TI01001F/00/EN/32.25-00
71705627
2025-04-25

Technical Information
Levelflex FMP51, FMP52, FMP54

Guided-wave radar

Level and interface measurement in liquids

Application

- Rod, rope or coaxial probe
- Process connection: thread as of ¾", flange or for hygienic application requirements (Tri-Clamp, 11851)
- Process temperature: −196 to +450 °C (−320 to +842 °F)
- Process pressure: −1 to +400 bar (−14.5 to +5 800 psi)
- Maximum measuring range: rod 10 m (33 ft); rope 45 m (148 ft); coaxial 6 m (20 ft)
- Accuracy: ±2 mm (±0.08 in)
- International explosion protection certificates; WHG (German Water Resources Act); marine approval; steam boiler approval; EN10204-3.1
- Linearity protocol (3-point, 5-point)

Your benefits

- Reliable measurement even in variable product and process conditions
- Integrated data memory
- Maximum reliability thanks to multi-echo tracking
- SIL2 as per IEC 61508, SIL3 for homogeneous redundancy
- Intuitive user interface in local language
- *Bluetooth*®wireless technology for commissioning, operation and maintenance
- Easy proof testing for SIL and WHG
- Heartbeat Technology™

Endress+Hauser
People for Process Automation

Table of contents

Important information about this document

Symbols

Safety symbols

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

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

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

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

Electrical symbols

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)
Ground terminals that must be connected to ground prior to establishing any other connections
The ground terminals are located on the interior and exterior of the device
- Inner ground terminal; protective earth is connected to the mains supply
- Outer ground terminal; device is connected to the plant grounding system

Symbols for certain types of information and graphics

Permitted
Procedures, processes or actions that are permitted

Forbidden
Procedures, processes or actions that are forbidden

Tip
Indicates additional information

Reference to documentation

Reference to graphic

Notice or individual step to be observed

1., 2., 3.
Series of steps

Result of a step

1, 2, 3, ...
Item numbers

A, B, C, ...
Views

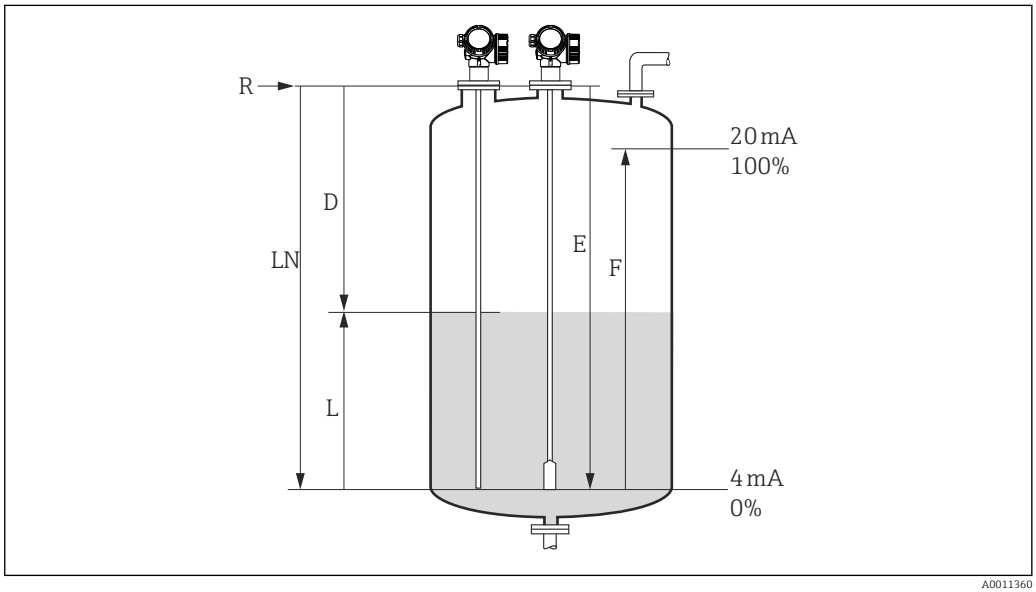
Temperature resistance of the connection cables
Specifies the minimum value of the temperature resistance of the connection cables

Function and system design

Measuring principle

General principles

The Levelflex is a "downward-looking" measuring system that functions according to the time-of-flight method (ToF). 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 guided wave radar*

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

If the ε_r value is less than 7 in the case of rope probes, measurement is not possible in the area of the tensioning weight (0 to 250 mm (0 to 9.84 in) from the probe end), (lower blocking distance).

The reference point **R** of the measurement is located at the process connection.

Relative permittivity

The relative permittivity (ε_r) of the medium directly affects the degree of reflection of the high-frequency pulses. In the case of a large ε_r, such as with water or ammonia, there is strong pulse reflection. Conversely, if the ε_r is low, such as with hydrocarbons, pulse reflection is weak.

Input

The reflected pulses are transmitted from the probe to the electronics. Here, a microprocessor evaluates the signals and identifies the level echo which was caused by the reflection of the high-frequency pulses at the product surface. This clear signal detection system benefits from over 30 years of experience with pulse time-of-flight procedures that have gone into the development of the PulseMaster® software.

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

$D = c \cdot t/2$,

where c is the speed of light.

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

$L = E - D$

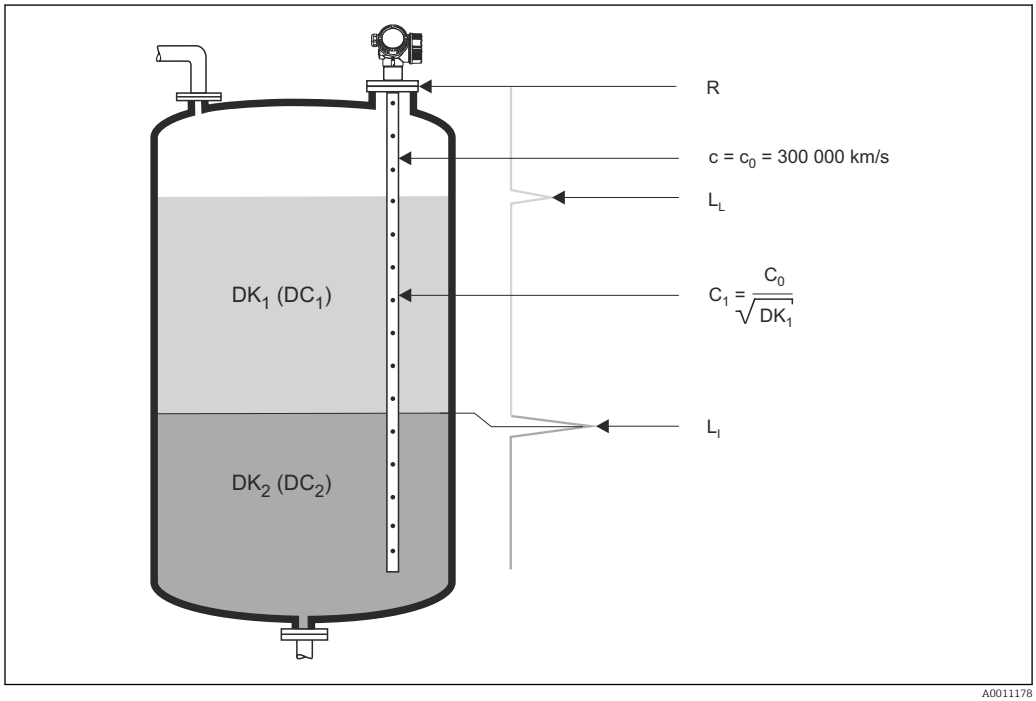
The Levelflex includes user-activated functions for filtering out interference echos (mapping). These functions guarantee that interference echoes from internal fixtures and struts are not interpreted as level echoes.

Output

The Levelflex is preadjusted 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 medium with a low DC_1, in particular, the other part enters 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 can now also be determined, taking into account the delayed time-of-flight of the pulse through the upper medium.



2 Interface measurement with the guided-wave radar

LL Total level
LI Interface level
R Reference point of measurement

In addition, the following general conditions must be observed for interface measurement:
- The relative permittivity of the upper medium must be known and constant. The relative permittivity can be determined using the DC Manual CP00019F or with the "DC Values App" (DC=dielectric constant). Furthermore, if the interface thickness is available and known, the relative permittivity can be calculated automatically in FieldCare.
- The relative permittivity of the upper medium may not exceed 10.
- The relative permittivity difference between the upper and lower medium must be >10.
- The minimum thickness of the upper medium is 60 mm (2.4 in).
- Emulsion layers in the area of the interface can greatly attenuate the signal. However, emulsion layers up to 50 mm (2 in) are permitted.

For the relative permittivity values (ε_r values) of many media commonly used in industry, please refer to:
- Relative permittivity (ε_r value), Compendium CP01076F
- The Endress+Hauser "DC Values app" (available for Android and iOS)

Product life cycle

Planning
- Universal measuring principle
- Measurement unaffected by medium properties
- Hardware and software developed according to SIL IEC61508
- Genuine, direct interface measurement

Procurement
- As the global market leader in level measurement, Endress+Hauser guarantees the security of your investment
- Worldwide support and service

Installation
- No special tools are required
- Protection against reverse polarity
- Modern, detachable terminals
- Main electronics protected by a separate connection compartment

Commissioning
- Fast, menu-guided commissioning in just 6 steps
- Plain text display in local language reduces the risk of error or confusion
- Direct local access to all parameters
- Printed Brief Operating Instructions in the device onsite

Operation
- Multi-echo tracking: Reliable measurement thanks to self-learning echo search algorithms taking into account the short-term and long-term history and plausibility of the detected signals to suppress interference echoes.
- In accordance with NAMUR NE107

Maintenance
- HistoROM: Data backup for device settings and measured values
- Exact device and process diagnostics to assist fast decisions with clear information regarding remedial action
- Intuitive, menu-guided operating concept in local language saves costs for training, maintenance and operation
- Cover of the electronics compartment can also be opened in the hazardous area

Retirement
- Order code translation for subsequent models
- RoHS-compliant (Restriction of certain Hazardous Substances), unleaded soldering of electronic components
- Environmentally friendly recycling approach

Measuring system

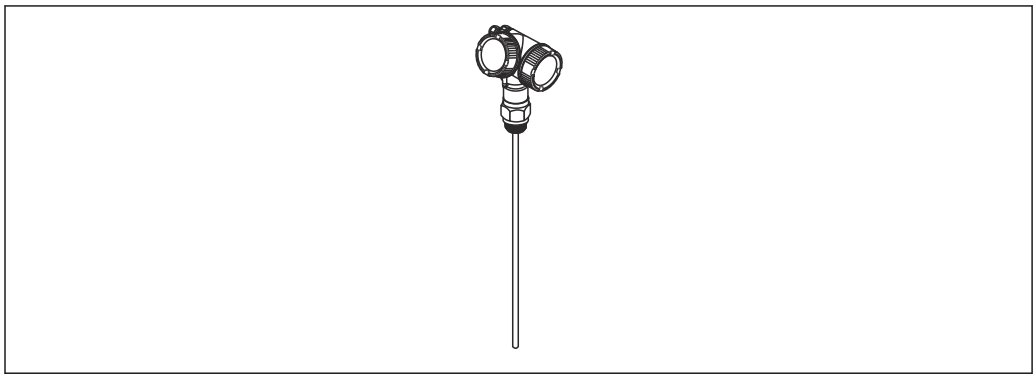
General notes on probe selection

- Rod probes or coaxial probes should normally be used for liquids. Rope probes are used in liquids for measuring ranges > 10 m (33 ft) (for FMP52: > 4 m (13 ft)) or if the ceiling clearance does not allow the installation of rigid probes.
- For interface measurement, ideally coaxial probes or rod probes are used in the bypass/stilling well.
- Coaxial probes are suitable for liquids with a viscosity of up to approx. 500 cst. The vast majority of liquefied gases can be measured with coaxial probes, provided the $\varepsilon_r > 1.4$. Furthermore, installation conditions, such as nozzles, internal fixtures in the tank etc., have no effect on the measurement when a coaxial probe is used. A coaxial probe offers maximum EMC safety when used in plastic tanks.

Probe selection

FMP51

For level measurement and interface measurement in liquids

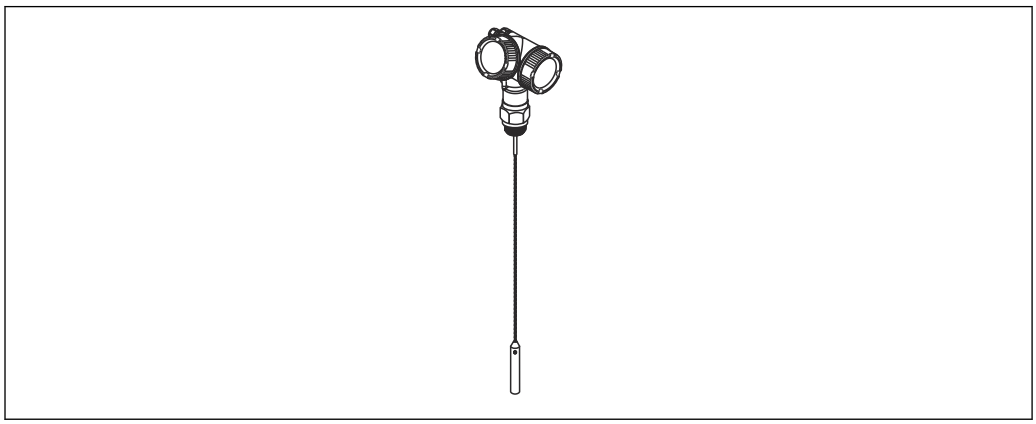


A0011387

3 Rod probe

Rod probe

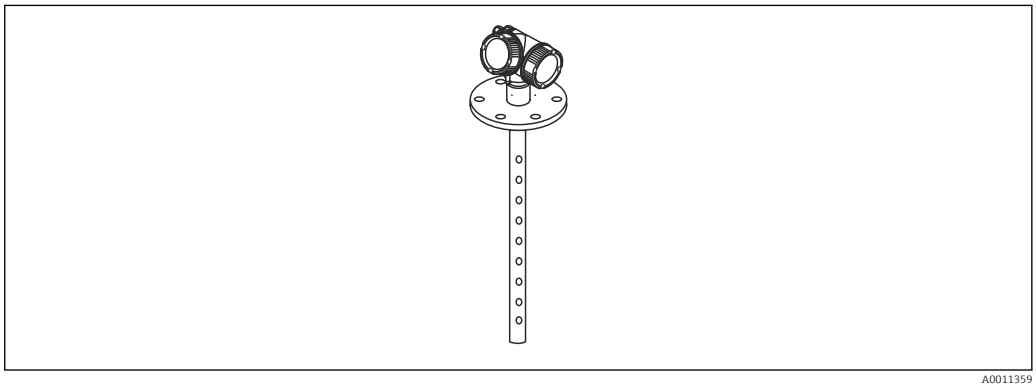
- Maximum probe length
  - 4 m (13 ft); inseparable rod probes
  - 10 m (33 ft); separable rod probes
- Material:
  - 316L; inseparable and separable rod probes
  - Alloy C; only inseparable rod probes



A0011388

4 Rope probe with centering rod

Rope probe
- Maximum probe length 45 m (148 ft)
- Material:
  - 316L
  - Alloy C
  - PFA>316L



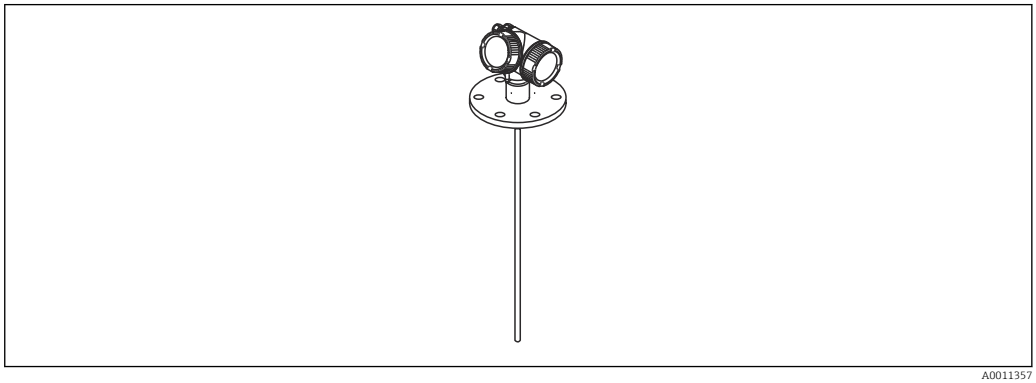
A0011359

5 Coaxial probe

Coaxial probe
- Maximum probe length 6 m (20 ft)
- Material:
  - 316L, multiple holes
  - Alloy C, one hole

FMP52

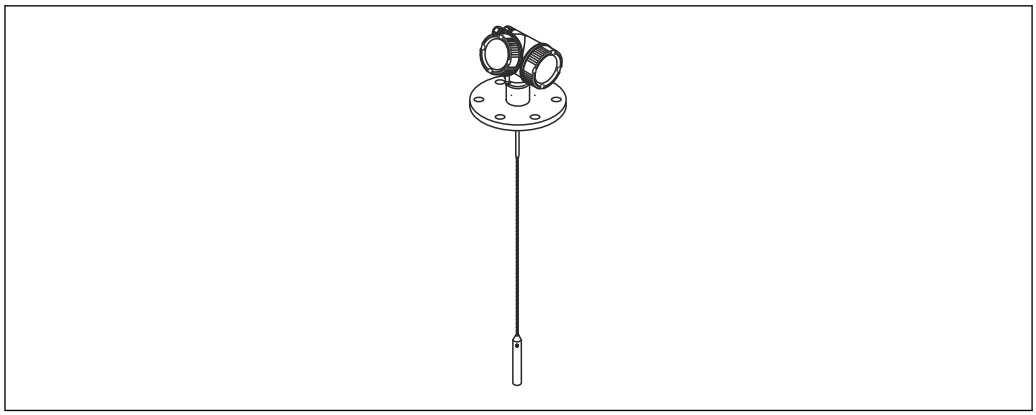
For level measurement and interface measurement in corrosive liquids



A0011357

6 Rod probe

Rod probe
- Maximum probe length 4 m (13 ft)
- Material PFA > 316 L

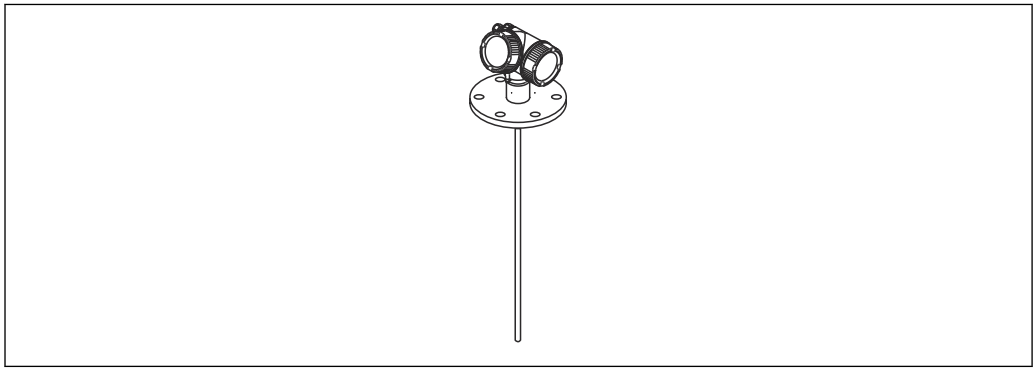


7 Rope probe with centering rod

Rope probe
- Maximum probe length 45 m (148 ft)
- Material PFA > 316 L

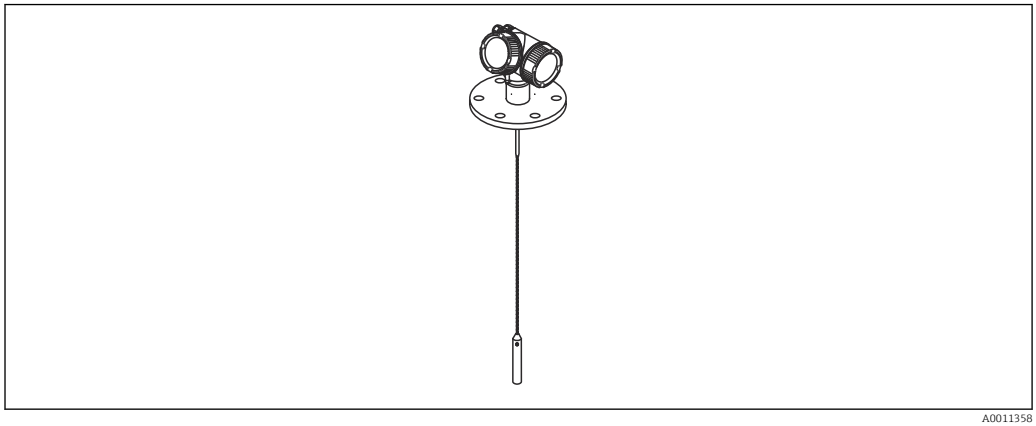
FMP54

For level measurement and interface measurement in liquids



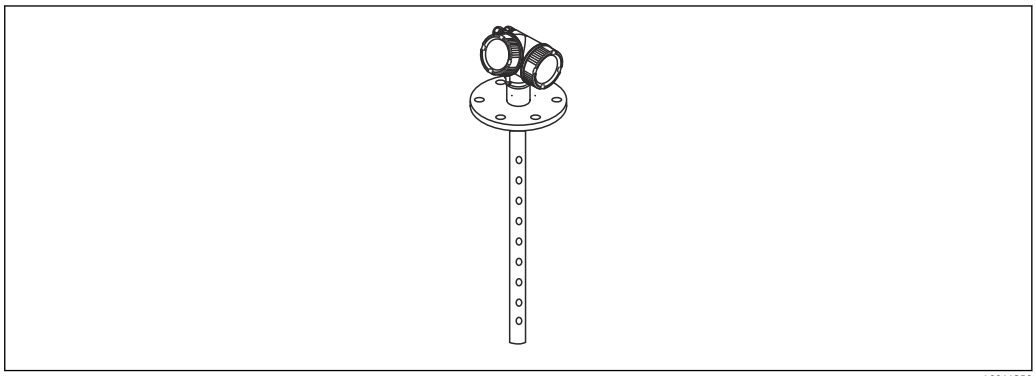
8 Rod probe

Rod probe
- Maximum probe length 4 m (13 ft)
- Material 316 L



9 Rope probe with centering rod

Rope probe
- Maximum probe length 45 m (148 ft)
- Material 316 L



A0011359

10 Coaxial probe

Coaxial probe
- Maximum probe length 6 m (20 ft)
- Material 316 L, multiple holes

Input

Measured variable

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

The level is calculated based on **E**, the empty distance entered.

Optionally, the level can be converted to other variables (volume, mass) by linearization (32 points).

Measuring range

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

Levelflex FMP51, FMP54						
Medium group	ε_r	Typical liquids	Measuring range [1]			
			Bare metallic Rod probes	Bare metallic Rope probes	PFA-coated Rope probes	Coaxial probes
1	1.4 to 1.6	Liquefied gases, e.g. N_2, CO_2	On request		–	6 m (20 ft)
2	1.6 to 1.9	▪ Liquefied gas, e.g. propane ▪ Solvents ▪ Freon ▪ Palm oil	▪ One-piece: 4 m (13 ft) ▪ Separable: 10 m (33 ft)	15 to 22 m (49 to 72 ft)	9 to 14 m (30 to 46 ft)	6 m (20 ft)
3	1.9 to 2.5	Mineral oils, fuels	▪ One-piece: 4 m (13 ft) ▪ Separable: 10 m (33 ft)	22 to 32 m (72 to 105 ft)	14 to 21 m (46 to 69 ft)	6 m (20 ft)
4	2.5 to 4.0	▪ Benzene, styrene, toluene ▪ Furan ▪ Naphthalene	▪ One-piece: 4 m (13 ft) ▪ Separable: 10 m (33 ft)	32 to 42 m (105 to 138 ft)	21 to 28 m (69 to 92 ft)	6 m (20 ft)
5	4.0 to 7.0	▪ Chlorobenzene, chloroform ▪ Nitrocellulose lacquers ▪ Isocyanate, aniline	▪ One-piece: 4 m (13 ft) ▪ Separable: 10 m (33 ft)	42 to 45 m (138 to 148 ft)	28 to 32 m (92 to 105 ft)	6 m (20 ft)
6	> 7.0	▪ Aqueous solutions ▪ Alcohols ▪ Ammonia	▪ One-piece: 4 m (13 ft) ▪ Separable: 10 m (33 ft)	45 m (148 ft)	32 to 45 m (105 to 148 ft)	6 m (20 ft)

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

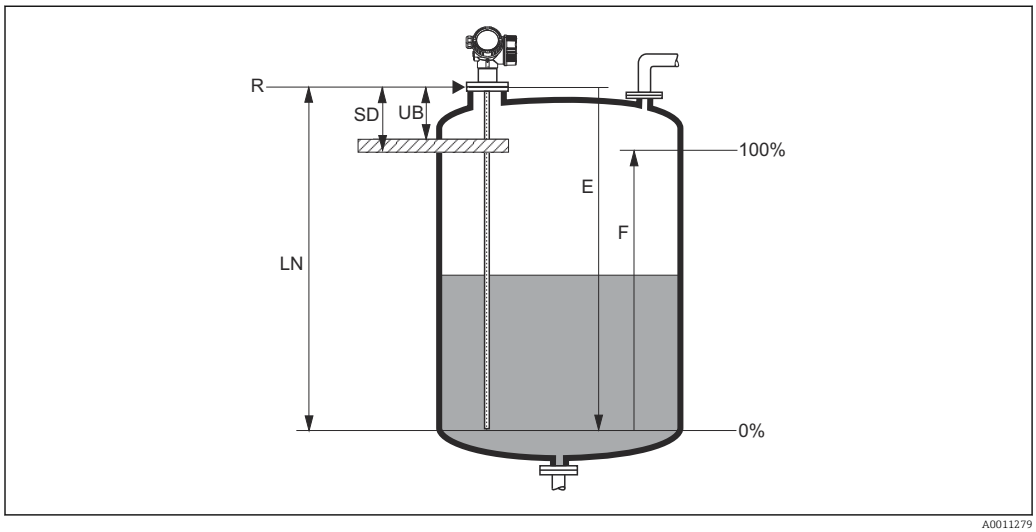
Levelflex FMP52				
Medium group	ε_r	Typical liquids	Measuring range [1]	
			PFA-coated Rod probes	PFA-coated Rope probes
1	1.4 to 1.6	Liquefied gases, e.g. N_2, CO_2	–	–
2	1.6 to 1.9	▪ Liquefied gas, e.g. propane ▪ Solvents ▪ Freon ▪ Palm oil	4 m (13 ft)	9 to 14 m (30 to 46 ft)
3	1.9 to 2.5	Mineral oils, fuels	4 m (13 ft)	14 to 21 m (46 to 69 ft)
4	2.5 to 4.0	▪ Benzene, styrene, toluene ▪ Furan ▪ Naphthalene	4 m (13 ft)	21 to 28 m (69 to 92 ft)
5	4.0 to 7.0	▪ Chlorobenzene, chloroform ▪ Nitrocellulose lacquers ▪ Isocyanate, aniline	4 m (13 ft)	28 to 32 m (92 to 105 ft)
6	> 7.0	▪ Aqueous solutions ▪ Alcohols ▪ Acids, alkalis	4 m (13 ft)	32 to 45 m (105 to 148 ft)

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

- The formation of buildup, particularly of moist products, can reduce the maximum possible measuring range
- Due to the high diffusion rate of ammonia, a gas-tight feedthrough is recommended for measurements in this medium
  - Gas-tight feedthrough optionally available for FMP51/FMP52
  - Gas-tight feedthrough included as standard for FMP54

Blocking distance

The upper blocking distance **UB** is the minimum distance from the reference point **R** of the measurement to the maximum level.



11 Definition of blocking distance and safety distance

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

Blocking distance (factory setting):
- For coaxial probes: 0 mm (0 in)
- For rod and rope probes up to 8 m (26 ft): 200 mm (8 in)
- For rod and rope probes over 8 m (26 ft): 0.025 × probe length

The specified blocking distances are factory-preset on delivery. These settings can be changed depending on the application.

For rod and rope probes, the blocking distance can generally be reduced to 100 mm (4 in) for media with $\varepsilon_r > 7.0$.

No blocking distance applies for applications in a bypass/stilling well.

A reliable measurement cannot be guaranteed within the blocking distance.

A safety distance **SD** can be defined in addition to the blocking distance. The device generates a warning if the level rises to enter this safety distance.

Measuring frequency spectrum

100 MHz to 1.5 GHz

Output

Output signal

HART
- Signal coding:
  FSK ±0.5 mA over current signal
- Data transmission rate:
  1 200 Bit/s
- Galvanic isolation:
  Yes

Bluetooth® wireless technology
- Device version:
  Order code 610 "Accessory mounted", option NF "Bluetooth"
- Operation / configuration:
  Via the *SmartBlue* app
- Range under reference conditions:
  > 10 m (33 ft)
- Encryption:
  Encrypted communication and password encryption prevent incorrect operation by unauthorized persons

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

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

Switch output

For HART devices, the switch output is available as an option.

- Function:
  Open collector switch output
- Switching behavior:
  Binary (conductive or non-conductive), switches when the programmable switch-on point/switch-off point is reached
- Failure mode:
  Non-conductive
- Electrical connection data:
  U = 16 to 35 V_{DC}, I = 0 to 40 mA
- Internal resistor:
  R_i < 880 Ω
  The voltage drop at this internal resistor must be taken into account when planning the configuration. For example, the resulting voltage at a connected relay must be sufficient to switch the relay.
- Insulation voltages:
  Floating, insulation voltage 1350 V_{DC} in relation to power supply and 500 V_{AC} ground
- Switch point:
  User-programmable, separate for switch-on point and switch-off point
- Switching delay:
  User-programmable in the 0 to 100 s range, separate for switch-on point and switch-off point
- Scan rate:
  Corresponds to the measuring cycle
- Signal source / device variables:
  - Level linearized
  - Distance
  - Terminal voltage
  - Electronic temperature
  - Relative echo amplitude
  - Diagnostic values, advanced diagnostic blocks
  - Only for active interface measurement
- Signal source / device variables for active interface measurement:
  - Interface linearized
  - Interface distance
  - Upper interface distance
  - Relative interface amplitude
- Number of switch cycles:
  Unlimited

Signal on alarm

Depending on the interface, failure information is displayed as follows:
- Current output
  - Choice of failure mode (in accordance with NAMUR Recommendation NE 43):
    Minimum alarm: 3.6 mA
    Maximum alarm (= factory setting): 22 mA
  - Failure mode with user-configurable value: 3.59 to 22.5 mA
- Local display
  - Status signal (as per NAMUR Recommendation NE 107)
  - Plain text display
- Operating tool via digital communication (HART, PROFIBUS PA, FOUNDATION Fieldbus) or service interface (CDI)
  - Status signal (as per NAMUR Recommendation NE 107)
  - Plain text display

Linearization

The device's linearization function allows the user to convert the measured value to any length or volume units. Linearization tables for calculating the volume in cylindrical vessels are preprogrammed into the device. 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

HART

Manufacturer ID:
17 (0x11{hex})

Device type ID:
0x1122

HART specification:
7

Device description files (DTM, DD)
Information and files available at:
- www.endress.com
  On the product page for the device: Documents/Software → Device drivers
- www.fieldcommgroup.org

HART load:
Min. 250 Ω

HART device variables

The measured values can be freely assigned to the device variables.

Measured values for PV (primary variable)
- Level linearized
- Distance
- For active interface measurement:
  - Interface
  - Interface distance
  - Upper interface thickness
  - Relative interface amplitude
- Electronics temperature
- Relative echo amplitude

Measured values for SV, TV, QV (second, third and fourth variable)
- Level linearized
- Distance
- For active interface measurement:
  - Interface linearized
  - Interface distance
  - Upper interface thickness
  - Absolute interface amplitude
  - Relative interface amplitude
- Terminal voltage
- Electronics temperature
- Absolute echo amplitude
- Relative echo amplitude
- Calculated ε_r value

Supported functions

- Burst mode
- Additional transmitter status

Wireless HART data

Minimum start-up voltage:
17.5 V

Start-up current:
4 mA

Starting time:
80 s

Minimum operating voltage:
17.5 V

Multidrop current:
4.0 mA

Time to establish connection:
30 s

PROFIBUS PA

Manufacturer ID:
17 (0x11)

Ident number:
0x1568 or 0x9700

Profile version:
3.02

GSD file and version
Information and files available at:
- www.endress.com
  On the product page for the device: Documents/Software → Device drivers
- www.profibus.com

Output values

Analog Input:
- Level linearized
- Distance
- For active interface measurement:
  - Interface
  - Interface distance
  - Upper interface thickness
  - Absolute interface amplitude
  - Absolute interface amplitude
- Terminal voltage
- Electronics temperature
- Absolute echo amplitude
- Relative echo amplitude
- Calculated ε_r value

Digital Input:
- Extended diagnostic blocks
- Status output PFS Block

Input values

Analog Output:
- Analog value from PLC (for sensor block, external pressure and temperature)
- Analog value from PLC to be indicated on the display

Digital Output:
- Extended diagnostic block
- Level Limiter
- Sensor Block Measurement On
- Sensor Block Save History On
- Status output

Supported functions

- Identification & Maintenance
  Straightforward device identification on the part of the control system and nameplate
- Automatic Ident Number Adoption
  GSD compatibility mode for generic profile 0x9700 "Transmitter with 1 Analog Input"
- Physical Layer Diagnostics
  Installation check of the PROFIBUS segment and device using terminal voltage and message monitoring
- PROFIBUS Upload/download
  Reading and writing parameters is up to ten times faster with PROFIBUSupload/download
- Condensed Status
  Straightforward and self-explanatory diagnostic information by categorizing diagnostic messages that occur

FOUNDATION Fieldbus

Manufacturer ID	0x452B48
Device type	0x1028

Device revision	0x01
DD revision CFF revision	Information and files available at: ▪ www.endress.com ▪ www.fieldcommgroup.org
Device Tester Version (ITK version)	6.0.1
ITK Test Campaign Number	IT085300
Link Master capability (LAS)	Yes
Choice of "Link Master" and "Basic Device"	Yes; factory setting: Basic Device
Node address	Factory setting: 247 (0xF7)
Supported functions	The following methods are supported: ▪ Restart ▪ ENP Restart ▪ Setup ▪ Linearization ▪ Self Check
Virtual Communication Relationships (VCRs)	
Number of VCRs	44
Number of link objects in VFD	50
Permanent entries	1
Client VCRs	0
Server VCRs	10
Source VCRs	43
Sink VCRs	0
Subscriber VCRs	43
Publisher VCRs	43
Device Link Capabilities	
Slot time	4
Min. delay between PDU	8
Max. response delay	20

Transducer blocks

Block	Content	Output values
Setup Transducer Block	Contains all the parameters for standard commissioning	▪ Level or volume (channel 1) (depending on the block configuration) ▪ Distance (channel 2)
Advanced Setup Transducer Block	Contains all the parameters for more accurate measurement configuration	No output values
Display Transducer Block	Contains parameters to configure the onsite display	No output values
Diagnostic Transducer Block	Contains diagnostic information	No output values
Advanced Diagnostic Transducer Block	Contains parameters for advanced diagnostics	No output values
Expert Configuration Transducer Block	Contains parameters that require the user to have in-depth knowledge of the operation of the device in order to configure the parameters appropriately	No output values
Expert Information Transducer Block	Contains parameters that provide information about the state of the device	No output values
Service Sensor Transducer Block	Contains parameters that can only be accessed by Endress+Hauser Service	No output values

Block	Content	Output values
Service Information Transducer Block	Contains parameters that provide Endress+Hauser Service with information about the state of the device	No output values
Data Transfer Transducer Block	Contains parameters for backing up the device configuration in the display module and for writing the saved configuration to the device. Access to these parameters is reserved for Endress+Hauser Service.	No output values

Function blocks

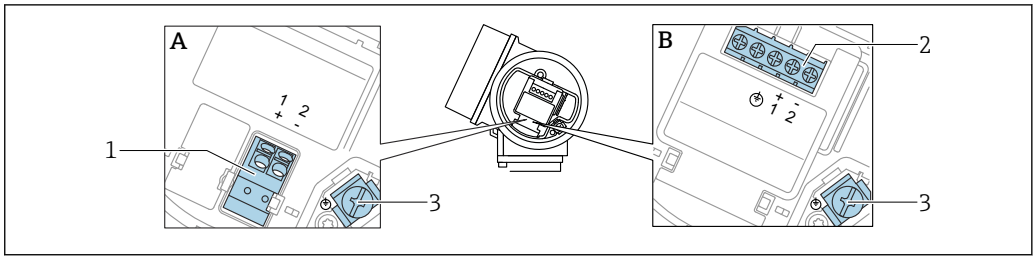
Block	Content	Number of permanent blocks	Number of instantiatable blocks	Execution time	Functionality
Resource Block	The Resource Block contains all the data that uniquely identify the device. It is an electronic version of a nameplate of the device.	1	0	-	Extended
Analog Input Block	The AI Block receives the measuring data from the Sensor Block (selectable via a channel number), and makes the data available to other blocks at its output.	2	3	25 ms	Extended
Discrete Input Block	The Discrete Input Block receives a discrete value (e.g. indicator that measuring range has been exceeded) and makes the value available for other blocks at the output.	1	2	20 ms	Standard
Multiple Analog Output Block	The Multiple Analog Output Block is used to transmit analog values from the bus to the device.	1	0	20 ms	Standard
Multiple Discrete Output Block	The Multiple Discrete Output Block is used to transmit discrete values from the bus to the device.	1	0	20 ms	Standard
PID Block	The PID Block is used as a proportional-integral-derivative controller and can be used universally for closed-loop-control in the field. It enables cascade mode and feedforward control.	1	1	25 ms	Standard
Arithmetic Block	This block is designed to enable the simple use of common mathematical functions in measuring technology. The user does not have to know how to write equations. The math algorithm is selected by name, chosen by the user for the function to be performed.	1	1	25 ms	Standard
Signal Characterizer Block	The Signal Characterizer Block has two sections, each with an output value that is a non-linear function of the input value. The non-linear function is generated by a single look-up table with 21 arbitrary x-y pairs.	1	1	25 ms	Standard
Input Selector Block	This block facilitates the selection of up to four inputs and generates an output value based on the configured action. This block normally receives its inputs from AI Blocks. The block enables the selection of maximum, minimum, average and 'first good' values.	1	1	25 ms	Standard
Integrator Block	The Integrator Block integrates a variable as a function of the time or accumulates the counts from a Pulse Input Block. The Block can be used as a totalizer that totalizes until a reset, or as a batch totalizer whereby the integrated value is compared against a target value generated before or during the control routine and generates a binary signal when the target value is reached.	1	1	25 ms	Standard
Analog Alarm Block		1	1	25 ms	Standard

Up to 20 blocks can be instantiated in the device altogether, including the blocks already instantiated.

