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Technical Information
Levelflex FMP51
Modbus

Guided wave radar

Level and interface measurement in liquids

Application

- Rod, rope or coax probe
- Process connection: Starting 3/4" thread or flange
- Process temperature: −50 to +200 °C (−58 to +392 °F)
- Process pressure: −1 to +40 bar (−14.5 to +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; EN10204-3.1
- Linearity protocol (3-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
- Seamless integration into control or asset management systems
- Intuitive user interface in national languages

Endress+Hauser
People for Process Automation

Table of contents

Important document information

Symbols

Safety symbols

Symbol	Meaning
DANGER	**DANGER!** This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.
WARNING	**WARNING!** This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.
CAUTION	**CAUTION!** This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or medium injury.
NOTICE	**NOTE!** This symbol contains information on procedures and other facts which do not result in personal injury.

Electrical symbols

Symbol	Meaning
	Direct current
	Alternating current
	Direct current and alternating current
	Ground connection A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.
	Protective Earth (PE) A terminal which must be connected to ground prior to establishing any other connections. The ground terminals are situated inside and outside the device: ▪ Inner ground terminal: Connects the protectiv earth to the mains supply. ▪ Outer ground terminal: Connects the device to the plant grounding system.

Symbols for certain types of information

Symbol	Meaning
	Permitted Procedures, processes or actions that are permitted.
	Preferred Procedures, processes or actions that are preferred.
	Forbidden Procedures, processes or actions that are forbidden.
	Tip Indicates additional information.
	Reference to documentation.
	Reference to page.
	Reference to graphic.
	Visual inspection.

Symbols in graphics

Symbol	Meaning
1, 2, 3 ...	Item numbers
1., 2., 3....	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 the non-hazardous area.

Symbols at the device

Symbol	Meaning
	**Safety instructions** Observe the safety instructions contained in the associated Operating Instructions.
	**Temperature resistance of the connection cables** Specifies the minimum value of the temperature resistance of the connection cables.

Terms and abbreviations

Term/abbreviation	Explanation
BA	Document type "Operating Instructions"
KA	Document type "Brief Operating Instructions"
TI	Document type "Technical Information"
SD	Document type "Special Documentation"
XA	Document type "Safety Instructions"
PN	Nominal pressure
MWP	Maximum Working Pressure The MWP can also be found on the nameplate.
ToF	Time of Flight
ε_r (DC value)	Relative dielectric constant
BD	Blocking Distance; no signals are analyzed within the BD.
PLC	Programmable Logic Controller
CDI	Common Data Interface

Registered trademarks

Modbus®
Registered trademark of SCHNEIDER AUTOMATION, INC.

KALREZ®, VITON®
Registered trademark of DuPont Performance Elastomers L.L.C., Wilmington, USA

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TRI CLAMP®
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NORD-LOCK®
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FISHER®
Registered trademark of Fisher Controls International LLC, Marshalltown, USA

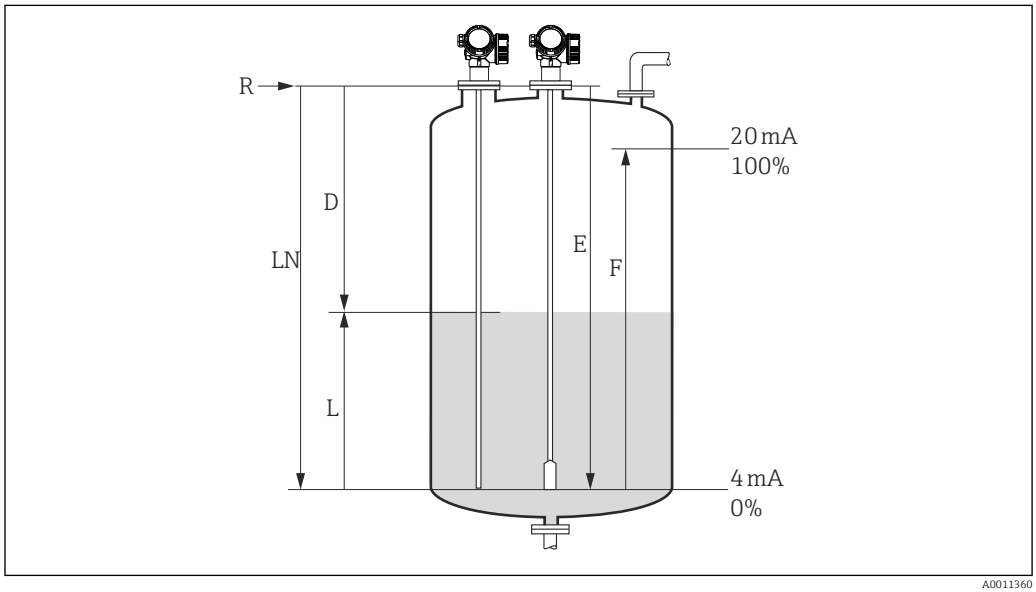
MASONEILAN®
Registered trademark of Dresser, Inc., Addison, USA

Function and system design

Measuring principle

Basic principles

The Levelflex 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).



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)*

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 (0 to 9.84 in) from end of probe; lower blocking distance).

Dielectric constant

The dielectric constant (DC) of the medium has a direct impact on the degree of reflection of the highfrequency 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.

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 that have been integrated into the development of the PulseMaster® software.

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

$D = c \cdot t/2$,

where c is the speed of light.

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

$L = E - D$

The reference point R of the measurement is located at the process connection. For details see the dimensional drawing:
FMP51: → 🖹 53

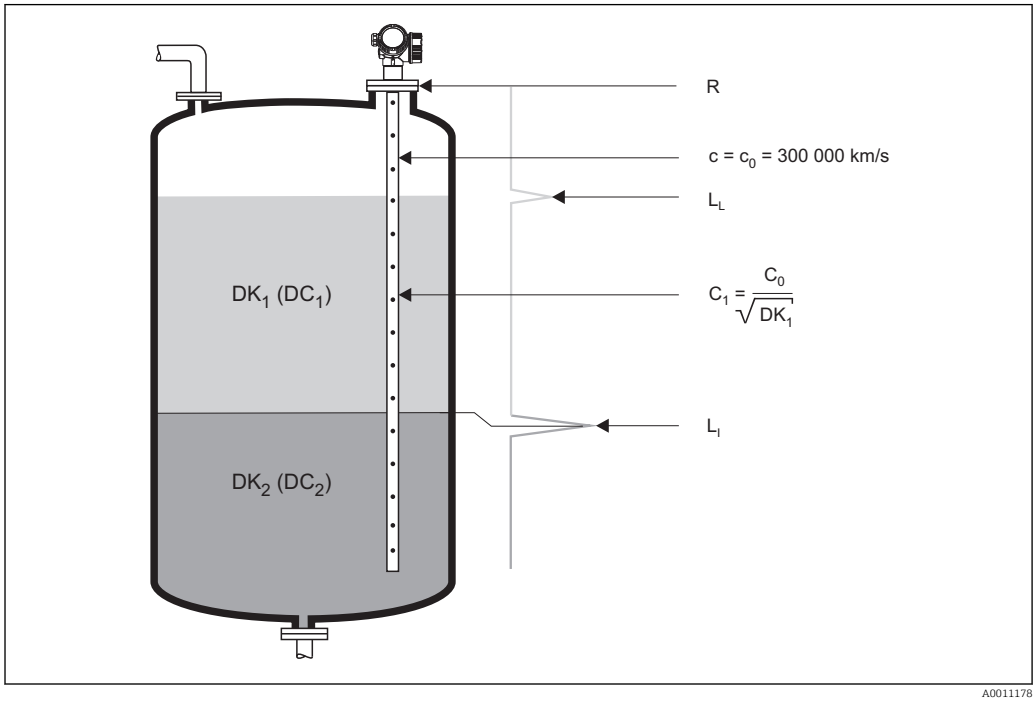
The Levelflex possesses functions for interference echo suppression that can be activated by the user. They guarantee that interference echoes from e.g. internals and struts are not interpreted as level echoes.

Output

The Levelflex 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.

Interface measurement

When the high-frequency pulses hit the surface of the medium, only a percentage of the transmission pulse is reflected. In the case of media with a low DC_1, in particular, the other part penetrates the medium. The pulse is reflected once more at the interface point to a second medium with a higher DC_2. The distance to the interface layer now can also be determined taking into account the delayed time-of-flight of the pulse through the upper medium.



2 *Interface measurement with the guided radar*

LL Level complete
LI Level interface
R Reference point of measurement

In addition, the following general conditions must be observed for interface measurement:
- The DC of the upper medium must be known and constant. If the interface thickness is existing and known, the DC can be calculated automatically via FieldCare.
- The DC of the upper medium may not be greater than 10.
- The DC difference between the upper medium and lower medium must be >10.
- The upper medium must have a minimum thickness of 60 mm (2.4 in).
- Emulsion layers in the area of the interface can strongly attenuate the signal. However, emulsion layers up to 50 mm (2 in) are admissible.

For dielectric constants (DC values) of many media commonly used in various industries refer to:
- the Endress+Hauser DC manual (CP01076F)
- the Endress+Hauser "DC Values App" (available for Android and iOS)

Life cycle of the product

Engineering
- Universal measuring principle
- Measurement unaffected by medium properties
- Genuine, direct interface measurement

Procurement
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 NE107

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

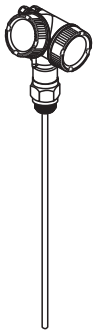
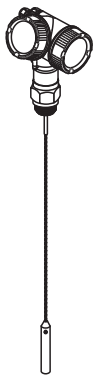
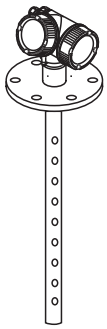
Measuring system

General notes on probe selection

- Normally use rod or coax probes for liquids. Rope probes are used in liquids for measuring ranges > 10 m (33 ft) (> 4 m (13 ft) for FMP52) and with restricted ceiling clearance which does not allow the installation of rigid probes.
- For interface measurement, ideally coax probes or rod probes in a bypass/stilling well are used.
- 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]:

Levelflex FMP51						
Type of probe	**Rod probe**		**Rope probe**		**Coax probe** [1]	
	 A0011387		 A0011388		 A0011359	
Feature 060 - Probe:	**Option:**		**Option:**		**Option:**	
	AA	8 mm (316L)	LA	4 mm (316)	UA	… mm (316L)
	AB	1/3" (316L)	LB	1/6" (316)	UB	… inch (316L)
	AC	12 mm (316L)	MB	4 mm (316) with center rod	UC	… mm (AlloyC)
	AD	1/2" (316L)	MD	1/6" (316) with center rod	UD	… inch (AlloyC)
	AL	12 mm (AlloyC)				
	AM	1/2" (AlloyC)				
	BA BC	16 mm (316L) divisible				
	BB BD	0.63 in (316L) divisible				
Max. probe length	10 m (33 ft) [2]		45 m (148 ft)		6 m (20 ft)	
For application	level and interface measurement in liquids		level and interface measurement in liquids		level and interface measurement in liquids	

1) Punched for process connections G1-1/2" or flange; multiple holes for 316L, one hole for AlloyC
2) 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.

Input

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).

Measuring range

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

Levelflex FMP51					
Media group	DC (ε_r)	Typical liquids	Measuring range [1]		
			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		6 m (20 ft)
2	1.6...1.9	▪ liquefied gas, e.g. propane ▪ solvent ▪ Freon ▪ palm oil	▪ one-piece: 4 m (13 ft) ▪ divisible: 10 m (33 ft)	15 to 22 m (49 to 72 ft)	6 m (20 ft)
3	1.9...2.5	mineral oils, fuels	▪ one-piece: 4 m (13 ft) ▪ divisible: 10 m (33 ft)	22 to 32 m (72 to 105 ft)	6 m (20 ft)
4	2.5...4	▪ benzene, styrene, toluene ▪ furan ▪ naphthalene	▪ one-piece: 4 m (13 ft) ▪ divisible: 10 m (33 ft)	32 to 42 m (105 to 138 ft)	6 m (20 ft)
5	4...7	▪ chlorobenzene, chloroform ▪ cellulose spray ▪ isocyanate, aniline	▪ one-piece: 4 m (13 ft) ▪ divisible: 10 m (33 ft)	42 to 45 m (138 to 148 ft)	6 m (20 ft)
6	> 7	▪ aqueous solutions ▪ alcohols ▪ ammonia	▪ one-piece: 4 m (13 ft) ▪ divisible: 10 m (33 ft)	45 m (148 ft)	6 m (20 ft)

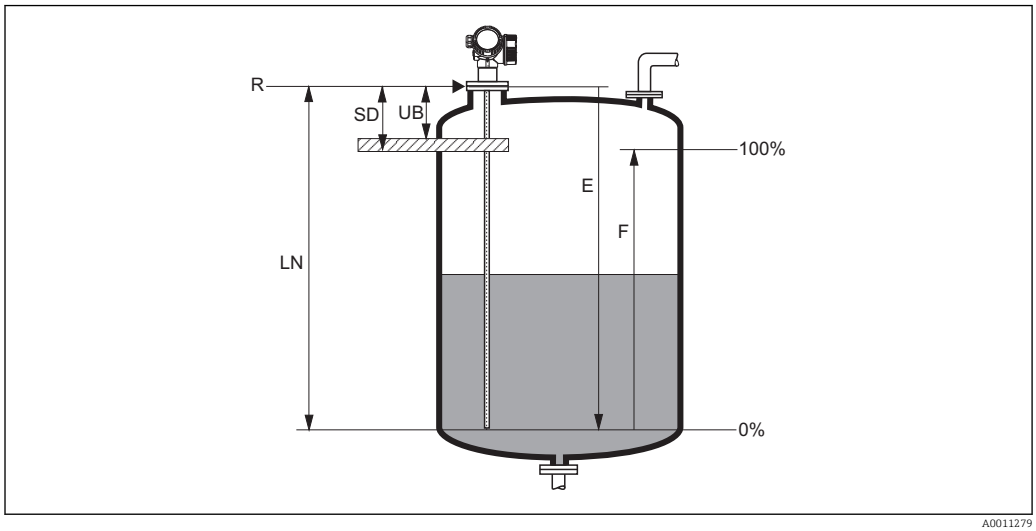
1) The measuring range for interface measurement is limited to 10 m (33 ft).

- 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 [2] for measurements in this medium.

2) optionally available for FMP51

Blocking distance

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



3 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 * (length of probe)

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").

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

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.

Measuring frequency spectrum

100 MHz to 1.5 GHz

Output

Output signal

Modbus

Physical interface	RS485 in accordance with EIA/TIA-485 standard
Terminating resistor	Not integrated

Signal on alarm

Depending on the interface, failure information is displayed as follows:
- Local display
  - Status signal (in accordance with NAMUR Recommendation NE 107)
  - Plain text display
- Operating tool via digital communication or service interface (CDI)
  - Status signal (in accordance with NAMUR Recommendation NE 107)
  - Plain text display

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.

Galvanic isolation

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

Protocol-specific data

Modbus

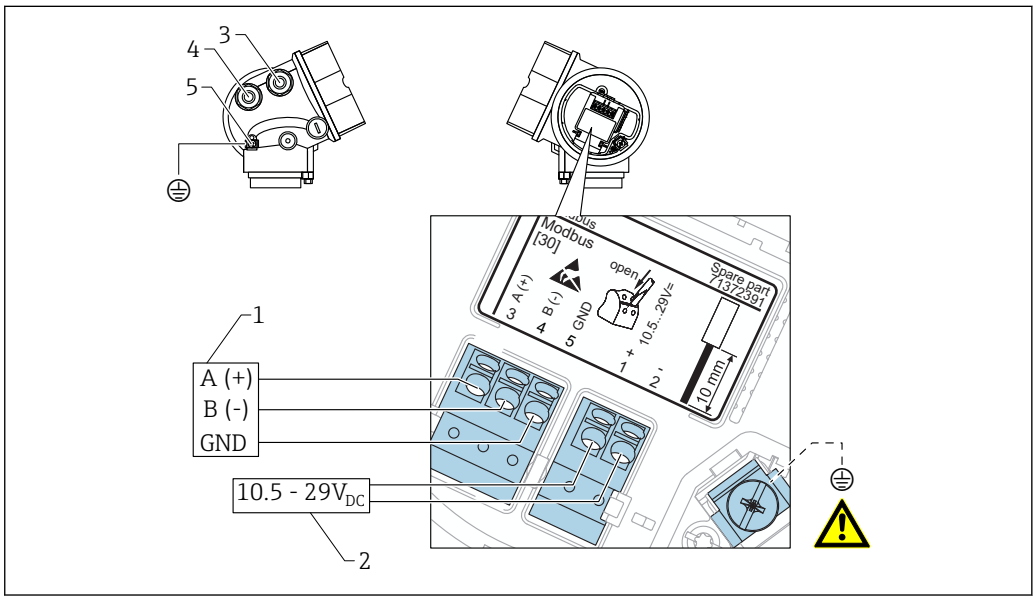
Protocol	▪ Modbus RTU ▪ Level Master
Response times	▪ Direct data access: typically 25 to 50 ms ▪ Auto-scan buffer (data range): typically 3 to 5 ms
Device type	Slave
Slave address range	1 to 63
Function codes	▪ 03: Read holding register ▪ 04: Read input register
Baud rate	Automatic baud rate detection
Parity	Automatic parity detection
Data transfer mode	RTU

Power supply

Terminal assignment

Modbus

Connection to a Modbus master



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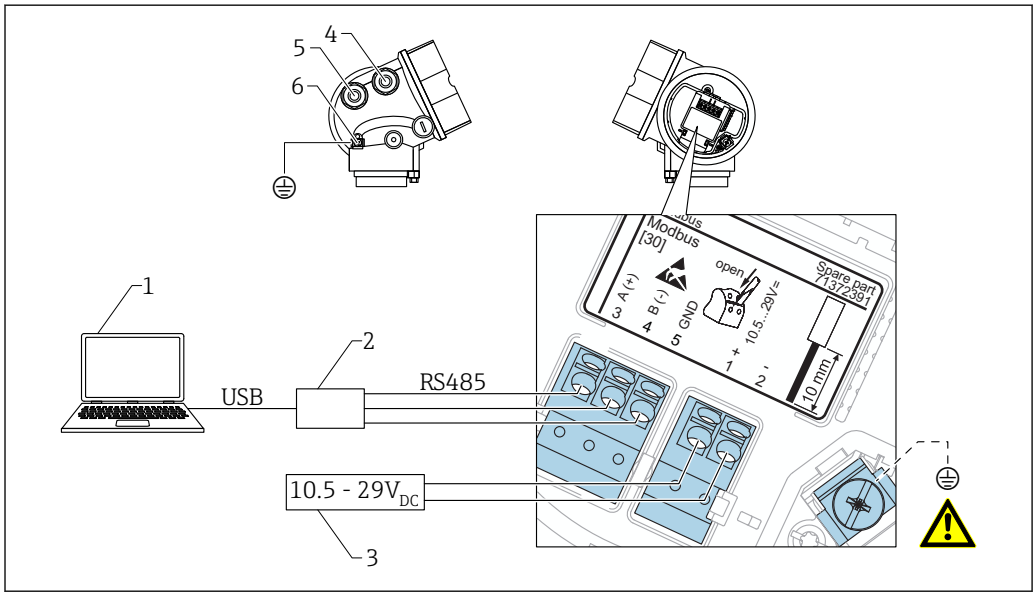
1 Modbus master
2 Power supply
3 Cable entry for Modbus connection
4 Cable entry for supply voltage
5 Protective earth connection

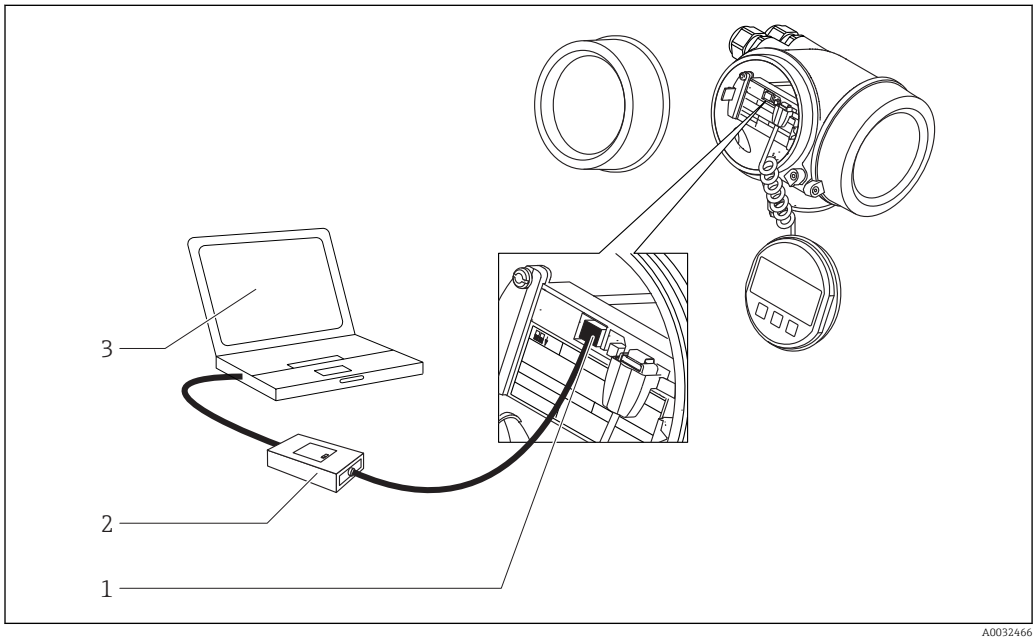
Connection to FieldCare/DeviceCare via RS485

To configure the device via FieldCare or DeviceCare, it is recommended to disconnect it from the Modbus master and to connect it to the computer via a USB to RS485 interface.



