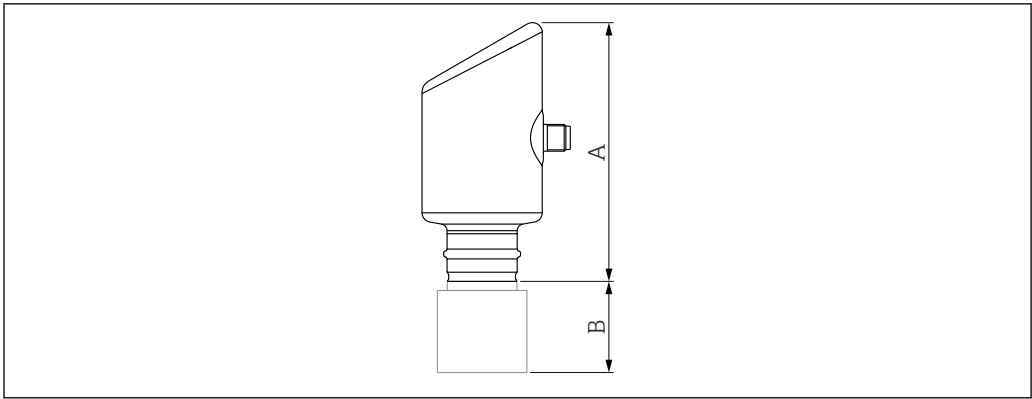
Device height

The total height consists of the heights of the individual components:

- Housing with electronics module
- Process connection
- Probe

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

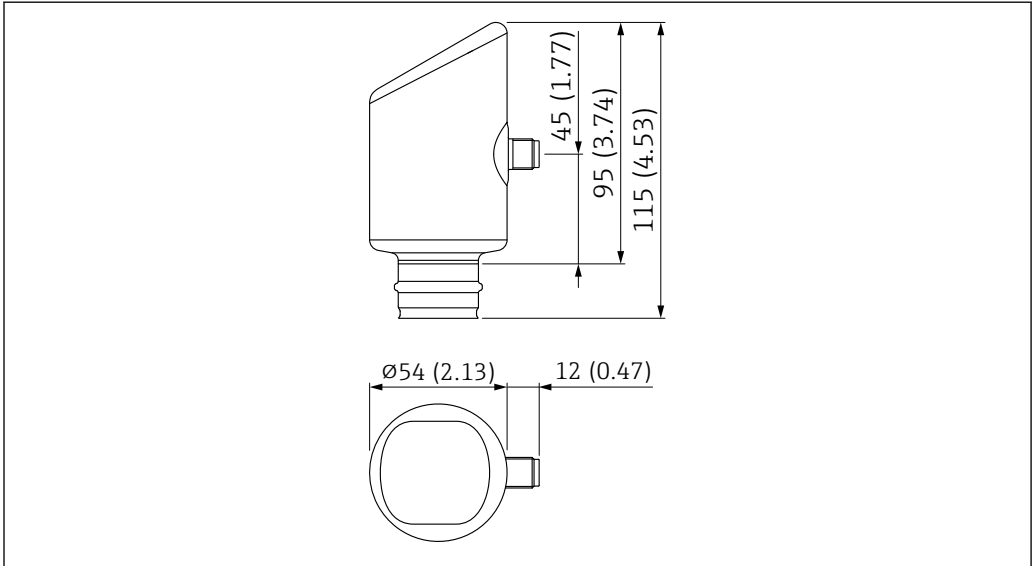
- Determine the height of the device and add the individual heights
- Take the installation clearance into consideration (space that is needed to install the device)



A0061391

- A Height of the housing
B Height of probe including process connection

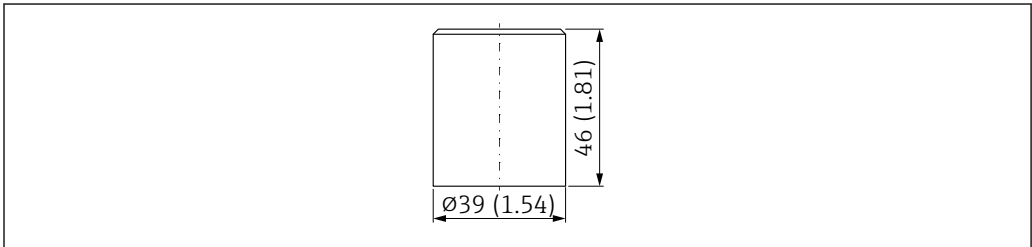
Housing



A0053970

18 Dimensions of housing. Unit of measurement mm (in)

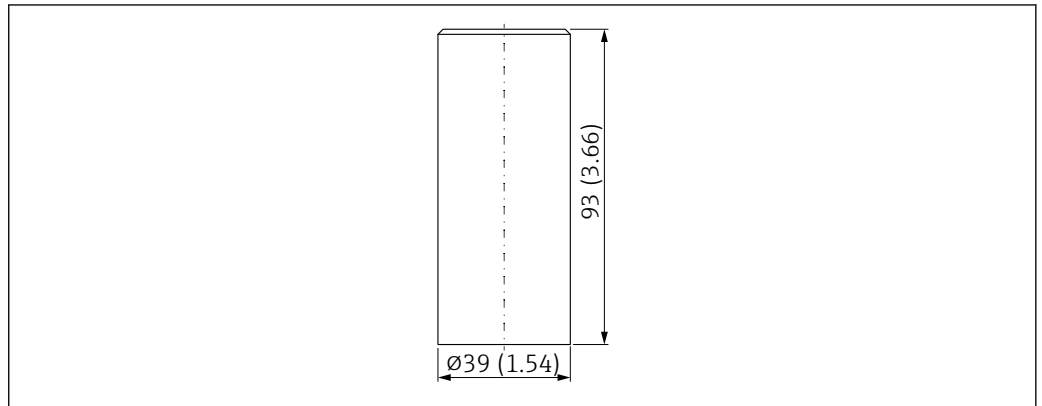
Housing adapter: Probe Ø10 mm, T_p max. 150 °C (302 °F)



A0061343

19 Housing adapter: Probe Ø10 mm, T_p max. 150 °C (302 °F). Unit of measurement mm (in)

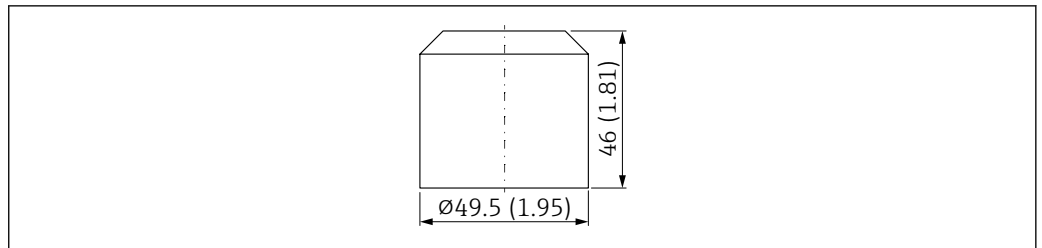
Housing adapter: Probe $\varnothing 10$ mm, T_p max. 200 °C (392 °F)



