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LENNTECH
WATER TREATMENT SOLUTIONS

# Technical Information
# **Levelflex FMP56, FMP57**

Guided-wave radar



## Level measurement in bulk solids

### Application

- Rod or rope probe
- Process connection: thread as of ¾" or flange
- Process temperature: −40 to +185 °C (−40 to +365 °F)
- Process pressure: −1 to +16 bar (−14.5 to +232 psi)
- Maximum measuring range: rod 4 m (13 ft); rope 45 m (148 ft)
- Accuracy: ±2 mm (±0.08 in)
- International explosion protection certificates; 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
- Heartbeat Technology™

Endress+Hauser
People for Process Automation

# Table of contents


**Important document information** . . . . . 3
Symbols . . . . . 3

**Function and system design** . . . . . 4
Measuring principle . . . . . 4
Measuring system . . . . . 5

**Input** . . . . . 7
Measured variable . . . . . 7
Measurement range . . . . . 7
Blocking distance . . . . . 8
Measuring frequency spectrum . . . . . 9

**Output** . . . . . 9
Output signal . . . . . 9
Signal on alarm . . . . . 10
Linearization . . . . . 10
Galvanic isolation . . . . . 10
Protocol-specific data . . . . . 10

**Power supply** . . . . . 14
Terminal assignment . . . . . 14
Device plug . . . . . 19
Supply voltage . . . . . 20
Power consumption . . . . . 22
Current consumption . . . . . 22
Power supply failure . . . . . 23
Potential equalization . . . . . 23
Terminals . . . . . 23
Cable entries . . . . . 23
Cable specification . . . . . 23
Overvoltage protection . . . . . 24

**Performance characteristics** . . . . . 24
Reference conditions . . . . . 24
Reference accuracy . . . . . 25
Resolution . . . . . 27
Response time . . . . . 27
Influence of ambient temperature . . . . . 27

**Installation** . . . . . 27
Mounting requirements . . . . . 27

**Environment** . . . . . 39
Ambient temperature . . . . . 39
Ambient temperature limits . . . . . 39
Storage temperature . . . . . 41
Climate class . . . . . 41
Operating height . . . . . 42
Degree of protection . . . . . 42
Vibration resistance . . . . . 42
Cleaning the probe . . . . . 42
Electromagnetic compatibility (EMC) . . . . . 42

**Process** . . . . . 42
Process temperature range . . . . . 42
Process pressure range . . . . . 43
Dielectric constant . . . . . 43
Extension of the rope probe . . . . . 43

**Mechanical construction** . . . . . 44
Dimensions . . . . . 44
Probe length tolerances . . . . . 48
Shortening probes . . . . . 48
Weight . . . . . 48
Materials . . . . . 49

**Operability** . . . . . 53
Operation concept . . . . . 53
Access to operating menu via local display . . . . . 55
Access to the operating menu via the operating tool . . . . . 56
SupplyCare . . . . . 59

**Certificates and approvals** . . . . . 61
CE mark . . . . . 61
RoHS . . . . . 61
RCM marking . . . . . 62
Ex-approval . . . . . 62
Dual seal ANSI/ISA 12.27.01 . . . . . 62
Functional safety . . . . . 62
ASME B31.1 and B31.3 . . . . . 62
Pressure Equipment Directive . . . . . 62
Marine approval . . . . . 62
Radio approval . . . . . 62
CRN approval . . . . . 62
Test, certificate . . . . . 63
Product documentation on paper . . . . . 63
External standards and guidelines . . . . . 63

**Ordering information** . . . . . 64
3-point linearity protocol . . . . . 64
5-point linearity protocol . . . . . 65
Customer-specific configuration . . . . . 66
Labeling (optional) . . . . . 66

**Application packages** . . . . . 66
Heartbeat Diagnostics . . . . . 66
Heartbeat Verification . . . . . 67
Heartbeat Monitoring . . . . . 67

**Accessories** . . . . . 68
Device-specific accessories . . . . . 68
Communication-specific accessories . . . . . 74
Service-specific accessories . . . . . 75
System components . . . . . 76

**Documentation** . . . . . 76

# Important document information

## 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 inside and outside 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

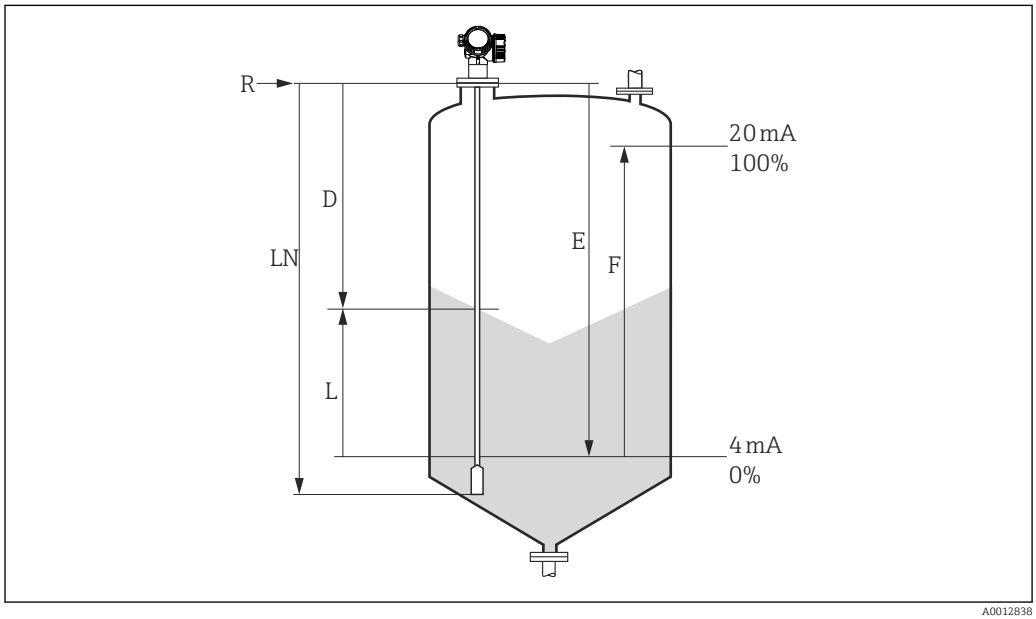
**Temperature resistance of the connection cables**
Specifies the minimum value of the temperature resistance of the connection cables

# 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 $\varepsilon_r$ 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 ($\varepsilon_r$) of the medium directly affects the degree of reflection of the high-frequency pulses. In the case of a large $\varepsilon_r$, such as with water or ammonia, there is strong pulse reflection. Conversely, if the $\varepsilon_r$ 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.

**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

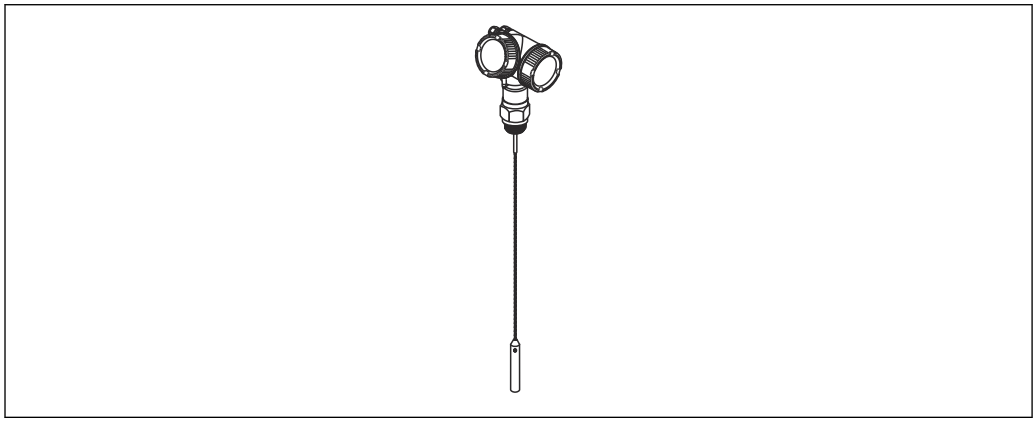
**General notes on probe selection**

- Rope probes should normally be used for bulk solids. Rod probes are only suitable in bulk solids for short measuring ranges up to approx. 2 m (6.6 ft). This applies particularly to applications in which the probe is installed laterally at an angle and for light and pourable bulk solids.
- In the case of large silos, the lateral pressure on the rope can be so high that a rope with plastic jacketing must be used. We recommend the use of PA-coated ropes for milled products such as cereals, wheat and flour.

### Probe selection

*FMP56*

For level measurement in bulk solids



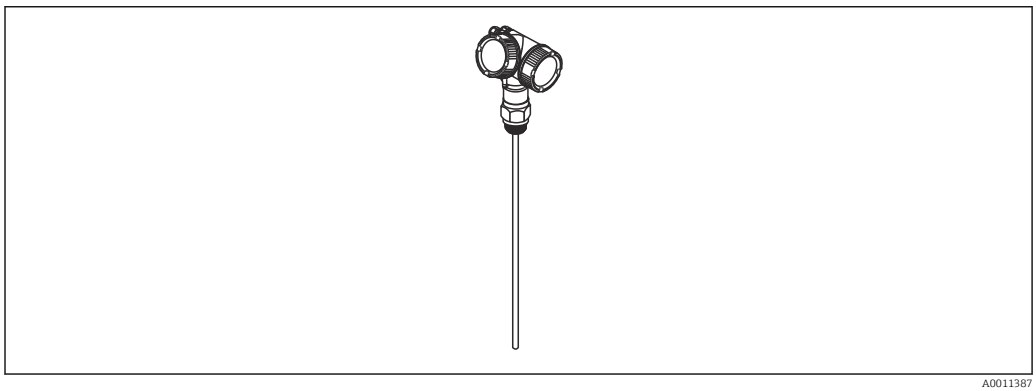
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*2 Rope probe with centering rod*

**Rope probe**
- Maximum probe length 12 m (40 ft)
- Material:
  - 316L
  - PA>steel
- Maximum tensile loading capacity 12 kN

*FMP57*

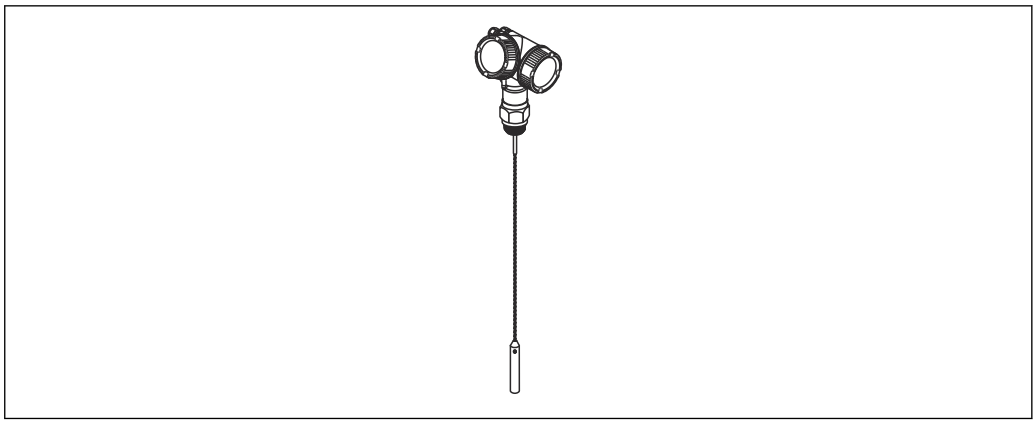
For level measurement in bulk solids



A0011387

*3 Rod probe*

**Rod probe**
- Maximum probe length 4 m (13 ft)
- Material 316 L
- Maximum tensile loading capacity 30 kN




4 *Rope probe with centering rod*

**Rope probe**
- Maximum probe length 45 m (148 ft)
- Material:
  - 316L
  - PA>steel
- Maximum tensile loading capacity 30 kN

# 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).

**Measurement range**

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

| Levelflex FMP56 | | | | |
|---|---|---|---|---|
| Media group | $\varepsilon_r$ | Typical bulk solids | Measurement range | |
| | | | Bare metallic Rope probes | PA-coated Rope probes |
| 1 | 1.4 to 1.6 | Plastic powder | 12 m (39 ft) [1] | – |
| 2 | 1.6 to 1.9 | ▪ Plastic granulate<br>▪ White lime, special cement<br>▪ Sugar | 12 m (39 ft) | 12 m (39 ft) |
| 3 | 1.9 to 2.5 | Portland cement, plaster | 12 m (39 ft) | – |
| | | Flour | – | 12 m (39 ft) |
| 4 | 2.5 to 4.0 | Grain, seeds | – | 12 m (39 ft) |
| | | ▪ Ground stones<br>▪ Sand | 12 m (39 ft) | 12 m (39 ft) |
| 5 | 4.0 to 7.0 | ▪ Naturally moist (ground) stones, ores<br>▪ Salt | 12 m (39 ft) | 12 m (39 ft) |
| 6 | > 7.0 | ▪ Metal powder<br>▪ Carbon black<br>▪ Coal dust | 12 m (39 ft) | 12 m (39 ft) |

1) Restriction: The measuring range may be reduced for media with strong signal damping, e.g. milled products, wheat bran or silicic acid.

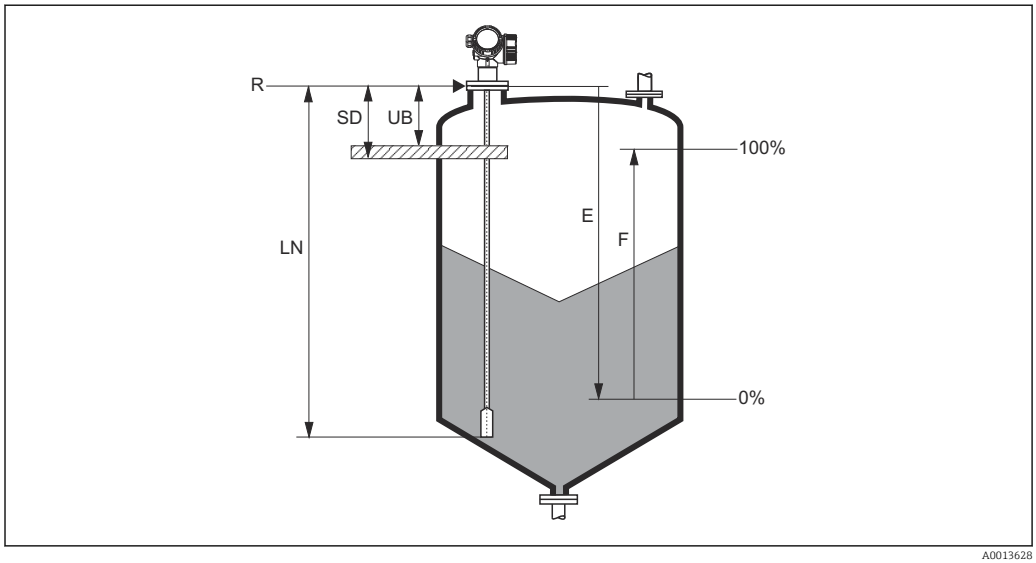
| Levelflex FMP57 | | | | | |
|---|---|---|---|---|---|
| Media group | $\varepsilon_r$ | Typical bulk solids | Measurement range | | |
| | | | Bare metallic Rod probes | Bare metallic Rope probes | PA-coated Rope probes |
| 1 | 1.4 to 1.6 | Plastic powder | 4 m (13 ft) [1] | 20 to 25 m (66 to 82 ft) [1] | – |
| 2 | 1.6 to 1.9 | ▪ Plastic granulate<br>▪ White lime, special cement<br>▪ Sugar | 4 m (13 ft) | 25 to 30 m (82 to 98 ft) | 12.5 to 15 m (41 to 49 ft) |
| 3 | 1.9 to 2.5 | Portland cement, plaster | 4 m (13 ft) | 30 to 45 m (98 to 148 ft) | – |
| | | Flour | 4 m (13 ft) | – | 15 to 25 m (49 to 82 ft) |
| 4 | 2.5 to 4.0 | Grain, seeds | 4 m (13 ft) | – | 25 to 35 m (82 to 115 ft) |
| | | ▪ Ground stones<br>▪ Sand | 4 m (13 ft) | 45 m (148 ft) | 25 to 35 m (82 to 115 ft) |
| 5 | 4.0 to 7.0 | ▪ Naturally moist (ground) stones, ores<br>▪ Salt | 4 m (13 ft) | 45 m (148 ft) | 35 to 36 m (115 to 118 ft) |
| 6 | > 7.0 | ▪ Metal powder<br>▪ Carbon black<br>▪ Coal dust | 4 m (13 ft) | 45 m (148 ft) | 36 to 45 m (118 to 148 ft) |

1) Restriction: The measuring range may be reduced for media with strong signal damping, e.g. milled products, wheat bran or silicic acid.

- The formation of buildup, particularly of moist products, can reduce the maximum possible measuring range.
- For very loose or loosened bulk solids, the lower group applies in each case.