1 *Computer with FieldCare/DeviceCare*
2 *USB to RS485 interface*
3 *Power supply*
4 *Cable entry for RS485 connection*
5 *Cable entry for supply voltage*
6 *Protective earth connection*

Connection to DeviceCare/FieldCare via service interface



1 *Service interface (CDI) of the measuring device (= Endress+Hauser Common Data Interface)*
2 *Commubox FXA291*
3 *Computer with DeviceCare/FieldCare operating tool*

Power supply

Supply voltage	10.5 to 29 V_{DC}
Ripple	1 V_{SS} (< 100 Hz); 10 mV_{SS} (> 100 Hz)

Power consumption

Maximum	1000 mW
Typical	400 mW

Power supply failure

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

Potential equalization

No special measures for potential equalization are required.

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

Terminals

- **Supply voltage**
  Plug-in spring terminals for wire cross-sections 0.2 to 2.5 mm^2 (24 to 14 AWG)
- **Modbus**
  Plug-in spring terminals for wire cross-sections 0.2 to 1.5 mm^2 (24 to 16 AWG)

Cable entries

Connection of power supply and signal line

To be selected in feature 050 "Electrical connection"
- Gland M20; Material dependent on the approval:
  - For Non-Ex, ATEX, IECEx, NEPSI Ex ia/ic:
    Plastics M20x1.5 for cable Ø5 to 10 mm (0.2 to 0.39 in)
  - For Dust-Ex, FM IS, CSA IS, CSA GP, Ex nA:
  - For Ex d:
    No gland available
- Thread
  - ½" NPT
  - G ½"
  - M20 × 1.5
- Plug M12 / Plug 7/8"
  Only available for Non-Ex, Ex ic, Ex ia

Connection of remote display FHX50

Dependent on feature 030: "Display, Operation":
- "Prepared for display FHX50 + M12 connection":
  M12 socket
- "Prepared for display FHX50 + custom connection":
  M16 cable gland

Cable specification

- Power line: Standard device cable
- Modbus connection : A shielded cable is recommended. Observe grounding concept of the plant.

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), an overvoltage protection module has to be installed.

External overvoltage protection module

HAW562 or HAW569 from Endress+Hauser are suited as external overvoltage protection.

Performance characteristics

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)
- For interface measurement:
  - Coax probe
  - DC of the lower medium = 80 (water)
  - DC of the upper medium = 2 (oil)

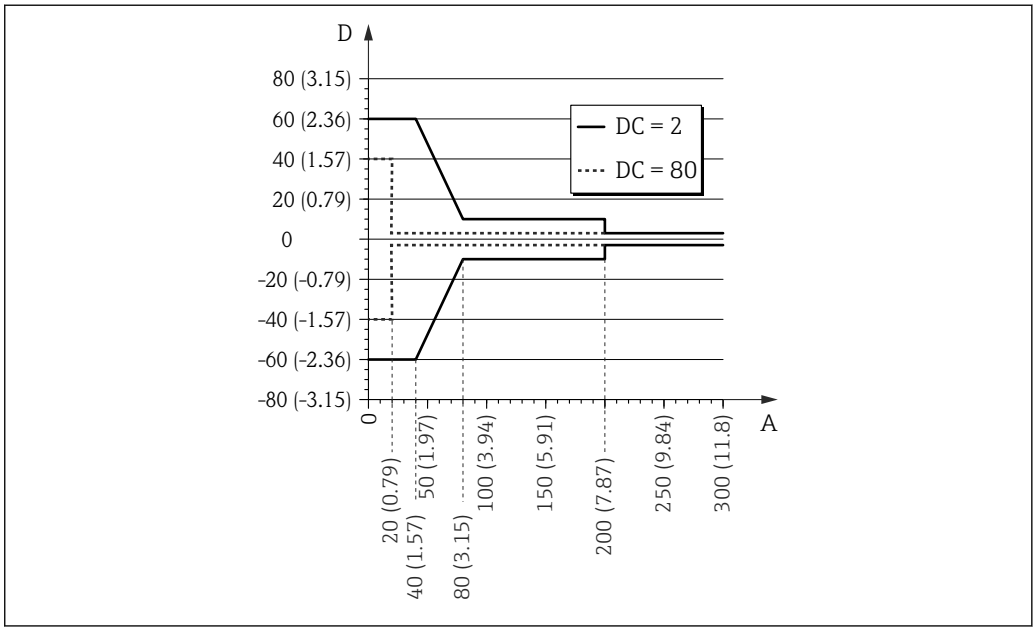
Reference accuracy

Typical data under reference operating conditions: DIN EN IEC 61298-2 / DIN EN IEC 60770-1, percentage values in relation to the span.

Output:	**digital**	**analog** [1]
Accuracy (Sum of non-linearity, nonrepeatability and hysteresis) [2]	**Level measurement:** ▪ Measuring distance up to 15 m (49 ft): ±2 mm (±0.08 in) [3] ▪ Measuring distance > 15 m (49 ft): ±10 mm (±0.39 in)	±0.02 %
	Interface measurement: ▪ Measuring distance up to 500 mm (19.7 in): ±20 mm (±0.79 in) ▪ Measuring distance > 500 mm (19.7 in): ±10 mm (±0.39 in) ▪ If the thickness of the upper medium is < 100 mm (3.94 in): ±40 mm (±1.57 in)	
Non-repeatability [4]	≤ 1 mm (0.04 in)	

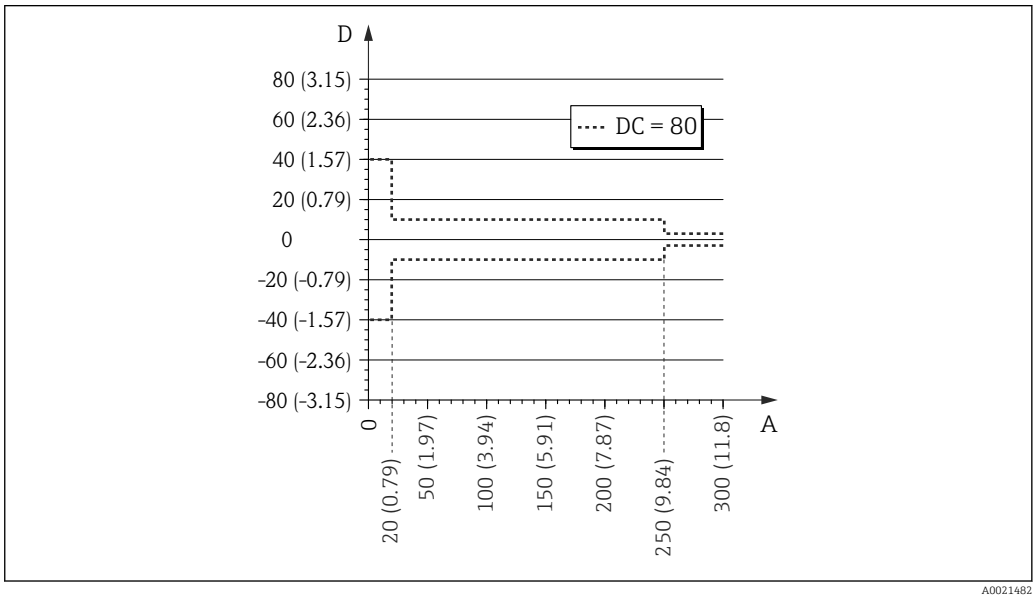
1) Add error of the analogous value to the digital value.
2) If the reference conditions are not met, the offset/zero point arising from the mounting conditions may be up to ±16 mm (±0.63 in). This additional offset/zero point can be compensated for by entering a correction (parameter "level correction") during commissioning.
3) For probes with centering stars, the accuracy may deviate close to the centering stars.
4) The non-repeatability is already considered in the accuracy.

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



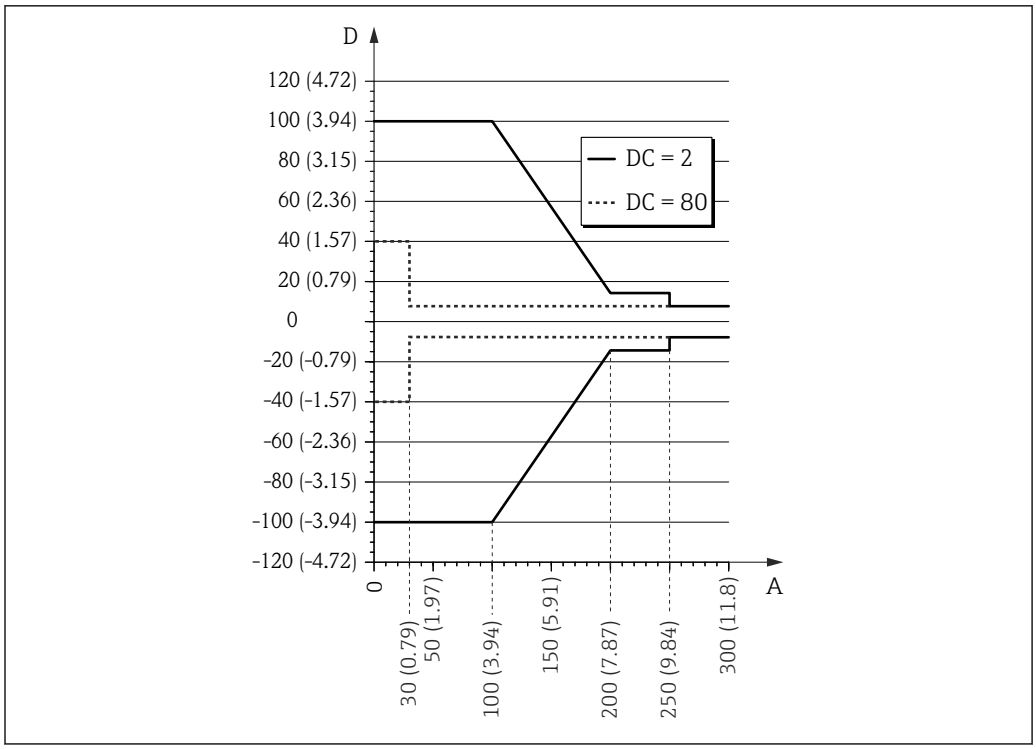
4 Measuring error at the end-of-probe for rod and coax probes

A Distance from probe end [mm(in)]
D Measuring error: Sum of non-linearity, non-repeatability and hysteresis



5 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

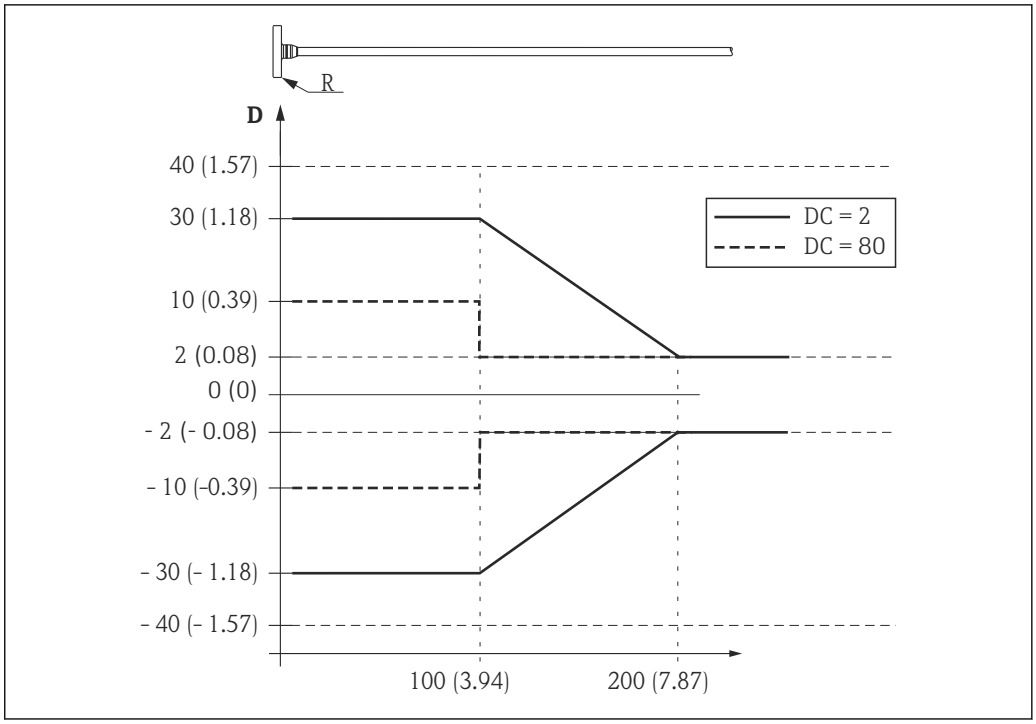


6 Measuring error at the end-of-probe for probes with metallic centering disk (product structure: feature 610 "Accessory mounted", option OA, OB or OC)

A Distance from probe end [mm(in)]
D Measuring error: Sum of non-linearity, non-repeatability and hysteresis

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):



7 *Measuring error at the upper end of the probe; dimensions: mm (in)*

D Sum of non-linearity, non-repeatability and hysteresis
R Reference point of measurement
DC Dielectric constant

Resolution

- digital: 1 mm
- analog: 1 µA

Reaction time

The reaction time can be parametrized. The following step response times (as per DIN EN IEC 61298-2 / DIN EN IEC 60770-1) [3] 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)	≥ 2.7 measurements/second	< 1 s

Interface measurement		
Probe length	**Sampling rate**	**Step response time**
< 10 m (33 ft)	≥ 1.1 measurements/second	< 2.2 s

Influence of ambient temperature

The measurements are carried out in accordance with DIN EN IEC 61298-3 / DIN EN IEC 60770-1

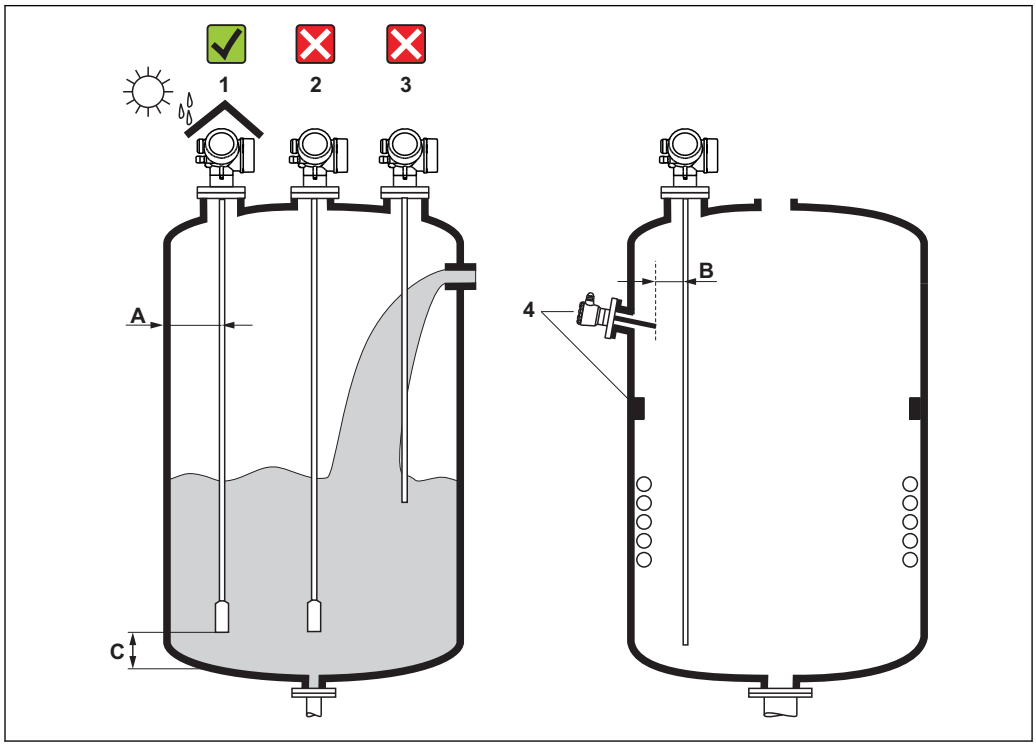
- digital (HART, PROFIBUS PA, FOUNDATION Fieldbus): average T_K = 0.6 mm/10 K
  For devices with remote sensor [4] there is an additional offset of ±0.3 mm/10K (±0.01 in/10K) per 1 m (3.3 ft) of the remote cable.
- analog (current output):
  - zero point (4 mA): average T_K = 0.02 %/10 K
  - span (20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

3) According to DIN EN IEC 61298-2 / DIN EN IEC 60770-1 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.
4) Product structure: Feature 600, options MB, MC or MD)

Mounting

Mounting requirements

Suitable mounting position



8 *Montagebedingungen für Levelflex*

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)
- When using more than one Levelflex:
  Minimum distance between the sensor axes: 100 mm (3.94 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)

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 suppresion(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.

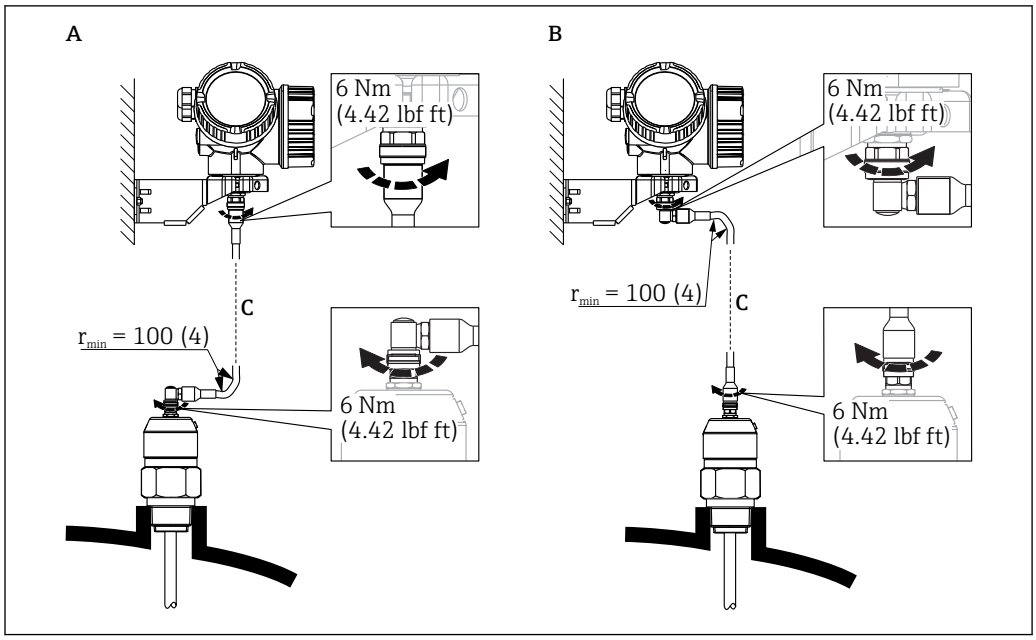
With suspended rope probes (probe end not fixed at the bottom) the distance between the probe rope and internal fittings in the tank must not fall below 300 mm (12") during the entire process. A sporadic contact between the probe weight and the cone of the vessel, however, does not influence the measurement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

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

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.

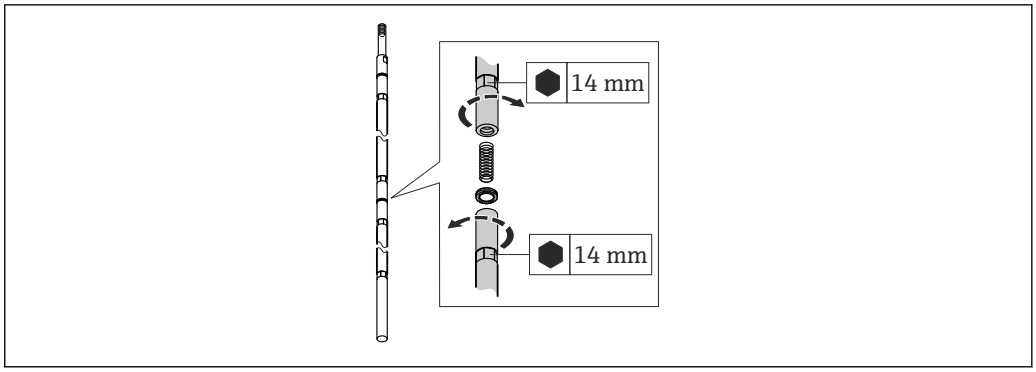


A Angled plug at the probe
B Angled plug at the electronics housing
C Length of the remote cable as ordered

- Product structure, feature 600 "Probe Design":
  - Option MB "Sensor remote, 3m/9ft cable"
  - Option MC "Sensor remote, 6m/18ft cable"
  - Option MB "Sensor remote, 9m/27ft cable"
- The remote cable is supplied with these device versions
  Minimum bending radius: 100 mm (4 inch)
- 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 inch)
- 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.