A0061344

20 Housing adapter: Probe $\varnothing 10$ mm, T_p max. 200 °C (392 °F). Unit of measurement mm (in)

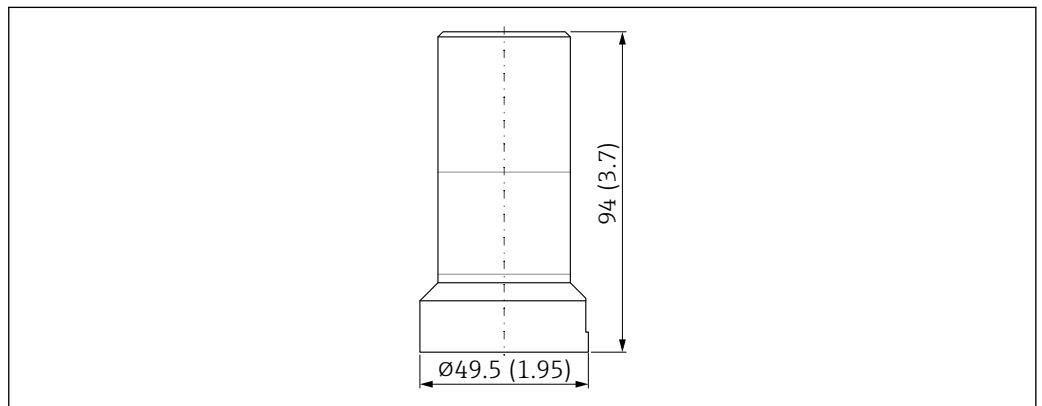
Housing adapter: Probe $\varnothing 16$ mm, T_p max. 150 °C (302 °F)



A0061345

21 Housing adapter: Probe $\varnothing 16$ mm, T_p max. 150 °C (302 °F). Unit of measurement mm (in)

Housing adapter: Probe $\varnothing 16$ mm, T_p max. 200 °C (392 °F)



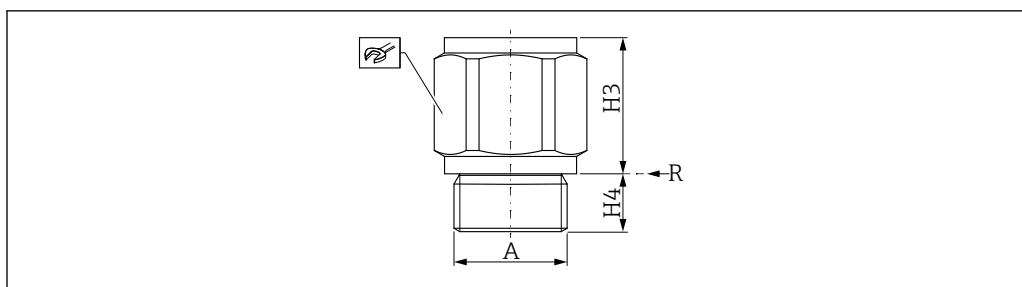
A0061346

22 Housing adapter: Probe $\varnothing 16$ mm, T_p max. 200 °C (392 °F). Unit of measurement mm (in)

Process connection thread ISO 228

Feature 105 – Process connection, sealing surface:

- Option I1 – thread ISO 228, G
- Option I2 – thread ISO 228, G



A0061337

23 Process connection thread ISO 228. Unit of measurement mm (in)

A Thread designation
H3 Height of process connection
H4 Thread height
R Reference surface

Feature 110 – Process connection: Option WJJ – G ½, 316L

A	H3	H4	Material		MWP ¹⁾
G ½	38 mm (1.5 in)	19 mm (0.75 in)	316L	41 mm	25 bar (362.5 psi)

1) Maximum Working Pressure

Feature 110 – Process connection: Option WKJ – G ¾, 316L

A	H3	H4	Material		MWP ¹⁾
G ¾	38 mm (1.5 in)	19 mm (0.75 in)	316L	41 mm	25 bar (362.5 psi)

1) Maximum Working Pressure

Feature 110 – Process connection: Option WLJ – G 1, 316L

A	H3	H4	Material		MWP ¹⁾
G 1	38 mm (1.5 in)	19 mm (0.75 in)	316L	41 mm	25 bar (362.5 psi)

1) Maximum Working Pressure

Feature 110 – Process connection: Option WNJ – G 1½, 316L

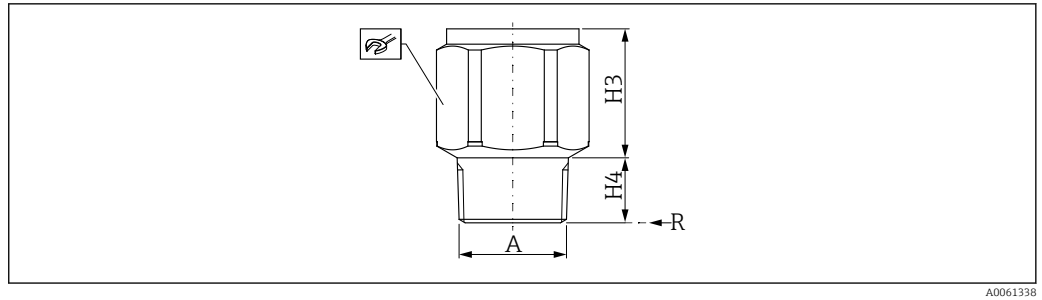
A	H3	H4	Material		MWP ¹⁾
G 1½	41 mm (1.61 in)	25 mm (0.98 in)	316L	55 mm	100 bar (1 450 psi)

1) Maximum Working Pressure

Process connection thread ASME B1.20.1

Feature 105 – Process connection, sealing surface:

Option A1 – Thread ASME B1.20.1, NPT



24 Process connection thread ASME B1.20.1. Unit of measurement mm (in)

A Thread designation
H3 Height of process connection
H4 Thread height
R Reference surface

Feature 110 – Process connection: Option VBJ – NPT ¾, 316L, 25 bar

A	H3	H4	Material		MWP ¹⁾
NPT ¾	38 mm (1.5 in)	19 mm (0.75 in)	316L	41 mm	25 bar (362.5 psi)

1) Maximum Working Pressure

Feature 110 – Process connection: Option VEJ – NPT 1½, 316L, 100 bar

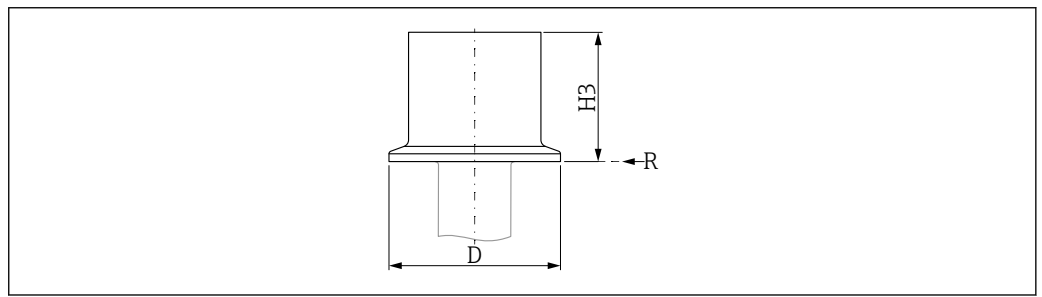
A	H3	H4	Material		MWP ¹⁾
NPT 1½	41 mm (1.61 in)	25 mm (0.98 in)	316L	55 mm	100 bar (1 450 psi)

1) Maximum Working Pressure

Clamp/Tri-Clamp process connection

Feature 105 – Process connection, sealing surface:

Option TA – Clamp/Tri-Clamp



25 Clamp/Tri-Clamp process connection. Unit of measurement mm (in)

D Diameter
H3 Height of process connection
R Reference surface

Feature 110 – Process connection: Option 3BJ – Tri-Clamp ISO 2852 DN 25 (1"), 316L, NA-CONNECT compatible

Nominal size	D	H3	Material	MWP ¹⁾
DN 25 (1")	50.5 mm (1.99 in)	57 mm (2.24 in)	316L	25 bar (362.5 psi)

1) Maximum Working Pressure

Feature 110 – Process connection: Option 3CJ – Tri-Clamp ISO 2852 DN 38 (1½"), 316L, NA-CONNECT compatible

