

TECHNICAL INFORMATION

Pulscon LTC51

Guided Level Radar



With regard to the supply of products, the current issue of the following document is applicable:
The General Terms of Delivery for Products and Services of the Electrical Industry,
published by the Central Association of the Electrical Industry (Zentralverband Elektrotechnik und
Elektroindustrie (ZVEI) e.V.) in its most recent version as well as the supplementary clause:
"Expanded reservation of proprietorship"

Application

- Rod, rope or coax probe
- Process connection: Starting 3/4 in thread or flange
- Temperature: -40 ... +200 °C (-40 ... +392 °F)
- Pressure: -1 ... +40 bar (-14.5 ... +580 psi)
- Maximum measuring range: Rod 10 m (33 ft); rope 45 m (148 ft); coax 6 m (20 ft)
- Accuracy: ±2 mm (0.08 in)
- International explosion protection certificates; WHG; ship building approval; steam boiler approval; EN 10204-3.1
- Linearity protocol (5-point)

Your benefits

- Reliable measurement even for changing product and process conditions
- HistoROM data management for easy commissioning, maintenance and diagnostics
- Highest reliability due to Multi-Echo Tracking
- Hardware and software developed according to IEC 61508 (up to SIL3)
- Seamless integration into control or asset management systems
- Intuitive user interface in national languages
- Easy proof test for SIL and WHG



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1 Important document information

1.1 Symbols

1.1.1 Symbols used

This document contains information that you must read for your own personal safety and to avoid property damage. Depending on the hazard category, the warning signs are displayed in descending order as follows:

Safety-relevant symbols



Danger!

This symbol indicates an imminent danger.

Non-observance will result in personal injury or death.



Warning!

This symbol indicates a possible fault or danger.

Non-observance may cause personal injury or serious property damage.



Caution!

This symbol indicates a possible fault.

Non-observance could interrupt devices and any connected facilities or systems, or result in their complete failure.

Informative symbols



Note!

This symbol brings important information to your attention.



Action

This symbol indicates a paragraph with instructions.

1.1.2 Electrical symbols







Symbol	Meaning
	Direct current A terminal to which DC voltage is applied or through which direct current flows.
	Alternating current A terminal to which alternating voltage is applied or through which alternating current flows.
	Direct current and alternating current <ul style="list-style-type: none"> • A terminal to which alternating voltage or DC voltage is applied. • A terminal through which alternating current or direct current flows.
	Ground connection A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.
	Protective ground connection A terminal which must be connected to ground prior to establishing any other connections.
	Equipotential connection A connection that has to be connected to the plant grounding system: This may be a potential equalization line or a star grounding system depending on national or company codes of practice.

Table 1.1

1.1.3 Symbols in graphics




Symbol	Meaning
1, 2, 3 ...	Item numbers
	Series of steps
A, B, C, ...	Views
A-A, B-B, C-C, ...	Sections
	Hazardous area Indicates a hazardous area.
	Safe area (non-hazardous area) Indicates a non-hazardous location.

Table 1.2

2 Function and system design

2.1 Measuring principle

2.1.1 Basic principles

The device is a "downward-looking" measuring system that functions according to the ToF method (ToF = Time of Flight). The distance from the reference point to the product surface is measured. High-frequency pulses are injected to a probe and led along the probe. The pulses are reflected by the product surface, received by the electronic evaluation unit and converted into level information. This method is also known as TDR (Time Domain Reflectometry).

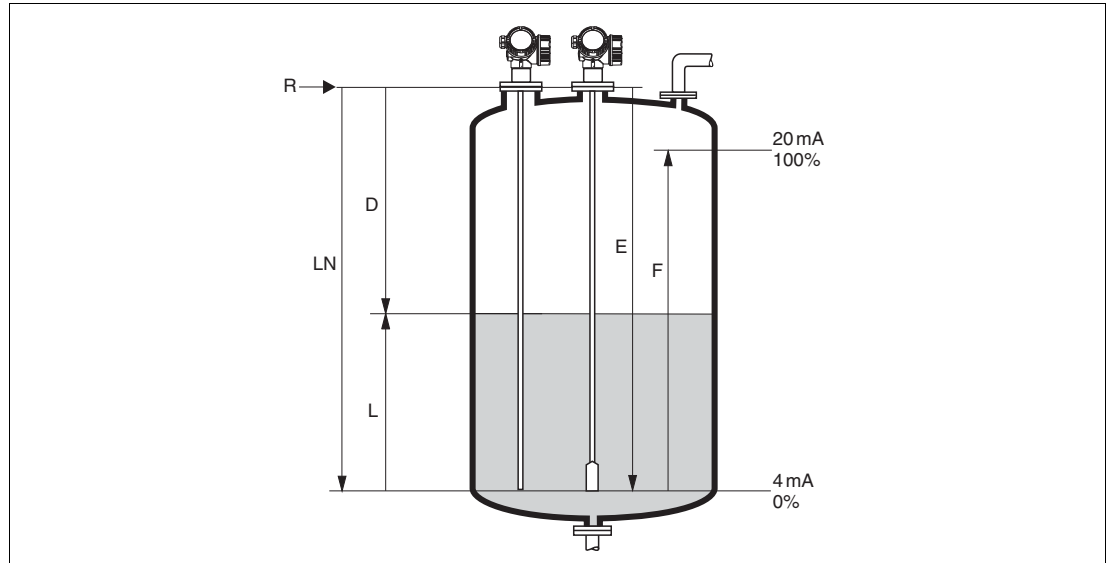


Figure 2.1 Parameters for level measurement with the guided radar

- LN Probe length
- D Distance
- L Level
- R Reference point of measurement
- E Empty calibration (= zero)
- F Full calibration (= span)



Note!

If, for rope probes, the DC value is less than 7, then measurement is not possible in the area of the straining weight (0 to 250 mm from end of probe; lower blocking distance).

2.1.2 Dielectric constant

The dielectric constant (DC) of the medium has a direct impact on the degree of reflection of the high frequency pulses. In the case of large DC values, such as for water or ammonia, there is strong pulse reflection while, with low DC values, such as for hydrocarbons, weak pulse reflection is experienced.



2.1.3 Input

The reflected pulses are transmitted from the probe to the electronics. There, a microprocessor analyzes the signals and identifies the level echo which was generated by the reflection of the high-frequency pulses at the product surface. This clear signal detection system benefits from over 30 years' experience with pulse time-of-flight procedures.

The distance D to the product surface is proportional to the time of flight t of the impulse:

$$D = c \times t / 2,$$

where c is the speed of light.

Based on the known empty distance E , the level L is calculated:

$$L = E - D$$



Note!

The reference point R of the measurement is located at the process connection. See chapter 10.

The device possesses functions for interference echo suppression that can be activated by the user. They guarantee that interference echoes from e. g. internals and struts are not interpreted as level echoes.

2.1.4 Output

The device is preset at the factory to the probe length ordered so that in most cases only the application parameters that automatically adapt the device to the measuring conditions need to be entered. For models with a current output, the factory adjustment for zero point E and span F is 4 mA and 20 mA, for digital outputs and the display module 0 % and 100 %. A linearization function with max. 32 points, which is based on a table entered manually or semi-automatically, can be activated on site or via remote operation. This function allows the level to be converted into units of volume or mass, for example.

2.2 Life cycle of the product

Engineering

- Universal measuring principle
- Measurement unaffected by medium properties
- Hardware and software developed according to SIL IEC 61508

Procurement

- Pepperl+Fuchs being the world market leader in level measurement guarantees asset protection
- Worldwide support and service

Installation

- Special tools are not required
- Reverse polarity protection
- Modern, detachable terminals
- Main electronics protected by a separate connection compartment



Commissioning

- Fast, menu-guided commissioning in only 6 steps
- Plain text display in national languages reduces the risk of error or confusion
- Direct local access of all parameters
- Short instruction manual at the device

Operation

- Multi-echo tracking: Reliable measurement through self-learning echo-search algorithms taking into account the short-term and long-term history in order to check the found echoes for plausibility and to suppress interference echoes.
- Diagnostics in accordance with NAMUR NE 107

Maintenance

- HistoROM: Data backup for instrument settings and measured values
- Exact instrument and process diagnosis to assist fast decisions with clear details concerning remedies
- Intuitive, menu-guided operating concept in national languages saves costs for training, maintenance and operation
- Cover of the electronics compartment can be opened in hazardous areas

Retirement

- Order code translation for subsequent models
- RoHS-conforming (Restriction of certain Hazardous Substances), unleaded soldering of electronic components
- Environmentally sound recycling concept

2.3 Measuring system

2.3.1 General notes on probe selection

- Normally use rod probes for liquids. Rope probes are used in liquids for measuring ranges > 10 m (33 ft) and with restricted ceiling clearance which does not allow the installation of rigid probes.
- Coax probes are suited to liquids with viscosities of up to approx. 500 cst. Coax probes can measure most liquefied gases, as of a dielectric constant of 1.4. Moreover, installation conditions, such as nozzles, tank internal fittings etc., have no effect on the measurement when a coax probe is used. A coax probe offers maximum EMC safety when used in plastic tanks.

Probe selection

The various types of probe in combination with the process connections are suitable for the following applications ¹:

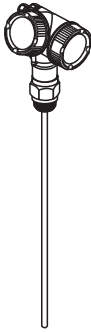

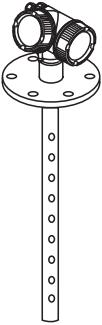
Type of probe	Rod probe	Rope probe	Coax probe ^a			
						
Feature "Probe"	Option		Option			
	1	8 mm (316L)	2	4 mm (316)	4	... mm (316L)
	5	1/3 in (316L)	3	1/6 in (316)	G	... inch (316L)
	8	12 mm (316L)	E	4 mm (316) with center rod	H	... mm (Alloy C)
	9	1/2 in (316L)	F	1/6 in (316) with center rod	K	... inch (Alloy C)
	6	12 mm (Alloy C)				
	7	1/2 in (Alloy C)				
	A C	16 mm (316L) divisible				
B D	0.63 in (316L) divisible					
Max. probe length	10 m (33 ft) ^b	45 m (148 ft)	6 m (20 ft)			
For application	Level measurement in liquids					

Table 2.1

^a Multiple punched for process connections G1-1/2 in or flange

^b Maximum probe length for indivisible rod probes: 4 m (13 ft)

¹ If required, rod and rope probes can be replaced. They are secured with Nord-Lock washers or a thread coating. For further information on service and spare parts please contact the Pepperl+Fuchs service.

3 Input

3.1 Measured variable

The measured variable is the distance between the reference point and the product surface.

Subject to the empty distance entered E the level is calculated.

Alternatively, the level can be converted into other variables (volume, mass) by means of linearization (32 points).

3.2 Measuring range

The following table describes the media groups and the possible measuring range as a function of the media group.

Pulskon LTC51					
Media group	DC (ϵ_r)	Typical liquids	Measuring range		
			bare metallic rod probes	bare metallic rope probes	coax probes
1	1.4 ... 1.6	condensed gases, e. g. N ₂ , CO ₂	on request		
2	1.6 ... 1.9	<ul style="list-style-type: none"> liquefied gas, e. g. propane solvent Freon palm oil 	<ul style="list-style-type: none"> one-piece: 4 m (13 ft) divisible: 10 m (33 ft) 	15 ... 22 m (49 ... 72 ft)	6 m (20 ft)
3	1.9 ... 2.5	mineral oils, fuels	<ul style="list-style-type: none"> one-piece: 4 m (13 ft) divisible: 10 m (33 ft) 	22 ... 32 m (72 ... 105 ft)	6 m (20 ft)
4	2.5 ... 4	<ul style="list-style-type: none"> benzene, styrene, toluene furan naphthalene 	<ul style="list-style-type: none"> one-piece: 4 m (13 ft) divisible: 10 m (33 ft) 	32 ... 42 m (105 ... 138 ft)	6 m (20 ft)
5	4 ... 7	<ul style="list-style-type: none"> chlorobenzene, chloroform cellulose spray isocyanate, aniline 	<ul style="list-style-type: none"> one-piece: 4 m (13 ft) divisible: 10 m (33 ft) 	42 ... 45 m (138 ... 148 ft)	6 m (20 ft)
6	> 7	<ul style="list-style-type: none"> aqueous solutions alcohols ammonia 	<ul style="list-style-type: none"> one-piece: 4 m (13 ft) divisible: 10 m (33 ft) 	45 m (148 ft)	6 m (20 ft)

Table 3.1



Note!

Reduction of the max. possible measuring range through buildup, above all of moist products. Due to the high diffusion rate of ammonia it is recommended with gas-tight bushing for measurements in this medium.



3.3 Blocking distance

The upper blocking distance (= UB) is the minimum distance from the reference point of the measurement (mounting flange) to the maximum level.

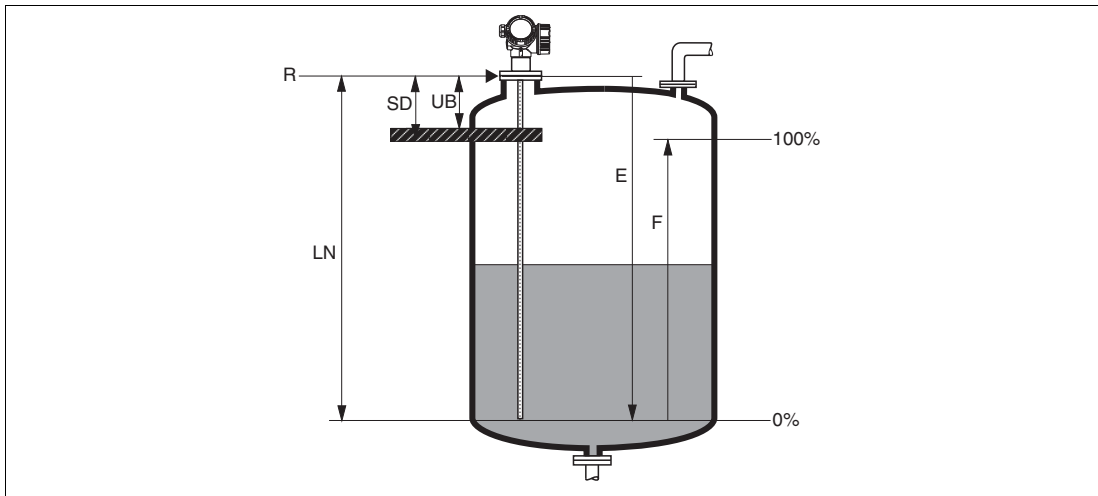


Figure 3.1 Definition of blocking distance and safety distance

- R** Reference point of measurement
- LN** Probe length
- UB** Upper blocking distance
- E** Empty calibration (= zero)
- F** Full calibration (= span)
- SD** Safety distance

Blocking distance (factory setting):

- with coax probes: 0 mm (0 in)
- with rod and rope probes up to 8 m (26 ft): 200 mm (8 in)
- with rod and rope probes exceeding a length of 8 m (26 ft): 0.025 x (length of probe)



Note!

The specified blocking distances are preset on delivery. Depending on the application these settings can be changed.

For rod and rope probes and for media with DC > 7 (or generally for stilling well/bypass applications) the blocking distance may be reduced to 100 mm (4 in).

Within the blocking distance, a reliable measurement can not be guaranteed.



Note!

A safety distance SD can be defined in addition to the blocking distance. A warning is generated if the level rises into this safety distance.

3.4 Measuring frequency spectrum

100 MHz to 1.5 GHz

4 Output

4.1 Output signal

HART

Signal coding	FSK ± 0.5 mA over currency signal
Data transmission rate	1200 Baud
Galvanic isolation	Yes

Table 4.1

PROFIBUS PA

Signal coding	Manchester Bus Powered (MBP)
Data transmission rate	31.25 kBit/s, voltage mode
Galvanic isolation	Yes

Table 4.2

Switch output



Note!

For HART devices, the switch output is available as an option. See product structure, feature "Electrical Output", option ID. Devices with PROFIBUS PA always have a switch output.

Switch output	
Function	Open collector switching output
Switching behavior	Binary (conductive or non-conductive), switches when the programmable switch point is reached
Failure mode	non-conductive
Electrical connection values	$U = 10.4 \dots 35$ V DC, $I = 0 \dots 40$ mA
Internal resistance	$R_I < 880 \Omega$ The voltage drop at this internal resistance has to be taken into account on planning the configuration. For example, the resulting voltage at a connected relay must be sufficient to switch the relay.
Insulation voltage	floating, Insulation voltage 1350 V DC to power supply and 500 V AC to ground
Switch point	freely programmable, separately for switch-on and switch-off point
Switching delay	freely programmable from 0 to 100 s, separately for switch-on and switch-off point
Number of switching cycles	corresponds to the measuring cycle
Signal source device variables	<ul style="list-style-type: none"> • Level linearized • Distance • Terminal voltage • Electronic temperature • Relative echo amplitude • Diagnostic values, Advanced diagnostics
Number of switching cycles	unlimited

Table 4.3



4.2 Signal on alarm

Depending on the interface, failure information is displayed as follows:

- Current output (for HART devices)
 - Fail-safe mode selectable (in accordance with NAMUR Recommendation NE 43):
Minimum alarm: 3.6 mA
Maximum alarm (= factory setting): 22 mA
 - Fail-safe mode with user-selectable value: 3.59 ... 22.5 mA
- Local display
 - Status signal (in accordance with NAMUR Recommendation NE 107)
 - Plain text display
- Operating tool via digital communication (HART, PROFIBUS PA) or service interface (CDI)
 - Status signal (in accordance with NAMUR Recommendation NE 107)
 - Plain text display

4.3 Linearization

The linearization function of the device allows the conversion of the measured value into any unit of length or volume. Linearization tables for calculating the volume in cylindrical tanks are pre-programmed. Other tables of up to 32 value pairs can be entered manually or semi-automatically.

4.4 Galvanic isolation

All circuits for the outputs are galvanically isolated from each other.

4.5 Protocol-specific data

HART

Manufacturer ID	17 (0x11)
Device type ID	0x34
HART specification	6.0
Device description files (DTM, DD)	Information and files under: <ul style="list-style-type: none"> • www.pepperl-fuchs.com • www.hartcomm.org
HART load	Min. 250Ω
HART device variables	The measured values can be freely assigned to the device variables. Measured values for PV (primary variable) <ul style="list-style-type: none"> • Level linearized • Distance • Electronic temperature • Relative echo amplitude Measured values for SV, TV, FV (second, third and fourth variable) <ul style="list-style-type: none"> • Level linearized • Distance • Terminal voltage • Electronic temperature • Absolute echo amplitude • Relative echo amplitude • Calculated DC
Supported functions	<ul style="list-style-type: none"> • Burst mode • Additional transmitter status

Table 4.4

Wireless HART data

Minimum start-up voltage	11.4 V
Start-up current	3.6 mA
Start-up time	15 s
Minimum operating voltage	11.4 V
Multidrop current	3.6 mA
Set-up time	1 s

Table 4.5



PROFIBUS PA

Manufacturer ID	93 (5D HEX)
Ident number	0E3B HEX
Profile version	3.02
GSD file	Information and files under: <ul style="list-style-type: none"> • www.pepperl-fuchs.com • www.profibus.org
GSD file version	
Output values	<p>Analog Input:</p> <ul style="list-style-type: none"> • Level linearized • Distance • Terminal voltage • Electronic temperature • Absolute echo amplitude • Relative echo amplitude • Calculated DC <p>Digital Input:</p> <ul style="list-style-type: none"> • Extended diagnostic blocks • Status output PFS Block
Input values	<p>Analog Output:</p> <ul style="list-style-type: none"> • Analog value from PLC (for sensor block external pressure and temperature) • Analog value from PLC to be indicated on the display <p>Digital Output:</p> <ul style="list-style-type: none"> • Extended diagnostic block • Level limiter • Sensor block measurement on • Sensor block save history on • Status output
Supported functions	<ul style="list-style-type: none"> • Identification & Maintenance Simple device identification via control system and nameplate • Automatic Ident Number Adoption GSD compatibility mode with respect to the previous device • Physical Layer Diagnostics Installation check of the PROFIBUS segment via terminal voltage and telegram monitoring • PROFIBUS Up-/Download Up to 10 times faster reading and writing of parameters via PROFIBUS Up-/Download • Condensed Status Simple and self-explanatory diagnostic information due to categorization of diagnostic messages

Table 4.6

5 Power supply

5.1 Terminal assignment

2-wire: 4 ... 20 mA HART

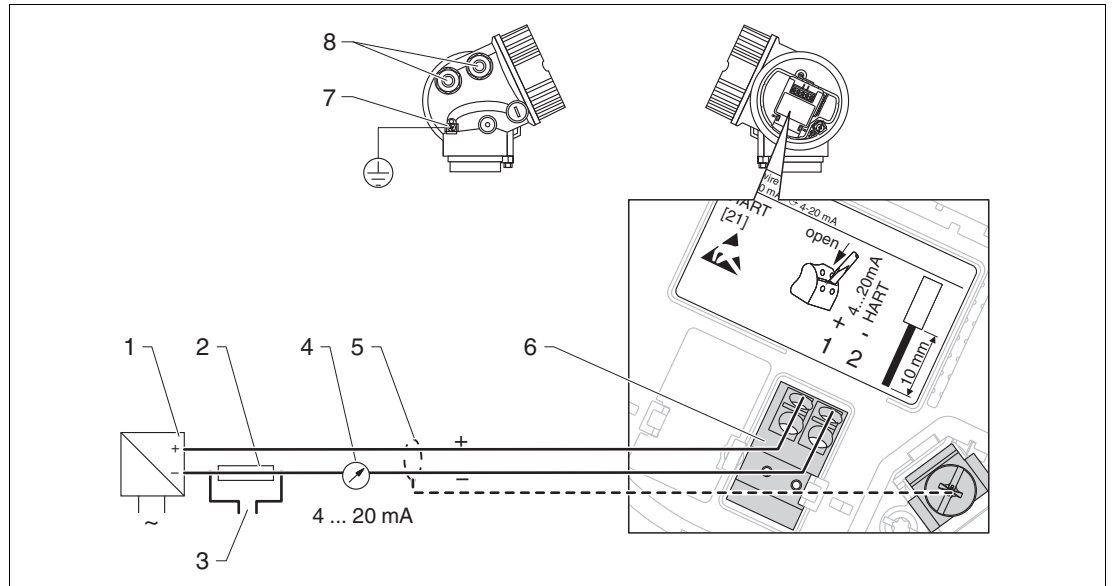


Figure 5.1 Terminal assignment 2-wire; 4 ... 20 mA HART

- 1 Active barrier with power supply (e. g. KCD2-STC-Ex1): observe terminal voltage
- 2 HART communication resistor ($\geq 250 \Omega$): observe maximum load
- 3 Connection for optional field communicator
- 4 Analog display device: observe maximum load
- 5 Cable screen; observe cable specification
- 6 4 ... 20 mA HART (passive): terminals 1 and 2
- 7 Terminal for potential equalization line
- 8 Cable entry

2-wire: 4 ... 20mA HART, switch output

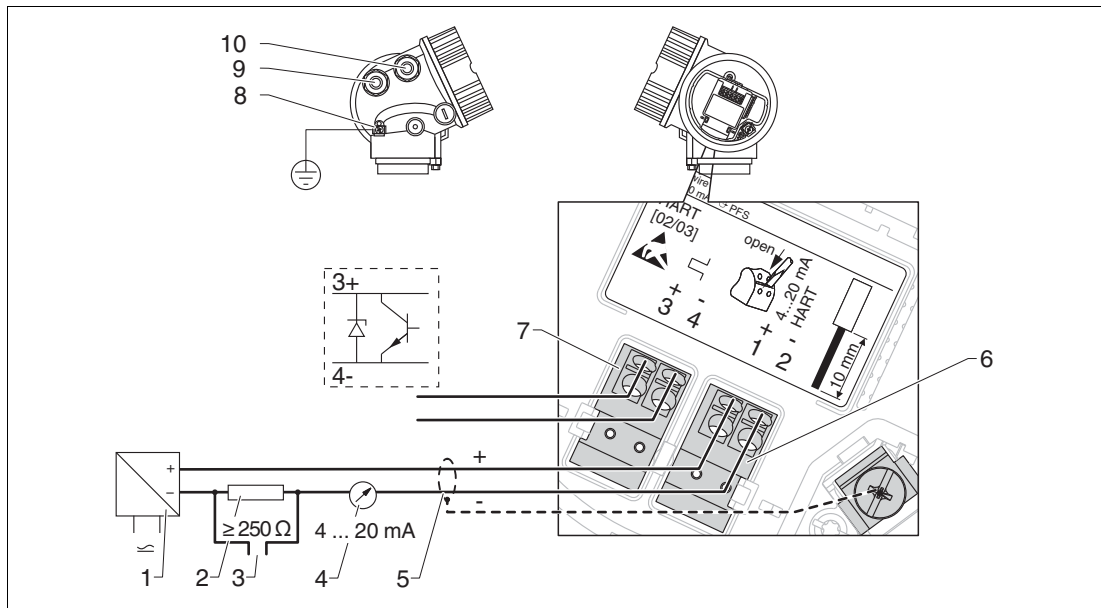


Figure 5.2 Terminal assignment 2-wire; 4 ... 20mA HART, switch output

- 1 Active barrier with power supply (e. g. KCD2-STC-Ex1): observe terminal voltage
- 2 HART communication resistor ($\geq 250 \Omega$): observe maximum load
- 3 Connection for optional field communicator
- 4 Analog display device: observe maximum load
- 5 Cable screen; observe cable specification
- 6 4 ... 20 mA HART (passive): terminals 1 and 2
- 7 Switch output (open collector): terminals 3 and 4
- 8 Terminal for potential equalization line
- 9 Cable entry for 4 ... 20 mA HART line
- 10 Cable entry for switch output line

2-wire: 4 ... 20 mA HART, 4 ... 20 mA

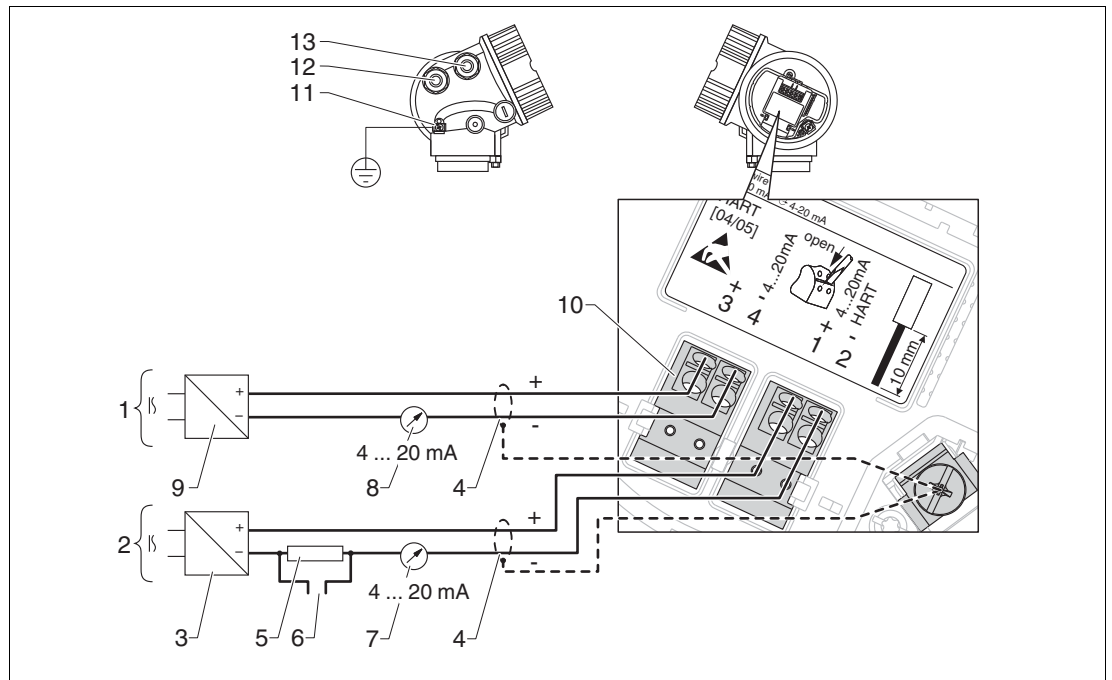


Figure 5.3 Terminal assignment 2-wire, 4 ... 20 mA HART, 4 ... 20 mA

- 1 Connection current output 2
- 2 Connection current output 1
- 3 Supply voltage for current output 1 (e. g. KCD2-STC-Ex1); observe terminal voltage
- 4 Cable screen; observe cable specification
- 5 HART communication resistor ($\geq 250 \Omega$); observe maximum load
- 6 Connection for optional field communicator
- 7 Analog display device; observe maximum load
- 8 Analog display device; observe maximum load
- 9 Supply voltage for current output 2 (e. g. KCD2-STC-Ex1); observe terminal voltage
- 10 Current output 2: terminals 3 and 4
- 11 Terminal for the potential equalization line
- 12 Cable entry for current output 1
- 13 Cable entry for current output 2



Note!