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



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If there is little mounting space (distance to the ceiling), it is advisable to use divisible rod probes (ϕ 16 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)
  - 1 000 mm (40 in)
- torque: 15 Nm

Notes on the mechanical load of the probe

Tensile load limit of rope probes

Sensor	Feature 060	Probe	Tensile load limit [kN]
FMP51	LA, LB MB, MD	Rope 4mm (1/6") 316	5

Bending strength of rod probes

Sensor	Feature 060	Probe	Bending strength [Nm]
FMP51	AA, AB	Rod 8mm (1/3") 316L	10
	AC, AD	Rod 12mm (1/2") 316L	30
	AL, AM	Rod 12mm (1/2") AlloyC	30
	BA, BB, BC, BD	Rod 16mm (0.63") 316L divisible	30

Bending load (torque) through fluid flow

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

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

with:

c_w: Friction factor

ρ [kg/m³]: Density of the medium

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

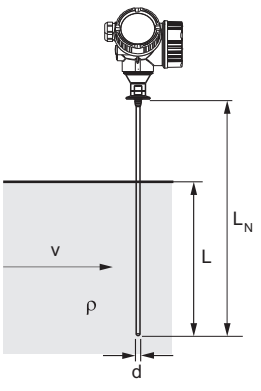
d [m]: Diameter of the probe rod

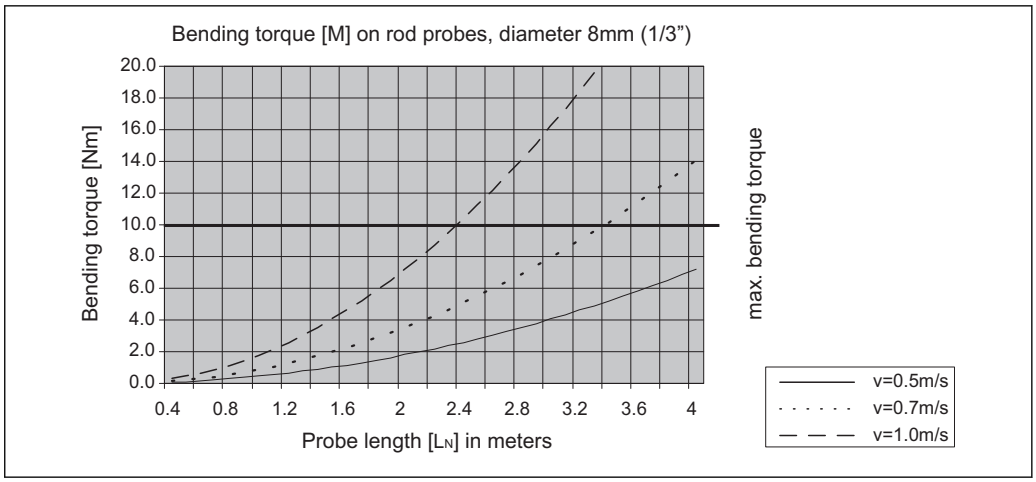
L [m]: Level

LN [m]: Probe length

Calculation example

Friction factor c_w	0,9 (on the assumption of a turbulent current - high Reynolds number)
Density ρ [kg/m³]	1000 (e.g. water)
Probe diameter d [m]	0,008
$L = L_N$	(worst case)





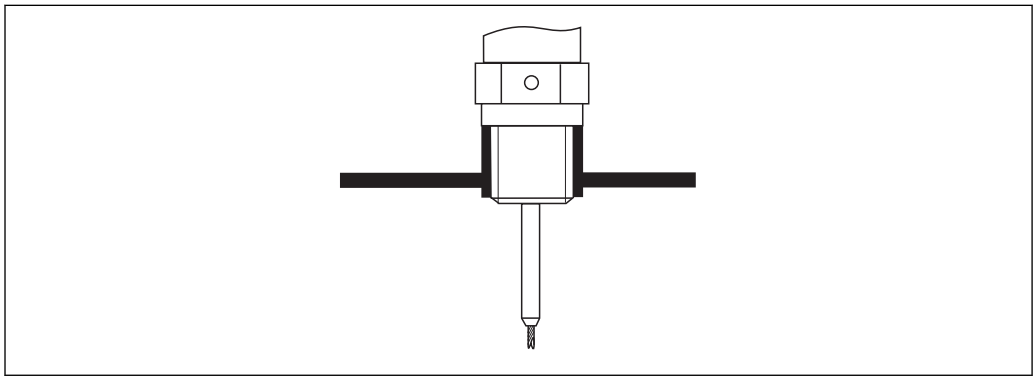
Bending strength of coax probes

Sensor	Feature 060	Process connection	Probe	Bending strength [Nm]
FMP51	UA, UB	Thread G¾ oder NPT¾	Coax 316L, Ø 21,3 mm	60
		▪ Thread G1½ or NPT1½ ▪ Flange	Coax 316L, Ø 42,4 mm	300
	UC, UD	Flange	Coax AlloyC, Ø 42,4 mm	300

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 → 📄 34.

Threaded connection



9 *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.

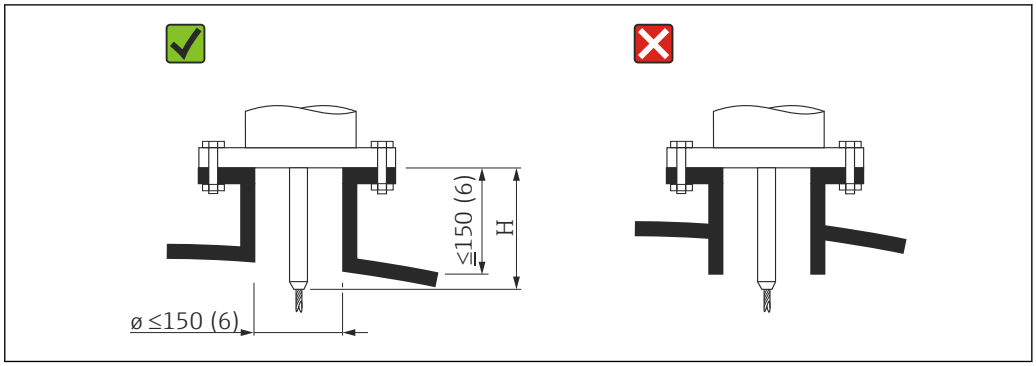
They can be sealed with the following types of sealing rings:

- Thread G3/4": According to DIN 7603 with the dimensions 27 x 32 mm
- 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.

For the length of the screwed plug refer to the dimensional drawing:
FMP51: → 📄 53

Nozzle mounting



H Length of the center rod or the rigid part of the rope probe

- Permissible nozzle diameter: ≤ 150 mm (6 in).
  For larger diameters the near range measuring capability may be reduced.
  For nozzles ≥ DN300: → 33.
- Permissible nozzle height [5]: ≤ 150 mm (6 in).
  For a larger height the near range measuring capability may be reduced.
  Larger nozzle heights may be possible in special cases (see sections "Center rod").
- The end of the nozzle should be flush with the tank ceiling in order to avoid ringing effects.

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

5) Larger nozzle heights on request

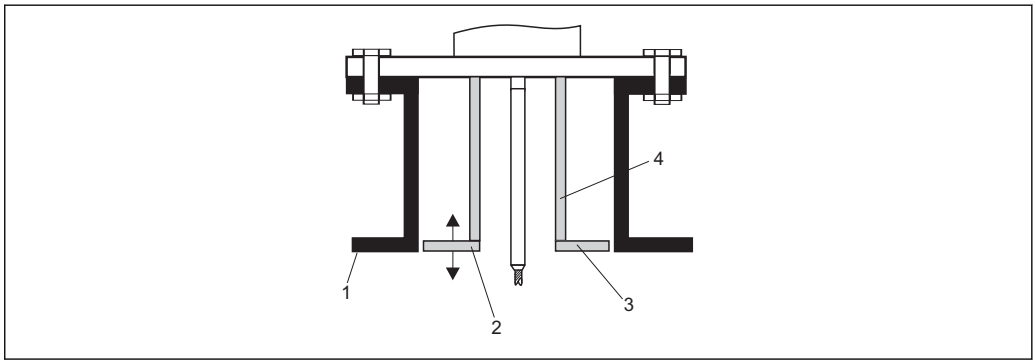
Center rod

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.

Probe	Max. nozzle height (= length of the center rod)	Option to be selected in feature 060 ("Probe")
FMP51	150 mm	LA
	6 inch	LB
	300 mm	MB
	12 inch	MD

Installation in nozzles ≥ DN300

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



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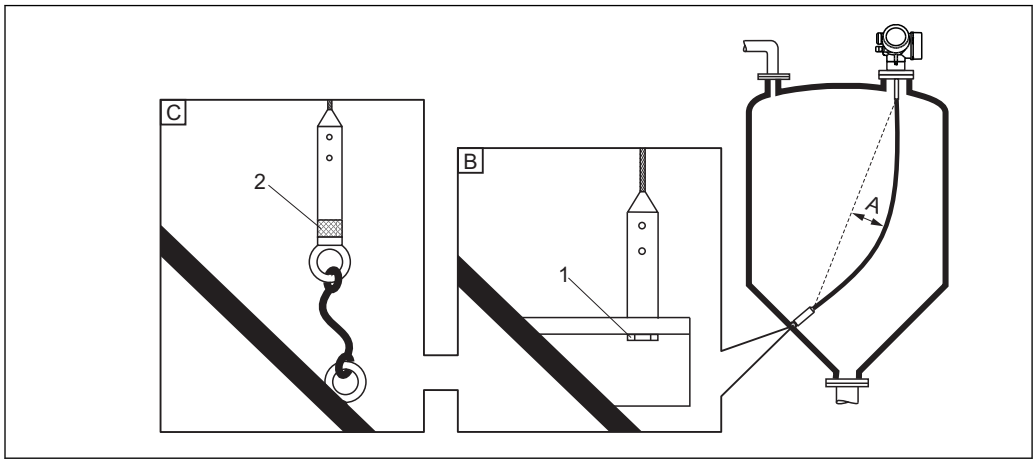
1 Lower edge of the nozzle
2 Approx. flush with the lower edge of the nozzle (± 50 mm/2")
3 Plate
4 Pipe Φ 150 to 180 mm (6 to 7 inch)

Nozzle diameter	Plate diameter
300 mm (12")	280 mm (11")
≥ 400 mm (16")	≥ 350 mm (14")

Securing the probe

Securing rope probes

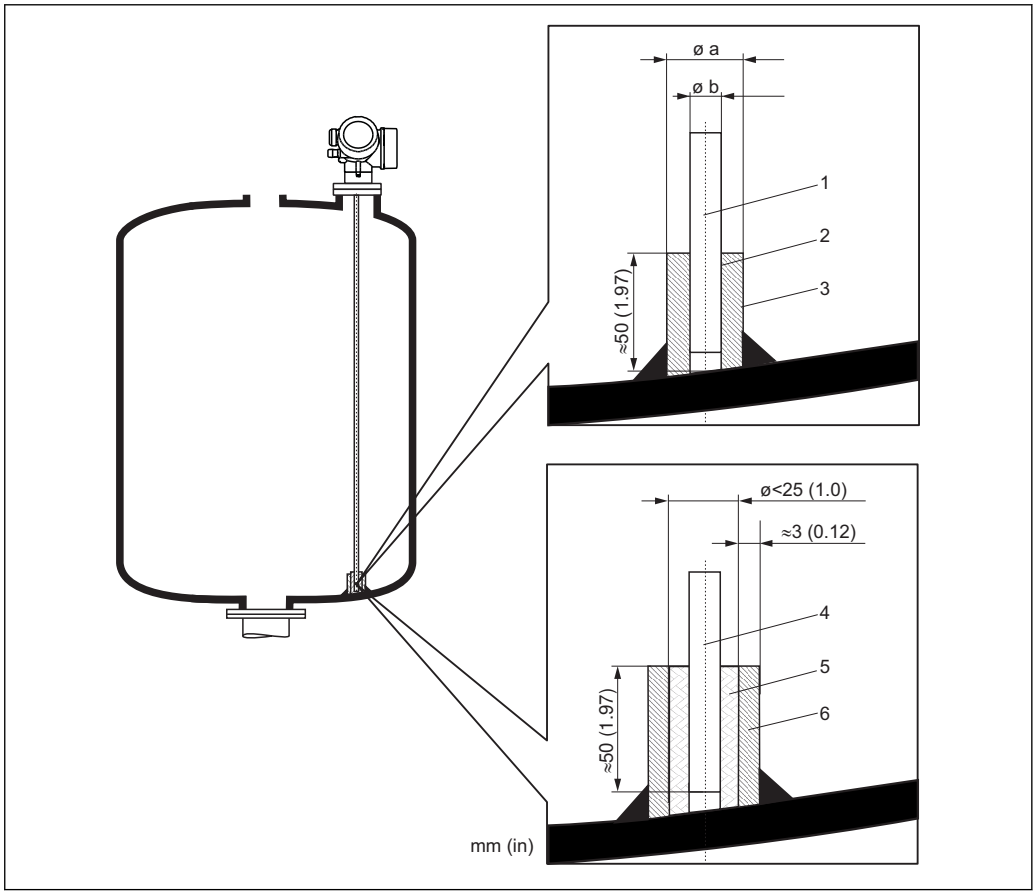


A Sag of the rope: ≥ 1 cm per 1m of the probe length (0.12 inch per 1 ft of the probe length)
B Reliably grounded end of probe
C Reliably isolated end of probe
1: Mounting and contact with a bolt
2 Mounting kit isolated

- 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"), 316: M 14
- 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 ≥ 1cm/(1 m rope length) [0.12 inch/(1 ft rope length)].
  Tensile load limit of rope probes: → 🖹 28

Securing rod probes

- For WHG 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.



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*

Φ probe	Φ a [mm (inch)]	Φ b [mm (inch)]
8 mm (1/3")	< 14 (0.55)	8.5 (0.34)
12 mm (1/2")	< 20 (0.78)	12.5 (0.52)
16 mm (0.63in)	< 26 (1.02)	16.5 (0.65)

NOTICE

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

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

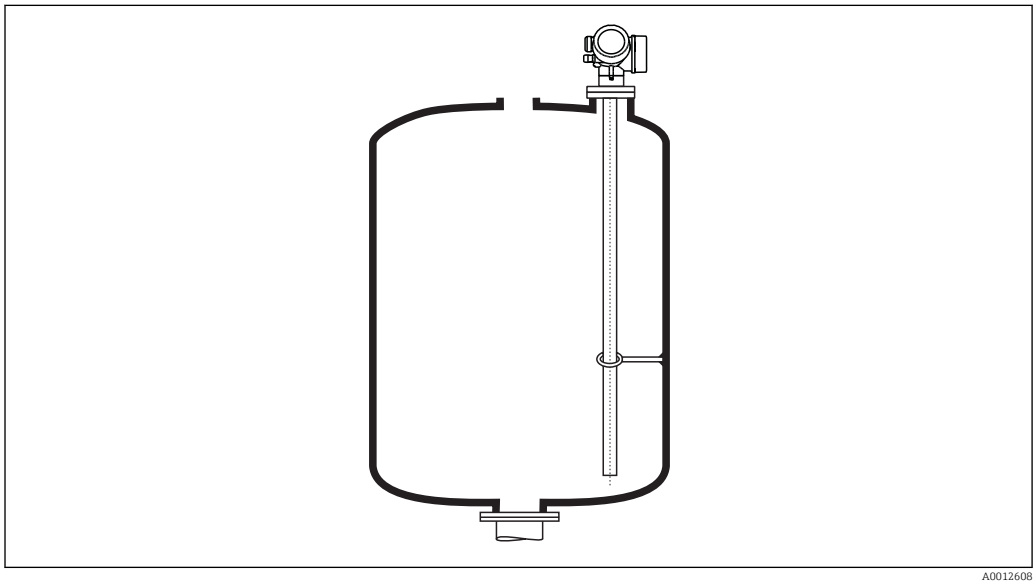
NOTICE

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.



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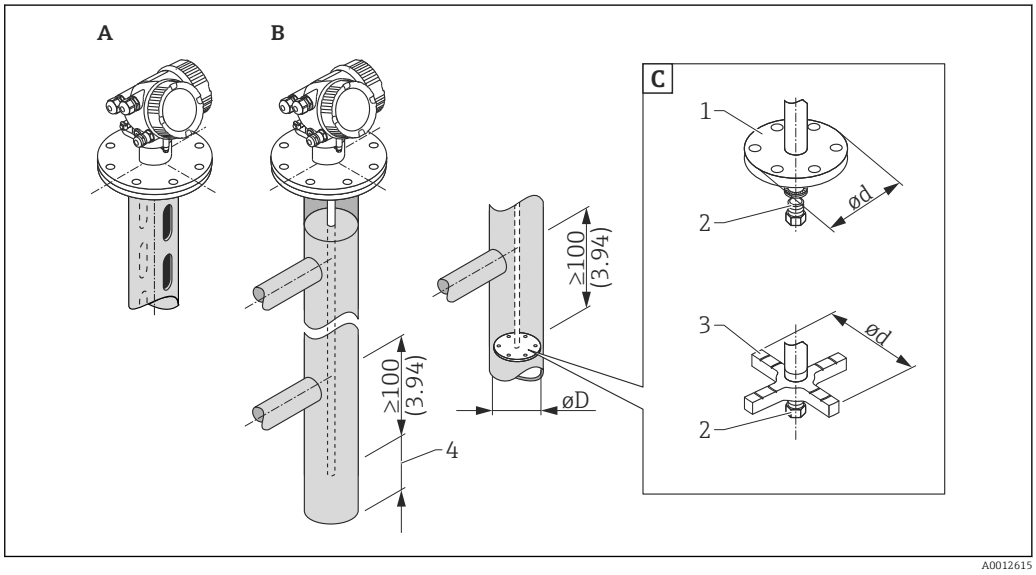
Coax probes can be supported at any point of the outer tube.

Special mounting conditions

Bypasses and stilling wells

In bypass and stilling well applications it is recommended to use a centering disks or stars.



10 *Dimensions: mm (in)*

A Mounting in a stilling well
B Mounting in a bypass
C Center washer or centering star
1 Metallic center washer (316L) for level measurement
2 Fixing screw; torque: 25 Nm ± 5 Nm
3 Non-metallic centering star (PEEK, PFA) for interface measurement
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

Feature 610 - Accessory mounted					
Application	**Option**	**Type of probe**	**Center washer Centering star**		**Pipe**
			Φ d [mm (in)]	**Material**	**Φ D [mm (in)]**
Level measurement	OA	Rod probe	75 (2,95)	316L	DN80/3" to DN100/4"
	OB	Rod probe	45 (1,77)	316L	DN50/2" to DN65/2½"
	OC	Rope probe	75 (2,95)	316L	DN80/3" to DN100/4"
Level or interface measurement	OD	Rod probe	48...95 (1,89...3,74)	PEEK [1]	≥ 50 mm (2")
	OE	Rod probe	37 (1,46)	PFA [2]	≥ 40 mm (1.57")

1) Operation temperature: −60 to +250 °C (−76 to 482 °F)
2) Operation temperature: −200 to +250 °C (−328 to +482 °F)

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

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

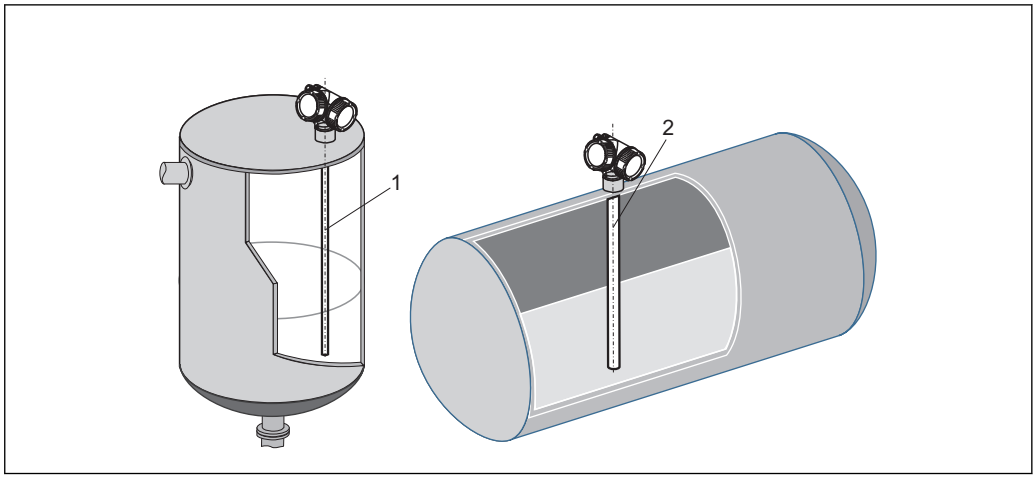
- Pipe diameter: > 40 mm (1.6") for rod probes
- Rod probe installation can take place up to a diameter size of 150 mm (6 in). In the event of larger diameters, a coax probe is recommended.
- Side disposals, holes or slits and welded joints that protrude up to approx. 5 mm (0.2") inwards do not influence the measurement.
- The pipe may not exhibit any steps in diameter.
- The probe must be 100 mm longer than the lower disposal.
- Within the measuring range, the probe must not get into contact with the pipe wall. If necessary, secure the probe by retaining or tensioning. All rope probes are prepared for tensioning in containers (tensioning weight with anchor hole).
- If a metallic center washer is mounted at the end of the probe, it enables a reliable recognition of the end-of-probe signal (see feature 610 of the product structure).
  Note: For interface measurements only use the nonmetallic centering star made of PEEK or PFA (feature 610, options OD or OE).
- Coax probes can always be applied if there is enough mounting space.

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 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.

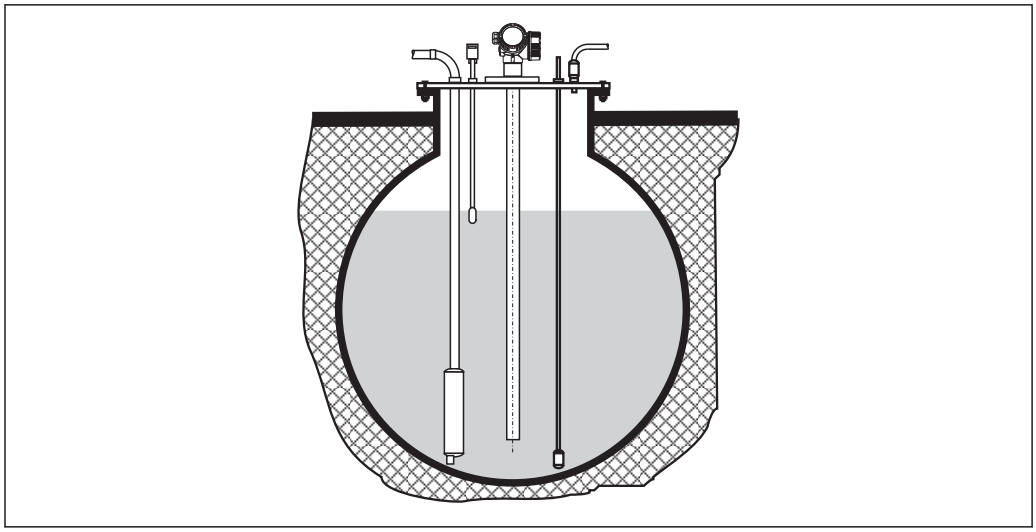
With heat insulated tanks the bypass should also be insulated in order to prevent condensate formation.