Power supply

Terminal assignment

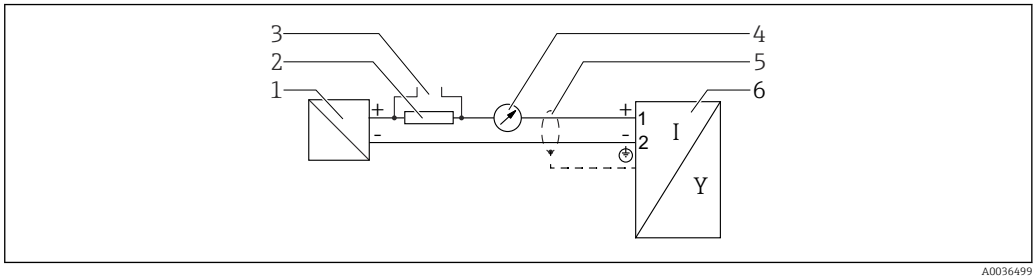
Terminal assignment, 2-wire: 4 to 20 mA HART



12 *Terminal assignment, 2-wire: 4 to 20 mA HART*

A Without integrated overvoltage protection
B With integrated overvoltage protection
1 Connection 4 to 20 mA, HART passive: terminals 1 and 2, without integrated overvoltage protection
2 Connection 4 to 20 mA, HART passive: terminals 1 and 2, with integrated overvoltage protection
3 Terminal for cable shield

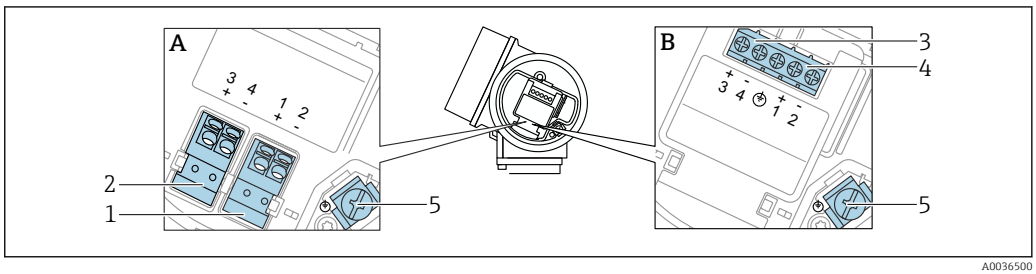
Function diagram 4 to 20 mA HART



13 *Function diagram 4 to 20 mA HART*

1 Active barrier for power supply; observe terminal voltage
2 Resistor for HART communication (≥ 250 Ω); observe maximum load
3 Connection for Commubox FXA195 or FieldXpert (via VIATOR Bluetooth modem)
4 Analog display unit; observe maximum load
5 Cable screen; observe cable specification
6 Measuring instrument

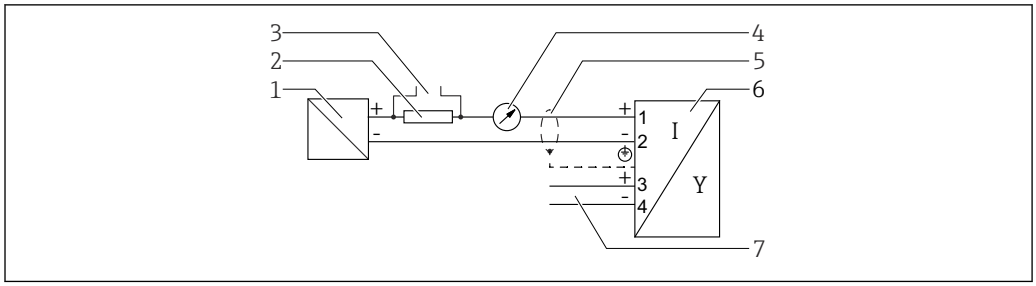
Terminal assignment, 2-wire: 4 to 20 mA HART, switch output



14 *Terminal assignment, 2-wire: 4 to 20 mA HART, switch output*

A Without integrated overvoltage protection
B With integrated overvoltage protection
1 Connection 4 to 20 mA, HART passive: terminals 1 and 2, without integrated overvoltage protection
2 Connection, switch output (open collector): terminals 3 and 4, without integrated overvoltage protection
3 Connection, switch output (open collector): terminals 3 and 4, with integrated overvoltage protection
4 Connection 4 to 20 mA, HART passive: terminals 1 and 2, with integrated overvoltage protection
5 Terminal for cable shield

Function diagram 4 to 20 mA HART, switching output (optional)

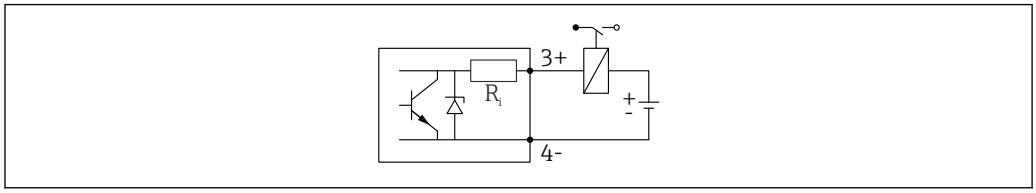


A0036501

15 Function diagram 4 to 20 mA HART, switching output

1 Active barrier for power supply; observe terminal voltage
2 Resistor for HART communication (≥ 250 Ω); observe maximum load
3 Connection for Commubox FXA195 or FieldXpert (via VIATOR Bluetooth modem)
4 Analog display unit; observe maximum load
5 Cable screen; observe cable specification
6 Measuring instrument
7 Switching output (open collector)

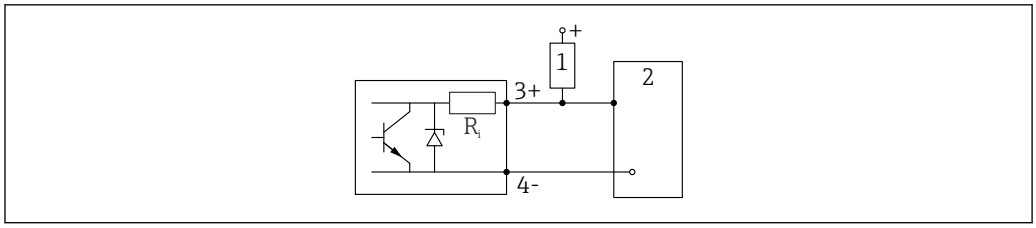
Connection example of relay



A0015909

16 Connection example of relay

Connection example for the digital input

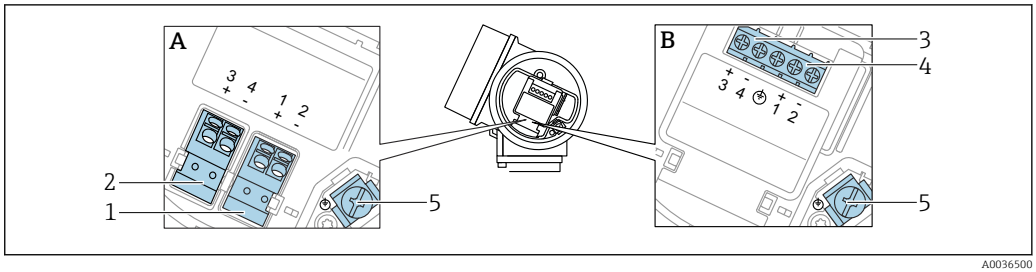


A0015910

17 Connection example for the digital input

1 Pull-up resistor
2 Digital input

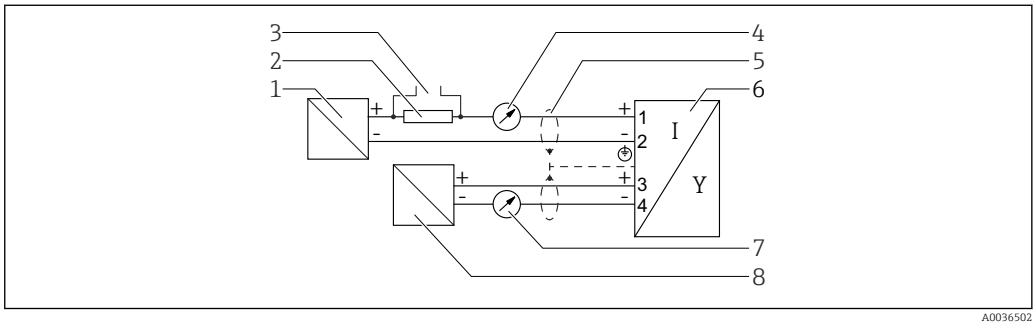
Terminal assignment, 2-wire: 4 to 20 mA HART, 4 to 20 mA



18 *Terminal assignment, 2-wire: 4 to 20 mA HART, 4 to 20 mA*

A Without integrated overvoltage protection
B With integrated overvoltage protection
1 Connection current output 1, 4 to 20 mA HART passive: terminals 1 and 2, without integrated overvoltage protection
2 Connection current output 2, 4 to 20 mA: terminals 3 and 4, without integrated overvoltage protection
3 Connection current output 2, 4 to 20 mA: terminals 3 and 4, with integrated overvoltage protection
4 Connection current output 1, 4 to 20 mA HART passive: terminals 1 and 2, with integrated overvoltage protection
5 Terminal for cable shield

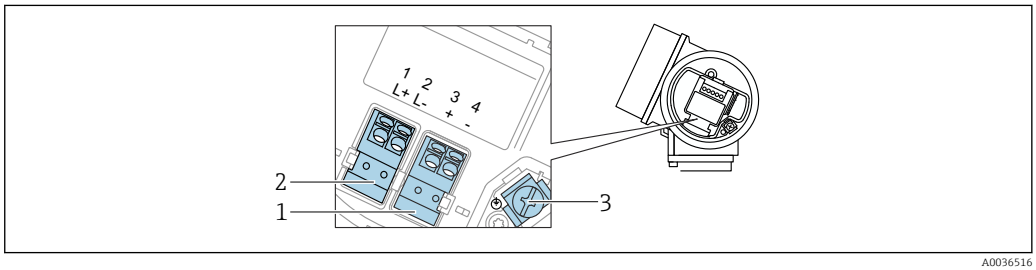
Function diagram 4 to 20 mA HART + 4 to 20 mA analog (optional)



19 *Function diagram 4 to 20 mA HART + 4 to 20 mA analog*

1 Active barrier for power supply, current output 1; observe terminal voltage
2 Resistor for HART communication (≥ 250 Ω); observe maximum load
3 Connection for Commubox FXA195 or FieldXpert (via VIATOR Bluetooth modem)
4 Analog display unit; observe maximum load
5 Cable screen; observe cable specification
6 Measuring instrument
7 Analog display unit; observe maximum load
8 Active barrier for power supply, current output 2; observe terminal voltage

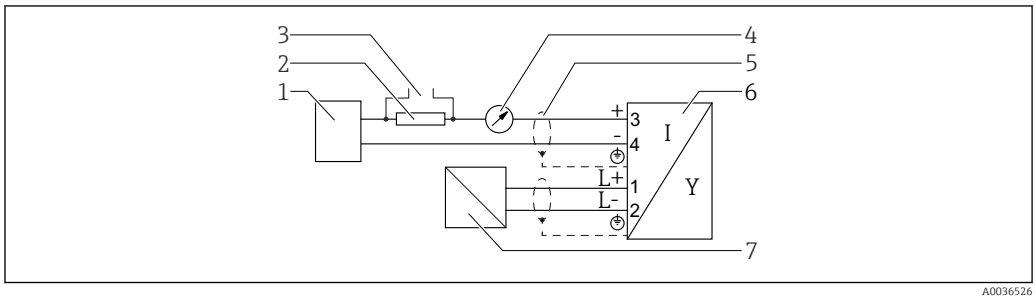
Terminal assignment, 4-wire: 4 to 20 mA HART (10.4 to 48 V_{DC})



20 *Terminal assignment, 4-wire: 4 to 20 mA HART (10.4 to 48 V_{DC})*

1 Connection 4 to 20 mA HART (active): terminals 3 and 4
2 Power supply connection: terminals 1 and 2
3 Terminal for cable shield

Function diagram 4-wire: 4 to 20 mA HART (10.4 to 48 V_{DC})

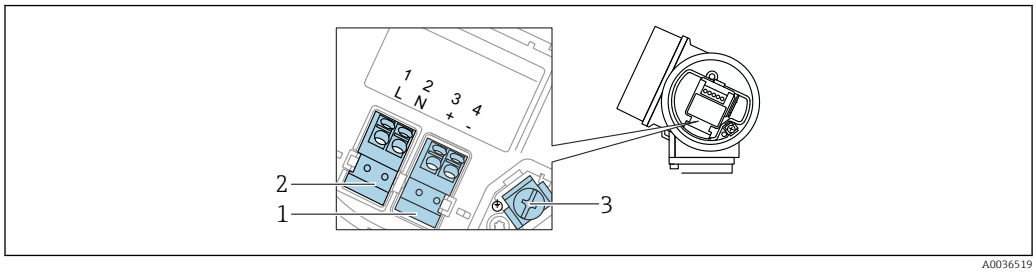


A0036526

21 Function diagram 4-wire: 4 to 20 mA HART (10.4 to 48 V_{DC})

1 *Evaluation unit, e.g. PLC*
2 *Resistor for HART communication (≥ 250 Ω); observe maximum load*
3 *Connection for Commubox FXA195 or FieldXpert (via VIATOR Bluetooth modem)*
4 *Analog display unit; observe maximum load*
5 *Cable screen; observe cable specification*
6 *Device*
7 *Supply voltage; observe terminal voltage, observe cable specification*

Terminal assignment, 4-wire: 4 to 20 mA HART (90 to 253 V_{AC})



A0036519

22 Terminal assignment, 4-wire: 4 to 20 mAHART (90 to 253 V_{AC})

1 *Connection 4 to 20 mA HART (active): terminals 3 and 4*
2 *Power supply connection: terminals 1 and 2*
3 *Terminal for cable shield*

⚠ CAUTION

To ensure electrical safety:

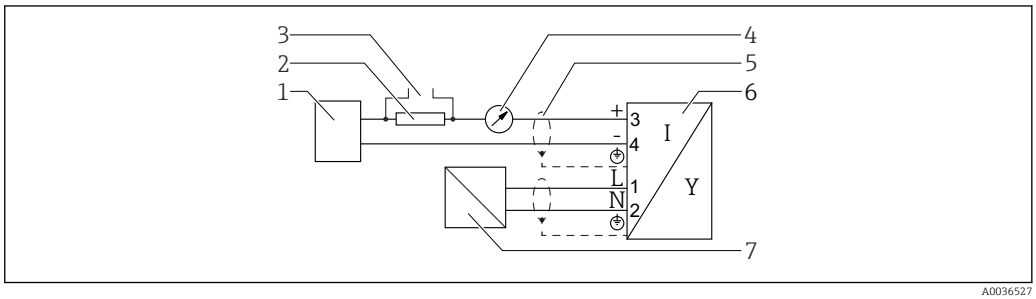
- ▶ Do not disconnect the protective ground connection.
- ▶ Disconnect the device from the supply voltage before disconnecting the protective ground.

Connect protective ground to the inner ground terminal (3) before connecting the power supply. If necessary, connect the potential matching line to the outer ground terminal.

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

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

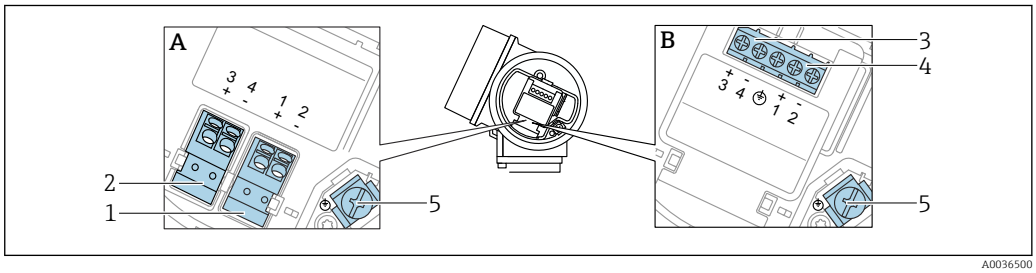
Function diagram 4-wire: 4 to 20 mA HART (90 to 253 V_{AC})



23 *Function diagram 4-wire: 4 to 20 mA HART (90 to 253 V_{AC})*

1 *Evaluation unit, e.g. PLC*
2 *Resistor for HART communication (≥ 250 Ω); observe maximum load*
3 *Connection for Commubox FXA195 or FieldXpert (via VIATOR Bluetooth modem)*
4 *Analog display unit; observe maximum load*
5 *Cable screen; observe cable specification*
6 *Device*
7 *Supply voltage; observe terminal voltage, observe cable specification*

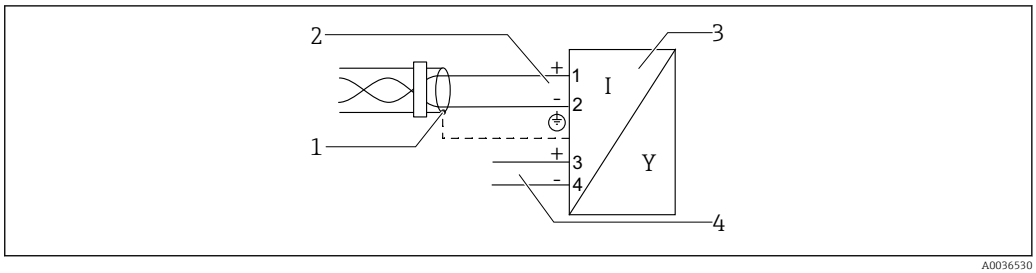
Terminal assignment PROFIBUS PA / FOUNDATION Fieldbus



24 *Terminal assignment PROFIBUS PA / FOUNDATION Fieldbus*

A *Without integrated overvoltage protection*
B *With integrated overvoltage protection*
1 *Connection, PROFIBUS PA / FOUNDATION Fieldbus: terminals 1 and 2, without integrated overvoltage protection*
2 *Connection, switch output (open collector): terminals 3 and 4, without integrated overvoltage protection*
3 *Connection, switch output (open collector): terminals 3 and 4, with integrated overvoltage protection*
4 *Connection, PROFIBUS PA / FOUNDATION Fieldbus: terminals 1 and 2, with integrated overvoltage protection*
5 *Terminal for cable shield*

Block view PROFIBUS PA / FOUNDATION Fieldbus

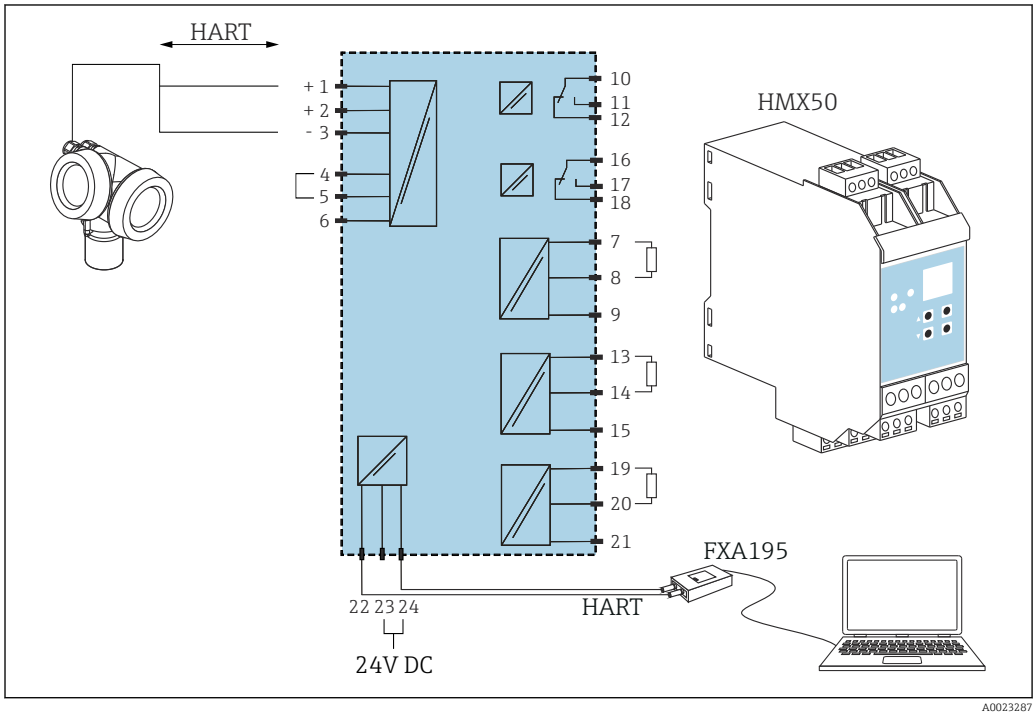


25 *Block view PROFIBUS PA / FOUNDATION Fieldbus*

1 *Cable screen; observe cable specification*
2 *Connection PROFIBUS PA / FOUNDATION Fieldbus*
3 *Measuring instrument*
4 *Switch output (open collector)*

HART loop converter HMX50

The dynamic variables of the HART protocol can be converted into individual 4 to 20 mA sections using the HART loop converter HMX50. The variables are assigned to the current output and the measuring ranges of the individual parameters are defined in the HMX50.



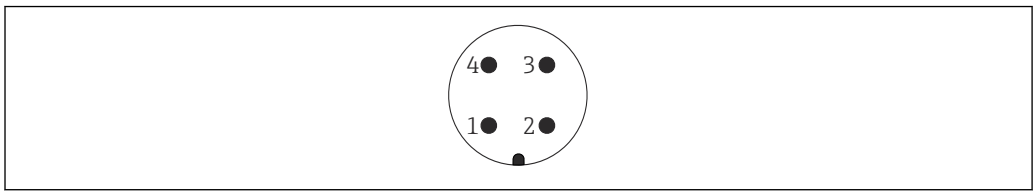
26 *Connection diagram for HART loop converter HMX50 (example: passive 2-wire device and current outputs connected as power source)*

The HART loop converter HMX50 can be acquired using the order number 71063562.

Additional documentation: TI00429F and BA00371F.

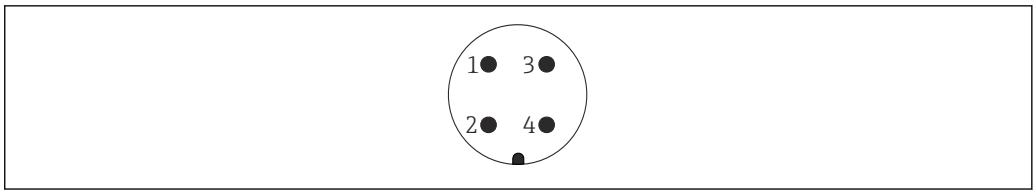
Device plug

In the case of the device versions with a plug, the housing does not need to be opened to connect the signal cable.



27 *Pin assignment of M12 plug*

1 *Signal +*
2 *Not assigned*
3 *Signal -*
4 *Ground*



28 Pin assignment of 7/8" plug

1 Signal -
2 Signal +
3 Not assigned
4 Shielding

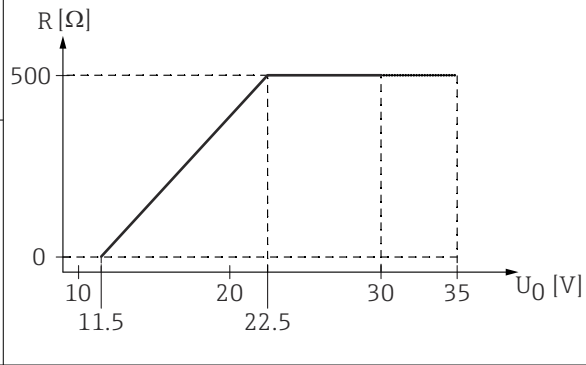
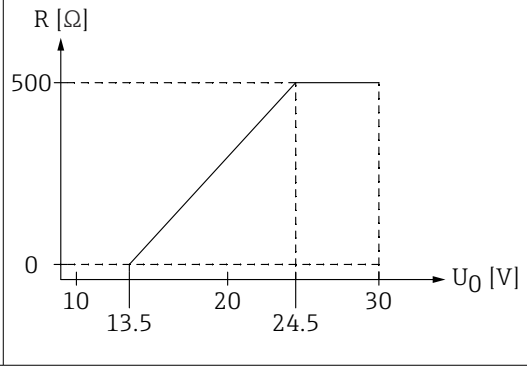
Supply voltage

An external power supply is necessary.

Various power supply units can be ordered from Endress+Hauser.

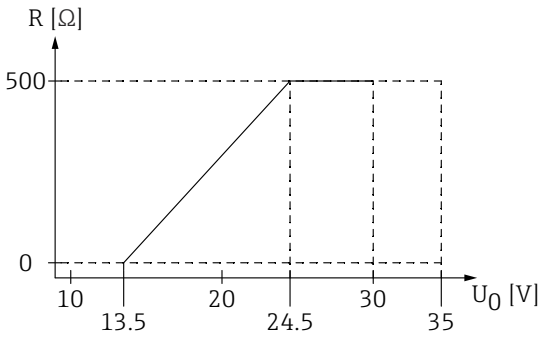
2-wire, 4-20mA HART, passive

2-wire; 4-20mA HART [1]

"Approval" [2]	Terminal voltage U at device	Maximum load R, depending on the supply voltage U_0 of the power supply unit
▪ Non-hazardous ▪ Ex nA ▪ Ex ic ▪ CSA GP	11.5 to 35 V [3] [4]	
Ex ia / IS	11.5 to 30 V [4]	
▪ Ex d / XP ▪ Ex ic[ia] ▪ Ex tD / DIP	13.5 to 30 V [4] [5]	

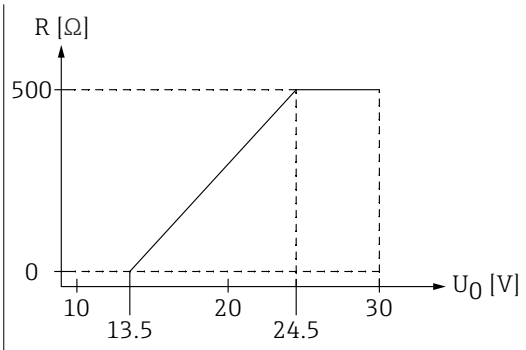
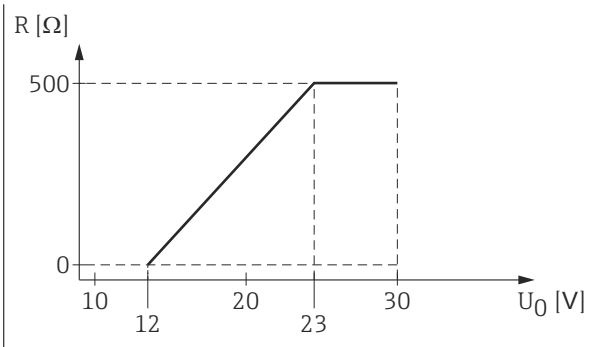
1) Feature 020 in the product structure: option A
2) Feature 010 in the product structure
3) At ambient temperatures $T_a \leq -30$ °C, a terminal voltage U ≥ 14 V is required to start the device with the minimum failure current (3.6 mA). At ambient temperatures $T_a > 60$ °C, a terminal voltage U ≥ 12 V is required to start the device with the minimum failure current (3.6 mA). The start-up current can be configured. If the device is operated with a fixed current I ≥ 4.5 mA (HART Multidrop mode), a voltage U ≥ 11.5 V in the entire ambient temperature range suffices.
4) If the Bluetooth module is used, the minimum supply voltage increases by 2 V.
5) At ambient temperatures $T_a \leq -30$ °C, a terminal voltage U ≥ 16 V is required to start the device with the minimum failure current (3.6 mA).

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

"Approval" [2]	Terminal voltage U at device	Maximum load R, depending on the supply voltage U_0 of the power supply unit
▪ Non-hazardous ▪ Ex nA ▪ Ex nA(ia) ▪ Ex ic ▪ Ex ic[ia] ▪ Ex d[ia] / XP ▪ Ex ta / DIP ▪ CSA GP	13.5 to 35 V [3] [4]	
▪ Ex ia / IS ▪ Ex ia + Ex d[ia] / IS + XP	13.5 to 30 V [3] [4]	

1) Feature 020 in the product structure: option B
2) Feature 010 in the product structure
3) At ambient temperatures $T_a \leq$ -30 °C, a terminal voltage U ≥ 16 V is required to start the device with the minimum failure current (3.6 mA).
4) If the Bluetooth module is used, the minimum supply voltage increases by 2 V.

2-wire; 4-20mA HART, 4-20mA [1]

"Approval" [2]	Terminal voltage U at device	Maximum load R, depending on the supply voltage U_0 of the power supply unit
all	**Channel 1:**	
	13.5 to 30 V [3] [4] [5]	
	Channel 2:	
	12 to 30 V	

1) Feature 020 in the product structure: option C
2) Feature 010 in the product structure
3) At ambient temperatures $T_a \leq$ -30 °C, a terminal voltage U ≥ 16 V is required to start the device with the minimum failure current (3.6 mA).
4) At ambient temperatures $T_a \leq$ -40 °C, the maximum terminal voltage must be limited to U ≤ 28 V.
5) If the Bluetooth module is used, the minimum supply voltage increases by 2 V.

Integrated polarity reversal protection	Yes
Permitted residual ripple with f = 0 to 100 Hz	U_{SS} < 1 V
Permitted residual ripple with f = 100 to 10 000 Hz	U_{SS} < 10 mV

4-wire, 4-20mA HART, active

"Power supply; output" [1]	Terminal voltage U	Maximum load R_{max}
K: 4-wire 90-253VAC; 4-20mA HART	90 to 253 V_{AC} (50 to 60 Hz), overvoltage category II	500 Ω
L: 4-wire 10.4-48VDC; 4-20mA HART	10.4 to 48 V_{DC}	

1) Feature 020 in the product structure

PROFIBUS PA, FOUNDATION Fieldbus

"Power supply; output" [1]	"Approval" [2]	Terminal voltage
E: 2-wire; FOUNDATION Fieldbus, switch output **G:** 2-wire; PROFIBUS PA, switch output	▪ Non-hazardous ▪ Ex nA ▪ Ex nA[ia] ▪ Ex ic ▪ Ex ic[ia] ▪ Ex d[ia] / XP ▪ Ex ta / DIP ▪ CSA GP	9 to 32 V [3]
	▪ Ex ia / IS ▪ Ex ia + Ex d[ia] / IS + XP	9 to 30 V [3]

1) Feature 020 in the product structure
2) Feature 010 in the product structure
3) Input voltages up to 35 V do not damage the device.

Polarity-dependent	Yes
FISCO/FNICO compliant according to IEC 60079-27	Yes

Power consumption

"Power supply; Output" [1]	Power consumption
A: 2-wire; 4-20mA HART	< 0.9 W
B: 2-wire; 4-20mA HART, switch output	< 0.9 W
C: 2-wire; 4-20mA HART, 4-20mA	< 2 x 0.7 W
K: 4-wire 90-253VAC; 4-20mA HART	6 VA
L: 4-wire 10,4-48VDC; 4-20mA HART	1.3 W

1) Feature 020 of the product structure

Current consumption

HART

Nominal current	3.6 to 22 mA, the start-up current for multidrop mode can be parametrized (is set to 3.6 mA on delivery)
Breakdown signal (NAMUR NE43)	adjustable: 3.59 to 22.5 mA

PROFIBUS PA

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

FOUNDATION Fieldbus

Device basic current	15 mA
Failure current FDE (Fault Disconnection Electronic)	0 mA

FISCO

U_i	17.5 V
I_i	550 mA
P_i	5.5 W
C_i	5 nF
L_i	10 µH

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

- **Without integrated overvoltage protection**
  Plug-in spring terminals for wire cross-sections 0.5 to 2.5 mm² (20 to 14 AWG)
- **With integrated overvoltage protection**
  Screw terminals for wire cross-sections 0.2 to 2.5 mm² (24 to 14 AWG)

Cable entries

Connection of the power supply and signal cables

To be selected in feature 050 "Electrical connection":

- Coupling M20, material depends on approval:
  - For non-Ex, ATEX, IECEx, NEPSI Ex ia/ic:
    Plastic M20x1.5 for cable Ø5 to 10 mm (0.2 to 0.39 in)
  - For Dust-Ex, FM IS, CSA IS, CSA GP, Ex ec:
  - For Ex db:
    No cable gland available
- Thread
  - ½" NPT
  - G ½"
  - M20 × 1.5
- M12 plug / 7/8" plug
  Only available for non-Ex, Ex ic, Ex ia

Connection of remote display FHX50

Feature 030 "Display, operation"	Cable entry for connection of FHX50
L: "Prepared for display FHX50 + M12 connection"	M12 socket
M: "Prepared for display FHX50 + custom connection"	M12 cable gland

Cable specification

- **Devices without integrated overvoltage protection**
  Pluggable spring-force terminals for wire cross-sections 0.5 to 2.5 mm² (20 to 14 AWG)
- **Devices with integrated overvoltage protection**
  Screw terminals for wire cross-sections 0.2 to 2.5 mm² (24 to 14 AWG)
- For ambient temperature $T_U \geq 60$ °C (140 °F): use cable for temperature T_U +20 K.

HART

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

PROFIBUS

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

For further information on the cable specifications, see Operating Instructions BA00034S "PROFIBUS DP/PA: Guidelines for planning and commissioning", PNO Guideline 2.092 "PROFIBUS PA User and Installation Guideline" and IEC 61158-2 (MBP).

FOUNDATION Fieldbus

Endress+Hauser recommends using twisted, shielded two-wire cables.

For further information on the cable specifications, see Operating Instructions BA00013S "FOUNDATION Fieldbus Overview", FOUNDATION Fieldbus Guideline and IEC 61158-2 (MBP).

Overvoltage protection

If the device is intended to be used for level measurement of flammable liquids which requires overvoltage protection in accordance with DIN EN 60079-14, test standard 60060-1 (10 kA, pulse $^{8}/_{20}$ µs): use the overvoltage protection module.

Integrated overvoltage protection module

An integrated overvoltage protection module is available for the HART 2-wire devices as well as for PROFIBUS PA and FOUNDATION Fieldbus.

Product structure: Feature 610 "Accessory mounted", option NA "Overvoltage protection".

Resistance per channel	Maximum 2 × 0.5 Ω
DC sparkover voltage	400 to 700 V
Trip surge voltage	< 800 V
Capacity at 1 MHz	< 1.5 pF
Nominal discharge current (8/20 µs)	10 kA

External overvoltage protection module

The HAW562 or HAW569 for example from Endress+Hauser are suitable options for external overvoltage protection.

More information is provided in the following documents:
- HAW562: TI01012K
- HAW569: TI01013K

Performance characteristics

Reference 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 coaxial 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:
  - Coaxial probe
  - ε_r of lower medium = 80 (water)
  - ε_r of upper medium = 2 (oil)

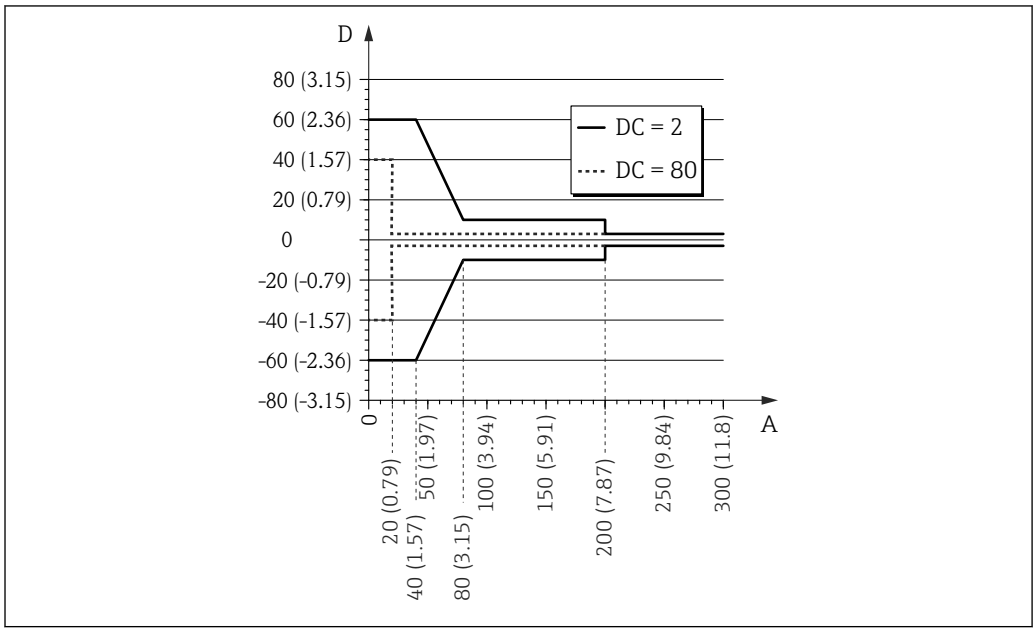
Reference accuracy

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, non-repeatability and hysteresis) [2]	**Level measurement:** ▪ Measuring distance ≤ 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 ≤ 500 mm (19.7 in): ±20 mm (±0.79 in) ▪ Measuring distance > 500 mm (19.7 in): ±10 mm (±0.39 in) ▪ If thickness of upper medium < 100 mm (3.94 in): ±40 mm (±1.57 in)	
Non-repeatability [4]	≤ 1 mm (0.04 in)	

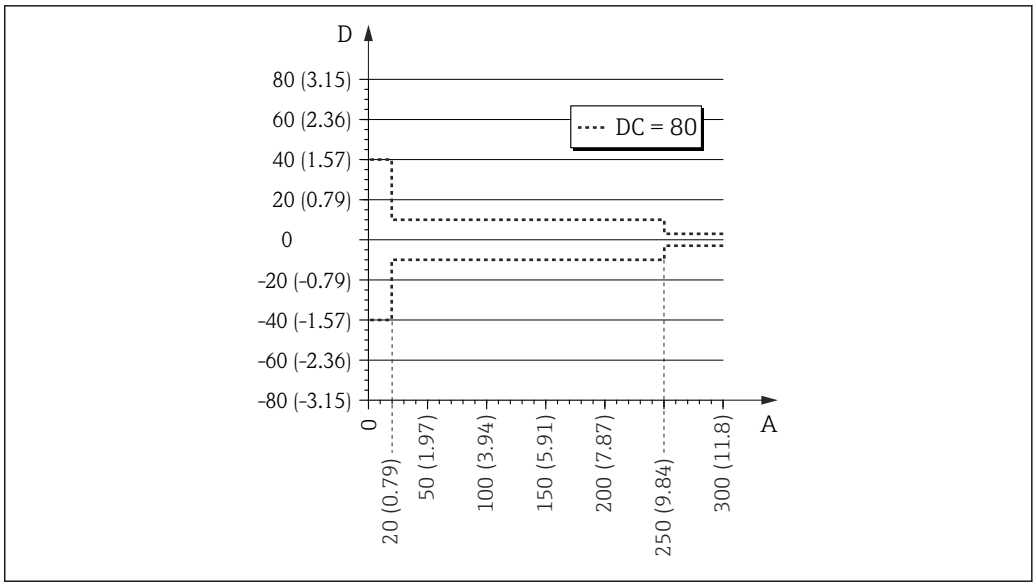
1) Add error of the analog value to the digital value.
2) If the reference conditions are not met, the offset/zero point resulting from the installation conditions can be up to ±16 mm (±0.63 in). This additional offset/zero point can be compensated for by entering a correction ("Level correction" parameter) 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.

In the area of the lower probe end, the following measurement error applies specifically for level measurement:



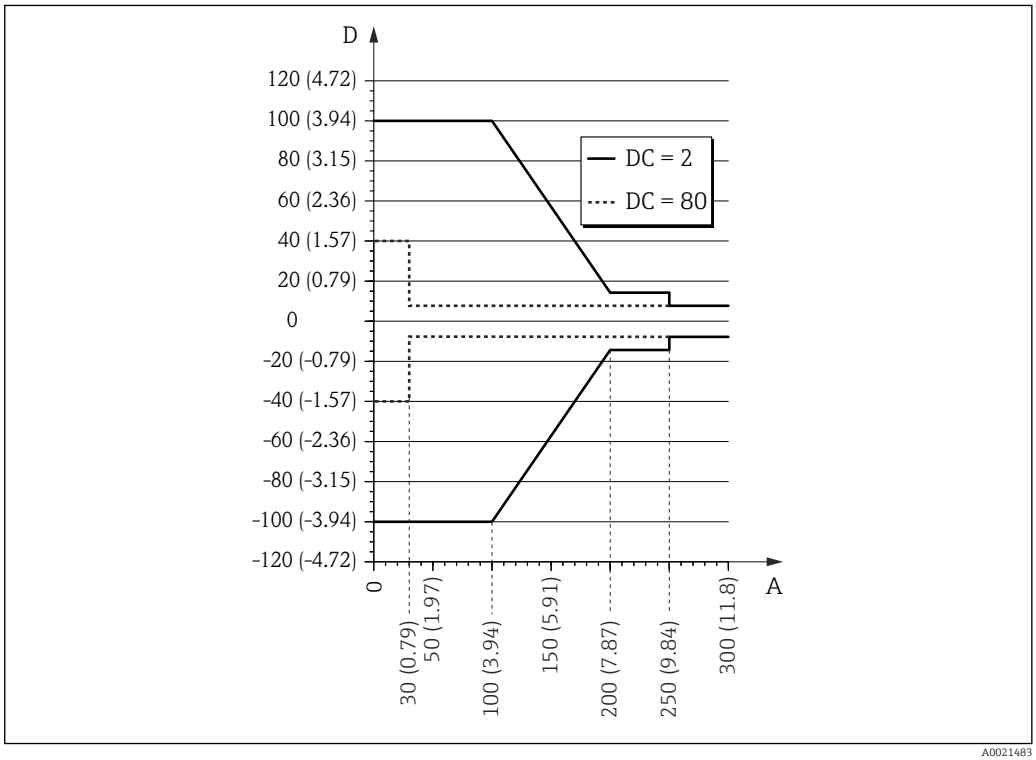
29 Measurement error at the probe end for rod and coaxial probes

A Distance from the probe end [mm(in)]
D Measurement error: Sum of non-linearity, non-repeatability and hysteresis
DC Dielectric constant (ε_r)



30 *Measurement error at the probe end for rope probes*

A Distance from the probe end [mm(in)]
D Measurement error: Sum of non-linearity, non-repeatability and hysteresis
DC Dielectric constant (ε_r)

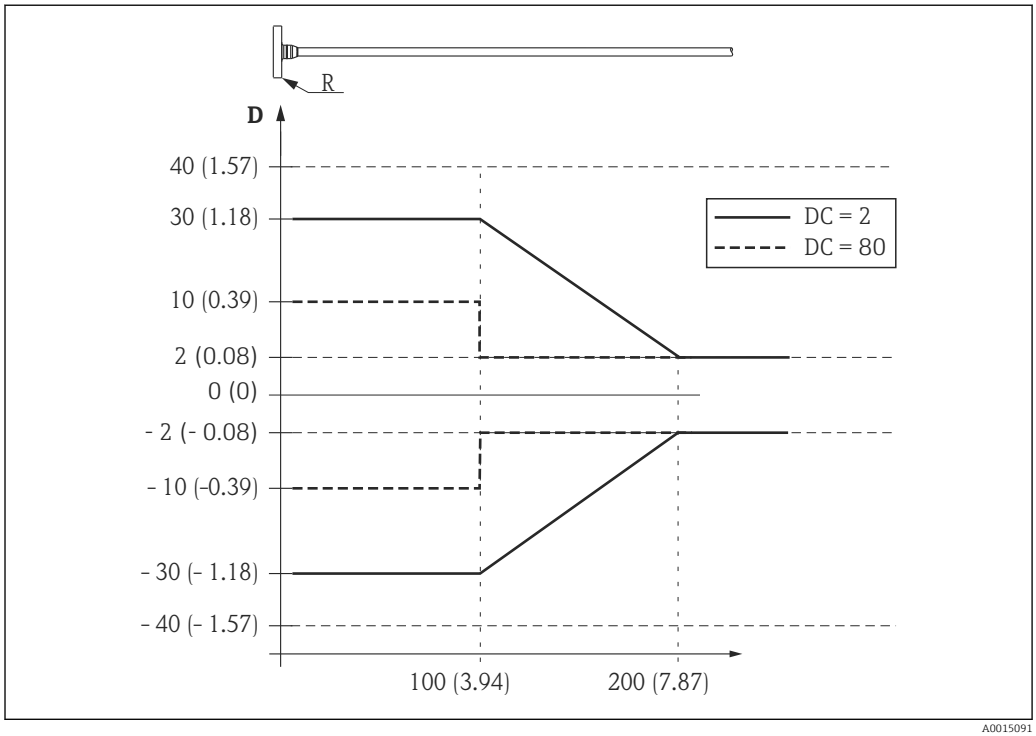


31 *Measurement error at the probe end in the case of metal centering disks (product structure: feature 610 "Accessory mounted", version OA, OB or OC)*

A Distance from the probe end [mm(in)]
D Measurement error: Sum of non-linearity, non-repeatability and hysteresis
DC Dielectric constant (ε_r)

If the ε_r value is less than 7 in the case of rope probes, measurement is not possible in the area of the probe weight (0 to 250 mm (0 to 9.84) from the probe end), (lower blocking distance).

The following measurement error applies for level measurement in the area of the upper probe end:



32 Measurement error at the upper probe end; unit: mm (in)

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

Resolution

- Digital: 1 mm
- Analog: 1 µA

Response time

The response time can be configured. The following step response times apply (in accordance with DIN EN IEC 61298-2/DIN EN IEC 60770-1) when damping is switched off.

In accordance with DIN EN IEC 61298-2/DIN EN IEC 60770-1, the step response time is the time following an abrupt change in the input signal up until the changed output signal has adopted 90% of the steady-state value for the first time.