**Blocking distance**

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




*5 Definition of blocking distance and safety distance*

*R Reference point of measurement*
*LN Length of probe*
*UB Upper blocking distance*
*E Empty calibration (zero)*
*F Full calibration (span)*
*SD Safety distance*

Blocking distance (factory setting):
- 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 1 350 $V_{DC}$ 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
- 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
- Electronics temperature
- Relative echo amplitude

**Measured values for SV, TV, QV (second, third and fourth variable)**
- Level linearized
- Distance
- Terminal voltage
- Electronics temperature
- Absolute echo amplitude
- Relative echo amplitude
- Calculated $\varepsilon_r$ 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
- Terminal voltage
- Electronics temperature
- Absolute echo amplitude
- Relative echo amplitude
- Calculated $\varepsilon_r$ 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 | Information and files available at:<br>▪ www.endress.com<br>▪ www.fieldcommgroup.org |
| CFF revision | |
| 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:<br>▪ Restart<br>▪ ENP Restart<br>▪ Setup<br>▪ Linearization<br>▪ 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)<br>▪ 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 |
| 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 |

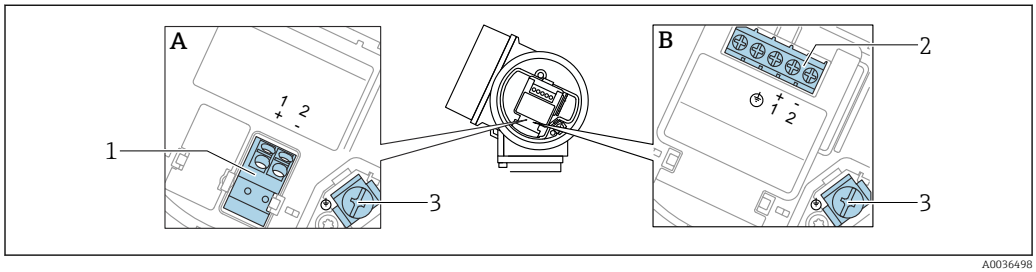
| Block | Content | Number of permanent blocks | Number of instantiatable blocks | Execution time | Functionality |
|---|---|---|---|---|---|
| Multiple Analog Output Block | The Multiple Analog Output Block is used to transmit analog values from the bus to the device. | 1 | 0 | 20 ms | Standard |
| 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

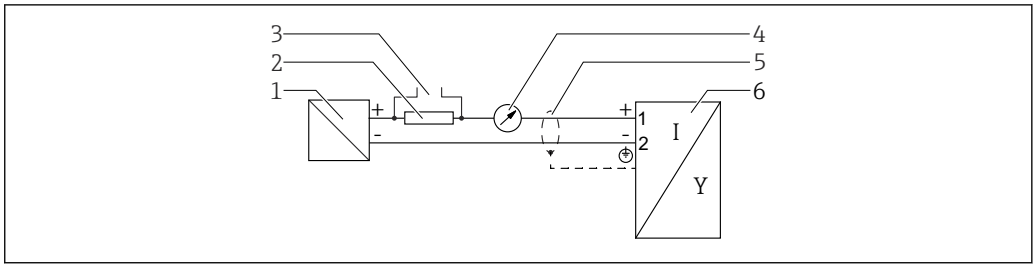
### Terminal assignment, 2-wire: 4 to 20 mA HART




6 *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 of 4 to 20 mA HART

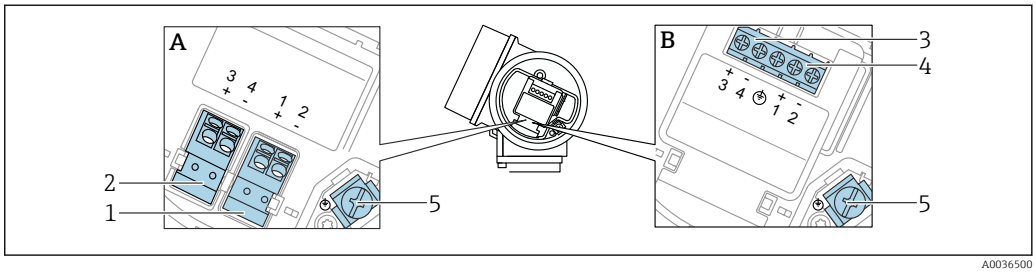



A0036499

7 *Function diagram of 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

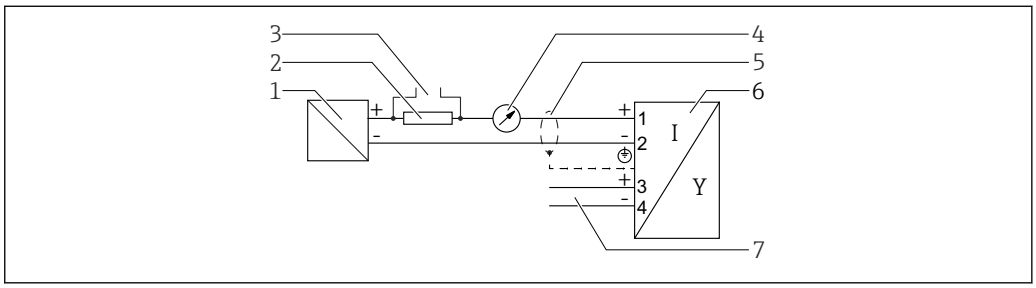



A0036500

8 *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, switch output

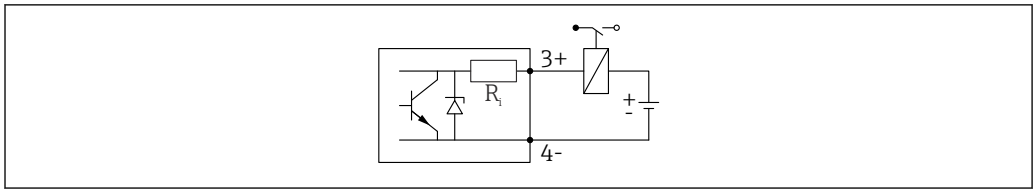



A0036501

9 *Function diagram 4 to 20 mA HART, switch output*

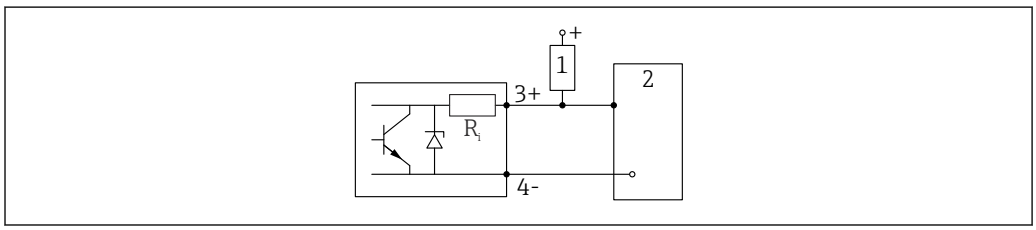
1 *Active barrier for power supply; observe terminal voltage.*
2 *Resistor for HART communication (≥ 250 Ω); observe maximum load.*
3 *Connection for Commubox FXA195 or FieldXpert (via VIATOR Bluetooth modem)*
4 *Analog display unit; observe maximum load*
5 *Cable screen; observe cable specification*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

*Connection example of relay*




*10 Connection example of relay*

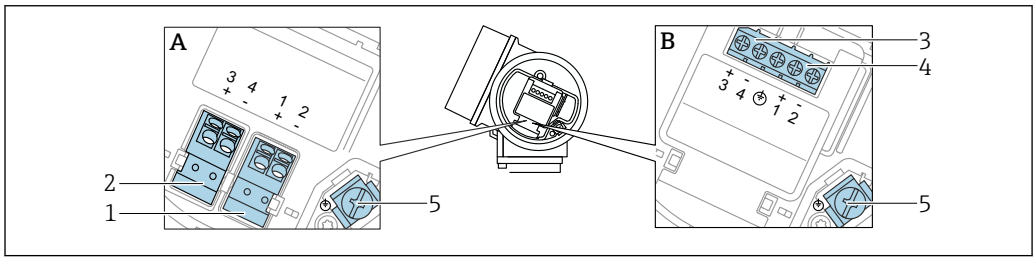
*Connection example for the digital input*




*11 Connection example for the digital input*

*1 Pull-up resistor*
*2 Digital input*

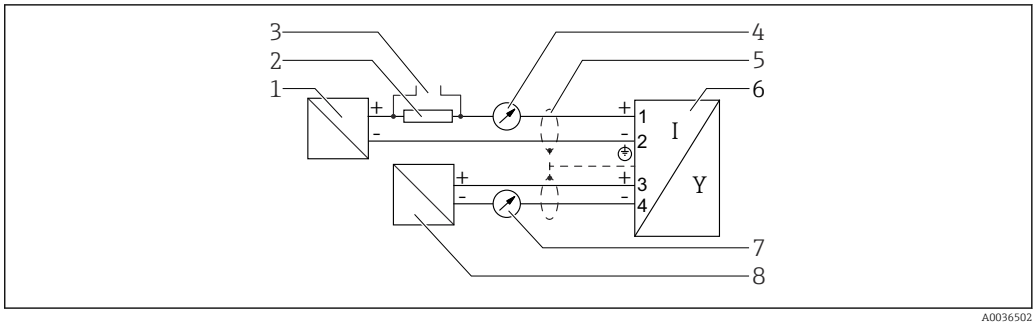
**Terminal assignment, 2-wire: 4 to 20 mA HART, 4 to 20 mA**




*12 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*

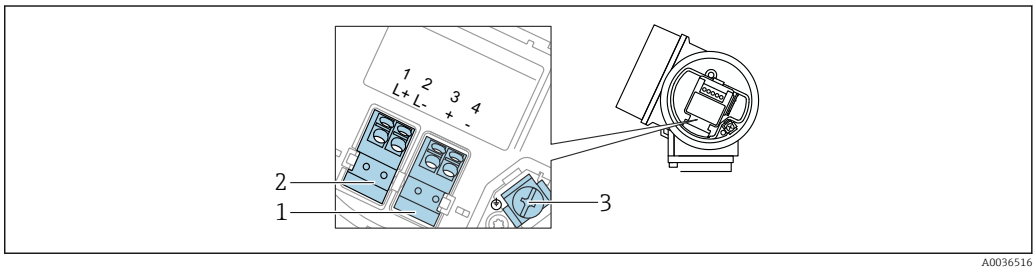
### Function diagram 4 to 20 mA HART + 4 to 20 mA analog




13 *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.*

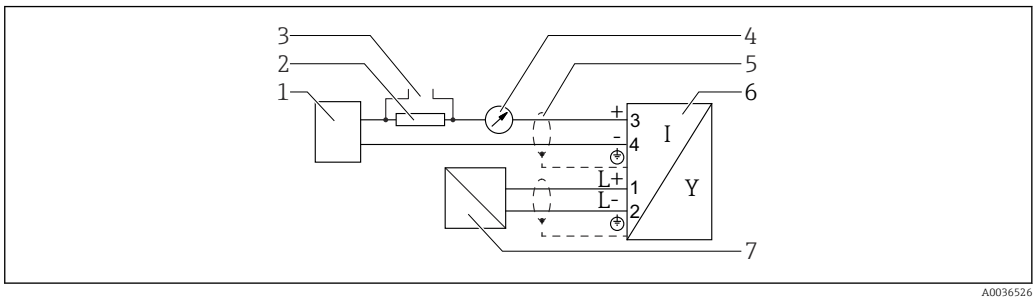
### Terminal assignment, 4-wire: 4 to 20 mA HART (10.4 to 48 $V_{DC}$)




14 *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*

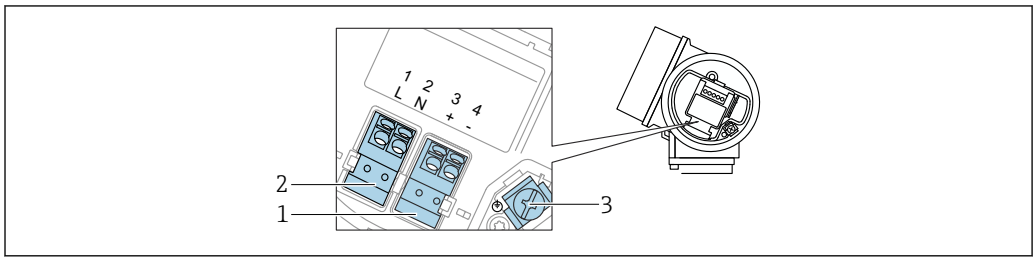
### Function diagram 4-wire: 4 to 20 mA HART (10.4 to 48 $V_{DC}$)




15 *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 $V_{AC}$)




16 *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:**

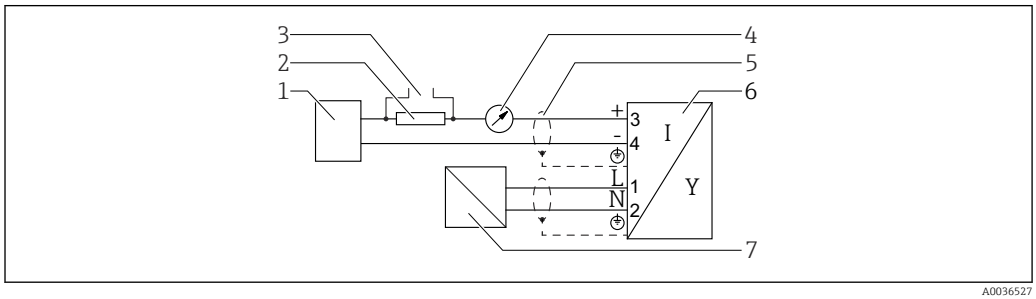
- ▶ Do not disconnect the protective ground connection.
- ▶ Disconnect the device from the supply voltage before disconnecting the protective ground.

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/).

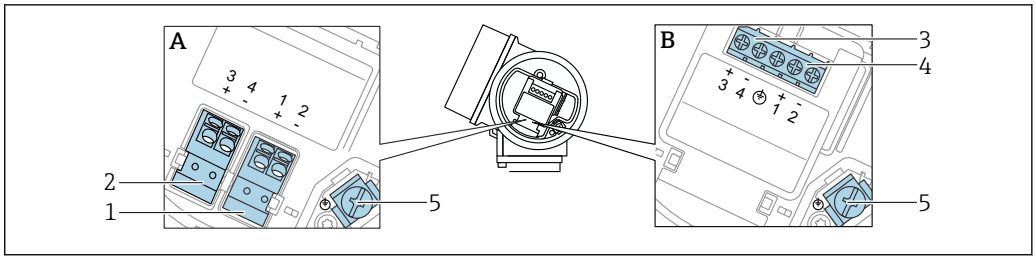
### Function diagram 4-wire: 4 to 20 mA HART (90 to 253 $V_{AC}$)




17 *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*

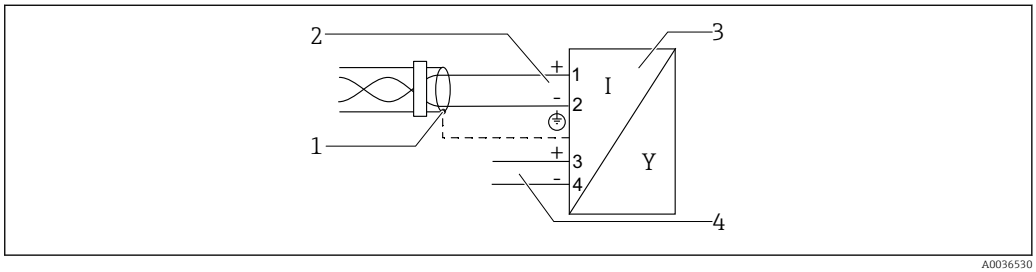
### Terminal assignment PROFIBUS PA / FOUNDATION Fieldbus




18 *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

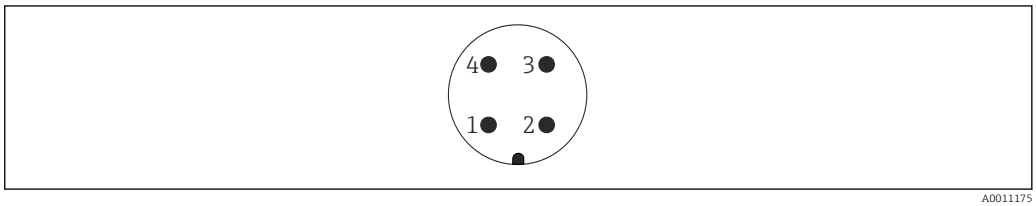



19 *Block view PROFIBUS PA / FOUNDATION Fieldbus*

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

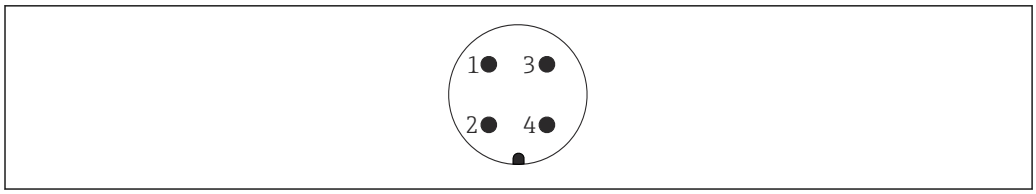
## Device plug

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




20 *Pin assignment of M12 plug*

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




*21 Pin assignment of 7/8" plug*

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

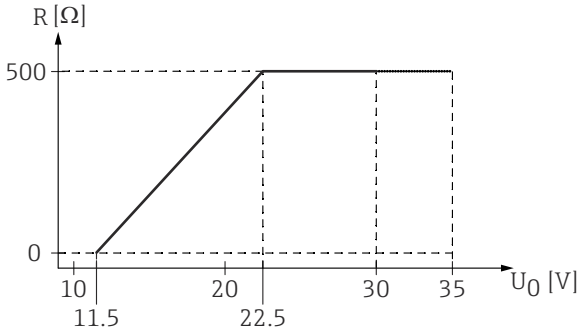
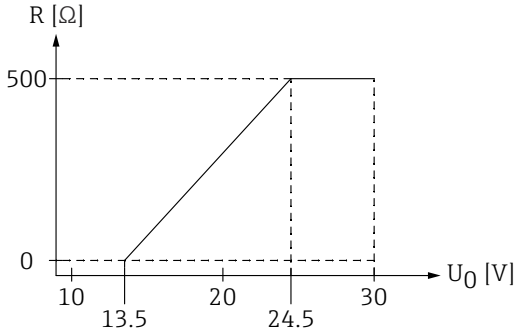
**Supply voltage**

An external power supply is necessary.

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

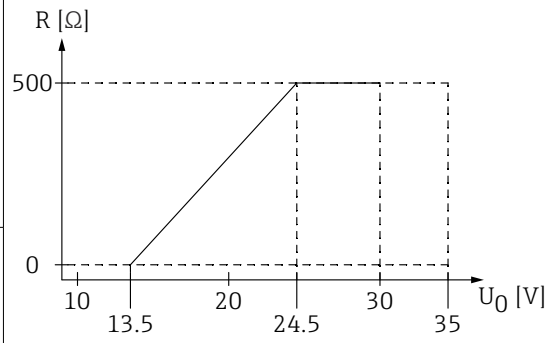
**2-wire, 4-20mA HART, passive**

*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<br>▪ Ex nA<br>▪ Ex ic<br>▪ CSA GP | 11.5 to 35 V [3] [4] |  |
| Ex ia / IS | 11.5 to 30 V [4] | |
| ▪ Ex d / XP<br>▪ Ex ic[ia]<br>▪ Ex tD / DIP | 13.5 to 30 V [4] [5] |  |

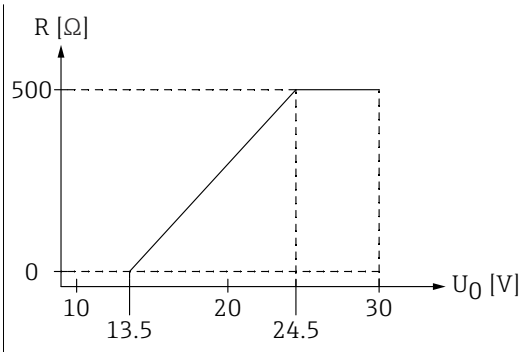
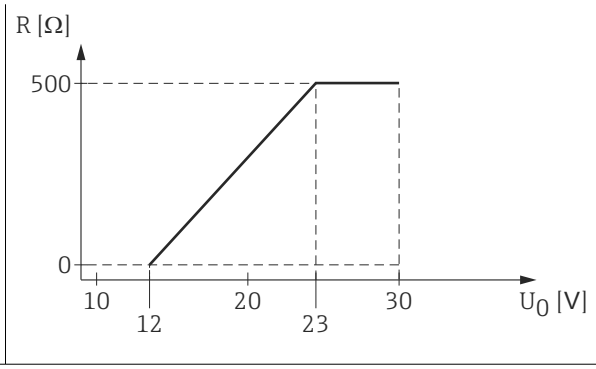
1) Feature 020 in the product structure: option A
2) Feature 010 in the product structure
3) At ambient temperatures $T_a \leq$ -30 °C, a terminal voltage U ≥ 14 V is required to start the device with the minimum failure current (3.6 mA). At ambient temperatures $T_a >$ 60 °C, a terminal voltage U ≥ 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<br>▪ Ex nA<br>▪ Ex nA(ia)<br>▪ Ex ic<br>▪ Ex ic[ia]<br>▪ Ex d[ia] / XP<br>▪ Ex ta / DIP<br>▪ CSA GP | 13.5 to 35 V [3] [4] |  |
| ▪ Ex ia / IS<br>▪ 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<br>**G:** 2-wire; PROFIBUS PA, switch output | ▪ Non-hazardous<br>▪ Ex nA<br>▪ Ex nA[ia]<br>▪ Ex ic<br>▪ Ex ic[ia]<br>▪ Ex d[ia] / XP<br>▪ Ex ta / DIP<br>▪ CSA GP | 9 to 32 V [3] |
| | ▪ Ex ia / IS<br>▪ 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 (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)