Installation in horizontal and upright cylindrical tanks



- 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.

Underground tanks



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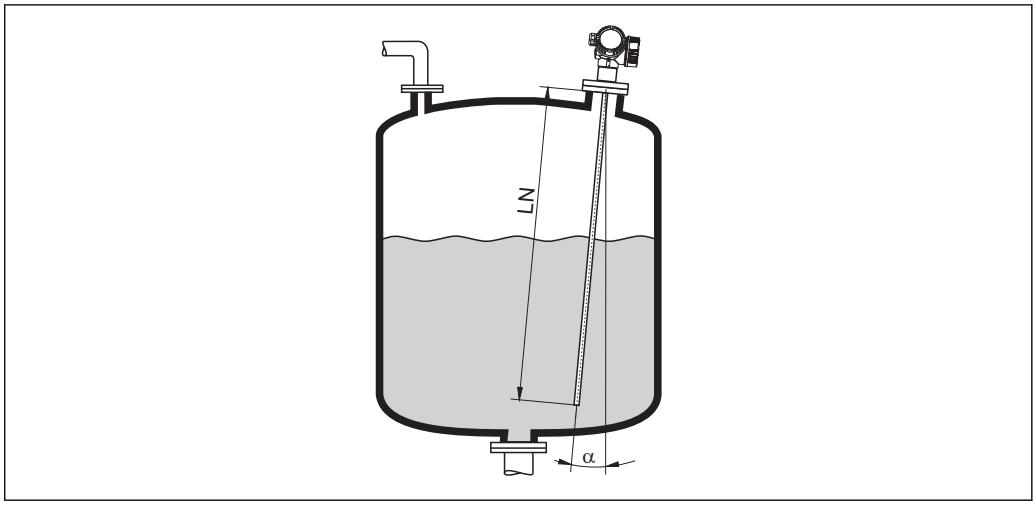
Use a coax probe for nozzles with large diameters in order to avoid reflections at the nozzle wall.

Installation at an angle



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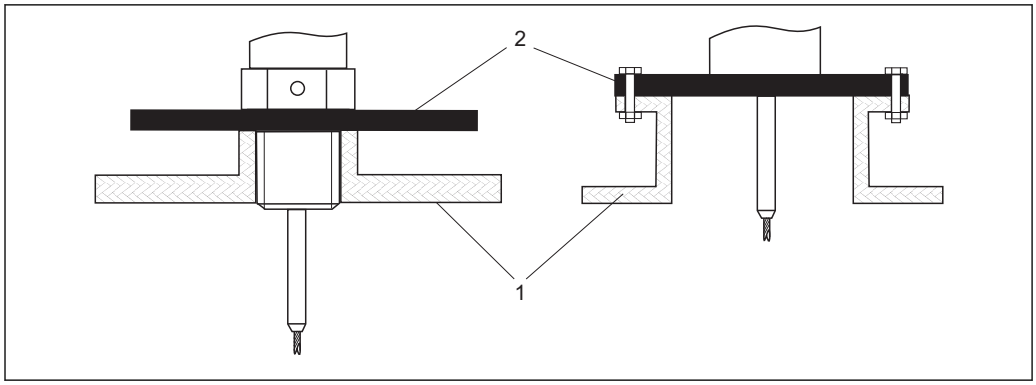
- For mechanical reasons, the probe should be installed as vertically as possible.
- With inclined installations the probe length has to be adjusted in dependence to the installation angle.
  - Up to LN = 1 m (3.3 ft): α = 30°
  - Up to LN = 2 m (6.6 ft): α = 10°
  - Up to LN = 4 m (13.1 ft): α = 5°

Non-metallic vessels

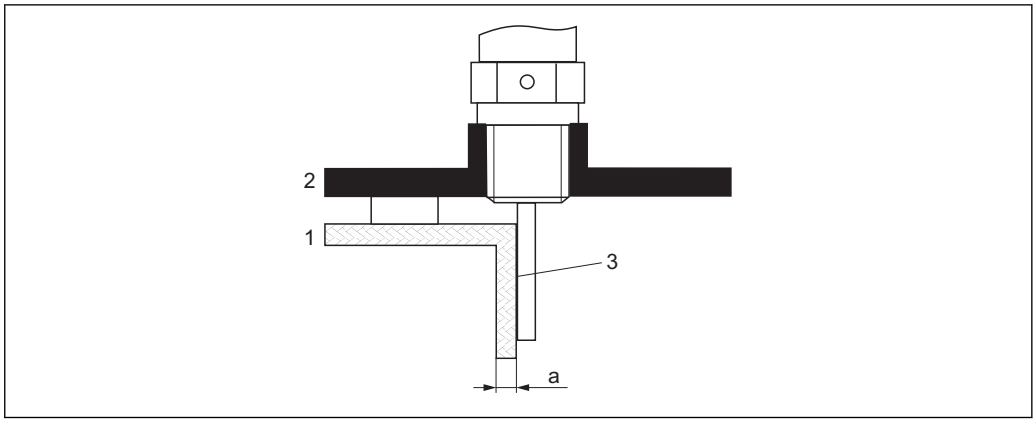


1 Non-metallic vessel
2 Metal sheet or metal flange

To ensure reliable measurements in non-metallic vessels:
- Select an instrument version with metal flange (minimum size DN50/2").
- 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.

A metallic surface is not required for coax probes.

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



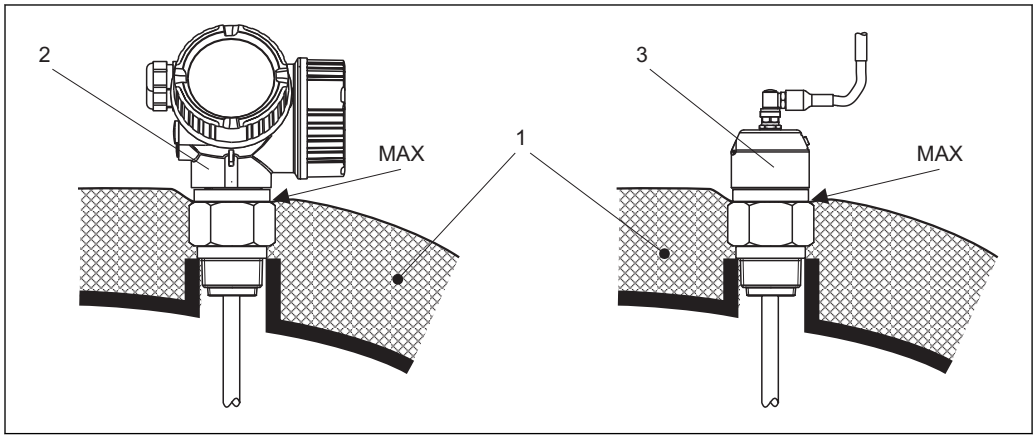
1 Plastic or glass tank
2 Metall sheet with threaded sleeve
3 No free space between tank wall and probe!

Requirements
- The dielectric constant of the medium must be at least DC > 7.
- The tank wall must be non-conductvie.
- Maximum wall thickness (a):
  - Plastic: < 15 mm (0.6")
  - Glass: < 10 mm (0.4")
- 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"), 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"):
  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"):
  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).

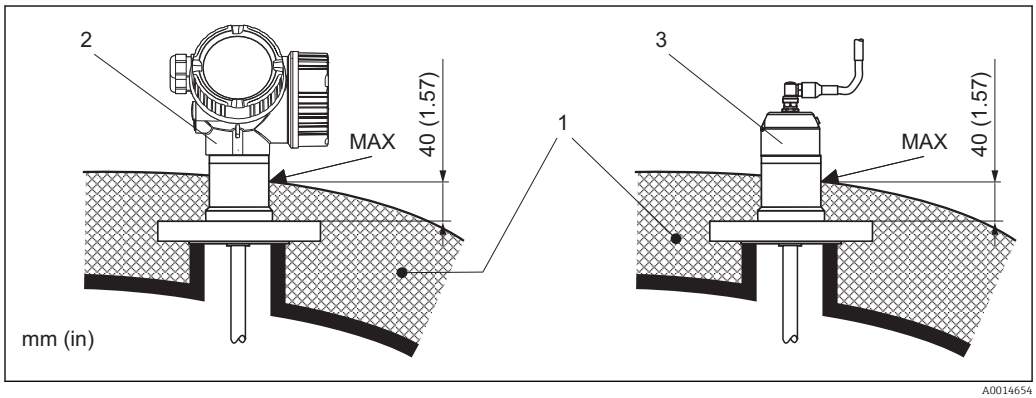
Vessels with heat insulation

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.



11 *Process connection with thread - FMP51*

1 *Tank insulation*
2 *Compact device*
3 *Sensor remote (feature 600)*



12 *Process connection with flange - FMP51*

1 *Tank insulation*
2 *Compact device*
3 *Sensor remote (feature 600)*

Operating conditions: Environment

Ambient temperature range

Measuring device	−40 to +80 °C (−40 to +176 °F)
Local display	−20 to +70 °C (−4 to +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)
Remote display FHX50	−40 to 80 °C (−40 to 176 °F)

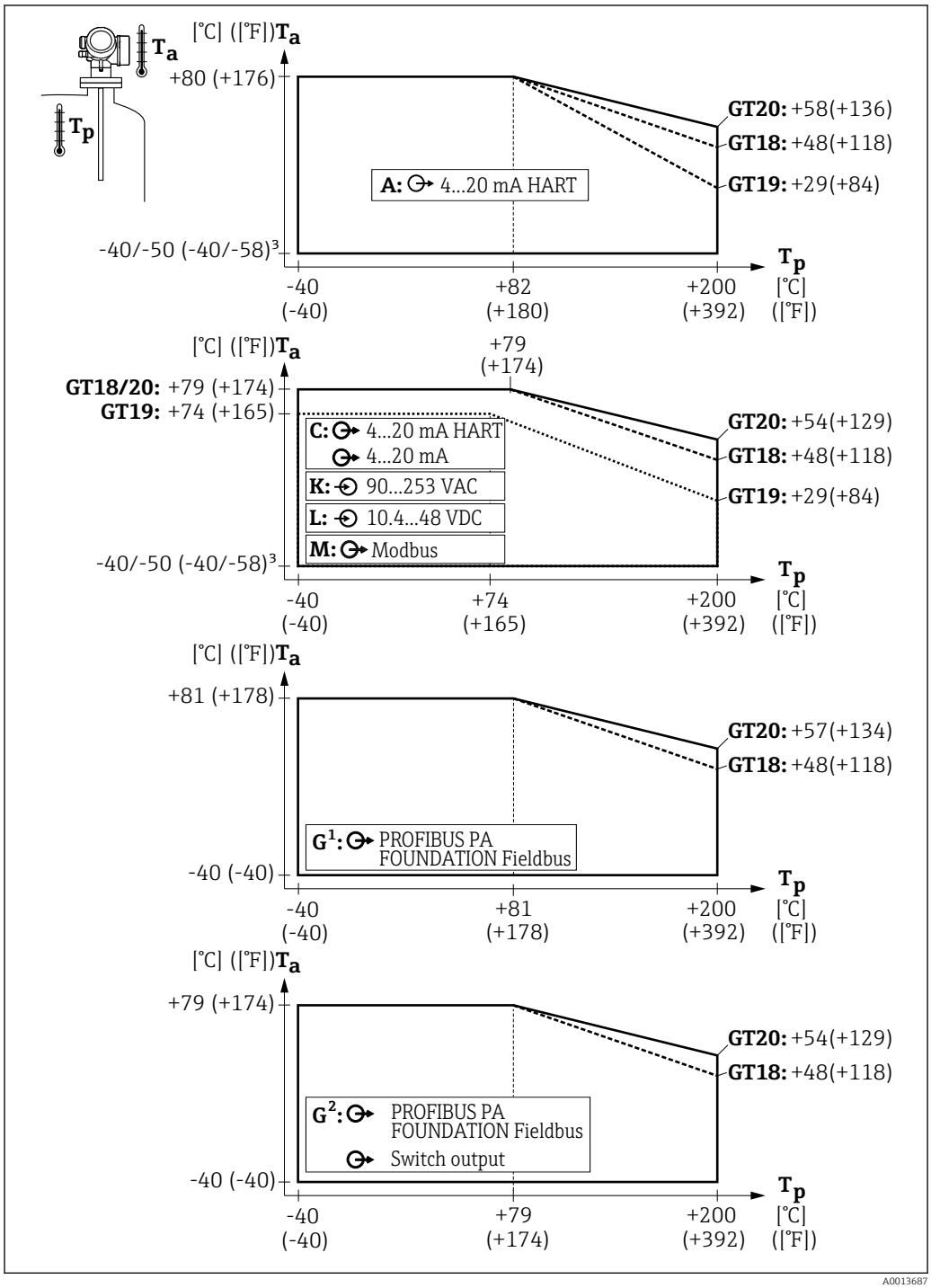
When operating the device in the open with strong sunlight:
- Mount the device in a shady position.
- Avoid direct sunlight, especially in warmer regions.
- Use a weather protection cover (see accessories).

Ambient temperature limits

The following diagrams take into account only function requirements. There may be further restrictions for certified device versions. Please refere to the separate Safety Instructions.

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 for FMP51 with threaded connection G¾ or NPT¾



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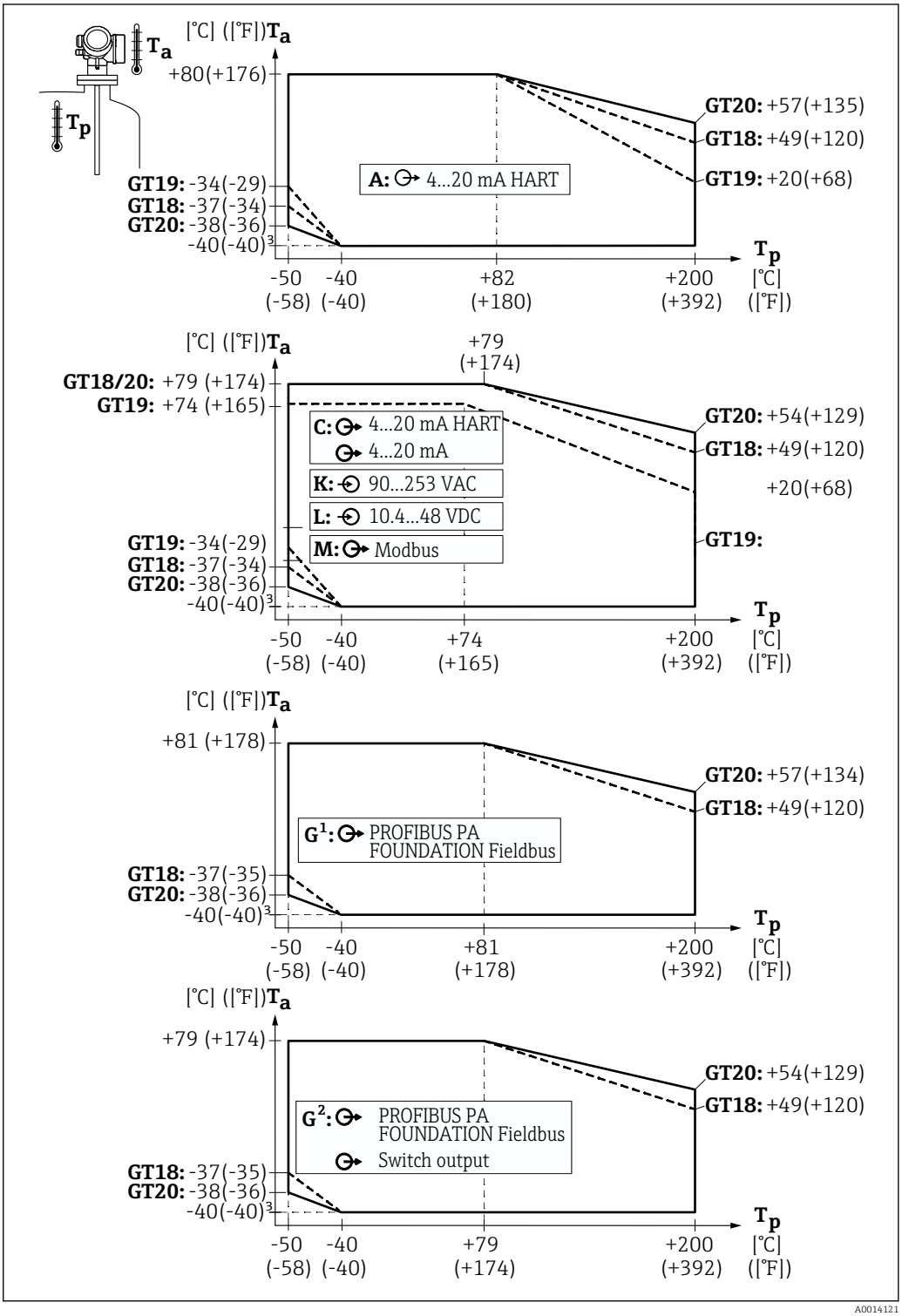
GT18 = stainless steel housing
GT19 = plastic housing
GT20 = aluminum housing

A = 1 current output
C = 2 current outputs
G1, G2 = PROFIBUS PA [1) 2)]
K, L = 4-wire

T_a = ambient temperature
T_p = temperature at the process connection

1) G1: switch output not used
2) G2: Switch output used

Temperature derating for FMP51 with threaded connection G1½ or NPT1½



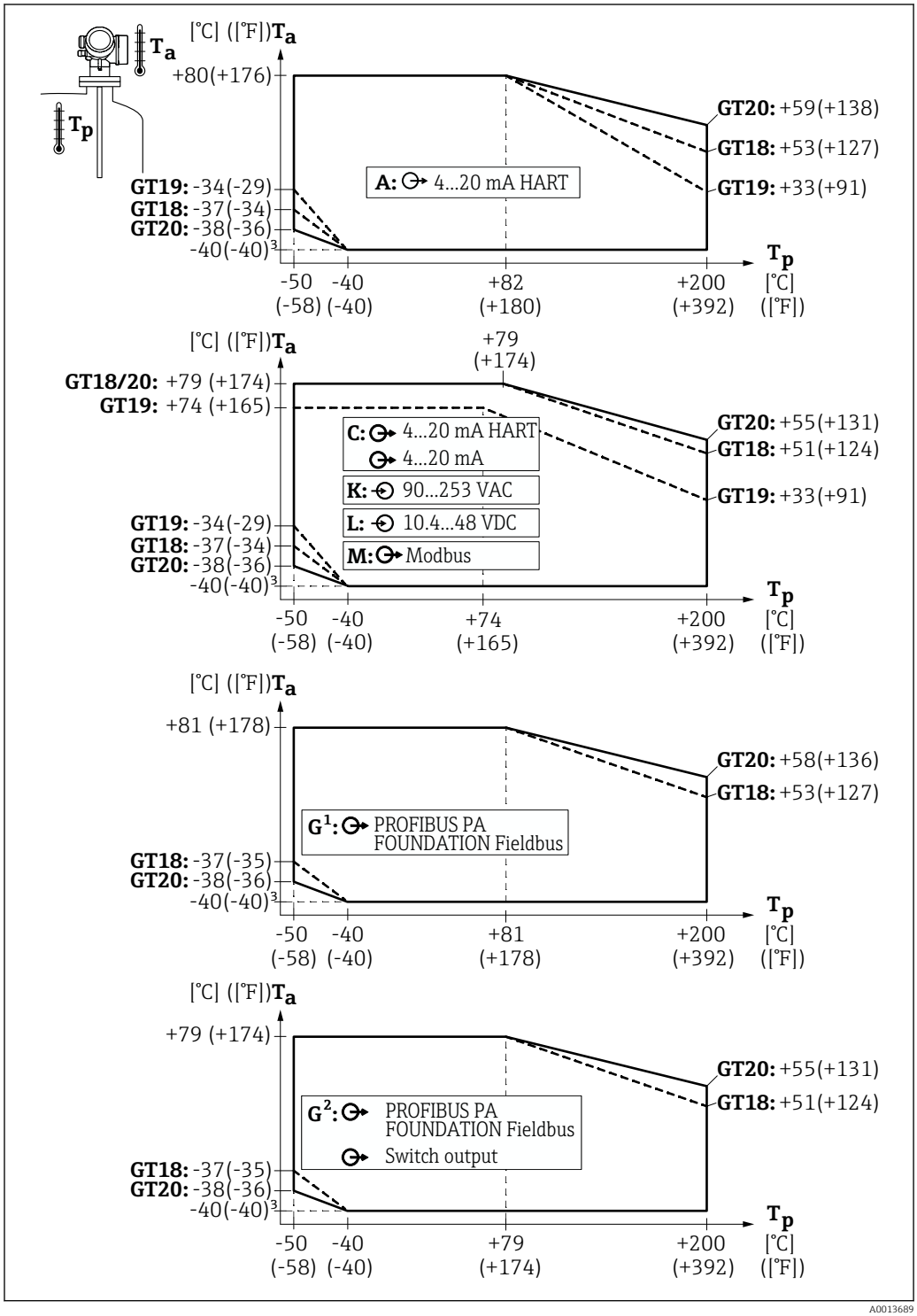
GT18 = stainless steel housing
GT19 = plastic housing
GT20 = aluminum housing

A = 1 current output
C = 2 current outputs
G^1, G^2 = PROFIBUS PA [1) 2)]
K, L = 4-wire

T_a = ambient temperature
T_p = temperature at the process connection

1) G^1: switch output not used
2) G^2: Switch output used

Temperature derating for FMP51 with flange



GT18 = stainless steel housing
GT19 = plastic housing
GT20 = aluminum housing

A = 1 current output
C = 2 current outputs
G^1, G^2 = PROFIBUS PA [1) 2)]
K, L = 4-wire

T_a = ambient temperature
T_p = temperature at the process connection

1) G^1: switch output not used
2) G^2: Switch output used

Storage temperature	−40 to +80 °C (−40 to +176 °F) Option for FMP51 and FMP54: −50 to +80 °C (−58 to +176 °F) [6]
Climate class	DIN EN 60068-2-38 (test Z/AD)
Altitude according to IEC61010-1 Ed.3	▪ Generally up to 2 000 m (6 600 ft) above MSL. ▪ Above 2 000 m (6 600 ft) if the following conditions are met: – Ordering feature 020 "Power supply; Output" = A, B, C, E or G (2-wire versions) – Supply voltage U < 35 V – Supply voltage of overvoltage category 1
Degree of protection	▪ With closed housing tested according to: – IP68, NEMA6P (24 h at 1.83 m under water surface) [7] – For plastic housing with transparent cover (display module): IP68 (24 h at 1.00 m under water surface) [8] – IP66, NEMA4X ▪ With open housing: IP20, NEMA1 ▪ Display module: IP22, NEMA2 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.
Vibration resistance	DIN EN 60068-2-64 / IEC 60068-2-64: 20 to 2 000 Hz, 1 $(m/s^2)^2/Hz$
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.
Electromagnetic compatibility (EMC)	Electromagnetic compatibility to all relevant requirements of the EN 61326- series and NAMUR recommendation EMC (NE21). For details see declaration of conformity. If only the analogue signal is used, unshielded interconnection lines are sufficient for the installation. In case of using the digital signal (HART/ PA/ FF) use shielded interconnection lines. Use a shielded cable when working with a digital communications signal. 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.