Level measurement		
Probe length	**Sampling rate**	**Response time**
< 10 m (33 ft)	3.6 measurements per second	< 0.8 s
< 40 m (131 ft)	≥ 2.7 measurements per second	< 1 s

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

Influence of ambient temperature

The measurements are performed according to 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 FMP51 and FMP52 with a remote sensor, there is an additional offset error of ±0.3 mm/10K (±0.01 in/10K) per 1 m (3.3 ft) of remote cable length.
- Analog (current output):
  - Zero point (4 mA): average T_C = 0.02 %/10 K
  - Span (20 mA): average T_C = 0.05 %/10 K

Influence of gas phase

High pressure reduces the wave velocity of the measuring signals in the gas/vapor above the medium. This effect depends on the type of gas phase and its temperature. This results in a systematic measurement error that increases with increasing distance between the reference point of the measurement (flange) and the surface of the product. The following table shows this measurement error for some typical gases/vapors (with regard to the distance, a positive value means that an excessively large distance is measured):

Gas phase	Temperature	Pressure		
		1 bar (14.5 psi)	10 bar (145 psi)	50 bar (725 psi)
Air	20 °C (68 °F)	0.00 %	0.22 %	1.20 %
	200 °C (392 °F)	−0.01 %	0.13 %	0.74 %
	400 °C (752 °F)	−0.02 %	0.08 %	0.52 %
Hydrogen	20 °C (68 °F)	−0.01 %	0.10 %	0.61 %
	200 °C (392 °F)	−0.02 %	0.05 %	0.37 %
	400 °C (752 °F)	−0.02 %	0.03 %	0.25 %

Gas phase	Temperature	Pressure		
		100 bar (1 450 psi)	200 bar (2 900 psi)	400 bar (5 800 psi)
Air	20 °C (68 °F)	2.40 %	4.9 %4.90 %	9.50 %
	200 °C (392 °F)	1.50 %	3.00 %	6.00 %
	400 °C (752 °F)	1.10 %	2.10 %	4.20 %
Hydrogen	20 °C (68 °F)	1.20 %	2.50 %	4.90 %
	200 °C (392 °F)	0.76 %	1.60 %	3.10 %
	400 °C (752 °F)	0.53 %	1.10 %	2.20 %

Gas phase	Temperature	Pressure			
		1 bar (14.5 psi)	2 bar (29 psi)	5 bar (72.5 psi)	10 bar (145 psi)
Water vapor (saturated steam)	100 °C (212 °F)	0.26 %	-	-	-
	120 °C (248 °F)	0.23 %	0.50 %	-	-
	152 °C (306 °F)	0.20 %	0.42 %	1.14 %	-
	180 °C (356 °F)	0.17 %	0.37 %	0.99 %	2.10 %
	212 °C (414 °F)	0.15 %	0.32 %	0.86 %	1.79 %
	264 °C (507 °F)	0.12 %	0.26 %	0.69 %	1.44 %
	311 °C (592 °F)	0.09 %	0.22 %	0.58 %	1.21 %
	366 °C (691 °F)	0.07 %	0.18 %	0.49 %	1.01 %

Gas phase	Temperature	Pressure			
		20 bar (290 psi)	50 bar (725 psi)	100 bar (1450 psi)	200 bar (2900 psi)
Water vapor (saturated steam)	100 °C (212 °F)	-	-	-	-
	120 °C (248 °F)	-	-	-	-
	152 °C (306 °F)	-	-	-	-
	180 °C (356 °F)	-	-	-	-
	212 °C (414 °F)	3.9 %	-	-	-
	264 °C (507 °F)	3.0 %	9.2 %	-	-
	311 °C (592 °F)	2.5 %	7.1 %	19.3 %	-
	366 °C (691 °F)	2.1 %	5.7 %	13.2 %	76 %

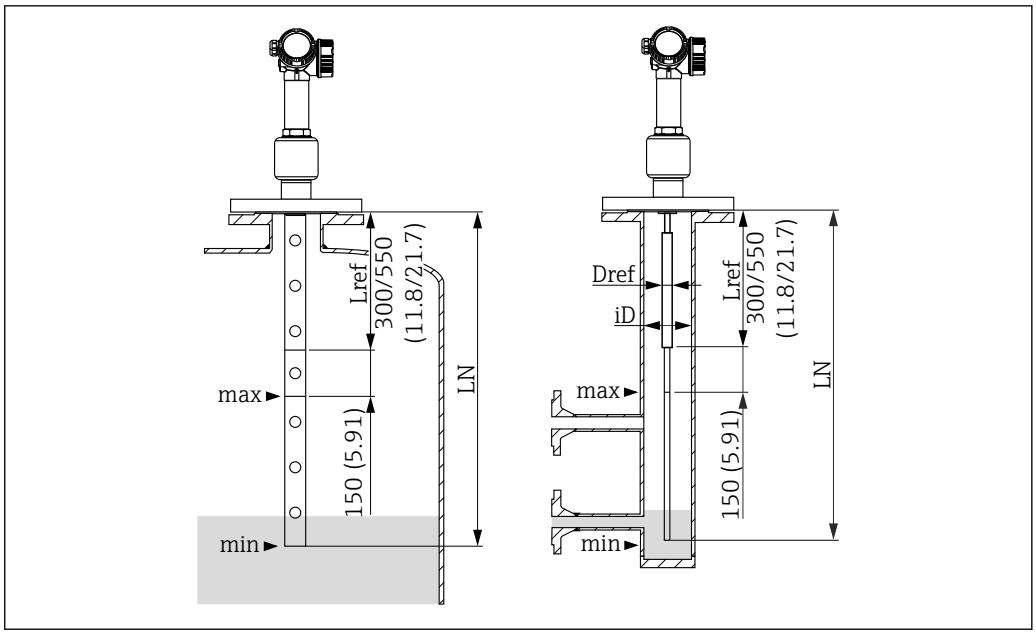
Gas phase compensation with external pressure measuring cell (PROFIBUS PA/FOUNDATION Fieldbus)

PROFIBUS and FOUNDATION Fieldbus devices can receive the signal from an external pressure measuring cell over the bus and use it to automatically perform a pressure-dependent time-of-flight correction. In the case of saturated steam in the temperature range from 100 to 350 °C (212 to 662 °F), this makes it possible to reduce the distance measurement error of up to 29 % (without compensation) to below 3 % (with compensation).

Gas phase compensation using reference signal (option for FMP54)

At high pressures and temperatures, the wave velocity of the microwave signals in the steam (polar media) is reduced above the liquid to be measured. This causes the Levelflex to display a level that is too low.

An optional version of the FMP54 is available with an automatic gas phase compensation function that corrects this measurement error (feature 540: "Application packages", option EF: "Gas phase comp. L_{ref} = 300 mm (11.8 in)"or EG: "Gas phase comp. L_{ref} = 550 mm (21.7 in)"). In this version, a difference in the diameter of the probe rod generates a reference reflection at the distance L_{ref} from the flange. This reference reflection must be at least 150 mm (5.91 in) above the highest level. The current wave velocity is measured on the basis of this shift in the reference reflection and the level value is corrected automatically.



33 *FMP54 with reference signal for gas phase compensation; unit: mm (in)*

Coaxial probes with reference reflection can be installed in any vessel (free in the tank or in a bypass). Coaxial probes are ready-mounted and adjusted at the factory and are ready for use without any additional parameter configuration.

The use of **rod probes** is only recommended if the installation of a coaxial probe is not possible (e.g. if the bypass diameter is very small).

Rod probes with reference reflection are only suitable for installation in stilling wells and bypass chambers. The diameter D_{ref} of the probe rod in the area of the reference distance L_{ref} must be chosen to suit the pipe internal diameter iD, see the table below. The pipe must be cylindrical in the area of the reference distance L_{ref}; cross-section changes, e.g. at flange connections, must not exceed 5 % of the internal diameter iD.

In addition, following installation the settings must be checked by expert staff and corrected if necessary.

Internal diameter iD of stilling well/bypass	Diameter D_{ref} of the rod probe in the area of the reference length L_{ref}
40 mm (1.57 in) ≥ iD < 45 mm (1.77 in)	22 mm (0.87 in)
45 mm (1.77 in) ≥ iD < 70 mm (2.76 in)	25 mm (0.98 in)
70 mm (2.76 in) ≥ iD < 100 mm (3.94 in)	30 mm (1.18 in)

Restrictions for coaxial and rod probes

Maximum probe length LN
- For rod probes:
  LN ≤ 4 000 mm (157 in)
- For coaxial probes:
  LN ≤ 6 000 mm (236 in)

Minimum probe length LN
LN > L_{ref} + 200 mm (7.87 in)

Reference distance L_{ref}
300 mm (11.81 in) or 550 mm (21.65 in); see feature 540 in the product structure.

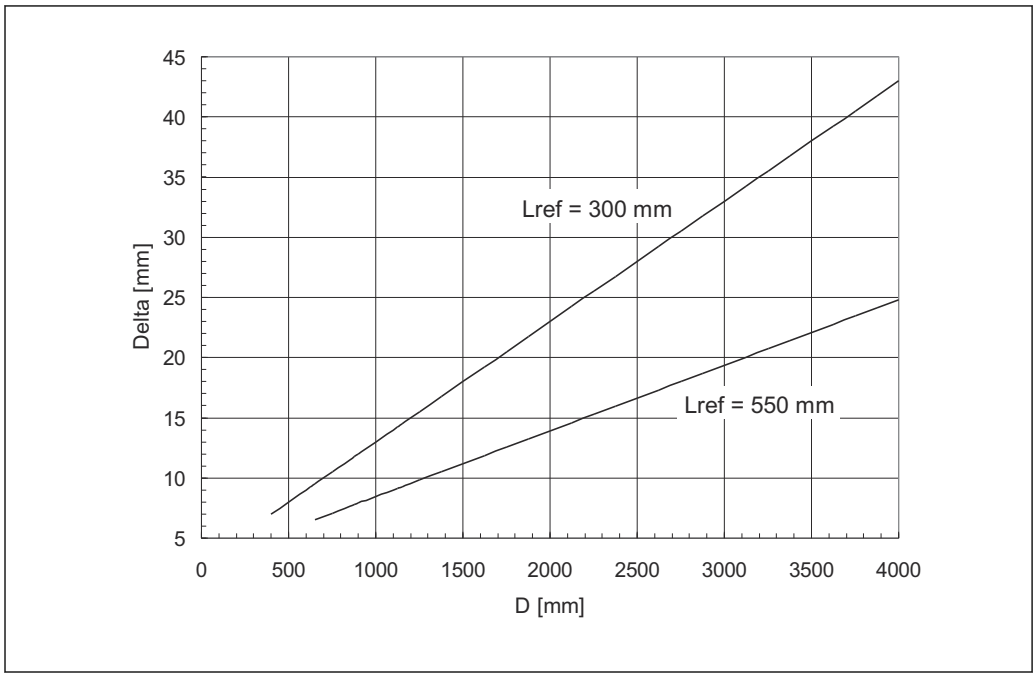
Maximum level in relation to the flange sealing surface
L_{ref} + 150 mm (5.90 in)

Minimum dielectric constant of the medium
ε_r > 7

Area of application

Level measurements at high pressure and measuring ranges of up to a few meters in polar media with a dielectric constant $\varepsilon_r > 7$ (e.g. water or ammonia), which would produce a large measurement error without compensation.

The measurement accuracy under reference conditions is higher the greater the reference distance L_{ref} and the smaller the measuring range:



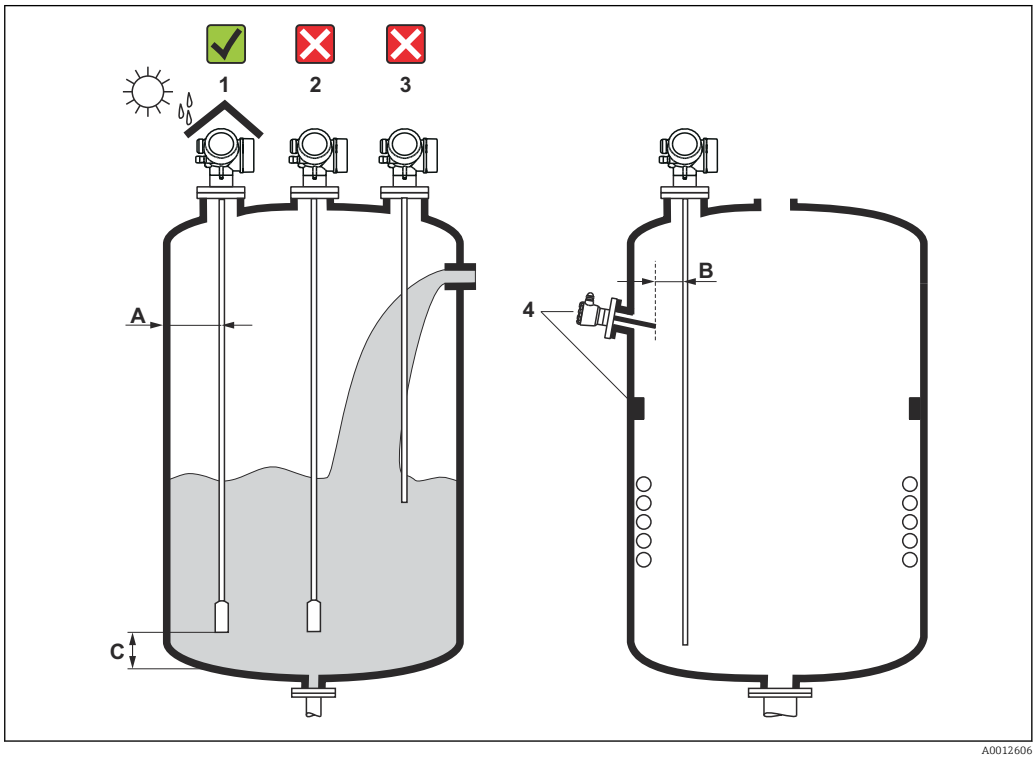
D Distance from lower edge of the flange to product
DeltaMeasurement error

In the event of fast pressure changes, an additional error may occur as the measured reference distance is averaged with the time constant of the level measurement. Furthermore, states of non-equilibrium - due to heating for example - may result in density gradients within the medium and condensation of steam at the probe. As a result, level readings may vary slightly at different locations in the vessel. These application-related influences can increase the measurement error indicated above by a factor of up to 2 to 3.

Installation

Installation requirements

Suitable mounting position



34 *Installation positions*

Spacing requirements when mounting

- Distance (A) between the vessel wall and rod and rope probes:
  - 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 permitted measuring range may be reduced.
- Distance (B) between rod probes and internal fittings (3): > 300 mm (12 in)
- When using more than one Levelflex:
  Minimum distance between the sensor axes: 100 mm (3.94 in)
- Distance (C) from the end of the probe to the bottom of the vessel:
  - Rope probe: > 150 mm (6 in)
  - Rod probe: > 10 mm (0.4 in)
  - Coaxial probe: > 10 mm (0.4 in)

Coaxial probes can be mounted at any distance to the wall and internal fixtures.

Additional installation requirements

- When mounting outdoors, a weather protection cover (1) can be used 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 cannot be avoided, it is essential to perform interference echo suppression (mapping) after commissioning the device.
- Do not mount the probe in the filling curtain (3).
- Avoid buckling the rope probe during installation or operation (e.g. as a result of product movement against silo wall) by selecting a suitable mounting location.

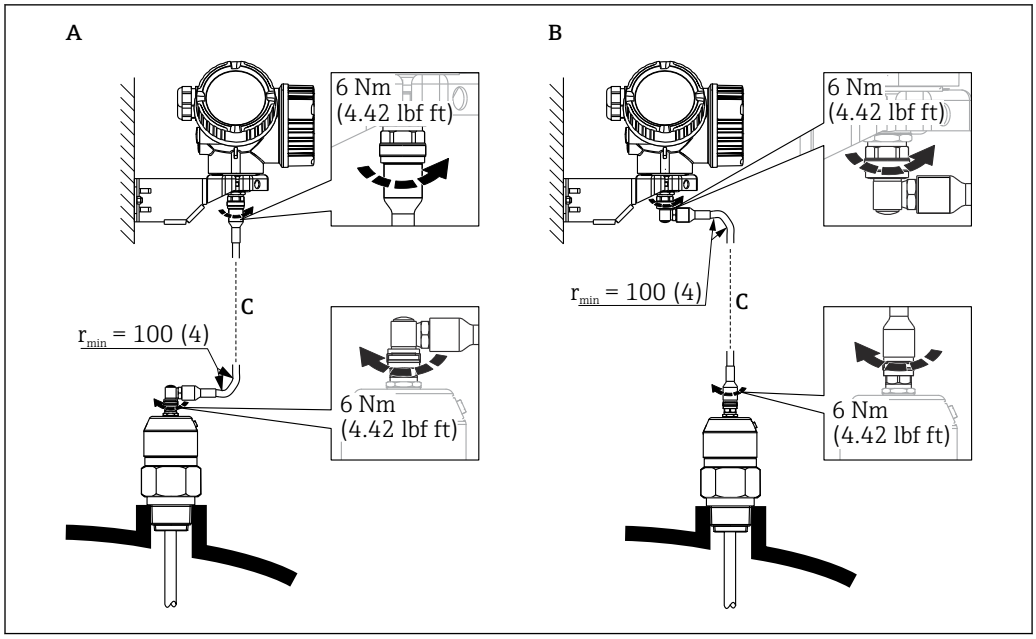
In the case of freely suspended rope probes (probe end not fixed at the bottom), the distance between the probe rope and internal fittings, which can change due to the movement of the product, must never be less than 300 mm (12 in). Occasional contact between the probe weight and the cone of the vessel, however, does not influence the measurement provided that the relative permittivity is at least $\varepsilon_r = 1.8$.

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

Mounting under confined conditions

Mounting with remote probe

The device version with a remote probe is suitable for applications with restricted mounting space. In this case, the electronics housing is mounted at a separate position from the probe.

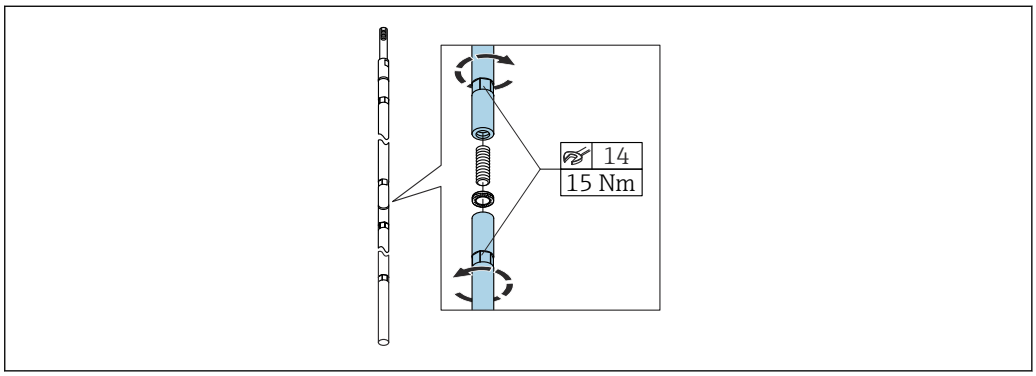


A Angled plug at the probe
B Angled plug at the electronics housing
C Length of the remote cable as ordered

- Product structure, feature 600 "Probe design":
  - Version MB "Sensor remote, 3 m cable"
  - Version MC "Sensor remote, 6 m cable"
  - Version MD "Sensor remote, 9 m cable"
- The connecting cable is included in the delivery with these versions.
  Minimum bending radius: 100 mm (4 inch)
- The mounting bracket for the electronics housing is included in the delivery with these versions.
  Mounting options:
  - Wall mounting
  - Mounting on DN32 to DN50 (1¼ to 2 inch) post or pipe
- The connection cable has one straight plug and one plug angled at 90 °. Depending on the local conditions the angled plug can be connected at the probe or at the electronics housing.

The probe, electronics and connection cable are mutually compatible and bear a common serial number. Only components with the same serial number may be connected to one another.

Separable probes



A0021647

In confined mounting conditions (little distance to the ceiling), the use of separable rod probes is advisable (Ø 16 mm).

- Max. probe length 10 m (394 in)
- Max. lateral loading capacity 30 Nm
- Probes can be separated several times, with the individual parts having the following lengths:
  - 500 mm (20 in)
  - 1 000 mm (40 in)

Notes on the mechanical load of the probe

Tensile loading capacity of rope probes

FMP51

Rope 4 mm (⅙ in) 316
Tensile loading capacity 5 kN

Rope 4 mm (⅙ in), Alloy C
Tensile loading capacity 5 kN

Rope 4 mm (⅙ in), PFA over 316L
Tensile loading capacity 1 kN

FMP52

Rope 4 mm (⅙ in) PFA over 316
Tensile loading capacity 2 kN

FMP54

Rope 4 mm (⅙ in), 316
Tensile loading capacity 10 kN

Lateral loading capacity (flexural strength) of rod probes

FMP51

Rod 8 mm (⅓ in), 316L
10 Nm

Rod 12 mm (½ in), 316L
Flexural strength 30 Nm

Rod 12 mm (½ in), Alloy C
Flexural strength 30 Nm

Rod 16 mm (0.63 in), 316L separable
Flexural strength 30 Nm

FMP52

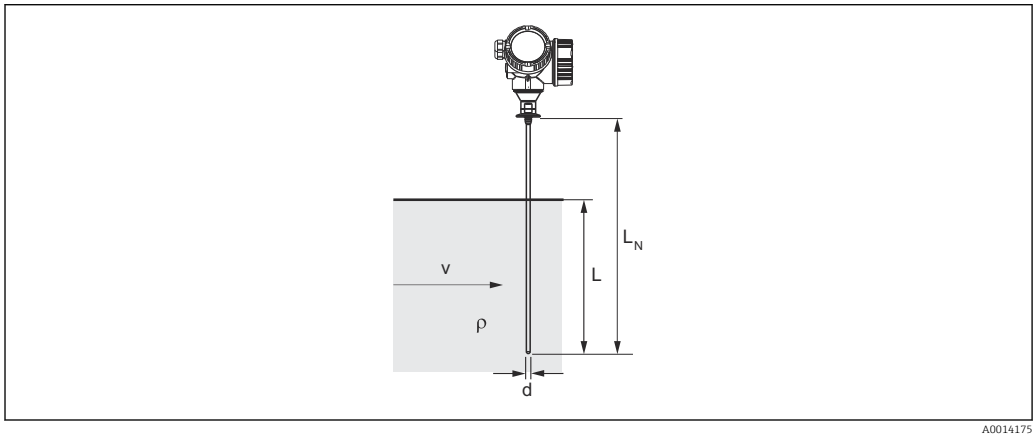
Rod 16 mm (0.63 in), PFA over 316L
Flexural strength 30 Nm

FMP54

Rod 16 mm (0.63 in) 316L
Flexural strength 30 Nm

Rod 16 mm (0.63 in), 316L separable
Flexural strength 30 Nm

Lateral load (bending moment) from flow conditions



ρ Density of the medium [kg/m³]
v Flow velocity [m/s] of the medium, perpendicular to the probe rod
d Diameter [m] of the probe rod
L Level [m]
LN Probe length [m]

The formula for calculating the bending moment M acting on the probe:

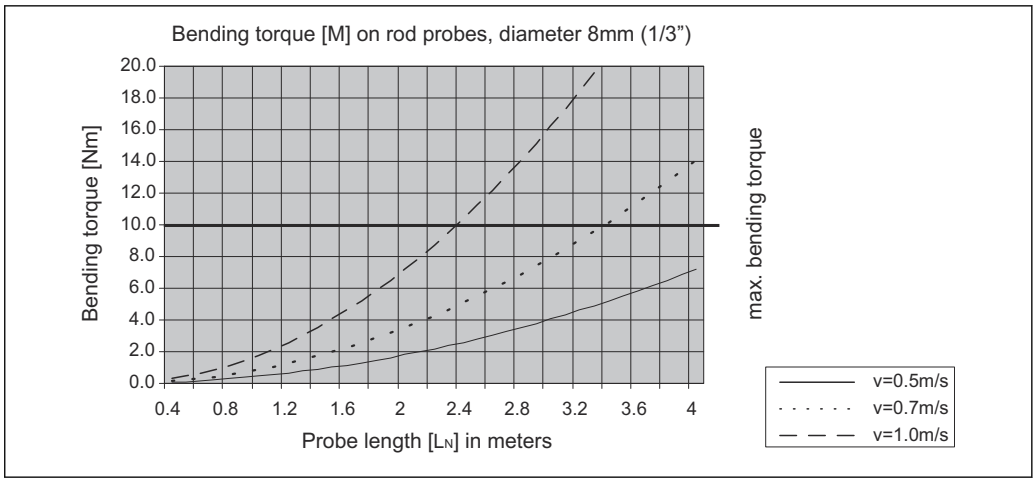
$M = c_w \times \rho/2 \times v^2 \times d \times L \times (L_N - 0.5 \times L)$

With:

c_w: coefficient of friction

Sample calculation

Coefficient of friction c_w	0.9 (assuming turbulent flow - high Reynolds number)
Density ρ [kg/m³]	1000 (e.g. water)
Probe diameter d [m]	0.008
$L = L_N$	(unfavorable conditions)



Lateral loading capacity (flexural strength) of coaxial probes

FMP51

Probe Ø 21.3 mm, 316L
Flexural strength:60 Nm

Probe Ø 42.4 mm, 316L
Flexural strength: 300 Nm

Probe Ø 42.4 mm, Alloy C
Flexural strength: 300 Nm

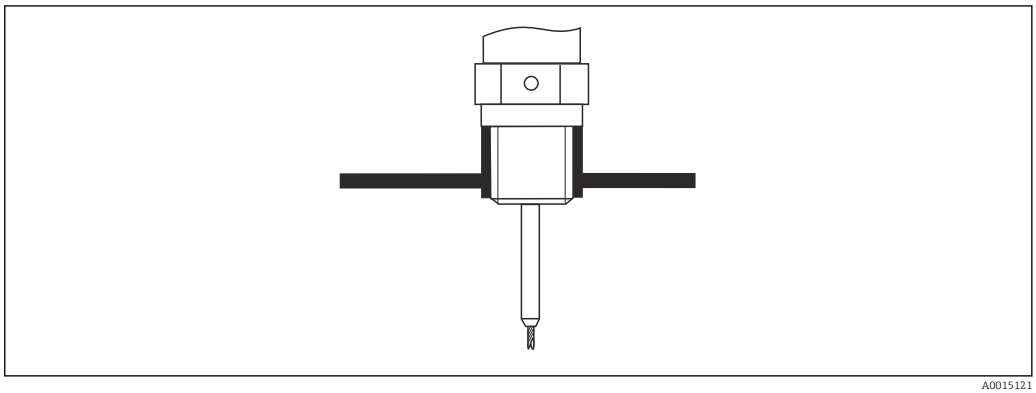
FMP54

Probe Ø 42.4 mm, 316L
Flexural strength:300 Nm

Information concerning the process connection

Probes are mounted on the process connection with threaded connections or flanges. If there is the danger with this installation that the probe end moves so much that it occasionally touches the vessel floor or cone, the probe may need to be shortened at the lower end and fixed in place.

Threaded connection



35 *Mounting with threaded connection; flush with the vessel ceiling*

Seal

The thread and the type of seal comply with DIN 3852 Part 2, screwed plug, form A.

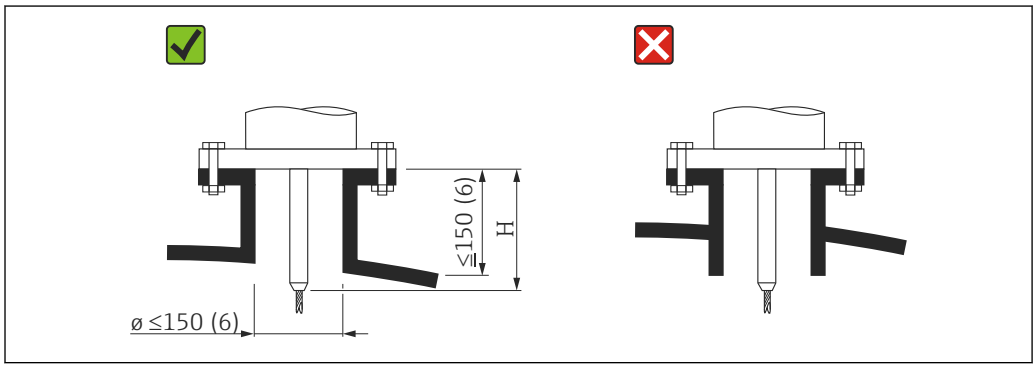
The following types of sealing ring can be used:

- For thread G¾": According to DIN 7603 with dimensions 27 mm × 32 mm
- For thread G1½": According to DIN 7603 with dimensions 48 mm × 55 mm

Use a sealing ring according to this standard in form A, C or D and of a material that offers appropriate resistance for the application.

Refer to the dimensional drawing for the length of the screwed plug:

Nozzle installation



H Length of the centering 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 large nozzles, see the section "Mounting in nozzles ≥ DN300"
- Permissible nozzle height: ≤ 150 mm (6 in)
  For larger heights, the near-range measuring capability may be reduced.
  Larger nozzle heights are possible in special cases (on request), see sections "Centering rod for FMP51 and FMP52" and "Rod extension/centering device HMP40 for FMP54".
- The end of the nozzle should be flush with the tank ceiling in order to avoid ringing effects.

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

Centering rod

In the case of rope probes, it may be necessary to use a version with a centering rod so that the rope does not come in contact with the nozzle wall during the process.

The length of the optional centering rod determines the maximum nozzle height.

Rod extension/centering device HMP40 for FMP54

For FMP54 with rope probes, the rod extension/centering device HMP40 is available as an accessory. It must be used if the probe rope would otherwise come into contact with the lower edge of the nozzle.

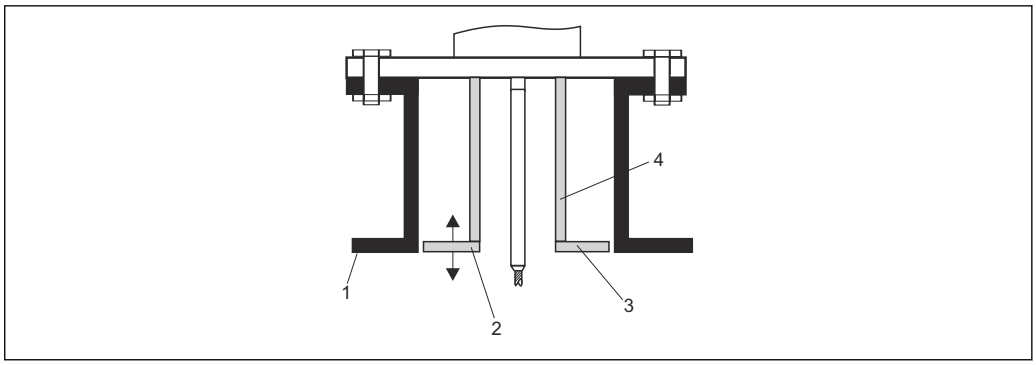
This accessory consists of the extension rod, corresponding to the nozzle height, on which a centering disk is also mounted if the nozzles are narrow or when used in bulk solids.

This component is delivered separately from the device. Order a correspondingly shorter probe length.

Only use centering disks with small diameters (DN40 and DN50) if there is no significant build-up in the nozzle above the disk. The nozzle must not become clogged with product.

Mounting in nozzles ≥ DN300

If installation in nozzles ≥ 300 mm (12 in) is unavoidable, installation must be carried out in accordance with the following diagram in order to avoid interference signals in the near range.



A0014199

1 *Lower edge of the nozzle*
2 *Approximately flush with the lower edge of the nozzle (±50 mm)*
3 *Platte, nozzle Ø 300 mm (12 in) = plate Ø 280 mm (11 in); nozzle Ø ≥ 400 mm (16 in) = plate Ø ≥ 350 mm (14 in)*
4 *Pipe Ø 150 to 180 mm*

Mounting cladded flanges

Note the following for cladded flanges:
- Use the same number of flange screws as the number of flange bores provided.
- Tighten the screws with the necessary torque (see Table).
- Retighten after 24 hours or after the first temperature cycle.
- Depending on the process pressure and temperature, check and retighten the screws, where necessary, at regular intervals.

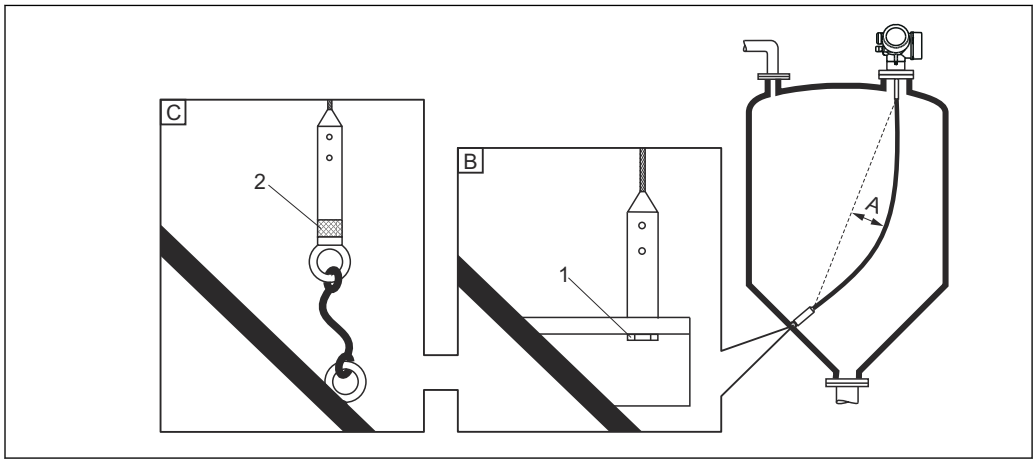
The PTFE flange cladding normally acts simultaneously as a seal between the nozzle and the device flange.

Flange size	Number of screws	Tightening torque
EN		
DN40/PN40	4	35 to 55 Nm
DN50/PN16	4	45 to 65 Nm
DN50/PN40	4	45 to 65 Nm
DN80/PN16	8	40 to 55 Nm
DN80/PN40	8	40 to 55 Nm
DN100/PN16	8	40 to 60 Nm
DN100/PN40	8	55 to 80 Nm
DN150/PN16	8	75 to 115 Nm
DN150/PN40	8	95 to 145 Nm
ASME		
1½"/150lbs	4	20 to 30 Nm
1½"/300lbs	4	30 to 40 Nm
2"/150lbs	4	40 to 55 Nm
2"/300lbs	8	20 to 30 Nm
3"/150lbs	4	65 to 95 Nm
3"/300lbs	8	40 to 55 Nm
4"/150lbs	8	45 to 70 Nm
4"/300lbs	8	55 to 80 Nm
6"/150lbs	8	85 to 125 Nm
6"/300lbs	12	60 to 90 Nm

Flange size	Number of screws	Tightening torque
JIS		
10K 40A	4	30 to 45 Nm
10K 50A	4	40 to 60 Nm
10K 80A	8	25 to 35 Nm
10K 100A	8	35 to 55 Nm
10K 100A	8	75 to 115 Nm

Securing the probe

Securing rope probes

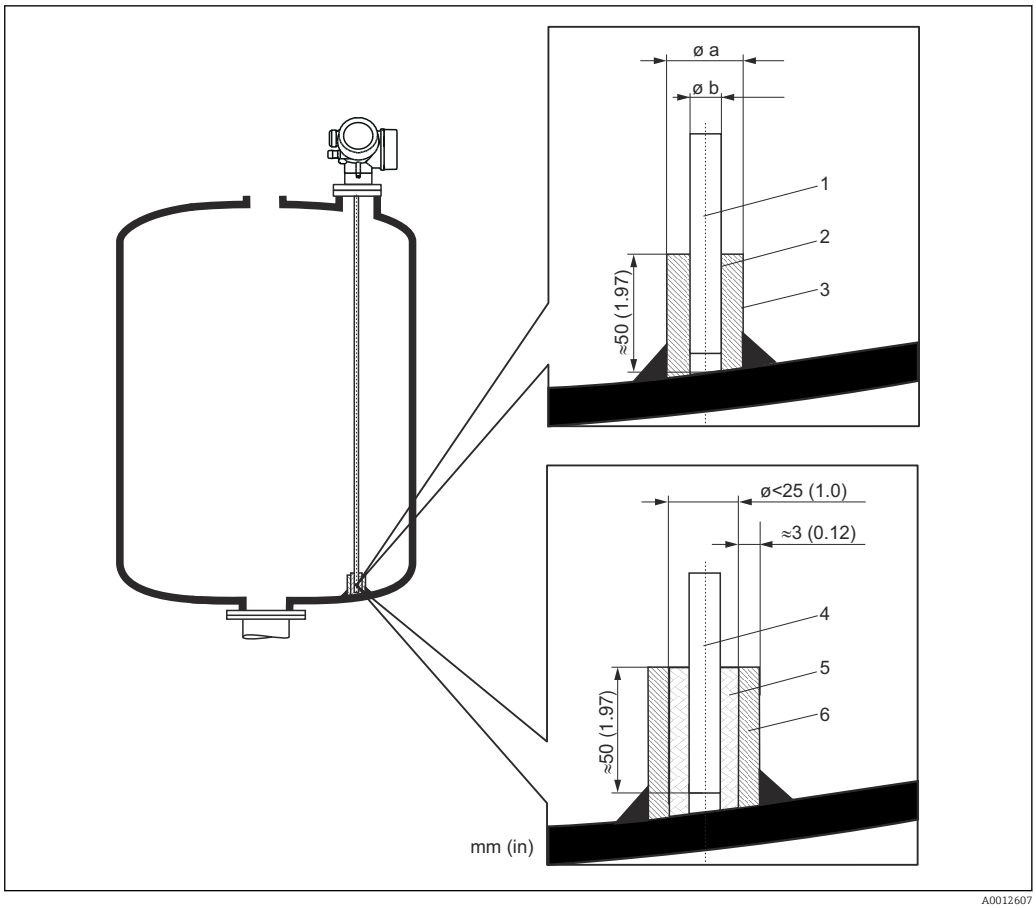


A Sag: ≥ 10 mm/m (0.12 in/ft) probe length
B Reliably grounded end of probe
C Reliably insulated end of probe
1 Fastener in female thread of probe weight
2 Insulated fastening kit

- The end of the rope probe must be secured or fixed down under the following conditions:
  If the probe temporarily comes into contact with the vessel wall, the cone, internal fittings/beams or another part of the installation
- A female thread is provided in the probe weight to secure the end of the probe:
  Rope 4 mm (⅙ in), 316: M 14
- When fixed down, the end of the probe must be reliably grounded or reliably insulated. If it is not otherwise possible to secure the probe with a reliably insulated connection, use the insulated fastening kit.
- To prevent an extremely high tensile load (e.g. due to thermal expansion) and the risk of the rope breaking, the rope must be slack. Required sag: ≥ 10 mm/m (0.12 in/ft) rope length.
  Pay attention to the tensile loading capacity of rope probes.

Securing rod probes

- In the case of WHG approval: a support is required for probe lengths ≥ 3 m (10 ft).
- In general, rod probes must be secured in the event of horizontal flow (e.g. from an agitator) or strong vibrations.
- Only secure rod probes directly at the end of the probe.



Unit of measurement mm (in)

1 *Probe rod, uncoated*
2 *Sleeve with narrow bore to ensure electrical contact between the sleeve and the rod.*
3 *Short metal pipe, e.g. welded in place*
4 *Probe rod, coated*
5 *Plastic sleeve, e.g. PTFE, PEEK, PPS*
6 *Short metal pipe, e.g. welded in place*

Probe Ø 8 mm (0.31 in)
- a < Ø 14 mm (0.55 in)
- b = Ø 8.5 mm (0.34 in)

Probe Ø 12 mm (0.47 in)
- a < Ø 20 mm (0.78 in)
- b = Ø 12.5 mm (0.52 in)

Probe Ø 16 mm (0.63 in)
- a < Ø 26 mm (1.02 in)
- b = Ø 16.5 mm (0.65 in)

NOTICE

Poor grounding of the probe end may cause incorrect measurements.

► Use a sleeve with a narrow bore to ensure good electrical contact between the sleeve and the probe rod.

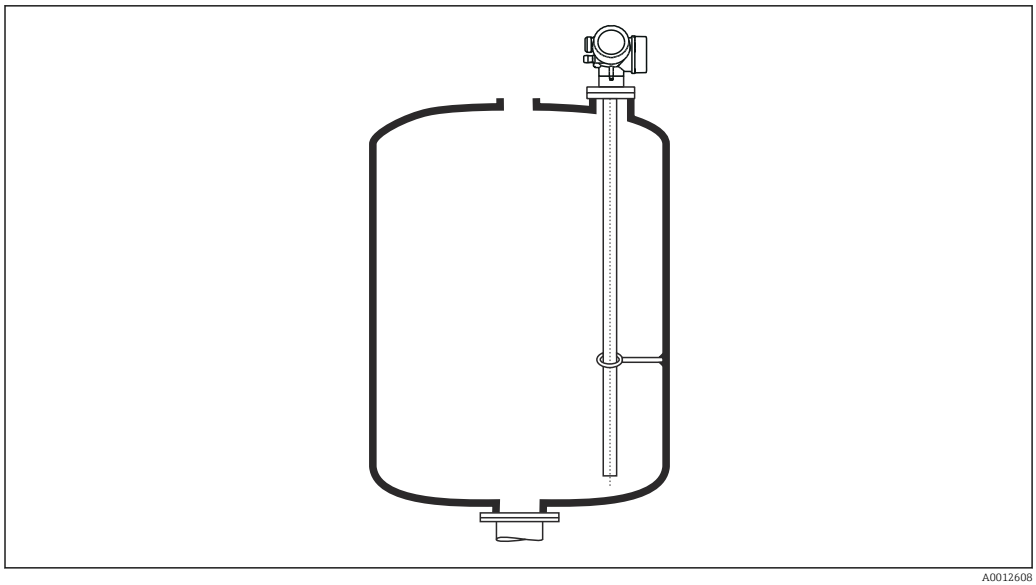
NOTICE

Welding can damage the main electronics module.

► Before welding: Ground the probe rod and remove the electronics.

Securing coaxial probes

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



A0012608

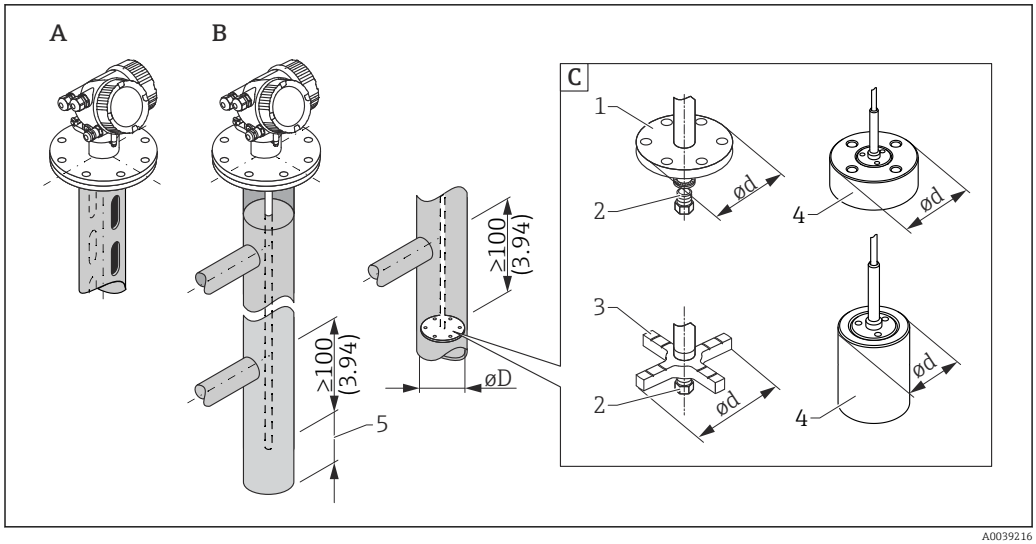
Coaxial probes can be secured (fixed) at any point in the ground tube.