This version is also suited for single-channel operation. In this case, current output 1 (terminals 1 and 2) must be used.

4-wire: 4 ... 20 mA HART (10.4 ... 48 V DC)

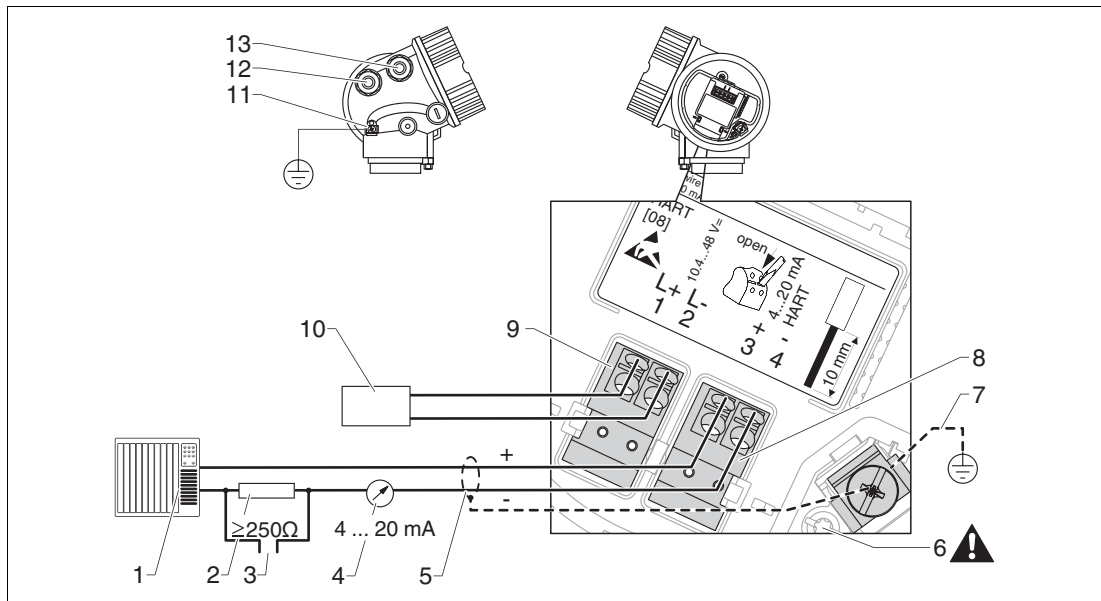


Figure 5.4 Terminal assignment 4-wire; 4 ... 20mA HART (10.4 ... 48 V DC)

- 1 Evaluation unit, e. g. PLC
- 2 HART communication resistor ($\geq 250 \Omega$): observe maximum load
- 3 Connection for optional field communicator
- 4 Analog display device: observe maximum load
- 5 Signal cable including screening (if required), observe cable specification
- 6 Protective connection; do not disconnect!
- 7 Protective earth, observe cable specification
- 8 4 ... 20 mA HART (active): terminals 3 and 4
- 9 Supply voltage: terminals 1 and 2
- 10 Supply voltage: Observe terminal voltage, observe cable specification
- 11 Terminal for potential equalization
- 12 Cable entry for signal line
- 13 Cable entry for power supply



Warning!

To ensure electrical safety:

- Do not disconnect the protective connection (6).
- Disconnect the supply voltage before disconnecting the protective earth (7).



Note!

Connect protective earth to the internal ground terminal (7) before connecting the supply voltage. If necessary, connect the potential matching line to the external ground terminal (11).



Note!

In order to ensure electromagnetic compatibility (EMC): Do not only ground the device via the protective earth conductor of the supply cable. Instead, the functional grounding must also be connected to the process connection (flange or threaded connection) or to the external ground terminal.



Note!

An easily accessible power switch must be installed in the proximity of the device. The power switch must be marked as a disconnecter for the device (IEC/EN 61010).

4-wire: 4 ... 20 mA HART (90 ... 253 V AC)

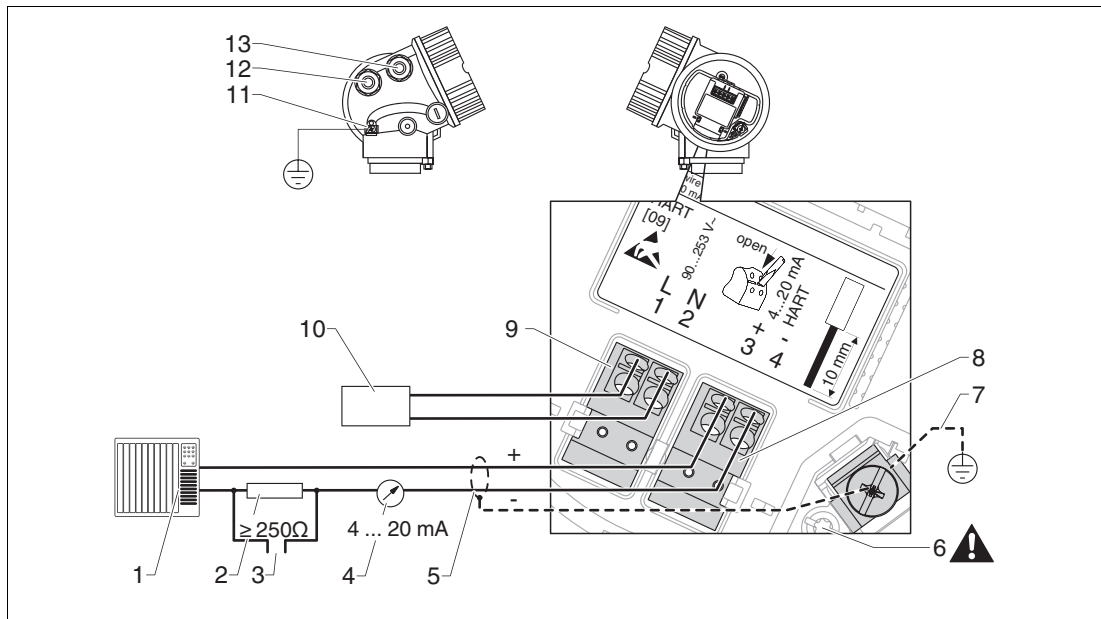


Figure 5.5 Terminal assignment 4-wire; 4 ... 20 mA HART (90 ... 253 V AC)

- 1 Evaluation unit, e. g. PLC
- 2 HART communication resistor ($\geq 250 \Omega$): observe maximum load
- 3 Connection for optional filed communicator
- 4 Analog display device: observe maximum load
- 5 Signal cable including screening (if required), observe cable specification
- 6 Protective connection; do not disconnect!
- 7 Protective earth, observe cable specification
- 8 4 ... 20 mA HART (active): terminals 3 and 4
- 9 Supply voltage: terminals 1 and 2
- 10 Supply voltage: observe terminal voltage, observe cable specification
- 11 Terminal for potential equalization
- 12 Cable entry for signal line
- 13 Cable entry for power supply



Warning!

To ensure electrical safety:

- Do not disconnect the protective connection (6).
- Disconnect the supply voltage before disconnecting the protective earth (7).



Note!

Connect protective earth to the internal ground terminal (7) before connecting the supply voltage. If necessary, connect the potential matching line to the external ground terminal (11).



Note!

In order to ensure electromagnetic compatibility (EMC): Do not only ground the device via the protective earth conductor of the supply cable. Instead, the functional grounding must also be connected to the process connection (flange or threaded connection) or to the external ground terminal.



Note!

An easily accessible power switch must be installed in the proximity of the device. The power switch must be marked as a disconnecter for the device (IEC/EN 61010).



PROFIBUS PA

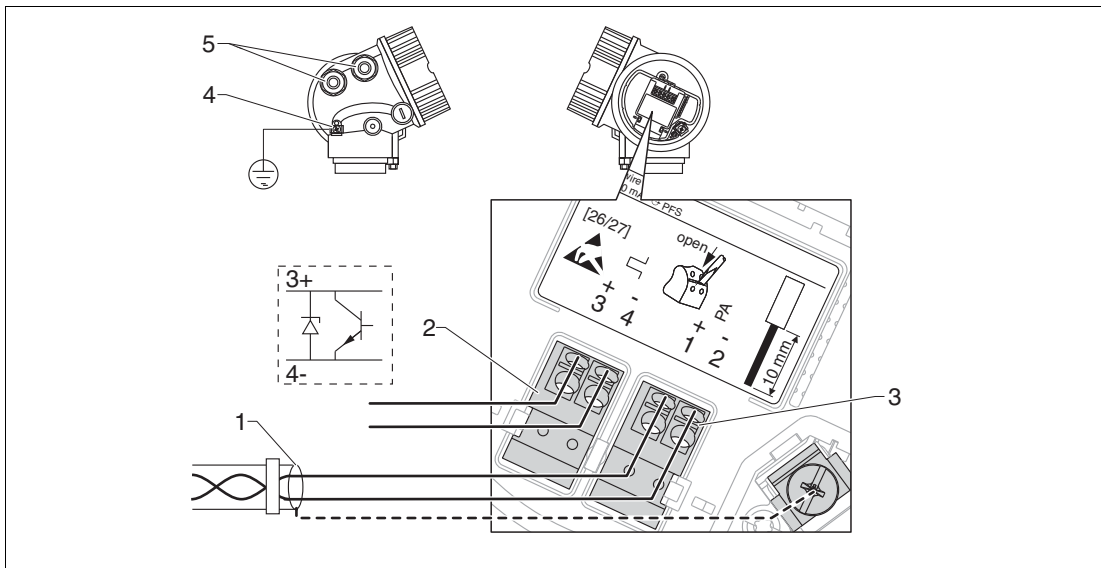


Figure 5.6 Terminal assignment PROFIBUS PA

- 1 Cable screen: observe cable specifications
- 2 Switch output (open collector): terminals 3 and 4
- 3 Connection PROFIBUS PA: terminals 1 and 2
- 4 Terminal for potential equalization line
- 5 Cable entries



Connection examples for the switch output



Note!

For HART devices, the switch output is available as an option. See product structure, feature "Electrical Output", option ID. Devices with PROFIBUS PA always have a switch output.

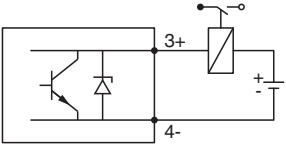
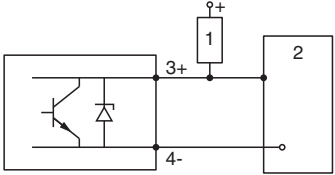
 <p>Connection of a relay Suitable relays (examples):</p> <ul style="list-style-type: none"> • Solid-state relay: Phoenix Contact OV-24DC/480AC/5 with mounting rail connector UMK-1 OM-R/AMS • Electromechanical relay: Phoenix Contact PLC-RSC-12DC/21 	 <p>Connection of a digital input</p> <ol style="list-style-type: none"> 1 Pull-up resistor 2 Digital input
---	--

Table 5.1



Note!

For optimum interference immunity we recommend to connect an external resistor (internal resistance of the relay or Pull-up resistor) of $< 1000 \Omega$.



5.2 HART Loop Converter KFD2-HLC-Ex1.D.**

The dynamic variables of the HART protocol can be converted into individual 4 to 20 mA sections using the HART loop converter KFD2-HLC-Ex1.D.**. The variables are assigned to the current output and the measuring ranges of the individual parameters are defined in the KFD2-HLC-Ex1.D.**.

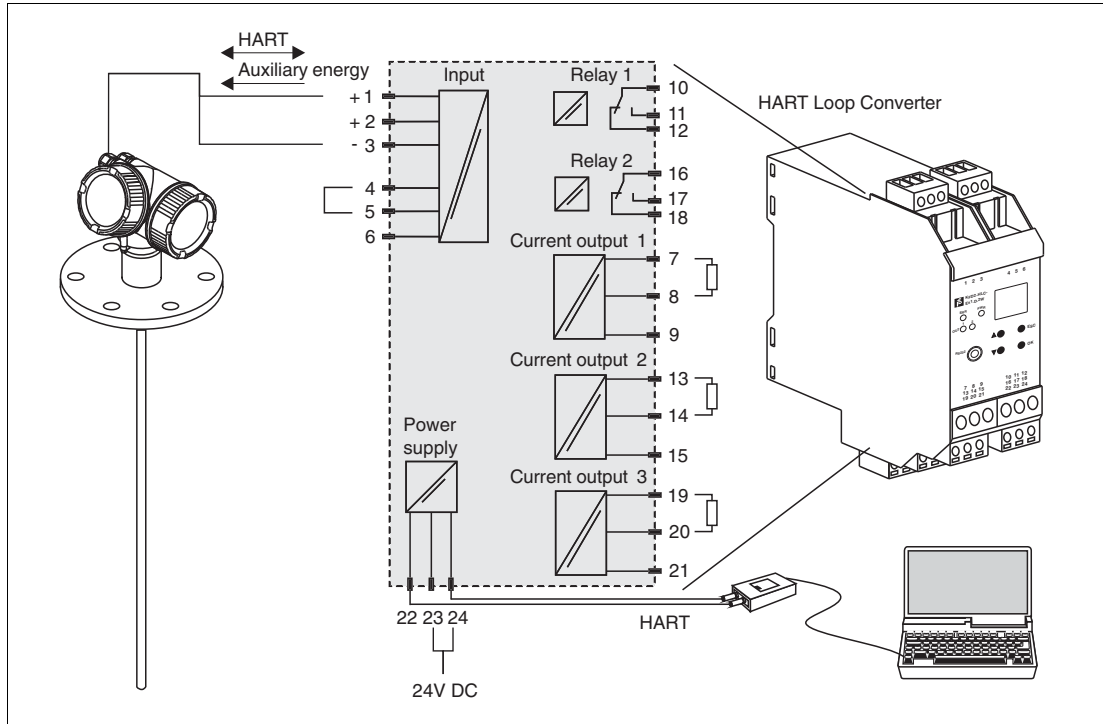


Figure 5.7 Connection example KFD2-HLC-Ex1.D.**: passive 2-wire device and current outputs connected as power source

The HART loop converter KFD2-HLC-Ex1.D.** can be acquired.



Note!

Additional documentation: see data sheets.



5.3 Device plug connectors



Note!

For the versions with fieldbus plug connector (M12 or 7/8 in), the signal line can be connected without opening the housing.

Pin assignment of the M12 plug connector

	Pin	Meaning
	1	Signal +
	2	not connected
	3	Signal -
	4	Ground

Table 5.2

Pin assignment of the 7/8 in plug connector

	Pin	Meaning
	1	Signal -
	2	Signal +
	3	not connected
	4	Screen

Table 5.3



5.4 Power supply

An external power supply is required.



Note!

Various supply units can be ordered from Pepperl+Fuchs: see chapter 14.4.

2-wire, 4 ... 20 mA HART, passive ¹

Approval ^a	Terminal voltage U at the device	Maximum load R, depending on the supply voltage U ₀ at the supply unit
<ul style="list-style-type: none"> • Non-Ex • Ex nA • CSA GP 	11.5 ... 35 V ^b	
<ul style="list-style-type: none"> • Ex ic 	11.5 ... 32 V ^c	
<ul style="list-style-type: none"> • Ex ia/IS 	11.5 ... 30 V ^d	
<ul style="list-style-type: none"> • Ex d/XP • Ex ic(ia) • Ex tD/DIP 	13.5 ... 30 V ^e	

Table 5.4

^a Feature "Approval" of the product structure

^b For ambient temperatures $T_a \leq -30\text{ °C}$ (-22 °F) a minimum voltage of 14 V is required for the startup of the device at the MIN error current (3.6 mA). The startup current can be parametrized. If the device is operated with a fixed current $I \geq 4.5\text{ mA}$ (HART multidrop mode), a voltage of $U \geq 11.5\text{ V}$ is sufficient throughout the entire range of ambient temperatures.

^c For ambient temperatures $T_a \leq -30\text{ °C}$ (-22 °F) a minimum voltage of 14 V is required for the startup of the device at the MIN error current (3.6 mA). The startup current can be parametrized. If the device is operated with a fixed current $I \geq 4.5\text{ mA}$ (HART multidrop mode), a voltage of $U \geq 11.5\text{ V}$ is sufficient throughout the entire range of ambient temperatures.

^d For ambient temperatures $T_a \leq -30\text{ °C}$ (-22 °F) a minimum voltage of 14 V is required for the startup of the device at the MIN error current (3.6 mA). The startup current can be parametrized. If the device is operated with a fixed current $I \geq 4.5\text{ mA}$ (HART multidrop mode), a voltage of $U \geq 11.5\text{ V}$ is sufficient throughout the entire range of ambient temperatures.

^e For ambient temperatures $T_a \leq -20\text{ °C}$ (-4 °F) a minimum voltage of 16 V is required for the startup of the device at the MIN error current (3.6 mA).

¹ Feature "Electrical Output" of the product structure, option IH

2-wire; 4 ... 20 mA HART, switch output ¹

Approval ^a	Terminal voltage U at the device	Maximum load R, depending on the supply voltage U ₀ at the supply unit
<ul style="list-style-type: none"> • Non-Ex • Ex nA • Ex nA(ia) • Ex ic • Ex ic(ia) • Ex d(ia)/XP • Ex ta/DIP • CSA GP 	12 ... 35 V ^b	<p>The graph plots Maximum load R [Ω] on the y-axis (0 to 500) against supply voltage U₀ [V] on the x-axis (10 to 35). The load is 0 Ω for U₀ < 12 V. It increases linearly from 0 Ω at 12 V to 500 Ω at 23 V. It remains constant at 500 Ω for U₀ between 23 V and 35 V.</p>
<ul style="list-style-type: none"> • Ex ia/IS • Ex ia + Ex d(ia)/IS + XP 	12 ... 30 V ^c	

Table 5.5

- ^a Feature "Approval" of the product structure
- ^b For ambient temperatures $T_a \leq -30\text{ °C}$ (-22 °F) a minimum voltage of 14 V is required for the startup of the device at the MIN error current (3.6 mA).
- ^c For ambient temperatures $T_a \leq -30\text{ °C}$ (-22 °F) a minimum voltage of 14 V is required for the startup of the device at the MIN error current (3.6 mA).



2-wire; 4 ... 20 mA HART, 4 ... 20 mA ¹

Approval ^a	Terminal voltage U at the device	Maximum load R, depending on the supply voltage U ₀ at the supply unit
all	Channel 1:	
	13.5 ... 30 V ^b	
	Channel 2:	
	12 ... 30 V	

Table 5.6

^a Feature "Approval" of the product structure

^b For ambient temperatures $T_a \leq -30\text{ °C}$ (-22 °F) a minimum voltage of 16 V is required for the startup of the device at the MIN error current (3.6 mA).

Polarity reversal protection	yes
Admissible residual ripple at $f = 0$ to 100 Hz	$U_{SS} < 1\text{ V}$
Admissible residual ripple at $f = 100$ to 10000 Hz	$U_{SS} < 10\text{ mV}$

Table 5.7

¹ Feature "Electrical output" of the product structure, option IE

4-wire, 4 ... 20 mA HART, active

Electrical Output ^a	Terminal voltage U	Maximum load R _{max}
AH: 4-wire 90 ... 253 V AC; 4 ... 20 mA HART	90 ... 253 V AC (50 ... 60 Hz), overvoltage category II	500 Ω
DH: 4-wire 10.4 ... 48 V DC; 4 ... 20 mA HART	10.4 ... 48 V DC	

Table 5.8

^a Feature "Electrical Output" the product structure

PROFIBUS PA

Electrical Output ^a	Approval ^b	Terminal voltage
PA: 2-wire; PROFIBUS PA, switch output	<ul style="list-style-type: none"> • Non-Ex • Ex nA • Ex nA(ia) • Ex ic • Ex ic(ia) • Ex d(ia)/XP • Ex ta/DIP • CSA GP 	9 ... 32 V ^c
	<ul style="list-style-type: none"> • Ex ia/IS • Ex ia + Ex d(ia)/IS + XP 	9 ... 30 V ^d

Table 5.9

^a Feature "Electrical Output" the product structure

^b Feature "Approval" of the product structure

^c Input voltages up to 35 V will not spoil the device.

^d Input voltages up to 35 V will not spoil the device.

Polarity sensitive	no
FISCO/FNICO compliant according to IEC 60079-27	yes

Table 5.10

5.5 Power consumption

Electrical output ^a	Power consumption
IH: 2-wire; 4 ... 20 mA HART	< 0.9 W
ID: 2-wire; 4 ... 20 mA HART, switch output	< 0.9 W
IE: 2-wire; 4 ... 20 mA HART, 4 ... 20 mA	< 2 x 0.7 W
AH: 4-wire 90 ... 253 V AC; 4 ... 20 mA HART	6 VA
DH: 4-wire 10.4 ... 48 V DC; 4 ... 20 mA HART	1.3 W

Table 5.11

^a Feature "Electrical Output" of the product structure

5.6 Current consumption

HART

Nominal current	3.6 ... 22 mA, the start-up current for multidrop mode can be parametrized (is set to 3.6 mA on delivery)
Breakdown signal (NAMUR NE 43)	adjustable: 3.59 ... 22.5 mA

Table 5.12

PROFIBUS PA

Nominal current	14 mA
Error current FDE (Fault Disconnection Electronic)	0 mA

Table 5.13

5.7 Power supply failure

- Configuration is retained in the HistoROM (EEPROM).
- Error messages (incl. value of operated hours counter) are stored.

5.8 Potential equalization

No special measures for potential equalization are required.



Note!

If the device is designed for hazardous areas, observe the information in the documentation "Safety Instructions" (SI, ZD).

5.9 Terminals

Plug-in spring terminals for wire cross-sections 0.5 ... 2.5 mm² (20 ... 14 AWG)

5.10 Cable entries

Connection of power supply and signal line

To be selected in feature "Electrical Connection"

- Gland M20; material dependent on the approval:
 - For Non-Ex, ATEX, IECEx, NEPSI Ex ia/ic: plastics M20 x 1.5 for cable Ø5 ... 10 mm (0.2...0.39 in)
 - For Dust-Ex, FM IS, CSA IS, CSA GP, Ex nA: metal M20 x 1.5 for cable Ø7 ... 10 mm (0.28...0.39 in) ¹
 - For Ex d: No gland available
- Thread
 - 1/2 in NPT
 - G1/2
 - M20 x 1.5
- Plug M12/plug 7/8 in
Only available for Non-Ex, Ex ic, Ex ia

5.11 Cable specification

- Minimum cross-section: dependent on terminals: see chapter 5.9.
- For ambient temperature $T_a \geq 60 \text{ °C}$ (140 °F): use cable for temperature $T_a + 20 \text{ K}$.

HART

- A normal device cable suffices if only the analog signal is used.
- A shielded cable is recommended if using the HART protocol. Observe grounding concept of the plant.
- For 4-wire devices: Standard device cable is sufficient for the power line.

PROFIBUS PA

- Use a twisted, screened two-wire cable, preferably cable type A.



Note!

For further information on the cable specifications, see PNO Guideline 2.092 "PROFIBUS PA User and Installation Guideline" and IEC 61158-2 (MBP).

5.12 Overvoltage protection

If the measuring device is used for level measurement in flammable liquids which requires the use of overvoltage protection according to DIN EN 60079-14, standard for test procedures 60060-1 (10 kA, pulse 8/20 µs), overvoltage protection has to be ensured by an external overvoltage protection module.

External overvoltage protection

For detailed information please refer to www.pepperl-fuchs.com

¹ The material of the gland is dependent on the housing type; A3 (GT18, stainless steel housing): 316L (1.4404); A1 (GT19, plastic housing) and A2 (GT20, aluminum housing): nickel-coated brass (CuZn).

6 Performance characteristics

6.1 Reference operating conditions

- Temperature = + 24 °C (+75 °F) ±5 °C (9 °F)
- Pressure = 960 mbar abs. (14 psia) ±100 mbar (1.45 psi)
- Humidity = 60 % ±15 %
- Reflection factor ≥ 0.8 (water surface for coax probe, metal plate for rod and rope probe with min.1 m (40 in) diameter)
- Flange for rod or rope probe ≥ 300 mm (12 in) diameter
- Distance to obstacles ≥ 1 m (40 in)

6.2 Maximum measured error

Typical data under reference operating conditions: DIN EN 61298-2, percentage values in relation to the span.

Output:	digital	analog ^a
Sum of non-linearity, non-repeatability and hysteresis	<ul style="list-style-type: none"> • Measuring distance up to 15 m (49 ft): ±2 mm (0.08 in) • Measuring distance > 15 m (49 ft): ±10 mm (0.39 in) 	0.02 %
Offset/Zero	±4 mm (0.16 in)	0.03 %

Table 6.1

^a Add error of the analogous value to the digital value.

If the reference conditions are not met, the offset/zero point arising from the mounting situation may be up to ±12 mm (0.47 in) for rope and rod probes. This additional offset/zero point can be compensated for by entering a correction (parameter "level correction") during commissioning.