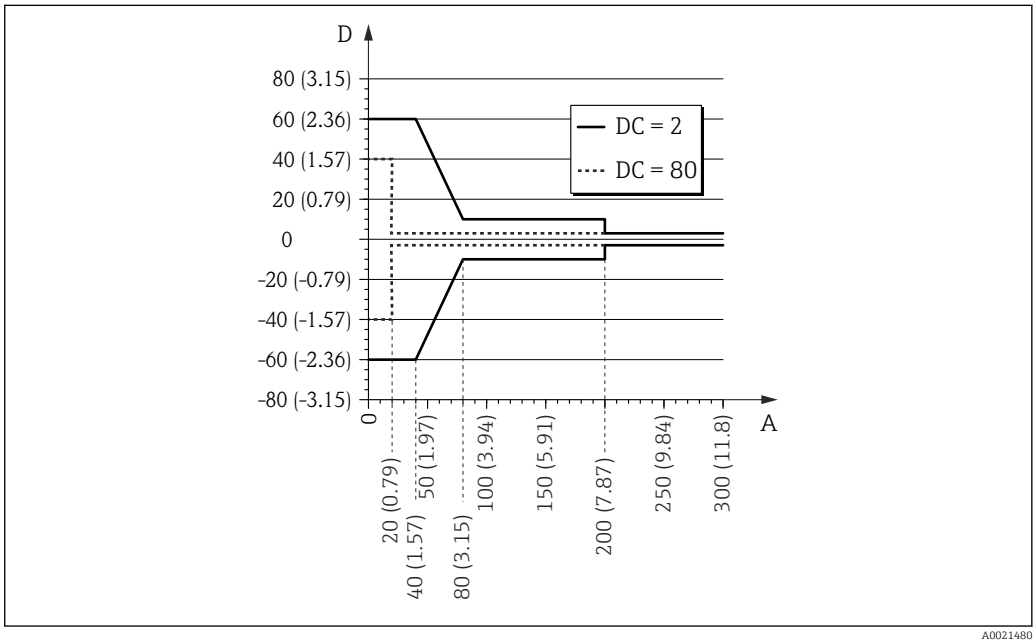
**Reference accuracy**

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] | ▪ Measuring distance ≤ 15 m (49 ft): ±2 mm (±0.08 in)<br>▪ Measuring distance > 15 m (49 ft): ±10 mm (±0.39 in) | ±0.02 % |
| Non-repeatability [3] | ≤ 1 mm (0.04 in) | |

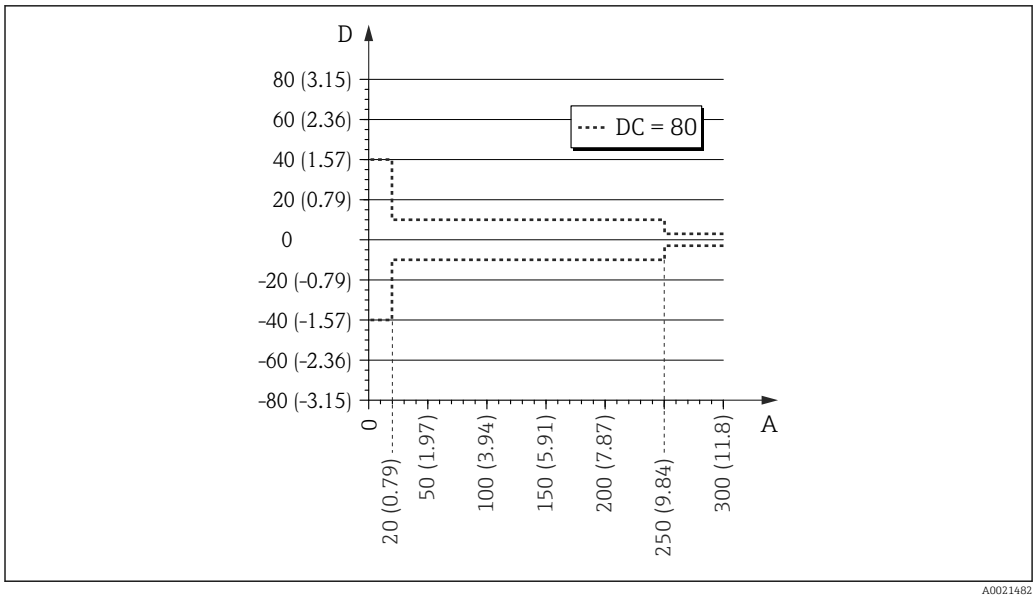
1) Add error of the analog value to the digital value.
2) If the reference conditions are not met, the offset/zero point resulting from the installation conditions can be up to ±16 mm (±0.63 in). This additional offset/zero point can be compensated for by entering a correction ("Level correction" parameter) during commissioning.
3) 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:**




*22 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 ($\varepsilon_r$)*

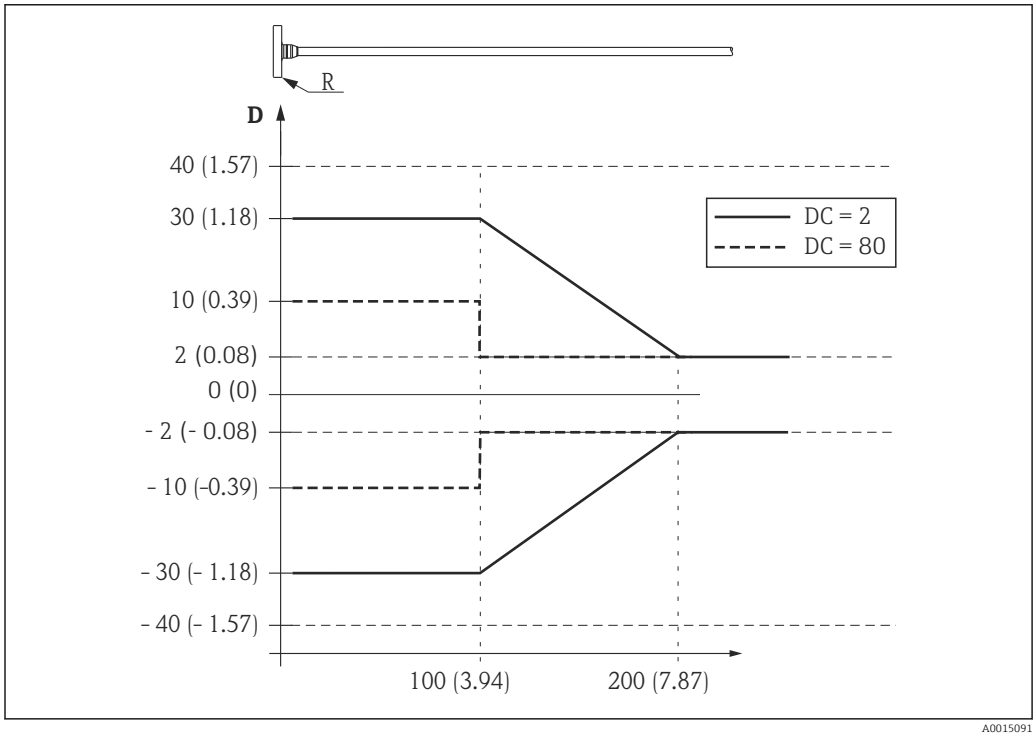



*23 Measurement error at the probe end for rope probes*

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

If the $\varepsilon_r$ 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:**




*24 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 ($\varepsilon_r$)*

**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 |

**Influence of ambient temperature**

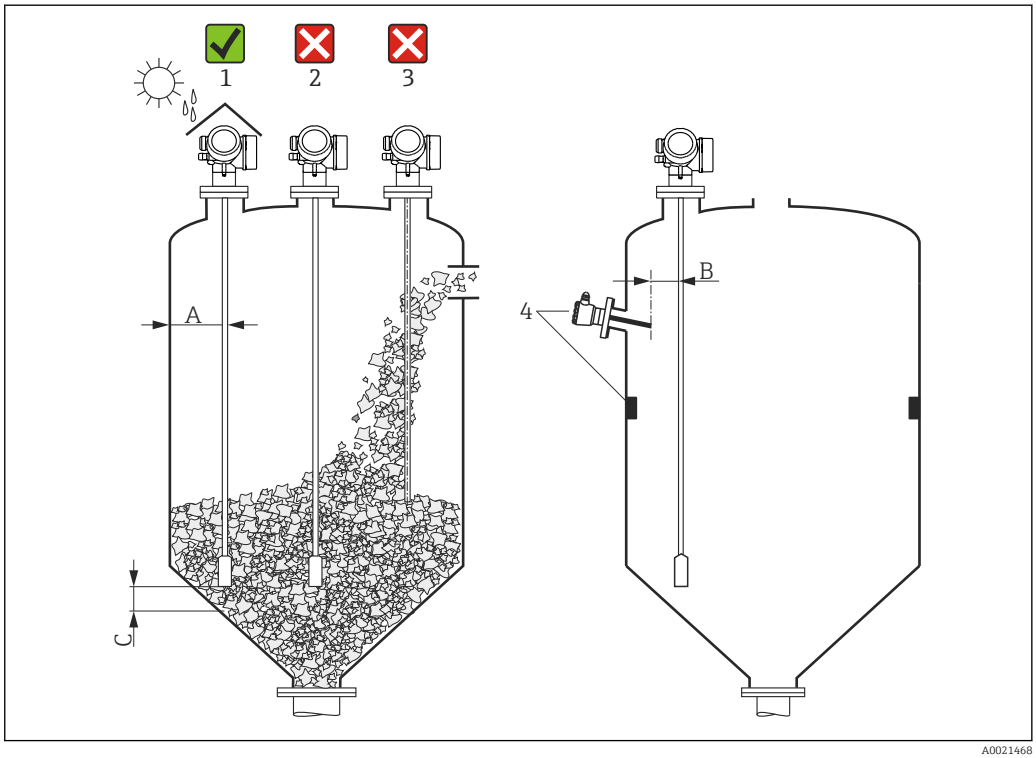
**The measurements are performed according to DIN EN IEC 61298-3 / DIN EN IEC 60770-1**

- Digital (HART, PROFIBUS PA, FOUNDATION Fieldbus): average $T_K$ = 0.6 mm/10 K
  For devices 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

# Installation

**Mounting requirements**

**Suitable mounting position**




25 *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)

*Additional mounting 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.
- The probe must be checked regularly for damage during operation.

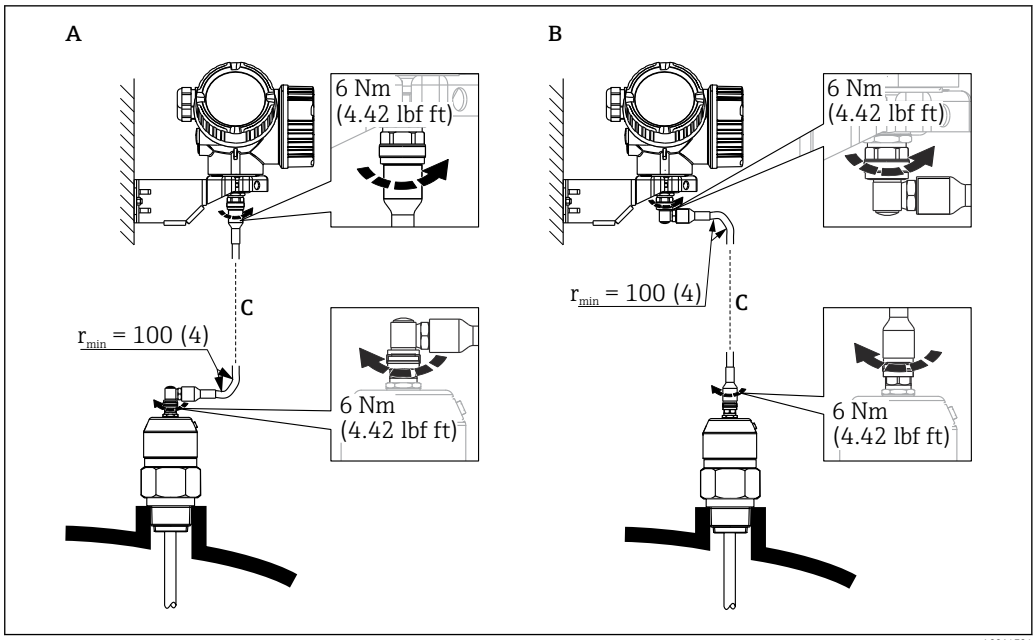
In the case of freely suspended rope probes (probe end not fixed at the bottom), the distance between the probe rope and internal fittings, which can change due to the movement of the product, must never be less than 300 mm (12 in). Occasional contact between the probe weight and the cone of the vessel,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

When mounting the housing 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 "Remote sensor, 3 m cable"
  - Version MC "Remote sensor, 6 m cable"
  - Version MD "Remote sensor, 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 connecting 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.

**Notes on the mechanical load of the probe**

*Tensile load*

Bulk solids exert tensile forces on rope probes which increase with:

- The probe length, i.e. the maximum cover
- The bulk density of the product
- The silo diameter and
- The diameter of the probe rope

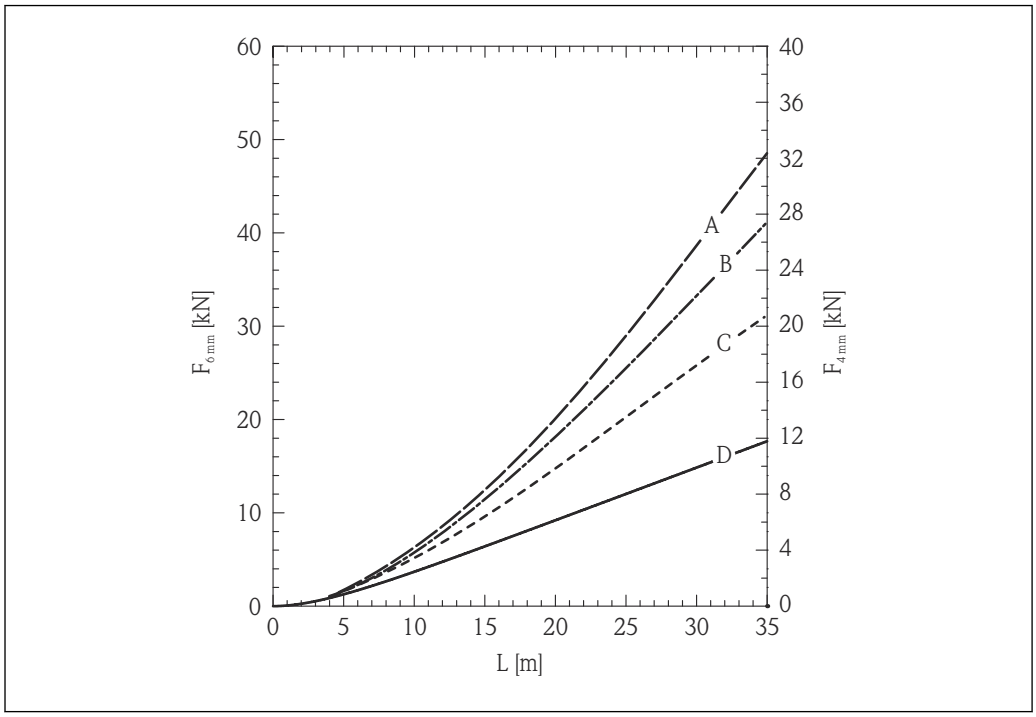
As the tensile forces also depend greatly on the flowability of the product, a higher safety factor is necessary for highly viscous products and if there is a risk of cornice buildup. In critical cases it is better to use a 6 mm (0.24 in) rope instead of a 4 mm (0.16 in) one.

The same forces also act on the silo ceiling. The tensile forces on a fixed rope are always greater, but cannot be calculated. Observe the tensile loading capacity of the probes.

Ways to reduce the tensile forces:
- Shorten the probe.
- If the maximum tensile load is exceeded, check whether it would be possible to use a non-contact ultrasonic or level radar device.

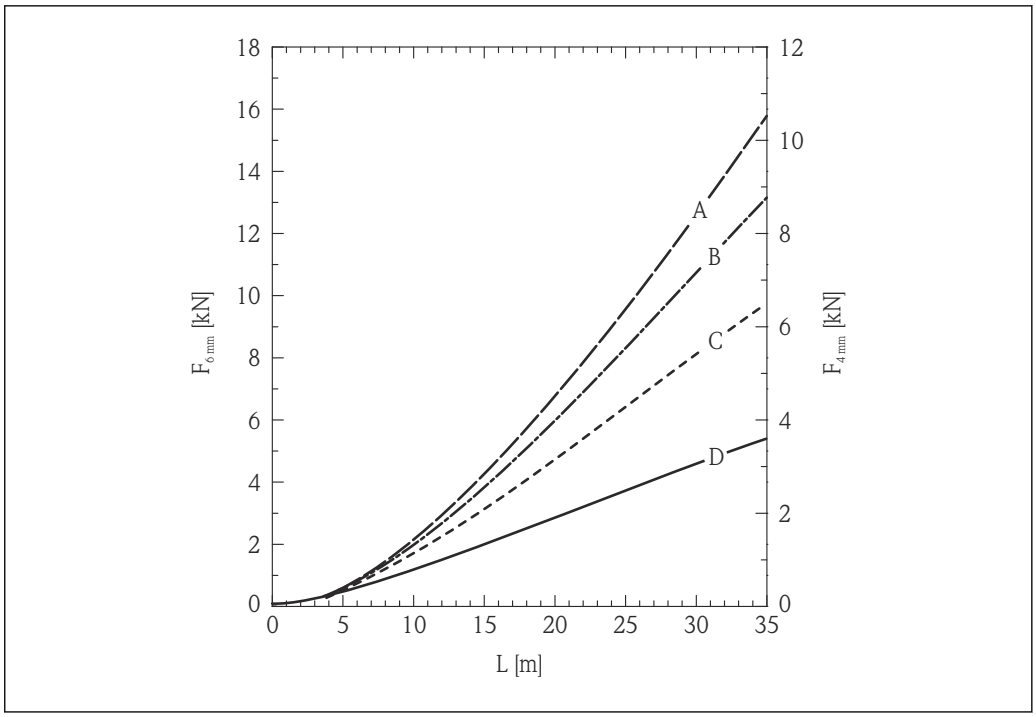
The following diagrams show typical loads for common bulk solids as reference values. The calculation was performed for the following conditions:

- Calculation according to DIN 1055, Part 6 for the cylindrical part of the silo
- Suspended probe (probe end not fixed at the bottom)
- Free-flowing bulk solid, i.e. mass flow. A calculation for core flow is not possible. In the event of collapsing cornices, considerably higher loads can occur.
- The specification for tensile forces contains safety factor 2 (in addition to the safety factors already contained in DIN 1055), which compensates for the normal fluctuation range in pourable bulk solids.