Nominal size	D	H3	Material	MWP ¹⁾
DN 38 (1½")	50.5 mm (1.99 in)	57 mm (2.24 in)	316L	25 bar (362.5 psi)

1) Maximum Working Pressure

Feature 110 – Process connection: Option 3CK – Tri-Clamp ISO 2852 DN 38 (1½"), 316L, NA-CONNECT compatible

Nominal size	D	H3	Material	MWP ¹⁾
DN 38 (1½")	50.5 mm (1.99 in)	57 mm (2.24 in)	PTFE, 316L	25 bar (362.5 psi)

1) Maximum Working Pressure

Feature 110 – Process connection: Option 3EJ – Tri-Clamp ISO 2852 DN40-51 (2"), 316L, NA-CONNECT compatible

Nominal size	D	H3	Material	MWP ¹⁾
DN 40-51 (2")	64 mm (2.52 in)	66 mm (2.6 in)	316L	40 bar (580 psi)

1) Maximum Working Pressure

Feature 110 – Process connection: Option 3EK – Tri-Clamp ISO 2852 DN 40-51 (2"), PTFE > 316L, NA-CONNECT compatible

Nominal size	D	H3	Material	MWP ¹⁾
DN 40-51 (2")	64 mm (2.52 in)	66 mm (2.6 in)	PTFE, 316L	40 bar (580 psi)

1) Maximum Working Pressure

Feature 110 – Process connection: Option 3JJ – Tri-Clamp ISO 2852 DN 63.5 (2½"), 316L, NA-CONNECT compatible

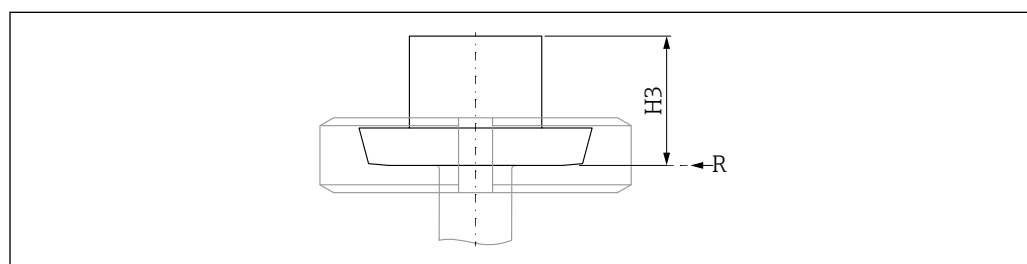
Nominal size	D	H3	Material	MWP ¹⁾
DN 63.5 (2½")	77.4 mm (3.05 in)	66 mm (2.6 in)	316L	25 bar (362.5 psi)

1) Maximum Working Pressure

Process connection DIN 11851 compression fitting

Feature 105 – Process connection, sealing surface:

Option N1 – DIN 11851 compression fitting



A0061340

26 Process connection DIN 11851 compression fitting. Unit of measurement mm (in)

H3 Height of process connection

R Reference surface

Feature 110 – Process connection: Option 1KJ – DIN 11851 DN50 PN40 slotted-nut, 316L

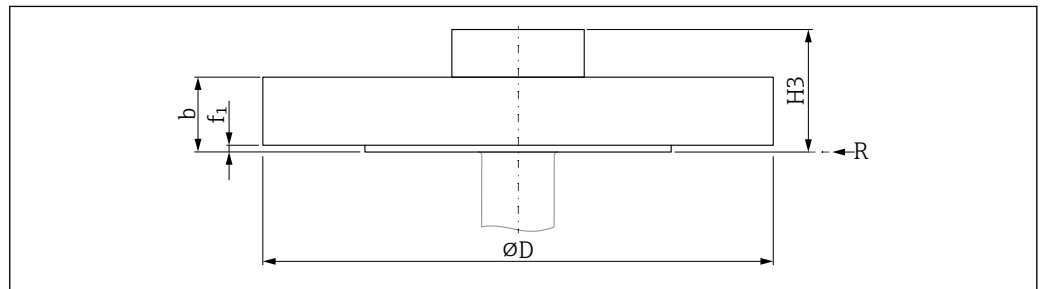
Nominal size	Pressure rating	H3	Material	MWP ¹⁾
DN50	PN40	57 mm (2.24 in)	316L	25 bar (362.5 psi)

1) Maximum Working Pressure

Process connection flange

Feature 105 – Process connection, sealing surface:

- Option **AA** – Flange ASME B16.5, RF
- Option **EA** – Flange EN 1092-1, A
- Option **EB** – Flange EN 1092-1, B1



A0061342

27 Process connection flange. Unit of measurement mm (in)

- D* Outer diameter
b Sheet thickness incl. raised face
*f*₁ Height of raised face
*H*₃ Process connection height, max. 66 mm (2.6 in); depends on probe type and diameter
R Reference surface

Feature 110 – Process connection: Option AAJ – NPS 1" Cl. 150 RF, 316L

Nominal size	Pressure rating	D	b	f ₁	Material
NPS 1"	Class 150	108 mm (4.25 in)	14.2 mm (0.56 in)	1.6 mm (0.063 in)	316L

Feature 110 – Process connection: Option ACJ – NPS 1½" Cl. 150 RF, 316L

Nominal size	Pressure rating	D	b	f ₁	Material
NPS 1½"	Class 150	127 mm (5.00 in)	17.5 mm (0.69 in)	1.6 mm (0.063 in)	316L

Feature 110 – Process connection: Option ADK – NPS 2" Cl. 150, PTFE > 316L

Nominal size	Pressure rating	D	b	f ₁	Material
NPS 2"	Class 150	152.4 mm (6.00 in)	15.7 mm (0.62 in)	1.6 mm (0.063 in)	PTFE, 316L

Feature 110 – Process connection: Option EZK – DN 25 PN25/40, PTFE > 316L

Nominal size	Pressure rating	D	b	f ₁	Material
DN 25	PN25/40	115 mm (4.53 in)	16 mm (0.63 in)	2 mm (0.08 in)	PTFE, 316L

Feature 110 – Process connection: Option E1J – DN 40 PN25/40 A, 316L

Nominal size	Pressure rating	D	b	f ₁	Material
DN40	PN25/40	150 mm (5.91 in)	18 mm (0.71 in)	0 mm (0 in)	316L

Feature 110 – Process connection: Option E2J – DN 50 PN25/40, 316L

Nominal size	Pressure rating	D	b	f ₁	Material
DN 50	PN25/40	165 mm (6.50 in)	20 mm (0.79 in)	2 mm (0.08 in)	316L

Feature 110 – Process connection: Option E2K – DN 50 PN25/40, PTFE > 316L

Nominal size	Pressure rating	D	b	f ₁	Material
DN 50	PN25/40	165 mm (6.50 in)	20 mm (0.79 in)	2 mm (0.08 in)	PTFE, 316L