6) This range is valid if option JN "Ambient temperature transmitter −50 °C (−58 °F)" has been selected in ordering features 580 "Test, Certificate". If the temperature is permanently below −40 °C (−40 °F), failure rates may be increased.
7) also valid for the "Sensor remote" version
8) This restriction is valid if the following options of the product structure have been selected at the same time: 030 ("Display, Operation") = C ("SD02") or E ("SD03"); 040 ("Housing") = A ("GT19").

Process

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	Approval
FMP51	FKM (Viton GLT 37559)	−30 to +150 °C (−22 to +302 °F)	
		−40 to +150 °C (−40 to +302 °F) only in combination with feature 610 "Accessory Mounted" option model NC "Gas-tight feed through"	
	EPDM (70C4 pW FKN or E7515)	−40 to +120 °C (−40 to +248 °F)	
	FFKM (Kalrez 6375) [1]	−20 to +200 °C (−4 to +392 °F) [2]	
	FVMQ (FVMQ 70C79)	−50 to 130 °C (−58 to 260 °F)	

1) Recommended for steam applications
2) Not recommended for saturated steam above 150 °C (302 °F). Use FMP54 instead.

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).

Process pressure range

Device	Process pressure
FMP51	−1 to 40 bar (−14.5 to 580 psi)

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: 2007 Tab. G.4.1-x
  With regard to their temperature stability properties, the materials 1.4435 and 1.4404 are grouped under 13E0 in EN 1092-1:2007 Tab. G.3.1-1. The chemical composition of the two materials can be identical.
- ASME B 16.5a - 2013 Tab. 2-2.2 F316
- ASME B 16.5a - 2013 Tab. 2.3.8 N10276
- JIS B 2220

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)

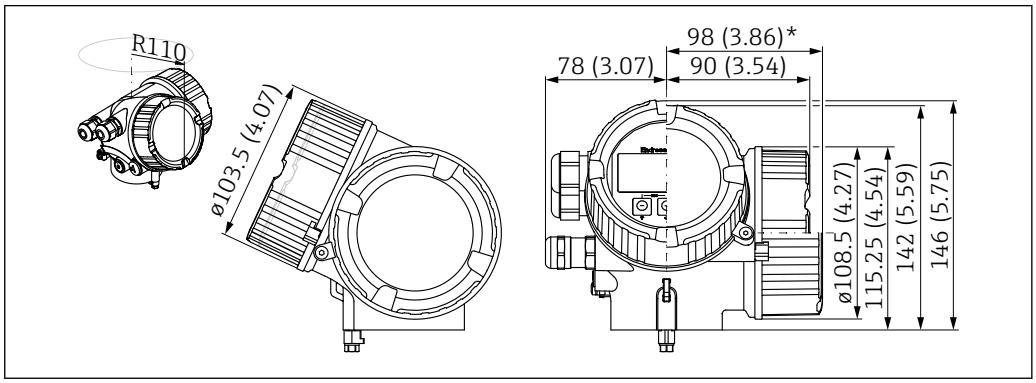
Expansion of the rope probes through temperature

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

Mechanical construction

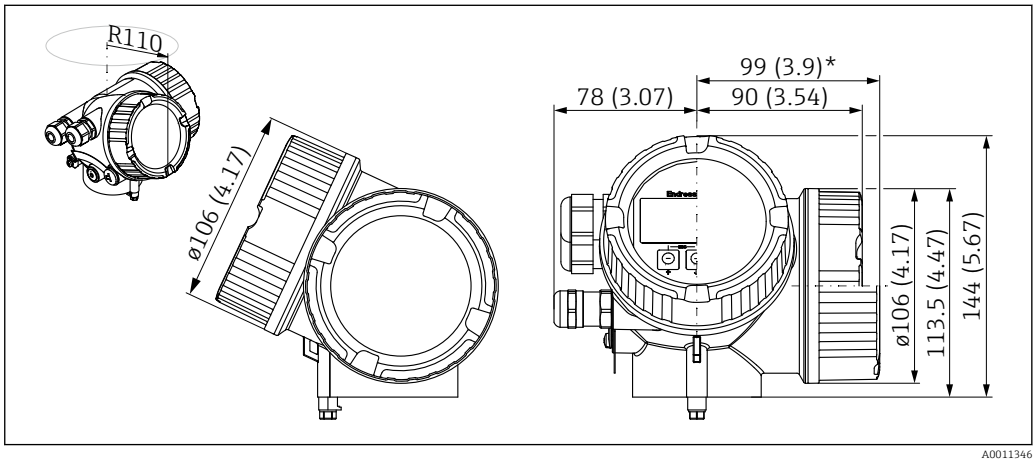
Dimensions

Dimensions of the electronics housing



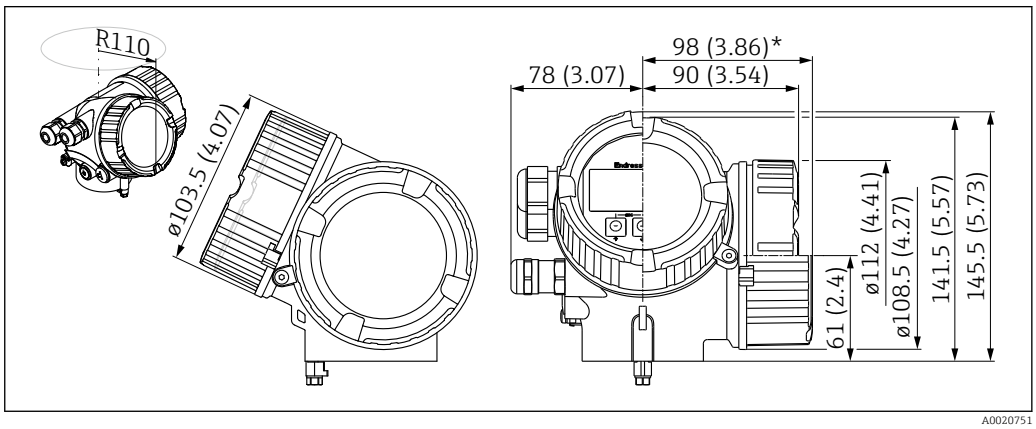
13 *Housing GT18 (316L); Dimensions in mm (in)*

**for devices with integrated overvoltage protection.*



14 *Housing GT19 (Plastics PBT); Dimensions in mm (in)*

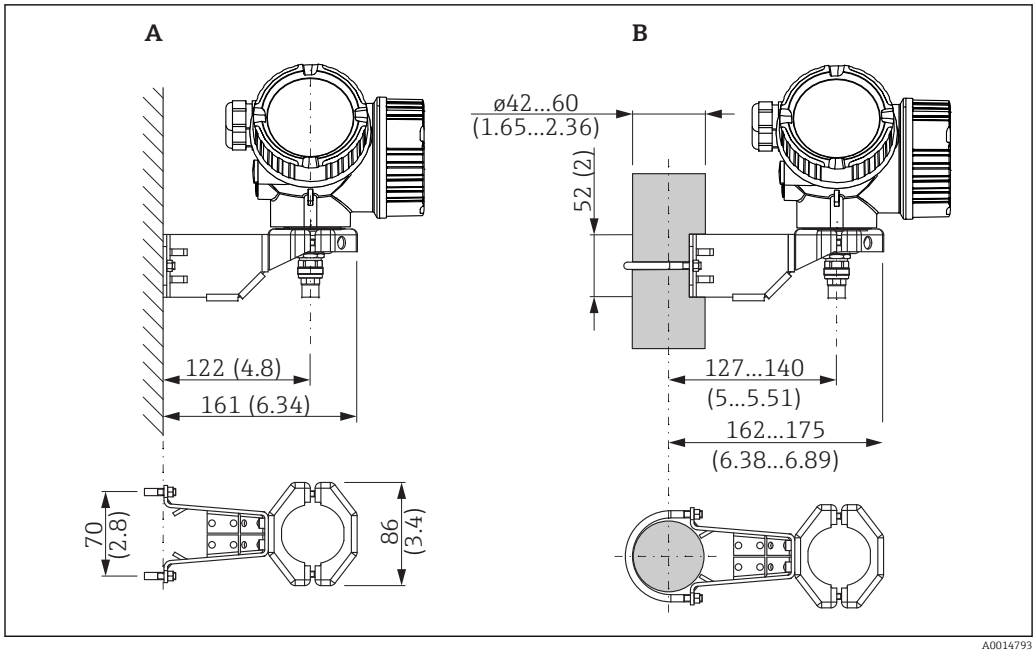
**for devices with integrated overvoltage protection.*



15 *Housing GT20 (Alu coated); Dimensions in mm (in)*

**for devices with integrated overvoltage protection.*

Dimensions of the mounting bracket

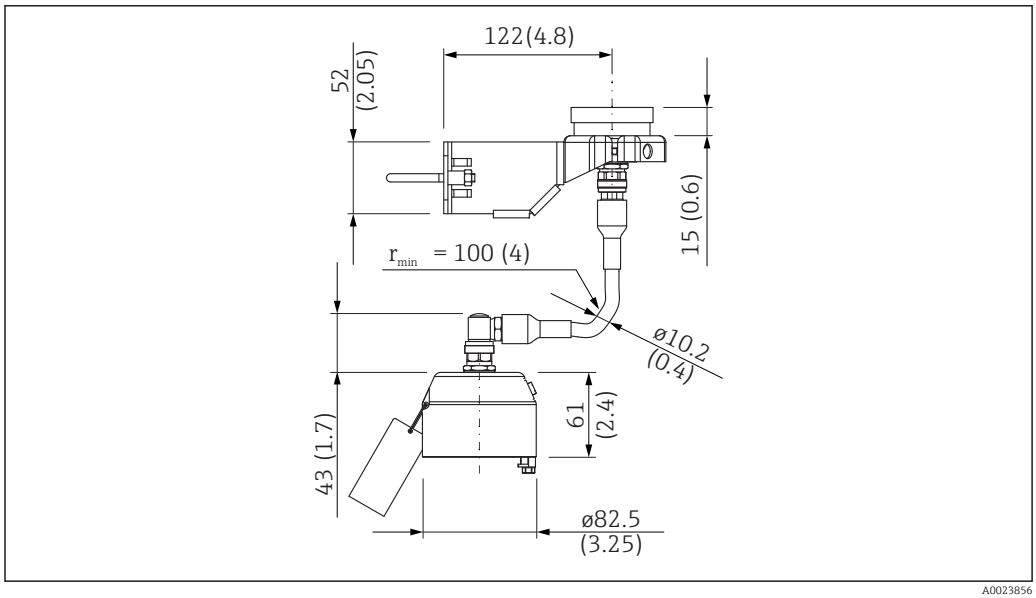


16 *Mounting bracket for the electronics housing: dimensions: mm (in)*

A Wall mounting
B Pipe mounting

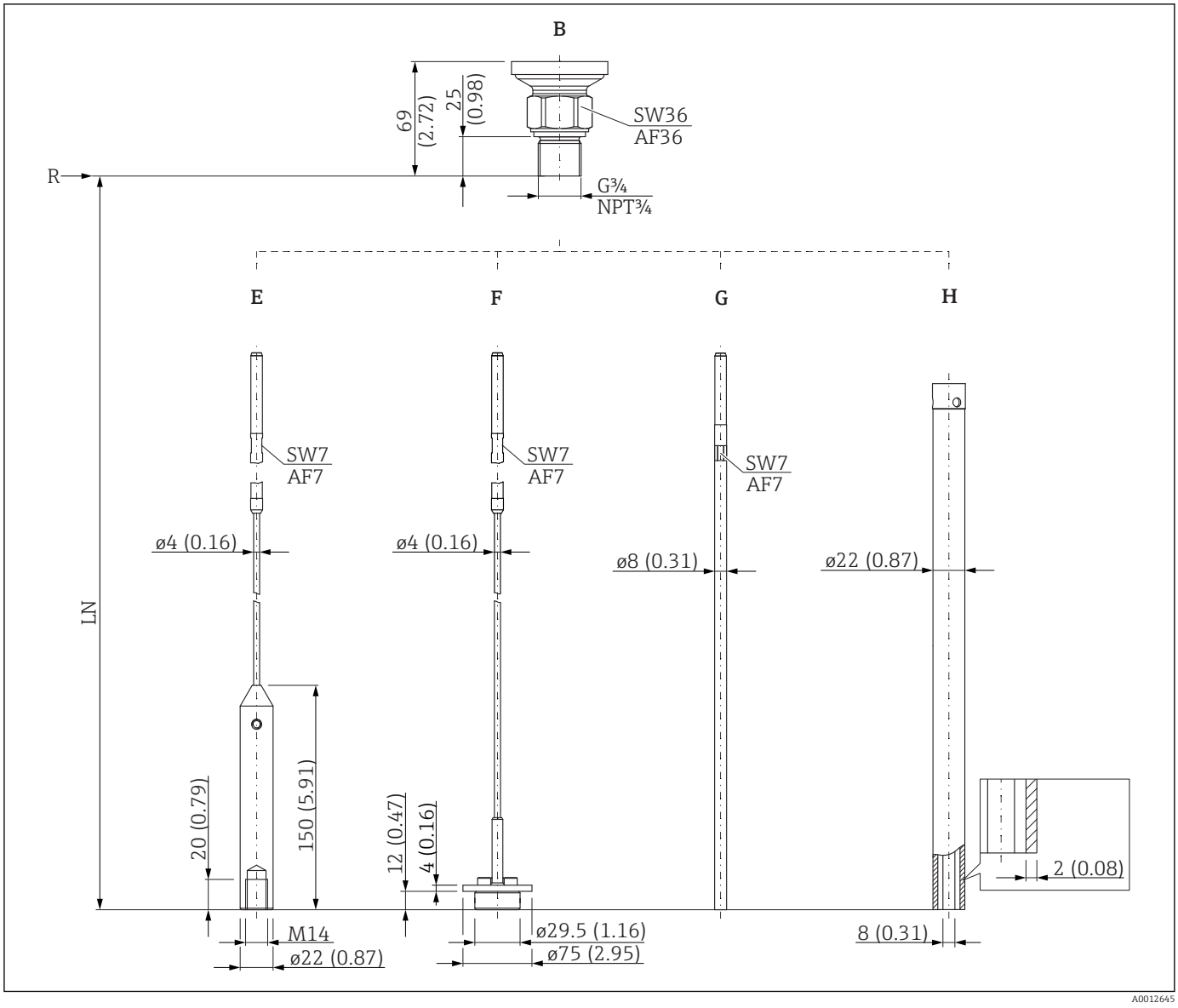
For the "Sensor remote" device version (see feature 060 of the product structure), the mounting bracket is part of the delivery. If required, it can also be ordered as an accessory (order code 71102216).

Dimensions of the connection piece for the remote probe



17 *Connection piece for the remote probe; dimensions: mm (in); Length of the connecting cable: as ordered*

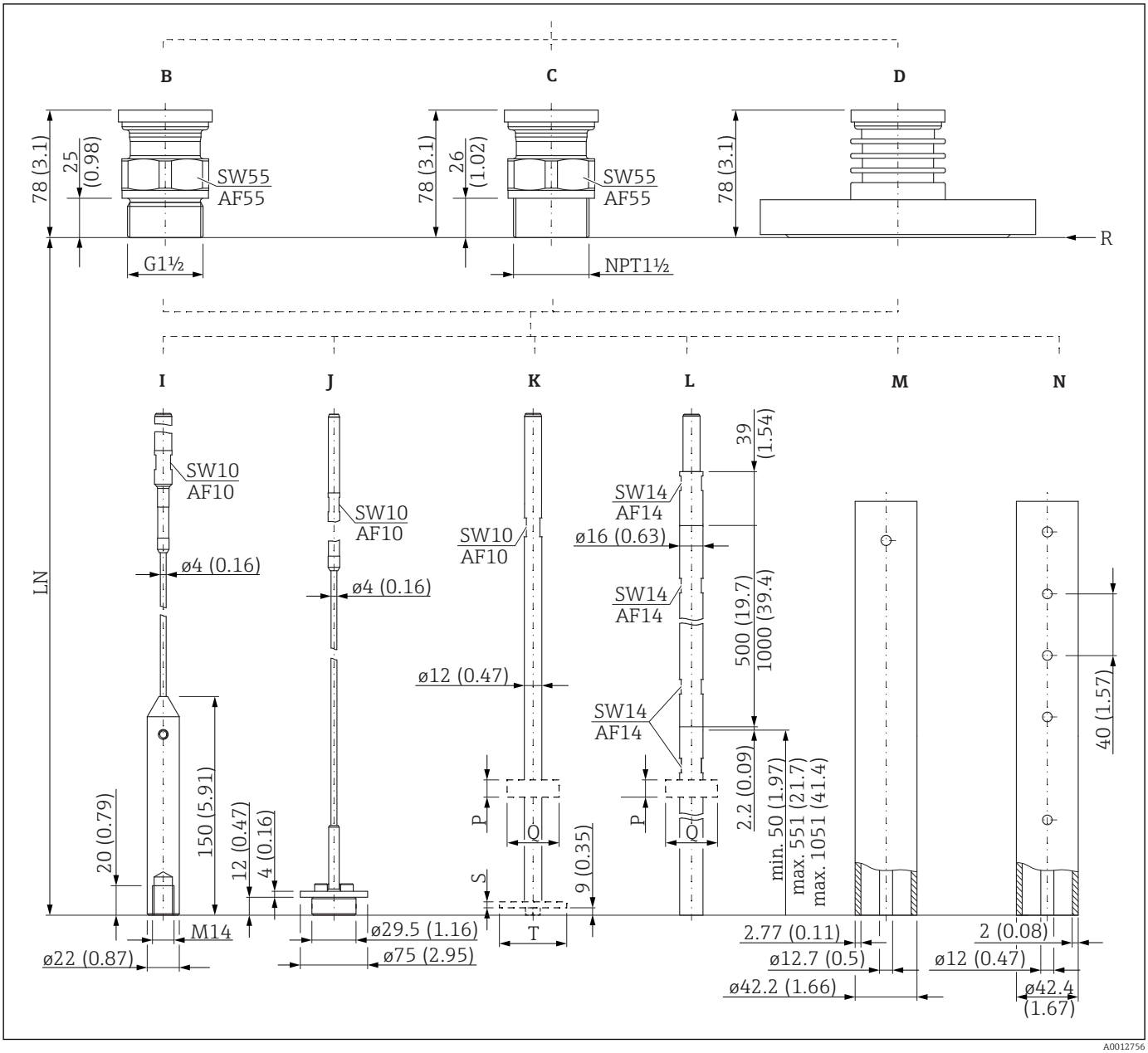
FMP51: Dimensions of process connection (G¾,NPT¾) and probe



18 FMP51: Process connection / probe; dimensions: mm (in). Unit of measurement mm (in)

B Thread ISO G3/4 or ANSI MNPT3/4 (Feature (100)
E Rope probe 4mm or 1/6" (Feature 060)
F Rope probe 4 mm or 1/6"; centering disk optional (Features 060 and 610)
G Rod probe 8mm or 1/3" (Feature 060)
H Coax probe (Feature 060); with venting hole Ø approx. 6 mm (0.24 in)
LN Length of probe
R Reference point of the measurement

FMP51: Dimensions of process connection (G1½,NPT1½,flange) and probe



19 *FMP51: Process connection / probe; dimensions: mm (in). Unit of measurement mm (in)*

- *B Thread ISO228 G1-1/2 (Feature 100)*
- *C Thread ANSI MNPT1-1/2 (Feature 100)*
- *D Flange ANSI B16.5, EN1092-1, JIS B2220 (Feature 100)*
- *I Rope probe 4mm or 1/6" (Feature 060)*
- *J Rope probe 4mm or 1/6"; centering disk optional (Features 060 and 610)*
- *K Rod probe 12mm or 1/2"; centering disk optional, see table below (Features 060 and 610)*
- *L Rod probe 16 mm or 0.63in, 20" or 40" divisible; centering disk optional, see table below (Feature 060 and 610)*
- *M Coax probe; AlloyC (Feature 060); with venting hole Ø approx. 8 mm (0.3 in)*
- *N Coax probe; 316L (Feature 060); with venting holes Ø approx. 10 mm (0.4 in)*
- *LN Length of probe*
- *P Thickness of the centering star; table of values: see below*
- *Q Diameter of the centering star; table of values: see below*
- *R Reference point of the measurement*
- *S Thickness of the center washer or centering star; table of values: see below*
- *T Diameter of the center washer or centering star; table of values: see below*

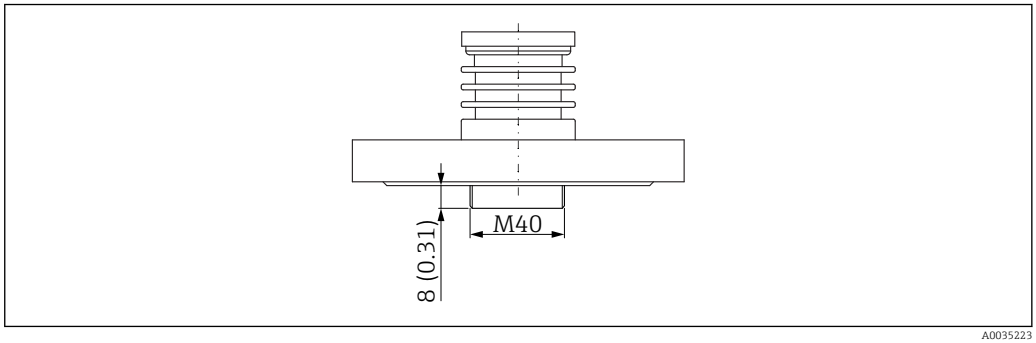
Center washer / centering star / centering weight

Ordering feature 610 "Accessory mounted"	Meaning	Thickness	Diameter
OA	Rod center washer 316L; pipe diameter DN80/3" + DN100/4"	S = 4 mm (0.16 in)	T = 75 mm (2.95 in)
OB	Rod center washer 316L; pipe diameter DN50/2" + DN65/2-1/2"	S = 4 mm (0.16 in)	T = 45 mm (1.77 in)
OC	Rope center washer 316L; pipe diameter DN80/3" + DN100/4"	S = 4 mm (0.16 in)	T = 75 mm (2.95 in)
OD	Rod centering star PEEK; interface measurement; pipe diameter DN50/2" + DN100/4"	S = 7 mm (0.28 in)	T = 48 to 95 mm (1.9 to 3.7 in)
OE	Rod centering star PFA; interface measurement; pipe diameter DN40/1-1/2" + DN50/2"	P = 10 mm (0.39 in)	Q = 37 mm (1.46 in)
OK	Rope centering weight 316L for DN50/2"	60 mm (2.4 in)	45 mm (1.77 in)
OL	Rope centering weight 316L for DN80/3"	30 mm (1.18 in)	75 mm (2.95 in)
OM	Rope centering weight 316L for DN100/4"	30 mm (1.18 in)	95 mm (3.7 in)

Note on AlloyC flanges

AlloyC flanges always have an additional thread, even if they are not used with a coax probe.