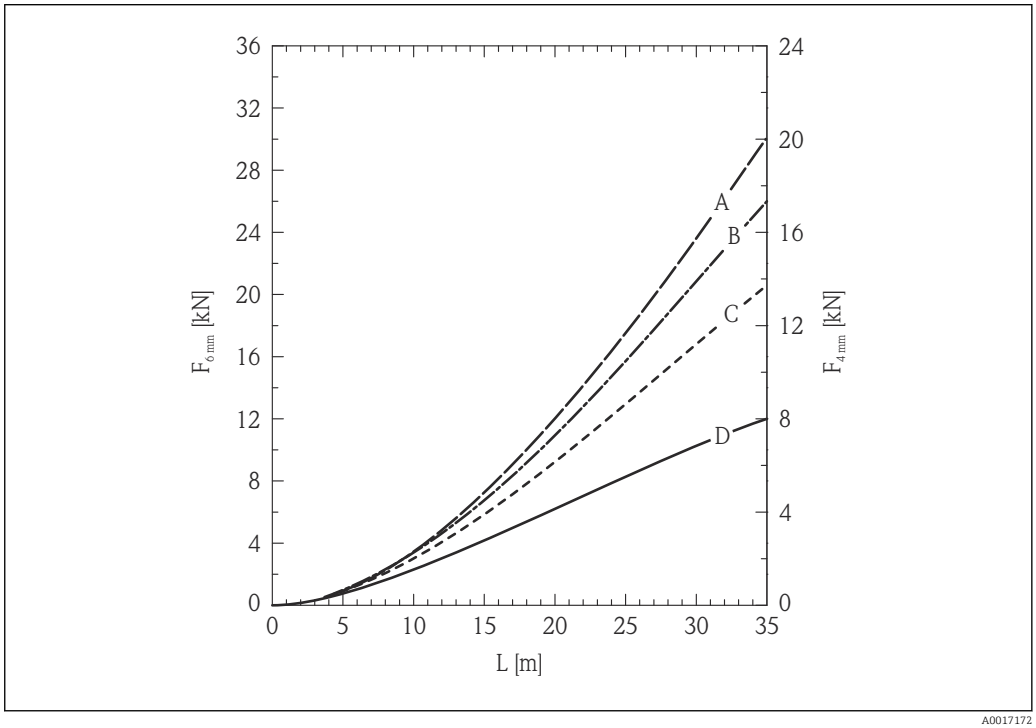

*26 Silica sand in metal silo with smooth walls; tensile load as a function of level L for rope diameters 6 mm (0.24 in) and 4 mm (0.16 in)*

*A Silo diameter 12 m (40 ft)*
*B Silo diameter 9 m (30 ft)*
*C Silo diameter 6 m (20 ft)*
*D Silo diameter 3 m (10 ft)*



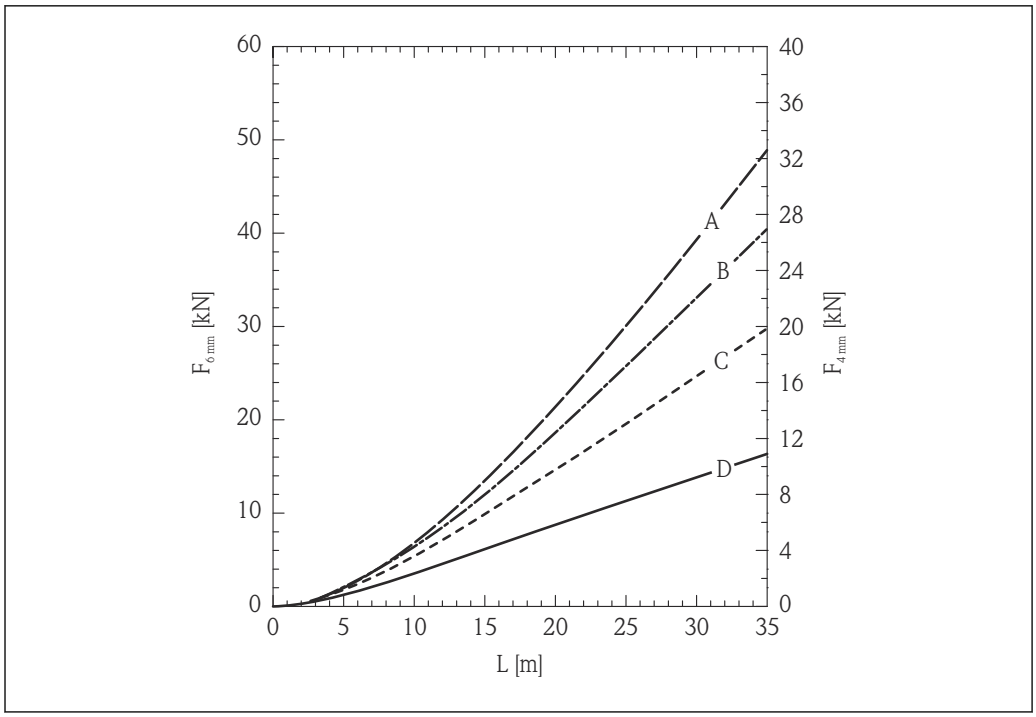

*27 Polyethylene pellets in metal silo with smooth walls; tensile load as a function of level L for rope diameters 6 mm (0.24 in) and 4 mm (0.16 in)*

*A Silo diameter 12 m (40 ft)*
*B Silo diameter 9 m (30 ft)*
*C Silo diameter 6 m (20 ft)*
*D Silo diameter 3 m (10 ft)*




*28 Wheat in metal silo with smooth walls; tensile load as a function of level L for rope diameters 6 mm (0.24 in) and 4 mm (0.16 in)*

*A Silo diameter 12 m (40 ft)*
*B Silo diameter 9 m (30 ft)*
*C Silo diameter 6 m (20 ft)*
*D Silo diameter 3 m (10 ft)*




*29 Cement in metal silo with smooth walls; tensile load as a function of level L for rope diameters 6 mm (0.24 in) and 4 mm (0.16 in)*

*A Silo diameter 12 m (40 ft)*
*B Silo diameter 9 m (30 ft)*
*C Silo diameter 6 m (20 ft)*
*D Silo diameter 3 m (10 ft)*

*Tensile loading capacity of rope probe and breaking load (silo ceiling)*

The ceiling of the silo must be designed to withstand the maximum breaking load.

*FMP56*

**Rope 4 mm (⅙ in) 316**
- Tensile loading capacity 12 kN
- Max. breaking load 20 kN

**Rope 6 mm (¼ in) PA>steel**
- Tensile loading capacity 12 kN
- Max. breaking load 20 kN

*FMP57*

**Rope 4 mm (⅙ in) 316**
- Tensile loading capacity 12 kN
- Max. breaking load 20 kN

**Rope 6 mm (¼ in) 316**
- Tensile loading capacity 30 kN
- Max. breaking load 42 kN

**Rope 6 mm (¼ in) PA>steel**
- Tensile loading capacity 12 kN
- Max. breaking load 20 kN

**Rope 8 mm (⅓ in) PA>steel**
- Tensile loading capacity 30 kN
- Max. breaking load 42 kN

*Lateral loading capacity (flexural strength) of rod probes*

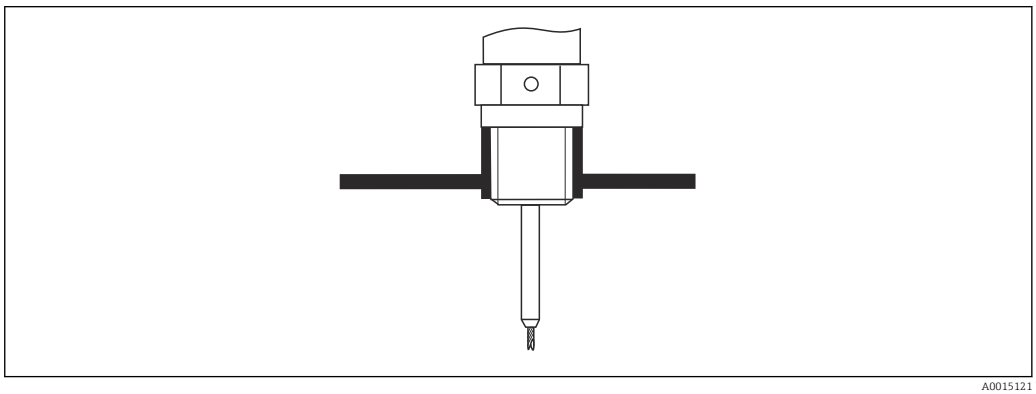
*FMP57*

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



A0015121

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

*Sealing*

The thread and the type of seal comply with DIN3852 Part 2, screwed plug, form A.

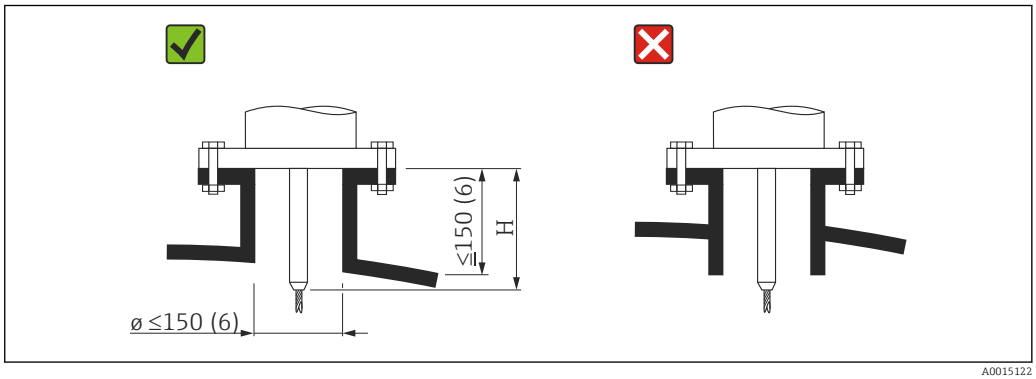
The following types of sealing ring can be used:

- For thread G¾": according to DIN7603 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*




A0015122

*H Length of the centering rod or the rigid part of the rope probe*

*FMP56*

**Rope, ø 4 mm (0.16 in)**
Length H 120 mm (4.7 in)

*FMP57*

**Rope, ø 4 mm (0.16 in)**
Length H 94 mm (3.7 in)

**Rope, ø 6 mm (0.24 in)**
Length H 135 mm (5.3 in)

- 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 section "Rod extension/ centering device HMP40 for FMP57".
- 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.

*Rod extension/centering device HMP40 for FMP57*

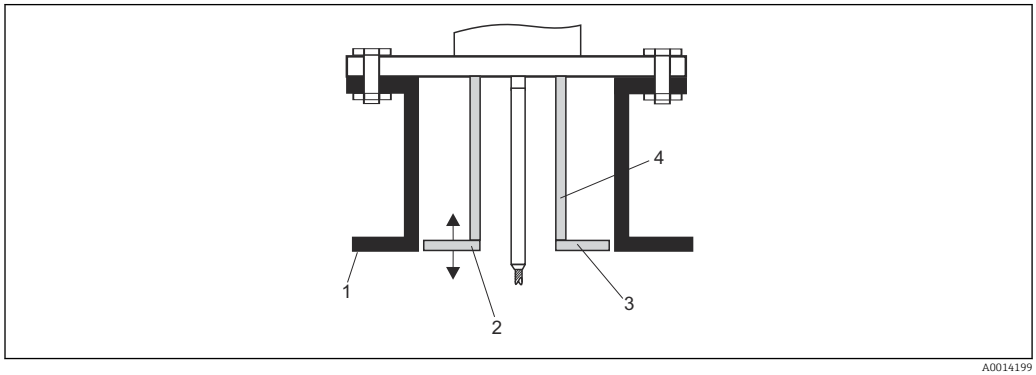
For FMP57 with rope probes, the rod extension/centering device HMP40 is available as an accessory. It must be used if the probe rope would otherwise come into contact with the lower edge of the nozzle.

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. We deliver this component separately from the device. Please 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.

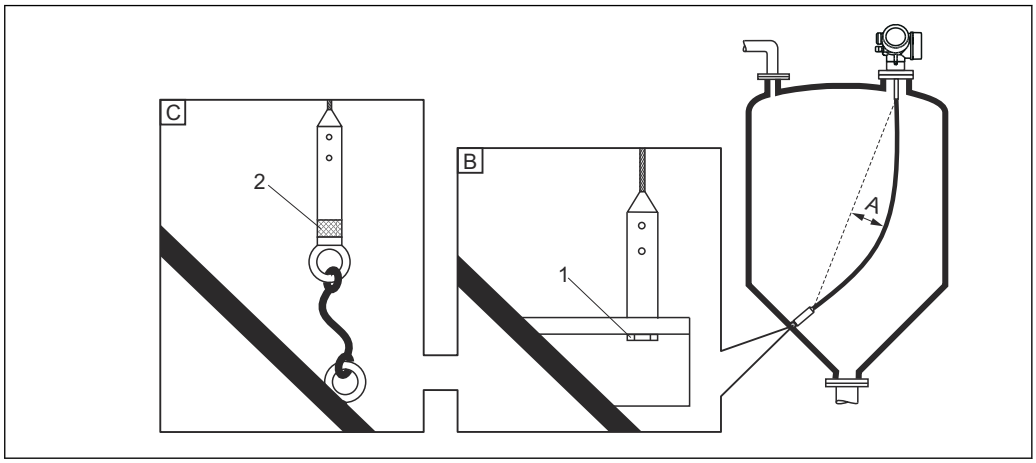



A0014199

1 *Lower edge of the nozzle*
2 *Approximately flush with the lower edge of the nozzle (±50 mm)*
3 *Plate, 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*

**Securing the probe**

*Securing rope probes*

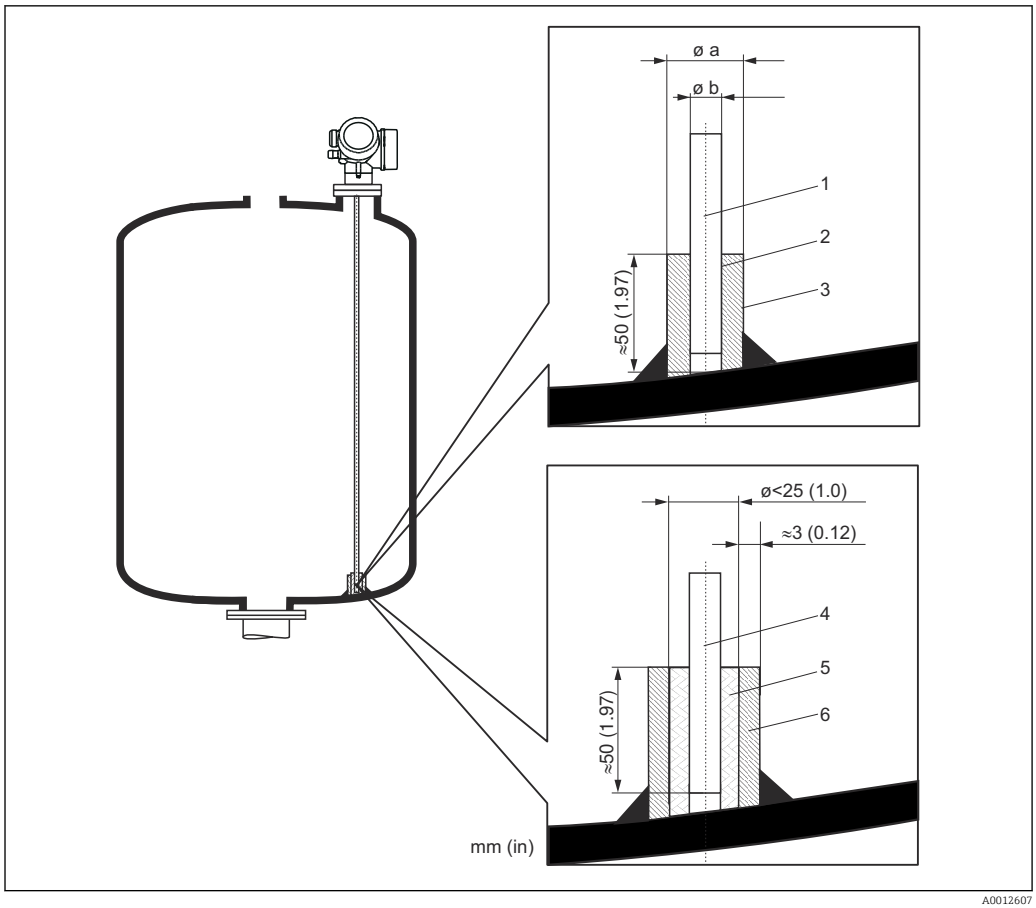



*A Sag: ≥ 10 mm/m (0.12 in/ft) probe length*
*B Reliably grounded end of probe*
*C Reliably insulated end of probe*
*1 Fastener in female thread of probe weight*
*2 Insulated fastening kit*

- 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
  - If the probe comes closer than 0.5 m (1.6 ft) to a concrete wall.
- A female thread is provided in the probe weight to secure the end of the probe:
  - Rope 4 mm (⅙ in), 316: M 14
  - Rope 6 mm (¼ in), 316: M 20
  - Rope 6 mm (¼ in), PA>steel: M14
  - Rope 8 mm (⅓ in), PA>steel: M20
- Far higher tensile loads occur on the probe when it is fixed down. It is therefore preferable to use the 6 mm (¼ in) rope probe.
- 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*

**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**

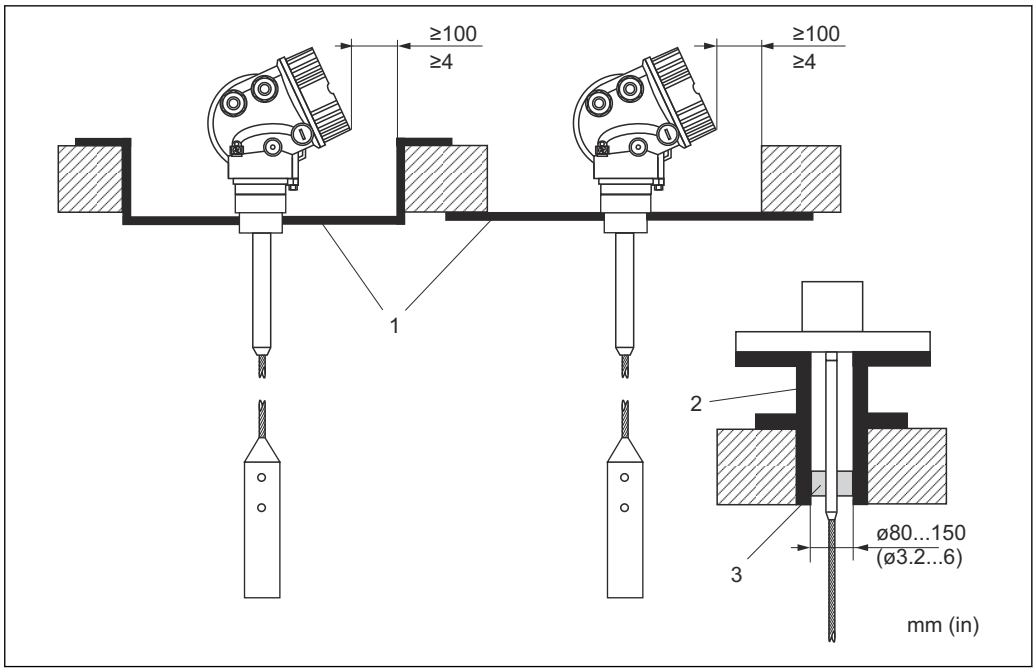
**Welding can damage the main electronics module.**

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

### Special installation situations

*Concrete silos*

Installation in a thick concrete ceiling, for example, should be flush with the lower edge. Alternatively, the probe can also be installed in a pipe that must not protrude over the lower edge of the silo ceiling. The pipe should be as short as possible. For installation suggestions, see the diagram below.