Differing from this, the following measuring error is present in the vicinity of the lower probe end:

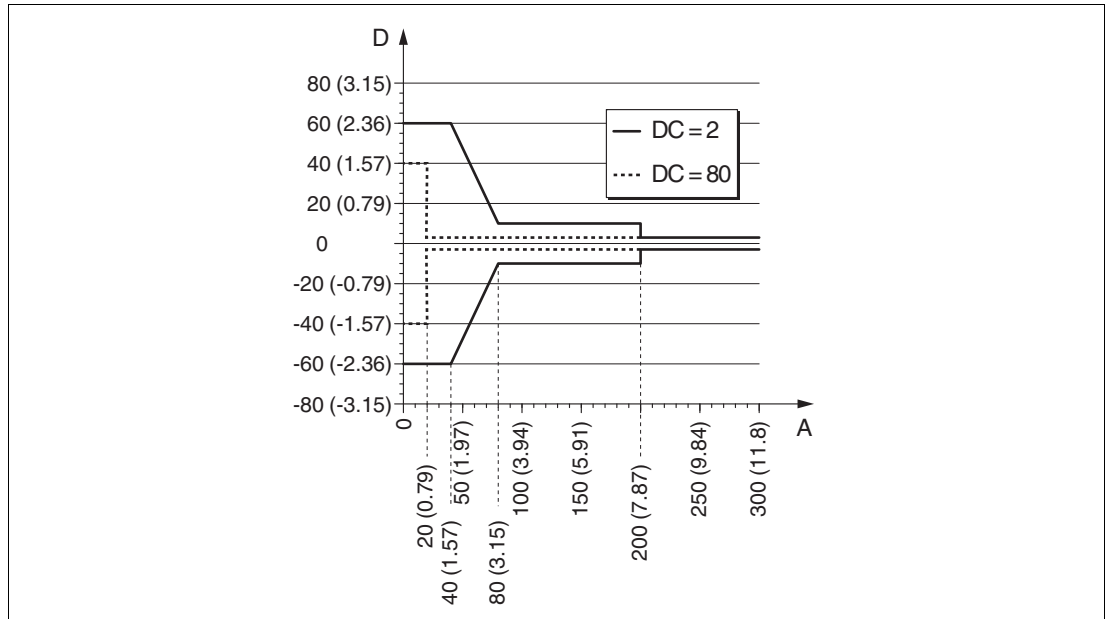


Figure 6.1 Measuring error at the end-of-probe for rod and coax probes

- A** Distance from probe end [mm (in)]
- D** Measuring error: sum of non-linearity, non-repeatability and hysteresis
- DC** Dielectric constant

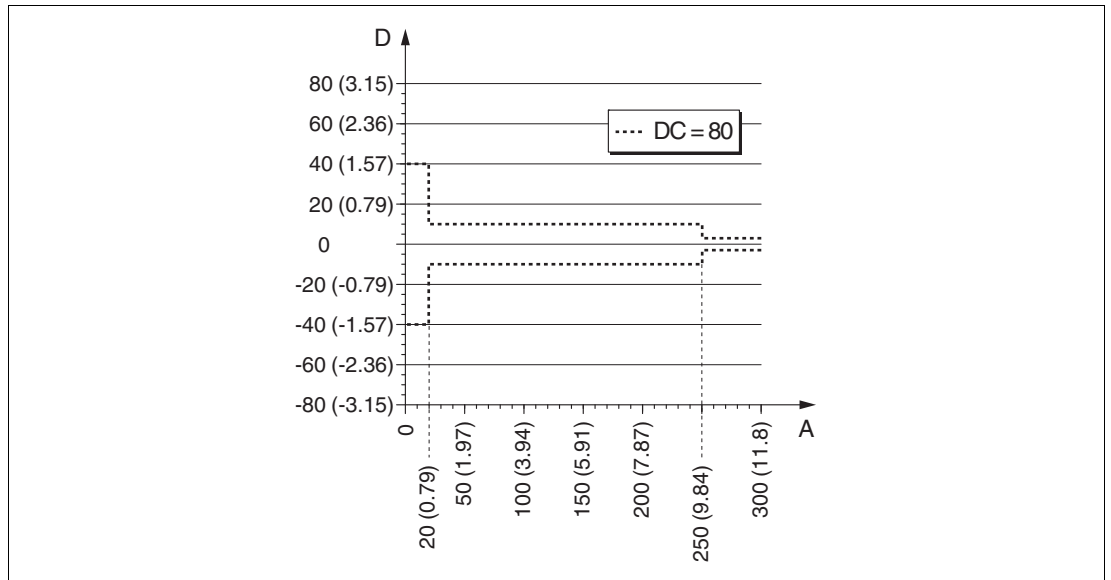


Figure 6.2 Measuring error at the end-of-probe for rope probes

- A** Distance from probe end
- D** Measuring error: sum of non-linearity, non-repeatability and hysteresis
- DC** Dielectric constant

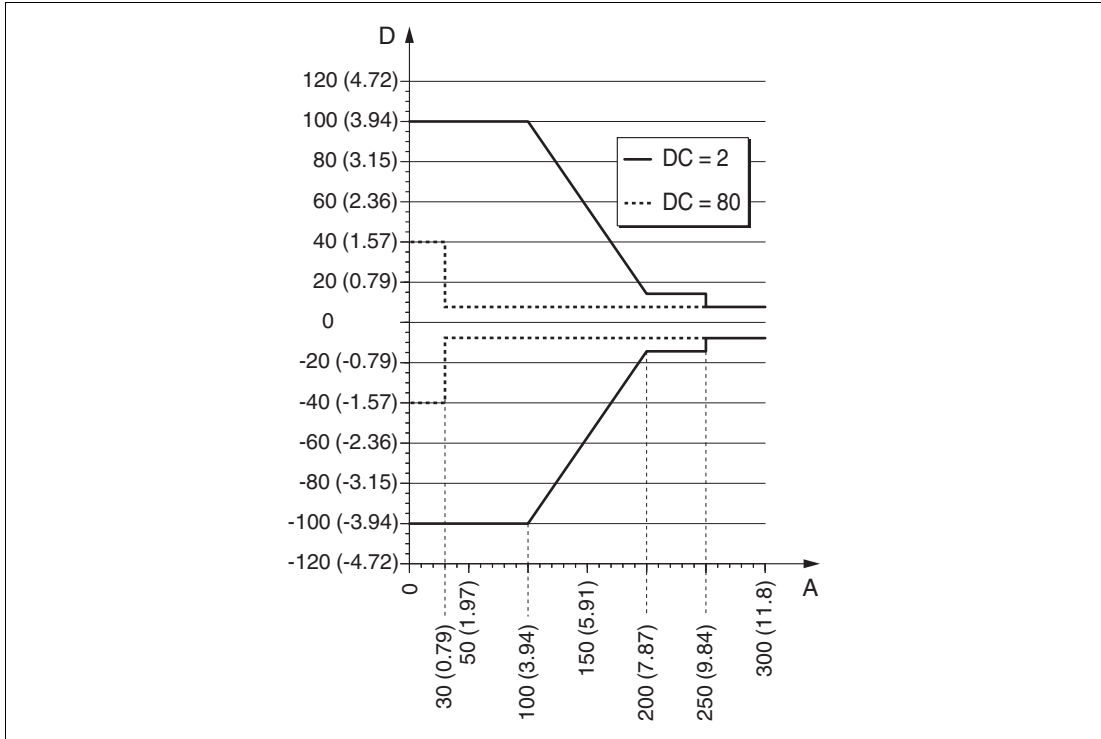


Figure 6.3 Measuring error at the end-of-probe for probes with a metallic centering disk

- A** Distance from probe end [mm (in)]
- D** Measuring error: sum of non-linearity, non-repeatability and hysteresis
- DC** Dielectric constant



Note!

If for rope probes the DC value is less than 7, then measurement is not possible in the area of the straining weight (0 to 250 mm from end of probe; lower blocking distance).

In the area of the upper probe end, the measuring error is as follows (rod/rope only):

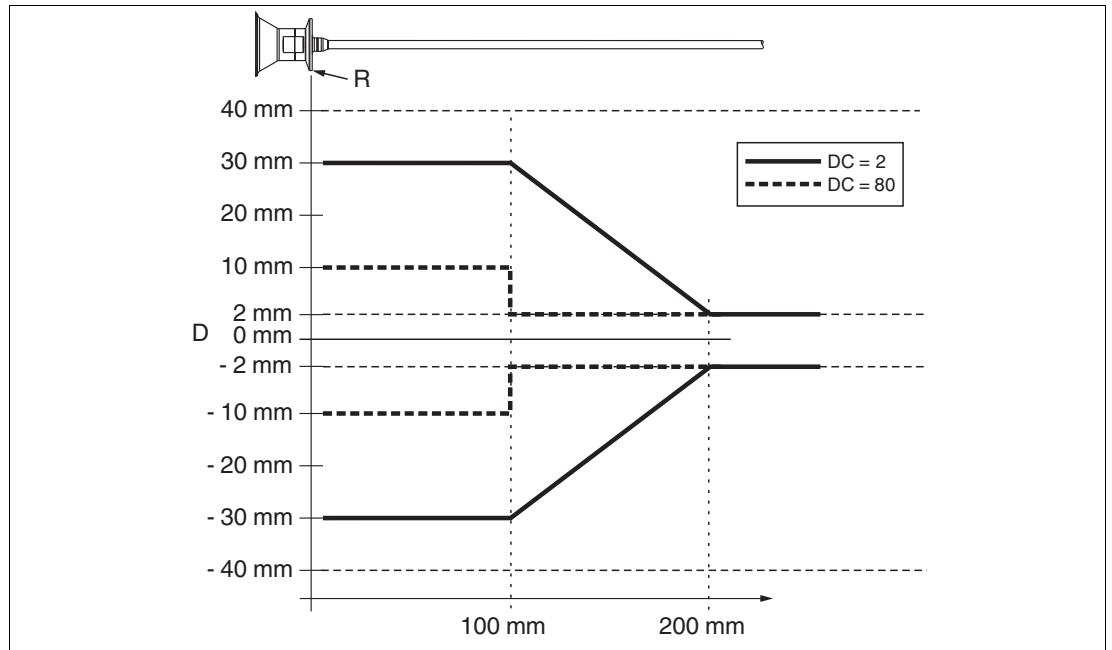


Figure 6.4 Measuring error at the upper end of the probe

D Sum of non-linearity, non-repeatability and hysteresis

R Reference point of measurement

DC Dielectric constant

6.3 Resolution

- digital: 1 mm
- analog: 1 μ A

6.4 Reaction time

The reaction time can be parametrized. The following step response times (as per DIN EN 61298-2)¹ are valid if the damping is switched off:

Level measurement		
Probe length	Sampling rate	Step response time
< 10 m (33 ft)	3.6 measurements/second	< 0.8 s
< 40 m (131 ft)	\geq 2.7 measurements/second	< 1 s

Table 6.2

¹ According to DIN EN 61209-2 the response time is the time which passes after a sudden change of the input signal until the output signal for the first time assumes 90 % of the steady-state value.

6.5 Influence of ambient temperature

The measurements are carried out in accordance with EN 61298-3

- digital (HART, PROFIBUS PA): average $T_K = 0.6 \text{ mm}/10 \text{ K}$
For devices with remote sensor ¹ there is an additional offset of $\pm 0.3 \text{ mm}/10\text{K}$ ($0.01 \text{ in}/10 \text{ K}$) per 1 m (3.3 ft) of the remote cable.
- analog (current output):
 - zero point (4 mA): average $T_K = 0.02 \text{ \%}/10 \text{ K}$
 - span (20 mA): average $T_K = 0.05 \text{ \%}/10 \text{ K}$

6.6 Influence of gas layer

High pressures reduce the propagation velocity of the measuring signals in the gas/vapor above the fluid. This effect depends on the kind of gas/vapor and of its temperature. This results in a systematic measuring error that gets bigger as the distance increases between the reference point of the measurement (flange) and the product surface. The following table illustrates this measured error for a few typical gases/vapors (with regard to distance; a positive value means that too large a distance is being measured):

Gas layer	Temperature		Pressure					
	°C	°F	1 bar (14.5 psi)	10 bar (145 psi)	50 bar (725 psi)	100 bar (1450 psi)	200 bar (2900 psi)	400 bar (5800 psi)
Air	20	68	0.00 %	0.22 %	1.2 %	2.4 %	4.9 %	9.5 %
	200	392	-0.01 %	0.13 %	0.74 %	1.5 %	3.0 %	6.0 %
	400	752	-0.02 %	0.08 %	0.52 %	1.1 %	2.1 %	4.2 %
Hydrogen	20	68	-0.01 %	0.10 %	0.61 %	1.2 %	2.5 %	4.9 %
	200	392	-0.02 %	0.05 %	0.37 %	0.76 %	1.6 %	3.1 %
	400	752	-0.02 %	0.03 %	0.25 %	0.53 %	1.1 %	2.2 %

Table 6.3

Gas layer	Temperature		Pressure							
	°C	°F	1 bar (14.5 psi)	2 bar (29 psi)	5 bar (72.5 psi)	10 bar (145 psi)	20 bar (290 psi)	50 bar (725 psi)	100 bar (1450 psi)	200 bar (2900 psi)
Water (saturated steam)	100	212	0.26 %	–	–	–	–	–	–	–
	120	248	0.23 %	0.50 %	–	–	–	–	–	–
	152	306	0.20 %	0.42 %	1.14 %	–	–	–	–	–
	180	356	0.17 %	0.37 %	0.99 %	2.10 %	–	–	–	–
	212	414	0.15 %	0.32 %	0.86 %	1.79 %	3.9 %	–	–	–
	264	507	0.12 %	0.26 %	0.69 %	1.44 %	3.0 %	9.2 %	–	–
	311	592	0.09 %	0.22 %	0.58 %	1.21 %	2.5 %	7.1 %	19.3 %	–
	366	691	0.07 %	0.18 %	0.49 %	1.01 %	2.1 %	5.7 %	13.2 %	76 %

Table 6.4

¹ Product structure: Feature "Probe design", option B)



6.7 Gas phase compensation with external pressure sensor (PROFIBUS PA)

PROFIBUS devices can receive the signal of an external pressure sensor through the bus and use it to perform a pressure dependent time-of-flight correction. In the case of saturated steam in the temperature range from 100 ... 350 °C (212 ... 662 °F), for example, the measuring error of the distance measurement can be reduced by this method from up to 29 % (without compensation) to less than 3 % (with compensation).



7 Mounting

7.1 Mounting requirements

7.1.1 Suitable mounting position

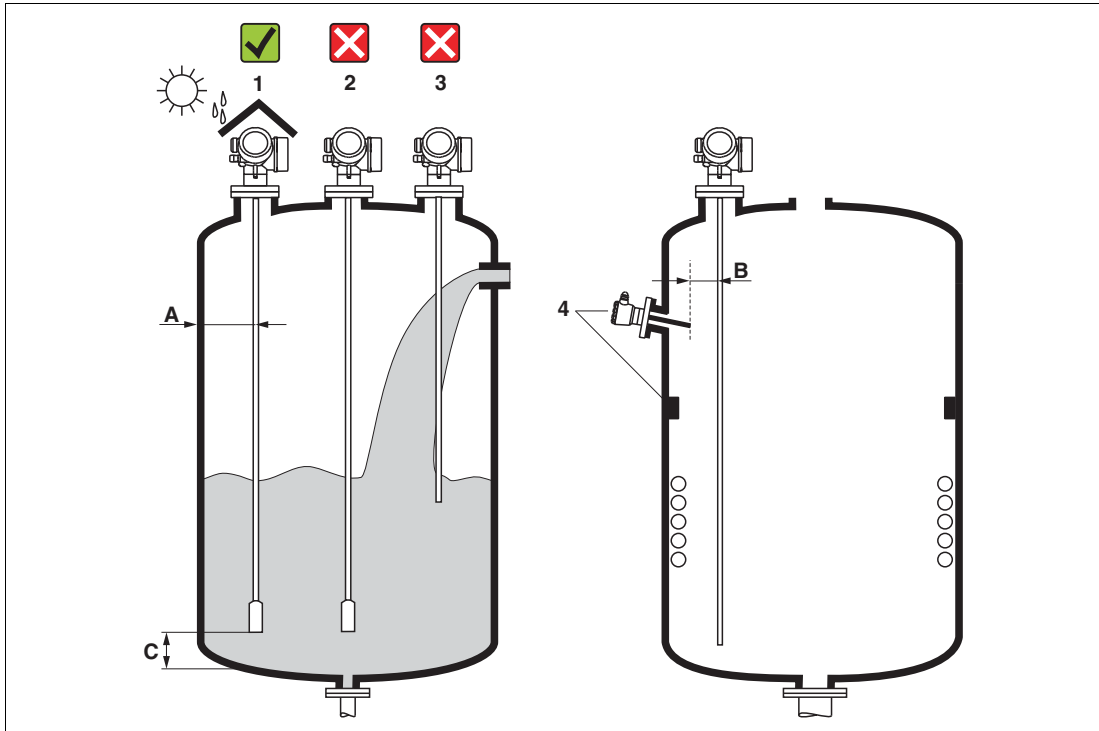


Figure 7.1 Mounting requirements

Mounting distances

- Distance (A) between wall and rod or rope probe:
 - for smooth metallic walls: > 50 mm (2 in)
 - for plastic walls: > 300 mm (12 in) to metallic parts outside the vessel
 - for concrete walls: > 500 mm (20 in), otherwise the available measuring range may be reduced.
- Distance (B) between rod or rope probe and internal fittings in the vessel: > 300 mm (12 in)
- Distance (C) from end of probe to bottom of the vessel:
 - Rope probe: > 150 mm (6 in)
 - Rod probe: > 10 mm (0.4 in)
 - Coax probe: > 10 mm (0.4 in)



Note!

For coax probes the distance to the wall and to internal fittings is arbitrary.

Additional conditions

- When mounting in the open, a weather protection cover (1) may be installed to protect the device against extreme weather conditions.
- In metallic vessels: Preferably do not mount the probe in the center of the vessel (2), as this would lead to increased interference echoes.
If a central mounting position can not be avoided, it is crucial to perform an interference echo suppression (mapping) after the commissioning of the device.
- Do not mount the probe in the filling curtain (3).
- Avoid buckling the rope probe during installation or operation (e. g. through product movement against silo wall) by selecting a suitable mounting location.
- Check the probe regularly for defects.



Note!

With suspended rope probes (probe end not fixed at the bottom) the distance between the probe rope and internal fittings in the tank must not fall below 300 mm (12 in) during the entire process. A sporadic contact between the probe weight and the cone of the vessel, however, does not influence the measurement as long as the dielectric constant of the medium is at least $DC = 1.8$.



Note!

When mounting the electronics housing into a recess (e. g. in a concrete ceiling), observe a minimum distance of 100 mm (4 in) between the cover of the terminal compartment/electronics compartment and the wall. Otherwise the connection compartment/electronics compartment is not accessible after installation.

7.1.2 Applications with restricted mounting space

Mounting with remote sensor

The device version with a remote sensor is suited for applications with restricted mounting space. In this case the electronics housing is mounted at a separate position from which it is easier accessible.

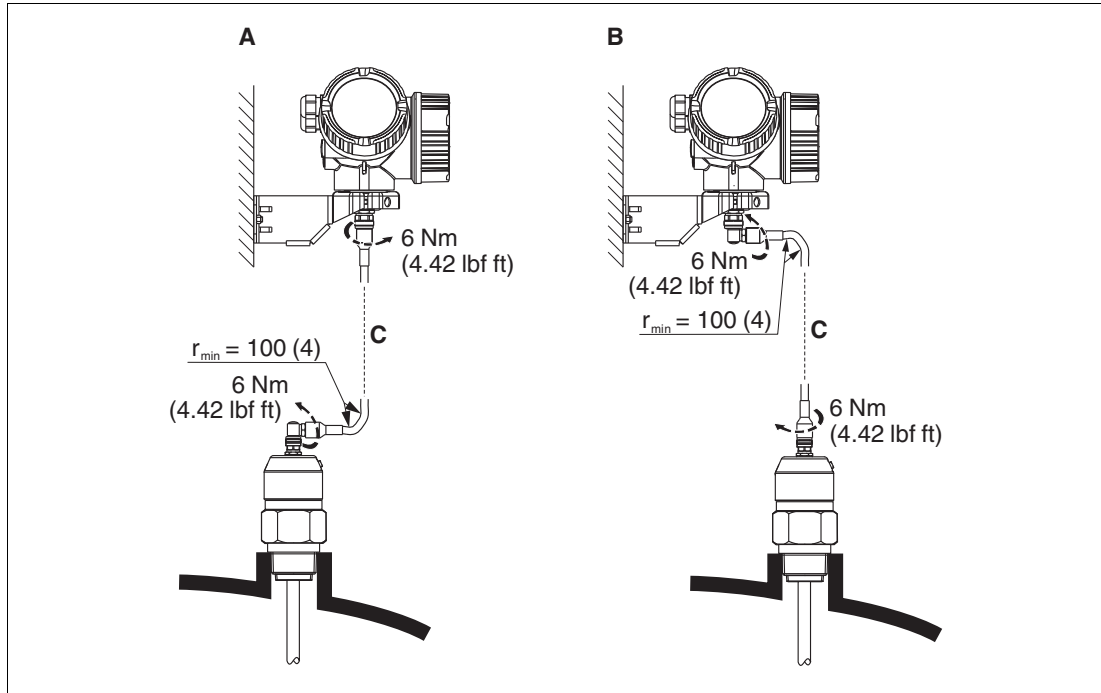


Figure 7.2

- A** Angled plug at the probe
- B** Angled plug at the electronics housing
- C** Length of the remote cable as ordered

- Product structure, feature "Probe Design": option B "Sensor remote, 3 m/9 ft cable"
- The remote cable is supplied with these device versions, minimum bending radius: 100 mm (4 in)
- A mounting bracket for the electronics housing is supplied with these device versions. Mounting options:
 - Wall mounting
 - Pipe mounting; diameter: 42 to 60 mm (1-1/4 to 2 in)
- The connection cable has got one straight and one angled plug (90°). Depending on the local conditions the angled plug can be connected at the probe or at the electronics housing.



Note!

Probe, electronics and connection cable are adjusted to match each other. They are marked by a common serial number. Only components with the same serial number shall be connected to each other.

Divisible probes

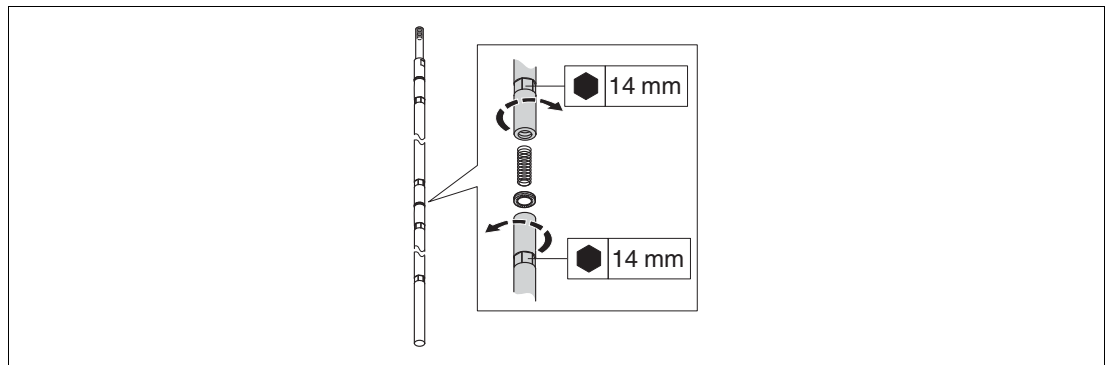


Figure 7.3

If there is little mounting space (distance to the ceiling), it is advisable to use divisible rod probes ($\text{Ø}16 \text{ mm}$).

- max. probe length 10 m (394 in)
- max. sideways capacity 30 Nm
- probes are separable several times with the following lengths of the individual parts:
 - 500 mm (20 in)
 - 1000 mm (40 in)
- torque: 15 Nm

7.1.3 Notes on the mechanical load of the probe

Tensile load limit of rope probes

Feature "Probe"	Probe	Tensile load limit [kN]
Option 2, 3, E, F	Rope 4 mm (1/6 in) 316	5

Table 7.1

Bending strength of rod probes

Feature "Probe"	Probe	Bending strength [Nm]
Option 1, 5	Rod 8 mm (1/3 in) 316L	10
Option 8, 9	Rod 12 mm (1/2 in) 316L	30
Option 6, 7	Rod 12 mm (1/2 in) AlloyC	30
Option A, B, C, D	Rod 16 mm (0.63 in) 316L divisible	30

Table 7.2

Bending load (torque) through fluid flow

The formula for calculating the bending torque M impacting on the probe:

$$M = c_w \times \rho / 2 \times v^2 \times d \times L \times (L_N - 0.5 \times L)$$

with:

c_w : friction factor

ρ [kg/m³]: Density of the medium

v [m/s]: Velocity of the medium perpendicular to the probe rod

d [m]: Diameter of the probe rod

L [m]: Level

L_N [m]: Probe length

Calculation example

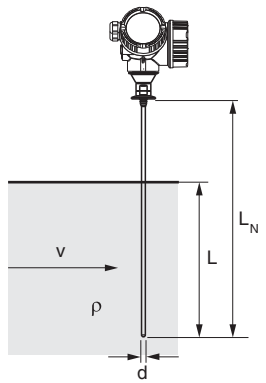
Friction factor c_w	0.9 (on the assumption of a turbulent current - high Reynolds number)	
Density ρ [kg/m ³]	1000 (e. g. water)	
Probe diameter d [m]	0.008	
$L = L_N$	(worst case)	

Table 7.3

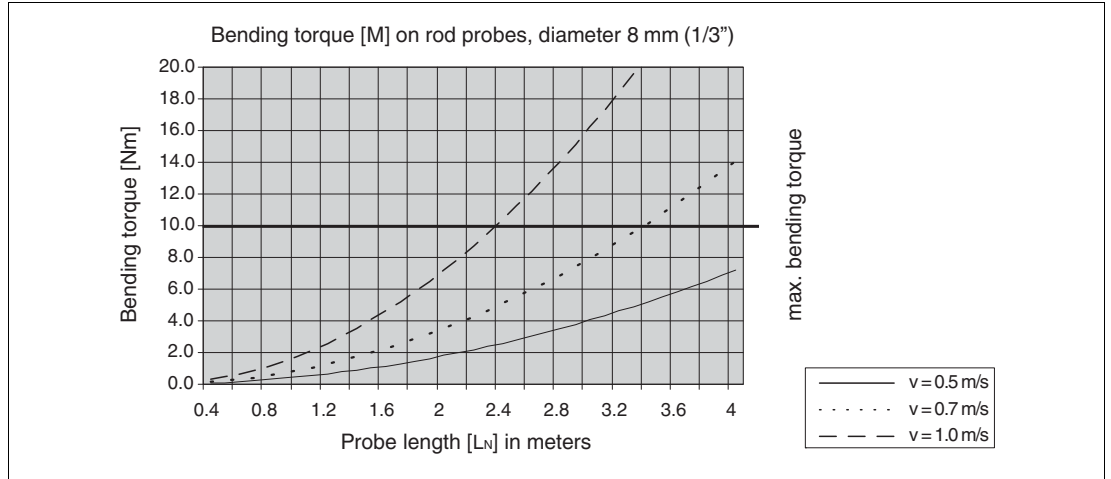


Figure 7.4

Bending strength of coax probes

Feature "Probe"	Process connection	Probe	Bending strength [Nm]
Option 4, G	Thread G3/4 or NPT3/4	Coax 316L, Ø21.3 mm	60
	<ul style="list-style-type: none"> • Thread G1-1/2 or NPT1-1/2 • Flange 	Coax 316L, Ø42.4 mm	300
Option H, K	Flange	Coax Alloy C, Ø42.4 mm	300

Table 7.4



7.1.4 Notes on the process connection

Probes are mounted to the process connection with threaded connections or flanges. If during this installation there is the danger that the probe end moves so much that it touches the tank floor or cone at times, the probe must, if necessary, be shortened and fixed down.