Affected options of ordering feature 100 "Process connection": AEM, AFM, AGM, AQM, ARM, ASM, ATM, CEM, CFM, CGM, CQM, CRM, CSM, CTM.



20 Dimensions of AlloyC flanges; Dimensions: mm (in)

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)

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)

Surface roughness of AlloyC-coated flanges

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

This value is valid for flanges with "AlloyC>316/316L"; see product structure, feature 100 "Process connection". For other flanges the surface roughness matches the corresponding flange standard.

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.

Rod probes of FMP52 can **not** be shortened as they are coated.

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).

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.

Weight

Housing

Part	Weight
Housing GT18 - stainless steel	approx. 4.5 kg
Housing GT19 - plastic	approx. 1.2 kg
Housing GT20 - aluminium	approx. 1.9 kg

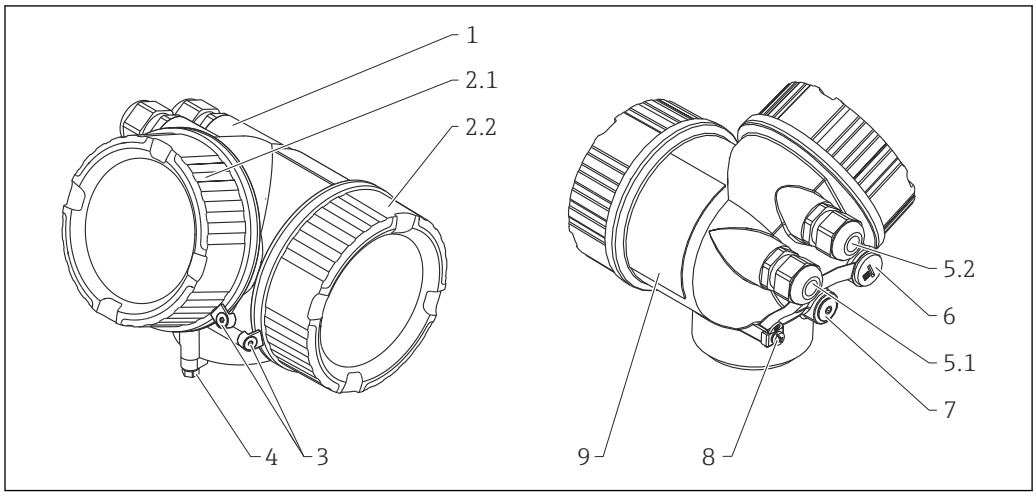
FMP51 with threaded connection G¾ or NPT¾

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

FMP51 with threaded connection G1½/NPT1½ or flange

Part	Weight	Part	Weight
Sensor	approx. 1.2 kg + 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		

Materials: GT18 housing (stainless steel, corrosion-resistant)



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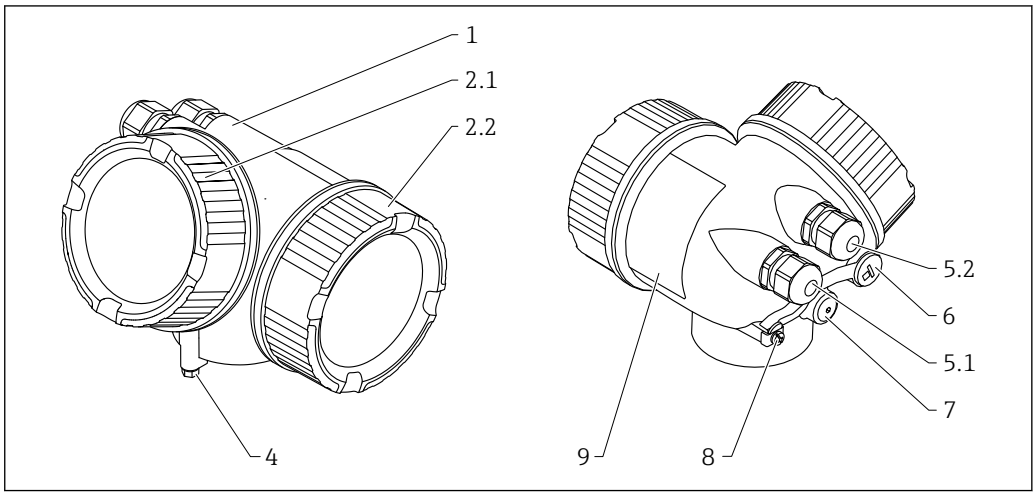
No.	Part	Material
1	Housing	CF3M similar to 316L/1.4404
2.1	Cover of the electronics compartment	▪ Cover: CF3M (similar to 316L/1.4404) ▪ Window: glass ▪ Cover seal: NBR ▪ Seal of the window: NBR ▪ Thread-coating: Graphite-based lubricant varnish
2.2	Cover of the terminal compartment	▪ Cover: CF3M (similar to 316L/1.4404) ▪ Cover seal: NBR ▪ Thread-coating: Graphite-based lubricant varnish
3	Cover lock	▪ Screw: A4 ▪ Clamp: 316L (1.4404)
4	Lock at the housing neck	▪ Screw: A4-70 ▪ Clamp: 316L (1.4404)
5.1	Dummy plug, cable gland, adapter or plug (depending on the device version)	▪ Dummy plug, depending on the device version: – 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 [1)] ▪ 7/8" plug: 316 (1.4401) [2)]
5.2	Dummy plug, cable gland or adapter (depending on the device version)	▪ 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)	▪ Dummy plug: 316L (1.4404) ▪ M12 socket: 316L (1.4404)
7	Pressure relief stopper	316L (1.4404)
8	Ground terminal	▪ Screw: A4 ▪ Spring washer: A4 ▪ Clamp: 316L (1.4404) ▪ Holder: 316L (1.4404)
9	Nameplate	▪ Plate: 316L (1.4404) ▪ Groove pin: A4 (1.4571)

1) For the version with M12 plug the sealing material is Viton.
2) For the version with 7/8" plug, the sealing material is NBR.

Materials: GT19 housing (plastic)

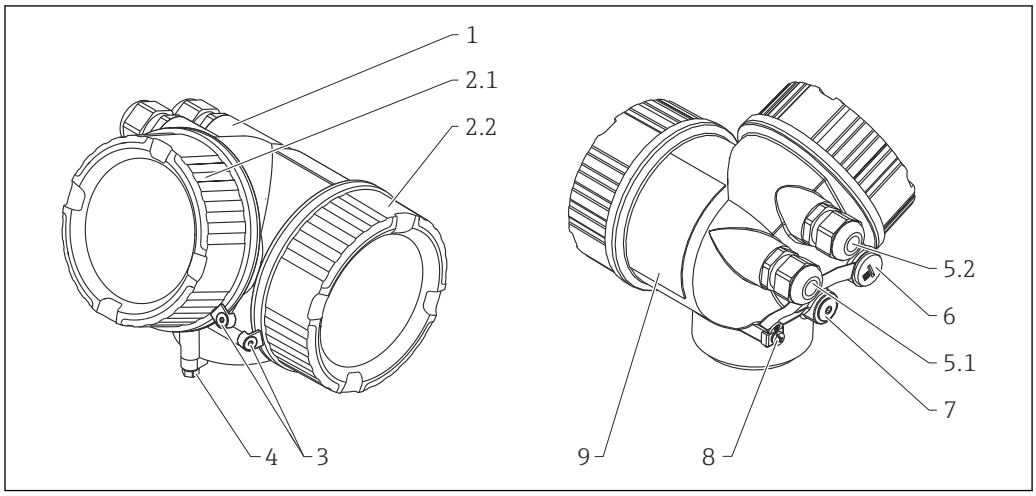


A0013788

No.	Part	Material
1	Housing	PBT
2.1	Cover of the electronics compartment	▪ Cover glass: PC ▪ Cover frame: PBT-PC ▪ Cover seal: EPDM ▪ Thread-coating: Graphite-based lubricant varnish
2.2	Cover of the terminal compartment	▪ Cover: PBT ▪ Cover seal: EPDM ▪ Thread-coating: Graphite-based lubricant varnish
4	Lock at the housing neck	▪ Screw: A4-70 ▪ Clamp: 316L (1.4404)
5.1	Dummy plug, cable gland, adapter or plug (depending on the device version)	▪ Dummy plug, depending on the device version: – PE – PBT-GF ▪ Cable gland, depending on the device version: – Nickel-plated brass (CuZn) – PA ▪ Adapter: 316L (1.4404/1.4435) ▪ Seal: EPDM ▪ M12 plug: Nickel-plated brass [1)] ▪ 7/8" plug: 316 (1.4401) [2)]
5.2	Dummy plug, cable gland or adapter (depending on the device version)	▪ Dummy plug, depending on the device version: – PE – PBT-GF – Nickel-plated steel ▪ Cable gland, depending on the device version: – Nickel-plated brass (CuZn) – PA ▪ Adapter: 316L (1.4404/1.4435) ▪ Seal: EPDM
6	Dummy plug or M12 socket (depending on the device version)	▪ Dummy plug: Nickel-plated brass (CuZn) ▪ M12 socket: Nickel-plated GD-Zn
7	Pressure relief stopper	Nickel-plated brass (CuZn)
8	Ground terminal	▪ Screw: A2 ▪ Spring washer: A4 ▪ Clamp: 304 (1.4301) ▪ Holder: 304 (1.4301)
9	Adhesive nameplate	Plastic

1) For the version with M12 plug the sealing material is Viton.
2) For the version with 7/8" plug, the sealing material is NBR.

Materials: GT20 housing (die-cast aluminum, powder-coated)



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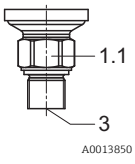
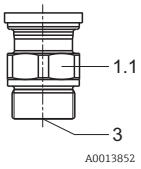
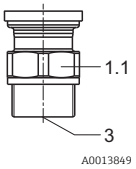
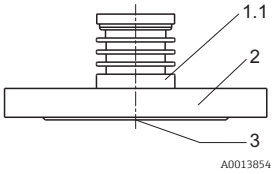
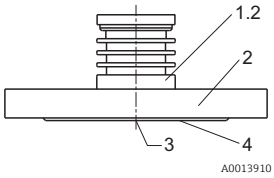
Nr.	Part	Material
1	Housing, RAL 5012 (blue)	▪ Housing: AlSi10Mg(<0,1% Cu) ▪ Coating: Polyester
2.1	Cover of the electronics compartment; RAL 7035 (gray)	▪ Cover: AlSi10Mg(<0,1% Cu) ▪ Window: Glass ▪ Cover seal: NBR ▪ Seal of the window: NBR ▪ Thread-coating: Graphite-based lubricant varnish
2.2	Cover of the terminal compartment; RAL 7035 (gray)	▪ Cover: AlSi10Mg(<0,1% Cu) ▪ Cover seal: NBR ▪ Thread-coating: Graphite-based lubricant varnish
3	Cover lock	▪ Screw: A4 ▪ Clamp: 316L (1.4404)
4	Lock at the housing neck	▪ Screw: A4-70 ▪ Clamp: 316L (1.4404)
5.1	Dummy plug, cable gland, adapter or plug (depending on the device version)	▪ Dummy plug, depending on the device version: – PE – PBT-GF ▪ Cable gland, depending on the device version: – Nickel-plated brass (CuZn) – PA ▪ Adapter: 316L (1.4404/1.4435) ▪ Seal: EPDM ▪ M12 plug: Nickel-plated brass [1)] ▪ 7/8" plug: 316 (1.4401) [2)]
5.2	Dummy plug, cable gland or adapter (depending on the device version)	▪ Dummy plug, depending on the device version: – PE – PBT-GF – Nickel-plated steel ▪ Cable gland, depending on the device version: – Nickel-plated brass (CuZn) – PA ▪ Adapter: 316L (1.4404/1.4435) ▪ Seal: EPDM
6	Dummy plug or M12 socket (depending on the device version)	▪ Dummy plug : Nickel-plated brass (CuZn) ▪ M12 socket: Nickel-plated GD-Zn
7	Pressure relief stopper	Nickel-plated brass (CuZn)

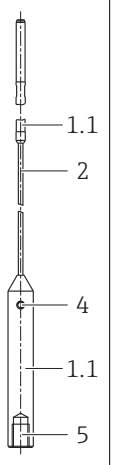
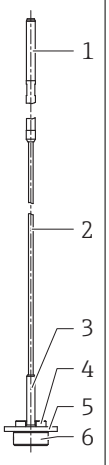
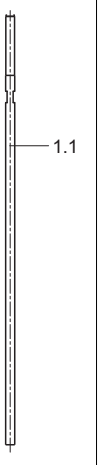
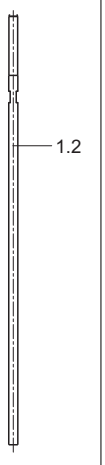
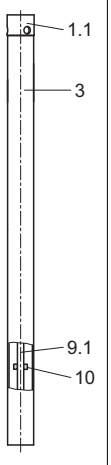
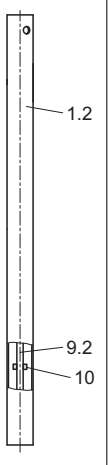
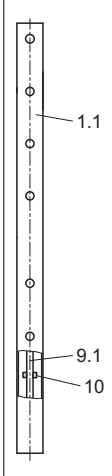
Nr.	Part	Material
8	Ground terminal	▪ Screw: A2 ▪ Spring washer: A2 ▪ Clamp: 304 (1.4301) ▪ Holder: 304 (1.4301)
9	Adhesive nameplate	Plastic

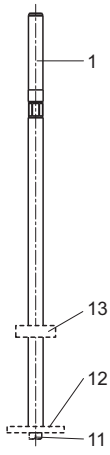
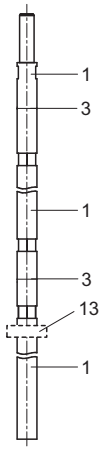
1) For the version with M12 plug the sealing material is Viton.
2) For the version with 7/8" plug, the sealing material is NBR.

Materials: Process connection

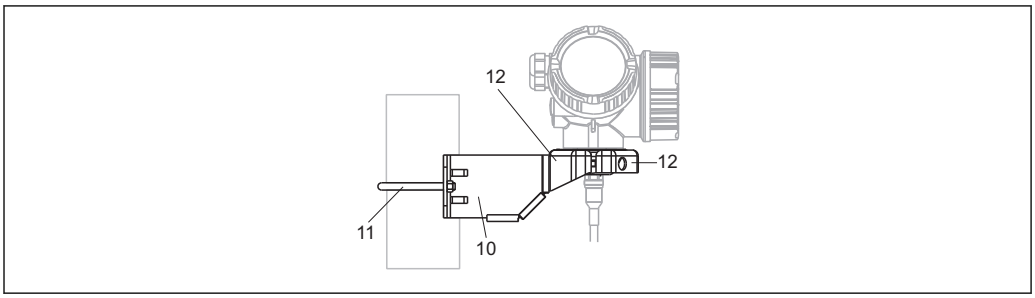
The supplied DIN/EN flanges and threaded process connections are made of stainless steel according to AISI 316L (DIN/EN material number 1.4404 or 1.4435). With regard to their temperature stability properties, the materials 1.4404 and 1.4435 are grouped under 13E0 in EN 1092-1:2007 Tab. G.3.1-1. The chemical composition of the two materials can be identical.

Levelflex FMP51						
Threaded connection			Flange		No.	Material
G¾, NPT¾	*G1½*	*NPT1½*	*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_2O_3 99.7 %
					4	Cladding: Alloy C22 (2.4602)

Levelflex FMP51								
Rope probe		Rod probe		Coax probe			No.	Material
Φ 4 mm (1/6")	*Φ 4 mm (1/6") with centering disk*	*Φ 8 mm (1/3")*	*Φ 12.7 mm (1/2") AlloyC*	*Thread G3/4*	*Thread G1-1/2 AlloyC*	*Thread G1-1/2 316L*		
							1.1	316L (1.4404)
							1.2	Alloy C22 (2.4602)
							2	316 (1.4401)
							3	316L (1.4404)
							4	Set screw: A4-70
							5	Screw for tightening: A2-70
							6	Socket cap screw: A4-80
							7	Disk: 316L (1.4404)
							8	Set screw: A4-70
							9.1	Rod: 316L (1.4404)
							9.2	Alloy C22 (2.4602)
							10	Centering star: PFA

Levelflex FMP51			
Rod probe		No.	Material
Φ 12 mm (1/2") 316L	*Φ 16 mm (2/3") divisible*		
		1	316L (1.4404)
		3	Connecting bolt: Alloy C22 (2.4602)
			Nordlock washer: 1.4547
		11	Hexagon head screw: A4-70
			Nordlock washer: 1.4547
		12	Centering star, PEEK
			Center washer, 316L (1.4404)
		13	Center washer, PFA

Materials: Mounting bracket



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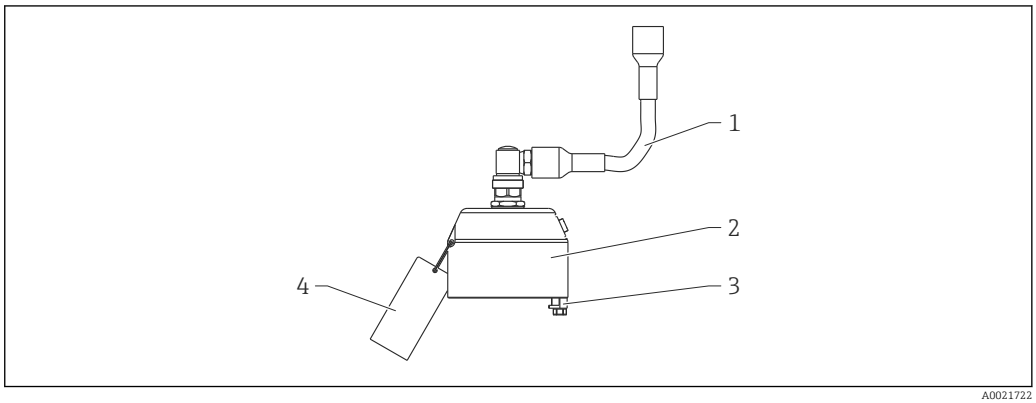
Mounting bracket for version "Sensor remote"		
Position	**Part**	**Material**
10	Bracket	316L (1.4404)
11	Bracket	316Ti (1.4571)
	Screw/nuts	A4-70
	Distance sleeves	316Ti (1.4571) or 316L (1.4404)
12	Half-shells	316L (1.4404)