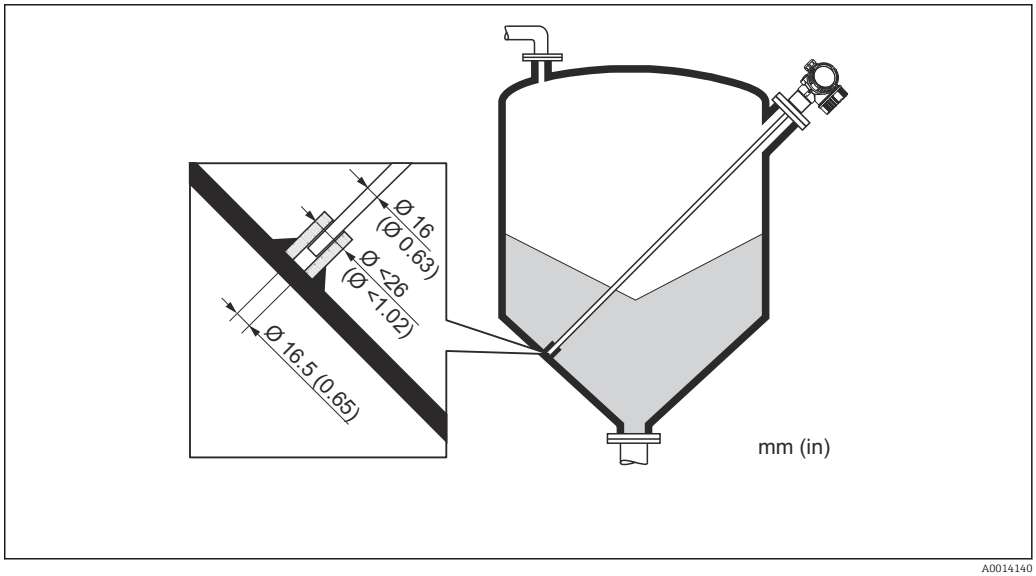



*1 Metal plate*
*2 Metal pipe*
*3 Rod extension/centering device HMP40 (see "Accessories")*

Installation with rod extension/centering device (accessory):

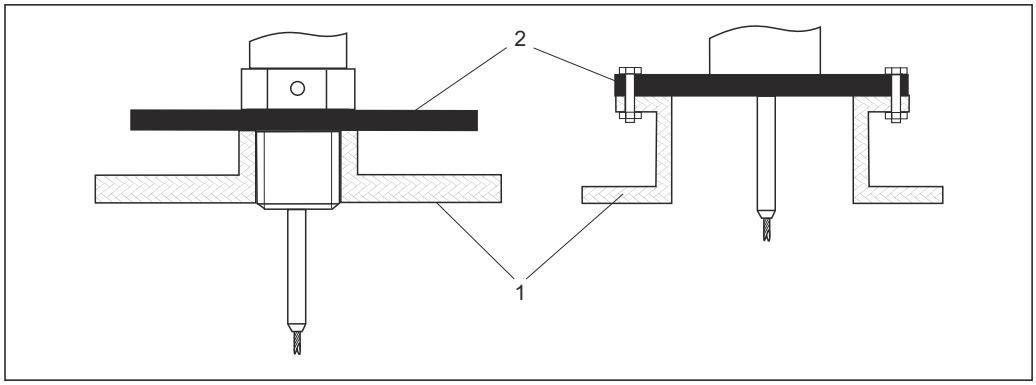
Strong dust generation can lead to build-up behind the centering disk. This can result in interference echoes. For other installation options, please contact Endress+Hauser.

*Mounting from the side*




- If installation from above is not possible, the device can also be mounted from the side
- Always secure the rope probe in this case
- Support the rod and coaxial probe if the lateral load-bearing capacity is exceeded
- Only secure rod probes at the end of the probe

*Non-metal vessels*

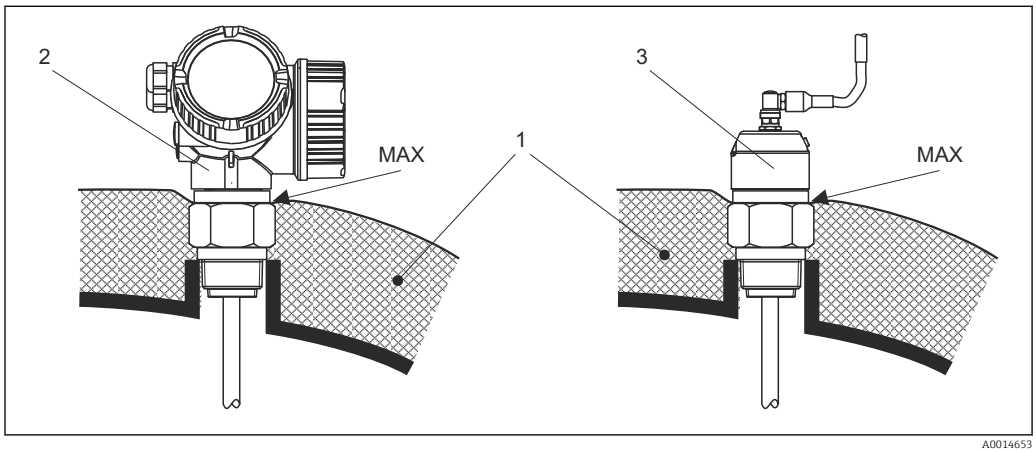



*1 Non-metal vessel*
*2 Metal sheet or metal flange*

To ensure good measurement results when mounting on non-metal vessels
- Use a device with a metal flange (minimum size DN50/2").
- Alternatively, 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.

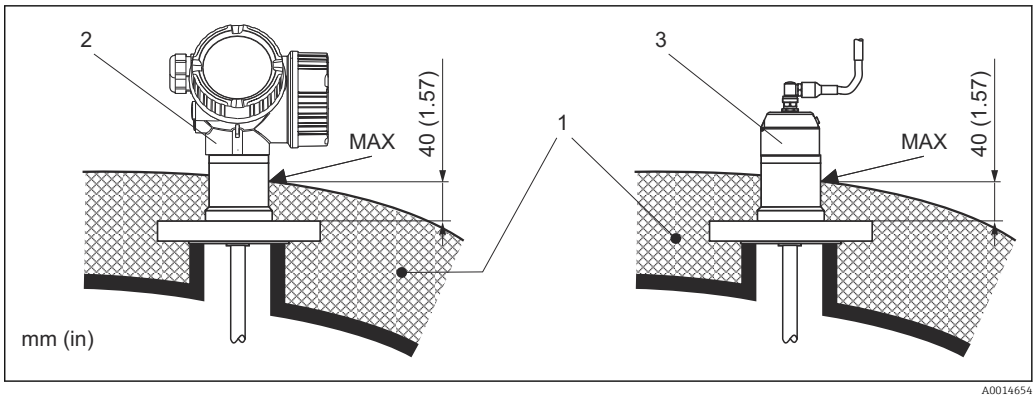
*Vessel with thermal insulation*

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.




*31 Process connection with thread*

*1 Vessel insulation*
*2 Compact device*
*3 Sensor, remote*




32 *Process connection with flange - FMP57*

*1 Vessel insulation*
*2 Compact device*
*3 Sensor, remote*

# Environment

**Ambient temperature**

| | |
|---|---|
| Device | −40 to +80 °C (−40 to +176 °F) |
| 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) [1)] |

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.

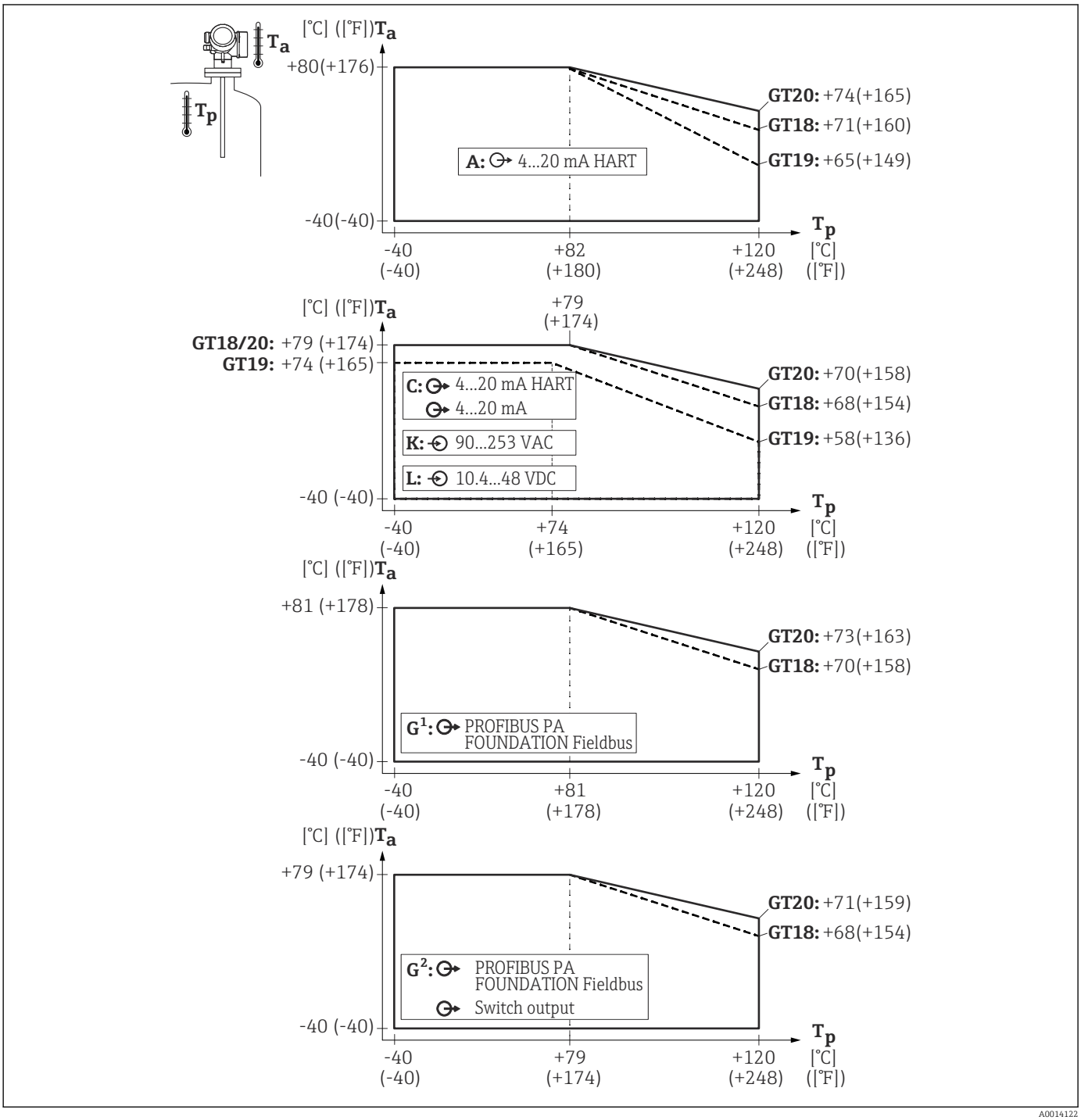
If operating outdoors in strong sunlight:
- Mount the device in the shade.
- Avoid direct sunlight, particularly in warm climatic regions.
- Use a weather protection cover (accessory).

**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 FMP56 with threaded connection G¾ or NPT¾*




A0014122

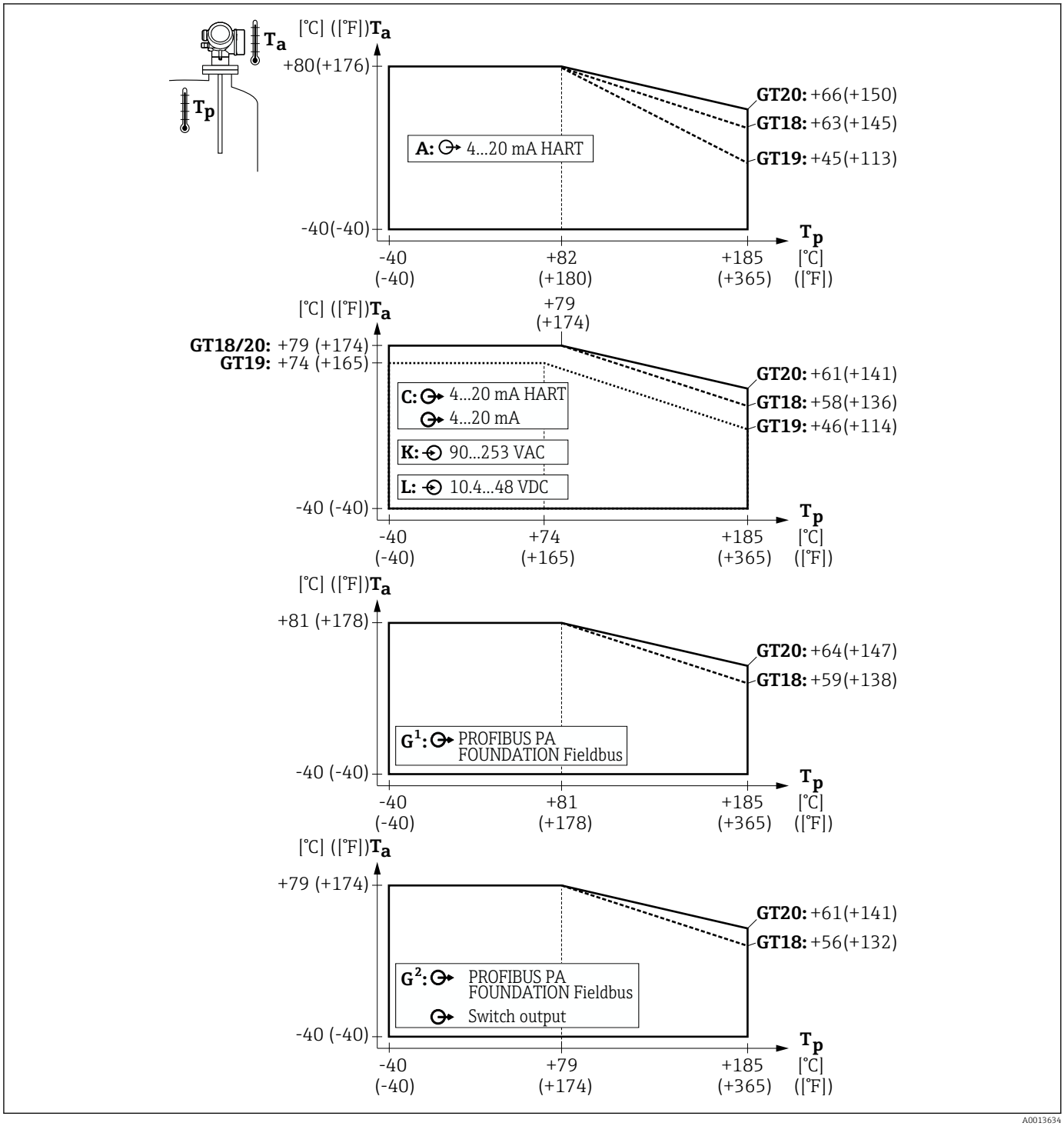
*GT18 = Stainless steel housing*
*GT19 = Plastic housing*
*GT20 = Aluminum housing*

*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*

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 ($G^1$).

*Temperature derating for FMP57*




*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*

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 ($G^1$).

**Storage temperature**

- Permitted storage temperature: −40 to +80 °C (−40 to +176 °F)
- Use original packaging.

**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 O-ring version ordered:

| Device | O-ring material | Process temperature [1]. | Approval |
|---|---|---|---|
| FMP56 | FKM (Viton GLT) | −30 to +120 °C<br>(−22 to +248 °F) | FDA |
| | EPDM (70C4 pW FKN) | −40 to +120 °C<br>(−40 to +248 °F) | FDA |

| Device | O-ring material | Process temperature [1]. | Approval |
|---|---|---|---|
| FMP57 | FKM (Viton GLT) | −30 to +150 °C<br>(−22 to +302 °F) | FDA |
| | EPDM (E7502 or E7515) | −40 to +120 °C<br>(−40 to +248 °F) | FDA |
| | FFKM (Kalrez 6375) | −5 to +185 °C (+23 to +365 °F) | |

1) for PA-coated rope probes max100 °C (212 °F)

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**

| Device | Process pressure |
|---|---|
| FMP56, FMP57 | −1 to 16 bar (−14.5 to 232 psi) |

The 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. Observe pressure-temperature dependency.