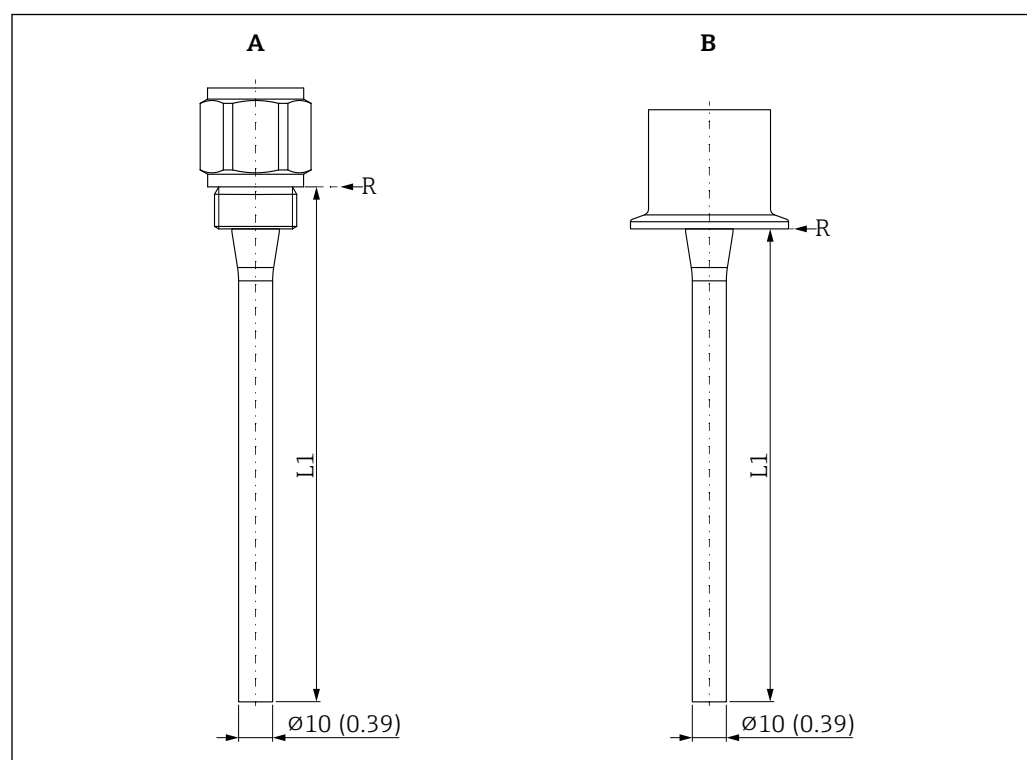
The flange dimensions depend on the selected standard and sealing surface (order options).

Dimensions that deviate from the standard are indicated.

Rod probes

- The active probe rod (L1) is fully insulated
- Total length of probe from reference surface: $L = L1 + L3$
- Thickness of insulation:
 - Probe rod $\varnothing 10$ mm (0.39 in): 1 mm (0.04 in)
 - Probe rod $\varnothing 16$ mm (0.63 in): 2 mm (0.08 in)
- The insulation is welded at the tip of the probe. No measurement can be performed in this area:
 - Probe rod $\varnothing 10$ mm (0.39 in), approx. 10 mm (0.39 in)
 - Probe rod $\varnothing 16$ mm (0.63 in), approx. 15 mm (0.59 in)
- The length tolerances for L1 and L3:
 - < 1 m (3.3 ft): 0 mm (0 in)/–5 mm (–0.2 in)
 - 1 m (3.3 ft)/3 m (9.8 ft): 0 mm (0 in)/–10 mm (–0.39 in)
 - 3 m (9.8 ft)/6 m (20 ft): 0 mm (0 in)/–20 mm (–0.79 in)

Rod probe $\varnothing 10$ mm (0.39 in)



A0061351

28 Rod probe $\varnothing 10$ mm (0.39 in). Unit of measurement mm (in)

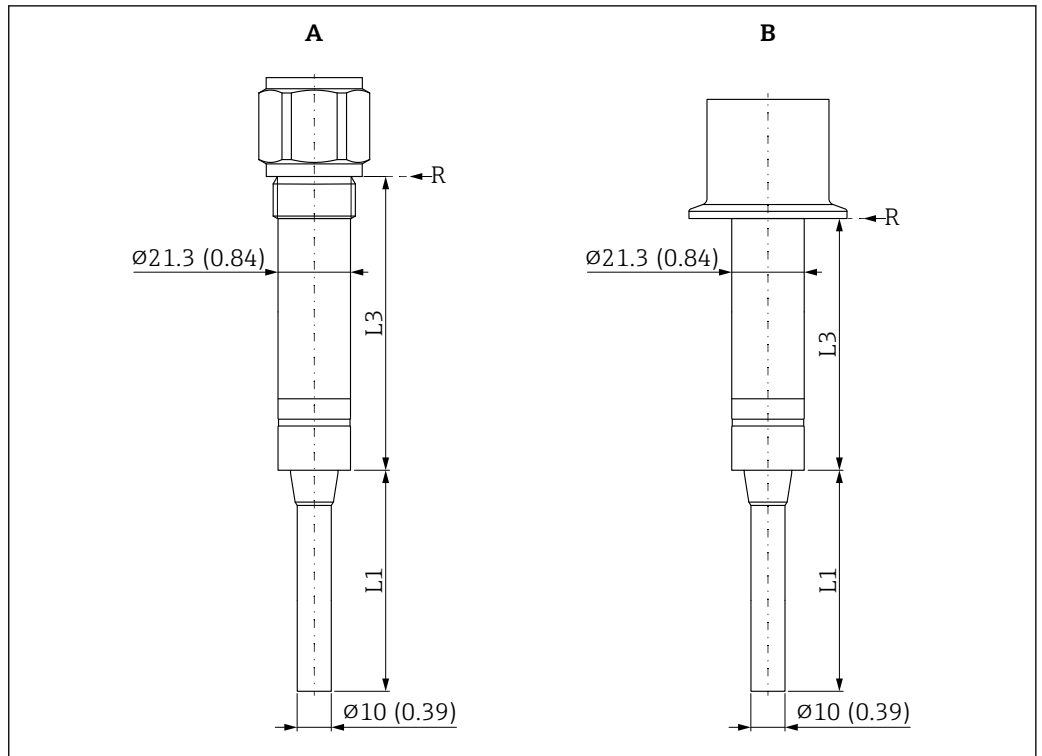
A Example: Rod probe with G thread

B Example: Rod probe with Tri-Clamp

L1 Active length

R Reference surface

Rod probe $\varnothing 10$ mm (0.39 in) with inactive length

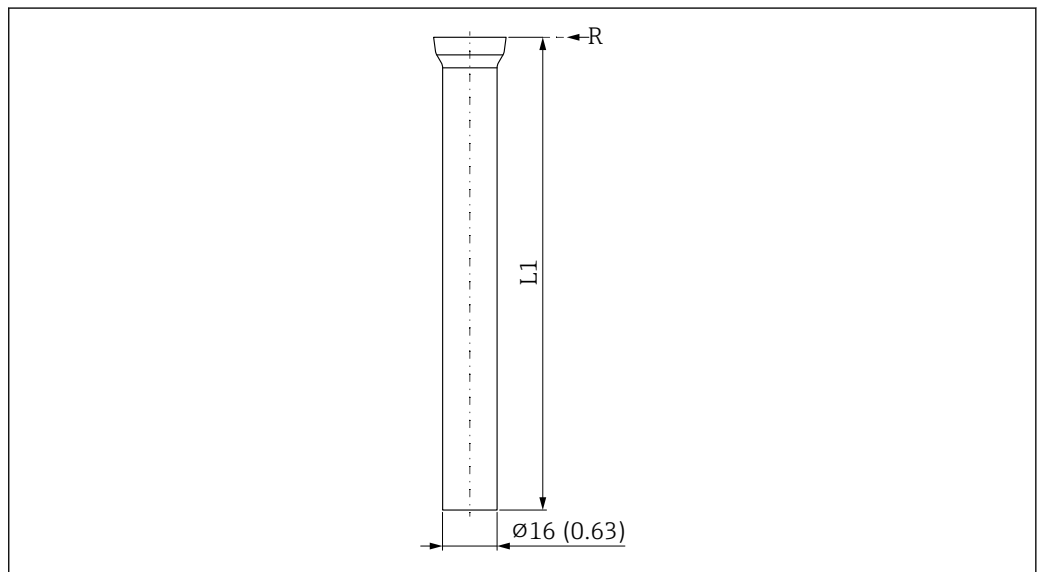


A0061353

29 Rod probe $\varnothing 10$ mm (0.39 in) with inactive length. Unit of measurement mm (in)

- A Example: Rod probe with G thread
- B Example: Rod probe with Tri-Clamp
- L1 Active length
- L3 Inactive length
- R Reference surface