Threaded connection

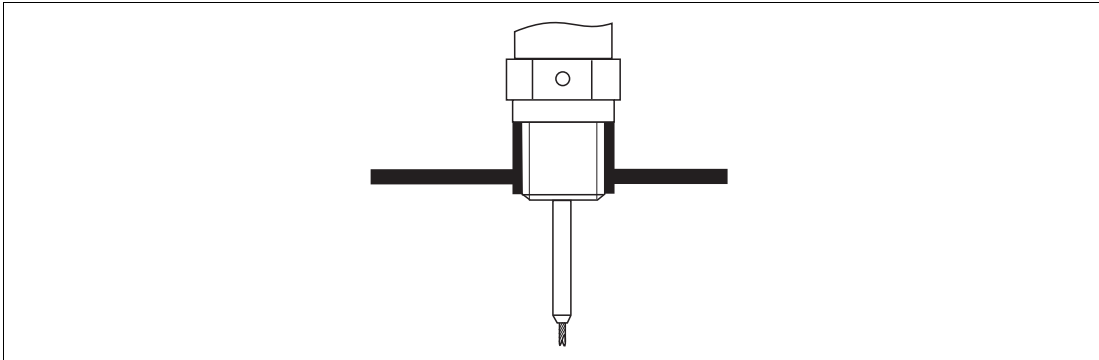


Figure 7.5 Mounting with threaded connection; flush with the container ceiling

Seal

The thread as well as the type of seal comply to DIN 3852 Part 1, screwed plug form A.

They can be sealed with the following types of sealing rings:

- Thread G1-1/2: according to DIN 7603 with the dimensions 48 x 55 mm

Please use a sealing ring according to this standard in the form A, C or D and of a material that is resistant to the application.



Note!

For the length of the screwed plug refer to the dimensional drawing: see chapter 10.

Nozzle mounting

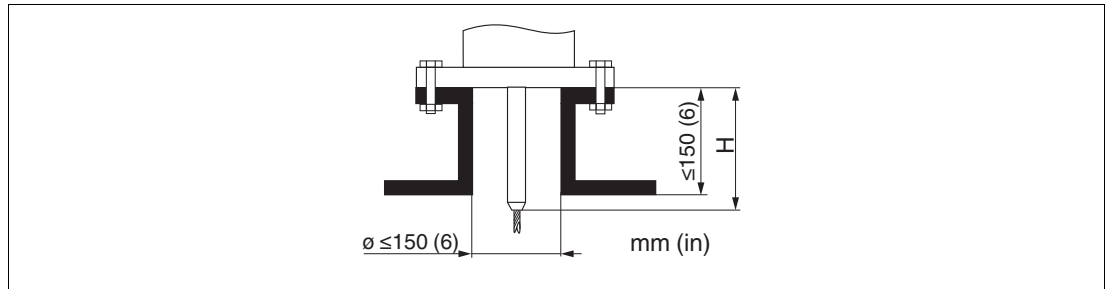


Figure 7.6

- Permissible nozzle diameter: ≤ 150 mm (6 in).
For larger diameters the near range measuring capability may be reduced.
For nozzles \geq DN300: see next section.
- Permissible nozzle height ¹: ≤ 150 mm (6 in).
For a larger height the near range measuring capability may be reduced.



Note!

With thermally insulated vessels the nozzle should also be insulated in order to prevent condensate formation.

Center rod

For rope probes it may be necessary to use a version with center rod in order to prevent the probe rod from coming into contact with the nozzle wall. Probes with center rod are available for the device.

Max. nozzle height (= length of the center rod)	Option to be selected in feature "Probe"
150 mm	2
6 in	3
300 mm	E
12 in	F

Table 7.5

¹ Larger nozzle heights on request



Installation in nozzles \geq DN300

If installation in \geq 300mm/12 in nozzles is unavoidable, installation must be carried out in accordance with the following sketch.

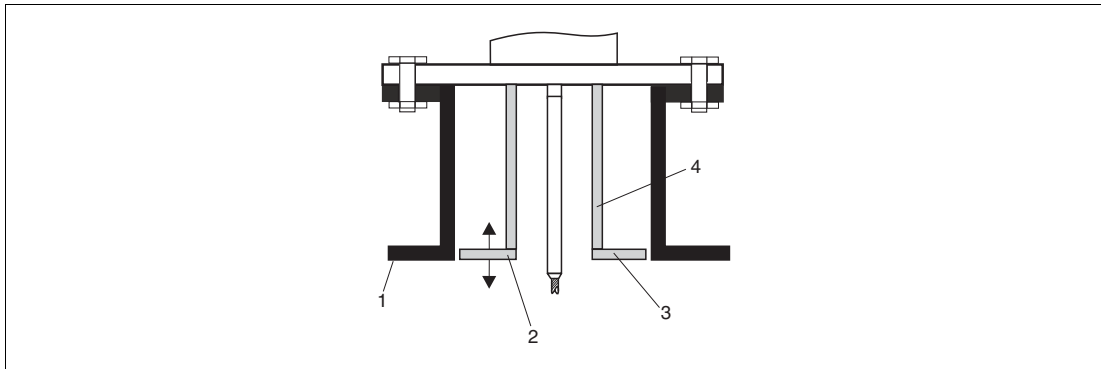


Figure 7.7

- 1 Lower edge of the nozzle
- 2 Approx. flush with the lower edge of the nozzle (\pm 50 mm/2 in)
- 3 Plate
- 4 Pipe diameter 150 to 180 mm (6 to 7 in)

Nozzle diameter	Plate diameter
300 mm (12 in)	280 mm (11 in)
\geq 400 mm (16 in)	\geq 350 mm (14 in)

Table 7.6

Mounting cladded flanges

For usage of cladded flanges, observe the following:

- Use flange screws according to the number of flange holes.
- Tighten the screws with the required torque (see table).
- Retighten the screws after 24 hours or after the first temperature cycle.
- Depending on process pressure and process temperature check and retighten the screws at regular intervals.

Flange size	Number of screws	Recommended torque [Nm]	
		minimum	maximum
EN			
DN40/PN40	4	35	55
DN50/PN16	4	45	65
DN50/PN40	4	45	65
DN80/PN16	8	40	55
DN80/PN40	8	40	55
DN100/PN16	8	40	60
DN100/PN40	8	55	80
DN150/PN16	8	75	115
DN150/PN40	8	95	145
ASME			
1-1/2 in/150 lbs	4	20	30
1-1/2 in/300 lbs	4	30	40
2 in/150 lbs	4	40	55
2 in/300 lbs	8	20	30
3 in/150 lbs	4	65	95
3 in/300 lbs	8	40	55
4 in/150 lbs	8	45	70
4 in/300 lbs	8	55	80
6 in/150 lbs	8	85	125
6 in/300 lbs	12	60	90
JIS			
10K 40A	4	30	45
10K 50A	4	40	60
10K 80A	8	25	35
10K 100A	8	35	55
10K 100A	8	75	115

Table 7.7

7.1.5 Securing the probe

Securing rope probes

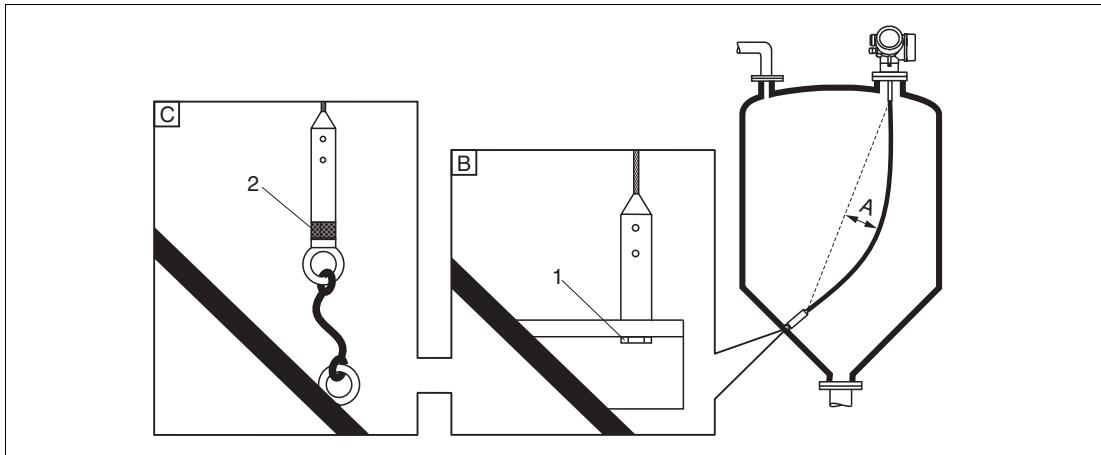


Figure 7.8

- A** Sag of the rope: ≥ 1 cm per 1 m of the probe length (0.12 in per 1 ft of the probe length)
- B** Reliably grounded end of probe
- C** Reliably isolated end of probe
- 1** Mounting and contact with a bolt
- 2** Mounting kit isolated

- The end of the probe needs to be secured under the following conditions: if otherwise the probe sporadically comes into contact with the wall of the vessel, the outlet cone, internal fittings or other parts of the installation.
- The end of probe can be secured at its internal thread: rope 4 mm (1/6 in), 316: M14
- The fixing must be either reliably grounded or reliably insulated. If it is not possible to mount the probe weight with a reliably insulated connection, it can be secured using an isolated eyelet, which is available as an accessory.
- In order to prevent an extremely high tensile load (e. g. due to thermal expansion) and the risk of rope crack, the rope has to be slack. Make the rope longer than the required measuring range such that there is a sag in the middle of the rope that is $\geq 1\text{cm}/(1\text{ m rope length})$ [0.12 in/(1 ft rope length)].
Tensile load limit of rope probes: see chapter 7.

Securing rod probes

- For Ex-approvals: For probe lengths ≥ 3 m (10 ft) a support is required.
- In general, rod probes must be supported if there is a horizontal flow (e. g. from an agitator) or in the case of strong vibrations.
- Rod probes may only be supported at the end of the probe.

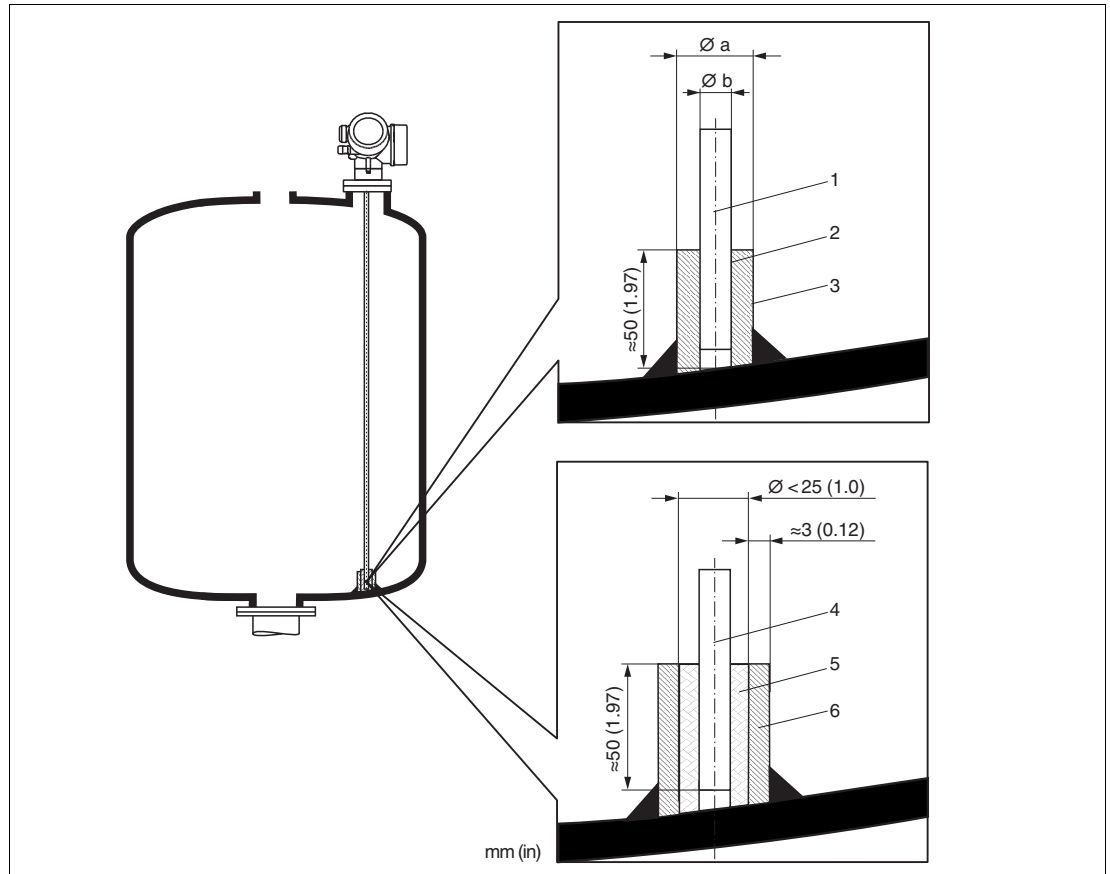


Figure 7.9

- 1 Probe rod, uncoated
- 2 Sleeve bored tight to ensure electrical contact between the rod and sleeve!
- 3 Short metal pipe, e. g. welded in place
- 4 Probe rod, coated
- 5 Plastic sleeve, e. g. PTFE, PEEK or PPS
- 6 Short metal pipe, e. g. welded in place

Ø probe	Øa [mm (in)]	Øb [mm (in)]
8 mm (1/3 in)	< 14 (0.55)	8.5 (0.34)
12 mm (1/2 in)	< 20 (0.78)	12.5 (0.52)
16 mm (0.63 in)	< 26 (1.02)	16.5 (0.65)

Table 7.8



Warning!

Poor grounding of the end of probe may cause measuring errors.

- Apply a narrow sleeve which has good electrical contact to the probe.



Warning!

Welding may damage the main electronics module.

- Before welding: Ground the probe and dismount electronics.

Securing coax probes

For WHG-approvals: For probe lengths ≥ 3 m (10 ft) a support is required.

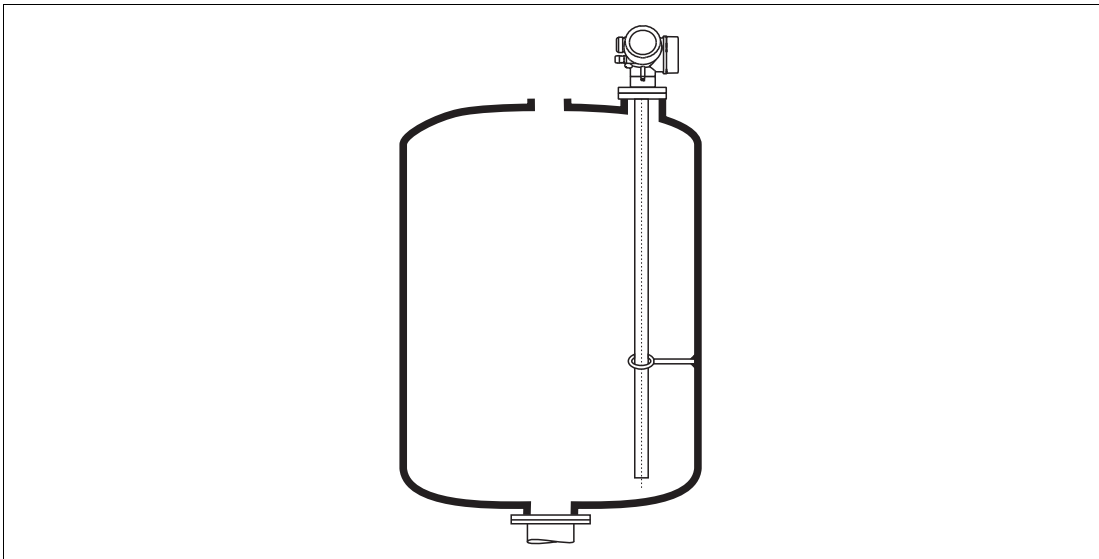


Figure 7.10

Coax probes can be supported at any point of the outer tube.

Special mounting conditions

Bypasses and stilling wells

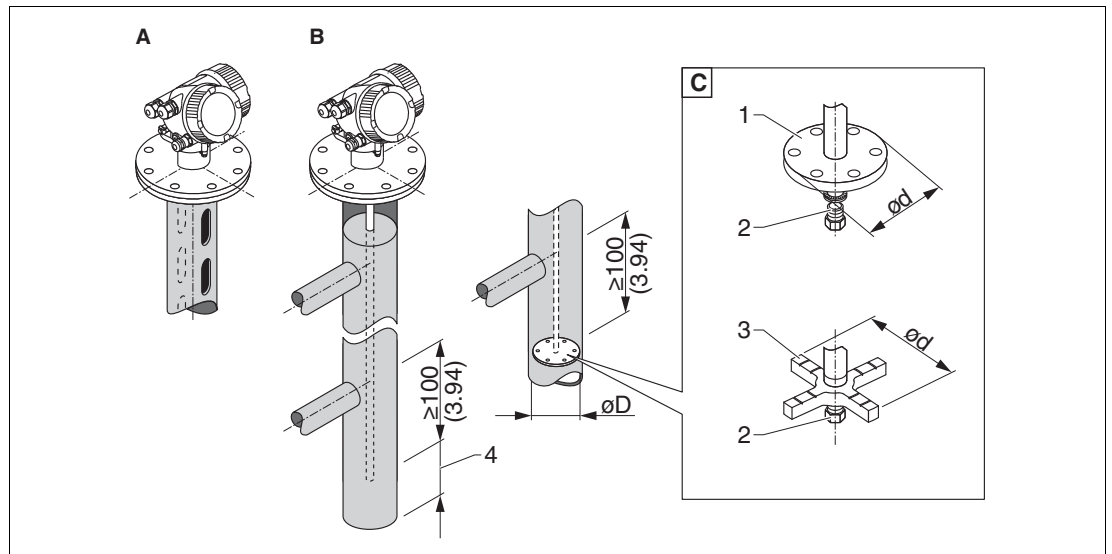


Figure 7.11

- A** Mounting in a stilling well
- B** Mounting in a bypass
- C** Center washer or centering star (on request)
 - 1** Metallic center washer (316L) for level measurement (on request)
 - 2** Fixing screw; torque: 25 Nm ±5 Nm
 - 3** Non-metallic centering star (PEEK, PFA) for interface measurement (on request)
 - 4** Minimum distance between end of probe and lower edge of the bypass; see table below

Allocation of probe type and center washer or centering star to pipe diameter

Type of probe	Center washer or centering star		Pipe
	Ød [mm (in)]	Material	ØD [mm (in)]
Rod probe	75 (2.95)	316L	DN80/3 to DN100/4 in
Rod probe	45 (1.77)	316L	DN50/2 to DN65/2-1/2 in
Rope probe	75 (2.95)	316L	DN80/3 to DN100/4 in

Table 7.9

Minimum distance between end of probe and lower edge of the bypass

Type of probe	Minimum distance
Rope	150 mm (6 in)
Rod	10 mm (0.4 in)
Coax	10 mm (0.4 in)

Table 7.10



- Pipe diameter: > 40 mm (1.6 in) for rod probes
- Rod probe installation can take place up to a diameter size of 150 mm (6 in). In the event of larger diameters, a coax probe is recommended.
- Side disposals, holes or slits and welded joints that protrude up to approx. 5 mm (0.2 in) inwards do not influence the measurement.
- The pipe may not exhibit any steps in diameter.
- The probe must be 100 mm (4 in) longer than the lower disposal.
- Within the measuring range, the probe must not get into contact with the pipe wall. If necessary, use a center washer or centering star.
- If the center washer or centering star is mounted at the end of the probe, it enables a reliable recognition of the end-of-probe signal.
- Coax probes can always be applied if there is enough mounting space.



Note!

For bypasses with condensate formation (water) and a medium with low dielectric constant (e. g. hydrocarbons):

In the course of time the bypass is filled with condensate up to the lower disposal and for low levels the level echo is superimposed by the condensate echo. Thus in this range the condensate level is measured instead of the correct level. Only higher levels are measured correctly. To prevent this, position the lower disposal 100 mm (4 in) below the lowest level to be measured and apply a metallic centering disk at the height of the lower edge of the lower disposal.



Note!

With heat insulated tanks the bypass should also be insulated in order to prevent condensate formation.



Note!

For rope probes with a length exceeding 2 m (6.7 ft) an additional weight or a spring should be mounted in addition to the center a washer in order to tighten the rope.



Note!

For information on bypass solutions from Pepperl+Fuchs please contact your Pepperl+Fuchs sales representative.



Installation in horizontal and upright cylindrical tanks

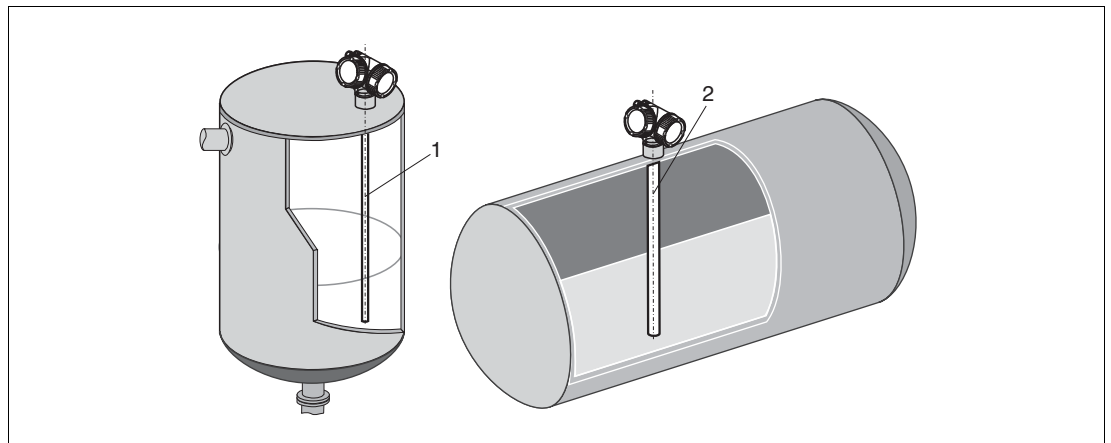


Figure 7.12

- Any distance from wall, as long as occasional contact is prevented.
- When installing in tanks with a lot of internals or internals situated close to the probe: use a coax probe (1), (2).

Underground tanks

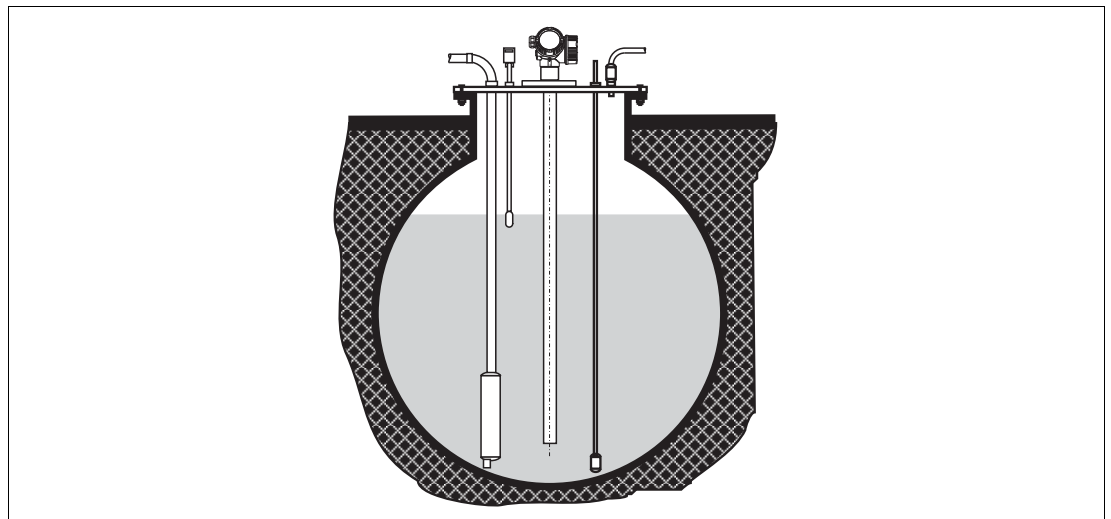


Figure 7.13

Use a coax probe for nozzles with large diameters in order to avoid reflections at the nozzle wall.



Installation at an angle

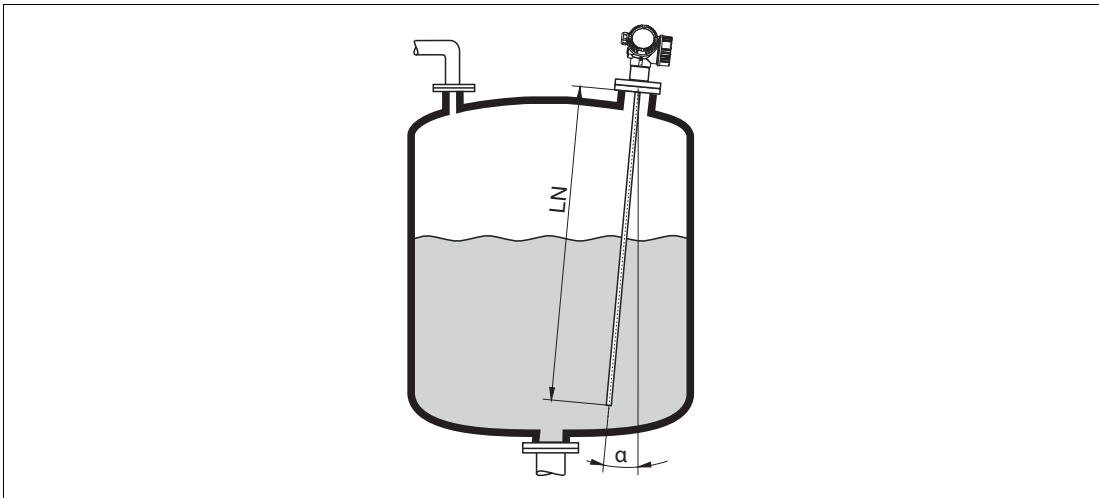


Figure 7.14

- For mechanical reasons, the probe should be installed as vertically as possible.
- With inclined installations the probe length has to be adjusted in dependence to the installation angle.
 - Up to LN = 1 m (3.3 ft): $\alpha = 30^\circ$
 - Up to LN = 2 m (6.6 ft): $\alpha = 10^\circ$
 - Up to LN = 4 m (13.1 ft): $\alpha = 5^\circ$

Non-metallic vessels

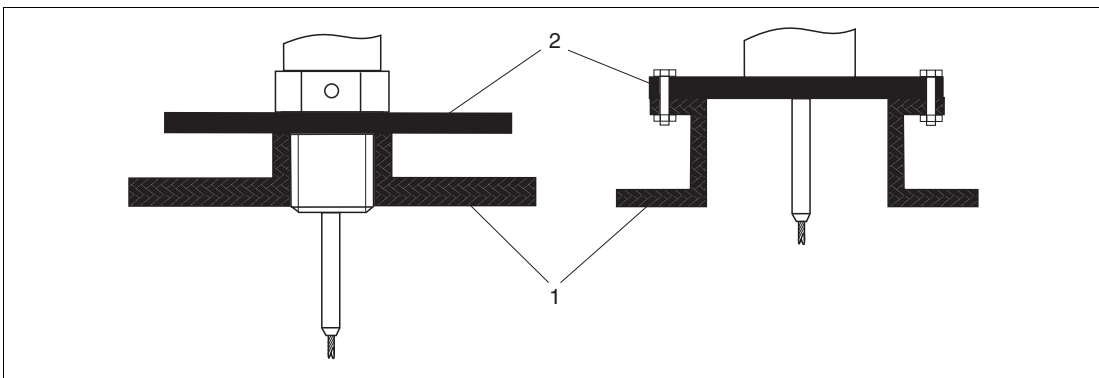


Figure 7.15

- 1 Non-metallic vessel
- 2 Metal sheet or metal flange

To measure, device with a rod probe needs a metallic surface at the process connection. Therefore:

- Select an instrument version with metal flange (minimum size DN50/2 in).
- Or: mount a metal sheet with a diameter of at least 200 mm (8 in) to the probe at the process connection. Its orientation must be perpendicular to the probe.