Please refer to the following standards for the pressure values permitted at higher temperatures:
- EN 1092-1: 2007 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: 2007 Tab. G.3.1-1. The chemical composition of the two materials can be identical.
- ASME B 16.5a - 2013 Tab. 2-2.2 F316
- ASME B 16.5a - 2013 Tab. 2.3.8 N10276
- JIS B 2220

**Dielectric constant**

Rod and rope probe: $\varepsilon_r \geq 1.6$

**Extension of the rope probe**

**Extension of the rope probes due to tension and temperature**

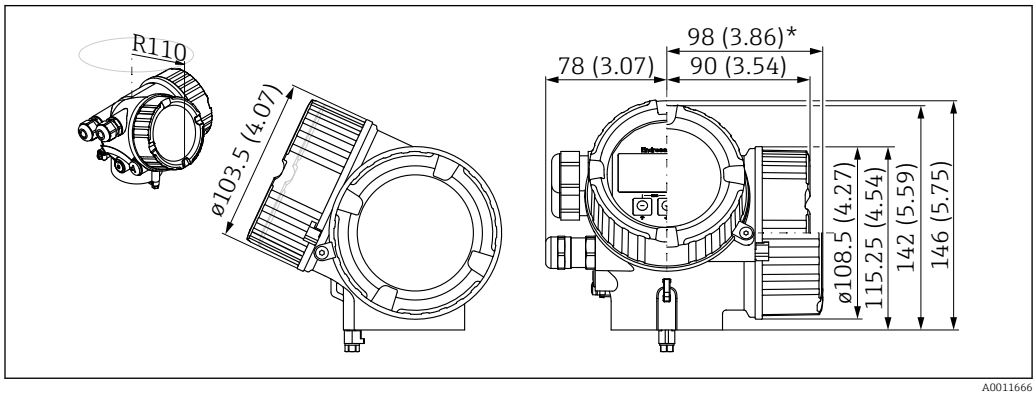
4 mm (0.16 in) rope:
- Elongation due to tension: at max. permissible tension load (12 kN): 11 mm/m (0.43 in/ft) rope length
- Elongation due to temperature increase from 30 °C (86 °F) to 150 °C (302 °F): 2 mm/m (0.08 in/ft) rope length

6 mm (0.24 in) rope:
- Elongation due to tension: at max. permissible tension load (30 kN): 13 mm/m (0.51 in/ft) rope length
- Elongation due to temperature increase from 30 °C (86 °F) to 150 °C (302 °F): 2 mm/m (0.08 in/ft) rope length

# Mechanical construction

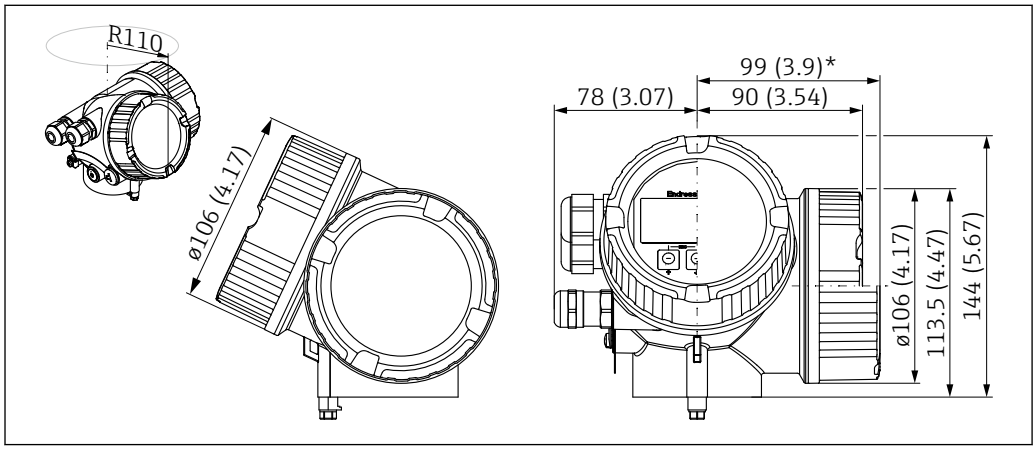
**Dimensions**

## Dimensions of the electronics housing



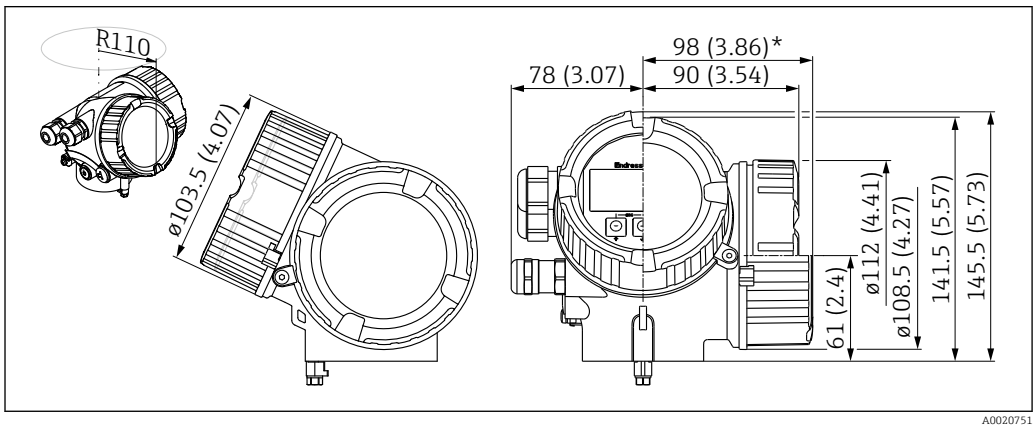

33 *Housing GT18 (316L). Unit of measurement mm (in)*

**For devices with integrated overvoltage protection.*




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

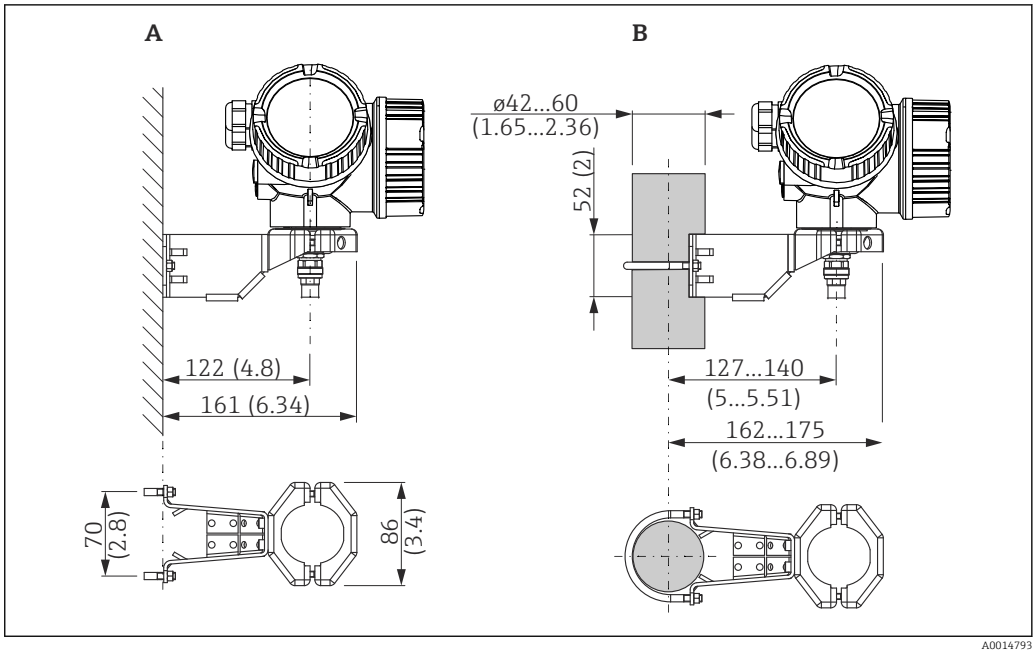
**For devices with integrated overvoltage protection.*




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

**For devices with integrated overvoltage protection.*

### Mounting bracket dimensions

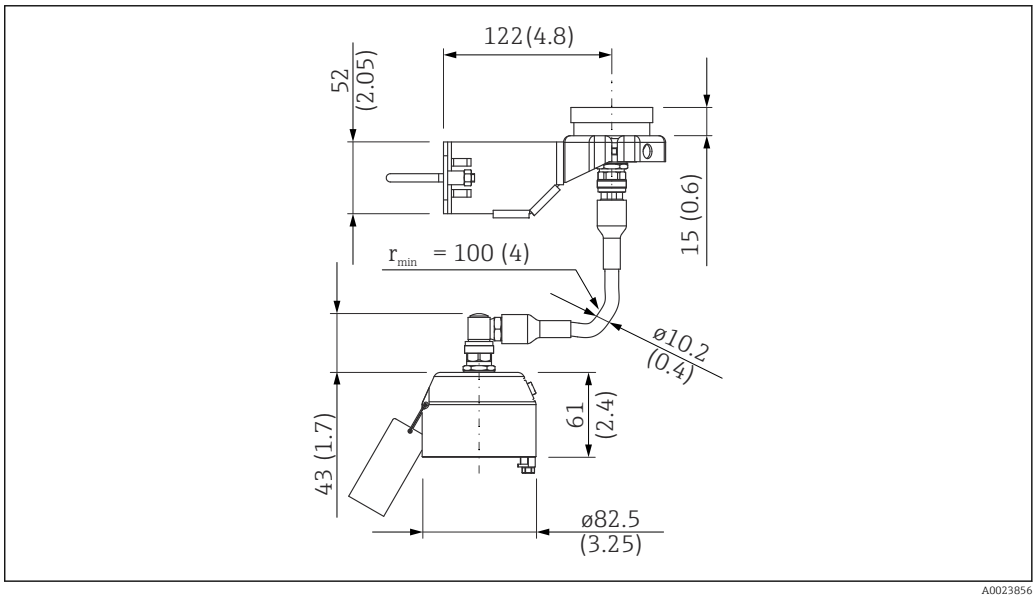



36 *Mounting bracket for electronics housing. Unit of measurement mm (in)*

*A Wall mounting*
*B Post mounting*

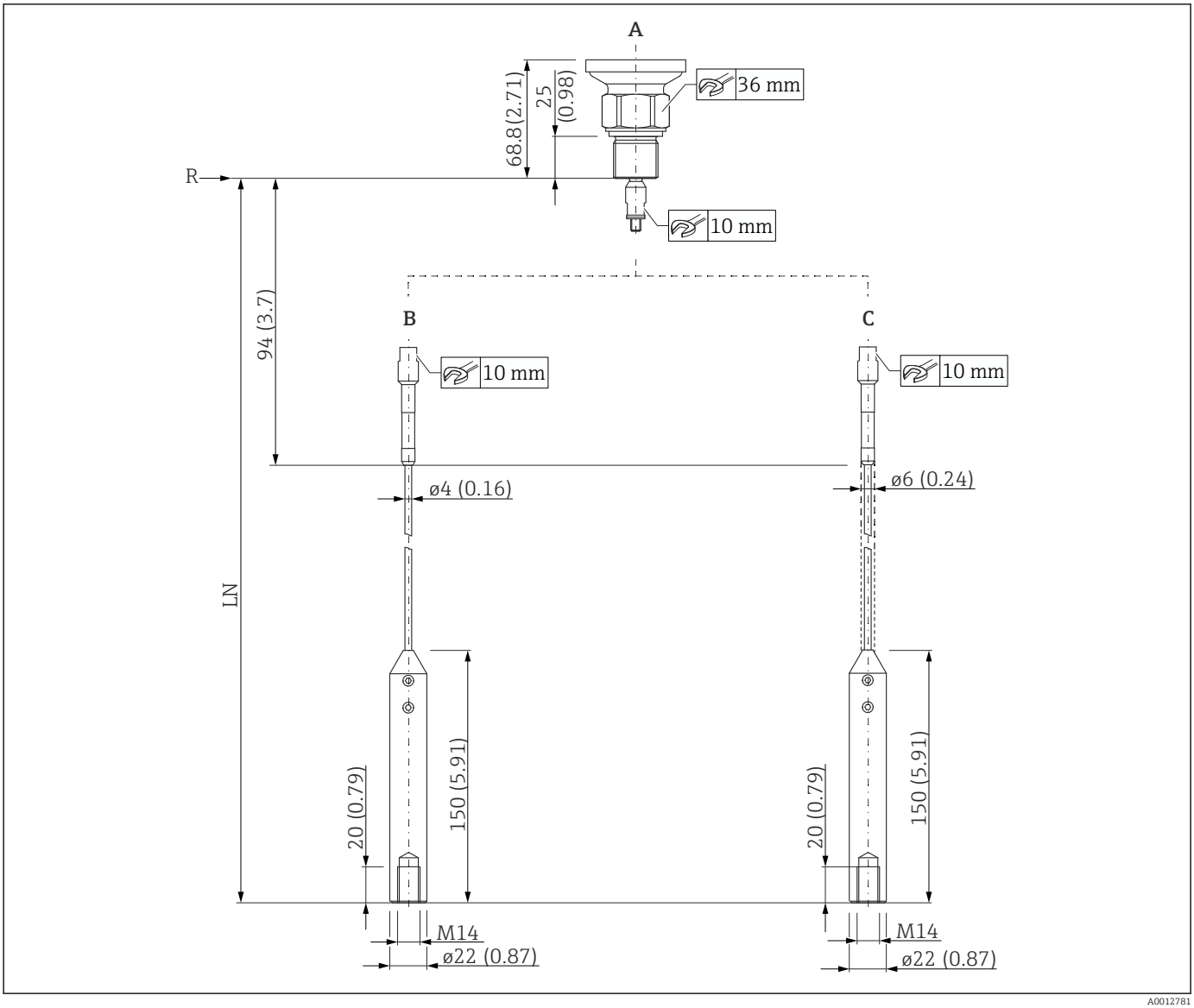
With "remote sensor" device versions (see feature 060 in the product structure), the mounting bracket is included in the scope of delivery. However, it can also be ordered separately as an accessory (order number: 71102216).

### Dimensions of connection piece for remote probe




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

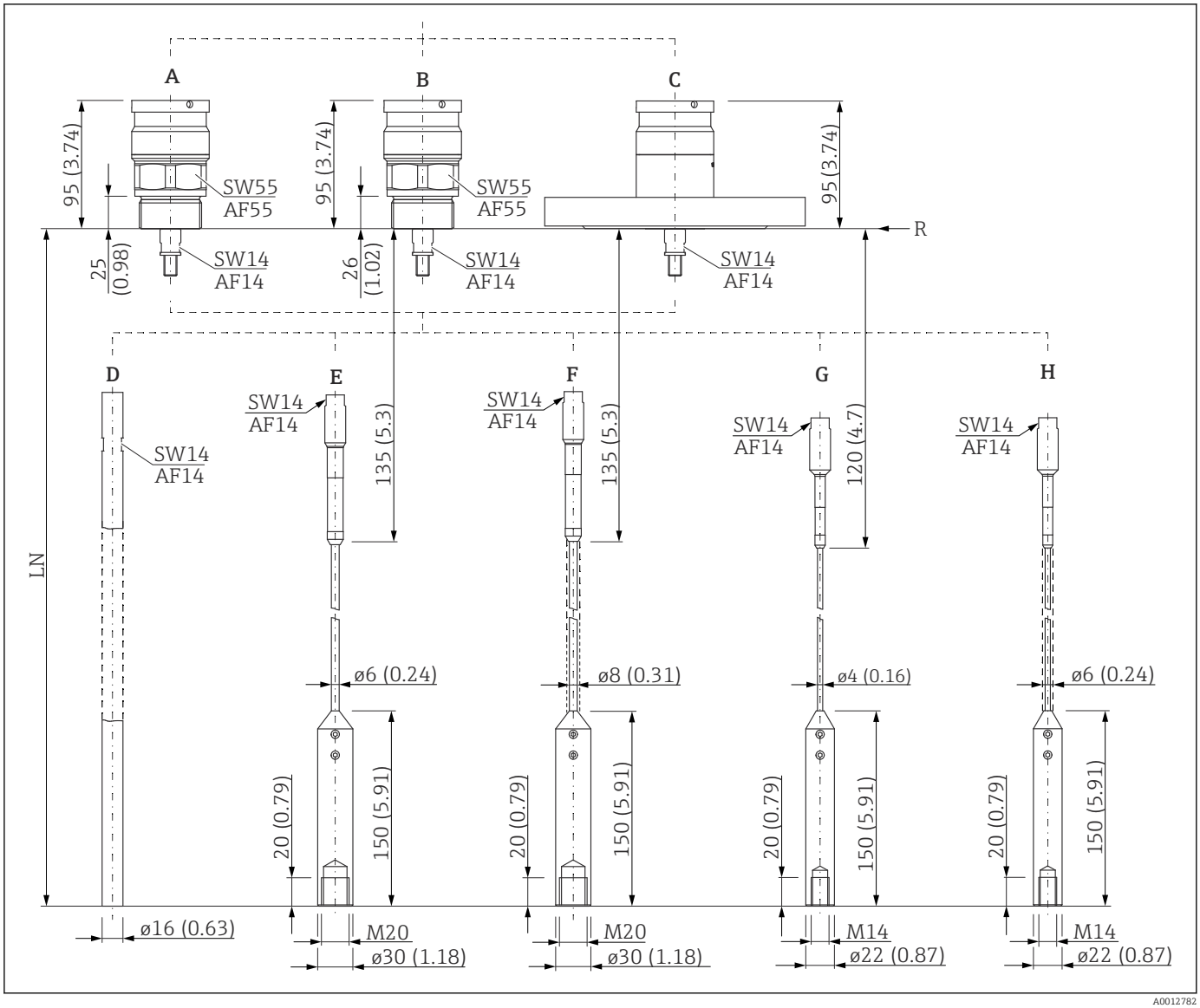
**FMP56: Dimensions of process connection/probe**




*38 FMP56: Process connection / probe. Unit of measurement mm (in)*

*A Thread ISO228 G¾ or ANSI MNPT¾ (feature 100)*
*B Rope probe 4 mm or 1/6" (feature 060)*
*C Rope probe 6 mm or ¼", PA > steel (feature 060)*
*LN Length of probe*
*R Reference point of measurement*

**FMP57: Dimensions of process connection/probe**




*39 FMP57: Process connection / probe. Unit of measurement mm (in)*

- *A Thread ISO228 G1½ (feature 100)*
- *B Thread ANSI MNPT1½ (feature 100)*
- *C Flange ANSI B16.5, EN1092-1, JIS B2220 (feature 100)*
- *D Rod probe 16 mm (feature 060)*
- *E Rope probe 6 mm or ¼" (feature 060)*
- *F Rope probe 8 mm or ⅓", PA>steel (feature 060)*
- *G Rope probe 4 mm or 1/6" (feature 060)*
- *H Rope probe 6 mm or ¼", PA > steel (feature 060)*
- *LN Length of probe*
- *R Reference point of measurement*

## Probe length tolerances

**Rod 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)

## 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).

## 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

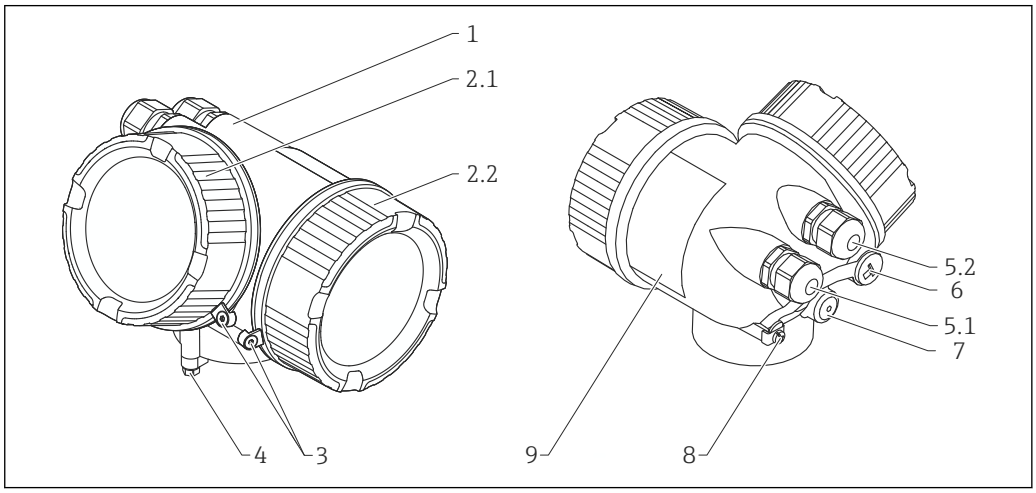
**FMP56**
The weights of the individual components must be added together for the total weight.
- Sensor
  Approx.0.8 kg/m (1.76 lb/in)
- Rope probe 4 mm or ⅙"
  Approx. 0.10 kg/m (0.22 lb/in) probe length
- Rope probe 6 mm or ¼"
  Approx. 0.20 kg/m (0.44 lb/in) probe length