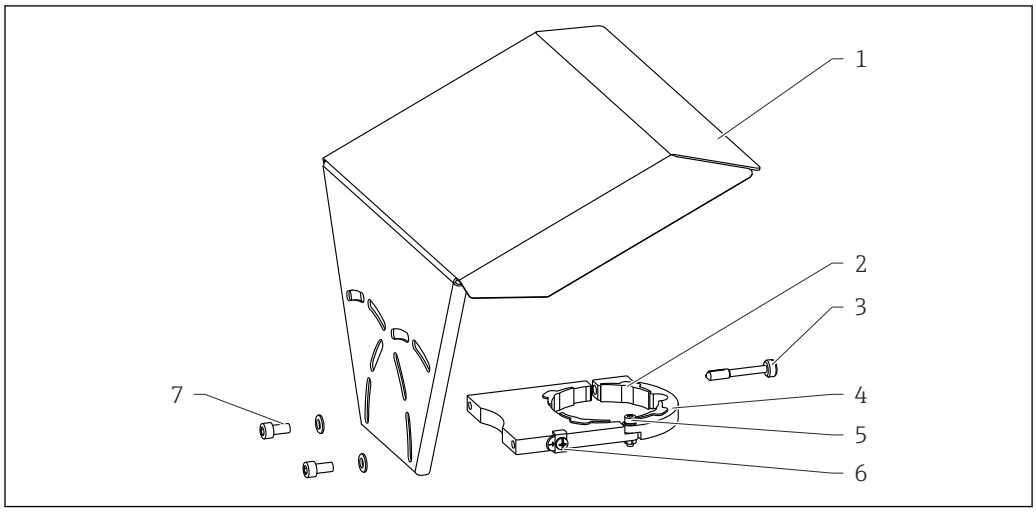
Materials: Adapter and cable for remote sensor



A0021722

Adapter and cable for version "Sensor remote"		
Position	**Part**	**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)

Materials: Weather protection cover



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No	Part: Material
1	Protection cover: 316L (1.4404)
2	Molded rubber part (4x): EPDM
3	Clamping screw: 316L (1.4404) + carbon fibre
4	Bracket: 316L (1.4404)
5	▪ Cheese head screw: A4-70 ▪ Nut: A4 ▪ Spring washer: A4
6	Ground terminal ▪ Screw: A4 ▪ Spring washer: A4 ▪ Clamp: 316L (1.4404) ▪ Holder: 316L (1.4404)
7	▪ Washer: A4 ▪ Cheese head screw: A4-70

Operability

Operating concept

Operator-oriented menu structure for user-specific tasks
- Commissioning
- Operation
- Diagnostics
- Expert level

Operating languages
- English
- Deutsch
- Français
- Español
- Italiano
- Nederlands
- Portuguesa
- Polski
- русский язык (Russian)
- Svenska
- Türkçe
- 中文 (Chinese)
- 日本語 (Japanese)
- 한국어 (Korean)
- Bahasa Indonesia
- tiếng Việt (Vietnamese)
- čeština (Czech)

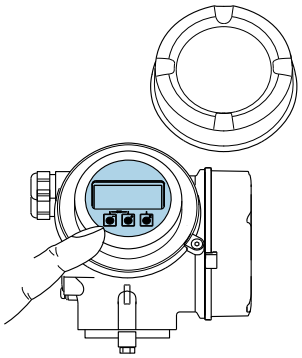
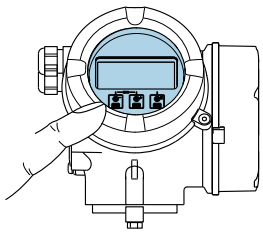
Feature 500 of the product structure determines which of these languages is preset on delivery.

Quick and save commissioning
- Interactive wizard with graphical interface for easy commissioning via FieldCare/DeviceCare
- Menu guidance with brief explanations of the individual parameter functions
- Standardized operation at the device and in the operating tools

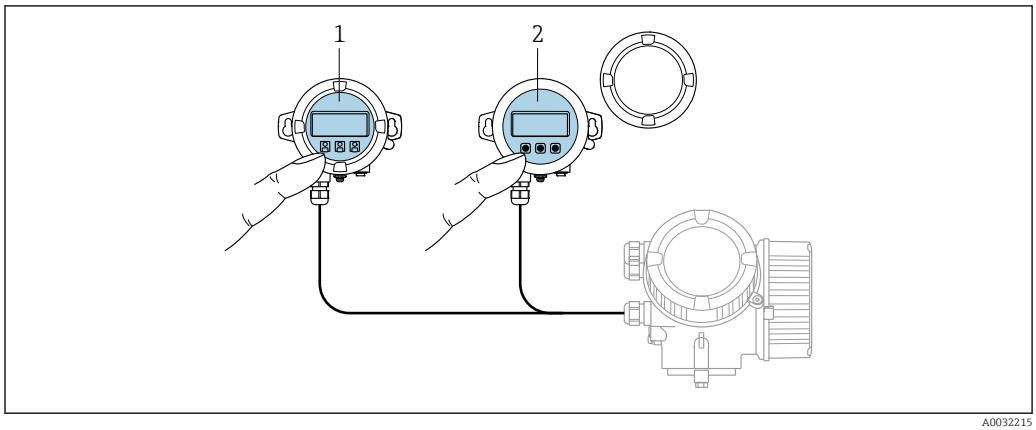
Integrated data storage device (HistoROM)
- Enables transfer of configuration when changing electronic modules
- Records up to 100 event messages in the device
- Records up to 1000 measured values in the device
- Saves the signal curve on commissioning which can later be used as a reference.

Efficient diagnostics increase measurement reliability
- Remedy information is integrated in plain text
- Diverse simulation options and line recorder functions

Local operation

Operation with	*Pushbuttons*	*Touch Control*
Order code for "Display; Operation"	Option **C** "SD02"	Option **E** "SD03"
	 A0032219	 A0032221
Display elements	4-line display	4-line display white background lighting; switches to red in event of device error
	Format for displaying measured variables and status variables can be individually configured	
	Permitted ambient temperature for the display: –20 to +70 °C (–4 to +158 °F) The readability of the display may be impaired at temperatures outside the temperature range.	
Operating elements	local operation with 3 push buttons (⊞, ⊟, Ⓔ)	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.	

Operation with remote display and operating module FHX50



A0032215

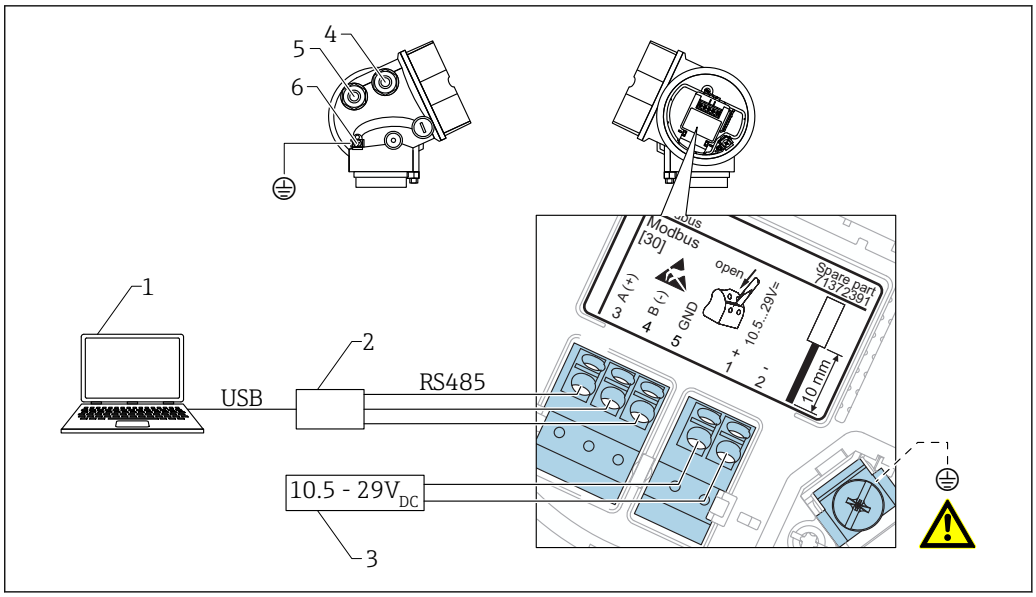
21 FHX50 operating options

1 Housing of the remote display and operating module FHX50
2 Display and operating module SD02, push buttons; cover must be removed
3 Display and operating module SD03, optical keys; can be operated through the glass of the cover

Remote operation

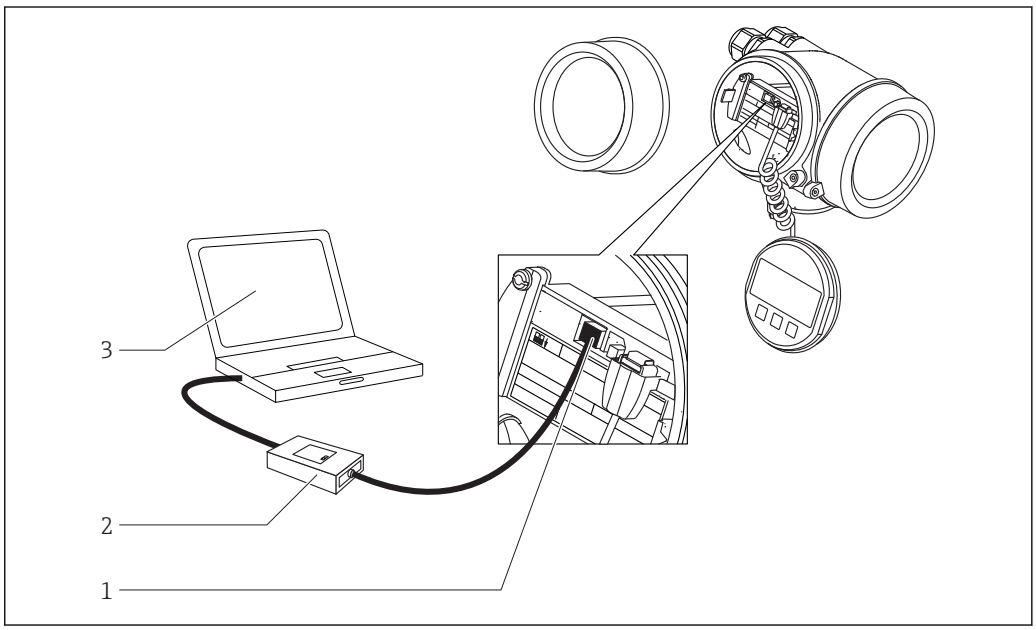
Via Modbus

To configure the device via FieldCare or DeviceCare, it is recommended to disconnect it from the Modbus Master and to connect it to the computer via a USB to RS485 interface.



1 *Computer with FieldCare/DeviceCare*
2 *Usb to RS485 interface*
3 *Power supply*
4 *Cable entry for RS485 connection*
5 *Cable entry for supply voltage*
6 *Protective earth connection*

Via service interface (CDI)



1 *Service interface (CDI) of the measuring device*
2 *Commubox FXA291*
3 *Computer with DeviceCare/FieldCare operating tool*

Certificates and approvals

Currently available certificates and approvals can be called up via the product configurator.

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.

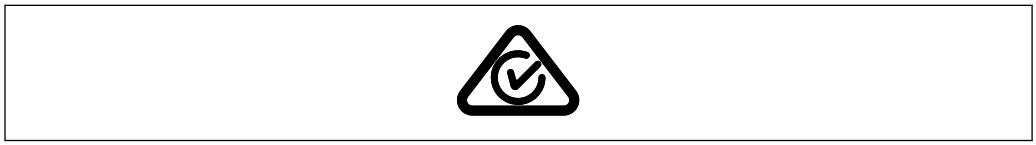
Successful testing of the device is confirmed by affixing to it the CE mark.

RoHS

The measuring system complies with the substance restrictions of the Restriction on Hazardous Substances Directive 2011/65/EU (RoHS 2).

RCM-Tick marking

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



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Ex approval

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

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 (XA) of the relevant devices.

Overfill prevention

WHG

DIBt Z-65.16-501

AD2000

- The wetted material 316L (1.4435/1.4404) corresponds to AD2000 - W2/W10.
- Declaration of conformity: see product structure, feature 580, option JF.

NACE MR 0175 / ISO 15156

- The wetted, metallic materials (except for ropes) comply with the requirements of NACE MR 0175 / ISO 15156.
- Declaration of conformity: see product structure, feature 580, option JB.

NACE MR 0103

- The wetted, metallic materials (except for ropes) comply with the requirements of NACE MR 0103 / ISO 17495.
- The certificate of compliance is based on NACE MR 0175.
  The hardness and the intercrystalline corrosion have been tested, as well as the heat treatment (solution annealed) has been carried out. The used materials comply therefore with the requirements of NACE MR 0103 / ISO 17495.
- Declaration of conformity: see product structure, feature 580, option JE.

ASME B31.1 and B31.3

- The dimensions, materials of construction, pressure / temperature ratings and identification markings of the device comply with the requirements of AMSE B31.1 and ASME B31.3
- Declaration of conformity: see product structure, feature 580, option KV.

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

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

Reasons:

According to Article 2, point 5 of EU Directive 2014/68/EU, pressure accessories are defined as "devices with an operational function and having pressure-bearing housings".

If a pressure instrument does not have a pressure-bearing housing (no identifiable pressure chamber of its own), there is no pressure accessory present within the meaning of the Directive.

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.

CRN approval

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

- The device has a CSA or FM approval (Product structure: Feature 010 "Approval")
- The device has a CRN approved process connection according to the following table.

Feature 100 of the product structure	Approval
AEJ	NPS 1-1/2" Cl. 150 RF, 316/316L flange ASME B16.5
AEM	NPS 1-1/2" Cl. 150, AlloyC>316/316L flange ASME B16.5
AFJ	NPS 2" Cl. 150 RF, 316/316L flange ASME B16.5
AFM	NPS 2" Cl. 150, AlloyC>316/316L flange ASME B16.5
AGJ	NPS 3" Cl. 150 RF, 316/316L flange ASME B16.5
AGM	NPS 3" Cl. 150, AlloyC>316/316L flange ASME B16.5
AHJ	NPS 4" Cl. 150 RF, 316/316L flange ASME B16.5
AJJ	NPS 6" Cl. 150 RF, 316/316L flange ASME B16.5
AKJ	NPS 8" Cl. 150 RF, 316/316L flange ASME B16.5
AQJ	NPS 1-1/2" Cl. 300 RF, 316/316L flange ASME B16.5
AQM	NPS 1-1/2" Cl. 300, AlloyC>316/316L flange ASME B16.5
ARJ	NPS 2" Cl. 300 RF, 316/316L flange ASME B16.5
ARM	NPS 2" Cl. 300, AlloyC>316/316L flange ASME B16.5
ASJ	NPS 3" Cl. 300 RF, 316/316L flange ASME B16.5
ASM	NPS 3" Cl. 300, AlloyC>316/316L flange ASME B16.5
ATJ	NPS 4" Cl. 300 RF, 316/316L flange ASME B16.5
ATM	NPS 4" Cl.300, AlloyC>316/316L flange ASME B16.5
GGJ	Thread ISO228 G1-1/2, 316L
RGJ	Thread ANSI MNPT1-1/2, 316L

- 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 0F14480.5C on the nameplate.

Test, Certificate

Feature 580 "Test, Certificate"	Designation	Available for
JA	3.1 Material certificate, wetted metallic parts, EN10204-3.1 inspection certificate	FMP51
JB	Conformity to NACE MR0175, wetted metallic parts	FMP51
JE	Conformity to NACE MR0103, wetted metallic parts	FMP51
JF	Conformity to AD2000, wetted metallic parts: Material of all wetted/pressurized parts conform to AD2000 (Technical rules W2, W9, W10)	FMP51
JN	Ambient temperature transmitter −50 °C (−58 °F) Devices with this option undergo a routine check test (startup test at −50 °C (−58 °F)).	FMP51
KD	Helium leak test, internal procedure, inspection certificate	FMP51
KE	Pressure test, internal procedure, inspection certificate	FMP51
KG	3.1 Material certificate+PMI test (XRF), internal procedure, wetted metallic parts, EN10204-3.1 inspection certificate	FMP51
KP	Liquid penetrant test AD2000-HP5-3(PT), wetted/pressurized metallic parts, inspection certificate	FMP51
KQ	Liquid penetrant test ISO23277-1 (PT), wetted/pressurized metallic parts, inspection certificate	FMP51
KR	Liquid penetrant test ASME VIII-1 (PT), wetted/pressurized metallic parts, inspection certificate	FMP51
KS	Welding documentation, wetted/pressurized seams consisting of ▪ Welding drawing ▪ WPQR (Welding Procedure Qualification Report) ▪ WPS (Welding Process Specification) ▪ WQR (Manufacturer Declaration)	FMP51
KV	Conformity to ASME B31.3: The dimensions, materials of construction, pressure / temperature ratings and identification markings of the device comply with the requirements of ASME B31.3	FMP51

Product documentation on paper

Test reports, declarations and material certificates can be ordered as hardcopies via ordering feature 570 "Service", option I7 „Product documentation on paper“. The printouts will be enclosed in the product delivery.

Other standards and guidelines

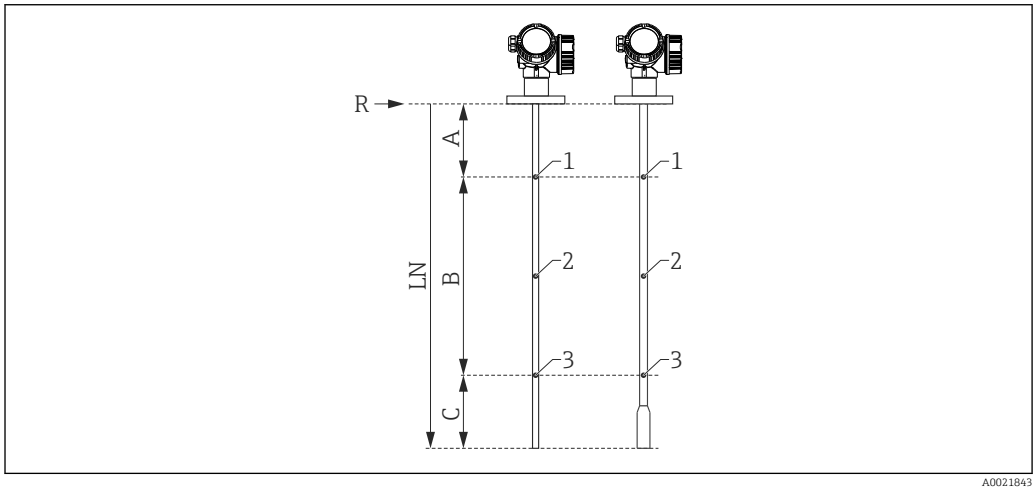
- EN 60529
  Degrees of protection by housing (IP code)
- EN 61010-1
  Protection Measures for Electrical Equipment for Measurement, Control, Regulation and Laboratory Procedures.
- IEC/EN 61326
  "Emission in accordance with Class A requirements". Electromagnetic compatibility (EMC requirements)
- NAMUR 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 NE107
- NAMUR NE 131
  Requirements for field devices for standard applications
- IEC61508
  Functional safety of electrical/electronic/programmable electronic safety-related systems

Ordering information

3-point linearity protocol

The following notes must be taken into account if option F3 ("3 point linearity protocol") has been selected in feature 550 ("Calibration").

Depending on the probe the 3 points of the linearity protocol are defined as follows:



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A Distance from reference point R to first measuring point
B Measuring range
C Distance from end of probe to third measuring point
LN Length of probe
R Reference point of the measurement
1 First measuring point
2 Second measuring point (centrally between first and third measuring point)
3 Third measuring point

	Rod or coax probe [1] **LN ≤ 6 m (20 ft)**	**Divisible rod probe LN > 6 m (20 ft)**	**Rope probe LN ≤ 6 m (20 ft)**	**Rope probe LN > 6 m (20 ft)**
Position of 1st measuring point	▪ FMP51/FMP52/FMP54 withoput gas phase compensation/ FMP55: A = 350 mm (13.8 in) ▪ FMP54 with gas phase compensation, L_{ref} = 300 mm (11 in): A = 600 mm (23.6 in) ▪ FMP54 with gas phase compensation, L_{ref} = 550 mm (21 in): A = 850 mm (33.5 in)		A = 350 mm (13.8 in)	A = 350 mm (13.8 in)
Position of 2nd measuring point	centrally between 1st and 3rd measuring point	centrally between 1st and 3rd measuring point	centrally between 1st and 3rd measuring point	centrally between 1st and 3rd measuring point
Position of 3rd measuring point	measured from the bottom end of the probe: C = 250 mm (9.84 in)	measured from the top end of the probe: A+B = 5 750 mm (226 in)	measured from the bottom end of the probe: C = 500 mm (19.7 in)	measured from the top end of the probe: A+B = 5 500 mm (217 in)
Minimum measuring range	B ≥ 400 mm (15.7 in)	B ≥ 400 mm (15.7 in)	B ≥ 400 mm (15.7 in)	B ≥ 400 mm (15.7 in)
Minimum length of probe	LN ≥ 1 000 mm (39.4 in)	LN ≥ 1 000 mm (39.4 in)	LN ≥ 1 250 mm (49.2 in)	LN ≥ 1 250 mm (49.2 in)

1) also valid for divisible rods

The position of the measuring points may vary by ±1 cm (±0.04 in).