Special installation situations

Bypasses and stilling wells

The use of centering disks/stars/weights (available as accessories) is recommended in bypass and stilling well applications.

Since the measuring signal permeates a large number of plastics, incorrect measurements can result when the device is installed in bypasses or stilling wells made of plastic. For this reason use a bypass or stilling well made of metal.



A0039216

36 *Unit: mm (in)*

A Mounting in stilling well
B Mounting in bypass
C Centering disk/centering star/centering weight
1 Metal centering disk (316L) for level measurement
2 Securing screw; torque: 25 Nm ± 5 Nm
3 Non-metal centering star (PEEK, PFA) preferred for interface measurement
4 Metal centering weight (316L) for level measurement
5 Minimum distance between probe end and lower edge of bypass 10 mm (0.4 in)

- Pipe diameter: > 40 mm (1.6 in) (for rod probes).
- A rod probe can be installed in pipes with a diameter of up to 150 mm (6 in). The use of a coaxial probe is recommended for larger pipe diameters.
- Side outlets, holes, slots and welds - with a maximum inward projection of 5 mm (0.2 in) - do not affect the measurement.
- There should not be any changes in the diameter of the pipe.
- The probe must be 100 mm (4 in) longer than the lower outlet.
- The probes must not touch the pipe wall within the measuring range. Support or brace the probe if necessary. All rope probes are prepared for bracing in vessels (probe weight with anchor hole).
- If a metal centering disk is mounted at the end of the probe rod, the signal for detecting the end of the probe is reliably defined.
  Note: The non-metal centering stars made of PEEK or PFA are recommended for interface measurements. When using metal centering disks, it is important to ensure that the lower medium covers the centering disk at all times. Otherwise, incorrect interface measurements can result.
- Coaxial probes can be used within any restrictions provided that the pipe diameter permits their installation.

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

Over time, the bypass fills with condensate up to the lower outlet. When levels are low, the level echo is masked by the echo of the condensate as a result. In this range, the level of the condensate is output and the correct value is only output when levels are higher. For this reason, ensure that the lower outlet is 100 mm (4 in) below the lowest level to be measured and fit a metal centering disk at the level of the lower edge of the lower outlet.

In thermally insulated vessels, the bypass should also be insulated in order to prevent condensate formation.

Assignment of centering disk/centering star/centering weight to the pipe diameter

Metal centering disk (316L)

for level measurement

Rod centering disk (Ø d) 45 mm (1.77 in)
for pipe diameters (Ø D)
DN50/2" to DN65/2½"

Rod centering disk (Ø d) 75 mm (2.95 in)
for pipe diameters (Ø D)
DN80/3" to DN100/4"

Rope centering disk (Ø d) 75 mm (2.95 in)
for pipe diameters (Ø D)
DN80/3" to DN100/4"

Metal centering weight (316L)

for level measurement

Rope centering weight (Ø d) 45 mm (1.77 in), h 60 mm (2.36 in)
for pipe diameters (Ø D)
DN50/2"

Rope centering weight (Ø d) 75 mm (2.95 in), h 30 mm (1.81 in)
for pipe diameters (Ø D)
DN80/3"

Rope centering weight (Ø d) 95 mm (3.74 in), h 30 mm (1.81 in)
for pipe diameters (Ø D)
DN100/4"

Non-metal centering star (PEEK)

For level and interface measurement, operating temperature: −60 to +250 °C (−76 to 482 °F)

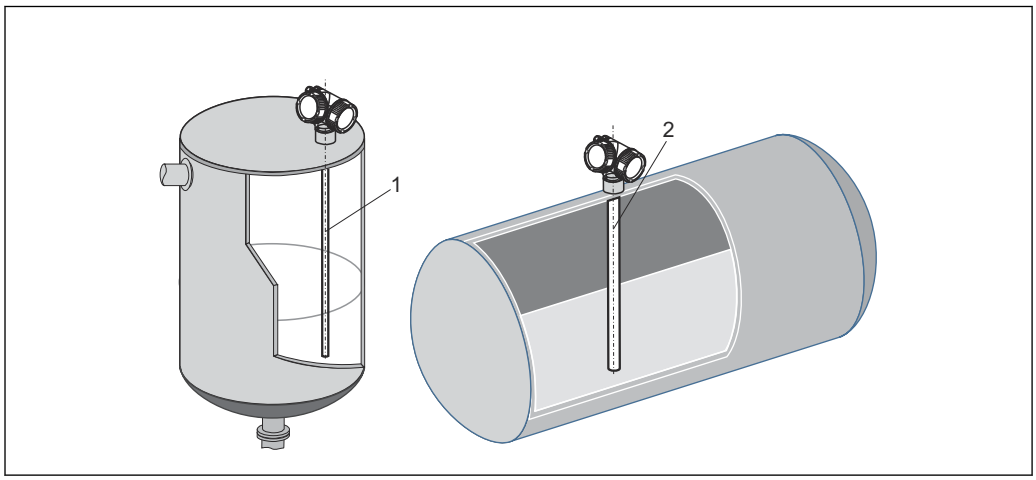
Rod centering star (Ø d) 48 to 95 mm (1.89 to 3.74 in)
for pipe diameters (Ø D)
≥ DN50/2"

Non-metal centering star (PFA)

for level and interface measurement, operating temperature: −200 to +250 °C (−328 to +482 °F)

Rod centering star (Ø d) 37 mm (1.46 in)
for pipe diameters (Ø D)
≥ 40 mm (1.57 in)

Horizontal cylindrical and vertical tanks

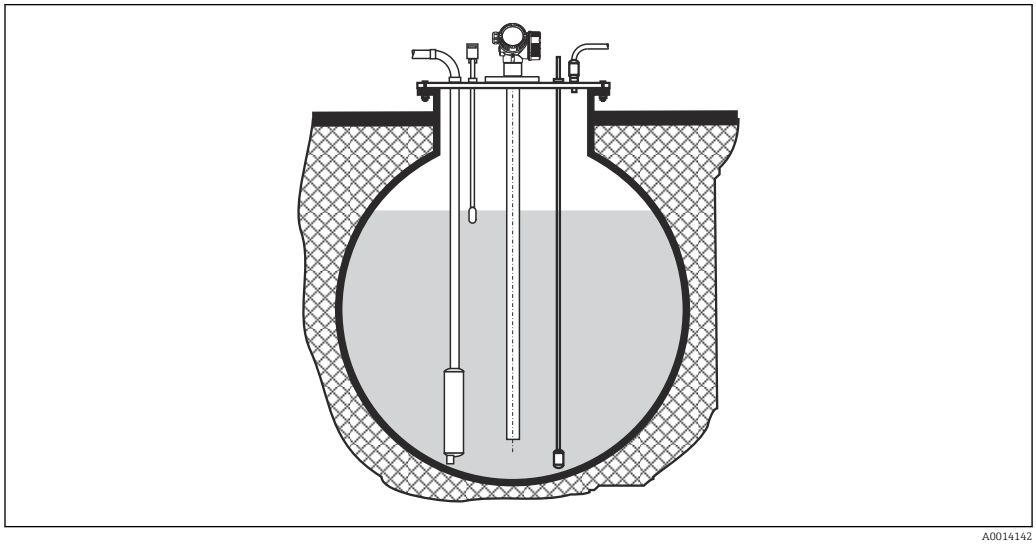


A0014141

1 Coaxial probe

- Any distance from wall provided occasional contact is avoided.
- Use a coaxial probe (1) if installing in tanks with many internal fixtures or internal fixtures located close to the probe.

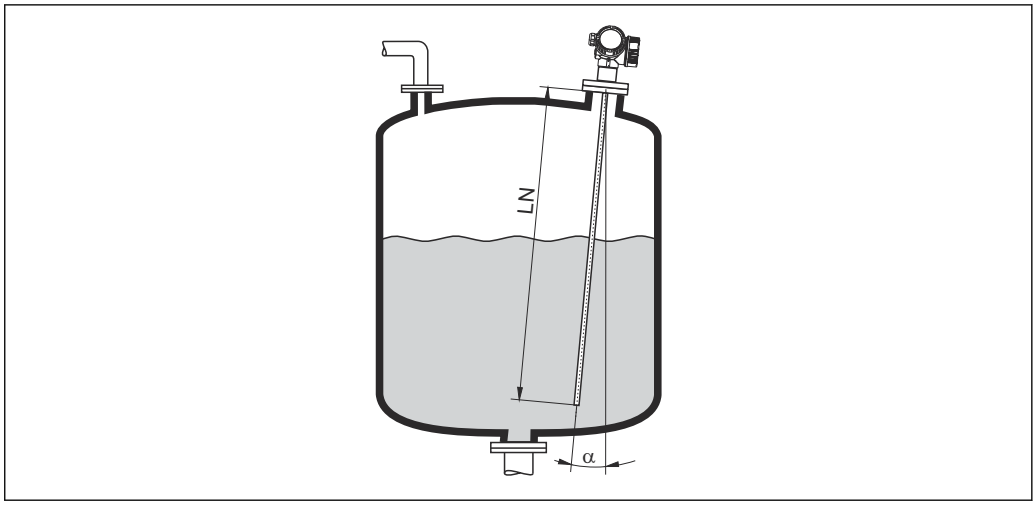
Underground tanks



A0014142

In the case of nozzles with large diameters, use a coaxial probe to avoid reflections at the nozzle wall.

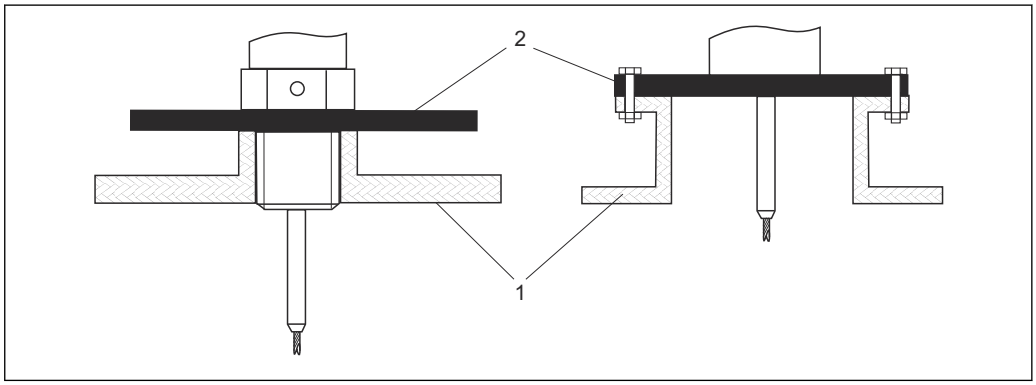
Mounting at an angle



A0014145

- For mechanical reasons, the probe should be installed as vertically as possible.
- If the probe is installed at an angle, the length of the probe must be reduced depending on the angle of installation.
  - α 5 °: $LN_{max.}$ 4 m (13.1 ft)
  - α 10 °: $LN_{max.}$ 2 m (6.6 ft)
  - α 30 °: $LN_{max.}$ 1 m (3.3 ft)

Non-metal vessels



A0012527

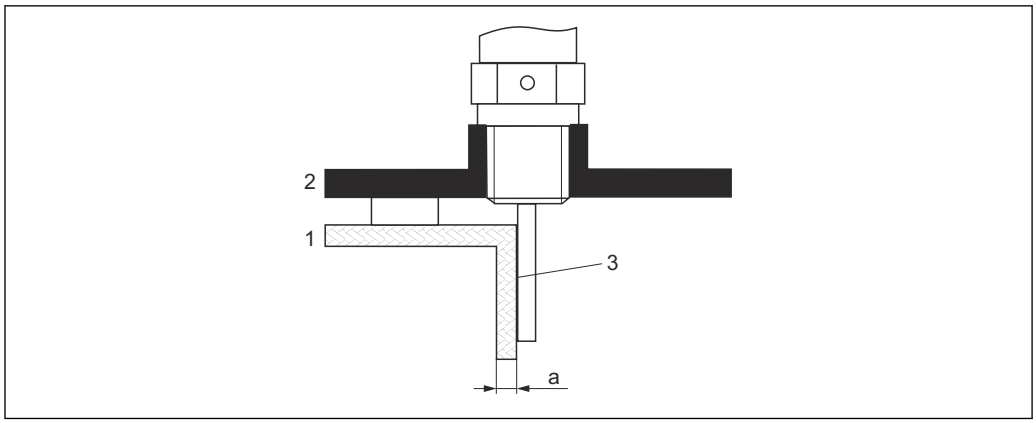
1 Non-metal vessel
2 Metal sheet or metal flange

To ensure good measurement results when mounting on non-metal vessels
- Use a device with a metal flange (minimum size DN50/2").
- Alternatively: at the process connection, mount a metal sheet with a diameter of at least 200 mm (8 in) at a right angle to the probe.

A metal surface is not required at the process connection in the case of coaxial probes.

Plastic and glass vessels: Mounting the probe on the outside wall

In the case of plastic and glass vessels, the probe can also be mounted on the outside wall under certain conditions.



A0014150

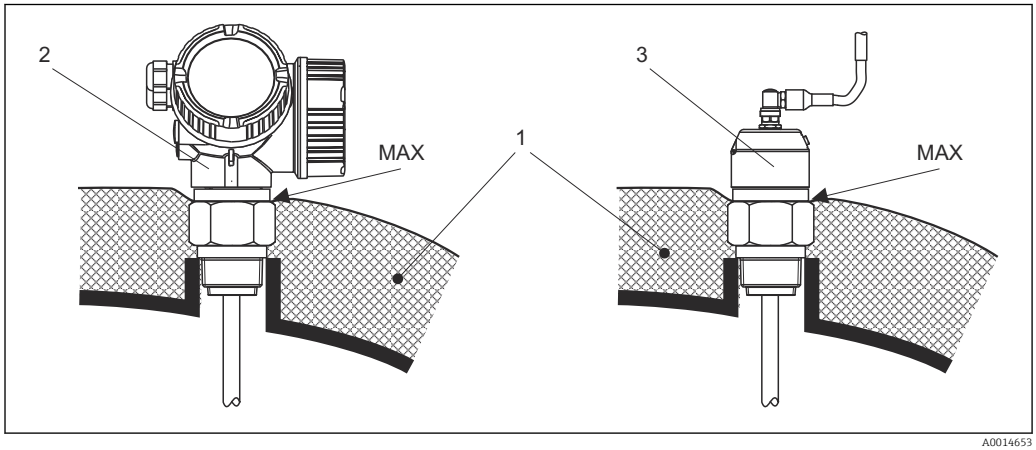
1 Plastic or glass vessel
2 Metal plate with screw-in sleeve
3 No space between vessel wall and probe!

Requirements
- Relative permittivity of the medium: $\varepsilon_r > 7$
- Non-conductive vessel wall.
- Maximum wall thickness (a):
  - Plastic: < 15 mm (0.6 in)
  - Glass: < 10 mm (0.4 in)
- No metal reinforcements on the vessel

Note the following when mounting the device:
- Mount the probe directly on the vessel wall without any space between the wall and probe
- To prevent any influences on the measurement, mount a plastic half pipe with a minimum diameter of 200 mm (8 in) or a similar protective unit on the probe
- For vessel diameters less than 300 mm (12 in):
  On the opposite side of the vessel, fit a grounding plate that is conductively connected to the process connection and covers around half of the vessel's circumference
- For vessel diameters of 300 mm (12 in) and higher:
  Mount a metal plate with a diameter of at least 200 mm (8 in) at a right angle to the probe at the process connection (see above)

Vessel with thermal insulation

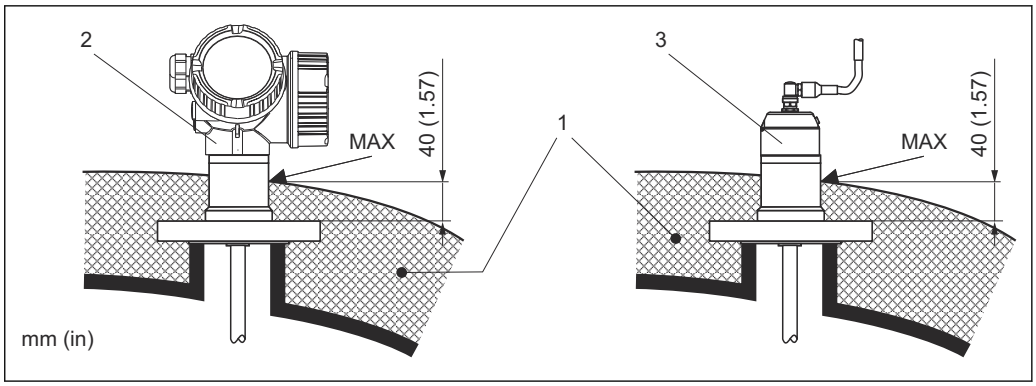
If process temperatures are high, the device must be included in normal vessel insulation (1) in order to prevent the electronics heating up as a result of thermal radiation or convection. The insulation may not go beyond the points labeled "MAX" in the drawings.



A0014653

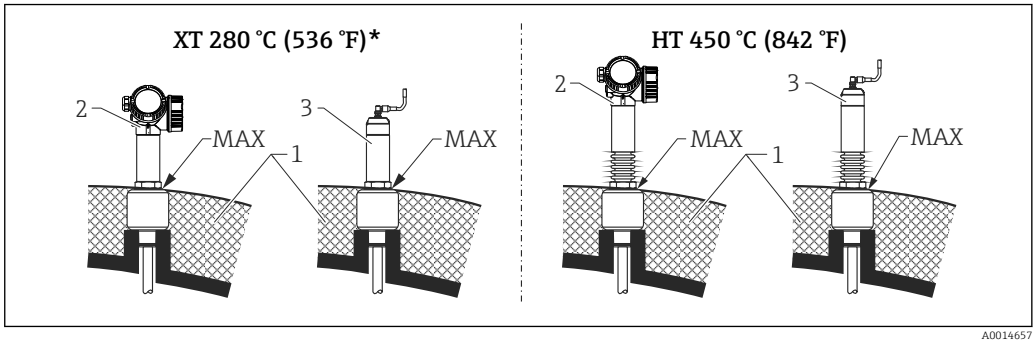
37 Process connection with thread

1 Vessel insulation
2 Compact device
3 Sensor, remote



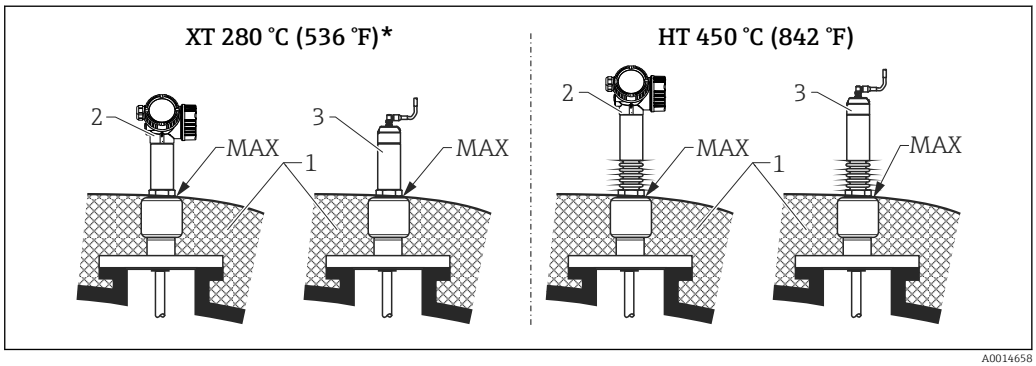
38 *Process connection with flange*

1 Vessel insulation
2 Compact device
3 Sensor, remote



39 *Process connection with thread - sensor version XT and HT*

1 Vessel insulation
2 Compact device
3 Sensor, remote
** The XT version is not recommended for saturated steam above 200 °C (392 °F); the HT version should be used instead*



40 *Process connection with flange - sensor version XT and HT*

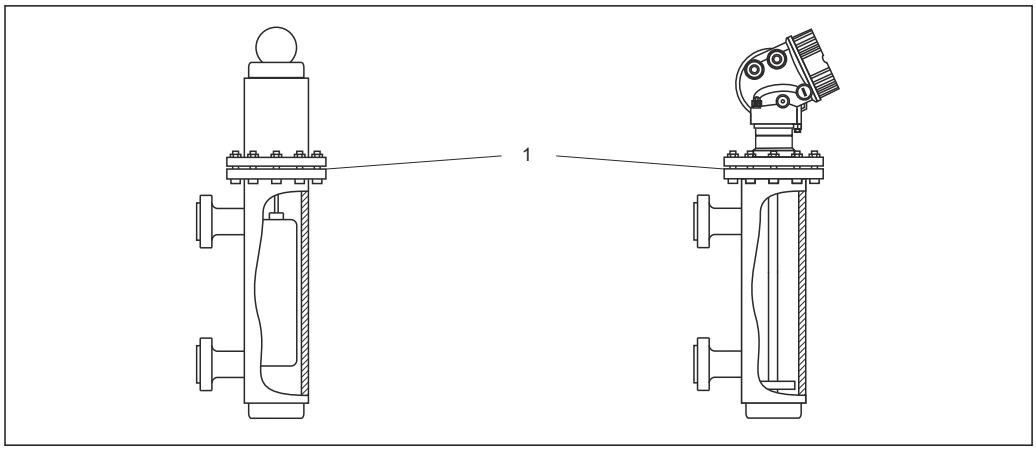
1 Vessel insulation
2 Compact device
3 Sensor, remote
** The XT version is not recommended for saturated steam above 200 °C (392 °F); the HT version should be used instead*

Replacing a displacer system in an existing displacer chamber

FMP51 and FMP54 are a perfect replacement for a conventional displacer system in an existing displacer chamber. Flanges that suit Fisher and Masoneilan displacer chambers are available for this purpose (special product for FMP51; feature 100 of the product structure, options LNJ, LPJ, LQJ for

FMP54). Thanks to menu-guided local operation, commissioning the Levelflex only takes a few minutes. Replacement is also possible when partially filled, and wet calibration is not required.

Your benefits:
- No moving parts, therefore zero-maintenance operation.
- Not affected by process influences such as temperature, density, turbulence and vibrations.
- The rod probes can be easily shortened or replaced. Therefore, the probe can also be easily adjusted on site.



1 Flange of the displacer chamber

Planning instructions:
- In normal cases, use a rod probe. When installing into a metal displacer chamber up to 150 mm (5.91 in), you have all the advantages of a coaxial probe.
- Contact between the probe and the side wall must be avoided. Where necessary, use a centering disk or centering star at the bottom end of the probe.
- The centering disk or centering star must be adapted as accurately as possible to the internal diameter of the displacer chamber to also ensure correct operation around the probe end.

Additional information regarding interface measurement
- In the case of oil and water, the centering star should be positioned at the lower edge of the lower outlet (water level).
- There should not be any changes in the diameter of the pipe. Use the coaxial probe if necessary.
- It must be ensured that rod probes do not come into contact with the wall. Where necessary, use a centering star at the end of the probe.
- The non-metal centering stars made of PEEK or PFA are recommended for interface measurements. When using metal centering disks, it is important to ensure that the lower medium covers the centering disk at all times. Otherwise, incorrect interface measurements can result.

Environment

Ambient temperature

Device	−40 to +80 °C (−40 to +176 °F)
Device (option for FMP51 and FMP54)	−50 to +80 °C (−58 to +176 °F) [1)]
Local display	−20 to +70 °C (−4 to +158 °F), the readability of the local display may be impaired at temperatures outside the temperature range.
Connecting cable (for "Sensor, remote" probe design)	−50 to +100 °C (−58 to +212 °F)

Remote display FHX50	−40 to 80 °C (−40 to 176 °F)
Remote display FHX50 (option)	−50 to 80 °C (−58 to 176 °F) [2]

1) This range applies if the option JN "Transmitter ambient temperature −50 °C (−58 °F)" has been selected in order code 580 "Test, certificate". If the temperature is permanently below −40 °C (−40 °F), higher failure rates can be expected.
2) This range applies if the option JN "Transmitter ambient temperature −50 °C (−58 °F)" has been selected in order code 580 "Test, certificate". If the temperature is permanently below −40 °C (−40 °F), higher failure rates can be expected.

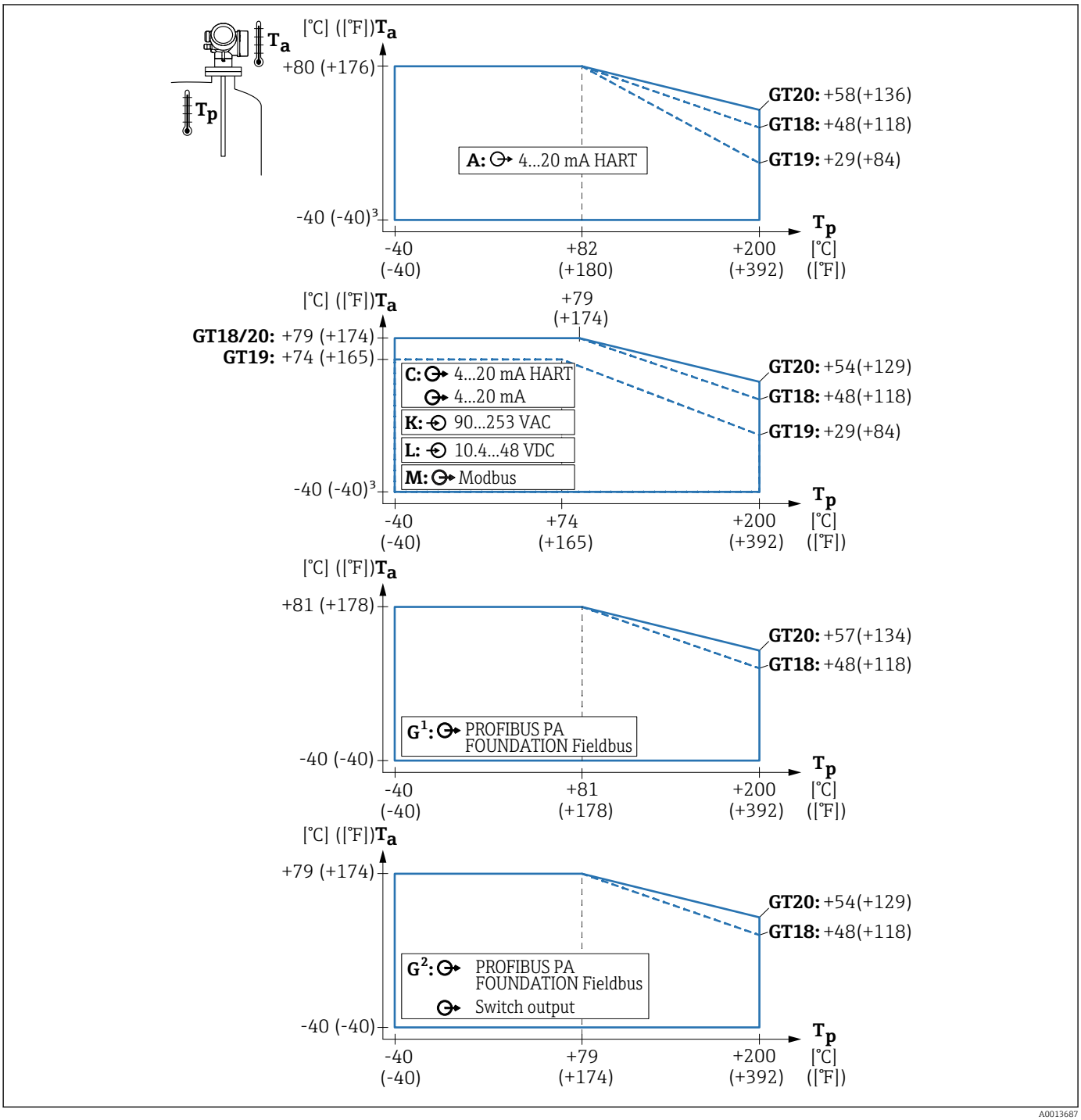
If operating outdoors in strong sunlight:
- Mount the device in the shade.
- Avoid direct sunlight, particularly in warm climatic regions.
- Use a weather protection cover (accessory).

Ambient temperature limits

The following diagrams only consider functional aspects. Additional restrictions may apply for certified device versions. See the separate Safety Instructions for more information.

In the event of temperature (T_p) at the process connection, the permitted ambient temperature (T_a) is reduced as indicated in the following diagram (temperature derating):

Temperature derating for FMP51 with threaded connection G¾ or NPT¾



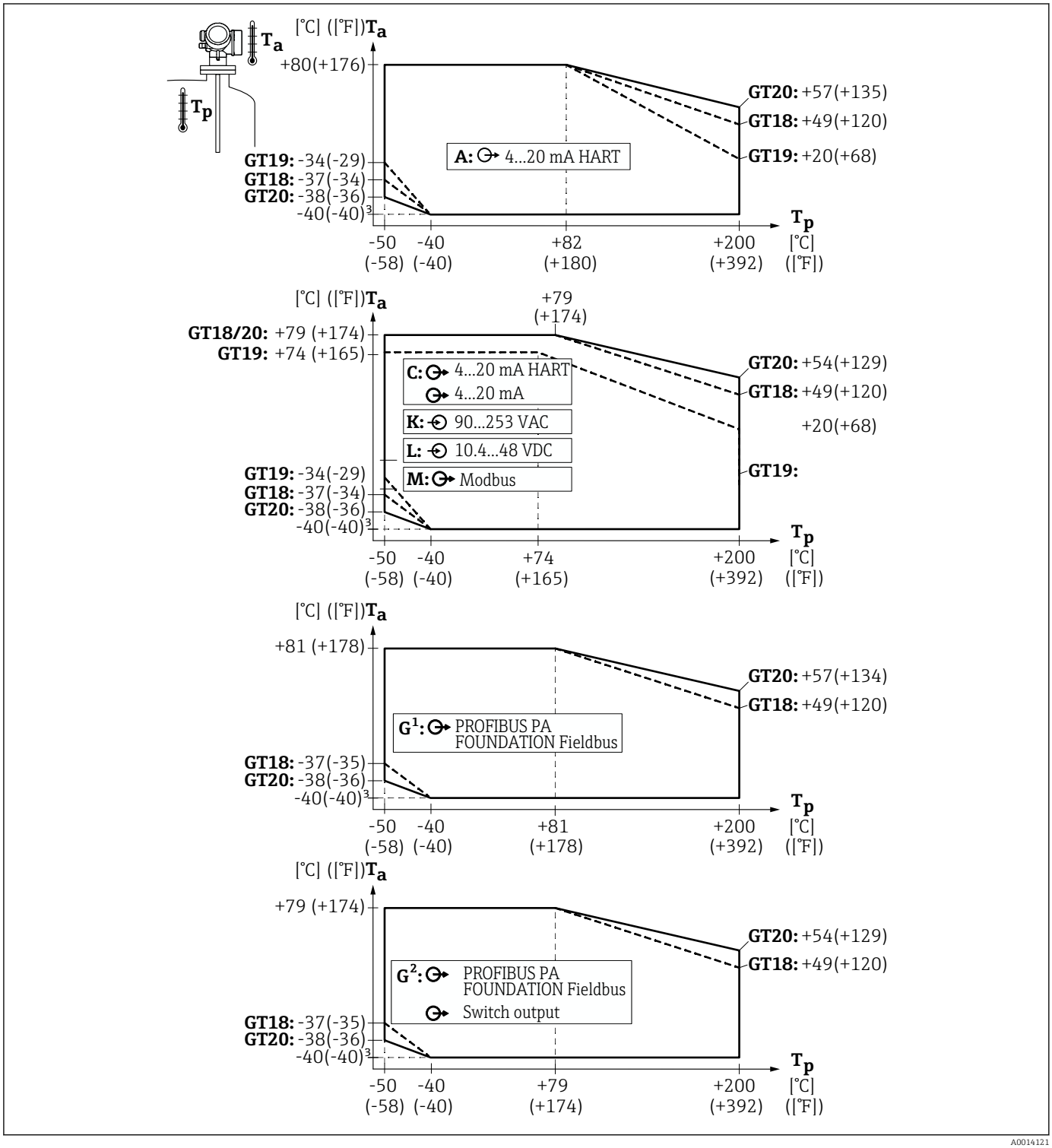
GT18 = Stainless steel housing
GT19 = Plastic housing
GT20 = Aluminum housing

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

T_a = Ambient temperature [3)]
T_p = Temperature at the process connection

1) G¹: Switch output not used
2) G²: Switch output used
3) T_a to −50 °C (−58 °F) for order code 580 "Test, certificate" = JN "Transmitter ambient temperature −50 °C (−58 °F)"; only available for 2-wire HART devices

Temperature derating for FMP51 with threaded connection G1½ or NPT1½



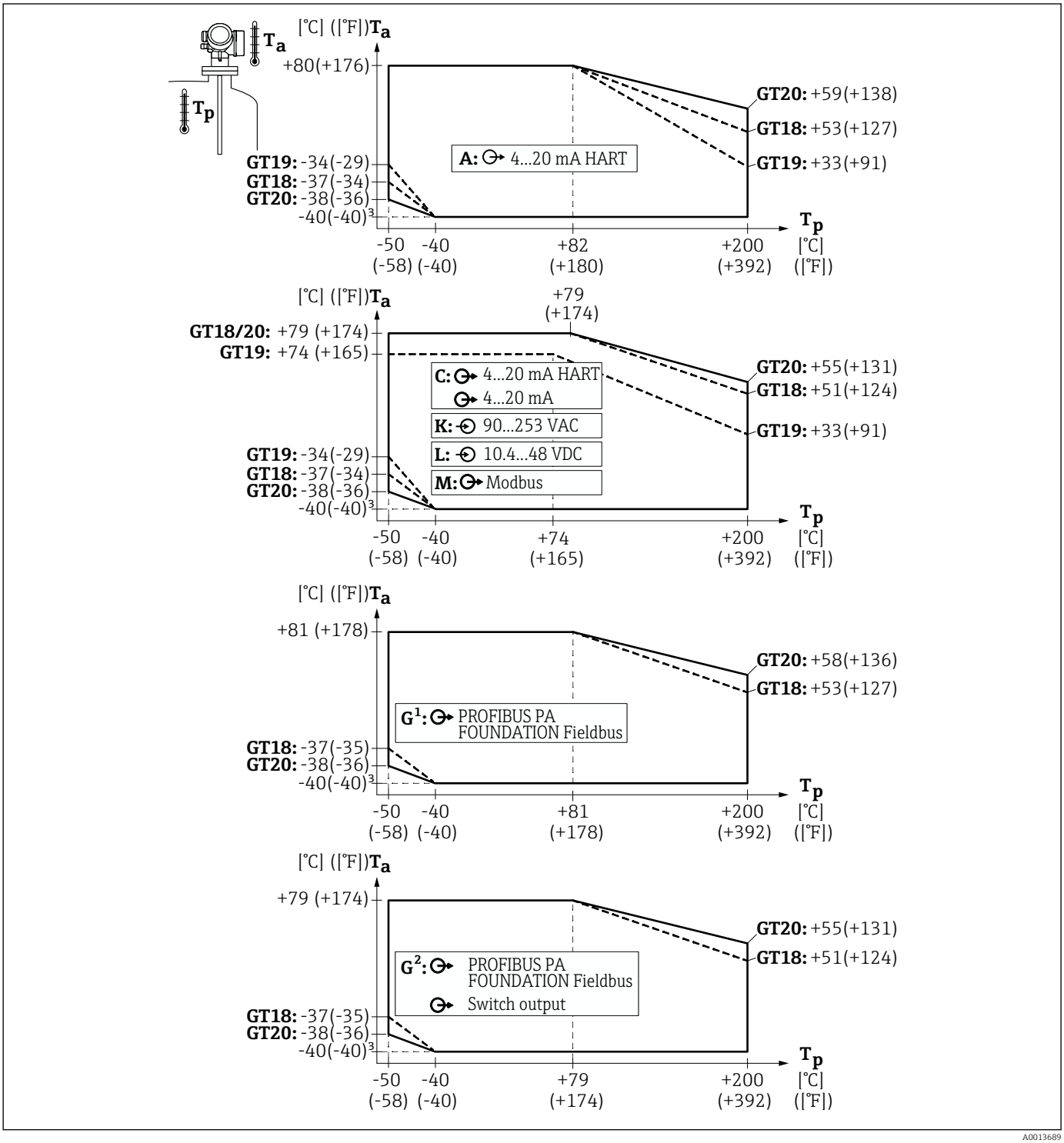
GT18 = Stainless steel housing
GT19 = Plastic housing
GT20 = Aluminum housing

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

T_a = Ambient temperature [3)]
T_p = Temperature at the process connection

1) G^1: Switch output not used
2) G^2: Switch output used
3) T_a to −50 °C (−58 °F) for order code 580 "Test, certificate" = JN "Transmitter ambient temperature −50 °C (−58 °F)"; only available for 2-wire HART devices

Temperature derating for FMP51 with flange



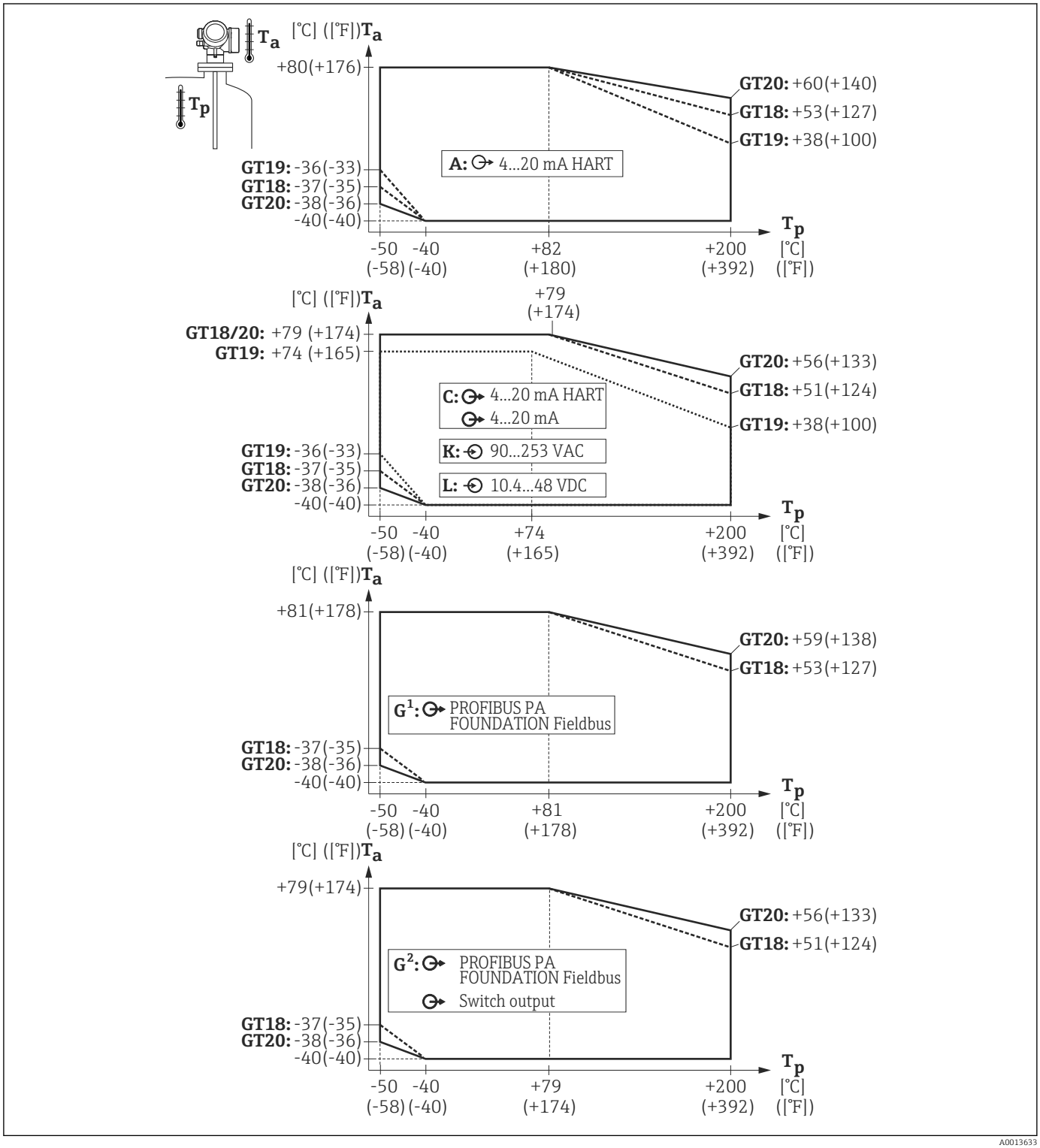
GT18 = Stainless steel housing
GT19 = Plastic housing
GT20 = Aluminum housing

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

T_a = Ambient temperature [3)]
T_p = Temperature at the process connection

1) G^1: Switch output not used
2) G^2: Switch output used
3) T_a to −50 °C (−58 °F) for order code 580 "Test, certificate" = JN "Transmitter ambient temperature −50 °C (−58 °F)"; only available for 2-wire HART devices

Temperature derating for FMP52



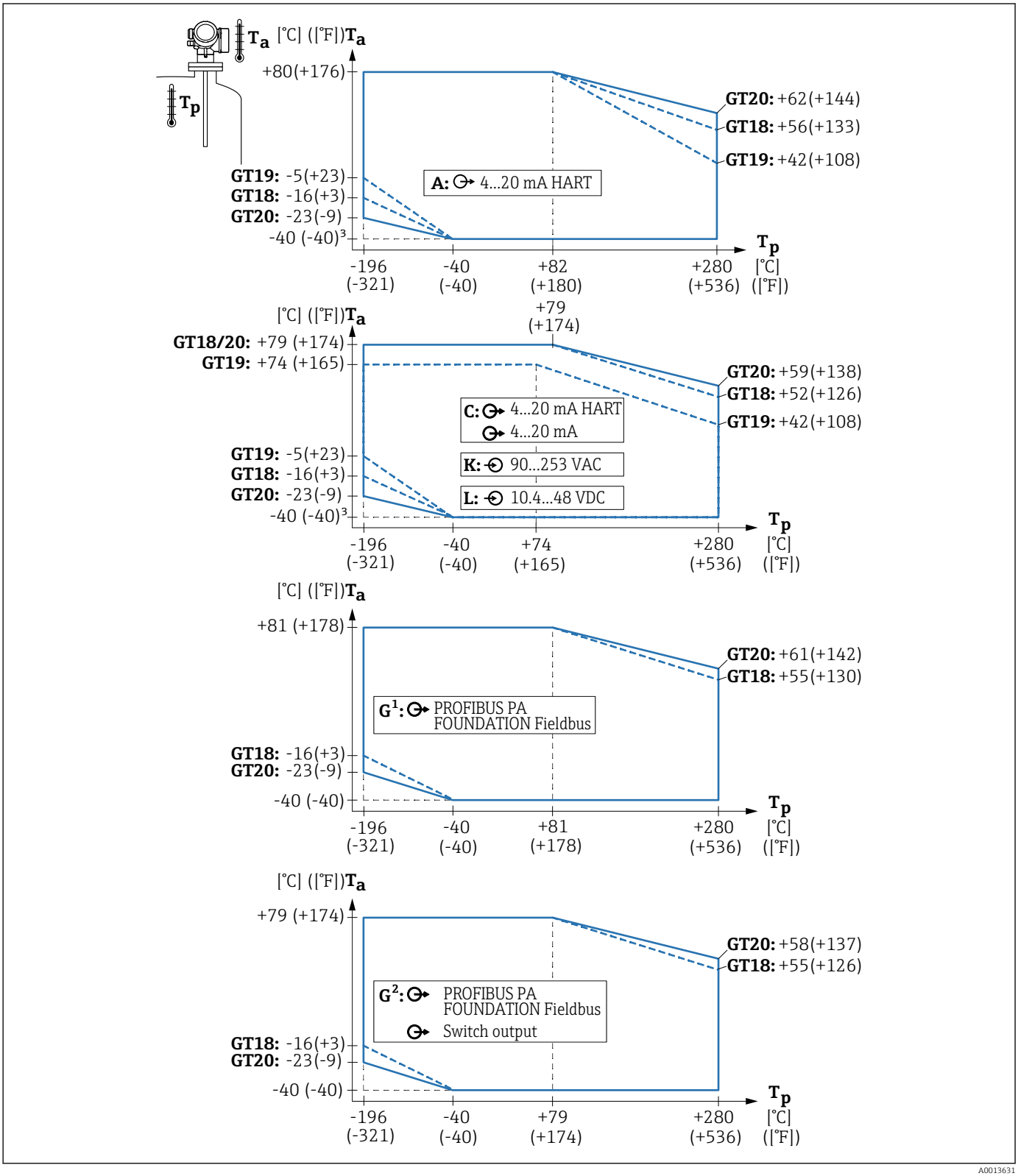
GT18 = Stainless steel housing
GT19 = Plastic housing
GT20 = Aluminum housing

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

T_a = Ambient temperature
T_p = Temperature at the process connection [2)]

1) In the case of PROFIBUS PA and FOUNDATION Fieldbus, the temperature derating depends on whether the switch output (terminals 3 and 4) is used (G^2) or not (G^1).
2) The process temperature should not exceed 150 °C (302 °F) for saturated steam applications. Use FMP54 for higher process temperatures.