**FMP57**
The weights of the individual components must be added together for the total weight.
- Sensor
  Approx. 1.40 kg/m (3.09 lb/in) + flange weight
- Rope probe 4 mm or ⅙"
  Approx. 0.10 kg/m (0.22 lb/in) probe length
- Rope probe 6 mm or ¼"
  Approx. 0.20 kg/m (0.44 lb/in) probe length
- Rod probe 16 mm
  Approx. 1.60 kg/m (3.53 lb/in) probe length

## Materials

### Materials not in contact with process

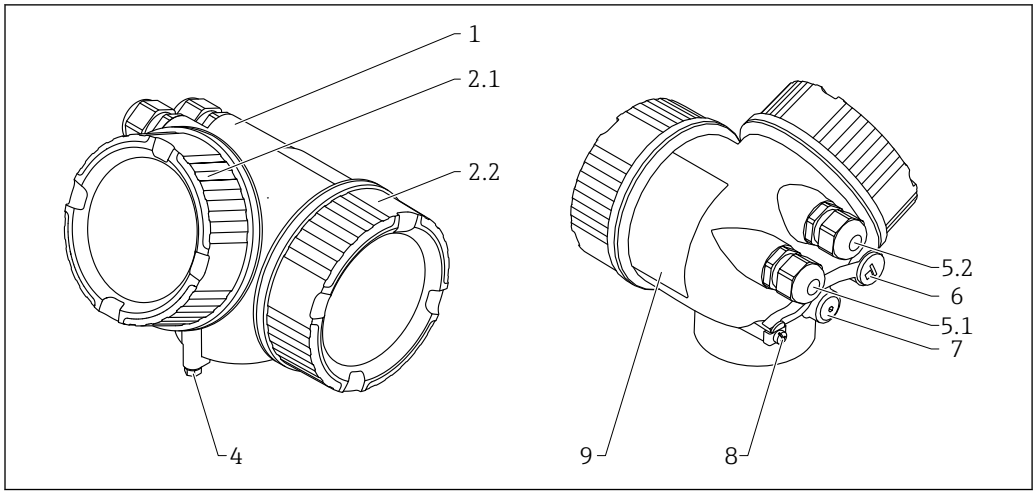
*GT18 housing (stainless steel, corrosion-resistant)*




*40 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)*

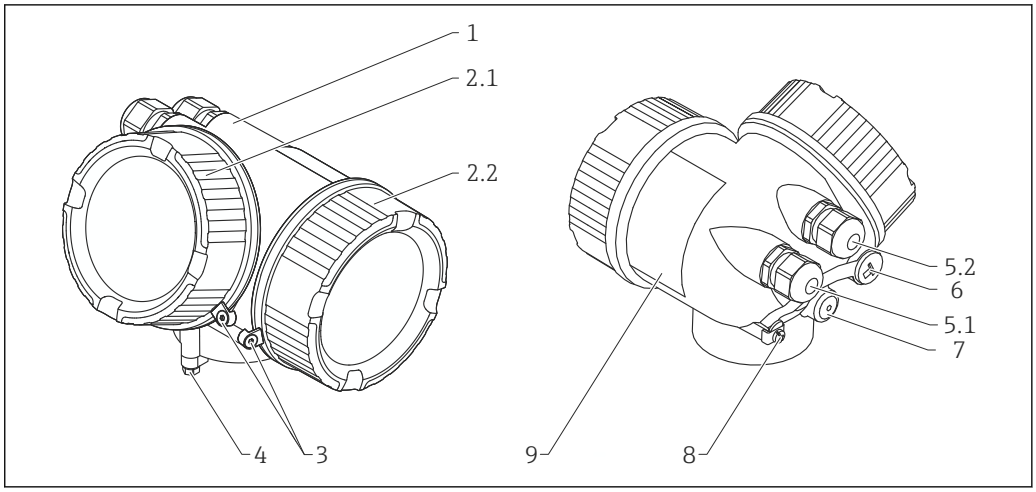
*GT19 housing (plastic)*




*41 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)*



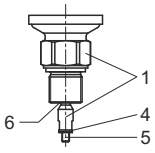
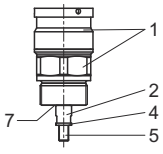
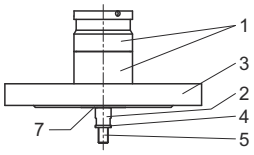

42 *Material; GT20 housing*

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*

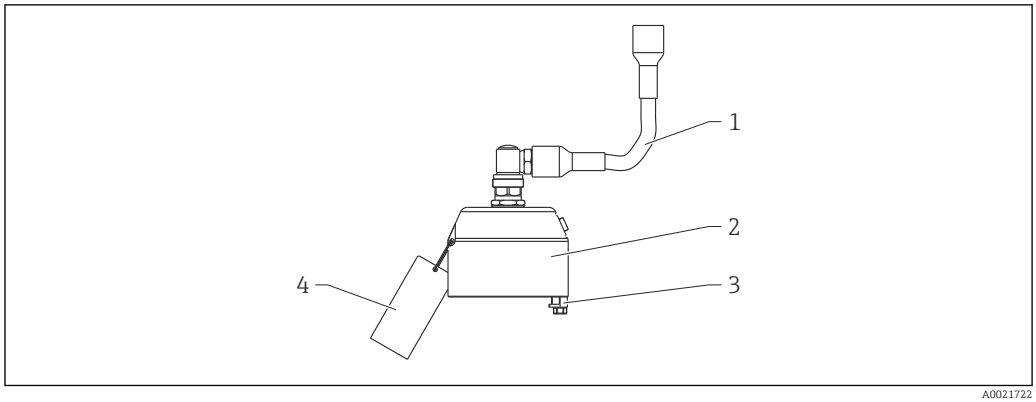
### Materials in contact with the medium

*Process connection*

Endress+Hauser supplies DIN/EN flanges 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: 2007 Tab. G.3.1-1. The chemical composition of the two materials can be identical.

| Levelflex FMP56. FMP57 | | | | |
|---|---|---|---|---|
| Threaded connection | | Flange | No. | Material |
| *G¾, NPT¾* | *G1½, NPT1½* | | | |
|  |  |  | 1 | 304 (1.4301) |
| | | | 2 | 316L (1.4404) |
| | | | 3 | ASME: 316/316L<br>EN: 316L (1.4404)<br>JIS: 316L (1.4435) |
| | | | 4 | Nord-Lock washer: 1.4547 |
| | | | 5 | 1.4462, Duplex CR22 |
| | | | 6 | PPS-GF40 |
| | | | 7 | PEEK GF30 |

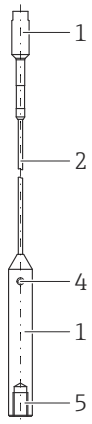
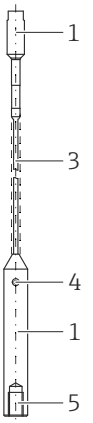
*Adapter and cable for remote sensor*

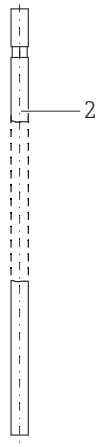
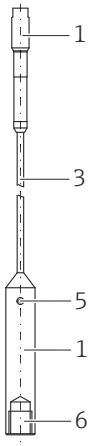
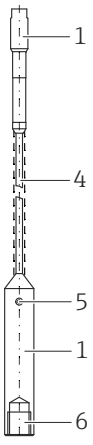



*43 Materials: Adapter and cable for "Remote sensor" version*

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

*Probe*

| Levelflex FMP56, FMP57 - standard probes | | | |
|---|---|---|---|
| Feature 060 "Probe" | | No. | Material |
| ▪ LA: rope 4mm, 316<br>▪ LB: rope 1/6", 316 | ▪ NB: rope 6mm, PA>steel<br>▪ NE: rope 1/4", PA>steel | | |
|  |  | 1 | 316L (1.4404) |
| | | 2 | 316 (1.4401) |
| | | 3 | Rope: steel, galvanized |
| | | | Coating 0.5 mm (0.02 in): PA 12 (Vestamid L 1940) |
| | | 4 | Setscrew: A4-70 |
| | | 5 | Screw for tightening: A2-70 |

| Levelflex FMP57 - additional probes | | | | |
|---|---|---|---|---|
| Feature 060 "Probe" | | | No. | Material |
| ▪ AE: ...mm, rod 16mm<br>▪ AF: ...inch, rod 16mm | ▪ LC: rope 6mm, 316<br>▪ LD: rope 1/4", 316 | ▪ NC: rope 8mm, PA>steel<br>▪ NF: rope 1/3", PA>steel | | |
|  A0013891 |  A0013892 |  A0013893 | 1 | 304 (1.4301) |
| | | | 2 | 316L (1.4404) |
| | | | 3 | 316 (1.4401) |
| | | | 4 | Rope: steel, galvanized |
| | | | | Coating 0.5 mm (0.02 in): PA 12 (Vestamid L 1940) |
| | | | 5 | Setscrew: A4-70 |
| | | | 6 | Screw for tightening: A2-70 |

# 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.

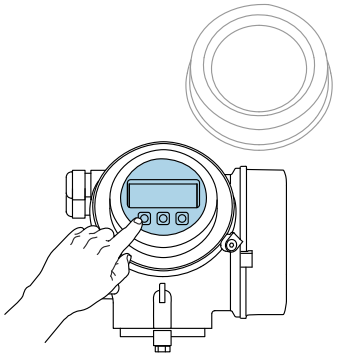
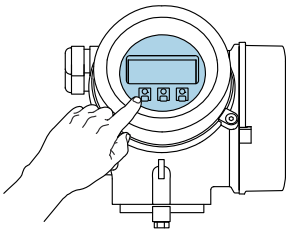
**Quick and safe commissioning**
- Interactive wizard with graphical user interface for guided commissioning in FieldCare/DeviceCare
- Menu guidance with brief descriptions of the individual parameter functions
- Standardized operation at the device and in the operating tools

**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

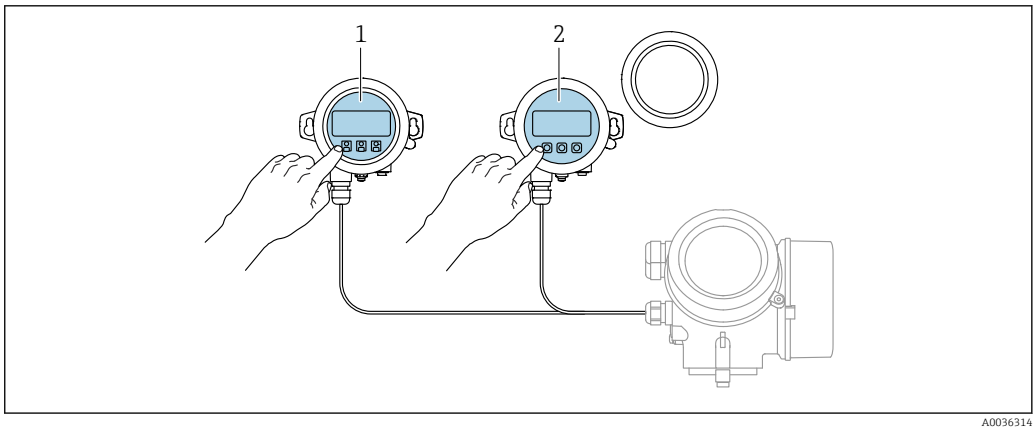
**Efficient diagnostics increase measurement availability.**
- Remedial measures are integrated in plain text.
- Diverse simulation options and line recorder functions

**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<br>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)<br>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<br>The device configuration can be saved in the display module. | |
| | Data comparison function<br>The device configuration saved in the display module can be compared to the current device configuration. | |
| | Data transfer function<br>The transmitter configuration can be transmitted to another device using the display module. | |

### Operation with remote display and operating module FHX50



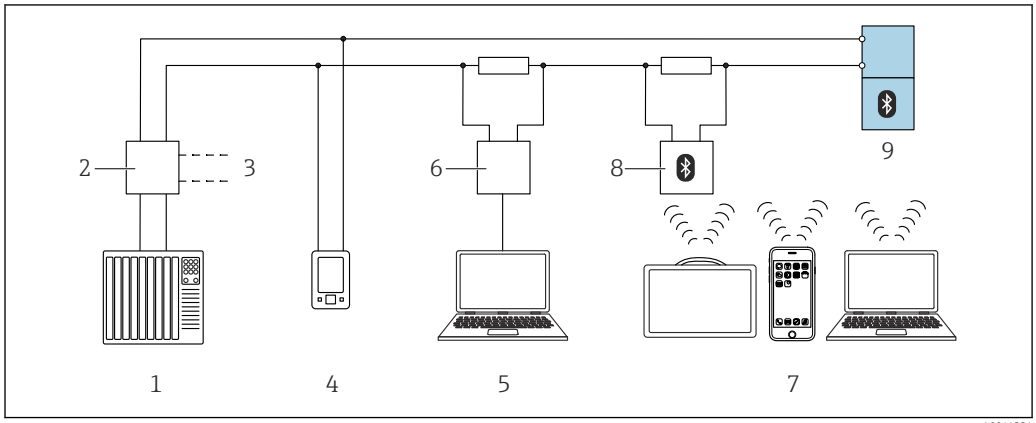
A0036314

44 *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

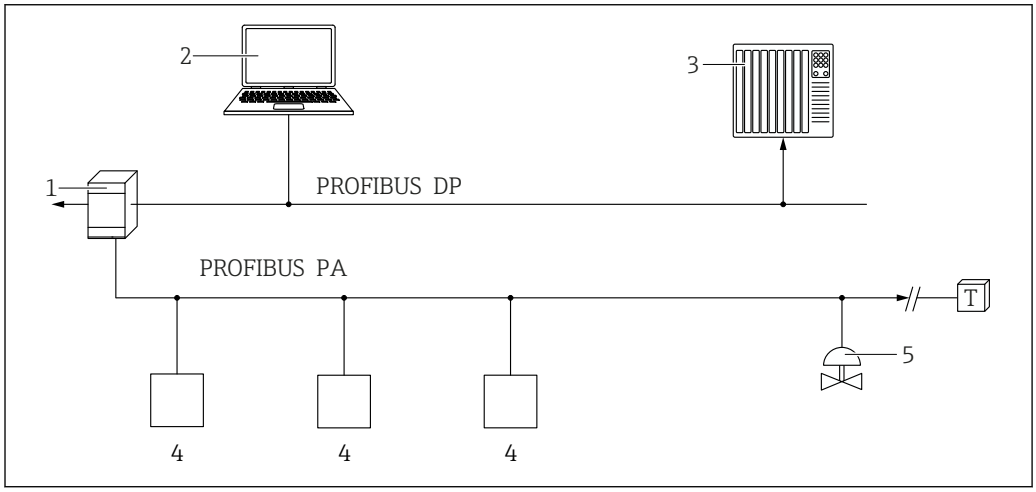
### Via HART protocol




45 *Options for remote operation via HART protocol*

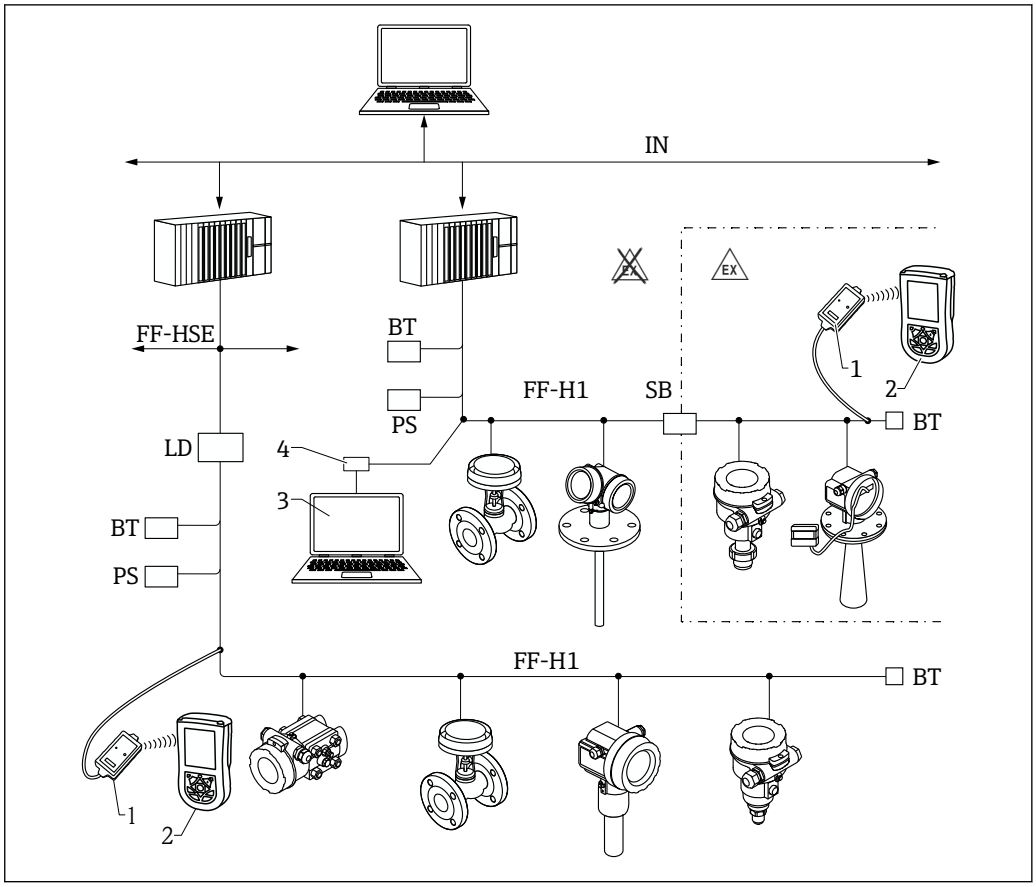
1 *PLC (programmable logic controller)*
2 *Transmitter power supply unit, e. g. RN42 (with communication resistor)*
3 *Connection for Commubox FXA195 and AMS Trex Device Communicator*
4 *AMS Trex Device Communicator*
5 *Computer with operating tool (e.g. DeviceCare, FieldCare, AMS Device View, SIMATIC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

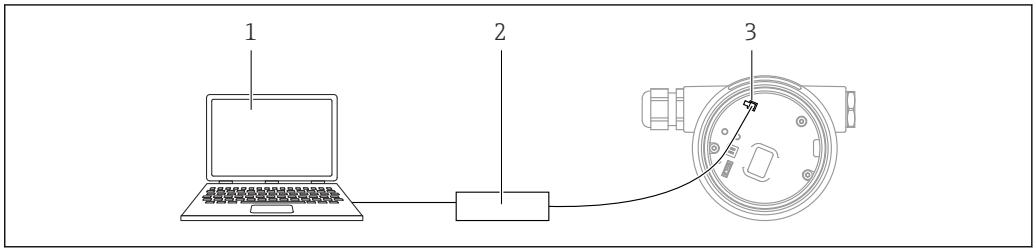
### Via FOUNDATION Fieldbus




*46 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*

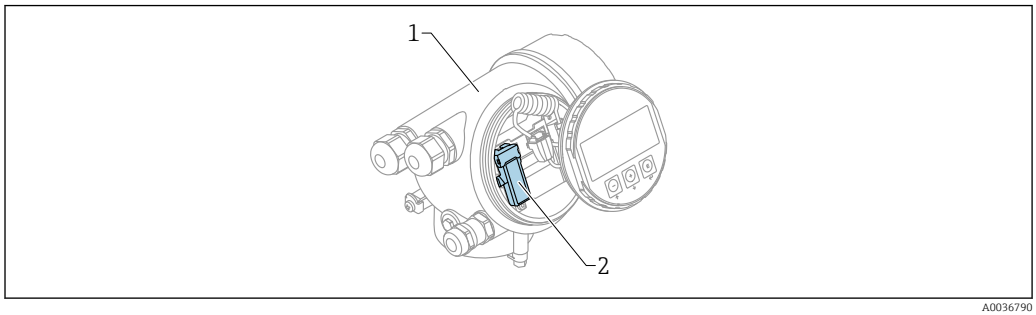
### Via service interface (CDI)