Note!

No additional measures are required for coax probes.

Plastic or glass tanks: Mounting the probe externally at the wall

For plastic and glass tanks, the probe can also be mounted on the outside wall under specific conditions.

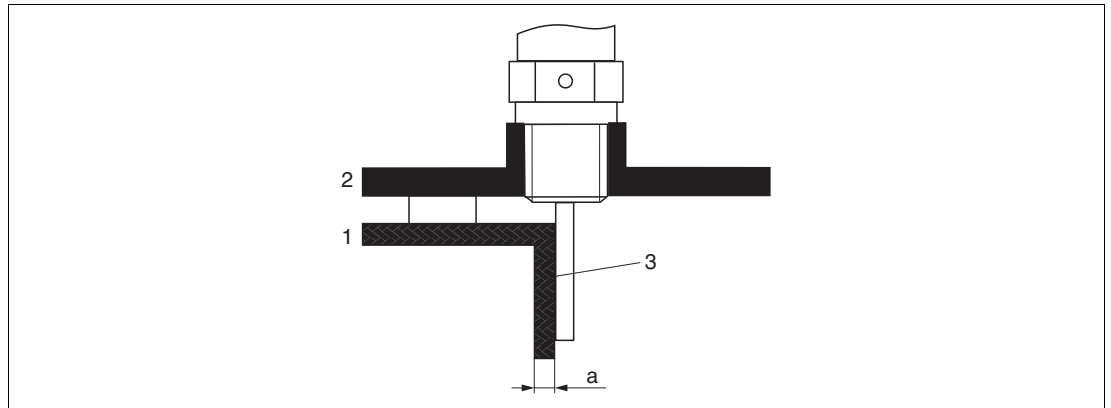


Figure 7.16

- 1 Plastic or glass tank
- 2 Metal sheet with threaded sleeve
- 3 No free space between tank wall and probe!

Requirements

- The dielectric constant of the medium must be at least $DC > 7$.
- The tank wall must be non-conductive.
- Maximum wall thickness (a):
 - Plastic: < 15 mm (0.6 in)
 - Glass: < 10 mm (0.4 in)
- There may be no metallic reinforcements fixed to the tank.

Mounting conditions:

- The probe must be mounted directly to the tank wall (no open space)
- A plastic half pipe with a diameter of approx. 200 mm (8 in), or some other protective unit, must be affixed externally to the probe to prevent any influences on the measurement.
- If the tank diameter is less than 300 mm (12 in):
A metallic grounding sheet must be installed at the opposite side of the tank. The sheet must be conductively connected to the process connection and cover about the half of the vessel's circumference.
- If the tank diameter exceeds 300 mm (12 in):
A metal sheet with a diameter of at least 200 mm (8") must be mounted to the probe at the process connection. Its orientation must be perpendicular to the probe (see above).



Vessels with heat insulation



Note!

If process temperatures are high, the device must be included in normal tank insulation to prevent the electronics heating up as a result of heat radiation or convection. The insulation may not exceed beyond the points labeled "MAX" in the drawings.

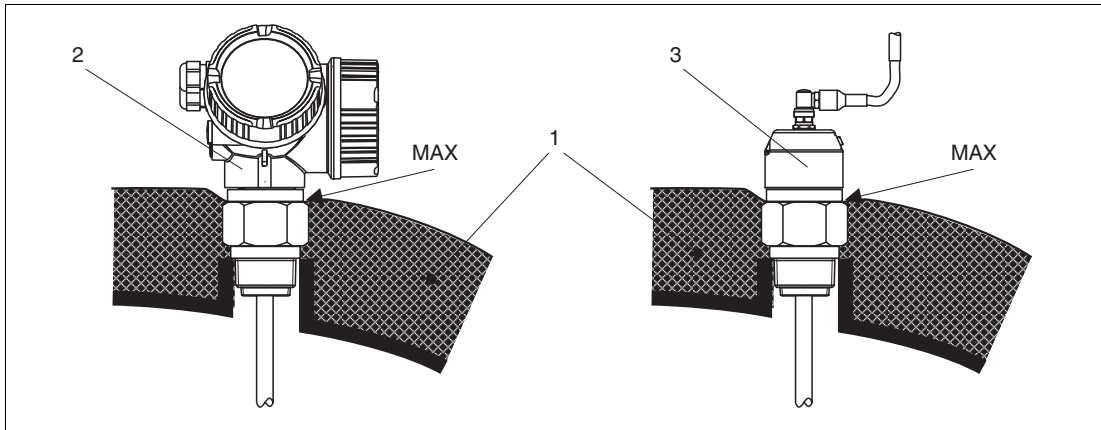


Figure 7.17 Process connection with thread

- 1 Tank insulation
- 2 Compact device
- 3 Sensor remote (feature "Probe design")

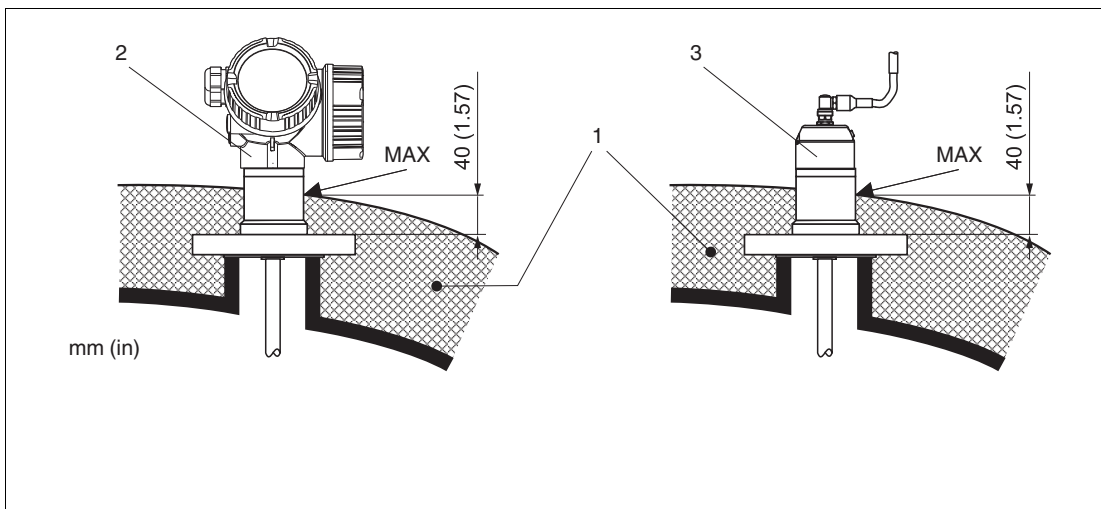


Figure 7.18 Process connection with flange

- 1 Tank insulation
- 2 Compact device
- 3 Sensor remote (feature "Probe design")

Replacing a displacer system in an existing displacer chamber

The device is a perfect replacement for a conventional displacer system in an existing displacer chamber. Pepperl+Fuchs offers flanges that suit Fischer and Masoneilan displacer chamber for this purpose. Thanks to menu-guided local operation, commissioning the device only takes a few minutes. Replacement is also possible when partially filled, and wet calibration is not required.

Your benefits:

- No moving parts, thus zero-maintenance operation.
- Not sensitive to process influences such as temperature, density, turbulence and vibrations.
- The rod probes can be shortened or replaced easily. In this way, the probe can be easily adjusted on site.

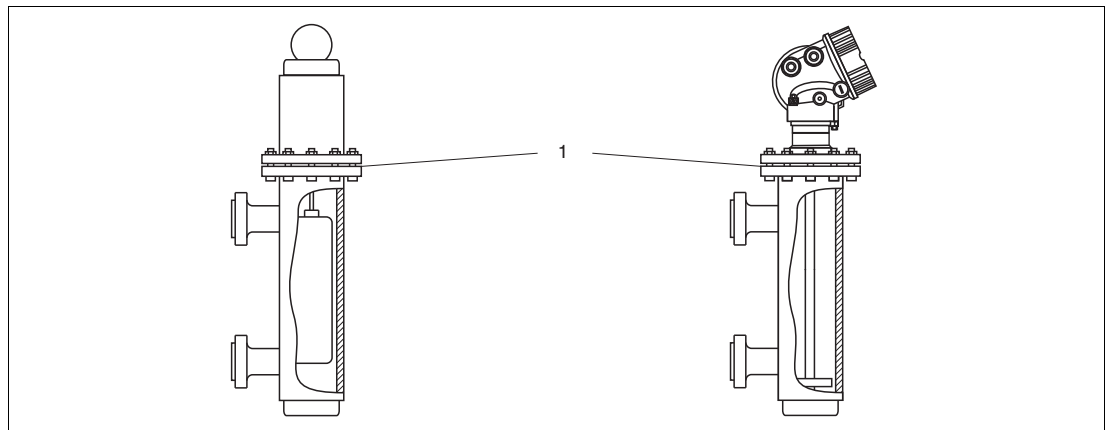


Figure 7.19

1 Flange of the displacer chamber

Planning instructions:

- In normal cases, use a rod probe. When installing into a metallic displacer chamber up to 150 mm, you have all the advantages of a coax probe.
- It must be ensured that the probe does not come into contact with the side wall. Where necessary, use a center washer or centering star at the lower end of the probe.
- The center washer or centering star must be adapted as accurately as possible to the internal diameter of the displacer chamber to also ensure perfect operation in the area of the probe end.



8 Operating conditions: Environment

8.1 Ambient temperature range

Measuring device	-40 ... +80 °C (-40 ... +176 °F)
Local display	-20 ... +70 °C (-4 ... +158 °F), the readability of the display may be impaired at temperatures outside the temperature range.
Connection cable (for "Probe Design" = "Sensor remote")	max. 100 °C (212 °F)

Table 8.1

When operating the device in the open with strong sunlight:

- Mount the device in a shady position.
- Avoid direct sunlight, especially in warmer regions.
- Use a weather protection cover (see accessories).

8.2 Ambient temperature limits

The following diagrams take into account only function requirements. There may be further restrictions for certified device versions. Separate Safety Instructions see chapter 15.2.

With a temperature (T_p) at the process connection the admissible ambient temperature (T_a) is reduced according to the following diagram (temperature derating):

Temperature derating with threaded connection G3/4 or NPT3/4

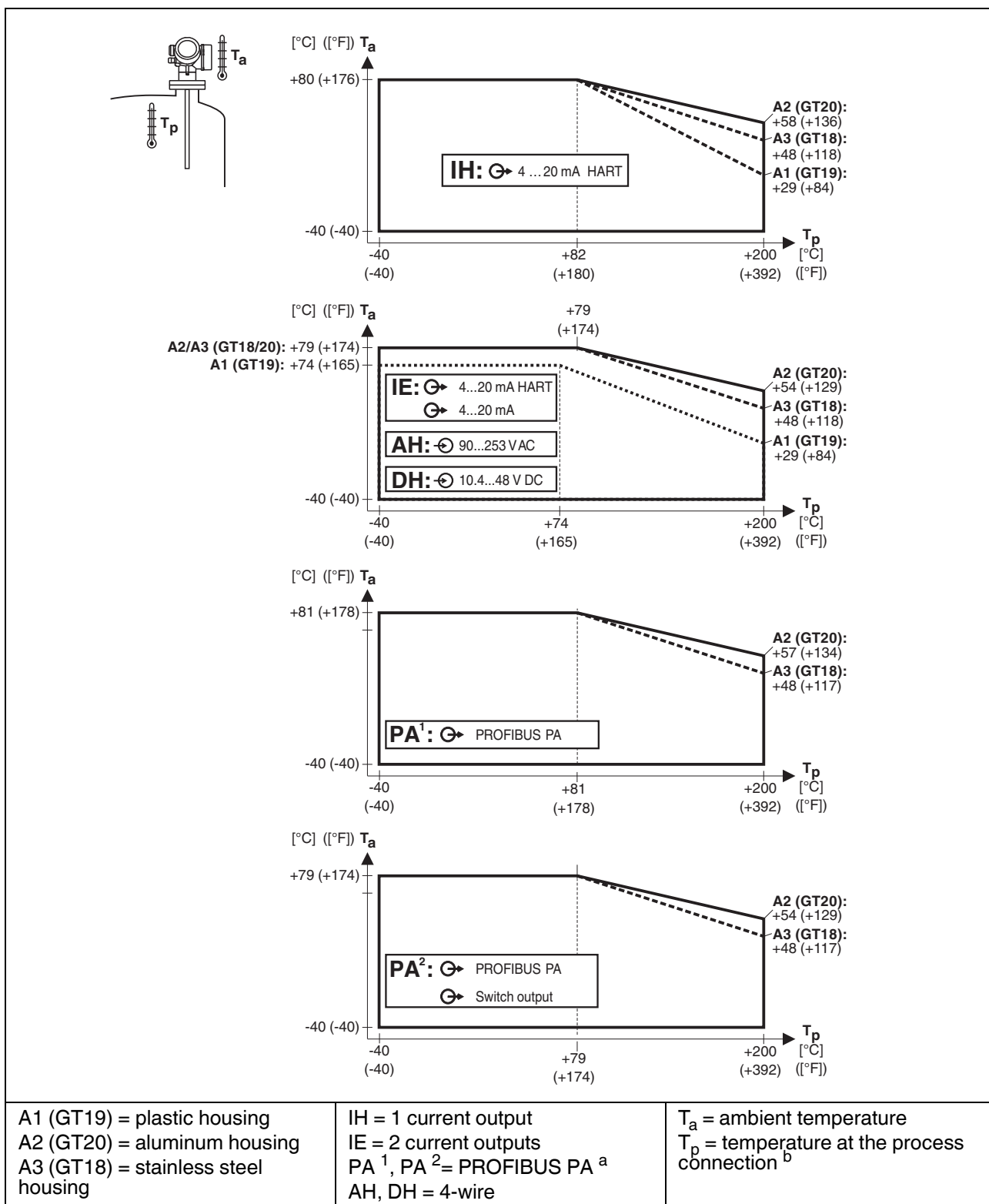


Table 8.2

^a For PROFIBUS PA the temperature derating depends on the usage of the switch output. (PA¹: switch output not connected; PA²: switch output connected).
^b For saturated steam applications the process temperature should not exceed 150 °C (302 °F).

Temperature derating for with threaded connection G1-1/2 or NPT1-1/2

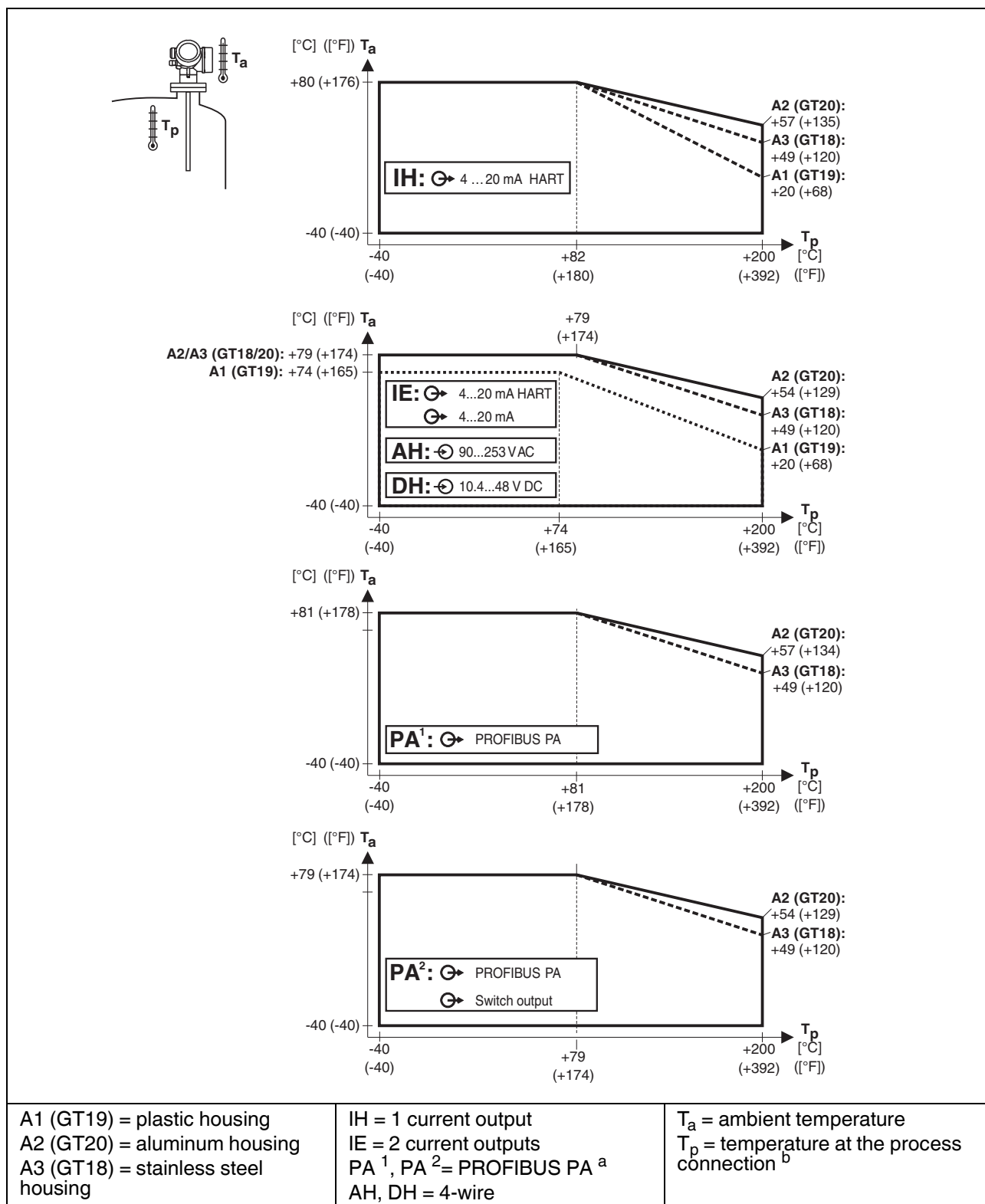
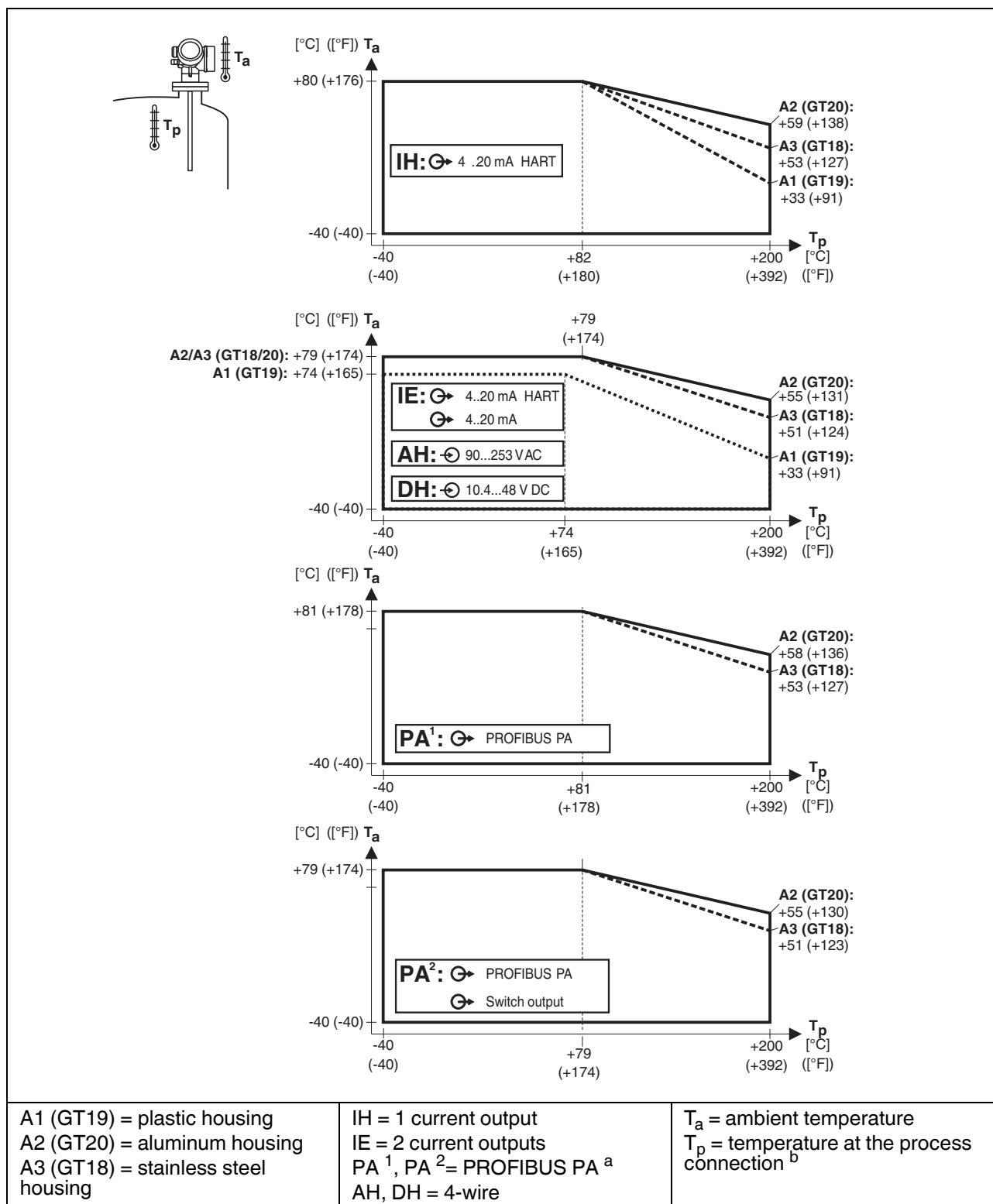


Table 8.3

^a For PROFIBUS PA the temperature derating depends on the usage of the switch output. (PA¹: switch output not connected; PA²: switch output connected).

^b For saturated steam applications the process temperature should not exceed 150 $^{\circ}\text{C}$ (302 $^{\circ}\text{F}$).

Temperature derating with flange



A1 (GT19) = plastic housing
A2 (GT20) = aluminum housing
A3 (GT18) = stainless steel housing

IH = 1 current output
IE = 2 current outputs
PA¹, PA² = PROFIBUS PA^a
AH, DH = 4-wire

T_a = ambient temperature
 T_p = temperature at the process connection^b

Table 8.4

^a For PROFIBUS PA the temperature derating depends on the usage of the switch output. (PA¹: switch output not connected; PA²: switch output connected).
^b For saturated steam applications the process temperature should not exceed 150 °C (302 °F).

8.3 Storage temperature

-40 ... +80 °C (-40 ... +176 °F)

8.4 Climate class

DIN EN 60068-2-38 (test Z/AD)

8.5 Altitude according to IEC 61010-1 Ed.3

Up to 2000 m (6600 ft) above MSL.

Can be expanded to 3000 m (9800 ft) above MSL by application of an overvoltage protection.

8.6 Degree of protection

- With closed housing tested according to:
 - IP68, NEMA6P (24 h at 1.83 m under water surface) ¹
 - For plastic housing with transparent cover (display module): IP68 (24 h at 1.00 m under water surface) ²
 - IP66, NEMA4X
- With open housing: IP20, NEMA1
- Display module: IP22, NEMA2



Note!

Degree of protection IP68 NEMA6P applies for M12 PROFIBUS PA plugs only when the PROFIBUS cable is plugged in and is also rated IP68 NEMA6P.

8.7 Vibration resistance

DIN EN 60068-2-64/IEC 68-2-64: 20 ... 2000 Hz, 1 (m/s²)²/Hz

8.8 Cleaning the probe

Depending on the application, contamination or buildup can accumulate on the probe. A thin, even layer only influences measurement slightly. Thick layers can dampen the signal and then reduce the measuring range. Severe, uneven buildup, adhesion e. g. through crystallization, can lead to incorrect measurement. In this case, we recommend that you use a non-contact measuring principle, or check the probe regularly for soiling.

¹ also valid for the "Sensor remote" version

² This restriction is valid if the following options of the product structure have been selected at the same time: feature "Display, Operation" = D "SD02" or E "SD03"; feature "Housing" = A1 (GT19).

8.9 Electromagnetic compatibility (EMC)

Electromagnetic compatibility to all relevant requirements of the EN 61326-X series and NAMUR recommendation EMC (NE 21). For details see declaration of conformity ¹. If only the analogue signal is used, unshielded interconnection lines are sufficient for the installation.

In case of using the digital signal (HART/PA) use shielded interconnection lines.

Max. fluctuations during EMC- tests: < 0.5 % of the span.

When installing the probes in metal and concrete tanks and when using a coax probe:

- Interference emission to EN 61326-X series, electrical equipment class B.
- Interference immunity to EN 61326-X series, requirements for industrial areas and NAMUR Recommendation NE 21 (EMC)

The measured value can be affected by strong electromagnetic fields when installing rod and rope probes without a shielding/metallic wall, e. g. in plastic and wooden silos.

- Interference emission to EN 61326-X series, electrical equipment class A.
- Interference immunity: the measured value can be affected by strong electromagnetic fields.

¹ Can be downloaded from www.pepperl-fuchs.com.

9 Process

9.1 Process temperature range

The maximum permitted temperature at the process connection is determined by the O-ring version ordered:

Device	O-ring material	Process temperature
LTC51	FKM (Viton GLT 37559)	-30 ... +150 °C (-22 ... +302 °F)
		-40 ... +150 °C (-40 ... +302 °F) ^a
	EPDM (70C4 pW FKN or E7515)	-40 ... +120 °C (-40 ... +248 °F)
	FFKM (Kalrez 6375) ^b	-20 ... +200 °C (-4 ... +392 °F) ^c

Table 9.1

- ^a only in combination with a gas-tight feed through.
^b Recommended for steam applications.
^c Not recommended for saturated steam above 150 °C (302 °F).



Note!

With uncoated probes, the medium temperature may be higher, under the condition that the maximum process temperature specified in the table above is not exceeded at the process connection.

However, when using rope probes, the stability of the probe rope is reduced by structural changes at temperatures above 350 °C (662 °F).

9.2 Process pressure range

Device	Process pressure
LTC51	-1 ... 40 bar (-14.5 ... 580 psi)

Table 9.2



Note!

This range may be reduced by the selected process connection. The pressure rating (PN) specified on the flanges refers to a reference temperature of 20 °C, for ASME flanges 100 °F. Pay attention to pressure-temperature dependencies.