Temperature derating for FMP54 - version XT to +280 °C (+536 °F)



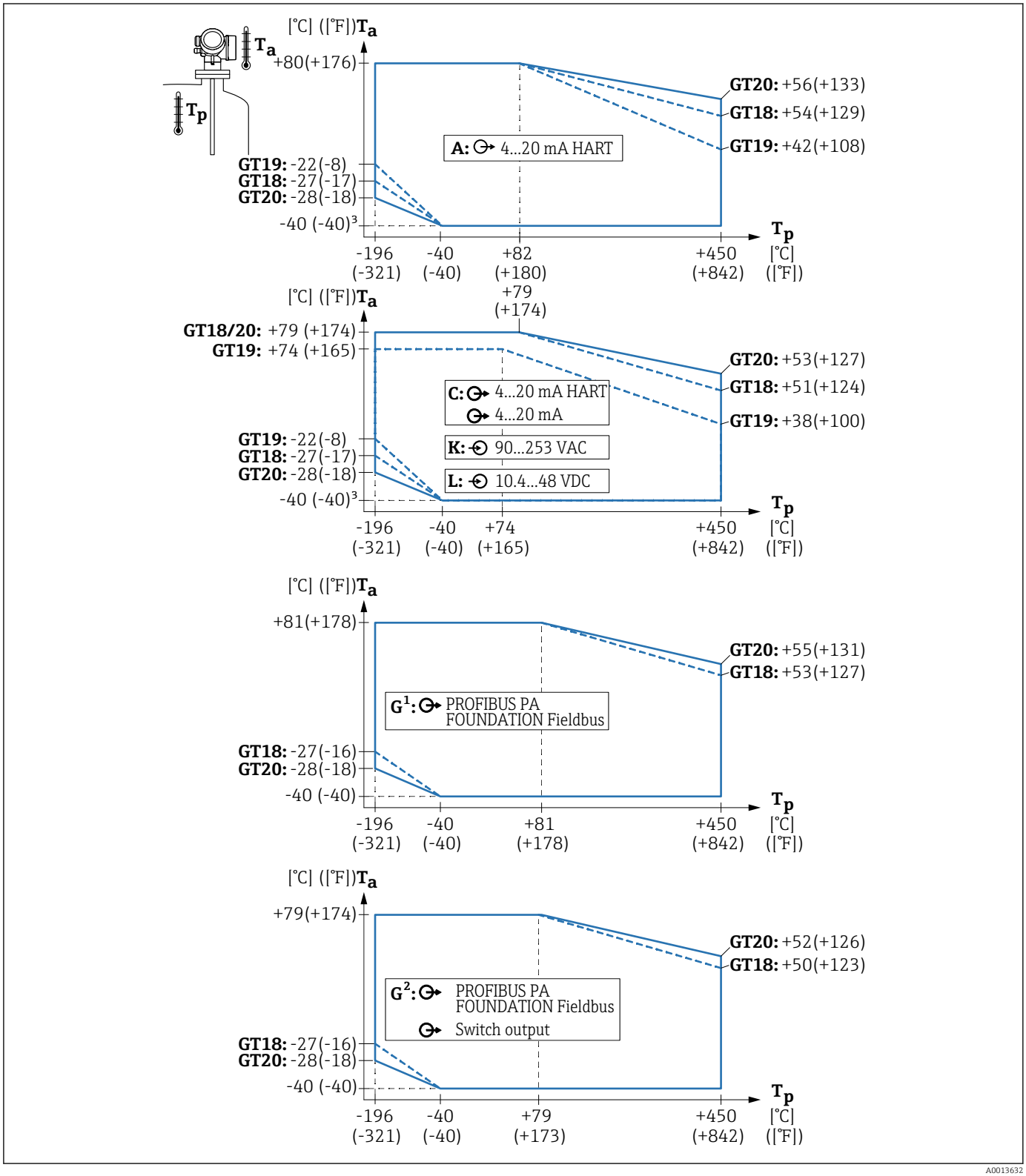
GT18 = Stainless steel housing
GT19 = Plastic housing
GT20 = Aluminum housing

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

T_a = Ambient temperature [3)]
T_p = Temperature at the process connection

1) G1: Switch output not used
2) G2: Switch output used
3) T_a to −50 °C (−58 °F) for order code 580 "Test, certificate" = JN "Transmitter ambient temperature −50 °C (−58 °F)"; only available for 2-wire HART devices

Temperature derating for FMP54 - version HT to +450 °C (+842 °F)



A0013632

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 [3)]
T_p = Temperature at the process connection

1) G^1: Switch output not used
2) G^2: Switch output used
3) T_a to −50 °C (−58 °F) for order code 580 "Test, certificate" = JN "Transmitter ambient temperature −50 °C (−58 °F)"; only available for 2-wire HART devices

Storage temperature

- Permitted storage temperature: −40 to +80 °C (−40 to +176 °F)
- Use original packaging.
- Option for FMP51 and FMP54: −50 to +80 °C (−58 to +176 °F)
  This range applies if the option JN "Transmitter ambient temperature" −50 °C (−58 °F) was selected in order code 580 "Test, Certificate". If the temperature is permanently below −40 °C (−40 °F), higher failure rates can be expected.

Climate class

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

Operating height

- Generally up to 2 000 m (6 600 ft) above sea level.
- Over 2 000 m (6 600 ft) under the following conditions:
  - Order code 020 "Power supply; output "= A, B, C, E or G (2-wire versions)
  - Supply voltage U < 35 V
  - Power supply, overvoltage category 1

Degree of protection

Tested according to:

- With housing closed: IP68, NEMA6P (24 h at 1.83 m (6 ft) under water)
  (also applies for the "Remote sensor" version)
  - For housing: GT19 dual compartment, PBT plastic in combination with display, operation: SD02 or SD03: IP68 (24 h at 1 m (3.28 ft) under water)
  - IP66, NEMA4X
- With housing open: IP20, NEMA1
- Display module: IP22, NEMA2
- For M12 plug: IP68 NEMA6P, only if the cable is plugged in and also specified according to 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

Dirt or buildup may form on the probe depending on the application. A thin, even layer has little impact on the measurement. Thick layers can dampen the signal and reduce the measuring range. Very uneven deposit formation or caking (e.g. due to crystallization) can result in incorrect measurements. In such cases, use a non-contact measuring principle, or regularly inspect the probe for contamination.

Cleaning with sodium hydroxide solution (e.g. in CIP procedures): if the coupling is wetted, larger measurement errors can occur than under reference operating conditions. Wetting can cause temporary incorrect measurements.

Electromagnetic compatibility (EMC)

Electromagnetic compatibility in accordance with all the relevant requirements outlined in the EN 61326 series and NAMUR Recommendation EMC (NE 21). For details, refer to the Declaration of Conformity.

Download from www.endress.com.

Use a shielded cable for signal transmission.

Maximum measurement error during EMC testing: < 0.5 % of the span.

When the probes are installed in metal and concrete vessels and when a coaxial probe is used:

- Interference emission according to EN 61326-x series, Class B equipment.
- Interference immunity according to EN 61326-x series, requirements for industry and NAMUR Recommendation NE 21 (EMC)

When probes are installed without a shielding/metal wall, e.g. installation in plastic or wooden silos, or when the "Remote sensor" device version is used, strong electromagnetic fields can affect the measured value.

- Interference emission according to EN 61326-x series, Class A equipment.
- Interference immunity: the effect of strong electromagnetic fields can influence the measured value.

Process

Process temperature range

The maximum temperature permitted at the process connection is determined by the seal version ordered:

Device	Seal	Process temperature
FMP51	FKM Viton (FDA approved)	−30 to +150 °C (−22 to +302 °F)
		−40 to +150 °C (−40 to +302 °F) ℹ Order code for **Accessory mounted**, option **Gas-tight feedthrough**:
	EPDM (FDA approved)	−40 to +120 °C (−40 to +248 °F)
		Do not exceed values for Tmax in oxygen applications (gaseous) −40 to +90 °C (−40 to +194 °F) ℹ Order code for **Service**, option **Verified cleaned, suitable for O_2 applications**
	FFKM Kalrez ℹ Recommended for water vapor applications.	−20 to +200 °C (−4 to +392 °F) ℹ Use FMP54 for saturated steam above +150 °C (+302 °F).
		Do not exceed values for Tmax in oxygen applications (gaseous) −20 to +120 °C (−4 to +248 °F) ℹ Order code for **Service**, option **Verified cleaned, suitable for O_2 applications**
	FVMQ	−50 to 130 °C (−58 to 260 °F)

Device	Wetted material	Process temperature
FMP52	PFA, PTFE (FDA, 3 A, EHEDG, USP Cl. VI approved) ℹ Plastic components in contact with the medium have been tested in accordance with USP <88> Class VI-70	−50 to +200 °C (−58 to +392 °F)
		Do not exceed values for Tmax in oxygen applications (gaseous) −50 to +120 °C (−58 to +248 °F) ℹ Order code for **Service**, option **Verified cleaned, suitable for O_2 applications**
ℹ High process temperatures (> 150 °C (302 °F)) may favor the diffusion of the medium through the probe coating, which may reduce the operating time.		

Device	Seal	Process temperature
FMP54	Graphite (XT)	−196 to +280 °C (−321 to +536 °F)
	Graphite (HT)	−196 to +450 °C (−321 to +842 °F) ℹ Recommended for saturated steam above 200 °C (392 °F)
ℹ The sensor material 1.4404/316L is resistant to attack from intergranular corrosion according to AD 2000 - instruction sheet W2 at operating temperatures up to 400 °C (752 °F) and with an operating time of 100,000 hours (11.4 years). For higher temperatures, the suitability of the material must be checked by the operator. Acids, in particular, may cause corrosion.		

ℹ With uncoated probes, the medium temperature may be higher provided that the process temperature specified in the table is not exceeded at the process connection.

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

Process pressure range

WARNING

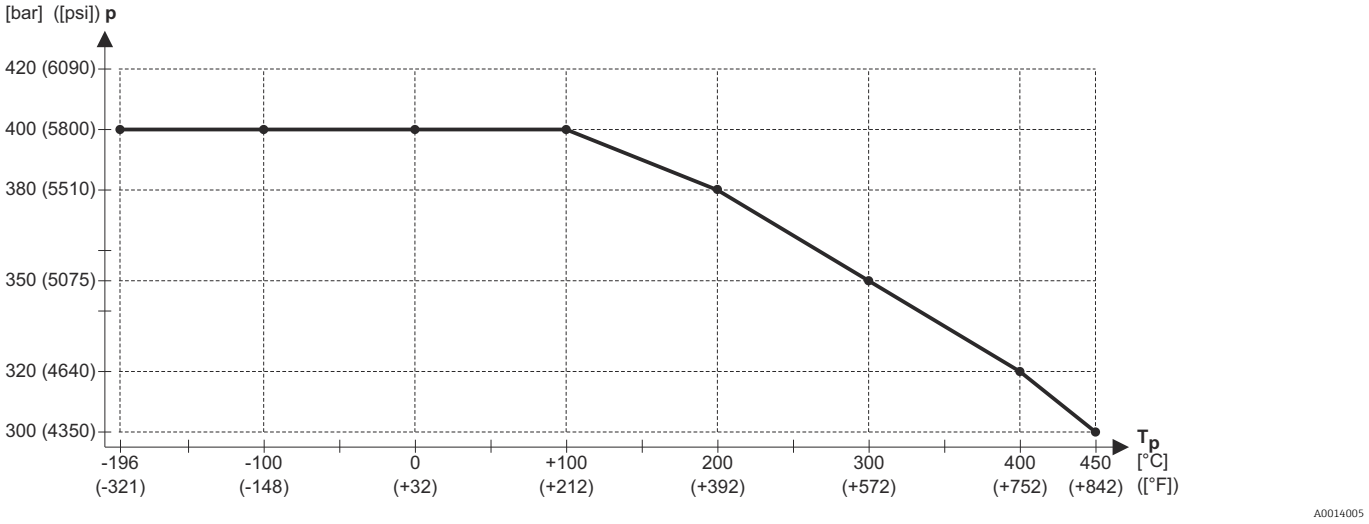
The maximum pressure for the device depends on the lowest-rated component with regard to pressure (components are: process connection, optional mounted parts or accessories).

- Only operate the device within the specified limits for the components!
- MWP (Maximum Working Pressure): The MWP is specified on the nameplate. This value refers to a reference temperature of +20 °C (+68 °F) and may be applied to the device for an unlimited time. Note temperature dependence of MWP. For flanges, refer to the following standards for the permitted pressure values at higher temperatures: EN 1092-1 (with regard to their stability/ temperature property, the materials 1.4435 and 1.4404 are grouped together under EN 1092-1; the chemical composition of the two materials can be identical), ASME B16.5, JIS B2220 (the latest version of the standard applies in each case). MWP data that deviate from this are provided in the relevant sections of the Technical Information.
- The Pressure Equipment Directive (2014/68/EU) uses the abbreviation **PS** . This corresponds to the maximum working pressure (MWP) of the device.
- Oxygen applications: do not exceed values for Pmax and Tmax.

Device	Process pressure
FMP51	−1 to 40 bar (−14.5 to 580 psi)
Do not exceed the values for Pmax in oxygen applications (gaseous) Order code for **Service**, option **Verified cleaned, suitable for O_2 applications**	Order code for **Seal**, option **EPDM** −1 to 10 bar (−14.5 to 145 psi)
	Order code for **Seal**, option **FFKM Kalrez** −1 to 40 bar (−14.5 to 580 psi)

Device	Process pressure
FMP52	−1 to 40 bar (−14.5 to 580 psi)
Do not exceed the values for Pmax in oxygen applications (gaseous) Order code for **Service**, option **Verified cleaned, suitable for O_2 applications**	−1 to 15 bar (−14.5 to 217.5 psi)

Device	Process pressure
FMP54	−1 to 400 bar (−14.5 to 5 800 psi)



41 *Permitted process pressure depending on the process temperature*

p *Permitted process pressure*
T_p *Process temperature*

The process pressure range indicated can be reduced by the choice of process connection. The maximum working pressure (MWP) indicated on the nameplate refers to a reference temperature of 20 °C, and of 100 °F for ASME flanges. Pay attention to the pressure/ temperature dependency.

In the case of higher temperatures, the permitted pressure values can be taken from the following standards:
- EN 1092-1 Tab. G.4.1-x
  With regard to their stability-temperature property, the materials 1.4435 and 1.4404 are grouped together under 13E0 in EN 1092-1 Tab. G.3.1-1. The chemical composition of the two materials can be identical.
- ASME B 16.5a Tab. 2-2.2 F316
- ASME B 16.5a Tab. 2.3.8 N10276
- JIS B 2220

Relative permittivity

- with coaxial probe: $\varepsilon_r \geq 1.4$
- rod and rope probe: $\varepsilon_r \geq 1.6$ (for installation in pipes DN ≤ 150 mm (6 in): $\varepsilon_r \geq 1.4$)

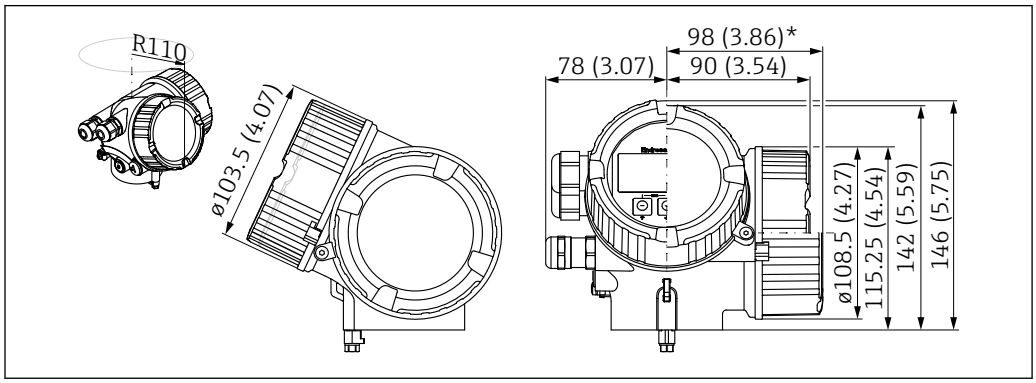
Extension of the rope probe

Extension of the rope probes due to temperature
Elongation from temperature increase from 30 °C (86 °F) to 150 °C (302 °F): 2 mm/m (0.08 in/ft) rope length

Mechanical construction

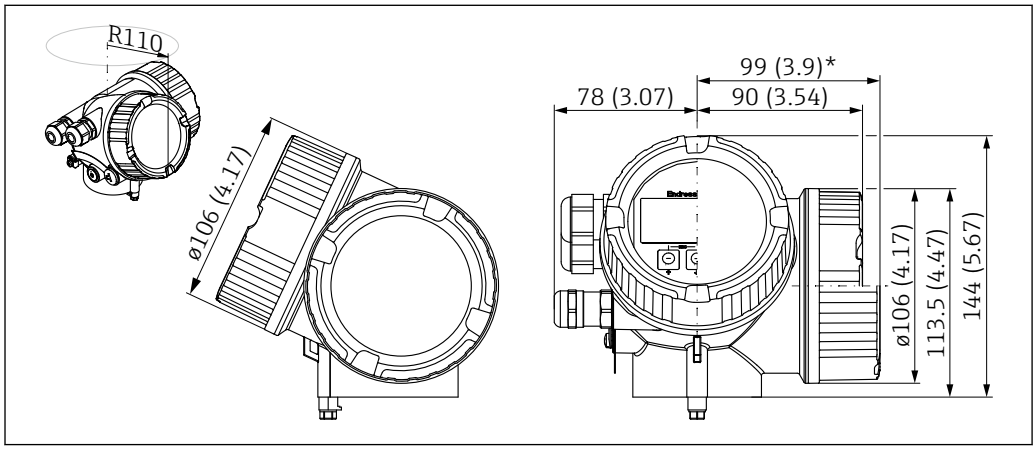
Dimensions

Dimensions of the electronics housing



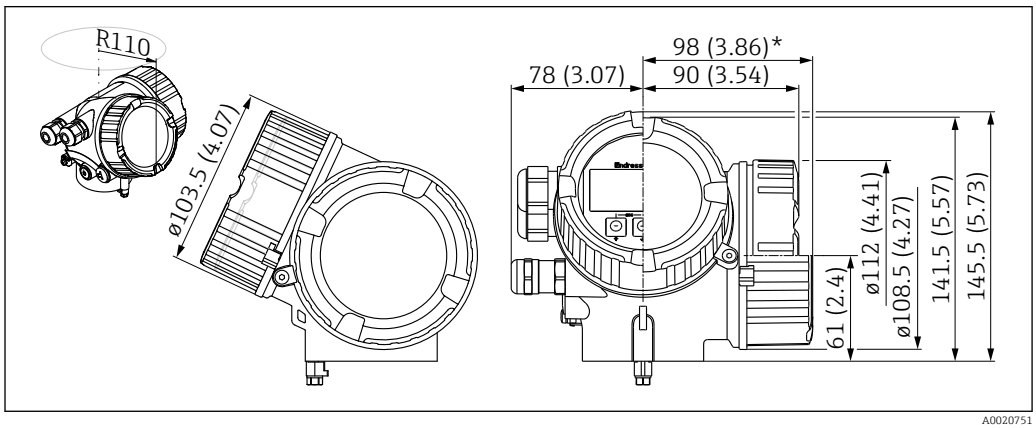
42 *Housing GT18 (316L). Unit of measurement mm (in)*

**For devices with integrated overvoltage protection.*



43 *GT19 housing (plastic PBT). Unit of measurement mm (in)*

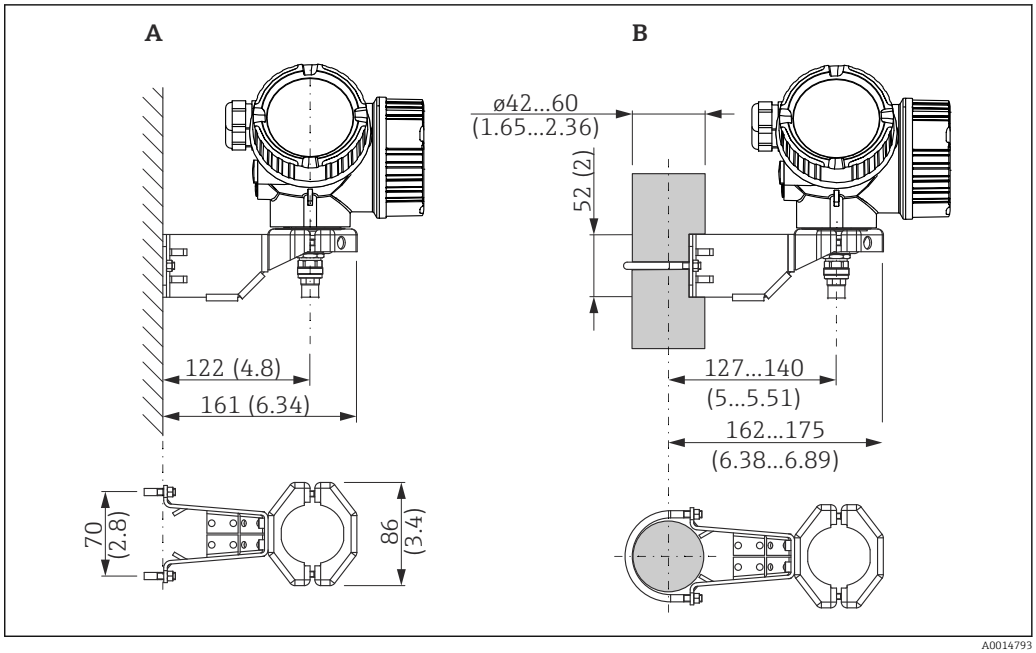
**For devices with integrated overvoltage protection.*



44 *Housing GT20 (aluminum coated). Unit of measurement mm (in)*

**For devices with integrated overvoltage protection.*

Mounting bracket dimensions

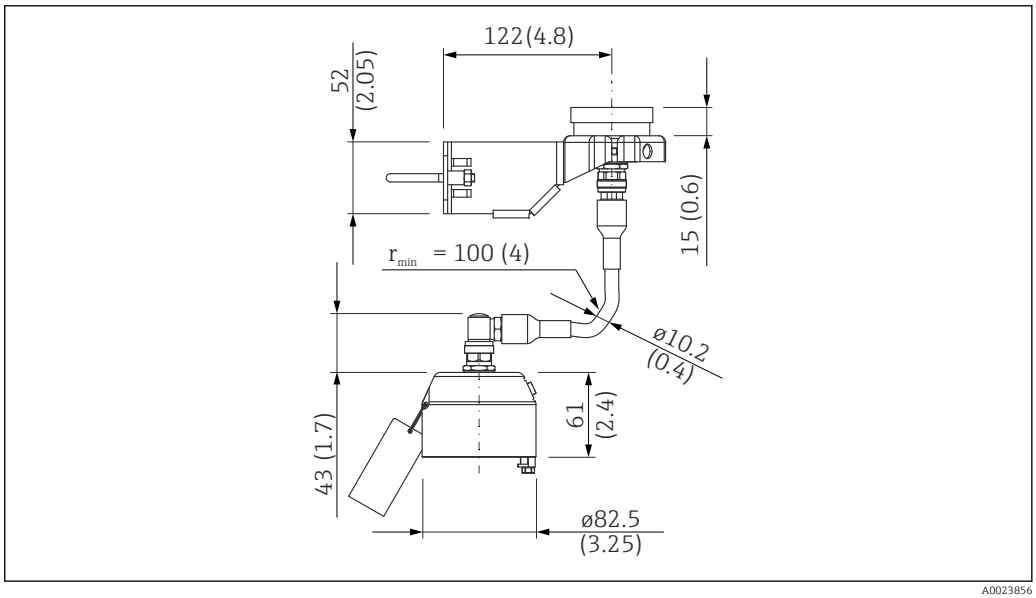


45 *Mounting bracket for electronics housing. Unit of measurement mm (in)*

A Wall mounting
B Post mounting

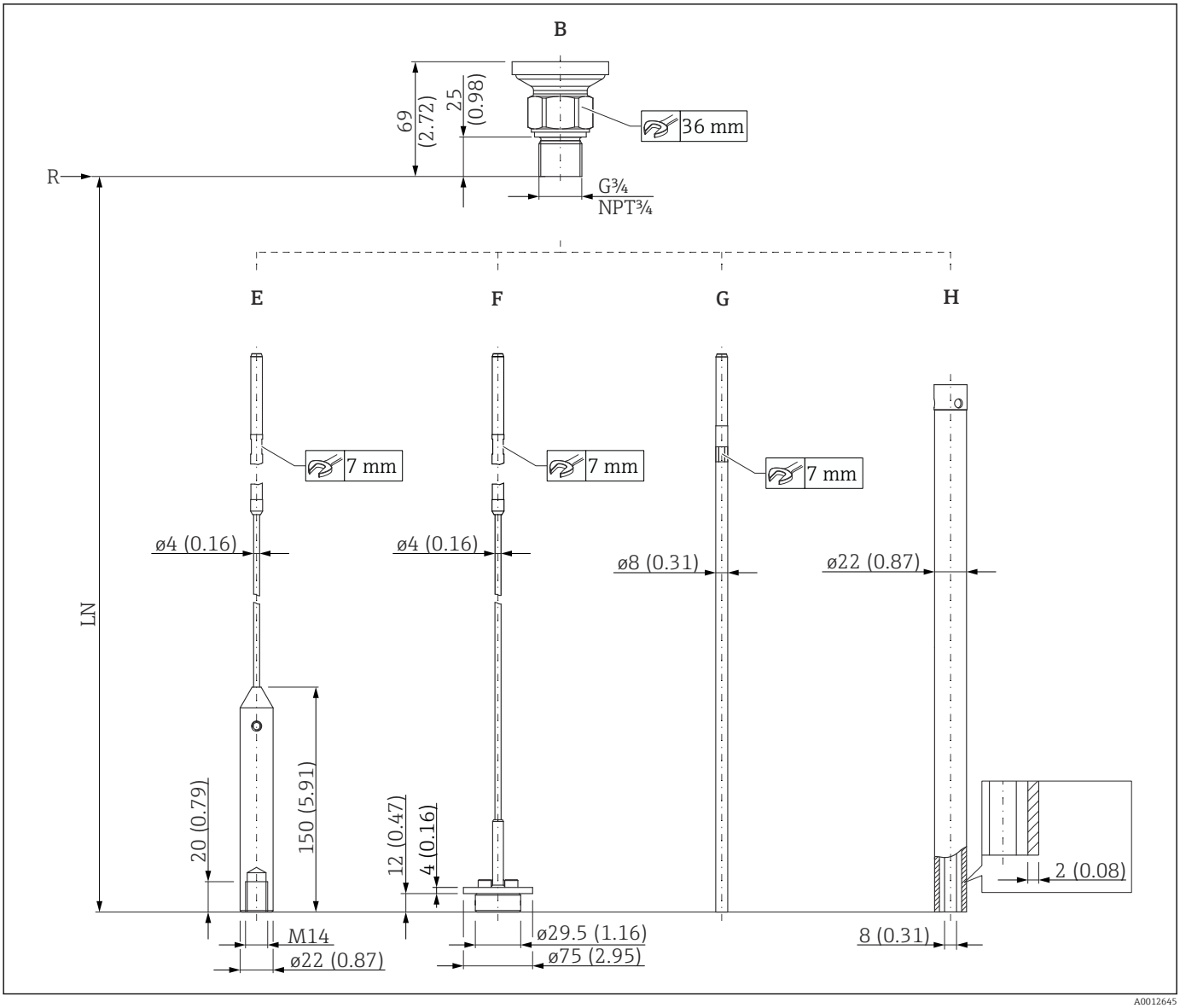
With "remote sensor" device versions (see feature 060 in the product structure), the mounting bracket is included in the scope of delivery. However, it can also be ordered separately as an accessory (order number: 71102216).

Dimensions of connection piece for remote probe



46 *Connection piece for remote probe; length of connecting cable: as per order. Unit of measurement mm (in)*

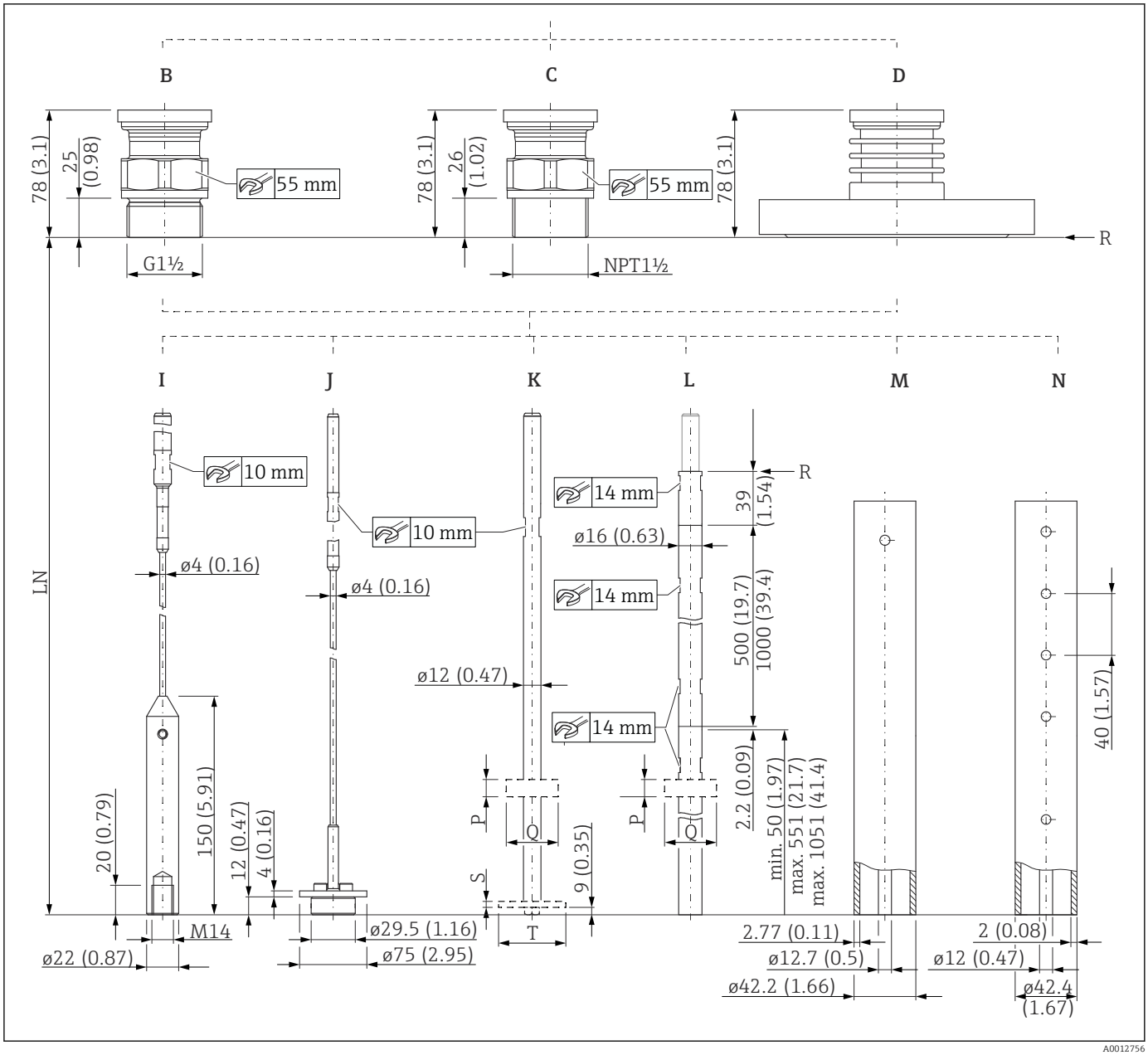
FMP51: Dimensions of process connection (G¾, NPT¾)/probe



47 *FMP51: Process connection/probe. Unit of measurement mm (in)*

B Thread ISO228 G¾ or ANSI MNPT¾ (feature 100)
E Rope probe 4 mm or ⅙" (feature 060)
F Rope probe 4 mm or ⅙" (feature 060), centering disk optional (feature 610)
G Rod probe 8 mm or ⅓" (feature 060)
H Coaxial probe (feature 060); with vent opening ⌀ approx. 6 mm (0.24 in)
LN Probe length
R Reference point of the measurement

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



48 FMP51: Process connection/probe. Unit of measurement mm (in)

- *B Thread ISO228 G1½ (feature 100)*
- *C Thread ANSI MNPT1½ (feature 100)*
- *D Flange ANSI B16.5, EN1092-1, JIS B2220 (feature 100)*
- *I Rope probe 4 mm or ⅙" (feature 060)*
- *J Rope probe 4 mm or ⅙"; centering disk optional (features 060 and 610)*
- *K Rod probe 12 mm or ½"; centering disk optional, see table below (features 060 and 610)*
- *L Rod probe 16 mm (0.63 in), 500 mm (20 in) or 1000 mm (40 in) separable; centering disk optional, see table below (features 060 and 610)*
- *M Coaxial probe; Alloy C (feature 060); with vent opening ø approx. 8 mm (0.3 in)*
- *N Coaxial probe; 316L (feature 060); with vent openings ø approx. 10 mm (0.4 in)*
- *LN Probe length*
- *P Thickness of centering star; for table of values, see below*
- *Q Diameter of centering star; for table of values, see below*
- *R Reference point of the measurement*
- *S Thickness of centering disk or centering star; for table of values, see below*
- *T Diameter of centering disk or centering star: for table of values, see below*

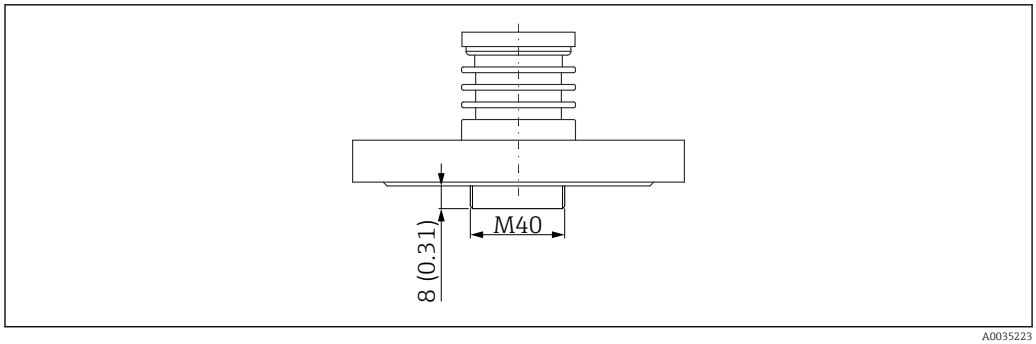
Centering disk/centering star/centering weight

Order code 610 "Accessory mounted"	Meaning	Thickness	Diameter
OA	Rod centering disk 316L; pipe diameter DN 80 (3") + DN 100 (4")	S = 4 mm (0.16 in)	T = 75 mm (2.95 in)
OB	Rod centering disk 316L; pipe diameter DN 50 (2") + DN 65 (2½")	S = 4 mm (0.16 in)	T = 45 mm (1.77 in)
OC	Rope centering disk 316L; pipe diameter DN 80 (3")+ DN 100 (4")	S = 4 mm (0.16 in)	T = 75 mm (2.95 in)
OD	Rod centering star PEEK; interface measurement; pipe diameter DN 50 (2") + DN 100 (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 DN 40 (1½") + DN 50 (2")	P = 10 mm (0.39 in)	Q = 37 mm (1.46 in)
OK	Rope centering weight 316L for DN 50 (2")	60 mm (2.4 in)	45 mm (1.77 in)
OL	Rope centering weight 316L for DN 80 (3")	30 mm (1.18 in)	75 mm (2.95 in)
OM	Rope centering weight 316L for DN 100 (4")	30 mm (1.18 in)	95 mm (3.7 in)

Note on Alloy C flanges

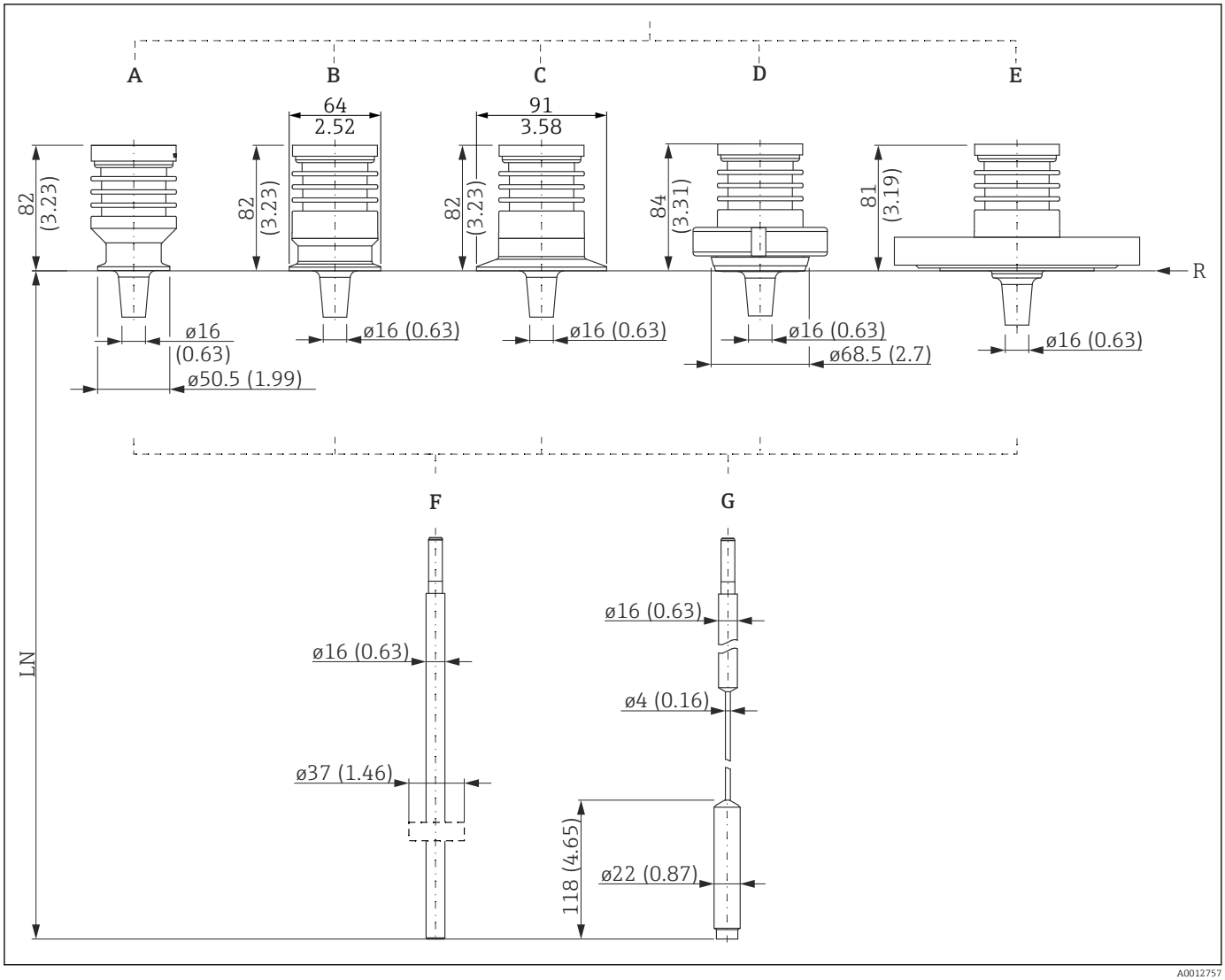
Alloy C flanges always have an additional thread, even if they are not used with a coaxial probe.