Rod probe $\varnothing 16$ mm (0.63 in)

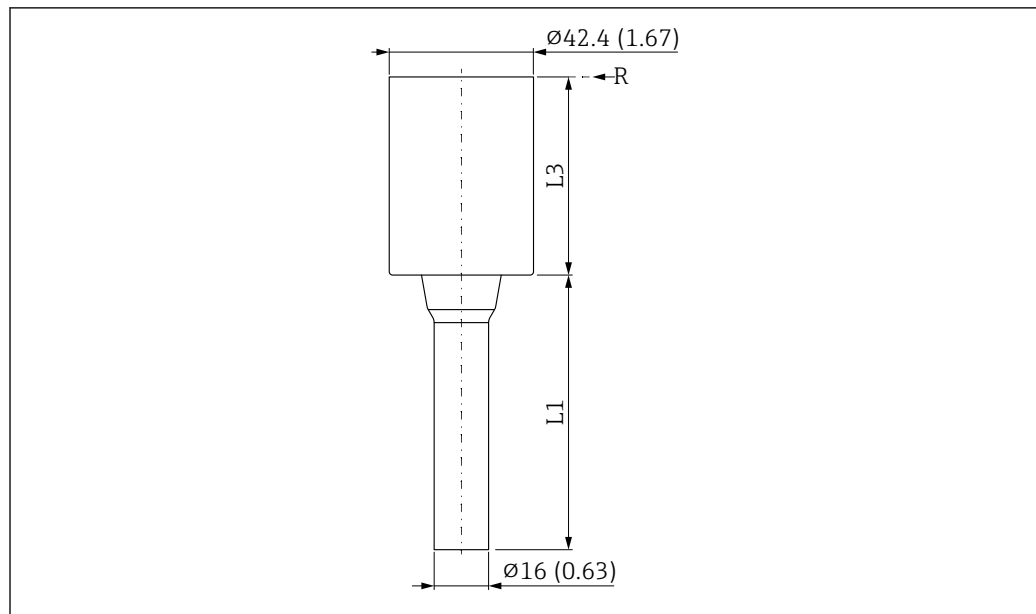


A0061355

30 Rod probe $\varnothing 16$ mm (0.63 in). Unit of measurement mm (in)

- L1 Active length
- R Reference surface

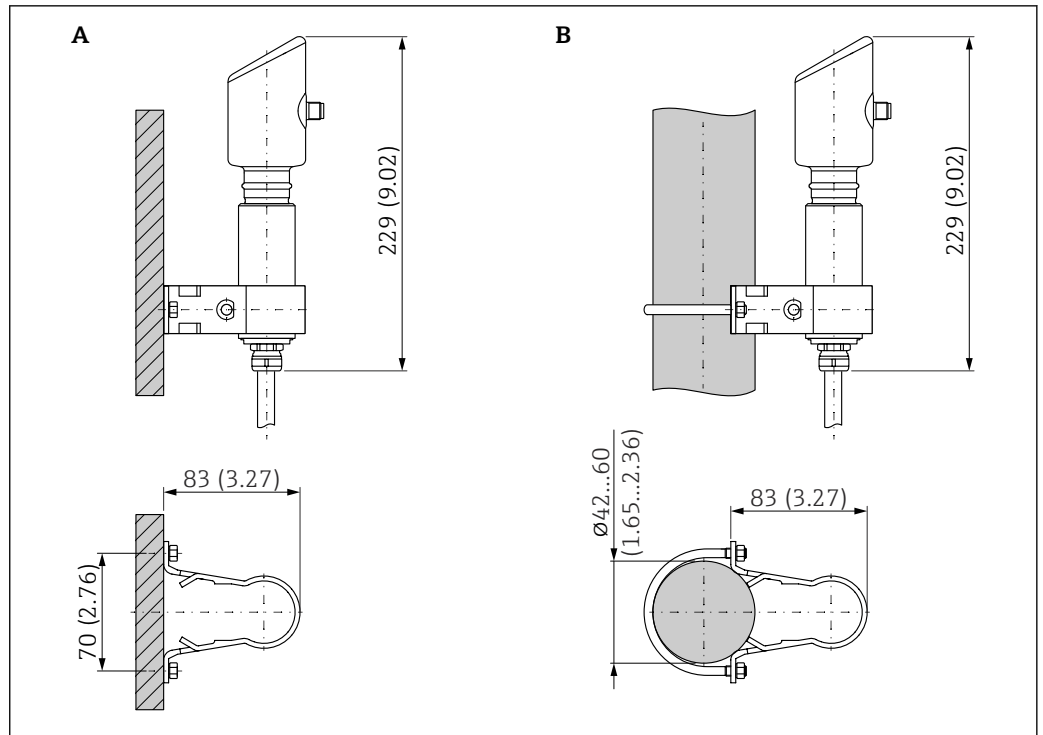
Rod probe $\varnothing 16$ mm (0.63 in) with inactive length



A0061360

31 Rod probe $\varnothing 16$ mm (0.63 in) with inactive length. Unit of measurement mm (in)

$L1$ Active length
 $L3$ Inactive length
 R Reference area



A0061613

40 Overall height per installation type

A Mounting on a wall
B Pipe mounting

Weight

The weights of the individual components must be added together for the total weight.

Housing weight including electronics and local display:

0.27 kg (0.60 lb)

Flange weight

The flange weight (316L) depends on the selected standard and sealing surface.

Additional information: Technical Information TI00426F

Probe weight:

- Probe rod Ø 10 mm (0.39 in)
0.5 kg/m (0.34 lb/ft)
- Probe rod Ø 16 mm (0.63 in)
1.1 kg/m (0.74 lb/ft)
- Probe rope: 0.04 kg/m (0.03 lb/ft)

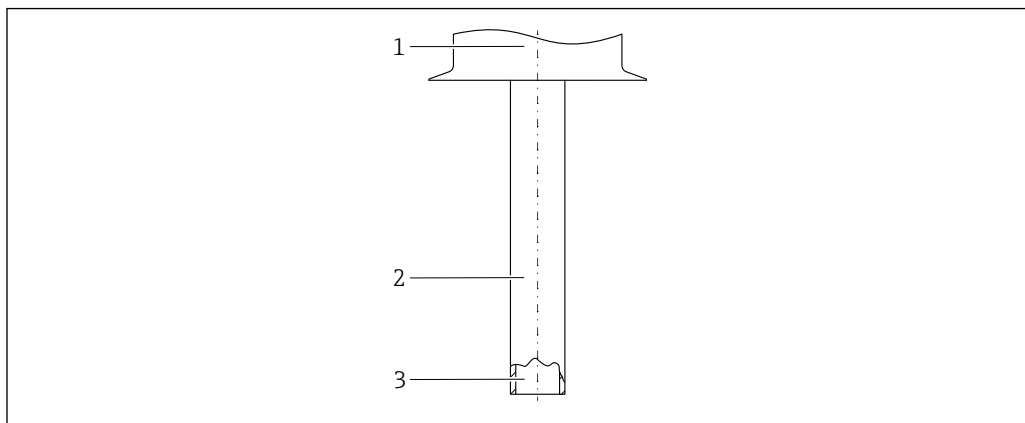
Materials

Delta-ferrite content

For the delta-ferrite content of the wetted parts, ≤ 1% can be guaranteed and certified (for welds ≤ 3%).