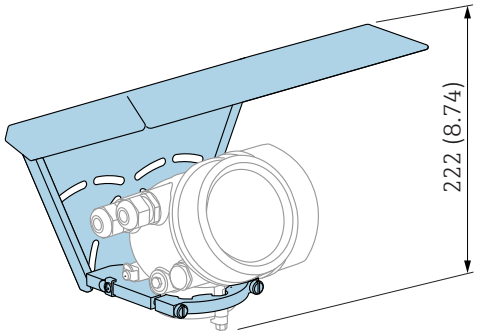
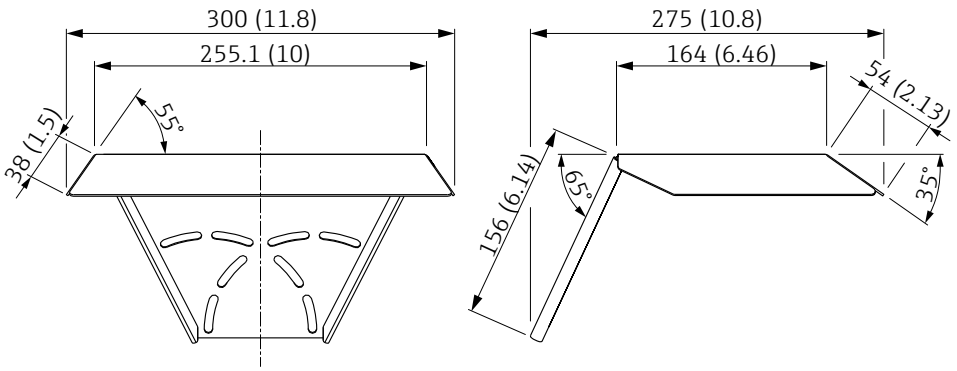
- For rod and rope probes the linearity check is performed with the complete device.
- For divisible rod probes a reference probe is used instead of the original one.
- For coax probes the electronics is mounted to a reference rod probe and the linearity check is performed to this configuration.
- The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

Tagging (TAG)

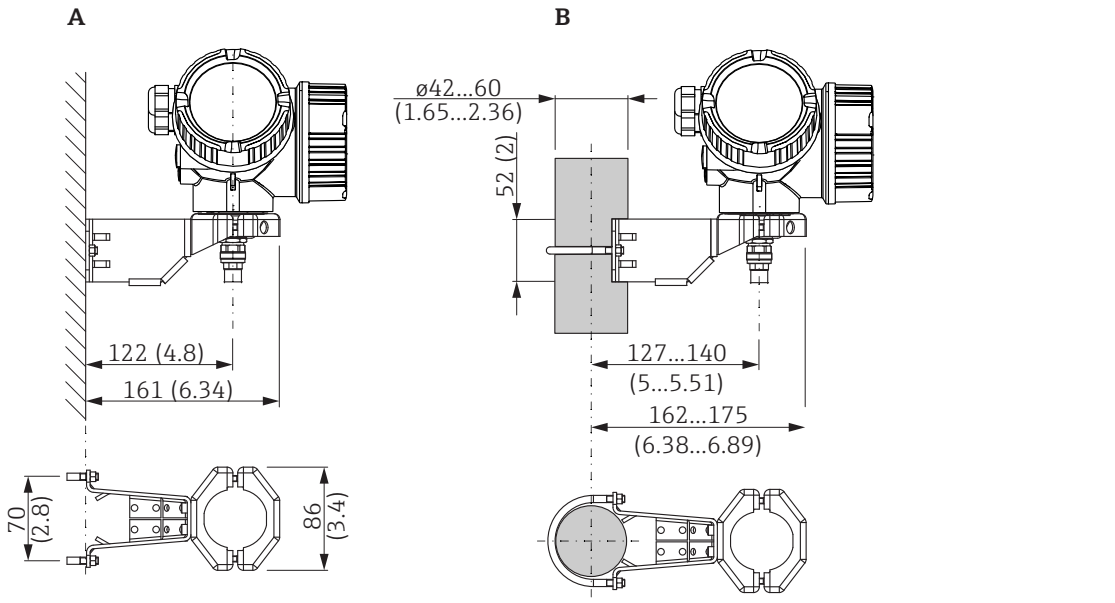
Ordering feature	895: Marking
Option	Z1: Tagging (TAG), see additional spec.
Position of the measuring point marking	To be selected in the additional specifications: ▪ Tag plate Stainless Steel ▪ Self-adhesive paper label ▪ Supplied label/plate ▪ RFID TAG ▪ RFID TAG + Tag plate Stainless Steel ▪ RFID TAG + Self-adhesive paper label ▪ RFID TAG + Supplied label/plate
Definition of the measuring point designation	To be defined in the additional specifications: 3 lines containing up to 18 characters each The measuring point designation appears on the selected label and/or the RFID TAG.
Designation in the Electronic Name Plate (ENP)	The first 32 characters of the measuring point designation
Designation on the display module	The first 12 characters of the measuring point designation

Accessories

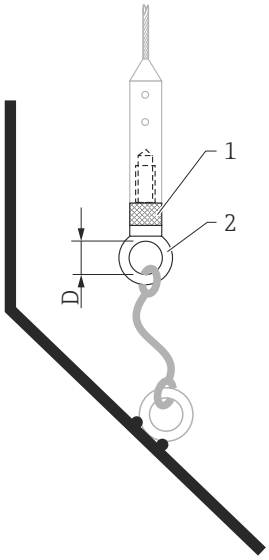
Device-specific accessories **Weather protection cover**

Accessory	Description
Weather protection cover	 A0015466  A0015472 *22 Weather protection cover; Dimensions: mm (in)* The weather protection cover can be ordered together with the device (product structure, feature 620 "Accessory Enclosed", option PB "Weather Protection Cover"). Alternatively, it can be separately ordered as an accessory; order code 71162242.

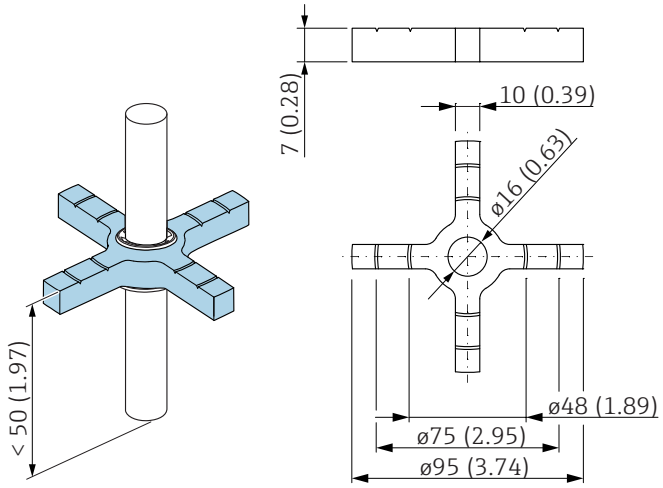
Mounting bracket for the electronics housing

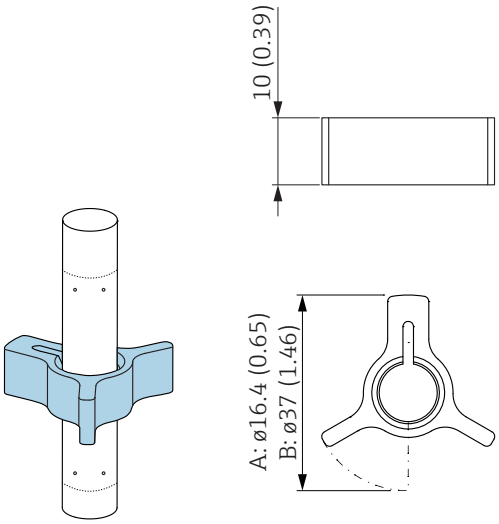
Accessory	Description
Mounting bracket for the electronics housing	 *23 Mounting bracket for the electronics housing; Dimensions: mm (in)* *A Wall mounting* *B Pipe mounting* For the "Sensor remote" device version (see feature 060 of the product structure), the mounting bracket is part of the delivery. If required, it can also be ordered as an accessory (order code 71102216).

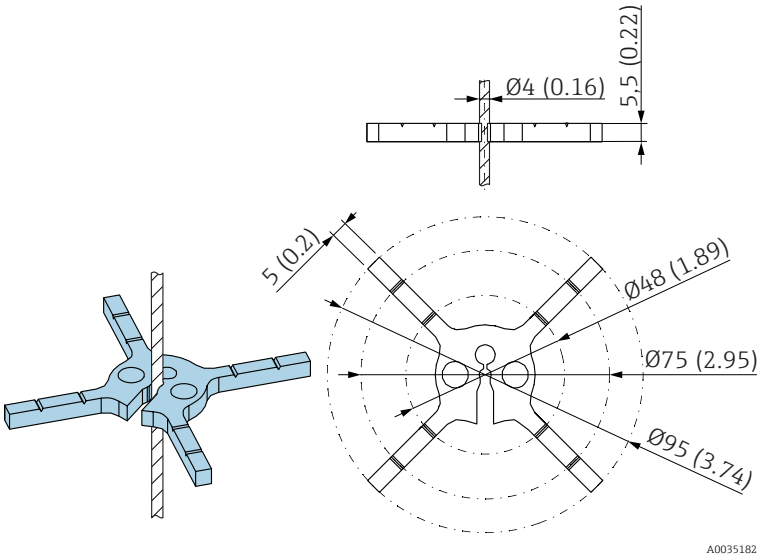
Mounting kit, isolated

Accessory	Description
Mounting kit, isolated can be used for FMP51	 A0013586 *24 Scope of supply of the mounting kit:* *1 Insulating sleeve* *2 Eye-bolt* For reliably insulated fixing of the probe. Maximum process temperature: 150 °C (300 °F) For rope probes 4 mm (⅙ in) or 6 mm (1/4 in) with PA>steel: ▪ Diameter D = 20 mm (0.8 in) ▪ Order-No.: 52014249 For rope probes 6 mm (¼ in) or 8 mm (1/3 in) with PA>steel: ▪ Diameter D = 25 mm (1 in) ▪ Order-No.: 52014250 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. The mounting kit can also be ordered directly with the device (see the Levelflex product structure, feature 620 "Accessory Enclosed", option PG "Mounting kit, isolated, rope").

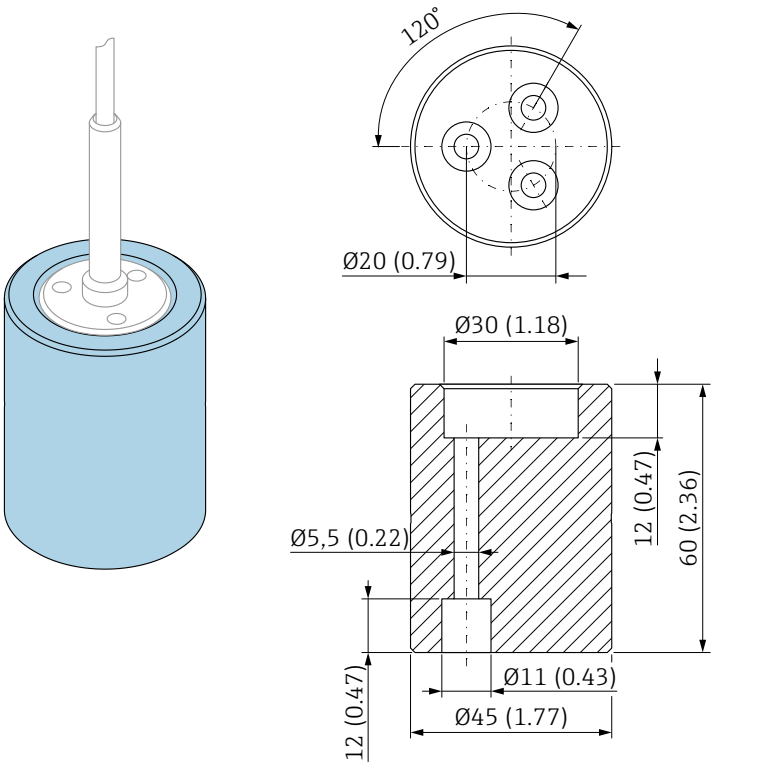
Centering star

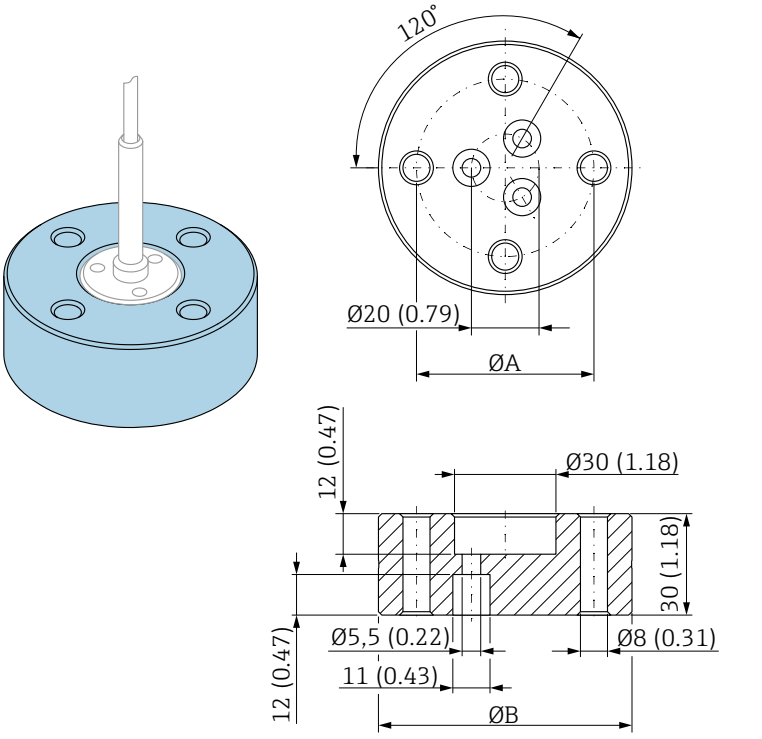
Accessories	Description
Centering star PEEK Φ 48-95 mm suitable for FMP51	 The centering star is suitable for probes with a rod diameter of 16 mm (0.6 in) and can be used in pipes from DN50 to DN100. The markings make it easer to cut to size, ensuring that the centering star can be adjusted to the pipe diameter. See also Operating Instructions SD02316F. ▪ Material of centering star: PEEK ▪ Material of retaining rings: PH15-7Mo (UNS S15700) ▪ Permitted process temperature range: −60 to +250 °C (−76 to +482 °F) ▪ Order number: 71069064 If the centering star is used in a bypass, it must be positioned below the lower bypass outlet. This must be taken into account when choosing the probe length. In general, the centering star should not be mounted more than 50 mm (1.97") above the probe tip. It is advised not to use the PEEK centering star in the measuring range of the rod probe. The PEEK centering star can also be ordered directly with the device (Levelflex product structure, feature 610 "Accessory mounted", option OD). In this case, it is not secured to the rod using the circlips, but instead is secured using a hexagonal-headed bolt (A4-70) and a Nord Lock washer (1.4547) at the tip of the probe rod.

Accessories	Description
Centering star PFA ▪ ϕ 16.4 mm (0.65 in) ▪ ϕ 37 mm (1.46 in) suitable for FMP51	 *A For probe 8 mm (0.3 in)* *B For probes 12 mm (0.47 in) and 16 mm (0.63 in)* The centering star is suitable for probes with a rod diameter of 8 mm (0.3 in), 12 mm (0.47 in) and 16 mm (0.63 in) (including coated rod probes) and can be used in pipes from DN40 to DN50. See also Operating Instructions BA00378F/00/A2. ▪ Material: PFA ▪ Permitted process temperature range: −200 to +250 °C (−328 to +482 °F) ▪ Order number – Probe 8 mm (0.3 in) : 71162453 – Probe 12 mm (0.47 in): 71157270 – Probe 16 mm (0.63 in): 71069065 The PFA centering star can also be ordered directly with the device (Levelflex product structure, feature 610 "Accessory mounted", option OE).

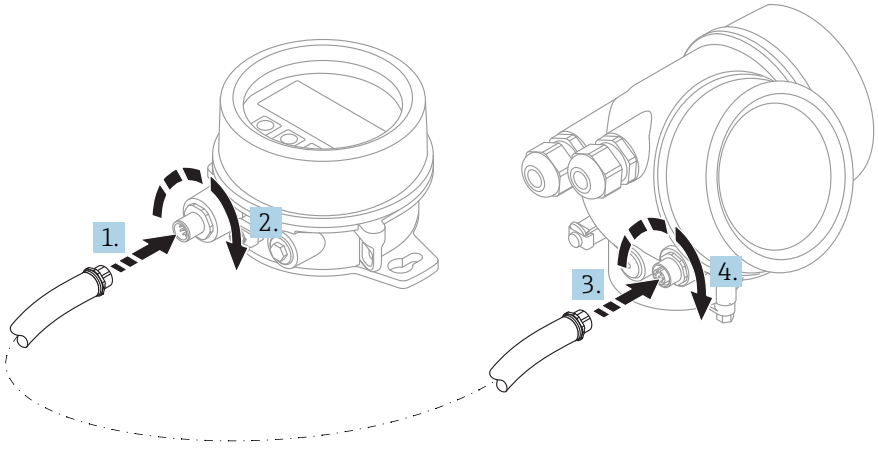
Accessories	Description
Centering star PEEK, Ø 48 to 95 mm (1.9 to 3.7 in) suitable for FMP51	 The centering star is suitable for probes with a rope diameter of 4 mm (⅙ in) (including coated rope probes). See also Operating Instructions SD01961F. ▪ Material: PEEK ▪ Permitted process temperature range: −60 to +250 °C (−76 to +482 °F) ▪ Order number – 71373490 (1x) – 71373492 (5x)

Centering weight

Accessories	Description
Centering weight 316L ϕ 45 mm (1.77 in) suitable for FMP51	 The centering weight is suitable for probes with a rope diameter of 4 mm (⅙ in) and can be used in DN50/2" pipes. Order number: 71420755 (for DN50/2" pipe) The centering weight can also be ordered directly with the device (Levelflex product structure, feature 610 "Accessory mounted", option OK (for DN50/2" pipe)).

Accessories	Description
Centering weight 316L ▪ ϕ 75 mm (2.95 in) ▪ ϕ 95 mm (3.7 in) suitable for FMP51	 *ϕA = 52.5 mm (2.07 in) for DN80/3" pipe* *= 62.5 mm (2.47 in) for DN100/4" pipe* *ϕB = 75 mm (2.95 in) for DN80/3" pipe* *= 95 mm (3.7 in) for DN100/4" pipe* The centering weight is suitable for probes with a rope diameter of 4 mm (⅙ in) and can be used in DN80/3" or DN100/4" pipes. ▪ Material: 316L ▪ Order number – 71420822 (for DN80/3" pipe) – 71420824 (for DN100/4" pipe) The centering weight can also be ordered directly with the device (Levelflex product structure, feature 610 "Accessory mounted", option OL (for DN80/3" pipe) or OM (for DN100/4" pipe)).

Remote display FHX50

Accessories	Description
Remote display FHX50	 A0019128 ▪ Material: – Plastic PBT – 316L/1.4404 – Aluminum ▪ Degree of protection: IP68 / NEMA 6P and IP66 / NEMA 4x ▪ Suitable for display modules: – SD02 (push buttons) – SD03 (touch control) ▪ Connecting cable: – Cable supplied with device up to 30 m (98 ft) – Standard cable supplied by customer up to 60 m (196 ft) ▪ Ambient temperature range: −40 to 80 °C (−40 to 176 °F) ▪ If the remote display should be used, order the device version "Prepared for display FHX50" (feature 030, version L or M). For the FHX50, you must select option A: "Prepared for display FHX50" under feature 050 "Measuring device version". ▪ If the device version "Prepared for display FHX50" was not originally ordered and a FHX50 display is to be retrofitted, you must select version B "Not prepared for display FHX50" under feature 050: "Measuring device version" when ordering the FHX50. In this case, a retrofit kit for the device is supplied with the FHX50. The kit can be used to prepare the device so that the FHX50 can be used. Use of the FHX50 may be restricted for transmitters with an approval. A device can only be retrofitted with the FHX50 if the option L or M ("Prepared for FHX50") is listed under *Basic specifications*, item 4 "Display, operation" in the Safety Instructions (XA) for the device. Also pay attention to the Safety Instructions (XA) of the FHX50. Retrofitting is not possible on transmitters with: ▪ An approval for use in areas with flammable dust (dust ignition-proof approval) ▪ Ex nA type of protection For details, see document SD01007F.

Communication-specific accessories

Accessory	Description
Commubox FXA291	Connects field devices with CDI interface to the USB interface of a computer. Order code: 51516983

Service-specific accessories

Accessory	Description
DeviceCare SFE100	Configuration tool for HART, PROFIBUS and FOUNDATION Fieldbus devices Technical Information TI01134S
FieldCare SFE500	FDT-based Plant Asset Management tool. Helps to configure and maintain all field devices of your plant. By supplying status information it also supports the diagnosis of the devices. Technical Information TI00028S

System components

Accessory	Description
Graphic Data Manager Memograph M	The graphic data manager Memograph M provides information on all the relevant process variables. Measured values are recorded correctly, limit values are monitored and measuring points analyzed. The data are stored in the 256 MB internal memory and also on an SD card or USB stick. For details refer to Technical Information TI00133R and Operating Instructions BA00247R

Documentation

Standard documentation

Levelflex FMP51

Correlation of documentations to the device:

Device	Communication	Document type	Document code
FMP51	Modbus	Technical Information	TI01454F
		Operating Instructions	BA01957F
		Brief Operating Instructions	KA01421F
		Description of Device Parameters	GP01140F

Supplementary documentation

Application Package [1]	Document type	Document code
▪ EH: Heartbeat Verification + Monitoring ▪ EJ: Heartbeat Verification	Special documentation	in preparation

1) Feature 540 of the product structure

Safety Instructions (XA)

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

Ordering feature 010 (Approval)		Ordering feature 020 (Power Supply; Output)		Safety Instructions
Option	Meaning	Option	Meaning	
CC	CSA C/US XP Cl. I, Div. 1, Groups A-D	M	4-wire, Modbus RS485	XA01700F
C3	CSA C/US XP Cl. I, II, III, Div. 1, Groups A-G; Class I, AEx d [ia] IIC/ Ex d [ia] IIC; Class I, Div. 2, Groups A-D	M	4-wire, Modbus RS485	XA01700F

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	---

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