Options for order feature 100 for "Process connection" that are affected: AEM, AFM, AGM, AQM, ARM, ASM, ATM, CEM, CFM, CGM, CQM, CRM, CSM, CTM.



49 Dimensions of Alloy C flanges. Unit of measurement mm (in)

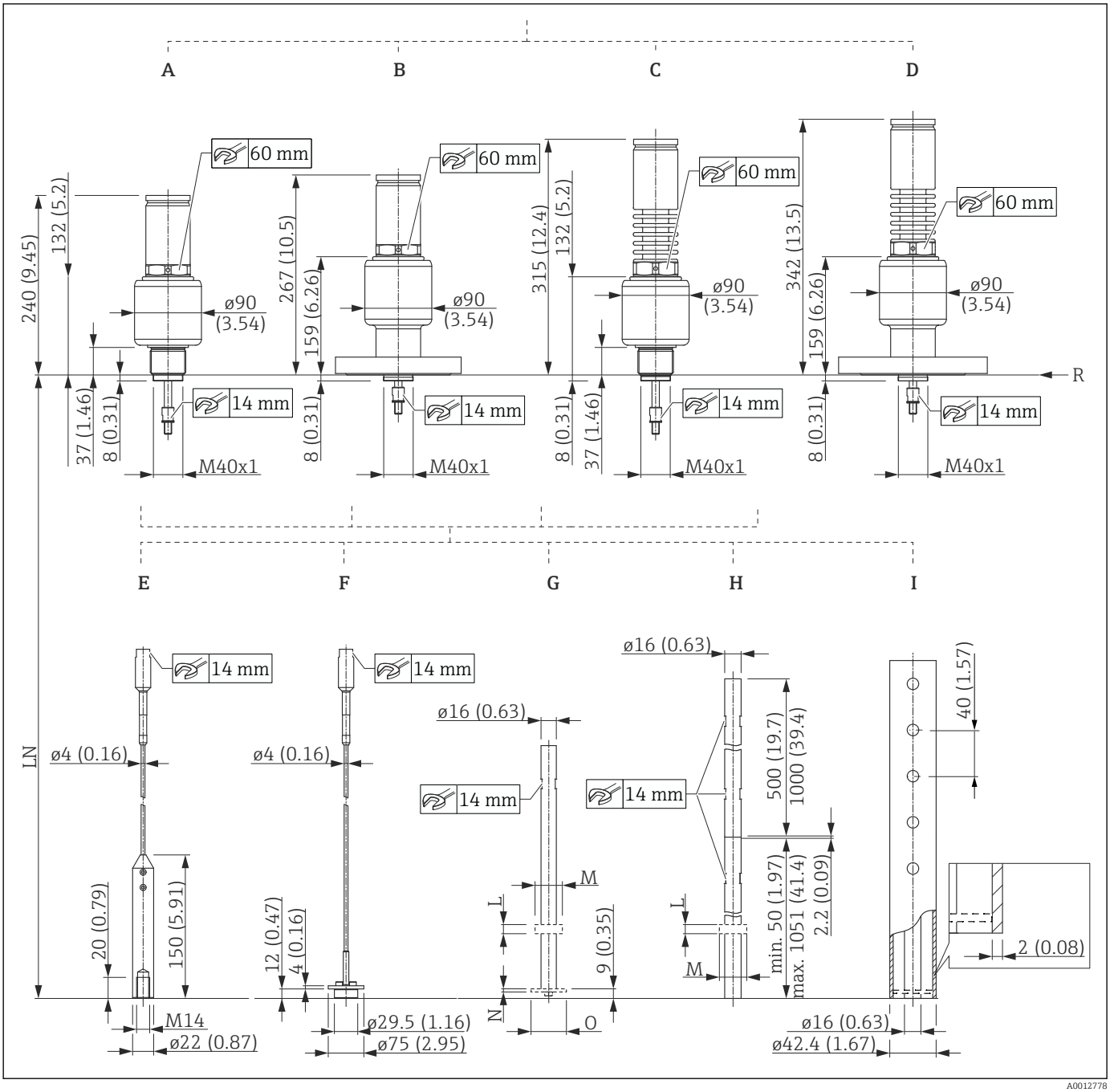
FMP52: Dimensions of process connection/probe



50 FMP52: Process connection/probe. Unit of measurement mm (in)

A Tri-Clamp 1½" (feature 100)
B Tri-Clamp 2" (feature 100)
C Tri-Clamp 3" (feature 100)
D DIN11851 (milk pipe) DN 50 (feature 100)
E Flange ANSI B16.5, EN1092-1, JIS B2220 (feature 100)
F Rod probe 16 mm or 0.63 in, PFA over 316L (feature 060); with optional centering stars (feature 610)
G Rope probe 4 mm or ⅙", PFA over 316 (feature 060)
LN Probe length
R Reference point of the measurement

FMP54: Dimensions of process connection/probe



51 *FMP54: Process connection/probe. Unit of measurement mm (in)*

A Thread ISO228 G1½ or ANSI MNPT1½; XT 280 °C (features 100 and 090)
B Flange ANSI B16.5, EN1092-1, JIS B2220; XT 280 °C (features 100 and 090)
C Thread ISO228 G1½ or ANSI MNPT1½; HT 450 °C (features 100 and 090)
D Flange ANSI B16.5, EN1092-1, JIS B2220 ; HT 450 °C (features 100 and 090)
E Rope probe 4 mm or ⅛" (feature 060)
F Rope probe 4 mm or ⅛" ; centering disk optional (features 060 and 610)
G Rod probe 16 mm (0.63 in); centering disk optional, see table below (features 060 and 610)
H Rod probe 16 mm (0.63 in); 500 mm (20 in) or 1 000 mm (40 in) separable; centering disk optional, see table below (features 060 and 610)
I Coaxial probe (feature 060); with vent openings Ø approx. 10 mm (0.4 in); with centering disk for "Gas phase compensation" application package (order code 540, option EF or EG)
LN Probe length
L Thickness of centering star; for table of values, see below
M Diameter of centering star; for table of values, see below

N Thickness of centering disk or centering star; for table of values, see below
O Diameter of centering disk or centering star: for table of values, see below
R Reference point of the measurement

Centering disk/centering star/centering weight

Order code 610 "Accessory mounted"	Meaning	Thickness	Diameter
OA	Rod centering disk 316L; pipe diameter DN 80 (3") + DN 100 (4")	N = 4 mm (0.16 in)	O = 75 mm (2.95 in)
OB	Rod centering disk 316L; pipe diameter DN 50 (2") + DN 65 (2½")	N = 4 mm (0.16 in)	O = 45 mm (1.77 in)
OC	Rope centering disk 316L; pipe diameter DN 80 (3")+ DN 100 (4")	N = 4 mm (0.16 in)	O = 75 mm (2.95 in)
OD	Rod centering star PEEK; interface measurement; pipe diameter DN 50 (2") + DN 100 (4")	N = 7 mm (0.28 in)	O = 48 to 95 mm (1.9 to 3.7 in)
OE	Rod centering star PFA; interface measurement; pipe diameter DN 40 (1½") + DN 50 (2")	L = 10 mm (0.39 in)	M = 37 mm (1.46 in)
OK	Rope centering weight 316L for DN 50 (2")	60 mm (2.4 in)	45 mm (1.77 in)
OL	Rope centering weight 316L for DN 80 3(")	30 mm (1.18 in)	75 mm (2.95 in)
OM	Rope centering weight 316L for DN 100 (4")	30 mm (1.18 in)	95 mm (3.7 in)

Probe length tolerances

Rod and coaxial probes
Permitted tolerance depending on the probe length:
- < 1 m (3.3 ft) = −5 mm (−0.2 in)
- 1 to 3 m (3.3 to 9.8 ft) = −10 mm (−0.39 in)
- 3 to 6 m (9.8 to 20 ft) = −20 mm (−0.79 in)
- > 6 m (20 ft) = −30 mm (−1.18 in)

Rope probes
Permitted tolerance depending on the probe length:
- < 1 m (3.3 ft) = −10 mm (−0.39 in)
- 1 to 3 m (3.3 to 9.8 ft) = −20 mm (−0.79 in)
- 3 to 6 m (9.8 to 20 ft) = −30 mm (−1.18 in)
- > 6 m (20 ft) = −40 mm (−1.57 in)

Surface roughness

Surface roughness of Alloy C coated flanges
Ra = 3.2 µm (126 µin); lower surface roughness available on request.

This value applies to flanges with "Alloy C over 316/316L"; see product structure, feature 100 "Process connection". For other flanges, the surface roughness corresponds to the relevant flange standard.

Shortening probes

If necessary, probes can be shortened by observing the following instructions:

Shortening rod probes

Rod probes must be shortened if the distance to the vessel floor or outlet cone is less than 10 mm (0.4 in). To shorten, saw off the bottom end of the rod probe.

It is **not** possible to shorten FMP52 rod probes due to their coating.

Shortening rope probes

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

It is **not** possible to shorten FMP52 rope probes due to their coating.

Shortening coaxial probes

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

Coaxial probes can be shortened by a maximum of 80 mm (3.2 in) from below. They have centering devices on the inside to secure the rod centrally in the pipe. A raised edge holds the centering devices in place on the rod. It is possible to shorten the probe up to approx. 10 mm (0.4 in) below the centering device.

Weight

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

Housing

Weight including electronics and display.

GT18 housing (stainless steel, corrosion-resistant)
4.5 kg (9.92 lb)

GT19 housing (plastic)
1.2 kg (2.65 lb)

GT20 housing (die-cast aluminum, powder-coated)
Approx.1.9 kg (4.19 lb)

Antenna and process connection adapter

FMP51 with threaded connection G¾ or NPT¾

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

- Sensor
  Approx.0.8 kg (1.76 lb)
- Rope probe 4 mm or ⅙"
  Approx. 0.10 kg/m (0.22 lb/in) probe length
- Rod probe 8 mm or ¾"
  Approx. 0.40 kg/m (0.88 lb/in) probe length
- Coaxial probe
  Approx. 1.20 kg/m (2.65 lb/in) probe length

FMP51 with threaded connection G1½/NPT1½ or flange

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

- Sensor
  Approx. 1.20 kg/m (2.65 lb/in) + flange weight
- Rope probe 4 mm or ⅙"
  Approx. 0.10 kg/m (0.22 lb/in) probe length
- Rod probe 12 mm or ½"
  Approx. 0.90 kg/m (1.98 lb/in) probe length
- Rod probe 16 mm (0.63 in)
  Approx. 1.10 kg/m (2.43 lb/in) probe length
- Coaxial probe
  Approx. 3.00 kg/m (6.61 lb/in) probe length

FMP52

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

- Sensor
  Approx. 1.20 kg/m (2.65 lb/in) + flange weight
- Rope probe 4 mm or ⅙"
  Approx. 0.50 kg/m (1.10 lb/in) probe length
- Rod probe 16 mm (0.63 in)
  Approx. 1.10 kg/m (2.43 lb/in) probe length

FMP54

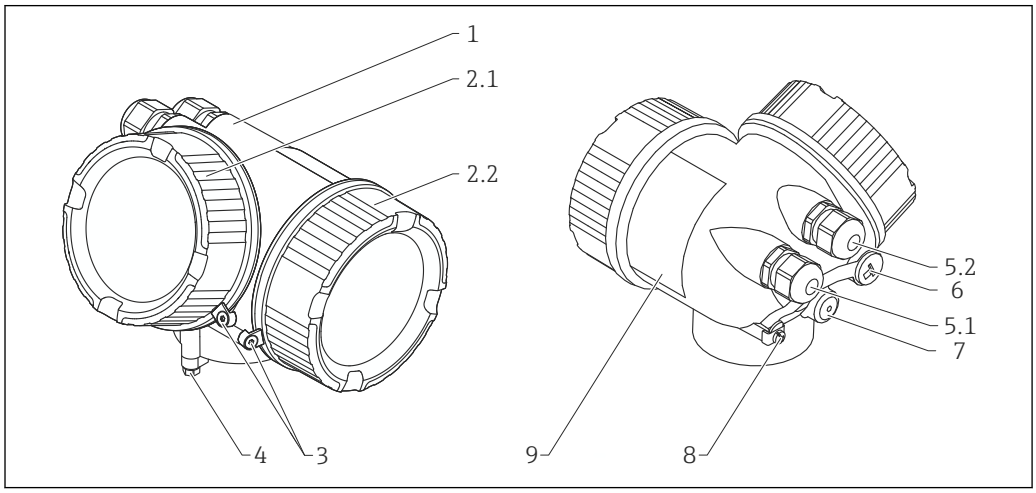
The weights of the individual components must be added together for the total weight.

- Sensor - version XT
  Approx. 6.70 kg/m (14.77 lb/in) + flange weight
- Sensor - version HT
  Approx. 7.70 kg/m (16.98 lb/in) + flange weight
- Rope probe 4 mm or ⅙"
  Approx. 0.10 kg/m (0.22 lb/in) probe length
- Rod probe 16 mm (0.63 in)
  Approx. 1.60 kg/m (3.53 lb/in) probe length
- Coaxial probe
  Approx. 3.50 kg/m (7.72 lb/in) probe length

Materials

Materials not in contact with process

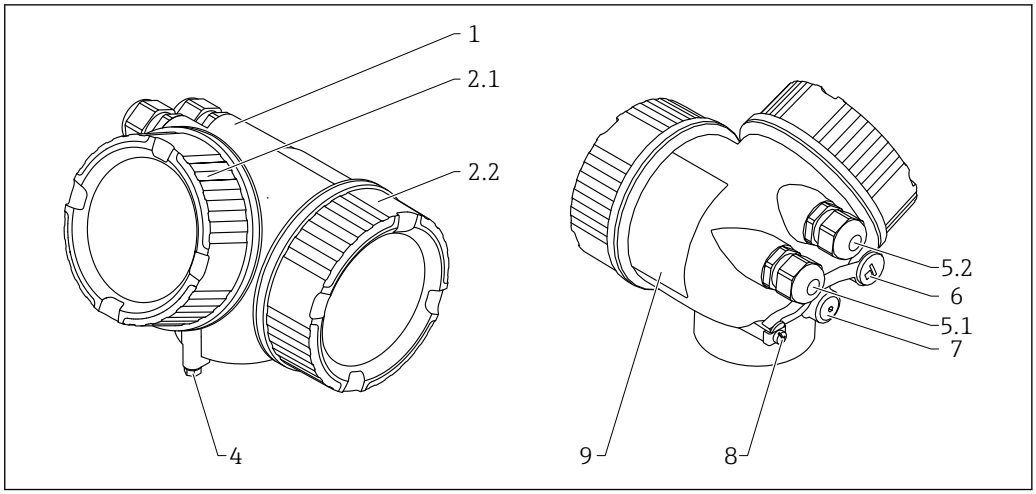
GT18 housing (stainless steel, corrosion-resistant)



52 Material; GT18 housing

1 Housing; CF3M (similar to 316L/ 1.4404)
2.1 Electronics compartment cover; CF3M (similar to 316L/ 1.4404), seals; NBR, window; glass, thread coating; graphite-based lubricant varnish
2.2 Connection compartment cover; CF3M (similar to 316L/ 1.4404), seal; NBR, thread coating; graphite-based lubricant varnish
3 Cover lock; 316L (1.4404), A4
4 Lock at the housing neck; 316L (1.4404), A4-70
5.1 Dummy plug, gland, adapter or plug (depending on the device version); 316L (1.4404), NBR, Viton, EPDM, PE, PBT-GF, nickel-plated brass (CuZn)
5.2 Dummy plug, gland, adapter or plug (depending on the device version); 316L (1.4404), NBR
6 Dummy plug or M12 socket (depending on the device version); 316L (1.4404)
7 Pressure relief plug; 316L (1.4404)
8 Ground terminal; 316L (1.4404), A4 (1.4571)
9 Nameplate; 316L (1.4404), A4 (1.4571)

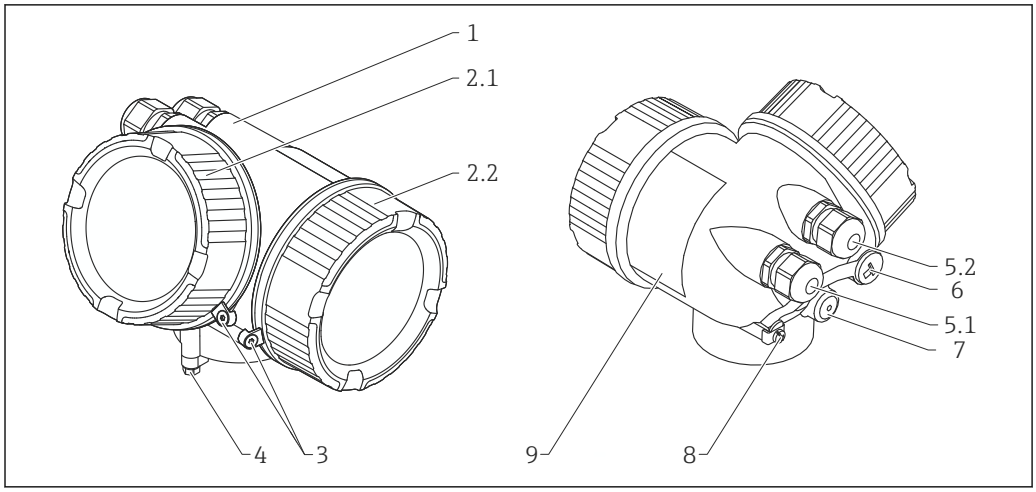
GT19 housing (plastic)



53 Material; GT19 housing

1 Housing; PBT
2.1 Electronics compartment cover; PBT-PC, seals; EPDM, window; PC, thread coating; graphite-based lubricant varnish
2.2 Connection compartment cover; PBT, seal; EPDM, thread coating; graphite-based lubricant varnish
4 Lock at the housing neck; 316L (1.4404), A4-70
5.1 Dummy plug, gland, adapter or plug (depending on the device version); 316L (1.4404), EPDM, PE, PBT-GF, nickel-plated brass (CuZn), PA
5.2 Dummy plug, gland, adapter or plug (depending on the device version); 316L (1.4404), EPDM, PE, PBT-GF, galvanized steel, nickel-plated brass (CuZn), PA
6 Dummy plug; nickel-plated brass (CuZn), M12 socket; GD-Zn nickel-plated
7 Pressure relief plug; nickel-plated brass (CuZn)
8 Ground terminal; 316L (1.4404), A4 (1.4571)
9 Adhesive nameplate; plastic

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



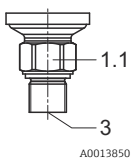
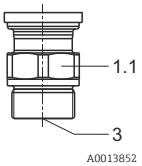
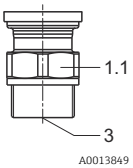
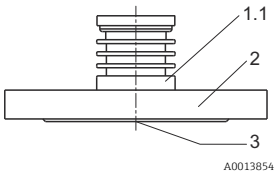
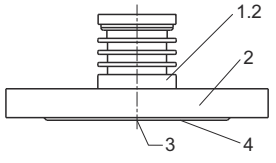
54 *Material; GT20 housing*

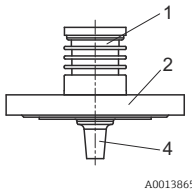
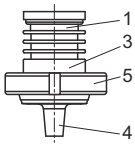
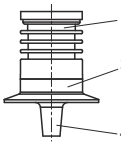
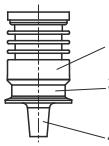
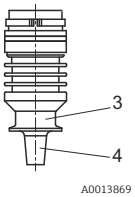
1 *Housing RAL 5012 (blue); AlSi10Mg (<0.1% Cu), coating; polyester*
2.1 *Electronics compartment cover RAL 7035 (gray); AlSi10Mg (<0.1% Cu), seals; NBR, window; glass, thread coating; graphite-based lubricant varnish*
2.2 *Connection compartment cover RAL 7035 (gray); AlSi10Mg (<0.1% Cu), seals; NBR, thread coating; graphite-based lubricant varnish*
3 *Cover lock; 316L (1.4404), A4*
4 *Lock at the housing neck; 316L (1.4404), A4-70*
5.1 *Dummy plug, gland, adapter or plug (depending on the device version); 316L (1.4404), EPDM, PE, PBT-GF, nickel-plated brass (CuZn), PA*
5.2 *Dummy plug, gland, adapter or plug (depending on the device version); 316L (1.4404), EPDM, PE, PBT-GF, galvanized steel, nickel-plated brass (CuZn), PA*
6 *Dummy plug; nickel-plated brass (CuZn), M12 socket; GD-Zn nickel-plated*
7 *Pressure relief plug; nickel-plated brass (CuZn)*
8 *Ground terminal; 316L (1.4404), A4 (1.4571)*
9 *Adhesive nameplate; plastic*

Wetted materials

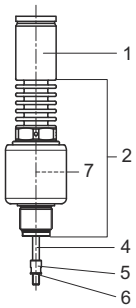
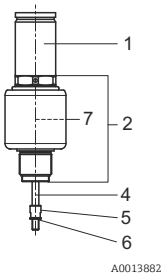
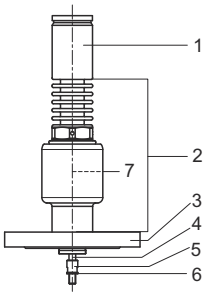
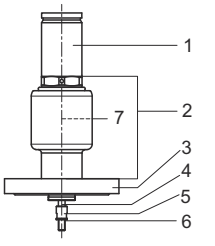
Process connection

Endress+Hauser supplies DIN/EN flanges and process connections with threaded connection in stainless steel as per AISI 316L (DIN/ EN material number 1.4404 or 14435). With regard to their stability-temperature property, the materials 1.4404 and 1.4435 are grouped together under 13E0 in EN 1092-1: Tab. 3.1-1. The chemical composition of the two materials can be identical.

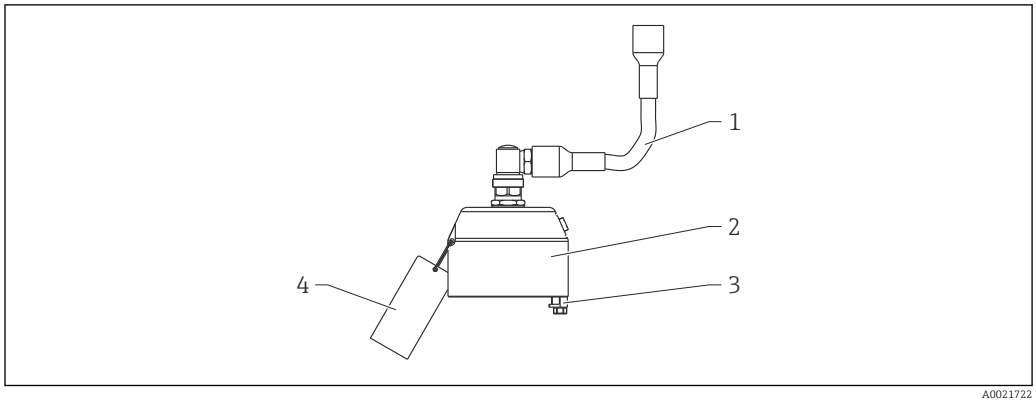
Levelflex FMP51						
Threaded connection			**Flange**		**No.**	**Material**
G¾, NPT¾	*G1½*	*NPT1½*	*DN40 to DN200*	*DN40 to DN100*		
					1.1	316L (1.4404)
					1.2	Alloy C22 (2.4602)
					2	ASME: 316/316L EN: 316L (1.4404) JIS: 316L (1.4435)
					3	Ceramic Al_2O_3 99.7 %
					4	Cladding: Alloy C22 (2.4602)

Levelflex FMP52							
Flange	**Milk pipe**	**Tri-Clamp**			**No.**	**Material**	**Approval**
EN/ASME/JIS	*DN50 (DIN 11851)*	*3″*	*2″*	*1½″*			
					1	316L (1.4404)	
					2	ASME: 316/316L EN: 316L (1.4404) JIS: 316L (1.4435)	
					3	316L (1.4404)	
					4	Coating 2 mm (0.8 in): PTFE	USP Cl.VI [1]
					5	304L (1.4307)	

1) Plastic components in contact with the medium have been tested in accordance with USP <88> Class VI-70°C

Levelflex FMP54						
Threaded connection *G1½, NPT1½*		**Flange**		**No.**	**Material**	
Version HT	*Version XT*	*Version HT*	*Version XT*			
				1	316L (1.4404)	
				2	316L (1.4404)	
				3	ASME: 316/316L EN: 316L (1.4404) JIS: 316L (1.4435)	
				4	Alloy C22 (2.4602)	
				5	316L (1.4404)	
				6	Nord-Lock washer: 1.4547	
				7	Ceramic Al_2O_3 99.5 %, pure graphite	

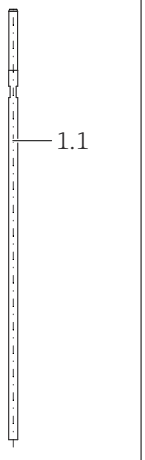
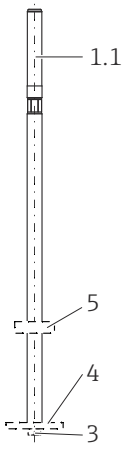
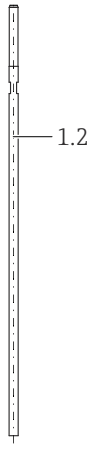
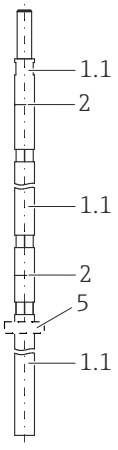
Adapter and cable for remote sensor



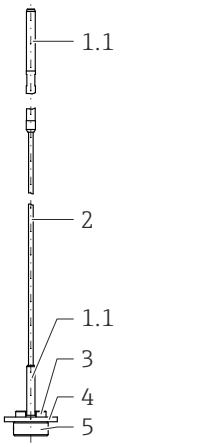
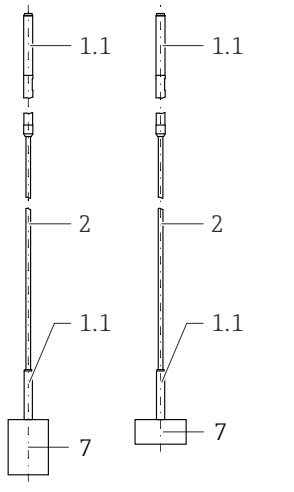
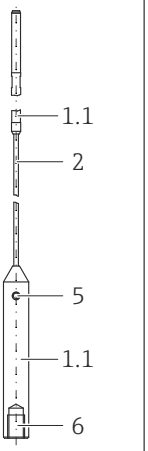
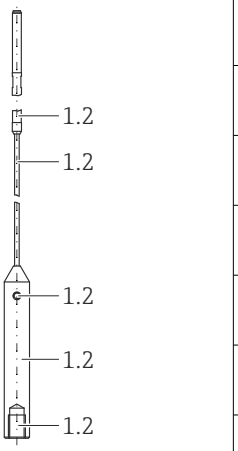
55 Materials: Adapter and cable for "Remote sensor" version

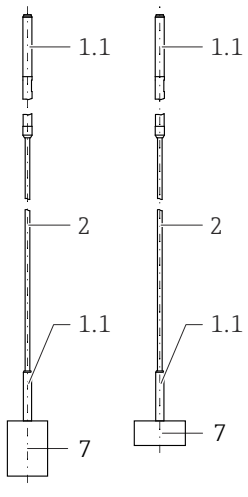
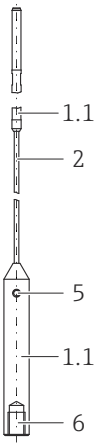
1 Cable, FRNC
2 Sensor adapter, 304 (1.4301)
3 Terminal, 316L (1.4404); screw, A4-70
4 Strap, 316 (1.4401); crimp sleeve, aluminum; nameplate, 304 (1.4301)

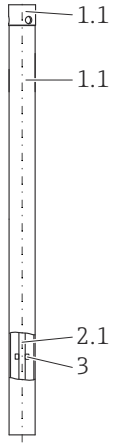
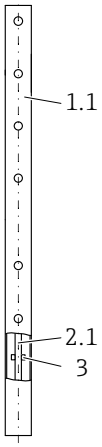
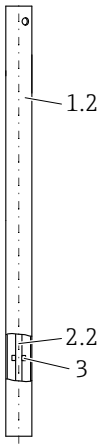
Probe

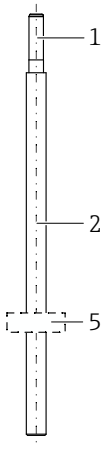
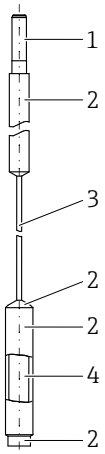
Levelflex FMP51: rod probes					
Feature 060 "Probe"				No.	Material
▪ AA: 8mm 316L ▪ AB: 1/3" 316L	▪ AC: 12mm 316L ▪ AD: 1/2" 316L	▪ AL: 12mm AlloyC ▪ AM: 1/2" AlloyC	▪ BA: 16mm 316L 500mm separable ▪ BB: 0.63in 316L 20inch separable ▪ BC: 16mm 316L 1000mm separable ▪ BD: 0.63in 316L 40inch separable		
				1.1	316L (1.4404)
				1.2	Alloy C22 (2.4602)
				2	Connecting bolts: Alloy C22 (2.4602)
					Nord-Lock washer: 1.4547
				3	Hexagonal-headed bolt: A4-70
					Nord-Lock washer: 1.4547
				4	Centering star, PEEK [1]
					Centering disk, 316L (1.4404) [2]
				5	Centering star, PFA [3]

1) Feature 610 "Accessory mounted" = OD "Rod centering star d=48-95mm, PEEK"
2) Feature 610 "Accessory mounted" = OA "Rod centering disk d=75mm" or OB "Rod centering disk d=45mm"
3) Feature 610 "Accessory mounted" = OE "Rod centering star d=37mm, PFA"

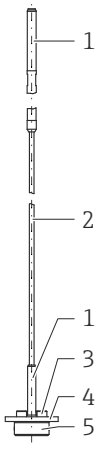
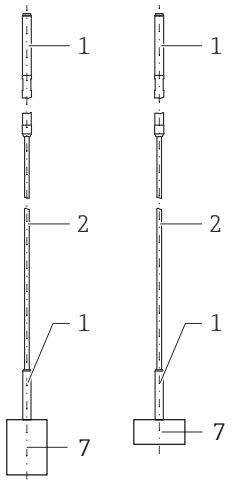
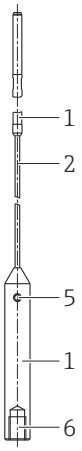
Levelflex FMP51: rope probes					
Feature 060 "Probe" ▪ LA: 4mm, 316L, max. 150mm nozzle ▪ LB: 1/6", 316L, max. 6in nozzle ▪ MB: 4mm, 316L, max. 300mm nozzle ▪ MD: 1/6", 316L, max. 12in nozzle			▪ LG: 4mm, AlloyC, max. 150mm nozzle ▪ LH: 1/6", AlloyC, max. 6in nozzle ▪ MG: 4mm, AlloyC, max. 300mm nozzle ▪ MH: 1/6", AlloyC, max. 12in nozzle	No.	Material
Feature 610 "Accessory mounted"					
OC: Centering disk d=75mm	▪ OK: Centering weight d=45mm ▪ OL: Centering weight d=75mm ▪ OM: Centering weight d=95mm	without option OC			
				1.1 1.2 2 3 4 5 6 7	316L (1.4404) Alloy C22 (2.4602) 316 (1.4401) Cylinder screw: A4-80 Disk: 316L (1.4404) Setscrew: A4-70 Screw for tightening: A2-70 Weight: 316L (1.4404)

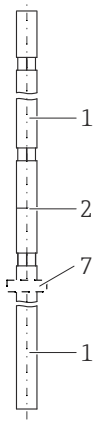
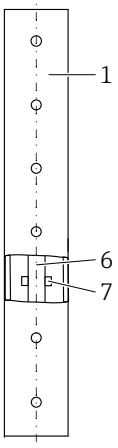
Levelflex FMP51: rope probes				
Feature 060 "Probe" ▪ LE: 4mm, PFA>316, max. 150mm nozzle ▪ LF: 1/6", PFA>316, max. 6in nozzle ▪ ME: 4mm, PFA>316, max. 300mm nozzle ▪ MF: 1/6", PFA>316, max. 12in nozzle			No.	Material
Feature 610 "Accessory mounted"				
▪ OK: Centering weight d=45mm ▪ OL: Centering weight d=75mm ▪ OM: Centering weight d=95mm	without option OC			
		1.1 2 5 6 7	316L (1.4404) Rope: 316 (1.4401) Coating 0.75 mm (0.03 in): PFA Setscrew: A4-70 Screw for tightening: A2-70 Weight: 316L (1.4404)

Levelflex FMP51: coaxial probes				
Feature 060 "Probe"			No.	Material
▪ UA: ...mm, coax 316L ▪ UB: ...inch, coax 316L		▪ UC: ...mm, coax AlloyC ▪ UD: ...inch, coax AlloyC		
Feature 100 "Process connection"				
▪ GDJ: thread ISO228 G3/4 ▪ RDJ: thread ANSI MNPT3/4	all other options			
 A0036590	 A0036591	 A0036592	1.1	316L (1.4404)
			1.2	Alloy C22 (2.4602)
			2.1	Rod: 316L (1.4404)
			2.2	Alloy C22 (2.4602)
			3	Spacer: PFA

Levelflex FMP52			
Feature 060 "Probe"		No.	Material
▪ CA: rod 16mm ▪ CB: rod 0.63in	▪ OA: rope 4mm, max. 150mm nozzle ▪ OB: rope 4mm, max. 300mm nozzle ▪ OC: rope 1/6", max. 6in nozzle ▪ OD: rope 1/6", max. 12in nozzle		
 A0013870	 A0036593	1	316L (1.4404)
		2	Coating 2 mm (0.8 in): PFA
		3	Rope: 316 (1.4401)
			Coating 0.75 mm (0.03 in): PFA
		4	Core: 316L (1.4435)
		5	Centering star, PFA [1]

1) Feature 610 "Accessory mounted" = OE "Rod centering star d=37mm, PFA, interface measurement"

Levelflex FMP54: rope probes				
Feature 060 "Probe" ▪ LA: rope 4mm ▪ LB: rope 0.63in			No.	Material
Feature 610 "Accessory mounted"				
OC: Centering disk d=75mm	▪ OK: Centering weight d=45mm ▪ OL: Centering weight d=75mm ▪ OM: Centering weight d=95mm	without option OC		
 A0036594	 A0039227	 A0036595	1	316L (1.4404)
			2	316 (1.4401)
			3	Cylinder screw: A4-80
			4	Disk: 316L (1.4404)
			5	Setscrew: A4-70
			6	Screw for tightening: A2-70
			7	Weight: 316L (1.4404)

Levelflex FMP54: rod and coaxial probes				
Feature 060 "Probe"			No.	Material
▪ AE: rod 16mm ▪ AF: rod 0.63in	▪ BA: rod 16mm, 500mm separable ▪ BB: rod 0.63in, 20inch separable ▪ BC: rod 16mm, 1000mm separable ▪ BD: rod 0.63in, 40inch separable	▪ UA: ... mm, coax ▪ UB: ... inch, coax		
 A0036596	 A0036597	 A0036598	1	316L (1.4404) [1]
			2	Connecting bolts: Alloy C22 (2.4602)
				Nord-Lock washer: 1.4547
			3	Hexagonal-headed bolt: A4-70
				Nord-Lock washer: 1.4547
			4	Centering star, PEEK [2]
				Centering disk, 316L (1.4404) [3]
			5	Centering disk, PFA [4]
			6	Rod: 316L (1.4404)
			7	Spacer: ceramic Al_2O_3 99.5 %

1) In the version with gas phase compensation, is also the material of the reference rod.
2) Feature 610 "Accessory mounted" = OD "Rod centering star d=48-95mm, PEEK"
3) Feature 610 "Accessory mounted" = OA "Rod centering disk d=75mm" or OB "Rod centering disk d=45mm"
4) Feature 610 "Accessory mounted" = OE "Rod, centering star d=37mm, PFA, interface measurement"

Operability

Operation 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 in the product structure determines which of these languages is preset on delivery.