Non-wetted materials

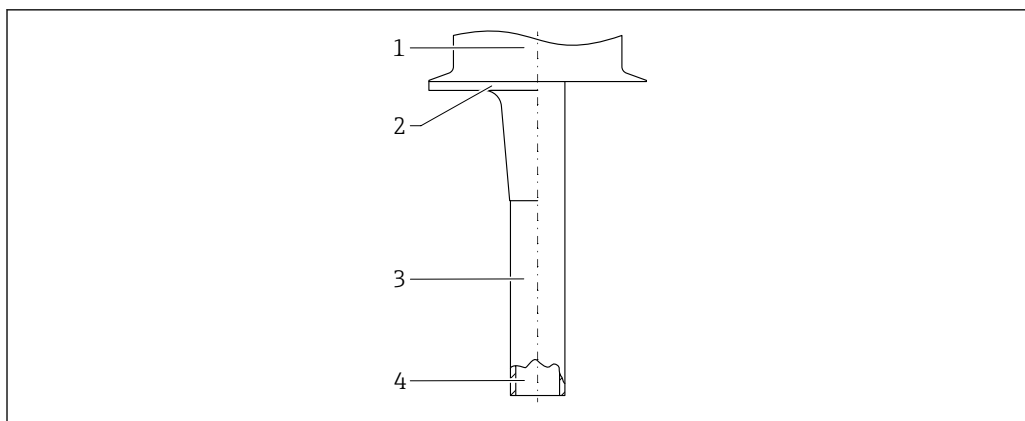
- Housing: 316L (1.4404)
- Display: Polycarbonate
- Device plug: For further information, see the “Device-specific accessories” section

Wetted material*PTFE-insulated rod probe*

A0061573

- 1 Process connection 316L
- 2 PTFE hose (order option)
- 3 PFA plug

Inactive length (L3) = 316L (order option)

PFA-insulated rod probe

A0061682

- 1 Process connection 316L
- 2 PTFE plating (order option)
- 3 PFA tube (order option)
- 4 PFA plug

Inactive length (L3) = 316L (order option)

The coating depends on the hygiene approval. With 3-A approval, the coating ends at the outer edge, with EHEDG approval on the sealing groove. Without 3-A or EHEDG approval, the coating is implemented up to the outer edge.

Surface roughness

Housing: Ra <1.6 µm (63 µin), electropolished

Display and user interface

Operation concept

Operator-oriented menu structure for user-specific tasks

- Guidance
- Diagnostics
- Application
- System

Fast and safe commissioning

- Interactive wizard with graphical interface for guided commissioning in FieldCare/DeviceCare or SmartBlue app
- Menu guidance with brief descriptions of the individual parameter functions
- Standardized operation at the device and in the operating tools
- IO-Link: Operation via DeviceCare/FieldCare, wired only

Integrated data memory

Up to 100 event messages recorded in the device

Efficient diagnostic behavior increases measurement reliability

- Remedial action is integrated in plain text
- Wide range of simulation options such as current, error messages, and process variables.

Bluetooth® wireless technology (optional)

- Quick and easy setup with the SmartBlue app or Field Xpert
- IO-Link: Bluetooth access only possible via SmartBlue app
- No additional tools or adapters required
- Encrypted single point-to-point data transmission (tested by Fraunhofer Institute) and password-protected communication via Bluetooth® wireless technology
- The device can be retrofitted with Bluetooth® wireless technology

Languages**Languages***Local display*

The operating language of the local display (optional) can be selected via the Product Configurator. If a different language was not selected, the local display is delivered from the factory with English. The operating language can be changed subsequently via the **Language** parameter.

Communication-specific notes

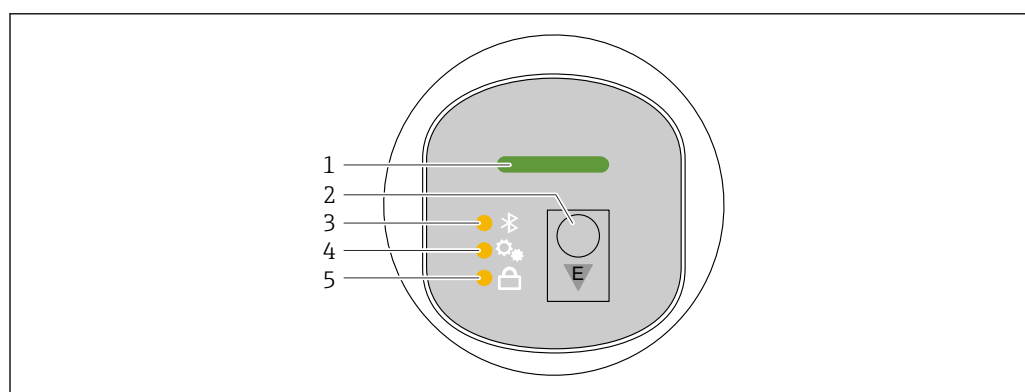
. 4–20 mA/IO-Link: The IODD is available in English.

LED

The device is optionally available with Bluetooth® wireless technology.

Functions:

- Displays the operating status (operation or fault)
- Displays Bluetooth® connection, locking status and function
- Easy setup of the following functions with one button:
 - Bluetooth® on/off
 - Locking on/off
 - Trigger function test



A0052426

- 1 Status LED
- 2 Operating key "E"
- 3 Bluetooth® LED
- 4 Trigger functional test LED
- 5 Keypad lock LED

Functional test

The functional test can be used for proof testing in accordance with the German Water Resources Act (WHG).

The operating status LED indicates the simulation status generated by the functional test.

Local display**Functions:**

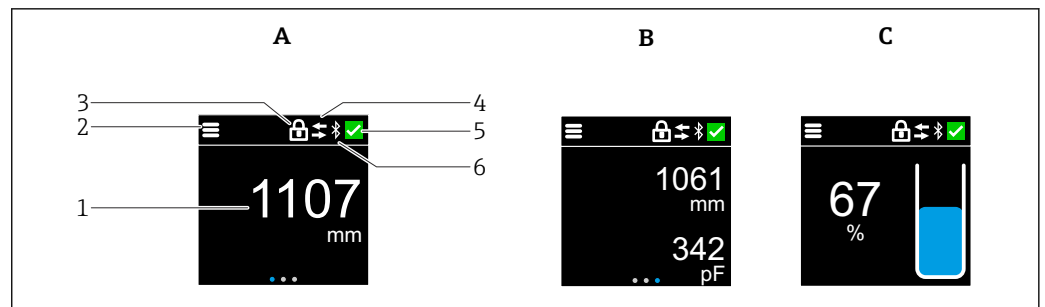
- Displays measured values along with fault and notice messages
- Displays a symbol in the event of an error
- Electronically adjustable local display (automatic or manual adjustment of display in 90° increments)
- Basic settings via the local display with touch function ⁴⁾
 - Locking on/off
 - Select the operating language
 - 4–20 mA/IO-Link: Starts Heartbeat Verification with passed/failed feedback on the local display
 - Bluetooth® wireless technology on/off
 - **Commissioning** wizard for basic set-up settings
 - Reads out device information such as Device name, Serial number and Firmware version
 - Active diagnostics and status
 - Reset device
 - Inverts colors for bright lighting conditions

The backlighting is reduced with lower terminal voltage.

Explanation of symbols and display contents

Optional display by swiping from left to right (see A, B and C in the following graphic). Swiping only works if the display has been ordered with touch control and the display has been unlocked beforehand.

The following figure is an example. The information shown depends on the settings of the local display.