Please refer to the following standards for the pressure values permitted for higher temperatures:

- EN 1092-1: 2001 table 18
With regard to their temperature stability properties, the materials 1.4435 and 1.4404 are grouped under 13E0 in EN 1092-1 table 18. The chemical composition of the two materials can be identical.
- ASME B 16.5a - 1998 table 2-2.2 F316
- ASME B 16.5a - 1998 table 2.3.8 N10276
- JIS B 2220



9.3 Dielectric constant (DC)

- Coax probes: DC (ϵ_r) ≥ 1.4
- Rod and rope probe: DC (ϵ_r) ≥ 1.6 (when installing in pipes DN ≤ 150 mm (6 in):
DC (ϵ_r) ≥ 1.4)

9.4 Expansion of the rope probes through temperature

Elongation through temperature increase from 30 °C (86 °F) to 150 °C (302 °F): 2 mm/m rope length



10 Mechanical construction

10.1 Dimensions

Dimensions of the electronics housing

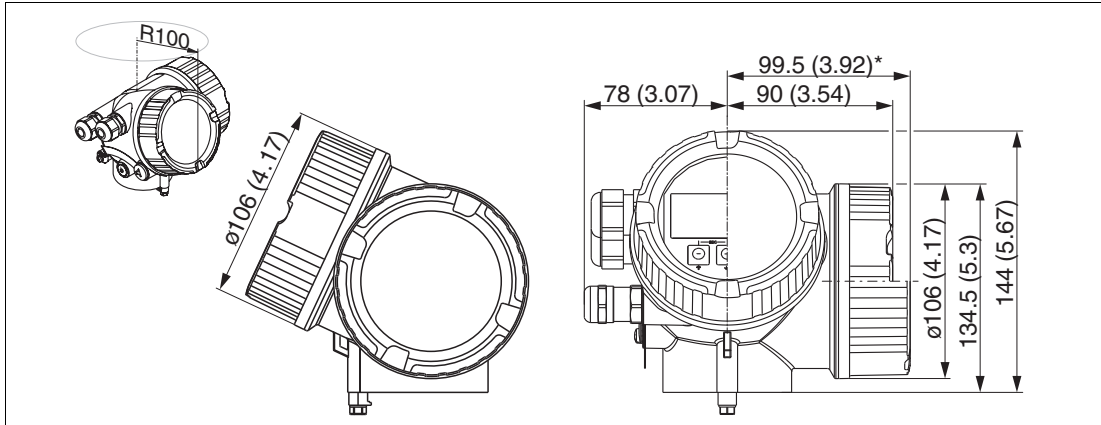


Figure 10.1 Housing A1 (GT19), plastics PBT; dimensions in mm (in)

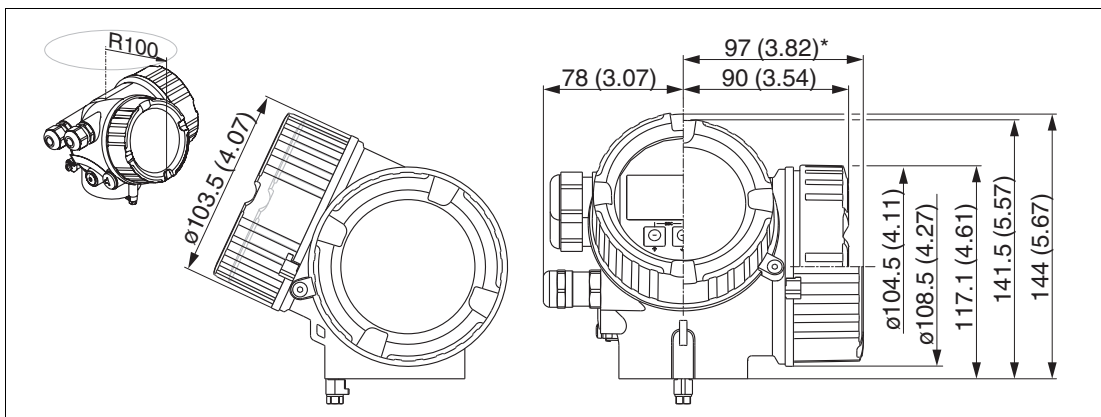


Figure 10.2 Housing A2 (GT20), Alu coated; dimensions in mm (in)

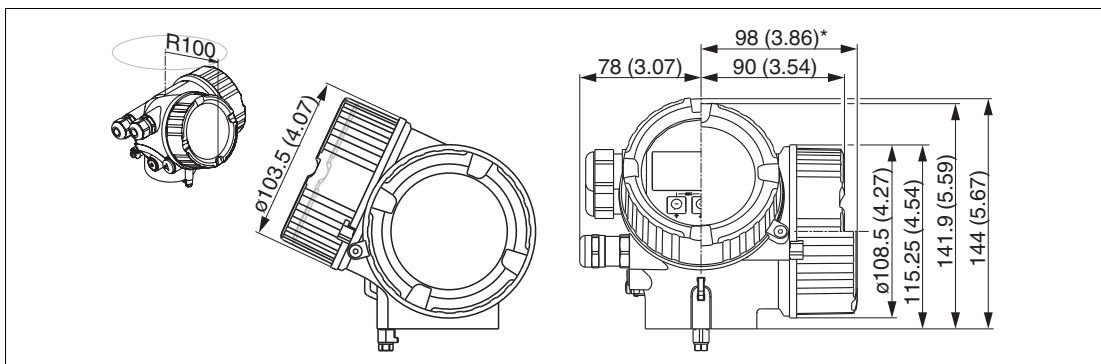


Figure 10.3 Housing A3 (GT18), 316L; Dimensions in mm (in)

Dimensions of the mounting bracket

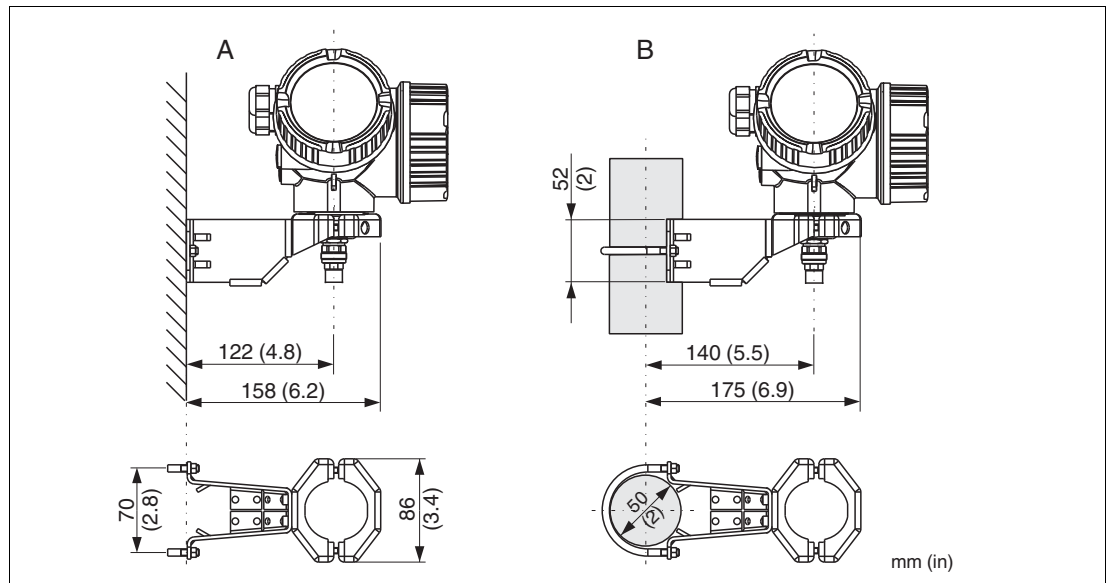


Figure 10.4

- A Wall mounting
- B Pipe mounting



Note!

For the "Sensor remote" device version (see feature "Probe Design" of the product structure), the mounting bracket is part of the delivery. If required, it can also be ordered as an accessory.

Dimensions of process connection (G3/4, NPT3/4) and probe

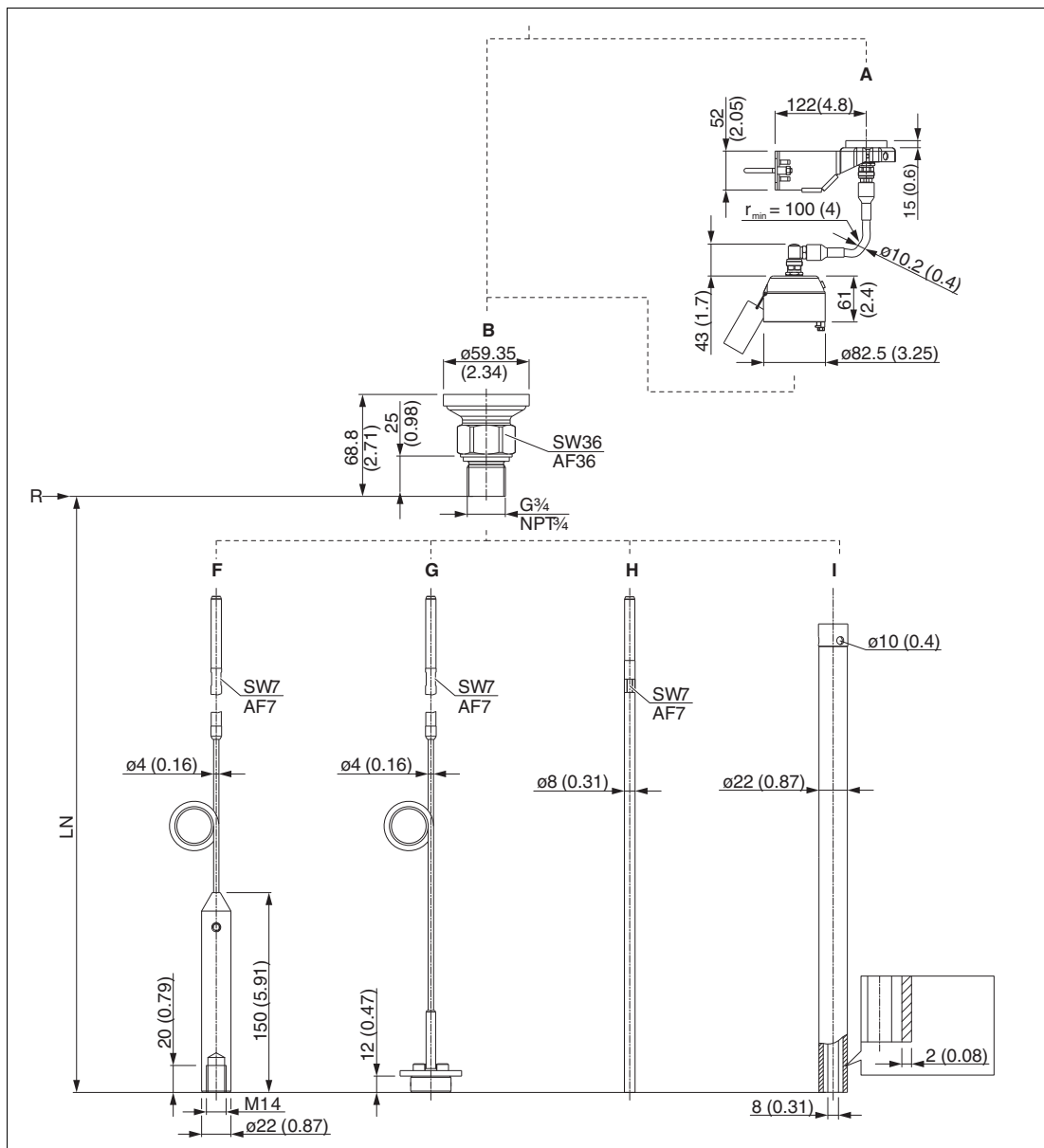


Figure 10.5 Process connection/probe

- A** Mounting bracket for probe design "Sensor remote" (feature "Probe design")
- B** Thread ISO228 G3/4 or ANSI MNPT3/4 (feature "Process connection")
- F** Rope probe 4 mm or 1/6 in (feature "Probe")
- G** Rope probe 4 mm or 1/6 in; centering disk on request (feature "Probe")
- H** Rod probe 8 mm or 1/3 in (feature "Probe")
- I** Coax probe (feature "Probe")
- LN** Length of probe
- R** Reference point of the measurement

Dimensions of process connection (G1-1/2, NPT1-1/2, flange) and probe

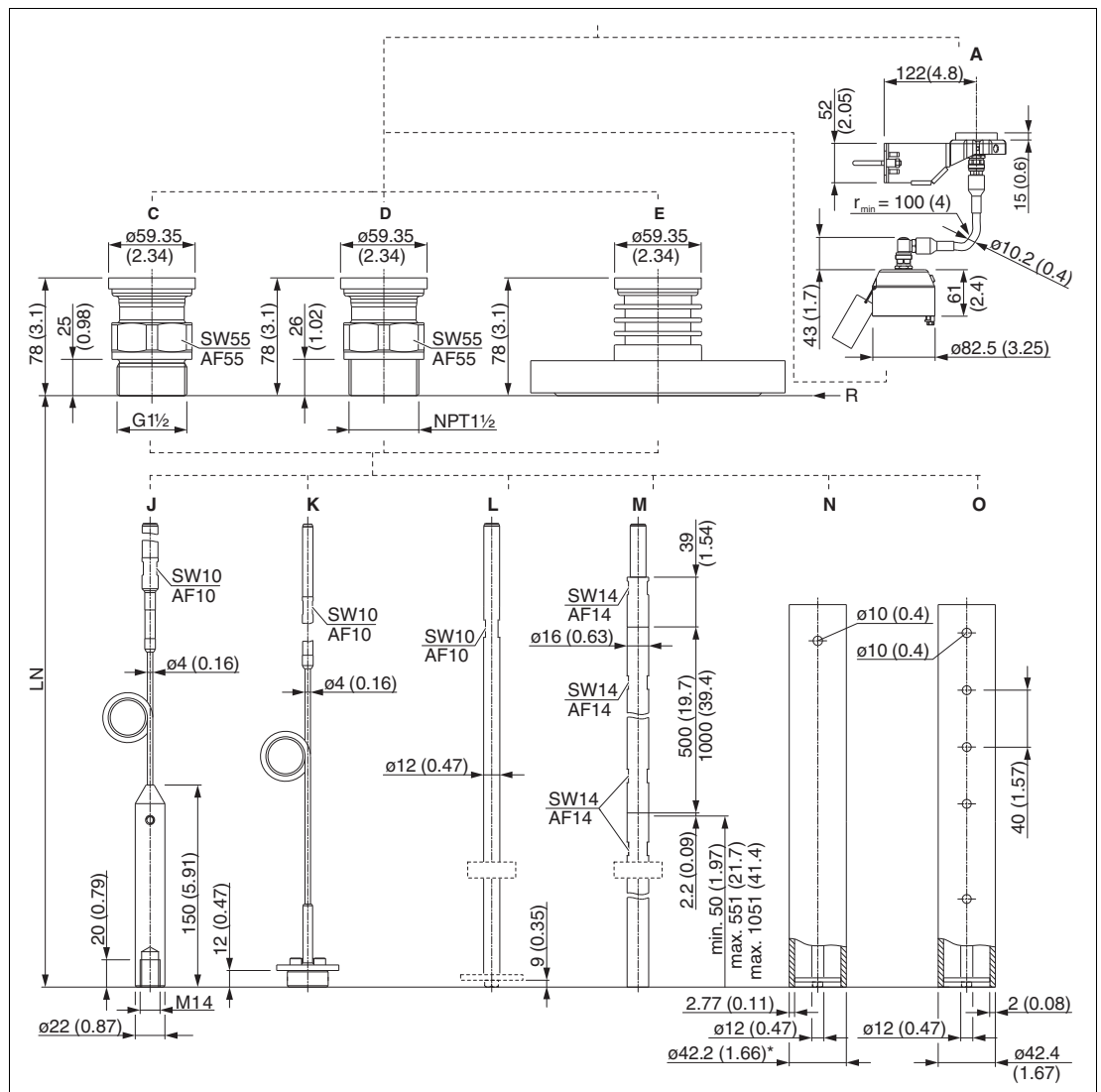


Figure 10.6 Process connection/probe

- A** Mounting bracket for probe design "Sensor remote" (feature "Probe design")
- C** Thread ISO228 G1-1/2 (feature "Process connection")
- D** Thread ANSI MNPT1-1/2 (feature "Process connection")
- E** Flange ANSI B16.5, EN1092-1, JIS B2220 (feature "Process connection")
- J** Rope probe 4 mm or 1/6 in (feature "Probe")
- K** Rope probe 4 mm or 1/6 in; centering disk on request (feature "Probe")
- L** Rod probe 12 mm or 1/2 in; centering disk on request (feature "Probe")
- M** Rod probe 16 mm or 0.63 in, 20 in or 40 in divisible; centering disk on request (feature "Probe")
- N** Coax probe; Alloy C (feature "Probe")
- O** Coax probe; 316L (feature "Probe")
- LN** Length of probe
- R** Reference point of the measurement

10.2 Tolerance of probe length

Rod and coax probes				
Over [m (ft)]	–	1 (3.3)	3 (9.8)	6 (20)
Up to [m (ft)]	1 (3.3)	3 (9.8)	6 (20)	–
Admissible tolerance [mm (in)]	-5 (-0.2)	-10 (-0.39)	-20 (-0.79)	-30 (-1.18)

Table 10.1

Rope probes				
Over [m (ft)]	–	1 (3.3)	3 (9.8)	6 (20)
Up to [m (ft)]	1 (3.3)	3 (9.8)	6 (20)	–
Admissible tolerance [mm (in)]	-10 (-0.39)	-20 (-0.79)	-30 (-1.18)	-40 (-1.57)

Table 10.2

10.3 Surface roughness of Alloy C coated flanges

Ra = 3.2 µm; lower surface roughness levels are available on request.

This value is valid for flanges with "Alloy C > 316/316L"; see product structure, feature "Process connection". For other flanges the surface roughness matches the corresponding flange standard.

10.4 Shortening probes

If necessary, probes can be shortened. When doing so, the following must be observed:

Shortening rod probes

Rod probes must be shortened if the distance to the container floor or outlet cone is less than 10 mm (0.4 in). The rods of a rod probe are shortened by sawing at the bottom end.

Shortening rope probes

Rope probes must be shortened if the distance to the container floor or outlet cone is less than 150 mm (6 in).

Shortening coax probes

Coax probes must be shortened if the distance to the container floor or outlet cone is less than 10 mm (0.4 in).



Note!

Coax probes can be shortened max. 80 mm (3.2 in) from the end. They have centering units inside, which fix the rod centrally in the pipe. The centerings are held with borders on the rod. Shortening is possible up to approx. 10 mm (0.4 in) below the centering unit.

10.5 Weight

Housing

Part	Weight
Housing A1 (GT19), plastic	approx. 1.2 kg
Housing A2 (GT20), aluminium	approx. 1.9 kg
Housing A3 (GT18), stainless steel	approx. 4.5 kg

Table 10.3

Device with threaded connection G3/4 or NPT3/4

Part	Weight	Part	Weight
Sensor	approx. 0.8 kg	Rod probe 8 mm	approx. 0.4 kg/m probe length
Rope probe 4 mm	approx. 0.,1 kg/m probe length	Coax probe	approx. 1.2 kg/m probe length

Table 10.4

Device with threaded connection G1-1/2/NPT1-1/2 or flange

Part	Weight	Part	Weight
Sensor	approx. 1.2 kg and weight of flange	Rod probe 16 mm	approx. 1.1 kg/m probe length
Rope probe 4 mm	approx. 0.1 kg/m probe length	Coax probe	approx. 3.0 kg/m probe length
Rod probe 12 mm	approx. 0.9 kg/m probe length		

Table 10.5

10.6 Materials: A1 (GT19) housing

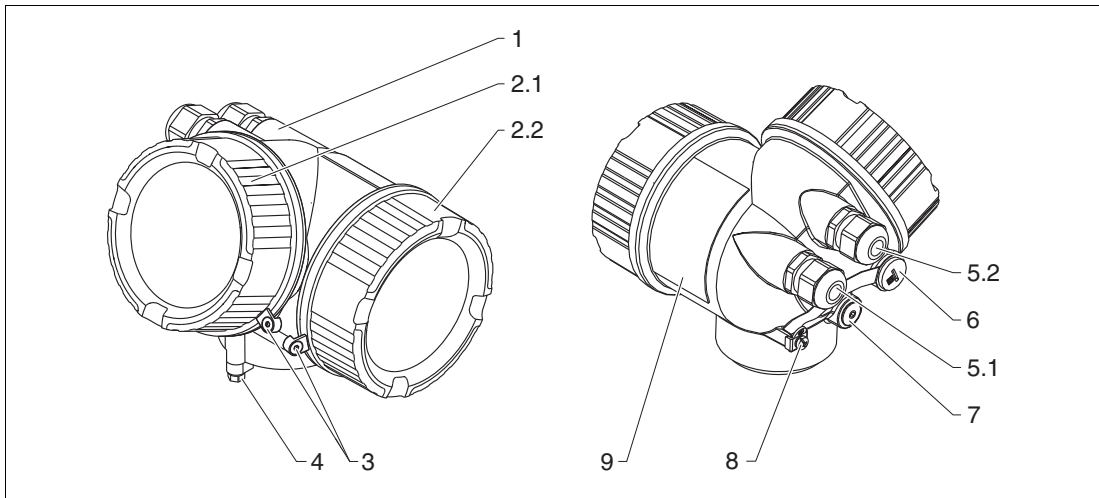


Figure 10.7

No.	Part	Material
1	Housing	PBT
2.1	Cover of the electronics compartment	<ul style="list-style-type: none"> • Cover, depending on the device version: <ul style="list-style-type: none"> – PA (transparent cover) – PBT (blind cover) • Cover seal: EPDM • Thread-coating: heat-curing lubricant varnish
2.2	Cover of the terminal compartment	<ul style="list-style-type: none"> • Cover: PBT • Cover seal: EPDM • Thread-coating: heat-curing lubricant varnish
4	Lock at the housing neck	<ul style="list-style-type: none"> • Screw: A4-70 • Clamp: 316L (1.4404)
5.1	Dummy plug, cable gland, adapter or plug (depending on the device version)	<ul style="list-style-type: none"> • Dummy plug, depending on the device version: <ul style="list-style-type: none"> – PE – PBT-GF • Cable gland, depending on the device version: <ul style="list-style-type: none"> – Nickel-plated brass (CuZn) – PA • Adapter: 316L (1.4404/1.4435) • Seal: EPDM • M12 plug: Nickel-plated brass ^a • 7/8 in plug: 316 (1.4401) ^b
5.2	Dummy plug, cable gland or adapter (depending on the device version)	<ul style="list-style-type: none"> • Dummy plug, depending on the device version: <ul style="list-style-type: none"> – PE – PBT-GF – Steel, galvanized • Cable gland, depending on the device version: <ul style="list-style-type: none"> – Nickel-plated brass (CuZn) – PA • Adapter: 316L (1.4404/1.4435) • Seal: EPDM

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No.	Part	Material
6	Dummy plug or M12 socket (depending on the device version)	<ul style="list-style-type: none"> Dummy plug: Nickel-plated brass (CuZn) M12 socket: Nickel-plated GD-Zn
7	Pressure relief stopper	Nickel-plated brass (CuZn)
8	Ground terminal	<ul style="list-style-type: none"> Screw: A2 Spring washer: A4 Clamp: 304 (1.4301) Holder: 304 (1.4301)
9	Nameplate	Sticker

Table 10.6

- ^a For the version with M12 plug the sealing material is Viton.
^b For the version with 7/8 in plug, the sealing material is NBR.

10.7 Materials: A2 (GT20) housing

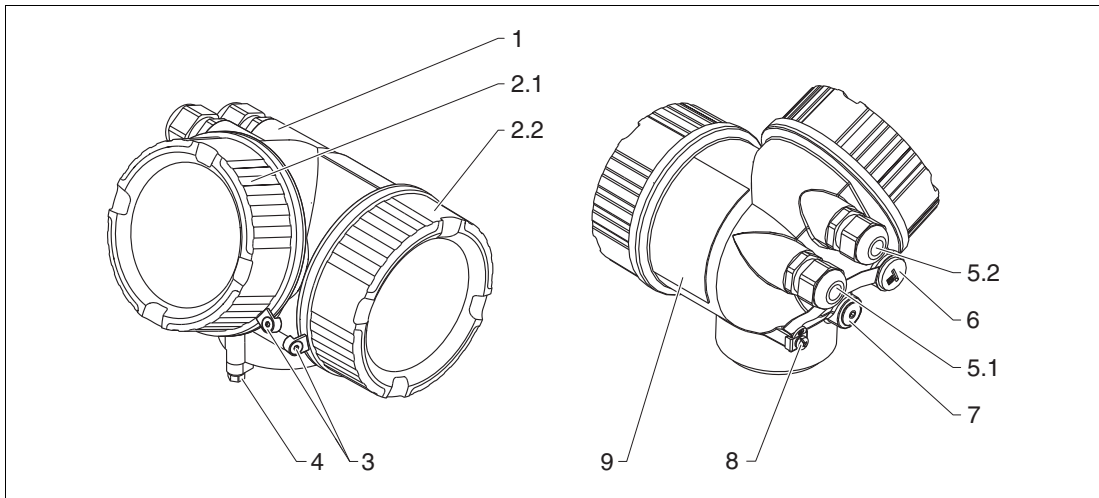


Figure 10.8

No.	Part	Material
1	Housing	<ul style="list-style-type: none"> Housing: AlSi10Mg (< 0.1 % Cu) Coating: Polyester
2.1	Cover of the electronics compartment	<ul style="list-style-type: none"> Cover: AlSi10Mg (< 0.1 % Cu) Window: glass Cover seal: EPDM Thread-coating: heat-curing lubricant varnish
2.2	Cover of the terminal compartment	<ul style="list-style-type: none"> Cover: AlSi10Mg (< 0.1 % Cu) Cover seal: EPDM Thread-coating: heat-curing lubricant varnish
3	Cover lock	<ul style="list-style-type: none"> Screw: A4 Clamp: 316L (1.4404)
4	Lock at the housing neck	<ul style="list-style-type: none"> Screw: A4-70 Clamp: 316L (1.4404)
5.1	Dummy plug, cable gland, adapter or plug (depending on the device version)	<ul style="list-style-type: none"> Dummy plug, depending on the device version: <ul style="list-style-type: none"> – PE – PBT-GF Cable gland, depending on the device version: <ul style="list-style-type: none"> – Nickel-plated brass (CuZn) – PA Adapter: 316L (1.4404/1.4435) Seal: EPDM M12 plug: Nickel-plated brass ^a 7/8 in plug: 316 (1.4401) ^b

No.	Part	Material
5.2	Dummy plug, cable gland or adapter (depending on the device version)	<ul style="list-style-type: none"> • Dummy plug, depending on the device version: <ul style="list-style-type: none"> – PE – PBT-GF – Steel, galvanized • Cable gland, depending on the device version: <ul style="list-style-type: none"> – Nickel-plated brass (CuZn) – PA • Adapter: 316L (1.4404/1.4435) • Seal: EPDM
6	Dummy plug or M12 socket (depending on the device version)	<ul style="list-style-type: none"> • Dummy plug: Nickel-plated brass (CuZn) • M12 socket: Nickel-plated GD-Zn
7	Pressure relief stopper	Nickel-plated brass (CuZn)
8	Ground terminal	<ul style="list-style-type: none"> • Screw: A2 • Spring washer: A2 • Clamp: 304 (1.4301) • Holder: 304 (1.4301)
9	Nameplate	Sticker

Table 10.7

- ^a For the version with M12 plug the sealing material is Viton.
^b For the version with 7/8 in plug, the sealing material is NBR.