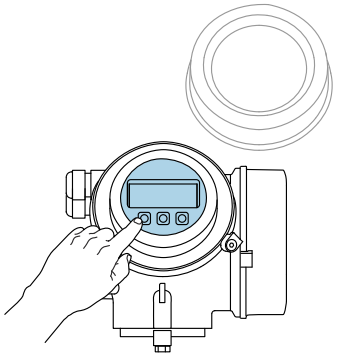
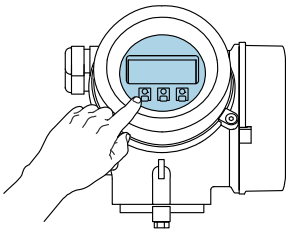
Quick and safe commissioning
- Interactive wizard with graphical user interface for guided commissioning in FieldCare/DeviceCare
- Menu guidance with brief descriptions of the individual parameter functions
- Standardized operation at the device and in the operating tools

Integrated data memory (HistoROM)
- Adoption of data configuration when electronics modules are replaced
- Up to 100 event messages recorded in the device
- Data logging with up to 1000 logged values
- A reference signal curve is saved during commissioning for later use as a reference during operation

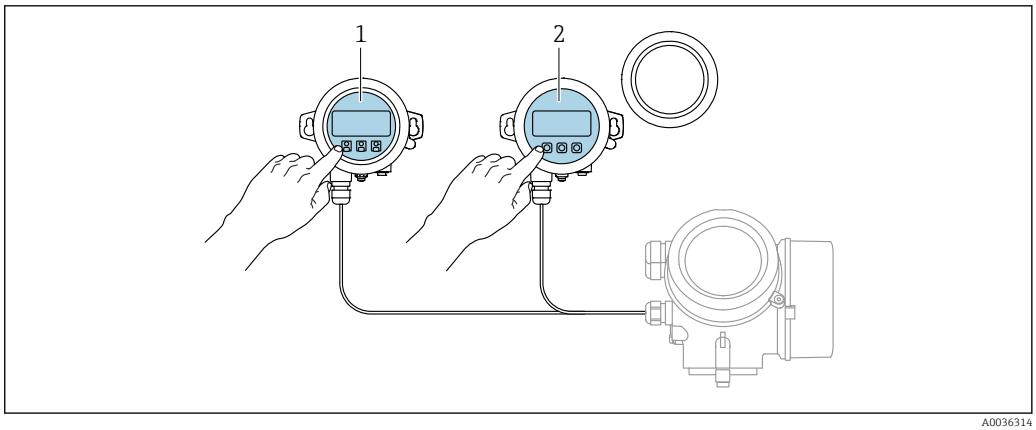
Efficient diagnostic behavior increases measurement reliability
- Remedial action is integrated in plain text
- Diverse simulation options and line recorder functions

Integrated Bluetooth module (option for HART devices)
- Quick and easy setup with the SmartBlue app
- No additional tools or adapters needed
- Signal curve via SmartBlue (app)
- Encrypted single point-to-point data transmission (tested by Fraunhofer Institute) and password-protected communication via *Bluetooth*® wireless technology

Access to operating menu via local display

Operation with	*Pushbuttons*	*Touch control*
Order code for "Display; operation"	Option **C** "SD02"	Option **E** "SD03"
	 A0036312	 A0036313
Display elements	4-line display	4-line display White background lighting; switches to red in event of device errors
	Format for displaying measured variables and status variables can be individually configured	
	Permitted ambient temperature for the display: −20 to +70 °C (−4 to +158 °F) The readability of the display may be impaired at temperatures outside the temperature range.	
Operating elements	Onsite operation with 3 pushbuttons (⊞, ⊟, Ⓔ)	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



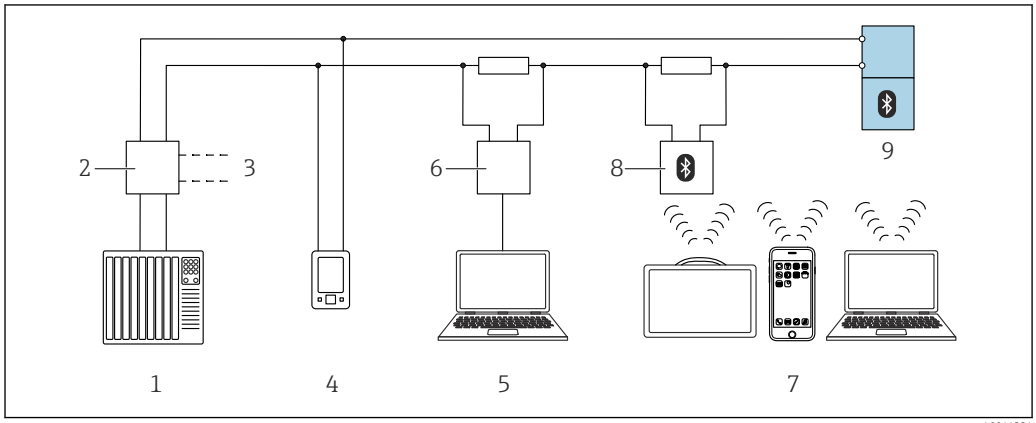
A0036314

56 FHX50 operating options

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

Access to the operating menu via the operating tool

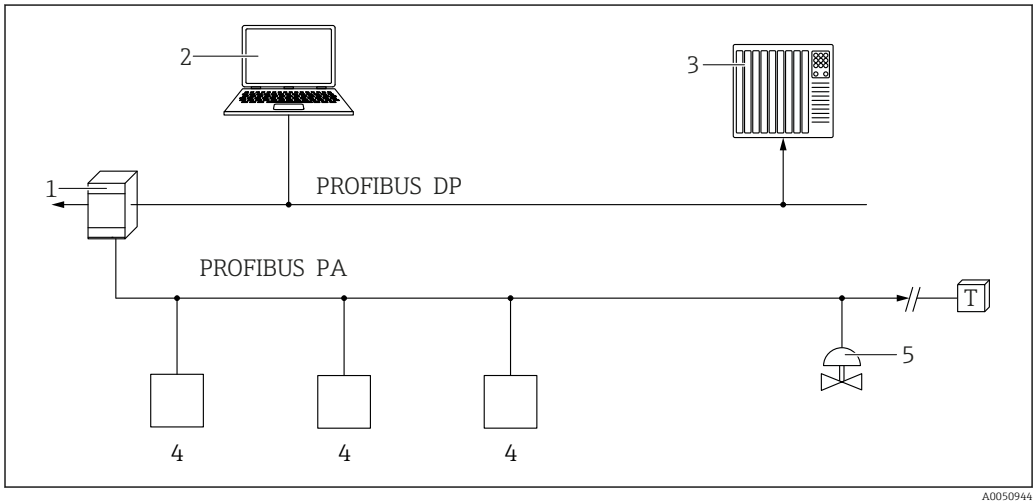
Via HART protocol



57 *Options for remote operation via HART protocol*

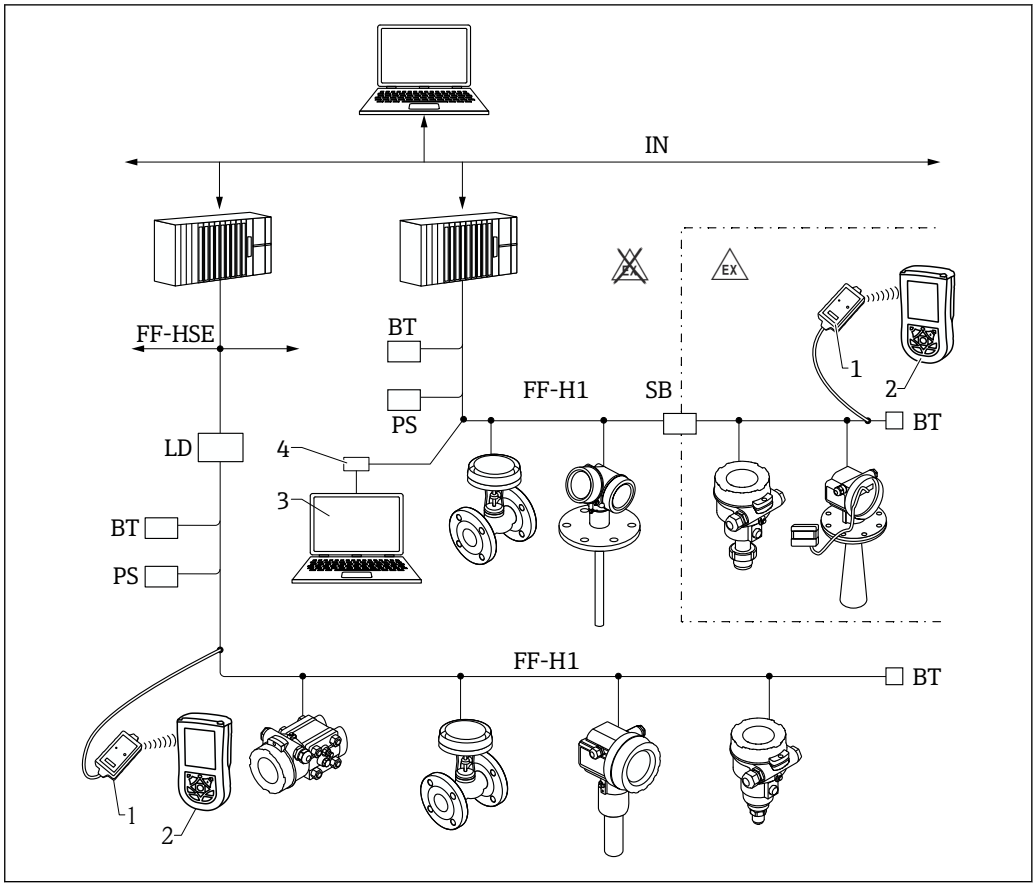
1 *PLC (programmable logic controller)*
2 *Transmitter power supply unit, e. g. RN42 (with communication resistor)*
3 *Connection for Commubox FXA195 and AMS Trex Device Communicator*
4 *AMS Trex Device Communicator*
5 *Computer with operating tool e.g. DeviceCare, FieldCare, AMS Device View, SIMATIC PDM)*
6 *Commubox FXA195 (USB)*
7 *Field Xpert SMT70/SMT77, smartphone or computer with operating tool (e.g. DeviceCare, SmartBlue app)*
8 *Bluetooth modem with connecting cable (e.g. VIATOR)*
9 *Transmitter*

Via PROFIBUS PA protocol



1 *Segment coupler*
2 *Computer with PROFIusb and operating tool (e.g. DeviceCare/FieldCare)*
3 *PLC (programmable logic controller)*
4 *Transmitter*
5 *Additional functions (valves etc.)*

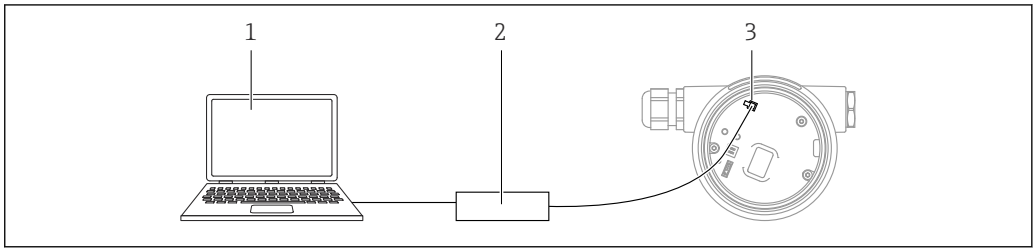
Via FOUNDATION Fieldbus



58 *FOUNDATION Fieldbus system architecture with associated components*

1 FFblue Bluetooth modem
2 Field Xpert
3 DeviceCare/FieldCare
4 NI-FF interface card
IN Industrial network
FF-HSE High Speed Ethernet
FF-H1 FOUNDATION Fieldbus-H1
LD Linking Device FF-HSE/FF-H1
PS Bus Power Supply
SB Safety barrier
BT Bus Terminator

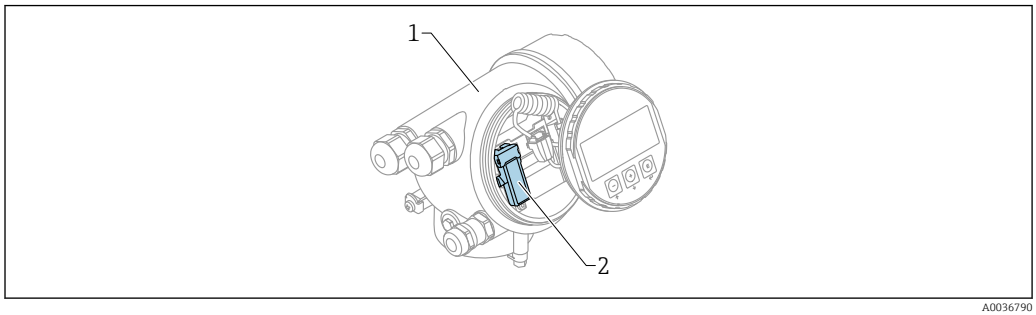
Via service interface (CDI)



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

Operation via Bluetooth® wireless technology

Requirements

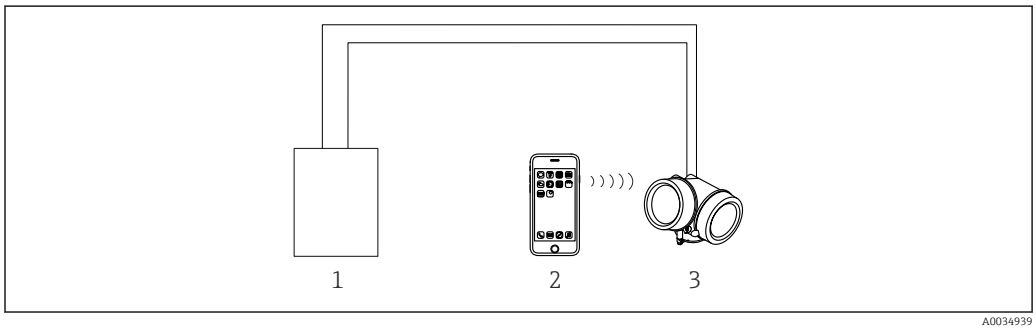


59 Device with Bluetooth module

1 Electronics housing of the device
2 Bluetooth module

This operation option is only available for devices with Bluetooth module. There are the following options:
- The device has been ordered with a Bluetooth module:
  Feature 610 "Accessory Mounted", option NF "Bluetooth"
- The Bluetooth module has been ordered as an accessory (ordering number: 71377355) and has been mounted. See Special Documentation SD02252F.

Operation via SmartBlue (app)

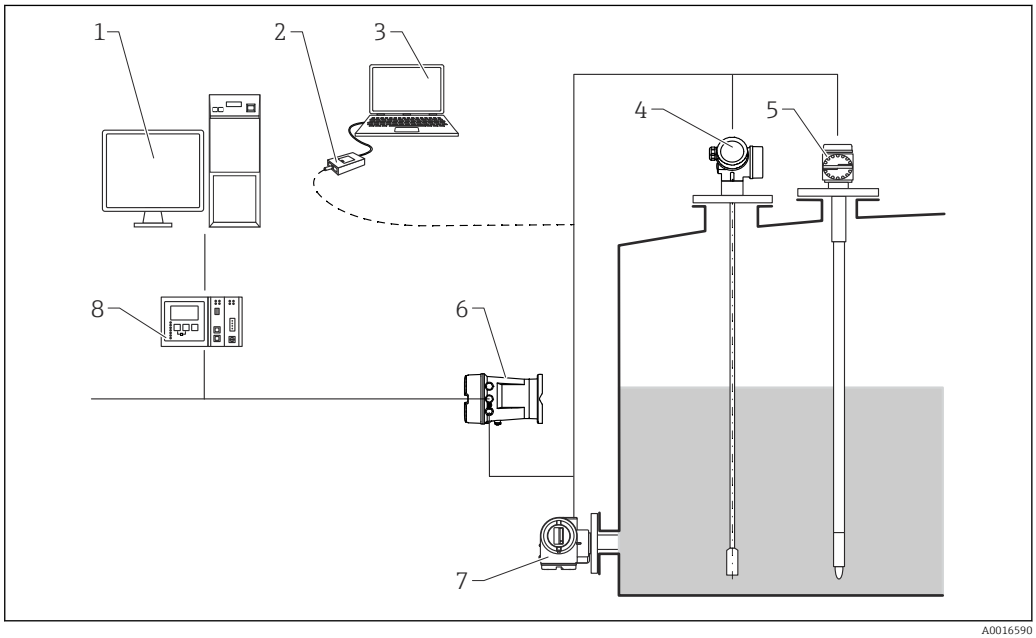


60 Operation via SmartBlue (app)

1 Transmitter power supply unit
2 Smartphone / tablet with SmartBlue (app)
3 Transmitter with Bluetooth module

Integration in tank gauging

The Endress+Hauser Tank Side Monitor NRF81 features integrated communication functions for facilities with multiple tanks. One or more sensors can be installed on each tank, including radar sensors, point or average temperature sensors, capacitive probes for water detection, and/or pressure measuring cells. The Tank Side Monitor's multi-protocol capability ensures compatibility with virtually all industry-standard tank gauging protocols. Optional connectivity for 4 to 20 mAsensors, digital inputs/outputs, and analog outputs facilitates the full integration of all sensors on the tank. Use of the proven intrinsically safe HART bus concept for all sensors on the tank minimizes cabling costs while ensuring maximum safety, reliability, and performance.



61 The complete measuring system consists of:

1 Tankvision workspace
2 Commubox FXA195 (USB) - optional
3 Computer with operating tool (ControlCare) - optional
4 Level transmitter
5 Temperature measuring instrument
6 Tank Side Monitor NRF81
7 Pressure measuring instrument
8 Tankvision Tank Scanner NXA820

SupplyCare

SupplyCare is a web-based operating program for coordinating the flow of material and information along the supply chain. SupplyCare provides a comprehensive overview of the levels of geographically distributed tanks and silos, for instance, providing complete transparency over the current inventory situation, regardless of time and location.

Based on the measuring and transmission technology installed onsite, the current inventory data are collected and sent to SupplyCare. Critical levels are clearly indicated and calculated forecasts provide additional security for material requirements planning.

The main functions of SupplyCare:

Inventory visualization

SupplyCare determines the inventory levels in tanks and silos at regular intervals. It displays current and historical inventory data and calculated forecasts of future demand. The overview page can be configured to suit the user's preferences.

Master data management

With SupplyCare you can create and manage the master data for locations, companies, tanks, products and users, as well as user authorization.

Report Configurator

The Report Configurator can be used to create personalized reports quickly and easily. The reports can be saved in a variety of formats, such as Excel, PDF, CSV and XML. The reports can be transmitted in many ways, such as by http, ftp or e-mail.

Event management

Events, such as when levels drop below the safety stock level or plan points, are indicated by the software. In addition, SupplyCare can also notify pre-defined users by e-mail.

Alarms

If technical problems occur, e.g. connection issues, alarms are triggered and alarm e-mails are sent to the System Administrator and the Local System Administrator.

Delivery planning

The integrated delivery planning function automatically generates an order proposal if a pre-set minimum inventory level is undershot. Scheduled deliveries and disposals are monitored continuously by SupplyCare. SupplyCare notifies the user if scheduled deliveries and disposals are not going to be met as planned.

Analysis

In the Analysis module, the most important indicators for the inflow and outflow of the individual tanks are calculated and displayed as data and charts. Key indicators of material management are automatically calculated and form the basis for optimizing the delivery and storage process.

Geographical visualization

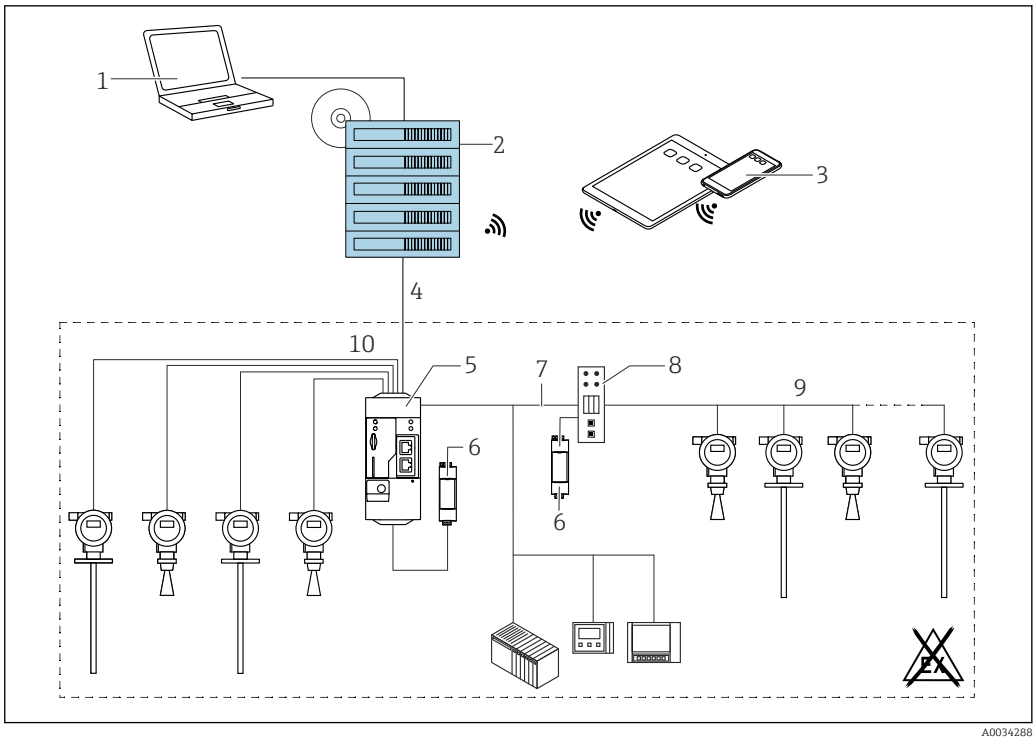
All the tanks and the tank inventories are represented graphically on a map (based on Google Maps). The tanks and inventory situations can be filtered by tank group, product, supplier or location.

Multi-language support

The multi-language user interface supports 9 languages, thereby enabling global collaboration on a single platform. The language and settings are recognized automatically using the browser settings.

SupplyCare Enterprise

SupplyCare Enterprise runs by default as a service under Microsoft Windows on an application server in an Apache Tomcat environment. The operators and administrators operate the application via a Web browser from their workstations.

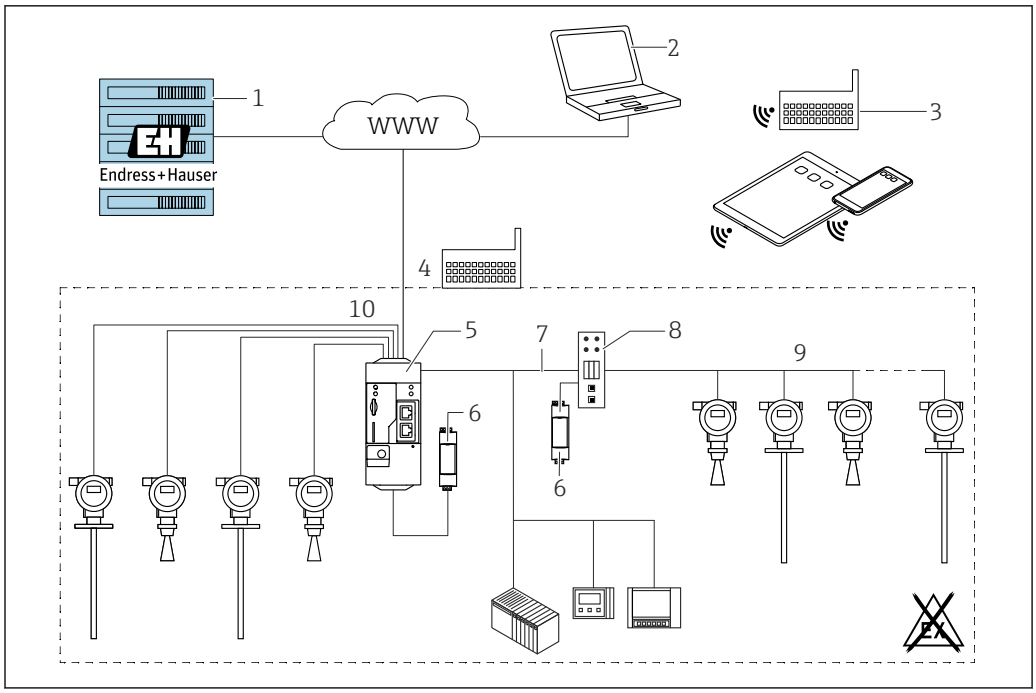


62 *Example of inventory management platform with SupplyCare Enterprise SCE30B*

1 *SupplyCare Enterprise (via Web browser)*
2 *SupplyCare Enterprise installation*
3 *SupplyCare Enterprise on mobile devices (via Web browser)*
4 *Ethernet/WLAN/UMTS*
5 *Fieldgate FXA42*
6 *Power supply 24 V_{DC}*
7 *Modbus TCP via Ethernet as server/client*
8 *Converter from Modbus to HART Multidrop*
9 *HART Multidrop*
10 *4 x analog input 4 to 20 mA (2-wire / 4-wire)*

SupplyCare Hosting

SupplyCare Hosting is offered as a hosting service (software as a service). Here, the software is installed within the Endress+Hauser IT infrastructure and made available to the user in the Endress +Hauser portal.



63 *Example of inventory management platform with SupplyCare Hosting SCH30*

1 *SupplyCare Hosting installation in Endress+Hauser data center*
2 *PC workstation with Internet connection*
3 *Warehouse locations with Internet connection via 2G/3G with FXA42 or FXA30*
4 *Warehouse locations with Internet connection with FXA42*
5 *Fieldgate FXA42*
6 *Power supply 24 V_{DC}*
7 *Modbus TCP via Ethernet as server/client*
8 *Converter from Modbus to HART Multidrop*
9 *HART Multidrop*
10 *4 x analog input 4 to 20 mA (2-wire/4-wire)*

In this case, users do not need to make the initial software purchase or install and run the IT infrastructure needed. Endress+Hauser constantly update SupplyCare Hosting and enhance the capability of the software in conjunction with the customer. The hosted version of SupplyCare is thus always up-to-date and can be customized to meet different customer requirements. Other services are also offered in addition to the IT infrastructure and the software that is installed in a secure, redundant Endress+Hauser data center. These services include defined availability of the global Endress+Hauser Service and Support Organization and defined response times in a service event.

Certificates and approvals

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

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

CE mark

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

The manufacturer confirms successful testing of the device by affixing to it the CE mark.

RoHS

The measuring system meets the substance restrictions of the Directive on the Restriction of the Use of Certain Hazardous Substances 2011/65/EU (RoHS 2) and the Delegated Directive (EU) 2015/863 (RoHS 3).

RCM marking

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

A0029561

Ex-approval

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

The separate "Safety Instructions" documentation (XA) containing all the relevant explosion protection data is available from your Endress+Hauser sales organization.

Dual seal ANSI/ISA 12.27.01

The devices have been designed as dual seal devices in accordance with ANSI /ISA 12.27.01. This allows the user to forego the use of - and save the cost of installing - an external secondary process seal in the protection pipe as required in ANSI/NFPA 70 (NEC) and CSA 22.1 (CEC). These instruments comply with the North American installation practice and provide a very safe and cost-saving installation for pressurized applications with hazardous fluids.

Please refer to the Safety Instructions (XA) of the relevant device for further information.

Functional safety

Use for level monitoring (MIN, MAX, range) up to SIL 3 (homogeneous redundancy), independently evaluated by TÜV Rheinland in accordance with IEC 61508, refer to the "Functional Safety Manual" SD00326F for more information.

Overfill protection system

WHG

DIBt Z-65.16-501

Sanitary compatibility

Information regarding device versions that meet the requirements of 3A Sanitary Standard No. 74 and/or are certified by the EHEDG:

SD02503F

Suitable fittings and seals must be used to ensure hygiene-compliant design according to 3A and EHEDG specifications.

The gap-free connections can be cleaned of all residue using the typical cleaning methods within this industry (CIP and SIP).

Wetted non-metal parts of the FMP52 comply with FDA 21 CFR 177.1550 and USP Class VI.

AD2000

- For FMP51/FMP54:
  The wetted material 316L (1.4435/1.4404) corresponds to AD2000 - W2/W10
- For FMP52:
  The pressure retaining material 316L (1.4435/1.4404) corresponds to AD2000 - W2/W10
- Declaration of Conformity: see the product structure, feature 580, version JF

NACE MR 0175/ISO 15156

For FMP51, FMP54:

- The wetted, metal materials (excluding ropes) meet the requirements of NACE MR 0175/ISO 15156
- Declaration of Conformity: see the product structure, feature 580, version JB

For FMP52:

- The pressure retaining, metal materials (excluding ropes) meet the requirements of NACE MR 0175/ISO 15156
- Declaration of Conformity: see the product structure, feature 580, version JB

NACE MR 0103

For FMP51, FMP54:
- The wetted, metal materials (excluding ropes) meet the requirements of NACE MR 0103/ISO 17495
- The Declaration of Conformity is based on NACE MR 0175
  The hardness and intergranular corrosion have been tested, and heat treatment (solution annealed) has been performed. The materials used therefore meet the requirements of NACE MR 0103/ISO 17495
- Declaration of Conformity: see the product structure, feature 580, version JE

For FMP52:
- The pressure retaining, metal materials (excluding ropes) meet the requirements of NACE MR 0103/ISO 17495
- The Declaration of Conformity is based on NACE MR 0175
  The hardness and intergranular corrosion have been tested, and heat treatment (solution annealed) has been performed. The materials used therefore meet the requirements of NACE MR 0103/ISO 17495
- Declaration of Conformity: see the product structure, feature 580, version JE

ASME B31.1 and B31.3

- The design, the material used, the pressure and temperature ranges and the labeling of the devices meet the requirements of ASME B31.1 and B31.3
- Declaration of Conformity: see the product structure, feature 580, version KV

Pressure Equipment Directive

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

Pressure instruments with a process connection that does not have a pressurized housing do not fall within the scope of the Pressure Equipment Directive, irrespective of the maximum allowable pressure.

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.

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

Pressure equipment designated for application in every process fluid having a pressurized volume V of <0.1 l and a max. allowable pressure PS > 200 bar (2 900 psi) shall satisfy the essential safety requirements set out in Annex I of the Pressure Equipment Directive 2014/68/EU. According to Article 13 pressure equipment shall be classified by category in accordance with Annex II. The conformity assessment of the pressure equipment shall be determined by the category I under consideration of the above-mentioned low pressurized volume. These devices shall be provided with CE marking.

Reasons:

- Pressure Equipment Directive 2014/68/EU, Article 13 and Annex II
- Pressure equipment directive 2014/68/EU, Commission's Working Group "Pressure", Guideline A-05

Note:

A partial examination shall be performed for pressure instruments that are part of safety equipment for the protection of a pipe or vessel from exceeding allowable limits (equipment with safety function in accordance with Pressure Equipment Directive 2014/68/EU, Article 2, point 4).

The conformity assessment was performed according to module A; and proof of static strength and fatigue strength according to EN 13445 and AD2000.

The FMP54 is not suitable for use with unstable gases at nominal pressures above 200 bar (2900 psi).

Oxygen application

Verified cleaned, suitable for O_2 applications (wetted parts)

Steam boiler approval

The FMP54 is approved as a limiting device for high water (HW) and low water (LW) for liquids in vessels which are subject to the requirements of EN12952-11 and EN12953-9 (certified by TÜV Nord).

Product structure: feature 590 "Additional approval", version LX "Steam boiler approval".

Safety instructions SD00349F and planning instructions SD01071F

Devices with a steam boiler approval always also have a SIL approval.

Marine approval

Device	Marine approval [1]				
	DNV GL	ABS	LR	BV	KR
FMP51	✔	✔	✔	✔	✔
FMP52	✔	✔	✔	✔	✔
FMP54	✔	✔	✔	-	-

1) See order code for 590 "Additional approval"

Radio approval

Satisfies "Part 15" of the FCC rules for an unintentional radiator. All probes meet the requirements for a Class A digital device.

In addition, coaxial probes and all probes in metal vessels meet the requirements for a Class B digital device.

CRN approval

Some device versions have CRN approval. Devices are CRN approved if the following 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 in the product structure	Approval
AAJ	NPS 2" Cl. 600 RF, 316/316L flange ASME B16.5
ABJ	NPS 3" Cl. 600 RF, 316/316L flange ASME B16.5
AEJ	NPS 1-1/2" Cl. 150 RF, 316/316L flange ASME B16.5
AEK	NPS 1-1/2" Cl. 150, PTFE over 316/316L flange ASME B16.5
AEM	NPS 1-1/2" Cl. 150, Alloy C over 316/316L flange ASME B16.5
AFJ	NPS 2" Cl. 150 RF, 316/316L flange ASME B16.5
AFK	NPS 2" C. 150, PTFE over 316/316L flange ASME B16.5
AFM	NPS 2" Cl. 150, Alloy C over 316/316L flange ASME B16.5
AGJ	NPS 3" Cl. 150 RF, 316/316L flange ASME B16.5
AGK	NPS 3" Cl. 150, PTFE over 316/316L flange ASME B16.5
AGM	NPS 3" Cl. 150, Alloy C over 316/316L flange ASME B16.5
AHJ	NPS 4" Cl. 150 RF, 316/316L flange ASME B16.5
AHK	NPS 4" Cl. 150, PTFE over 316/316L flange ASME B16.5
AJJ	NPS 6" Cl. 150 RF, 316/316L flange ASME B16.5
AJK	NPS 6" Cl. 150, PTFE over 316/316L flange ASME B16.5
AKJ	NPS 8" Cl. 150 RF, 316/316L flange ASME B16.5
AOJ	NPS 4" Cl. 600 RF, 316/316L flange ASME B16.5
AQJ	NPS 1-1/2" Cl. 300 RF, 316/316L flange ASME B16.5
AQK	NPS 1-1/2" Cl. 300, PTFE over 316/316L flange ASME B16.5
AQM	NPS 1-1/2" Cl. 300, Alloy C over 316/316L flange ASME B16.5
ARJ	NPS 2" Cl. 300 RF, 316/316L flange ASME B16.5
ARK	NPS 2" Cl. 300, PTFE over 316/316L flange ASME B16.5
ARM	NPS 2" Cl. 300, Alloy C over 316/316L flange ASME B16.5

Feature 100 in the product structure	Approval
ASJ	NPS 3" Cl. 300 RF, 316/316L flange ASME B16.5
ASK	NPS 3" Cl. 300, PTFE over 316/316L flange ASME B16.5
ASM	NPS 3" Cl. 300, Alloy C over 316/316L flange ASME B16.5
ATJ	NPS 4" Cl. 300 RF, 316/316L flange ASME B16.5
ATK	NPS 4" Cl. 300, PTFE over 316/316L flange ASME B16.5
ATM	NPS 4" Cl.300, Alloy C over 316/316L flange ASME B16.5
AZJ	NPS 4" Cl. 900 RF, 316/316L flange ASME B16.5
A6J	NPS 2" Cl. 1500 RF, 316/316L flange ASME B16.5
A7J	NPS 3" Cl. 1500 RF, 316/316L flange ASME B16.5
A8J	NPS 4" Cl. 1500 RF, 316/316L flange ASME B16.5
GGJ	Thread ISO228 G1-1/2, 316L
GIJ	Thread ISO228 G1-1/2, 200 bar, 316L
GJJ	Thread ISO228 G1-1/2, 400 bar, 316L
RAJ	Thread ANSI MNPT1-1/2, 200 bar, 316L
RBJ	Thread ANSI MNPT1-1/2, 400 bar, 316L
RGJ	Thread ANSI MNPT1-1/2, 316L
TAK	Tri-Clamp ISO2852 DN40-51 (2"), 3A, PTFE over 316L
TDK	Tri-Clamp ISO2852 DN40-51 (2"), PTFE over 316L
TFK	Tri-Clamp ISO2852 DN70-76.1 (3"), PTFE over 316L
TJK	Tri-Clamp ISO2852 DN38 (1-1/2"), PTFE over 316L
TLK	Tri-Clamp ISO2852 DN70-76.1 (3"), 3A, PTFE over 316L
TNK	Tri-Clamp ISO2852 DN38 (1-1/2"), 3A, PTFE over 316L

- Process connections that do not have CRN approval are not listed in this table
- Please refer to the product structure to discover which process connections are available for a specific device type
- CRN-approved devices are labeled with registration number 0F14480.5C on the nameplate

Test, certificate

Feature 580 "Test, certificate"	Description	Approval
YES	3.1 Material documentation, wetted metal parts, EN10204-3.1 inspection certificate	▪ FMP51 ▪ FMP54
JB	Declaration of Conformity NACE MR0175, wetted metal parts	▪ FMP51 ▪ FMP52 ▪ FMP54
JD	3.1 Material certificate, pressurized parts, EN10204-3.1 inspection certificate	FMP52
JE	Declaration of Conformity NACE MR0103, wetted metal parts	▪ FMP51 ▪ FMP52 ▪ FMP54
JF	Declaration of Conformity AD2000, wetted metal parts: Material conformity for all metal wetted/pressurized parts according to AD2000 (data sheets W2, W9, W10)	▪ FMP51 ▪ FMP52 ▪ FMP54
JN	Ambient temperature of transmitter −50 °C (−58 °F) Devices with this option are routine tested (start-up test at −50 °C (−58 °F)).	▪ FMP51 ▪ FMP54

Feature 580 "Test, certificate"	Description	Approval
KD	Helium leak test, internal procedure, inspection certificate	▪ FMP51 ▪ FMP54
KE	Pressure test, internal procedure, inspection certificate	▪ FMP51 ▪ FMP52 ▪ FMP54
KG	3.1 Material certificate+PMI test (XRF), internal procedure, wetted metallic parts, EN10204-3.1 inspection certificate	▪ FMP51 ▪ FMP54
KP	Penetrant testing AD2000-HP5-3(PT), wetted/pressurized metal parts, inspection certificate	▪ FMP51 ▪ FMP54
KQ	Penetrant testing ISO23277-1 (PT), wetted/pressurized metal parts, inspection certificate	▪ FMP51 ▪ FMP54
KR	Penetrant testing ASME VIII-1 (PT), wetted/pressurized metal parts, inspection certificate	▪ FMP51 ▪ FMP54
KT	Welding documentation ISO, wetted/pressurized seams, declaration Consists of: ▪ Welding drawing ▪ WPQR (Welding Procedure Qualification Record) according to ISO 14613/ISO14614 ▪ WPS (Welding Procedure Specifications) ▪ WPQ (Manufacturer Declaration for Welding Professionals' Qualifications)	▪ FMP51 ▪ FMP54
KU	Welding documentation ASME, wetted/pressurized seams, declaration Consists of: ▪ Welding drawing ▪ WPQR (Welding Procedure Qualification Record) according to ASME BPVC Sect. IX ▪ WPS (Welding Procedure Specifications) ▪ WPQ (Manufacturer Declaration for Welding Professionals' Qualifications)	▪ FMP51 ▪ FMP54
KV	Declaration of Conformity ASME B31.3: The design, the material used, the pressure and temperature ranges and the labeling of the devices meet the requirements of ASME B31.3	▪ FMP51 ▪ FMP52 ▪ FMP54

Test reports, declarations and inspection certificates are available in electronic format in the *W@M Device Viewer*:
Enter the serial number from the nameplate (www.endress.com/deviceviewer)

This concerns the options for the following order codes:
- 550 "Calibration"
- 580 "Test, certificate"

Product documentation on paper

A printed (hard copy) version of test reports, declarations and inspection certificates can optionally be ordered via order code 570 "Service", option I7 "Product documentation on paper". The documents are then supplied with the product.

External standards and guidelines

- EN 60529
  Degrees of protection provided by enclosure (IP code)
- EN 61010-1
  Safety requirements for electrical equipment for measurement, control and laboratory use
- 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 safety-related electric/electronic/programmable electronic systems

Ordering information

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

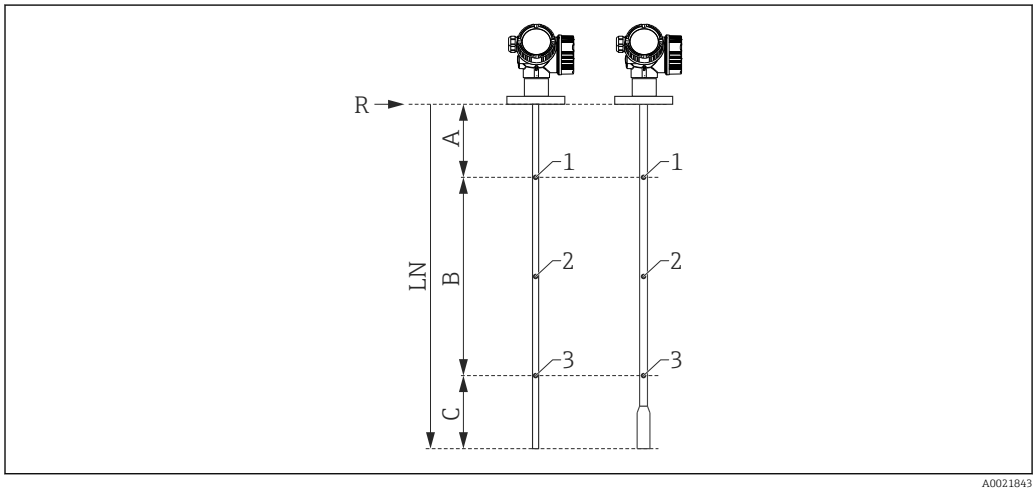
1. Select the product using the filters and search field.
2. Open the product page.
3. Select **Configuration**.

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

3-point linearity protocol

The following points must be considered if option "3-point linearity protocol" was selected in the "Calibration" feature.

The 3 points of the linearity protocol are defined as follows, depending on the selected probe:



A0021843

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

	Rod or coaxial probe LN ≤ 6 m (20 ft)	Separable 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 without 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	In the middle between the 1st and 3rd measuring point			
Position of 3rd measuring point	Measured from bottom: C = 250 mm (9.84 in)	Measured from top: A+B = 5 750 mm (226 in)	Measured from bottom: C = 500 mm (19.7 in)	Measured from top: 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 probe length	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)

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

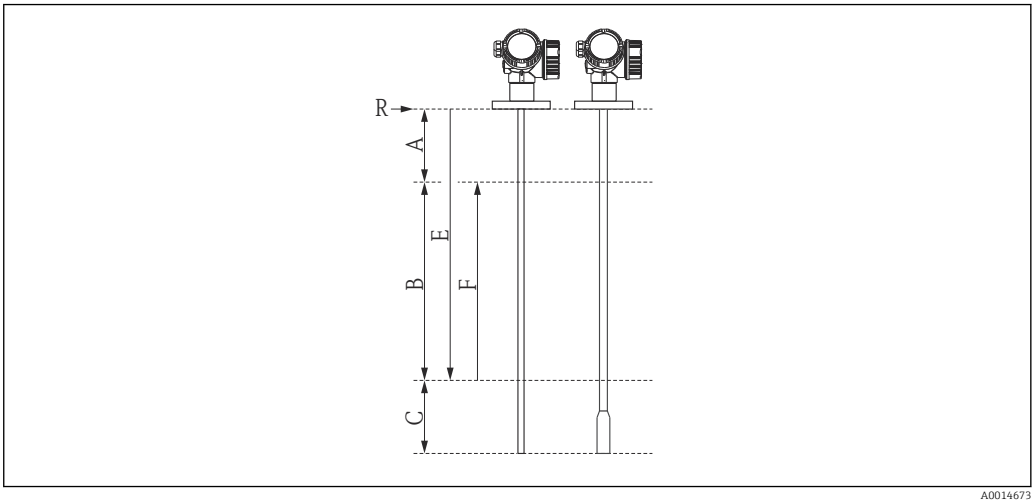
- In the case of rod and rope probes, the linearity check is performed with the entire device
- For separable rod probes, a reference rod probe is used instead of the original probe
- In the case of coaxial probes, the device electronics unit is mounted on a reference rod probe during the test and the linearity check is performed
- The linearity check is performed under reference operating conditions

5-point linearity protocol

The following points must be considered if option "5-point linearity protocol" was selected in the "Calibration" feature.

The 5 points of the linearity protocol are evenly distributed over the measuring range (0% - 100%). The **empty calibration** (E) and **full calibration** (F) must be specified to define the measuring range. If this information is missing, probe-dependent default values are used instead.

The following restrictions must be considered when selecting E and F:



A0014673

A Distance from the reference point R to the 100% mark
B Measuring range
C Distance from the probe end to the 0% mark
E Empty calibration
F Full calibration
R Reference point of the measurement

Sensor	Minimum distance between reference point R and 100% mark	Minimum measuring range
FMP51	A ≥ 250 mm (10 in)	B ≥ 100 mm (4 in)
FMP51 Rope probe ... mm (... in), 4 mm (⅙ in)PFA over 316, max. 300 mm (12 in) nozzle height, centering rod	A ≥ 350 mm (14 in)	B ≥ 100 mm (4 in)
FMP52	A ≥ 250 mm (10 in)	B ≥ 100 mm (4 in)
FMP52 Rope probe ... mm (... in), 4 mm (⅙ in)PFA over 316, max. 300 mm (12 in) nozzle height, centering rod	A ≥ 350 mm (14 in)	B ≥ 100 mm (4 in)
FMP54 without gas phase compensation	A ≥ 250 mm (10 in)	B ≥ 100 mm (4 in)
FMP54 with gas phase compensation, L_{ref} = 300 mm	A ≥ 450 mm (18 in)	B ≥ 100 mm (4 in)
FMP54 with gas phase compensation, L_{ref} = 550 mm	A ≥ 700 mm (28 in)	B ≥ 100 mm (4 in)

Probe type	Minimum distance from the probe end to the 0% mark	Maximum value for "Empty calibration"
Rod (non-separable)	C ≥ 100 mm (4 in)	E ≤ 3.9 m (12.8 ft)
Rod (separable)	C ≥ 100 mm (4 in)	E ≤ 5.9 m (19.4 ft)
Coaxial		
Rope	C ≥ 1 000 mm (40 in)	E ≤ 23 m (75 ft)

- In the case of rod and rope probes, the linearity check is performed with the entire device
- In the case of coaxial probes, the device electronics unit is mounted on a reference rod probe during the test and the linearity check is performed
- The linearity check is performed under reference operating conditions

The selected values for **Empty calibration** and **Full calibration** are only used to create the linearity protocol. Afterwards, the values are reset to the default values specific for the probe. If values other than the default values are required, they must be ordered as a customized parameterization.

Verified cleaned, suitable for O_2 applications (wetted parts)

Oxygen applications (gaseous)
Oxygen can react explosively with oils, greases and plastics. The following precautions must be taken:
- All components of the system, such as devices, must be cleaned in accordance with national requirements
- Dependent on the materials used, a certain maximum temperature and a maximum pressure for oxygen applications must not be exceeded

Customized parameter configuration

If the option "Customized parameterization HART", "Customized parameterization PA" or "Customized parameterization FF" has been selected in feature "Service", presettings that differ from the default settings can be selected for the following parameters:

Parameter	Communication protocol	Picklist/value range
Setup → Unit of length	▪ HART ▪ PA ▪ FF	▪ in ▪ ft ▪ mm ▪ m
Setup → Empty calibration	▪ HART ▪ PA ▪ FF	0 to 45 m (0 to 147 ft)
Setup → Full calibration	▪ HART ▪ PA ▪ FF	0 to 45 m (0 to 147 ft)
Setup → Extended setup → Curr. output 1/2 → Damping	HART	0 to 999.9 s

Parameter	Communication protocol	Picklist/value range
Setup → Extended setup → Curr. output 1/2 → Failure mode	HART	▪ Min ▪ Max ▪ Last valid value
Expert → Comm. → HART config. → Burst mode	HART	▪ Off ▪ On

Labeling (optional)

Various types of measuring point labeling can be selected in the Product Configurator.

This includes:
- Tag
- Adhesive label
- RFID TAG
- Labeling according to DIN91406, also with NFC

Tag name
3 lines of maximum 18 characters each

Labeling in the electronic nameplate (ENP)
The first 32 characters of the tag name

Labeling on the display module
The first 12 characters of the tag name

Application packages

Heartbeat Diagnostics

Availability

Available in all device versions.

Function

- Continuous self-monitoring of the device.
- Diagnostic messages output to
  - the local display.
  - an asset management system (e.g. FieldCare/DeviceCare).
  - an automation system (e.g. PLC).

Advantages

- Device condition information is available immediately and processed in time.
- The status signals are classified in accordance with VDI/VDE 2650 and NAMUR recommendation NE 107 and contain information about the cause of the error and remedial action.

Detailed description

See the "Diagnostics and troubleshooting" section of the Operating Instructions for the device.