A0062158

- A Standard display: One measured value with unit (adjustable)
- B Two measured values, each with unit (adjustable)
- C Graphic measured value display in %
- 1 Measured value
- 2 Menu or home symbol
- 3 Locking (locking only visible if locked via the "Safety mode" wizard. The "Safety mode" wizard is available if WHG option or Heartbeat Verification+ Monitoring option have been selected.)
- 4 Communication (symbol appears if communication is enabled)
- 5 Diagnostic symbol
- 6 Bluetooth® (symbol flashes if Bluetooth® connection is active)

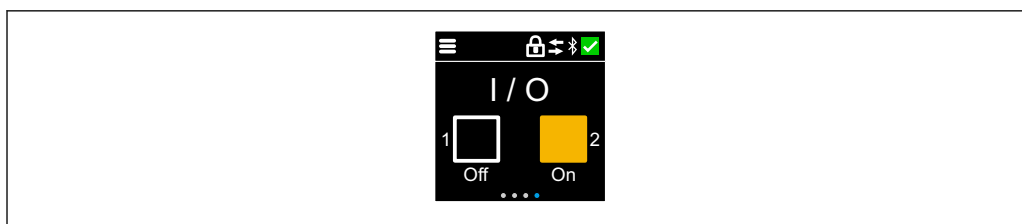
The default display can be permanently set via the operating menu.

4–20 mA/IO-Link: Shows the switch outputs

The default display can be permanently set via the operating menu.

The physical switch outputs are displayed by means of an additional setting on the local display.

⁴⁾ For devices without touch function, settings can be configured using operating tools (FieldCare, DeviceCare, SmartBlue).



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41 Switch status display of outputs OUT1 and OUT2

This function OUT2 active can be ordered via feature 570 "Service", option IQ, and is activated at the factory.

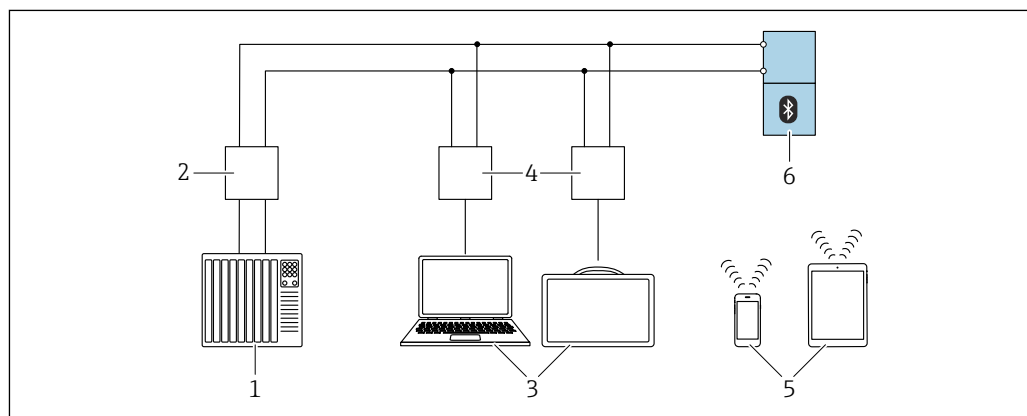
When the switch output is active, the button turns yellow and the display changes from "Off" to "On".

When a current output is used, the output value is displayed under the symbol instead of "Off" or "On".

Remote operation

IO-Link

Via 4-20 mA/IO-Link or Bluetooth® wireless technology



A0053130

43 Options for remote operation via IO-Link

- 1 PLC (programmable logic controller)
- 2 IO-Link master
- 3 Computer with operating tool e.g. DeviceCare/FieldCare)
- 4 FieldPort SFP20
- 5 Smartphone or tablet with SmartBlue app
- 6 Transmitter

Operation via Bluetooth® wireless technology (optional)

Prerequisite

- Device with Bluetooth® wireless technology order option
- Smartphone or tablet with Endress+Hauser SmartBlue app or PC with DeviceCare from version 1.07.07 or FieldXpert

The connection has a range of up to 25 m (82 ft). The range can vary depending on environmental conditions such as attachments, walls or ceilings.

The operating keys on the display are locked as soon as the device is connected via Bluetooth®.

System integration

4–20 mA/IO-Link

- IO-Link V1.1.
- Smart Sensor Profile type 4.3
- IO-Link device port: IO-Link port class A
- SIO mode: Yes
- Speed: COM2; 38.4 kBaud
- Process data width: See Operating Instructions
- Data storage: Yes
- Block configuration: Yes

Supported operating tools

4–20 mA/IO-Link

Smartphone or tablet with Endress+Hauser SmartBlue app, DeviceCare from version 1.07.07, FieldCare.

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**.

The features described in this section depend on the selected product configuration.

General material compliance	Endress+Hauser guarantees compliance with all relevant laws and regulations, including the current guidelines for materials and substances. Examples: ■ RoHS ■ China RoHS ■ REACH ■ POP VO (Stockholm Convention) For further information and general declarations of compliance, see the Endress+Hauser website www.endress.com
Material compliance for contact with food	The device has been developed for food contact applications. Versions can be selected that meet the following requirements: ■ EU Food Contact Material (EC) 1935/2004 ■ US Food Contact Material FDA CFR 21 ■ CN Food Contact Material GB 4806
Hygienic design compliance	3-A and EHEDG-certified versions of the sensor are suitable for Cleaning-in-Place (CIP) and Sterilization-in-Place (SIP) without removing them from the plant. This means that the sensor does not need to be removed during cleaning. The maximum permitted pressure and temperature values for sensor and adapter must not be exceeded (see notes in this TI). ■ Notes on installation and certification in accordance with 3-A and EHEDG: SD02503F document "Hygienic approvals" ■ Information on 3-A and EHEDG-certified adapters: TI00426F document "Weld-in adapters, process adapters and flanges"
CRN approval	Device 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. Product Configurator: feature "Additional approval"
RoHS	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).
cGMP	The device was developed for life sciences applications. You can select versions with a cGMP declaration (Current Good Manufacturing Practice) for process-wetted parts with the following content in English: ■ Materials of construction ■ Polishing and surface treatment ■ Materials and compounds compliance table: USP, FDA ■ TSE/BSE-compliant based on EMA/410/01 Rev.3

TSE (BSE) compliance (ADI free - Animal Derived Ingredients)	Versions can be selected that meet the following requirements: ■ The parts of this product in contact with the process are not made from materials derived from animals or ■ The parts of this product in contact with the process correspond to at least the requirements of the EMA/410/01 Rev. 3 guideline (TSE (BSE) compliant)
ASME B31.3/31.1	Versions can be selected that meet the following requirements: The design, the material used, the pressure and temperature ranges and the labeling of the devices meet the requirements of ASME B31.1 (piping for power plants) and/or ASME B31.3 (process piping).
ASME BPE	The measuring system was developed for life sciences applications. Options can be selected that meet the requirements of the ASME BPE (Bioprocessing Equipment) standard.
Pressure equipment with permitted pressure less than 200 bar, no pressure-bearing volume	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 working pressure. If pressure equipment does not have a pressure-bearing housing, there is no pressure accessory present within the meaning of the Directive. Druckgeräterichtlinie DGRL (PED) 2014/68/EU, Artikel 2, Absatz 5

Ordering 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 information specific to the measuring point, such as the 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

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 (https://www.endress.com/de/pages/supporting-tools/device-viewer) 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.
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Identification	Measuring point (TAG) The device can be ordered with a tag name. Location of tag name In the additional specification, select: ■ Stainless steel tag plate ■ Paper adhesive label ■ TAG provided by the customer ■ Nameplate ■ IEC 61406 stainless steel TAG ■ IEC 61406 stainless steel + NFC TAG ■ IEC 61406 stainless steel, stainless steel TAG
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- IEC 61406 stainless steel + NFC, stainless steel
- IEC 61406 stainless steel TAG, plate provided
- IEC 61406 stainless steel + NFC, plate provided

Definition of tag name

In the additional specification, specify:

Three lines of maximum 18 characters each

The specified tag name appears on the selected plate.