10.8 Materials: A3 (GT18) housing

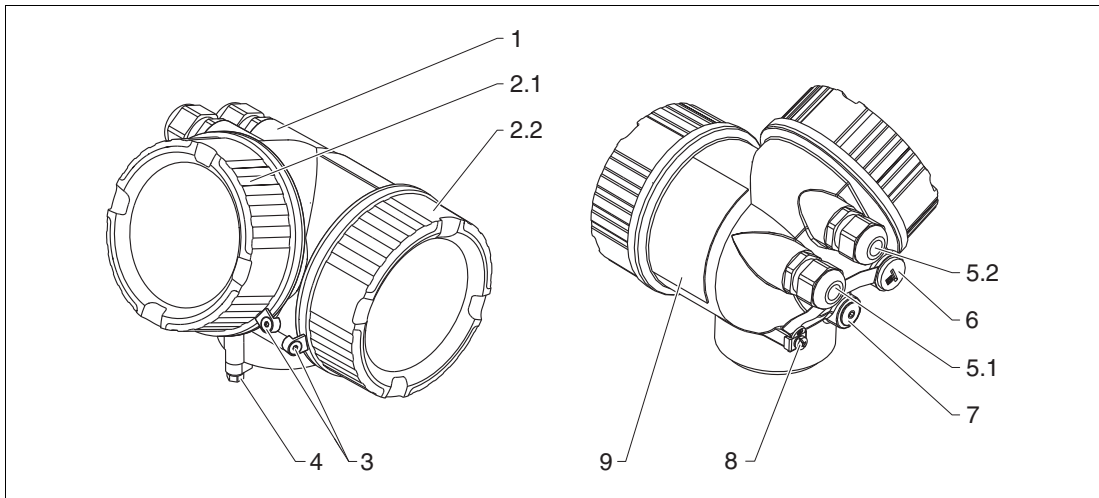


Figure 10.9

No.	Part	Material
1	Housing	316L (CF-3M, 1.4404)
2.1	Cover of the electronics compartment	<ul style="list-style-type: none"> Cover: 316L (CF-3M, 1.4404) Window: glass Cover seal: EPDM Thread-coating: heat-curing lubricant varnish
2.2	Cover of the terminal compartment	<ul style="list-style-type: none"> Cover: 316L (CF-3M, 1.4404) Cover seal: EPDM Thread-coating: heat-curing lubricant varnish
3	Cover lock	<ul style="list-style-type: none"> Screw: A4 Clamp: 316L (1.4404)
4	Lock at the housing neck	<ul style="list-style-type: none"> Screw: A4-70 Clamp: 316L (1.4404)
5.1	Dummy plug, cable gland, adapter or plug (depending on the device version)	<ul style="list-style-type: none"> Dummy plug, depending on the device version: <ul style="list-style-type: none"> – PE – PBT-GF Cable gland: 316L (1.4404) or nickel-plated brass Adapter: 316L (1.4404/1.4435) Seal: EPDM M12 plug: Nickel-plated brass ^a 7/8 in plug: 316 (1.4401)^b
5.2	Dummy plug, cable gland or adapter (depending on the device version)	<ul style="list-style-type: none"> Dummy plug: 316L (1.4404) Cable gland: 316L (1.4404) or nickel-plated brass Adapter: 316L (1.4404/1.4435) Seal: EPDM
6	Dummy plug or M12 socket (depending on the device version)	<ul style="list-style-type: none"> Dummy plug: 316L (1.4404) M12 socket: 316L (1.4404)
7	Pressure relief stopper	316L (1.4404)

No.	Part	Material
8	Ground terminal	<ul style="list-style-type: none"> • Screw: A4 • Spring washer: A4 • Clamp: 316L (1.4404) • Holder: 316L (1.4404)
9	Nameplate	<ul style="list-style-type: none"> • Plate: 316L (1.4404) • Groove pin: A4 (1.4571)

Table 10.8

- ^a For the version with M12 plug the sealing material is Viton.
^b For the version with 7/8 in plug, the sealing material is NBR.

10.9 Materials: Process connection



Note!

Pepperl+Fuchs supplies DIN/EN flanges and threaded process connections made of stainless steel according to AISI 316L (DIN/EN material number 1.4404 or 1.4435). With regard to their temperature stability properties, the materials 1.4404 and 1.4435 are grouped under 13E0 in EN 1092-1 table 18. The chemical composition of the two materials can be identical.

Threaded connection			Flange		No.	Material
G3/4, NPT3/4	G1-1/2	NPT1-1/2	DN40 ... DN200	DN40 ... DN100		
					1.1	316L (1.4404)
					1.2	Alloy C22 (2.4602)
					2	ASME: 316/316L EN: 316L (1.4404) JIS: 316L (1.4435)
					3	Ceramic Al ₂ O ₃ 99.7 %
					4	Cladding: Alloy C22 (2.4602)

Table 10.9

10.10 Materials: Probe

Rope probe		Rod probe		Coax probe			No.	Material
Ø4 mm (1/6 in)	Ø4 mm (1/6 in) with centering disk (on request)	Ø8 mm (1/3 in)	Ø12.7 mm (1/2 in) Alloy C	Thread G3/4	Thread G1-1/2 Alloy C	Thread G1-1/2 316L		
							1.1	316L (1.4404)
							1.2	Alloy C22 (2.4602)
							2	316 (1.4401)
							3	316L (1.4435)
							4	Set screw: A4-70
							5	Screw for tightening: A2-70
							7	Disk: e. g. 316L (1.4404)
							9.1	Rod: 316L (1.4404)
							9.2	Alloy C22 (2.4602)
							10	Centering star: PFA

Table 10.10



Rod probe		No.	Material
Ø12 mm (1/2 in) 316L	Ø16 mm (2/3 in) divisible		
		1	316L (1.4404)
		3	Connecting bolt: Alloy C22 (2.4602) Nord-Lock washer: 1.4547
		11	Hexagon head screw: A4-70 Nord-Lock washer: 1.4547
		12	Centering star on request: PEEK Center washer on request: 316L (1.4404)
		13	Center washer on request: PFA

Table 10.11



10.11 Materials: Mounting bracket

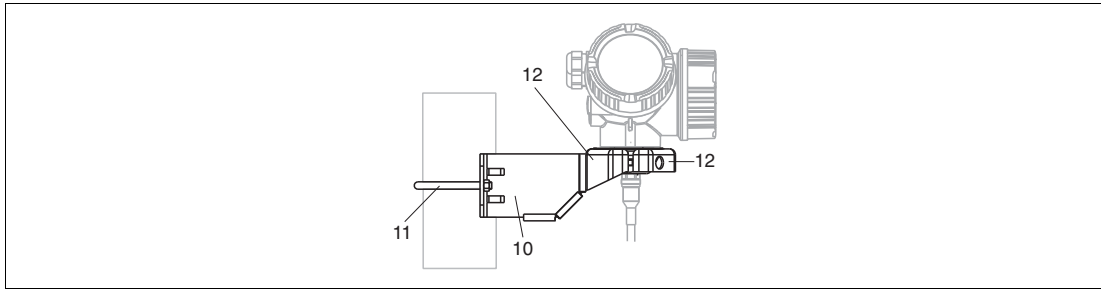


Figure 10.10

Mounting bracket for version "Sensor remote"		
No.	Component	Material
10	Bracket	316L (1.4404)
11	Bracket	316Ti (1.4571)
	Screw/nuts	A4-70
	Distance sleeves	316Ti (1.4571) or 316L (1.4404)
12	Half-shells	316L (1.4404)

Table 10.12

10.12 Materials: Adapter and cable

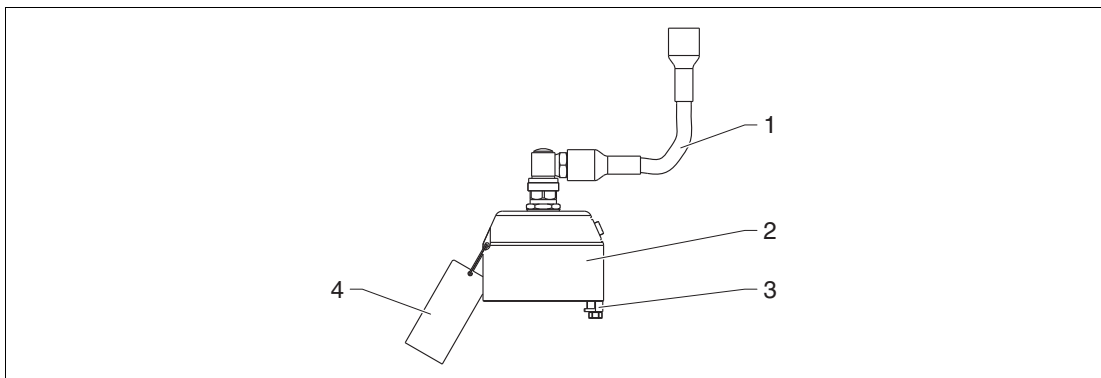


Figure 10.11

Adapter and cable for version "Sensor remote"		
No.	Component	Material
1	Cable	FRNC
2	Sensor adapter	304 (1.4301)
3	Clamp	316L (1.4404)
	Screw	A4-70
4	Loop	316 (1.4401)
	Crimp sleeve	aluminum
	Nameplate	304 (1.4301)

Table 10.13



10.13 Materials: Weather protection cover

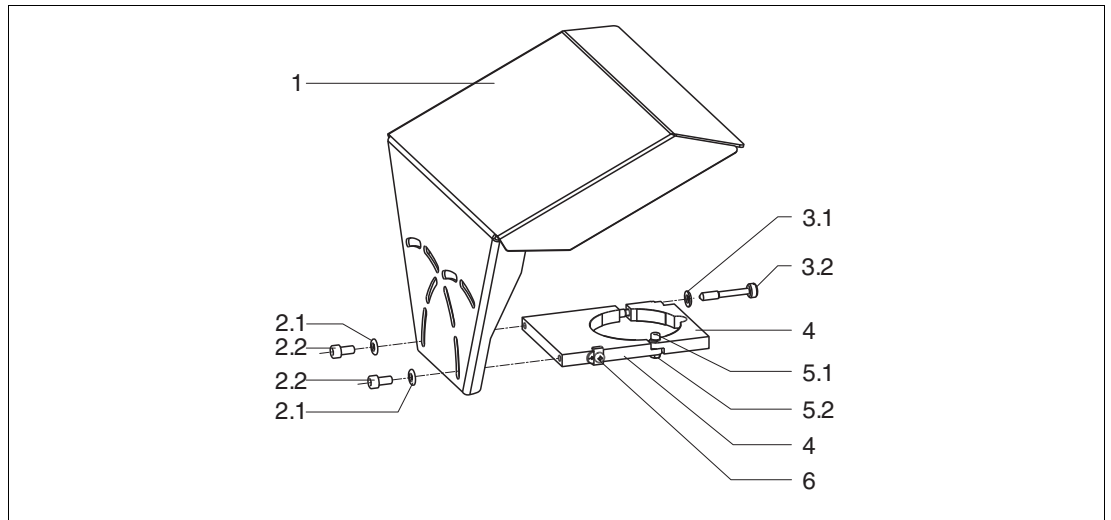


Figure 10.12

Weather protection cover			
No.	Part: material	No.	Part: material
1	Protection cover: 304 (1.4301)	4	Bracket: 304 (1.4301)
2.1	Washer: A2	5.1	Cheese head screw: A2-70
2.2	Cheese head screw: A4-70	5.2	Nut: A2
3.1	Washer: A2	6	Ground terminal <ul style="list-style-type: none"> • Screw: A4 • Spring washer: A4 • Clamp: 316L (1.4404) • Holder: 316L (1.4404)
3.2	Tightening screw: 304 (1.4301)		

Table 10.14



11 Operability

11.1 Operating concept

Operator-oriented menu structure for user-specific tasks

- Commissioning
- Operation
- Diagnostics
- Expert level

Operating languages

- English (contained in every device)
- One additional language as ordered (feature "Additional operation language" of the product structure)

Quick and safe commissioning

- Guided menus ("Make-it-run" wizards) for applications
- Menu guidance with brief explanations of the individual parameter functions

Reliable operation

- Standardized operation at the device and in the operating tools
- Data storage device (HistoROM) for process and measuring device data with event logbook available at all times – even if electronics modules are replaced

Efficient diagnostics increase measurement reliability

- Remedy information is integrated in plain text
- Diverse simulation options and line recorder functions

11.2 Local operation

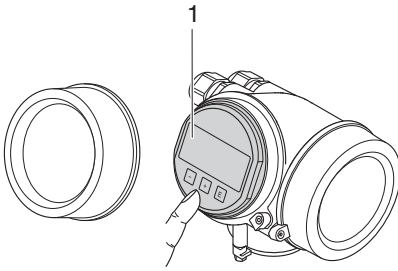
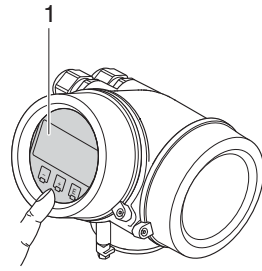
Order code for "Display, operation", option D "SD02"		Order code for "Display, operation", option E "SD03"	
			
1	Operation with push buttons	1	Operation with touch control

Table 11.1

Display elements

- 4-line display
- In the case of order code for "Display, operation", option E: white background lighting; switches to red in event of device errors
- Format for displaying measured variables and status variables can be individually configured
- Permitted ambient temperature for the display: -20 ... +70 °C (-4 ... +158 °F)
The readability of the display may be impaired at temperatures outside the temperature range.

Operating elements

- In the case of order code "Display, operation", option C: local operation with 3 push buttons (⊕, ⊖, ⊞)
- In the case of order code for "Display, operation", option E: external operation via touch control; 3 optical keys: ⊕, ⊖, ⊞
- Operating elements also accessible in various hazardous areas

Additional functionality

- Data backup function
The device configuration can be saved in the display module.
- Data comparison function
The device configuration saved in the display module can be compared to the current device configuration.
- Data transfer function
The transmitter configuration can be transmitted to another device using the display module.



11.3 Remote operation Via HART protocol

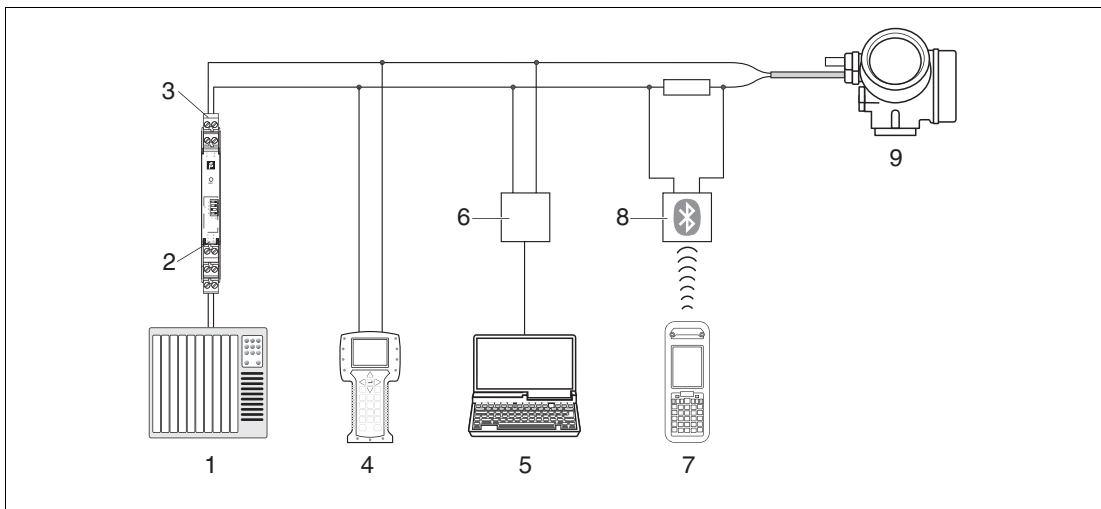


Figure 11.1 Options for remote operation via HART protocol

- 1 PLC (programmable logic controller)
- 2 Transmitter power supply unit, e. g. KFD2-STC-Ex1 (with communication resistor)
- 3 Connection for optional field communicator
- 4 Field communicator
- 5 Computer with operating tool (e. g. PACTware)
- 6 Modem (USB)
- 7 Bluetooth field communicator
- 8 Bluetooth modem with connecting cable
- 9 Transmitter



Via PROFIBUS PA protocol

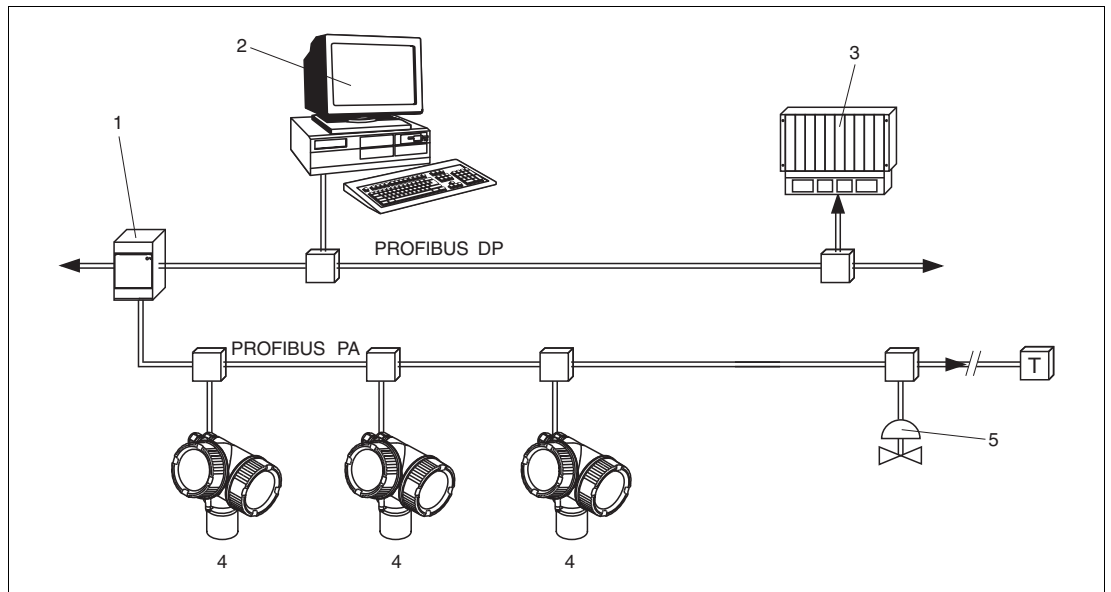


Figure 11.2

- 1 Segment coupler
- 2 Computer with Profibus DP/Proficard and operating tool (e. g. PACTware)
- 3 PLC (Programmable Logic Controller)
- 4 Transmitter
- 5 Additional functions (valves etc.)

Via service interface (CDI)

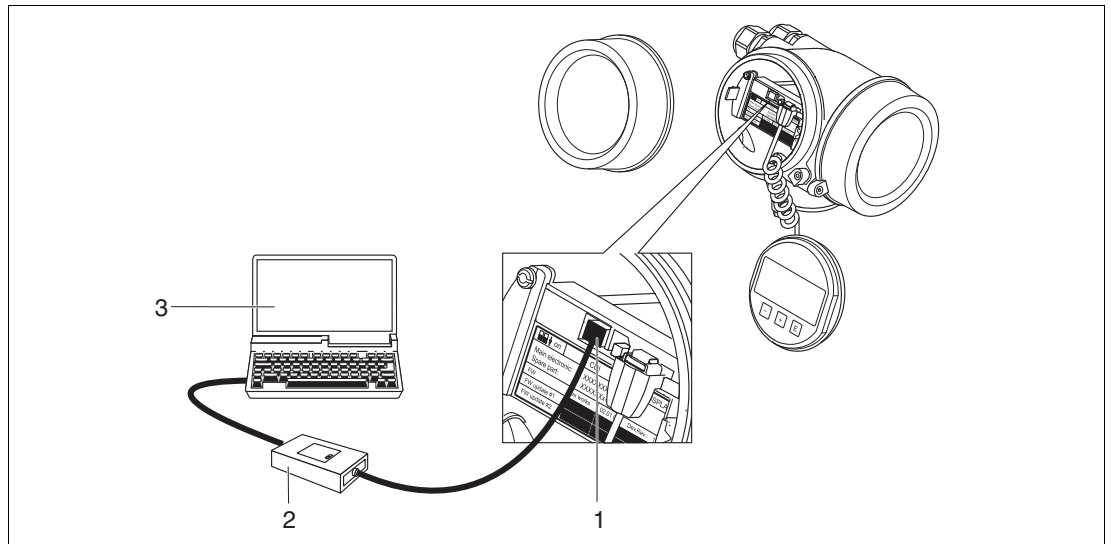


Figure 11.3

- 1 Service interface (CDI) of the measuring device (Common Data Interface)
- 2 Modem
- 3 Computer with PACTware operating tool



12 Certificates and approvals

12.1 CE mark

The measuring system meets the legal requirements of the applicable EC guidelines. These are listed in the corresponding EC Declaration of Conformity together with the standards applied.

Pepperl+Fuchs confirms successful testing of the device by affixing to it the CE mark.

12.2 C-Tick symbol

The measuring system meets the EMC requirements of the "Australian Communications and Media Authority (ACMA)".

12.3 Ex approval

The devices are certified for use in hazardous areas and the relevant safety instructions are provided in the separate "Safety Instructions" (SI) document. Reference is made to this document on the nameplate.



Note!

The separate documentation "Safety Instructions" (SI) containing all the relevant explosion protection data is available from your Pepperl+Fuchs Sales Center. Correlation of documentations to the device: see chapter 15.2.

12.4 Dual seal according to ANSI/ISA 12.27.01

The devices have been designed according to ANSI/ISA 12.27.01 as dual seal devices, allowing the user to waive the use and save the cost of installing external secondary process seals in the conduit as required by the process sealing sections of 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.

Further information can be found in the Safety Instructions (SI) of the relevant devices.

12.5 Functional Safety

Used for level monitoring (MIN, MAX, range) up to SIL3 (homogeneous redundancy), independently assessed by TÜV Rheinland as per IEC 61508. Other information see manual "Safety Integrity Level".

12.6 Overfill prevention

WHG



Note!

Devices with WHG approval are supplied with software version 01.01.18. Any other devices are supplied with software version 01.02.xx.

12.7 Telecommunications

Complies with part 15 of the FCC rules for an unintentional radiator. All probes meet the requirements for a class A digital device.

In addition, all probes in metallic tanks as well as the coax probe meet the requirements for a class B digital device.

12.8 CRN approval

Some device versions have a CRN approval. Devices are CRN approved if the following two conditions are met:

- The device has a CSA approval (Product structure: Feature "Approval")
- The device has a CRN approved process connection according to the following table.

Feature "Process Connection"	Approval
A51	1-1/2 in 150 lbs RF, 1.4401/316/1.4404/316L, flange ANSI B16.5 (CRN)
A52	1-1/2 in 300 lbs RF, 1.4401/316/1.4404/316L, flange ANSI B16.5 (CRN)
A61	2 in 150 lbs RF, 1.4401/316/1.4404/316L, flange ANSI B16.5 (CRN)
A62	2 in 300 lbs RF, 1.4401/316/1.4404/316L, flange ANSI B16.5 (CRN)
A81	3 in 150 lbs RF, 1.4401/316/1.4404/316L, flange ANSI B16.5 (CRN)
A82	3 in 300 lbs RF, 1.4401/316/1.4404/316L, flange ANSI B16.5 (CRN)
A91	4 in 150 lbs RF, 1.4401/316/1.4404/316L, flange ANSI B16.5 (CRN)
A92	4 in 300 lbs RF, 1.4401/316/1.4404/316L, flange ANSI B16.5 (CRN)
AA1	6 in 150 lbs RF, 1.4401/316/1.4404/316L, flange ANSI B16.5 (CRN)
AB1	8 in 150 lbs RF, 1.4401/316/1.4404/316L, flange ANSI B16.5 (CRN)
C51	1-1/2 in 150 lbs, Alloy C > 1.4401/316/1.4404/316L, flange ANSI B16.5 (CRN)
C52	1-1/2 in 300 lbs, Alloy C > 1.4401/316/1.4404/316L, flange ANSI B16.5 (CRN)
C61	2 in 150 lbs, Alloy C > 1.4401/316/1.4404/316L, flange ANSI B16.5 (CRN)
C62	2 in 300 lbs, Alloy C > 1.4401/316/1.4404/316L, flange ANSI B16.5 (CRN)
C81	3 in 150 lbs, Alloy C > 1.4401/316/1.4404/316L, flange ANSI B16.5 (CRN)
C82	3 in 300 lbs, Alloy C > 1.4401/316/1.4404/316L, flange ANSI B16.5 (CRN)
G51	Thread ISO228 G1-1/2, 1.4404/316L (CRN)
N51	Thread ANSI MNPT1-1/2, 1.4404/316L (CRN)

Table 12.1



Note!

- Process connections without CRN approval are not included in this table.
- Refer to the product structure to see which process connections are available for a specific device type.
- CRN approved devices are marked with the registration number 0F14480.5 on the nameplate.



12.9 Other standards and guidelines

- EN 60529
Degrees of protection by housing (IP code)
- EN 61010-1
Protection Measures for Electrical Equipment for Measurement, Control, Regulation and Laboratory Procedures.
- IEC/EN 61326
"Emission in accordance with class A requirements". Electromagnetic compatibility (EMC requirements)
- NAMUR NE 21
Electromagnetic compatibility (EMC) of industrial process and laboratory control equipment.
- NAMUR NE 43
Standardization of the signal level for the breakdown information of digital transmitters with analog output signal.
- NAMUR NE 53
Software of field devices and signal-processing devices with digital electronics
- NAMUR NE 107
Status classification as per NE 107
- NAMUR NE 131
Requirements for field devices for standard applications
- IEC 61508
Functional safety of electrical/electronic/programmable electronic safety-related systems

13 Ordering information

13.1 Design

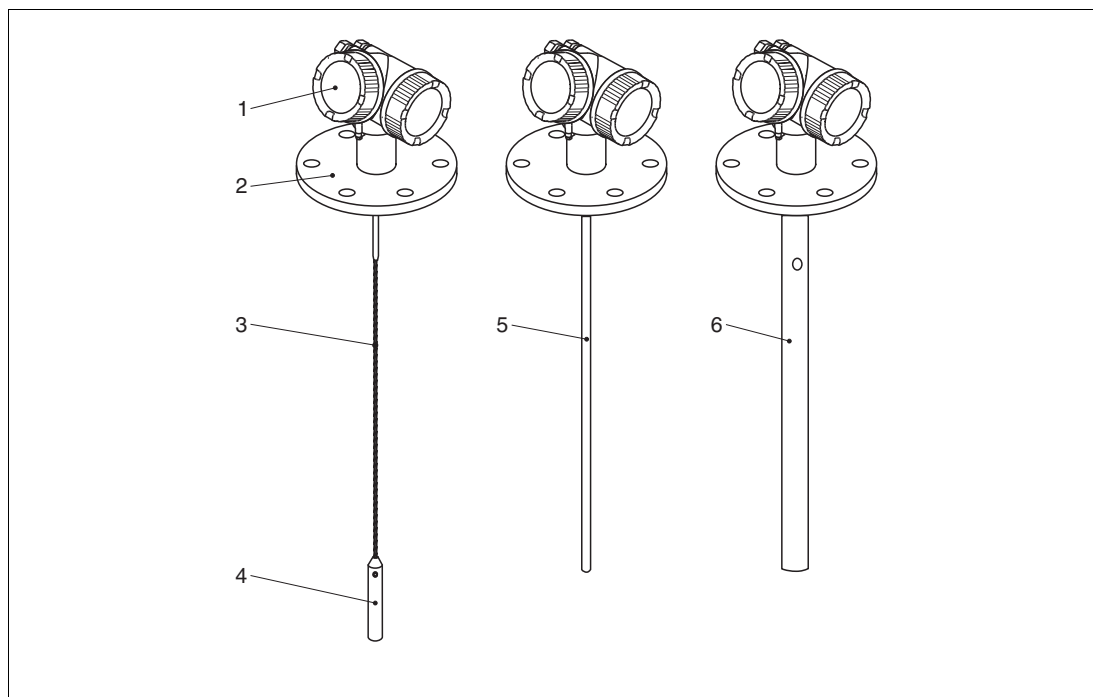


Figure 13.1 Design of the device

- 1 Electronics housing
- 2 Process connection (example flange)
- 3 Rope probe
- 4 End-of-probe weight
- 5 Rod probe
- 6 Coax probe

13.2 Product structure



Note!