Heartbeat Verification

Availability

Available for the following versions of feature 540 "Application package":
- **EH**
  Heartbeat Verification + Monitoring
- **EJ**
  Heartbeat Verification

Device functionality checked on demand

- Verification of the correct functioning of the device within specifications.
- The verification result provides information about the condition of the device: **Passed** or **Failed**.
- The results are documented in a verification report.
- The automatically generated report supports the obligation to demonstrate compliance with internal and external regulations, laws and standards.
- Verification is possible without interrupting the process.

Advantages

- Onsite access to the device is not required to use the functionality.
- The DTM triggers verification in the device and interprets the results. No specific knowledge is required on the part of the user.
  (DTM: Device Type Manager; controls device operation via DeviceCare, FieldCare or a DTM-based process control system.)
- The verification report can be used to prove quality measures to a third party.
- **Heartbeat Verification** can replace other maintenance tasks (e.g. periodic check) or extend the test intervals.

SIL/WHG-locked devices

Only relevant for devices with SIL or WHG approval: order code 590 ("Additional approval"), option LA ("SIL") or LC ("WHG").

- The **Heartbeat Verification** module contains a wizard for the proof test which must be performed at appropriate intervals for the following applications:
  - SIL (IEC61508/IEC61511)
  - WHG (German Water Resources Act)
- To perform a proof test, the device must be locked (SIL/WHG locking).
- The wizard can be used via FieldCare, DeviceCare or a DTM-based process control system.

In the case of SIL-locked and WHG-locked devices, it is **not** possible to perform verification without taking additional measures (e.g. bridging the output current) because the output current must be simulated (Increased safety mode) or the level must be approached manually (Expert mode) during subsequent re-locking (SIL/WHG locking).

Detailed description

SD01872F

Heartbeat Monitoring

Availability

Available for the following versions of feature 540 "Application package":
EH
Heartbeat Verification + Monitoring

Function

- In addition to the verification parameters, the corresponding parameter values are also logged.
- Existing measured variables, such as the echo amplitude, are used in the **Foam detection** and **Build-up detection** wizards.

In the Levelflex FMP5x, the **Foam detection** and **Build-up detection** wizards cannot be used together.

"Foam detection" wizard

- The Heartbeat Monitoring module contains the **Foam detection** wizard.
- This wizard is used to configure automatic foam detection, which detects foam on the product surface on the basis of the reduced signal amplitude. Foam detection can be linked to a switch output in order to control a sprinkler system, for example, which dissolves the foam.
- This wizard can be used via FieldCare, DeviceCare or a DTM-based process control system.

"Build-up detection" wizard

- The Heartbeat Monitoring module contains the **Build-up detection** wizard.
- The wizard is used to configure automatic buildup detection, which detects the buildup of deposits on the probe on the basis of the reduced signal amplitude.
- This wizard can be used via FieldCare, DeviceCare or a DTM-based process control system.

Advantages

- Early detection of changes (trends) to ensure plant availability and product quality.
- Use of information for the proactive planning of measures (e.g. cleaning/maintenance).
- Identification of undesirable process conditions as the basis to optimizing the facility and the processes.
- Automated control of measures to remove foam or buildup.

Detailed description

SD01872F

Accessories

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

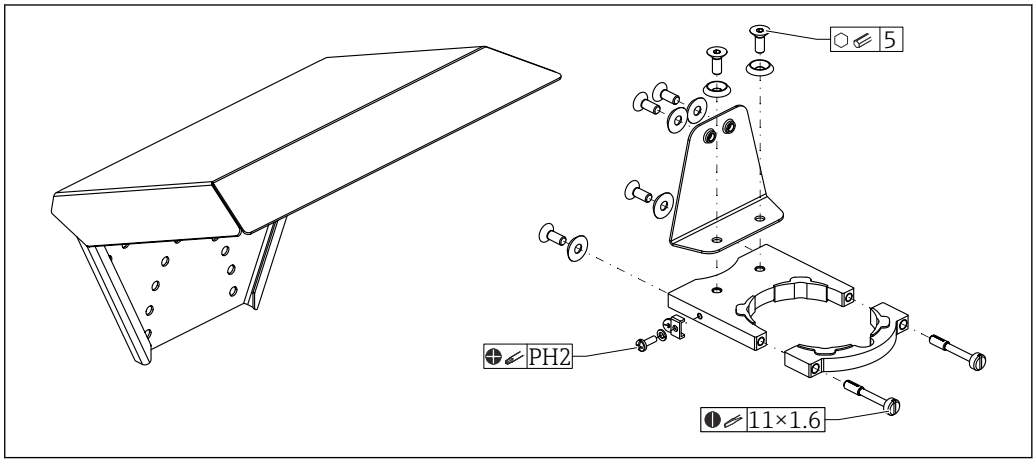
1. Select the product using the filters and search field.
2. Open the product page.
3. Select **Spare parts & Accessories**.

Device-specific accessories

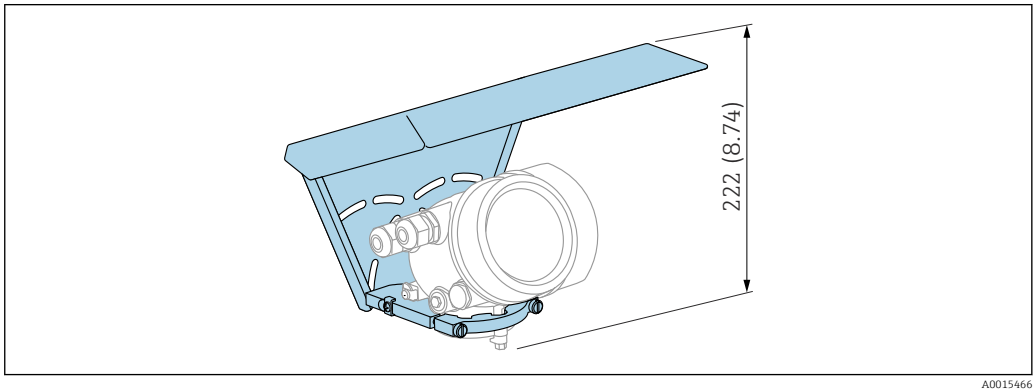
Weather protection cover

The weather protection cover can be ordered together with the device via the "Accessory enclosed" product structure.

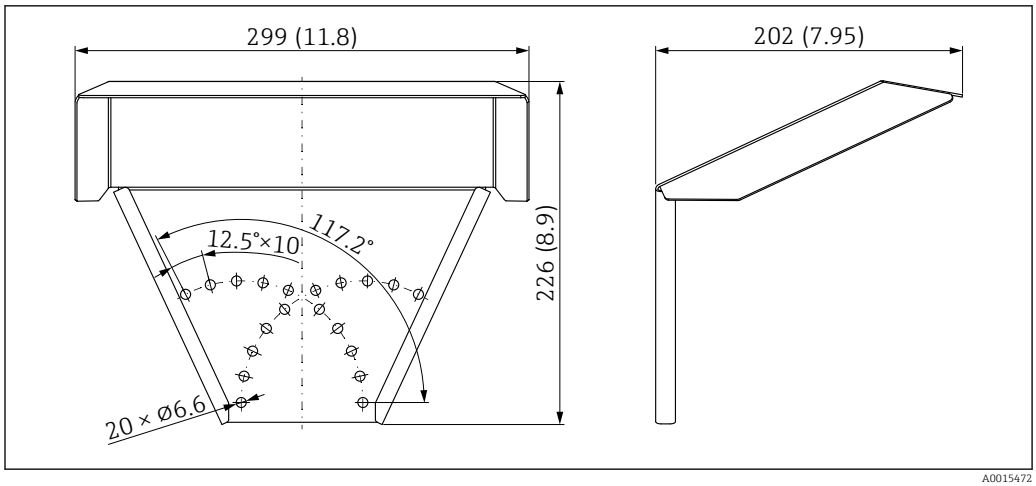
It is used to protect against direct sunlight, precipitation and ice.



64 *Overview*



65 *Height. Unit of measurement mm (in)*



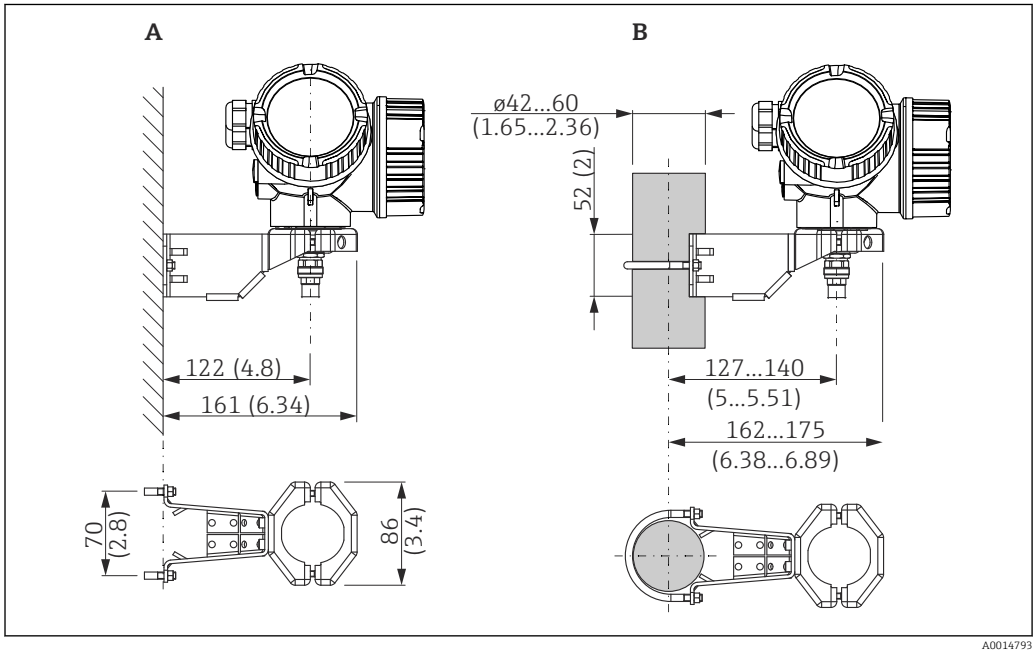
66 Dimensions. Unit of measurement mm (in)

Material
- Protection cap; 316L (1.4404)
- Bracket; 316L (1.4404)
- Angle bracket; 316L (1.4404)
- Clamping screw; 316L (1.4404) + carbon fiber
- Molded rubber part (4x); EPDM
- Screws; A4
- Disks; A4
- Ground terminal; A4, 316L (1.4404)

Order number for accessories:
71162242

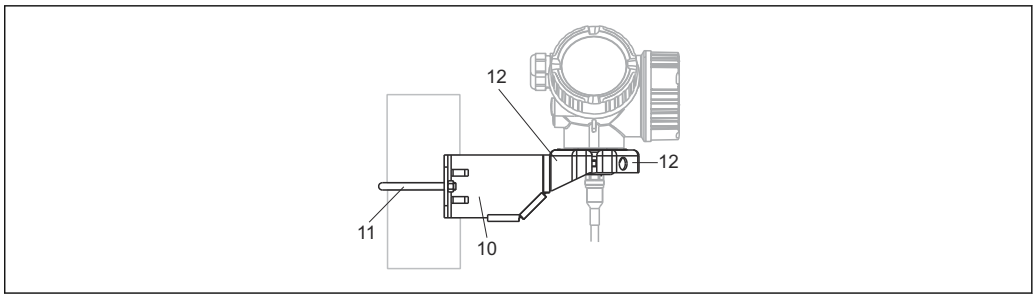
Mounting bracket for electronics housing

With "remote sensor" device versions (feature 060 in the product structure), the mounting bracket is included in the scope of delivery. It can be ordered as a separate accessory .



67 Mounting bracket for electronics housing; unit: mm (in)

A Wall mounting
B Post mounting



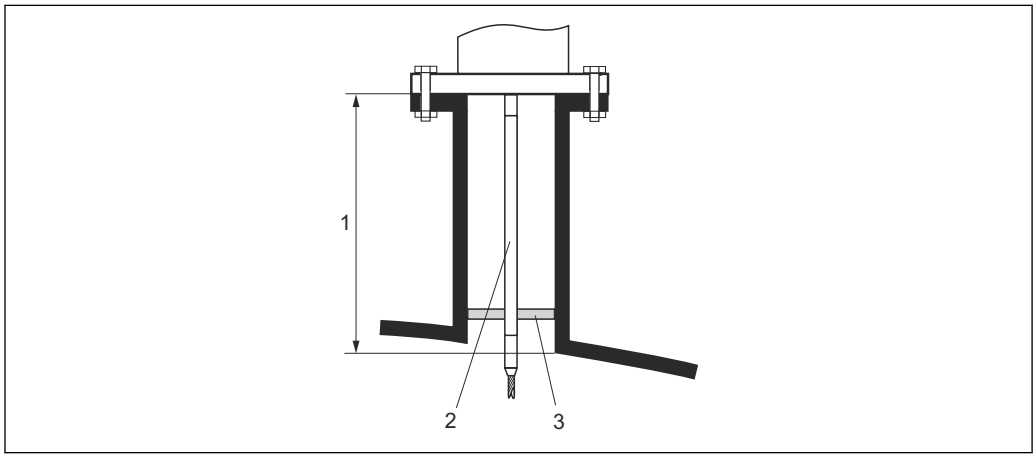
68 Material; mounting bracket

10 Bracket, 316L (1.4404)
11 Round bracket, 316L (1.4404); screws/nuts, A4-70; distance sleeves, 316L (1.4404)
12 Half-shells, 316 L (1.4404)

Order number for accessories:
71102216

Rod extension (centering device) HMP40

The rod extension (centering device) HMP40 is ordered via the Product Configurator.



A0013597

1 Nozzle height
2 Extension rod
3 Centering disk

Permitted temperature at lower edge of nozzle:
- Without centering disk, no restriction
- With centering disk, −40 to +150 °C (−40 to +302 °F)

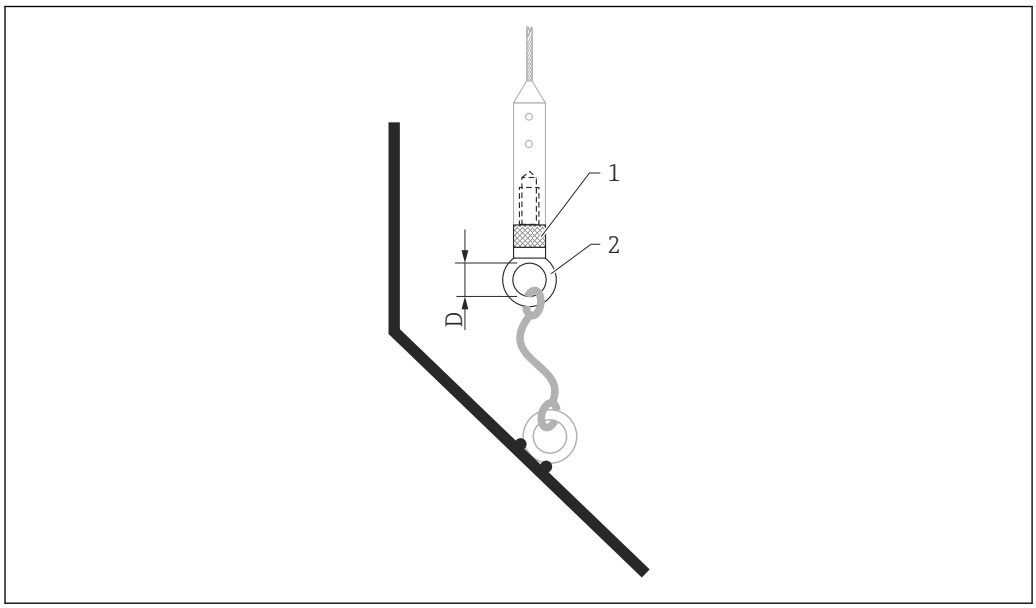
For details, see SD01002F.

Mounting kit, insulated

To secure rope probes so that they are reliably insulated.

Maximum process temperature: 150 °C (300 °F)

Mounting set, insulated, can be used for:
- FMP51
- FMP54



A0013586

69 Scope of delivery of mounting kit:

1 Insulation sleeve
2 Ring bolt

For rope probes 4 mm (⅙ in) or 6 mm (¼ in) with PA > steel:
Diameter D = 20 mm (0.8 in)

Order number for accessories:
52014249

For rope probes 6 mm (¼ in) or 8 mm (⅓ in) with PA > steel:
Diameter D = 25 mm (1 in)

Order number for accessories:
52014250

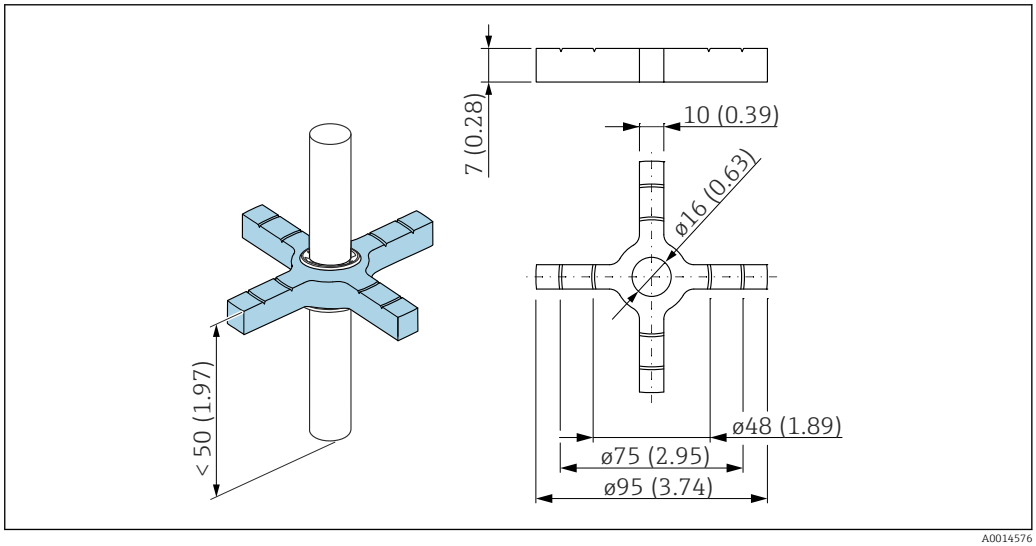
Due to the risk of electrostatic charge, the insulation sleeve is not suitable for use in hazardous areas! In this case, the probe must be secured so that it is reliably grounded.

The mounting kit can also be ordered directly with the device (Levelflex product structure, feature 620 "Accessory enclosed", version PG "mounting kit, insulated, rope").

Centering star

Centering star PEEK, Ø 48 to 95 mm (1.89 to 3.74 in)

Suitable for:
- FMP51
- FMP54



70 Dimensions; centering star PEEK Ø 48 to 95 mm (1.89 to 3.74 in)

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.

For details, see 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 for accessories:
71069064

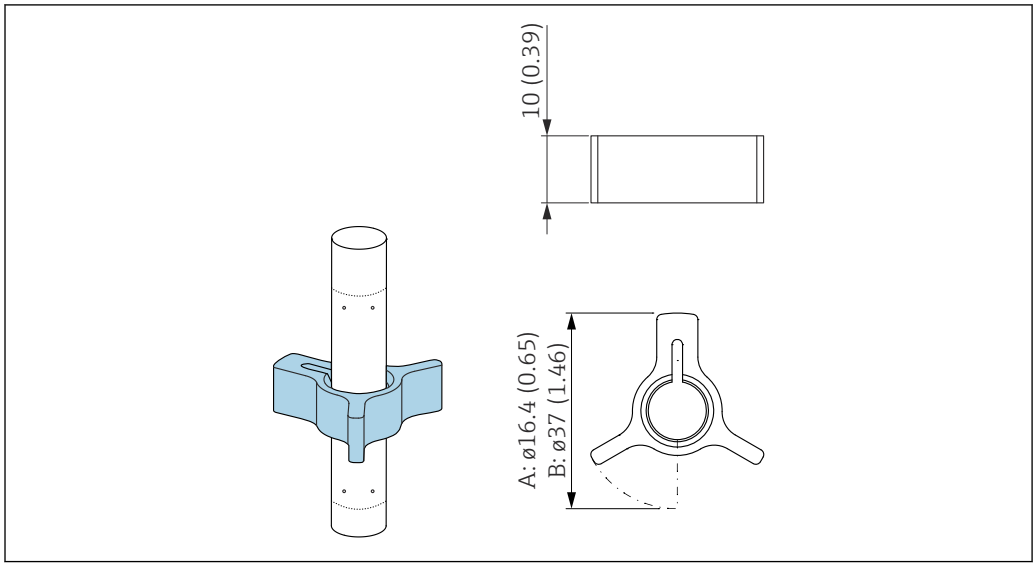
If the centering star is used in a bypass, it must be positioned below the lower bypass outlet. This must be taken into account when choosing the probe length. In general, the centering star should not be mounted more than 50 mm (1.97") above the probe tip. It is advised not to use the PEEK centering 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 retaining rings, 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.

Centering star PFA

Suitable for:
- FMP51
- FMP52
- FMP54

Available versions:
- Ø 16.4 mm (0.65 in)
- Ø 37 mm (1.46 in)



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.

For details, see BA00378F.

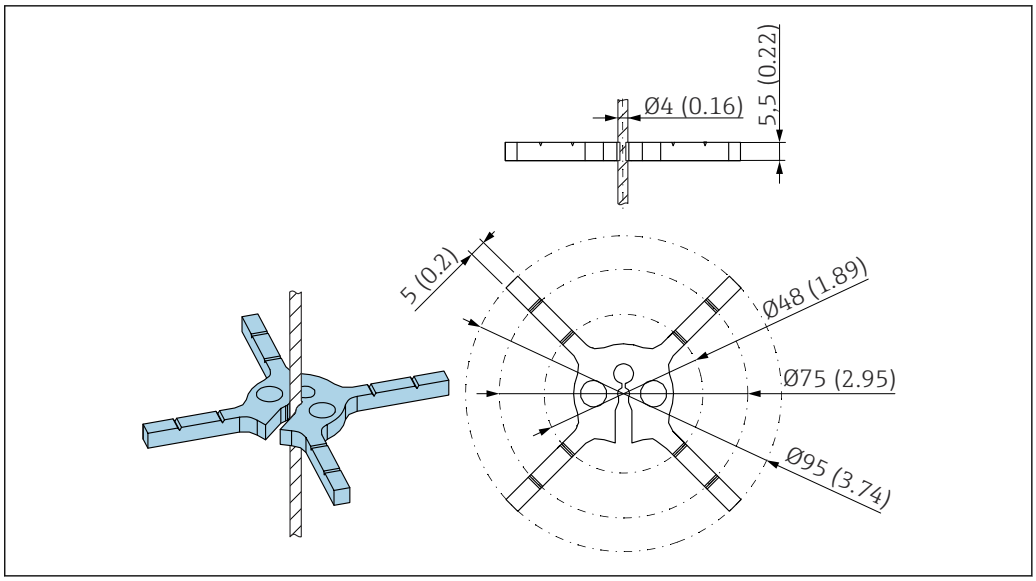
- Material: PFA
- Permitted process temperature range: −200 to +250 °C (−328 to +482 °F)

Order number for accessories:
- 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).

Centering star PEEK, Ø 48 to 95 mm (1.9 to 3.7 in)

Suitable for:
- FMP51
- FMP52
- FMP54



The centering star is suitable for probes with a rope diameter of 4 mm (⅙ in) (including coated rope probes).

For details, see SD01961F.

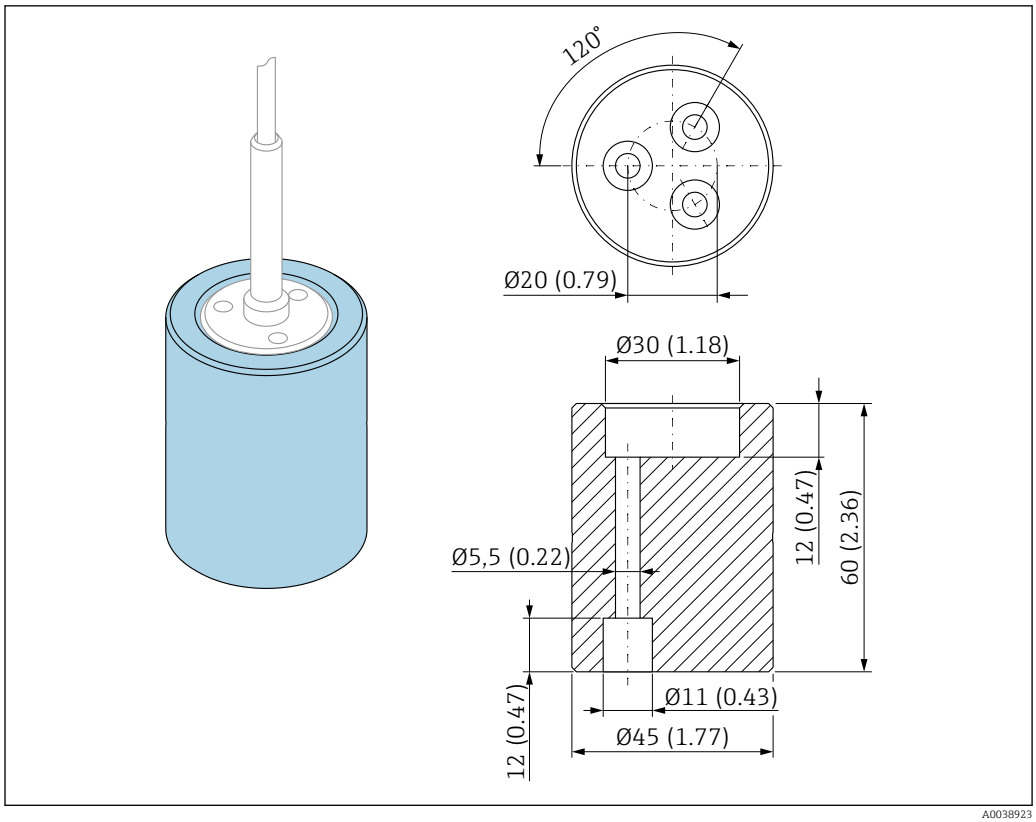
- Material: PEEK
- Permitted process temperature range: −60 to +250 °C (−76 to +482 °F)

Order number for accessories:
- 71373490 (1x)
- 71373492 (5x)

Centering weight

Centering weight 316 L for DN50/2" pipes

Suitable for:
- FMP51
- FMP54



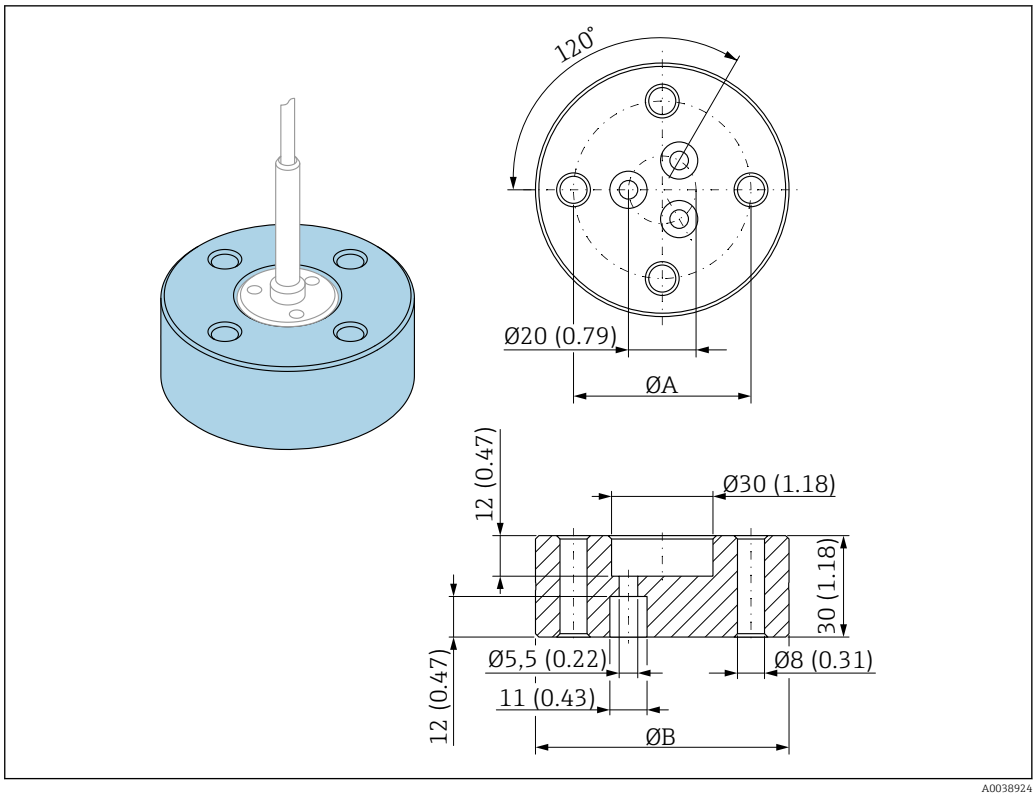
The centering weight is suitable for probes with a rope diameter of 4 mm (⅙ in) and can be used in DN50/2" pipes.

The centering weight can be ordered directly with the device (product structure Levelflex) or as a probe without a process connection (product structure XPF0005-) using feature 610 "Accessory mounted", version **OK** (for pipe DN50/2").

Centering weight 316 L for pipes ≥ DN80/3"

Suitable for:
- FMP51
- FMP54

Available versions:
- Ø 75 mm (2.95 in)
- Ø 95 mm (3.7 in)

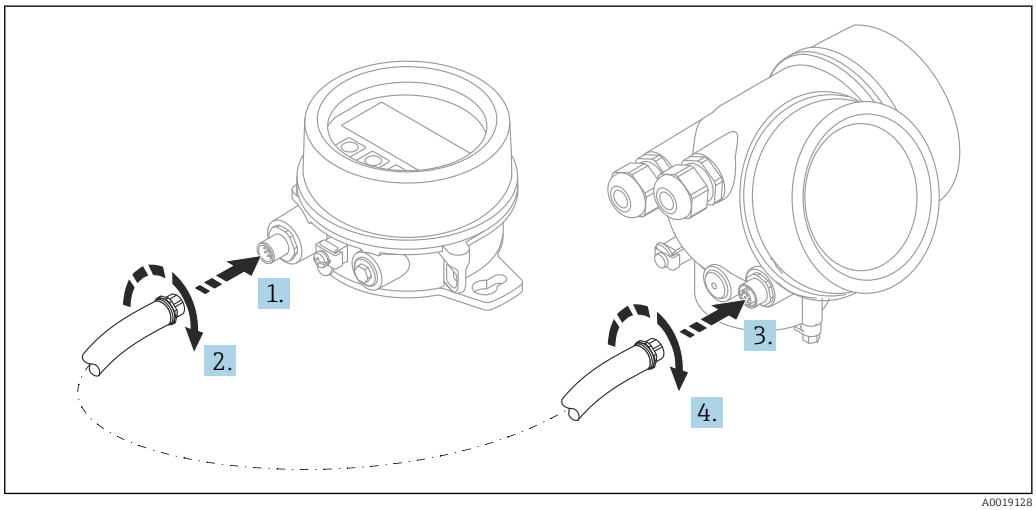


Ø A = 52.5 mm (2.07 in) for DN80/3" pipe
= 62.5 mm (2.47 in) for DN100/4" pipe
Ø B = 75 mm (2.95 in) for DN80/3" pipe
= 95 mm (3.7 in) for DN100/4" pipe

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.

The centering weight can be ordered directly with the device (product structure Levelflex) or as a probe without a process connection (product structure XPF0005-) using feature 610 "Accessory mounted", version **OL** (for pipe DN80/3") or **OM** (for pipe DN100/4").

Remote display FHX50



Technical data
- 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 provided by customer onsite up to 60 m (196 ft)
- Ambient temperature: −40 to 80 °C (−40 to 176 °F)
- Ambient temperature, optionally available for order. −50 to 80 °C (−58 to 176 °F)
  NOTICE If the temperature is permanently below −40 °C (−40 °F), higher failure rates can be expected.

Ordering information
- If the remote display is to be used, the device version "Prepared for display FHX50" must be ordered.
  For FHX50, the option "Prepared for display FHX50" must be selected under "Measuring device version".
- If a measuring instrument has not been ordered with the version "Prepared for display FHX50" and is to be retrofitted with an FHX50, the version "Not prepared for display FHX50" must be ordered for the FHX50 under "Measuring device version". 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 "Prepared for FHX50" is listed under *Basic specifications*, "Display, operation" in the Safety instructions (XA) for the device.

Also refer to the Safety Instructions (XA) of the FHX50.

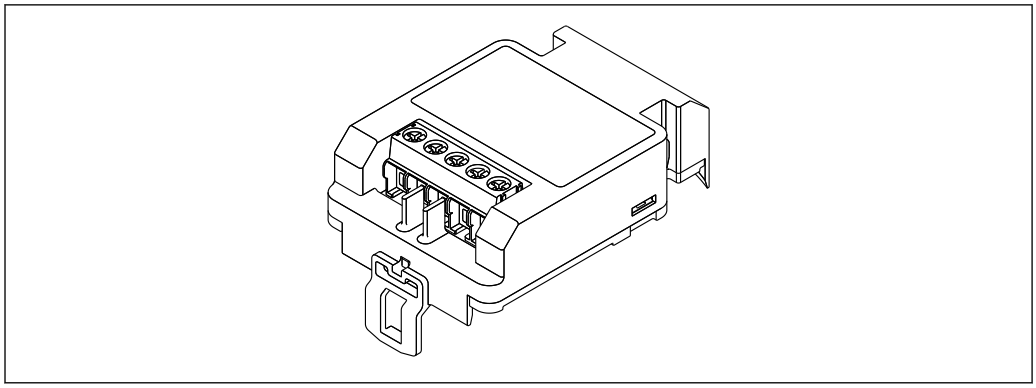
Retrofitting is not possible on transmitters with:
- An approval for use in areas with flammable dust (dust ignition-proof approval)
- Type of protection Ex nA

For details, see "Special Documentation" document SD01007F.

Surge arrester

The surge arrester for loop-powered devices can be ordered together with the device via the "Accessory mounted" section of the product order structure.

The surge arrester can be used for loop-powered devices.
- 1-channel devices - OVP10
- 2-channel devices - OVP20



A0021734

Technical data
- Resistance per channel: 2 × 0.5 Ω_{max}
- Threshold DC voltage: 400 to 700 V
- Threshold surge voltage: < 800 V

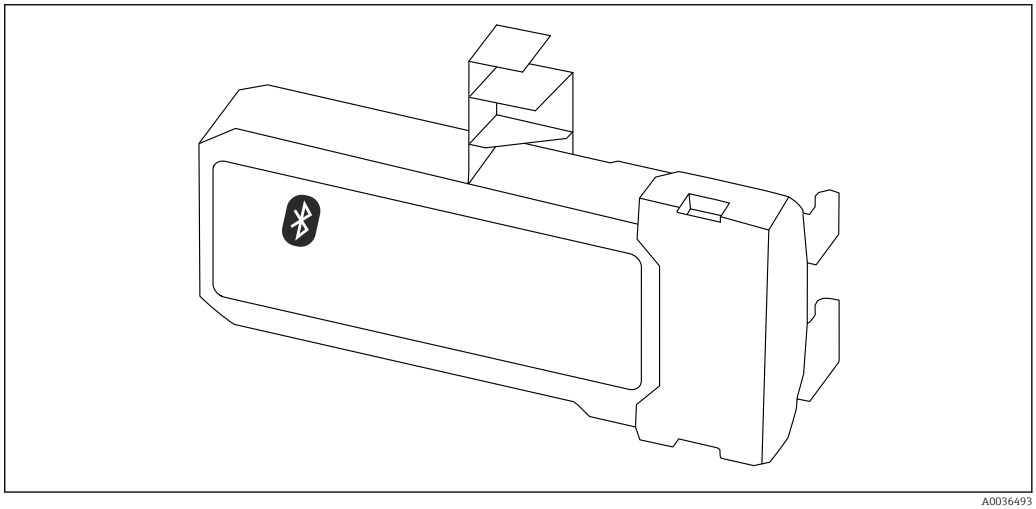
- Capacitance at 1 MHz: < 1.5 pF
- Nominal leakage current (8/20 µs): 10 kA
- Suitable for conductor cross-sections: 0.2 to 2.5 mm² (24 to 14 AWG)

If retrofitting:
- Order number for 1-channel devices (OVP10): 71128617
- Order number for 2-channel devices (OVP20): 71128619
- The use of the OVP module may be restricted depending on the transmitter approval. A device may only be retrofitted with the OVP module if the option *NA* (overvoltage protection) is listed under *Optional specifications* in the Safety Instructions (XA) associated with the device.
- In order to keep the necessary safety distances when using the surge arrester module, the housing cover also needs to be replaced when the device is retrofitted.
  Depending on the housing type, the suitable cover can be ordered using the following order number:
  - Housing GT18: 71185516
  - Housing GT19: 71185518
  - Housing GT20: 71185517

For details, see the "Special Documentation" SD01090F

Bluetooth module BT10 for HART devices

The Bluetooth module BT10 can be ordered together with the device via the "Accessory mounted" section of the product order structure.



A0036493

Technical data
- Quick and easy setup with the SmartBlue app
- No additional tools or adapters needed
- Signal curve via SmartBlue (app)
- Encrypted single point-to-point data transmission (tested by Fraunhofer Institute) and password-protected communication via Bluetooth® wireless technology
- Range under reference conditions:
  > 10 m (33 ft)
- When the Bluetooth module is used, the minimum supply voltage of the device increases by up to 3 V.

If retrofitting:
- Order number: 71377355
- The use of the Bluetooth module may be restricted depending on the transmitter approval. A device may only be retrofitted with the Bluetooth module if the option *NF* (Bluetooth module) is listed under *Optional specifications* in the Safety Instructions (XA) associated with the device.

For details, see the "Special Documentation" SD02252F

Communication-specific accessories

Commubox FXA195 HART
For intrinsically safe HART communication with FieldCare via the USB interface

For details, see "Technical Information" TI00404F

Commubox FXA291
Connects Endress+Hauser field devices with a CDI interface (= Endress+Hauser Common Data Interface) and the USB port of a computer or laptop
Order number: 51516983

For details, see "Technical Information" TI00405C

HART Loop Converter HMX50
Is used to evaluate and convert dynamic HART process variables to analog current signals or limit values
Order number: 71063562

For details, see "Technical Information" TI00429F and Operating Instructions BA00371F

WirelessHART adapter SWA70
- Is used for the wireless connection of field devices
- The WirelessHART adapter can be easily integrated into field devices and existing infrastructures, offers data protection and transmission safety and can be operated in parallel with other wireless networks

For details, see Operating Instructions BA00061S

Fieldgate FXA42
Fieldgates enable communication between connected 4 to 20 mA, Modbus RS485 and Modbus TCP devices and SupplyCare Hosting or SupplyCare Enterprise. The signals are transmitted either via Ethernet TCP/IP, WLAN or mobile communications (UMTS). Advanced automation capabilities are available, such as an integrated Web-PLC, OpenVPN and other functions.

For details, see "Technical Information" TI01297S and Operating Instructions BA01778S.

SupplyCare Enterprise SCE30B
Inventory management software that displays the level, volume, mass, temperature, pressure, density or other parameters of tanks. The parameters are recorded and transmitted by means of gateways like Fieldgate FXA42, Connect Sensor FXA30B or other gateway types.
This Web-based software is installed on a local server and can also be visualized and operated with mobile terminals such as a smartphone or tablet.

For details, see Technical Information TI01228S and Operating Instructions BA00055S

SupplyCare Hosting SCH30
Inventory management software that displays the level, volume, mass, temperature, pressure, density or other parameters of tanks. The parameters are recorded and transmitted by means of gateways like Fieldgate FXA42, Connect Sensor FXA30B or other gateway types.
SupplyCare Hosting is offered as a hosting service (Software as a Service, SaaS). In the Endress +Hauser portal, the user is provided with the data over the Internet.

For details, see Technical Information TI01229S and Operating Instructions BA00050S

Field Xpert SFX350
Field Xpert SFX350 is a mobile computer for commissioning and maintenance. It enables efficient device configuration and diagnostics for HART and FOUNDATION Fieldbus devices in the **non-Ex area**.

For details, see Operating Instructions BA01202S

Field Xpert SFX370
Field Xpert SFX370 is a mobile computer for commissioning and maintenance. It enables efficient device configuration and diagnostics for HART and FOUNDATION Fieldbus devices in the **non-Ex area** and the **Ex area**.

For details, see Operating Instructions BA01202S

Service-specific accessories

DeviceCare SFE100
Configuration tool for HART, PROFIBUS and FOUNDATION Fieldbus field devices

Technical Information TI01134S

FieldCare SFE500
FDT-based plant asset management tool
It can configure all smart field units in your system and helps you manage them. By using the status information, it is also a simple but effective way of checking their status and condition.

Technical Information TI00028S

System components

Memograph M RSG45

The Advanced Data Manager is a flexible and powerful system for organizing process values.

The Memograph M is used for electronic acquisition, display, recording, analysis, remote transmission and archiving of analog and digital input signals as well as calculated values.

Technical Information TI01180R and Operating Instructions BA01338R

RN42

Single-channel active barrier with wide-range power supply for safe electrical isolation of 4 to 20 mA standard signal circuits, HART transparent.

Technical Information TI01584K and Operating Instructions BA02090K

Documentation

The following document types are available in the Downloads area of the Endress+Hauser website (www.endress.com/downloads), depending on the device version:

Document type	Purpose and content of the document
Technical Information (TI)	**Planning aid for your device** The document contains all the technical data on the device and provides an overview of the accessories and other products that can be ordered for the device.
Brief Operating Instructions (KA)	**Guide that takes you quickly to the 1st measured value** The Brief Operating Instructions contain all the essential information from incoming acceptance to initial commissioning.
Operating Instructions (BA)	**Your reference document** The Operating Instructions contain all the information that is required in various phases of the life cycle of the device: from product identification, incoming acceptance and storage, to mounting, connection, operation and commissioning through to troubleshooting, maintenance and disposal.
Description of Device Parameters (GP)	**Reference for your parameters** The document provides a detailed explanation of each individual parameter. The description is aimed at those who work with the device over the entire life cycle and perform specific configurations.
Safety instructions (XA)	Depending on the approval, safety instructions for electrical equipment in hazardous areas are also supplied with the device. These are an integral part of the Operating Instructions. The nameplate indicates which Safety Instructions (XA) apply to the device.
Supplementary device-dependent documentation (SD/FY)	Always comply strictly with the instructions in the relevant supplementary documentation. The supplementary documentation is a constituent part of the device documentation.

www.addresses.endress.com

Endress+Hauser

People for Process Automation