Visualization in SmartBlue app

The first 32 characters of the tag name

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

Display on the nameplate

The first 16 characters of the tag name

Display in electronic nameplate (ENP)

The first 32 characters of the tag name



For details, see document SD03128P

Application packages

The application package can be ordered together with the device or can be activated subsequently with an activation code. Detailed information on the relevant order code is available from the website www.endress.com or from the Endress +Hauser Sales Center.

Heartbeat Technology

Heartbeat Technology offers diagnostic functionality by means of continuous self-monitoring, the transmission of additional measured variables to external condition monitoring as well as in situ verification of devices in the application.

Heartbeat Diagnostics

Continuous self-monitoring of the device.

Diagnostic messages output to:

- the local display
- an asset management system (e.g. FieldCare or DeviceCare)
- an automation system (e.g. PLC)

Heartbeat Verification

- Monitoring of the installed device without interrupting the process, including a verification report
- Clear measuring point assessment (pass/fail) with high total test coverage as part of the manufacturer's specification
- Can be used to document normative requirements
- Meets the requirements for metrological traceability in accordance with ISO 9001 (ISO 9001:2015 Section 7.1.5.2)

The verification report can be generated via Bluetooth® wireless technology.

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.
- **Loop diagnostics** wizard: This wizard can be used to detect increased measuring circuit resistance values or decreasing power supply.
- **Process window DC value** wizard: This wizard is used to set the monitoring of the relative permittivity. The function can be used to detect a change in medium. The probe must be completely covered for this function.
- **Process window probe insulation** wizard: The **Insulation breakage monitoring** parameter can be configured with this wizard. Probe insulation monitoring only works if the probe is covered by the medium in the monitored area and is electrically conductive.
- **Build-up detection** wizard: This wizard can be used to configure automatic buildup detection and optimize maintenance intervals. Buildup detection only works if the probe is not covered.
- **Safety mode** wizard: The device can be write-protected via the software using this wizard. The safety-related parameters must be confirmed in the wizard.

Detailed description

See Special Documentation for SD Heartbeat Technology.

Accessories

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

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

Device-specific accessories**M12 socket**

M12 socket, straight

- Material:
Body: PA; union nut: stainless steel; seal: EPDM
- Degree of protection (fully locked): IP69
- Order number: 71638191

M12 socket, elbowed

- Material:
Body: PA; union nut: stainless steel; seal: EPDM
- Degree of protection (fully locked): IP69
- Order number: 71638253

Cable

Cable 4 x 0.34 mm² (20 AWG) with M12 socket, elbowed, screw plug, length 5 m (16 ft)

- Union nut: nickel-plated die-cast zinc
 - Degree of protection (fully locked): IP68/69
 - Body: TPU; cable: PVC
 - Order number: 52010285
- Union nut: 316L
 - Degree of protection (fully locked): IP69
 - Body: TPU; cable: PVC
 - Order number: 52024216

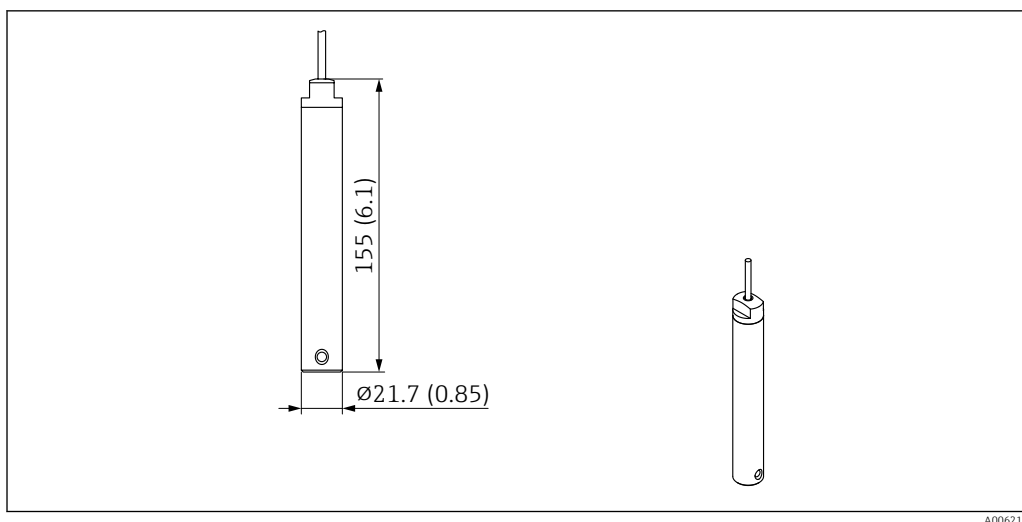
Wire colors:

- 1 = BN = brown
- 2 = WT = white
- 3 = BU = blue
- 4 = BK = black

Rope shortening set for fully insulated probes

A rope shortening set is available as an accessory for shortening the rope probe. The rope shortening set contains a new probe weight among other items.

In the case of devices with explosion protection approval (Ex) or water-law approval (WHG), the rope probe may only be shortened by Endress+Hauser Service.



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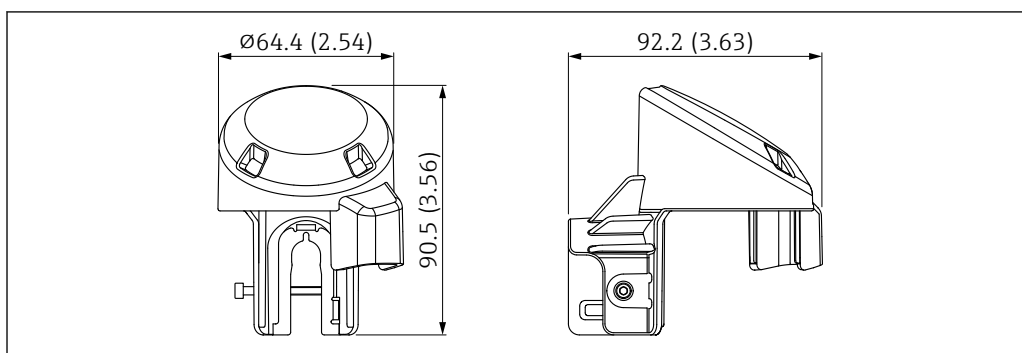
Order number: 942901-0001



Additional information: SD03578F

Protection cover

The protection cover is available as an accessory. The protection cover protects the device from the effects of weather conditions and provides additional protection from unintentional shock.



A0060871

Order number: 71765845



Additional information: SD03566F

Weld-in adapter, process adapter and flange

Additional information: Technical Information TI00426F

SmartBlue app

Mobile app for easy configuration of devices on site via Bluetooth® wireless technology.

Service-specific accessories**DeviceCare SFE100**

Configuration tool for IO-Link, HART, PROFIBUS and FOUNDATION Fieldbus field devices. DeviceCare is available for download free of charge at www.software-products.endress.com. You need to register in the Endress+Hauser software portal to download the application.



Additional information: Technical Information TI01134S

FieldCare SFE500

FDT-based plant asset management tool

It can configure all intelligent field units in your system and helps you manage them. By using the status information, it is also a simple but effective way of checking their status and condition.



Additional information: Technical Information TI00028S

Online tools**Device Viewer**

All the spare parts for the device, along with the order code, are listed in the *Device Viewer* (www.endress.com/deviceviewer).

System components**Field Xpert**

Universal, high-performance tablet PC for device configuration in Ex Zone 2 and non-Ex areas.

Additional information on www.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)**

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

Document type: Description of Device Parameters (GP)

The document is part of the Operating Instructions and serves as a reference for parameters, providing a detailed explanation of each individual parameter of the operating menu.

Document type: Brief Operating Instructions (KA)

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

Document type: Safety Instructions, certificates

Depending on the approval, safety instructions are supplied with the device, e.g. XA. This documentation is 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.

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