This overview does not mark options which are mutually exclusive.
Option with * = on request/in preparation

Device	
LTC51	Guided level radar

Probe	
1	in mm, rod Ø8 mm, 1.4404/316L
2	in mm, rope Ø4 mm, 1.4401/316, max. 150 mm nozzle height, center rod
3	in inch, rope Ø1/6 in, 1.4401/316, max. 6 in nozzle height, center rod
4	in mm, coax, 1.4404/316L
5	in inch, rod Ø1/3 in, 1.4404/316L
6	in mm, rod Ø12 mm, Alloy C
7	in inch, rod Ø1/2 in, Alloy C
8	in mm, rod Ø12 mm, 1.4404/316L
9	in inch, rod Ø1/2 in, 1.4404/316L
A	in mm, rod Ø16 mm, 1.4404/316L, 500 mm divisible
B	in inch, rod Ø0.63 in, 1.4404/316L, 20 in divisible
C	in mm, rod Ø16 mm, 1.4404/316L, 1000 mm divisible
D	in inch, rod Ø0.63 in, 1.4404/316L, 40 in divisible
E	in mm, rope Ø4 mm, 1.4401/316, max. 300 mm nozzle height, center rod
F	in inch, rope Ø1/6 in, 1.4401/316, max. 12 in nozzle height, center rod
G	in inch, coax, 1.4404/316L
H	in mm, coax, Alloy C
K	in inch, coax, Alloy C
X	Special version

Process connection	
A51	1-1/2 in 150 lbs RF, 1.4401/316/1.4404/316L, flange ANSI B16.5 (CRN)
A52	1-1/2 in 300 lbs RF, 1.4401/316/1.4404/316L, flange ANSI B16.5 (CRN)
A61	2 in 150 lbs RF, 1.4401/316/1.4404/316L, flange ANSI B16.5 (CRN)
A62	2 in 300 lbs RF, 1.4401/316/1.4404/316L, flange ANSI B16.5 (CRN)
A81	3 in 150 lbs RF, 1.4401/316/1.4404/316L, flange ANSI B16.5 (CRN)
A82	3 in 300 lbs RF, 1.4401/316/1.4404/316L, flange ANSI B16.5 (CRN)
A91	4 in 150 lbs RF, 1.4401/316/1.4404/316L, flange ANSI B16.5 (CRN)
A92	4 in 300 lbs RF, 1.4401/316/1.4404/316L, flange ANSI B16.5 (CRN)
AA1	6 in 150 lbs RF, 1.4401/316/1.4404/316L, flange ANSI B16.5 (CRN)
AB1	8 in 150 lbs RF, 1.4401/316/1.4404/316L, flange ANSI B16.5 (CRN)
C51	1-1/2 in 150 lbs, Alloy C > 1.4401/316/1.4404/316L, flange ANSI B16.5 (CRN)
C52	1-1/2 in 300 lbs, Alloy C > 1.4401/316/1.4404/316L, flange ANSI B16.5 (CRN)

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Process connection	
C61	2 in 150 lbs, Alloy C > 1.4401/316/1.4404/316L, flange ANSI B16.5 (CRN)
C62	2 in 300 lbs, Alloy C > 1.4401/316/1.4404/316L, flange ANSI B16.5 (CRN)
C65	DN40 PN10-40, Alloy C > 1.4404/316L, flange EN 1092-1
C73	DN50 PN10/16, Alloy C > 1.4404/316L, flange EN 1092-1
C75	DN50 PN25/40, Alloy C > 1.4404/316L, flange EN 1092-1
C81	3 in 150 lbs, Alloy C > 1.4401/316/1.4404/316L, flange ANSI B16.5 (CRN)
C82	3 in 300 lbs, Alloy C > 1.4401/316/1.4404/316L, flange ANSI B16.5 (CRN)
C93	DN80 PN10/16, Alloy C > 1.4404/316L, flange EN 1092-1
C95	DN100 PN10/16, Alloy C > 1.4404/316L, flange EN 1092-1
CA3	DN80 PN25/40, Alloy C > 1.4404/316L, flange EN 1092-1
CA5	DN100 PN25/40, Alloy C > 1.4404/316L, flange EN 1092-1
D73	DN50 PN10/16 B1, 1.4404/316L, flange EN 1092-1
D75	DN50 PN25/40 B1, 1.4404/316L, flange EN 1092-1
D93	DN80 PN10/16 B1, 1.4404/316L, flange EN 1092-1
DA3	DN80 PN25/40 B1, 1.4404/316L, flange EN 1092-1
DA5	DN100 PN25/40 B1, 1.4404/316L, flange EN 1092-1
DC3	DN150 PN10/16 B1, 1.4404/316L, flange EN 1092-1
DE3	DN200 PN16 B1, 1.4404/316L, flange EN 1092-1
F65	DN40 PN10/40 B1, 1.4404/316L, flange EN 1092-1
G21	Thread ISO228 G3/4, 1.4404/316L
G51	Thread ISO228 G1-1/2, 1.4404/316L (CRN)
J16	10K 50A RF, 1.4404/316L, flange JIS B2220
J17	10K 80A RF, 1.4404/316L, flange JIS B2220
J18	10K 40A RF, 1.4404/316L, flange JIS B2220
J19	10K 100A RF, 1.4404/316L, flange JIS B2220
N21	Thread ANSI MNPT3/4, 1.4404/316L
N51	Thread ANSI MNPT1-1/2, 1.4404/316L (CRN)
XXX	Special version

Electrical connection	
A	Gland M20, IP66/68, NEMA 4X/6P
B	Thread M20, IP66/68, NEMA 4X/6P
C	Thread G1/2, IP66/68, NEMA 4X/6P
D	Thread NPT1/2, IP66/68, NEMA 4X/6P
I	Plug M12, IP66/68, NEMA 4X/6P
M	Plug 7/8 in, IP66/68, NEMA 4X/6P
X	Special version

Seal	
3	EPDM, -40 ... 120 °C
4	Kalrez, -20 ... 200 °C, saturated steam max. 150 °C

Seal	
5	Viton, -30 ... 150 °C
X	Special version

Housing	
A1	GT19 dual compartment, plastics PBT
A2	GT20 dual compartment, alu coated
A3	GT18 dual compartment, 1.4404/316L
XX	Special version

Electrical output	
AH	4-wire, 90 ... 253 V AC, 4 ... 20 mA, HART
DH	4-wire, 10.4 ... 48 V DC, 4 ... 20 mA, HART
ID	* 2-wire, 4 ... 20 mA, HART, switching output
IE	2-wire, 4 ... 20 mA, HART, 4 ... 20 mA
IH	2-wire, 4 ... 20 mA, HART
PA	2-wire, PROFIBUS PA, switching output
XX	Special version

Display, operation	
B	Without display, via communicator
D	SD02 4-line, push-buttons and data backup function
E	* SD03 4-line, illuminated, touch control and data backup function

Approval	
C1	* CSA C/US IS Cl.I,II,III Div.1 Gr.A-G, NI Cl.1 Div.2, Ex ia
C2	* CSA C/US XP Cl.I,II,III Div.1 Gr.A-G, NI Cl.1 Div.2, Ex d
CG	CSA C/US General Purpose
E1	ATEX II 1G Ex ia IIC T6-T1 Ga
E2	ATEX II 1/3G Ex ic [ia] IIC T6-T1 Ga/Gc
E3	ATEX II 3G Ex nA IIC T6-T1 Gc
E4	ATEX II 3G Ex ic IIC T6-T1 Gc
ED	ATEX II 1/2G Ex d [ia] IIC T6-T1 Ga/Gb
EG	* ATEX II 1/2G Ex d [ia] IIC T6-T6 Ga/Gb or 1/2 D Ex ta IIIC Txx°C Da/Db
EW	ATEX II 1/2G Ex ia IIC T6-T1 Ga/Gb or 1/2 G Ex d [ia] IIC T6-T1 Ga/Gb
EX	ATEX II 1/2G Ex ia IIC T6-T1 Ga/Gb
FI	* FM IS Cl.I,II,III Div.1 Gr.A-G, AEx ia, NI Cl.1 Div.2
FN	* FM XP Cl.I,II,III Div.1 Gr.A-G, AEx d, NI Cl.1 Div.2
IA	IECEX Ex ia T6-T1 Ga
IB	IECEX Ex ia IIC T6-T1 Ga/Gb
IC	IECEX Ex d [ia] IIC T6-T1 Ga/Gb
ID	IECEX Ex ic [ia] IIC T6-T1 Ga/Gc
IG	IECEX Ex nA IIC T6-T1 Gc

2014-10



Approval	
IH	IECEX Ex ic IIC T6-T1 Gc
NA	Version for non-hazardous area
SX	* ATEX II 1/2G Ex ia IIC T6-T1 Ga/Gb or 1/2 D Ex ia IIIC Txx°C Da/Db

Length	
XXXXX	Always indicate length. Length specification depends on chosen probe. See probe versions.



Additional options



Note!

Option with * = on request/in preparation

Feature with ** = multiple options can be selected

Additional operation language	
0	No option
A	English
B	German
C	French
D	Spanish
E	Italian
F	Dutch
G	* Portuguese
H	* Polish
I	* Russian
J	* Turkish
K	* Chinese abbreviations
L	Japanese
M	* Korean
N	* Arabian
O	* Bahasa
P	* Thai
Q	* Vietnamese
R	* Czech

Application packages	
0	No option
A	* HistoROM, extended function, event and data recording, envelope curve diagnosis
9	Special version

Calibration	
0	No option
4	* 5-point linearity protocol
9	Special version

Service **	
0	No option
J	Customized parametrization HART
K	Customized parametrization PA
9	Special version

Test, certificate **	
0	No option
A	Material certificate, wetted metallic parts, EN 10204-3.1 inspection certificate
9	Special version

Additional approval **	
0	No option
A	* SIL
C	* WHG overfill prevention
9	Special version

Probe design **	
0	No option
B	Sensor remote, 3 m cable, detachable, with mounting bracket
9	Special version

Accessory mounted **	
0	No option
9	Special version

Accessory enclosed **	
0	No option
B	Weather protection cover
G	Mounting kit, insulated, rope
9	Special version

Firmware version	
0	No option
5	01.00.zz, HART, DevRev01
7	01.00.zz, PROFIBUS PA, DevRev01

Tagging	
0	No option
1	Tagging (TAG), see additional specifications
2	Bus address, see additional specifications

13.3 5-point linearity protocol



Note!

The following notes must be taken into account if option "5 point linearity protocol" has been selected in feature "Calibration".

The five points of the linearity protocol are evenly distributed across the measuring range (0 to 100 %). In order to define the measuring range, **Empty calibration (E)** and **Full calibration (F)** have to be specified ¹.

The following restrictions have to be taken into account when defining E and F:

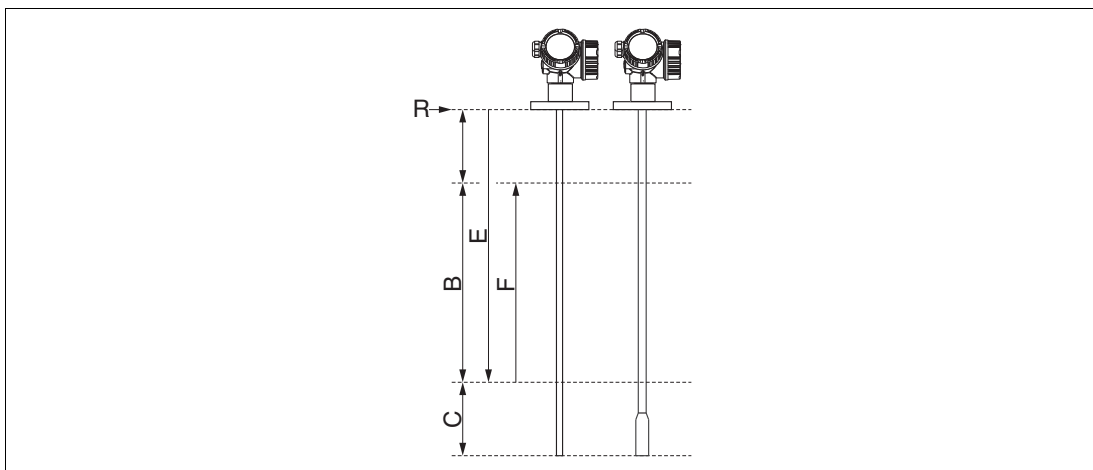


Figure 13.2

Sensor	Minimum distance between reference point (R) and 100 % level	Minimum measuring range
General	$A \geq 250 \text{ mm (10 in)}$	$B \geq 400 \text{ mm (16 in)}$
Rope probe with center rod, max.300 mm (12 in) nozzle height ^a	$A \geq 350 \text{ mm (14 in)}$	$B \geq 400 \text{ mm (16 in)}$

Table 13.1

^a Product structure: feature "Probe", option E or F

Type of probe	Minimum distance from end of probe to 0 % level	Maximum value for "Empty calibration"
Rod ^a	$C \geq 100 \text{ mm (4 in)}$	$E \leq 3.9 \text{ m (12.8 ft)}$
Coax	$C \geq 100 \text{ mm (4 in)}$	$E \leq 5.9 \text{ m (19.4 ft)}$
Rope	$C \geq 1000 \text{ mm (40 in)}$	$E \leq 11 \text{ m (36 ft)}$

Table 13.2

^a Also valid for divisible rod probes.

¹ If E and F are not specified, probe dependent default values will be used instead.



Note!

- For rod and rope probes the linearity check is performed with the complete device.
- For coax probes the electronics is mounted to a reference rod probe and the linearity check is performed to this configuration.
- The linearity is checked under reference conditions.



Note!

The selected values of **Empty calibration** and **Full calibration** are only used to record the linearity protocol and are reset to their probe specific default values thereafter. If values different from the default are required, they must be ordered as a customized parametrization.

13.4 Customized parametrization

If the option IJ "Customized parametrization HART" or option IK "Customized parametrization PA" has been selected in feature "Service", customer specific presettings can be selected for the following parameters:

Parameter	Communication	Selection list / range of values
Setup → Distance unit	<ul style="list-style-type: none"> • HART • PA • FF 	<ul style="list-style-type: none"> • in • mm
Setup → Empty calibration	<ul style="list-style-type: none"> • HART • PA • FF 	0 ... 45 m (0 ... 147 ft)
Setup → Full calibration	<ul style="list-style-type: none"> • HART • PA • FF 	0 ... 45 m (0 ... 147 ft)
Setup → Adv. Setup → Current output 1/2 → Damping	<ul style="list-style-type: none"> • HART 	0 ... 999.9 s
Setup → Adv. Setup → Current output 1/2 → Failure mode	<ul style="list-style-type: none"> • HART 	<ul style="list-style-type: none"> • Min • Max • Last valid value
Setup → Adv. Setup → Current output 1/2 → Burst mode	<ul style="list-style-type: none"> • HART 	<ul style="list-style-type: none"> • Off • On

Table 13.3



14 Accessories
14.1 Device-specific accessories
Weather protection cover

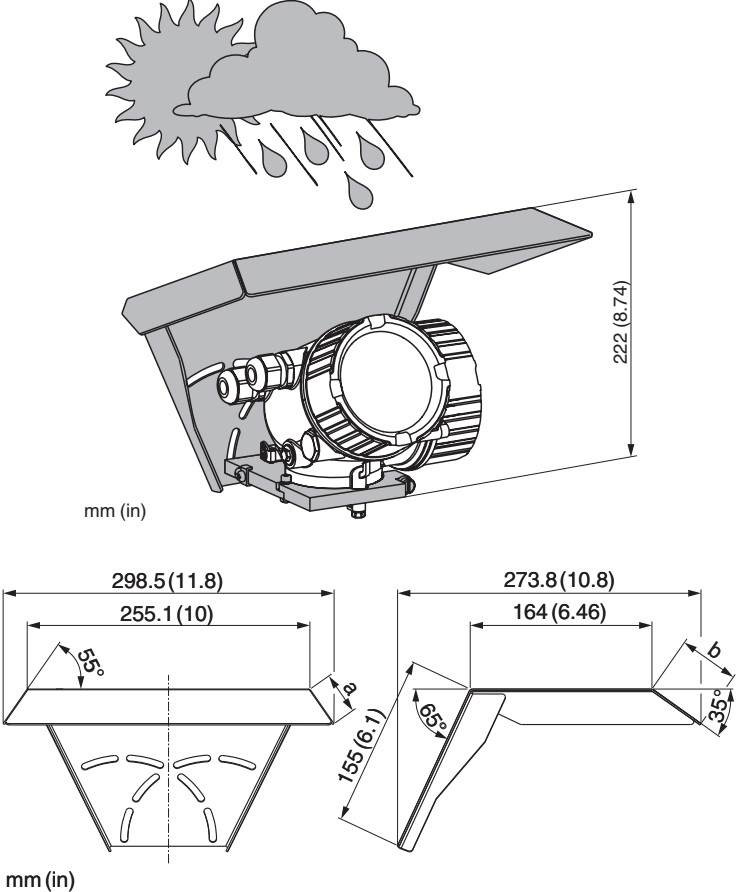
Accessory	Description
Weather protection cover	 <p>mm (in)</p> <p>mm (in)</p> <p>a 37.8 mm (1.49 in) b 54 mm (2.13 in)</p> <p>The weather protection cover can be ordered together with the device (product structure, feature "Accessory enclosed", option B "Weather protection cover"). Alternatively, it can be separately ordered as an accessory.</p>

Table 14.1

Mounting bracket for the electronics housing

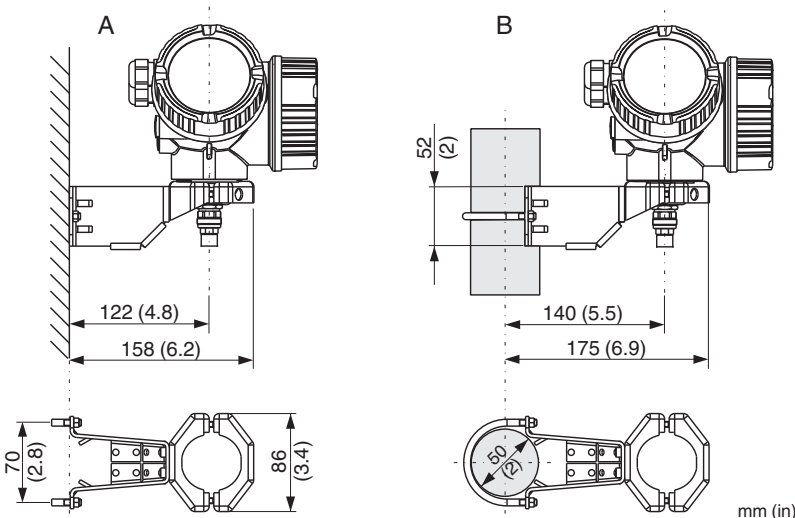
Accessory	Description
<p>Mounting bracket for the electronics housing</p>	 <p>A Wall mounting B Pipe mounting</p> <p>For the "Sensor remote" device version, the mounting bracket is part of the delivery. If required, it can also be ordered as an accessory.</p> <p>mm (in)</p>

Table 14.2

Mounting kit, isolated

Accessory	Description
Mounting kit, isolated	<div data-bbox="826 347 1104 907" data-label="Image"> </div> <p> 1 Insulating sleeve 2 Eye-bolt </p> <p>For reliably insulated fixing of the probe. Maximum process temperature: 150 °C (300 °F)</p> <p>For rope probes 4 mm (1/6 in) or 6 mm (1/4 in) with PA > steel:</p> <ul style="list-style-type: none"> • Eye-bolt M8 DIN 580 • Diameter D = 20 mm (0.8 in) <p>For rope probes 6 mm (1/4 in) or 8 mm (1/3 in) with PA > steel:</p> <ul style="list-style-type: none"> • Eye-bolt M10 DIN 580 • Diameter D = 25 mm (1 in) <p>Due to the risk of electrostatic charge, the insulating sleeve is not suitable for use in hazardous areas. In these cases the fixing must be reliably grounded.</p> <p>The mounting kit can also be ordered directly with the device (see product structure, feature "Accessory enclosed", option G "Mounting kit, isolated, rope").</p>

Table 14.3

14.2 Communication-specific accessories

Accessory	Description
HART Loop Converter KFD2-HLC-Ex1.D.**	Evaluates the dynamic HART variables and converts them to analog current signals or limit values.

Table 14.4

Accessory	Description
WirelessHART-Adapter WHA-ADP-F8B2-*-P*-*	Connects field devices to a WirelessHART network. The WirelessHART adapter can be mounted directly at a HART device and is easily integrated into an existing HART network. It ensures safe data transmission and can be operated in parallel with other wireless networks.

Table 14.5



Note!

For details refer to data sheet on www.pepperl-fuchs.com.

14.3 Service-specific accessories

Accessory	Description
PACTware	PACTware is an operating software with graphical support (MS Windows) for intelligent transmitters with the communication protocols HART and PROFIBUS PA.

Table 14.6



Note!

For details refer to data sheet on www.pepperl-fuchs.com.

14.4 System components

Accessory	Description
KFD2-STC-Ex1	Transmitter power supply with power supply for safe isolation of 4 ... 20 mA current circuits. Provides bi-directional HART communication.

Table 14.7

Accessory	Description
KFD2-STC-1	Transmitter power supply for 2-wire sensors or transmitters exclusively for non-Ex areas. Provides bi-directional HART communication.

Table 14.8



Note!

For details refer to data sheet on www.pepperl-fuchs.com.

15 Documentation



Note!

The following document types are available in the download area of the Pepperl+Fuchs internet site: www.pepperl-fuchs.com → Download.

15.1 Standard documentation

Guided level radar Pulscon LTC51

Correlation of documentations to the device:

Device	Electrical output	Communication	Document type	Document code
LTC51	AH, DH, IE, IH	HART	Technical Information	TI01001O
			Operating Instructions	BA01001O
			Brief Operating Instructions	KA01077O
			Brief Operating Instructions	GP01000O
	PA	PROFIBUS PA	Technical Information	TI01001O
			Operating Instructions	BA01006O
			Brief Operating Instructions	KA01079O
			Brief Operating Instructions	GP01001O

Table 15.1

15.2 Safety documentation

Depending on the approval, the following Safety instructions (SI) are supplied with the device. They are an integral part of the Operating instructions.

Safety instructions (SI)

Feature "Approval"	Approval	Feature "Electrical output"				
		Option IH ^a	Option ID ^b	Option IE ^c	Option PA ^d	Option AH ^e Option DH ^f
E1	ATEX II 1G Ex ia IIC T6-T1 Ga	SI00496O	SI01125O	SI01126O	SI00516O	–
EX	ATEX II 1/2G Ex ia IIC T6-T1 Ga/Gb	SI00496O	SI01125O	SI01126O	SI00516O	–
ED	ATEX II 1/2G Ex d [ia] IIC T6-T1 Ga/Gc	SI00499O	SI00499O	SI00499O	SI00519O	SI01133O
E2	ATEX II 1/3G Ex ic [ia] IIC T6-T1 Ga/Gc	SI00497O	SI01127O	SI01128O	SI00517O	SI01129O
E3	ATEX II 3G Ex nA IIC T6-T1 Gc	SI00498O	SI01130O	SI01131O	SI00518O	SI01132O
E4	ATEX II 3G Ex ic IIC T6-T1 Gc	SI00498O	SI01130O	SI01131O	SI00518O	SI01132O
SX	ATEX II 1/2G Ex ia IIC T6-T1 Ga/Gb or 1/2 D Ex ia IIIC Txx°C Da/Db	SI00502O	SI00502O	SI00502O	SI00522O	–
EG	ATEX II 1/2G Ex d [ia] IIC T6-T6 Ga/Gb or 1/2 D Ex ta IIIC Txx°C Da/Db	SI00503O	SI00503O	SI00503O	SI00523O	SI01136O
EW	ATEX II 1/2G Ex ia IIC T6-T1 Ga/Gb or 1/2 G Ex d [ia] IIC T6-T1 Ga/Gb	SI00500O	SI01134O	SI01135O	SI00520O	–
C1	CSA C/US IS Cl.I,II,III Div.1 Gr.A-G, NI Cl.1 Div.2, Ex ia	SI00530O	SI00530O	SI00530O	SI00571O	SI00530O
C2	CSA C/US XP Cl.I,II,III Div.1 Gr.A-G, NI Cl.1 Div.2, Ex d	SI00529O	SI00529O	SI00529O	SI00570O	SI00529O
FI	FM IS Cl.I,II,III Div.1 Gr.A-G, AEx ia, NI Cl.1 Div.2	SI00531O	SI00531O	SI00531O	SI00573O	SI00531O
FN	FM XP Cl.I,II,III Div.1 Gr.A-G, AEx d, NI Cl.1 Div.2	SI00532O	SI00532O	SI00532O	SI00572O	SI00532O
IA	IECEEx Ex ia T6-T1 Ga	SI00496O	SI01125O	SI01126O	SI00516O	–
IB	IECEEx Ex ia IIC T6-T1 Ga/Gb	SI00496O	SI01125O	SI01126O	SI00516O	–
IC	IECEEx Ex d [ia] IIC T6-T1 Ga/Gb	SI00499O	SI00499O	SI00499O	SI00519O	SI01133O
ID	IECEEx Ex ic [ia] IIC T6-T1 Ga/Gc	SI00497O	SI01127O	SI01128O	SI00517O	SI01129O
IG	IECEEx Ex nA IIC T6-T1 Gc	SI00498O	SI01130O	SI01131O	SI00518O	SI01132O
IH	IECEEx Ex ia IIC T6-T1 Gc	SI00498O	SI01130O	SI01131O	SI00518O	SI01132O

Table 15.2

- ^a Option IH: 2-wire, 4 ... 20 mA, HART
- ^b Option ID: 2-wire, 4 ... 20 mA, HART, switching output
- ^c Option IE: 2-wire, 4 ... 20 mA, HART, 4 ... 20 mA
- ^d Option PA: 2-wire, PROFIBUS PA, switching output
- ^e Option AH: 4-wire, 90 ... 253 V AC, 4 ... 20 mA, HART
- ^f Option DH: 4-wire, 10.4 ... 48 V DC, 4 ... 20 mA, HART



Note!

For certified devices the relevant Safety instructions (SI) are indicated on the nameplate.



16 Registered trademarks

HART®

- Registered trademark of the HART Communication Foundation, Austin, USA

PROFIBUS®

- Registered trademark of the PROFIBUS User Organization, Karlsruhe, Germany

KALREZ®, VITON®

- Registered trademark of DuPont Performance Elastomers L.L.C., Wilmington, USA

TEFLON®

- Registered trademark of E.I. DuPont de Nemours & Co., Wilmington, USA

TRI CLAMP®

- Registered trademark of Alfa Laval Inc., Kenosha, USA



17 Patents

This product may be protected by at least one of the following patents.

Further patents are pending.

US patents	EP patents
5.827.985	–
5.884.231	–
5.973.637	–
6.087.978	955 527
6.140.940	–
6.481.276	–
6.512.358	1 301 914
6.559.657	1 020 735
6.640.628	–
6.691.570	–
6.847.214	–
7.441.454	–
7.477.059	–
–	1 389 337
7.965.087	–

Table 17.1





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