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

### Operation via Bluetooth® wireless technology

*Requirements*



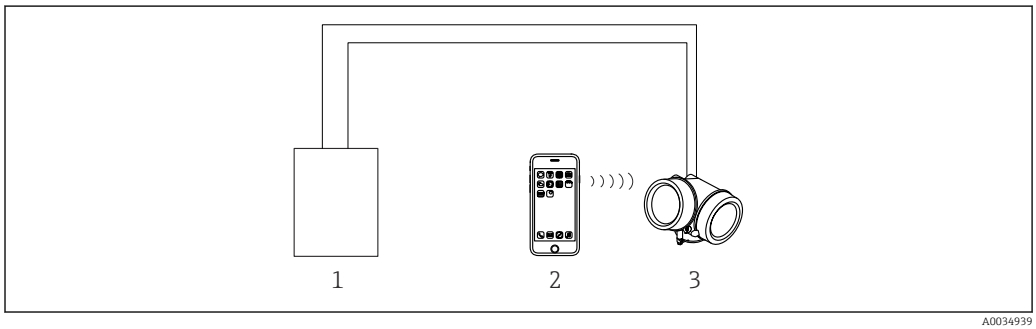

A0036790

*47 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)*




A0034939

*48 Operation via SmartBlue (app)*

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

**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**

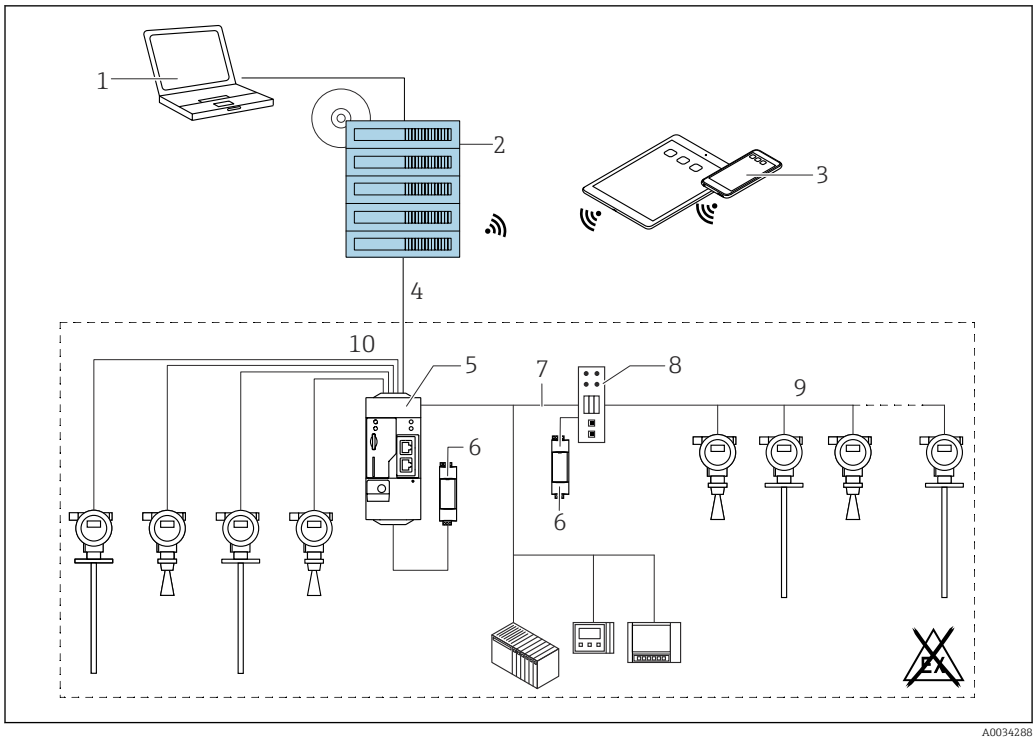
All the tanks and the tank inventories are represented graphically on a map (based on Google Maps). The tanks and inventory situations can be filtered by tank group, product, supplier or location.

**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.

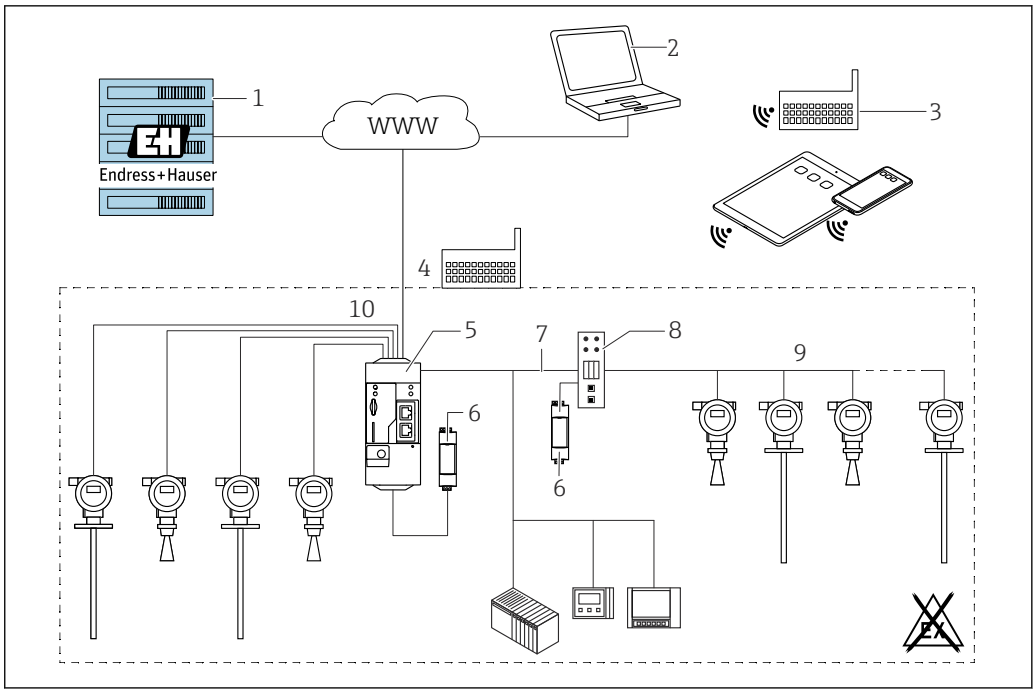



*49 Example of inventory management platform with SupplyCare Enterprise SCE30B*

*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.




50 *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.

**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.

**Marine approval**

| Device | Marine approval [1] | | | | |
|---|---|---|---|---|---|
| | DNV GL | ABS | LR | BV | KR |
| FMP56 | - | - | - | - | - |
| FMP57 | ✔ | ✔ | ✔ | ✔ | - |

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 |
|---|---|
| AEJ | NPS 1-1/2" Cl. 150 RF, 316/316l flange ASME B16.5 |
| AFJ | NPS 2" Cl. 150 RF, 316/316l flange ASME B16.5 |
| AGJ | NPS 3" Cl. 150 RF, 316/316l flange ASME B16.5 |
| AHJ | NPS 4" Cl. 150 RF, 316/316l flange ASME B16.5 |
| AJJ | NPS 6" Cl. 150 RF, 316/316l flange ASME B16.5 |
| AKJ | NPS 8" Cl. 150 RF, 316/316l flange ASME B16.5 |
| GGE | Thread ISO228 G1-1/2, 304 |
| RGE | Thread ANSI MNPT1-1/2, 304 |

- 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 |
|---|---|---|
| JD | 3.1 Material certificate, pressurized parts, EN10204-3.1 inspection certificate | FMP57 |
| KV | Declaration of Conformity ASME B31.3:<br>The design, the material used, the pressure and temperature ranges and the labeling of the devices meet the requirements of ASME B31.3 | FMP57 |

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 enclosures (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 electrical/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:

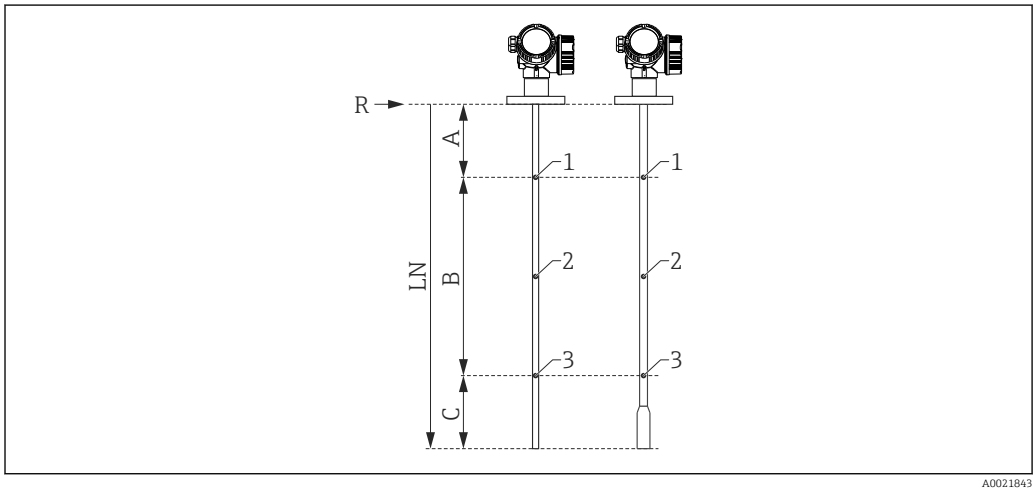
1. Select the product using the filters and search field.
2. Open the product page.
3. Select **Configuration**.

**Product Configurator - the tool for individual product configuration**
- Up-to-the-minute configuration data
- Depending on the device: Direct input of measuring point-specific information such as 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 the order option 3-point linearity protocol was selected under 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 measurement*
*1 First measuring point*
*2 Second measuring point (in the middle between the first and third measuring point)*
*3 Third measuring point*

| | **Rod probe** | **Rope probe**<br>**LN ≤ 6 m (20 ft)** | **Rope probe**<br>**LN > 6 m (20 ft)** |
|---|---|---|---|
| Position of 1st measuring point | A = 350 mm (13.8 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 | C = 250 mm (9.84 in) | C = 500 mm (19.7 in) | A+B = 5 500 mm (217 in) |

| | Rod probe | Rope probe<br>LN ≤ 6 m (20 ft) | Rope probe<br>LN > 6 m (20 ft) |
|---|---|---|---|
| Minimum measuring range | 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 ≥ 1 250 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).

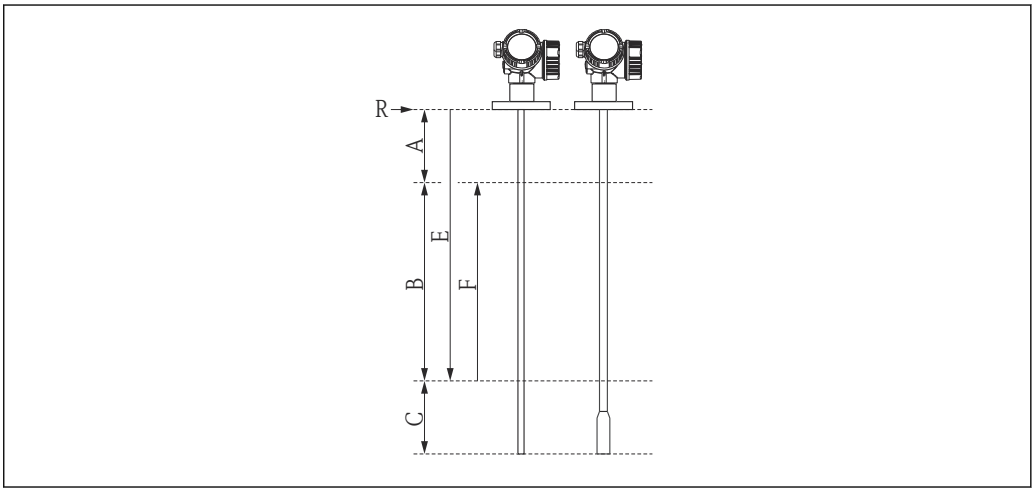
The linearity check is performed with the entire device and under reference operating conditions.

**5-point linearity protocol**

The following points must be considered if the order option 5-point linearity protocol was selected under 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 measurement*

| Sensor | Minimum distance between reference point R and 100% mark | Minimum measuring range |
|---|---|---|
| FMP56<br>FMP57 | A ≥ 250 mm (10 in) | B ≥ 100 mm (4 in) |

| Probe type | Minimum distance from the probe end to the 0% mark | Maximum value for "Empty calibration" |
|---|---|---|
| Rod | C ≥ 100 mm (4 in) | E ≤ 3.9 m (12.8 ft) |
| Rope, FMP56 | C ≥ 1 000 mm (40 in) | E ≤ 11 m (36 ft) |
| Rope, FMP57 | C ≥ 1 000 mm (40 in) | E ≤ 23 m (75 ft) |

The linearity check is performed with the entire device and 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.

**Customer-specific configuration**

If the order 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<br>▪ PA<br>▪ FF | ▪ in<br>▪ ft<br>▪ mm<br>▪ m |
| Setup → Empty calibration | ▪ HART<br>▪ PA<br>▪ FF | FMP56: 0 to 12 m (0 to 36 ft)<br>FMP57: 0 to 45 m (0 to 147 ft) |
| Setup → Full calibration | ▪ HART<br>▪ PA<br>▪ FF | FMP56: 0 to 12 m (0 to 36 ft)<br>FMP57: 0 to 45 m (0 to 147 ft) |
| Setup → Advanced setup → Curr. output 1/2 → Damping | HART | 0 to 999.9 s |
| Setup → Advanced setup → Curr. output 1/2 → Failure mode | HART | ▪ Min<br>▪ Max<br>▪ Last valid value |
| Expert → Comm. → HART config. → Burst mode | HART | ▪ Off<br>▪ 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 with a maximum of 18 characters per line

**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:

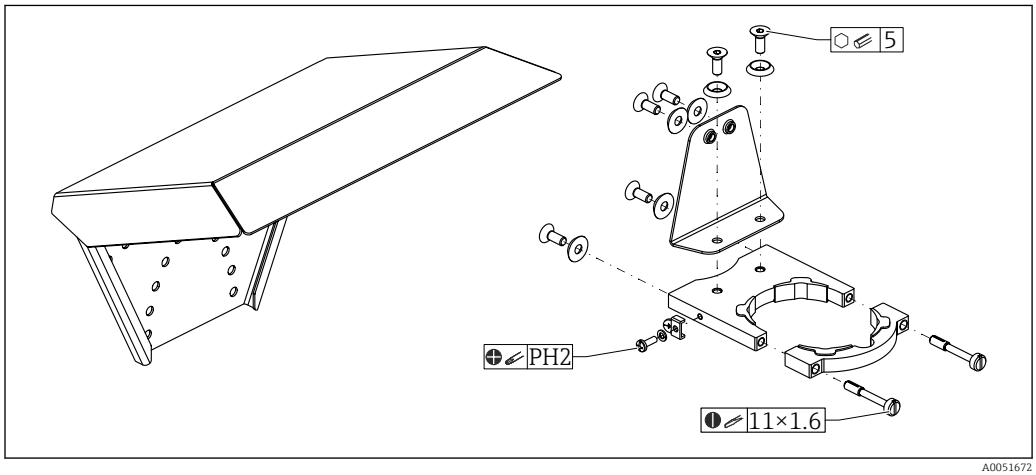
1. Select the product using the filters and search field.
2. Open the product page.
3. Select **Spare parts & Accessories**.

## Device-specific accessories

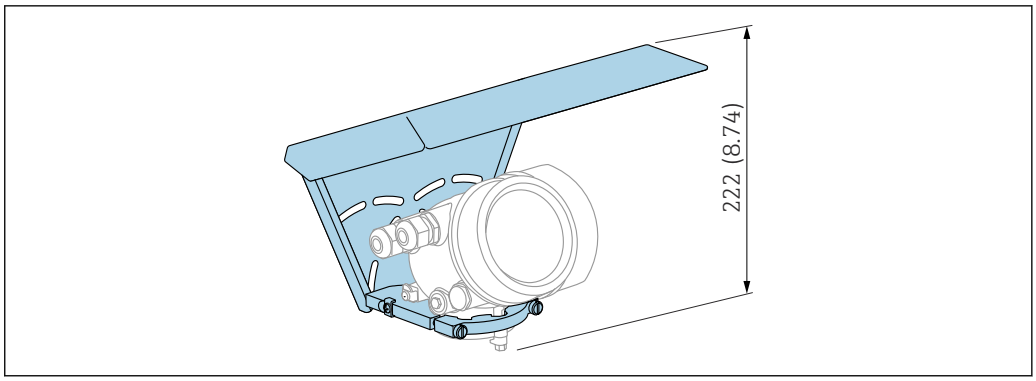
### Weather protection cover

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

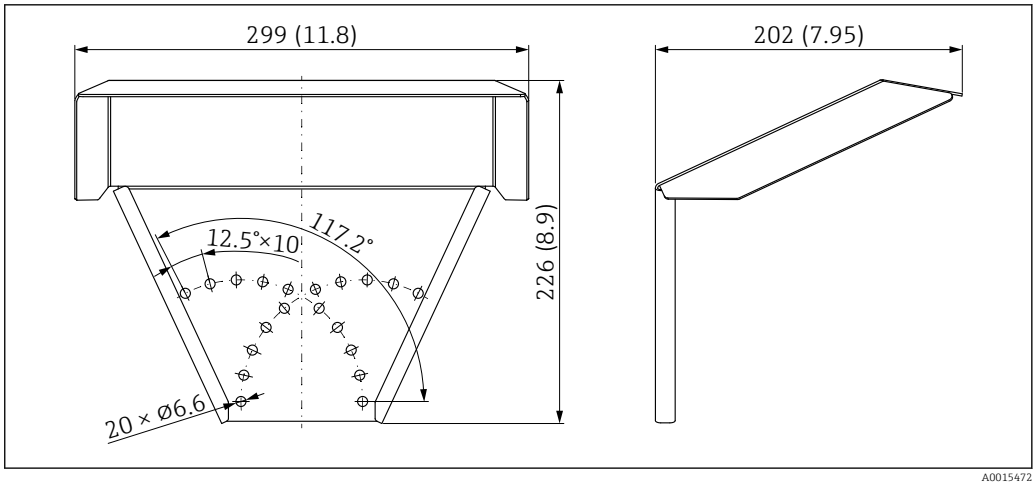
It is used to protect against direct sunlight, precipitation and ice.




51 *Overview*




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



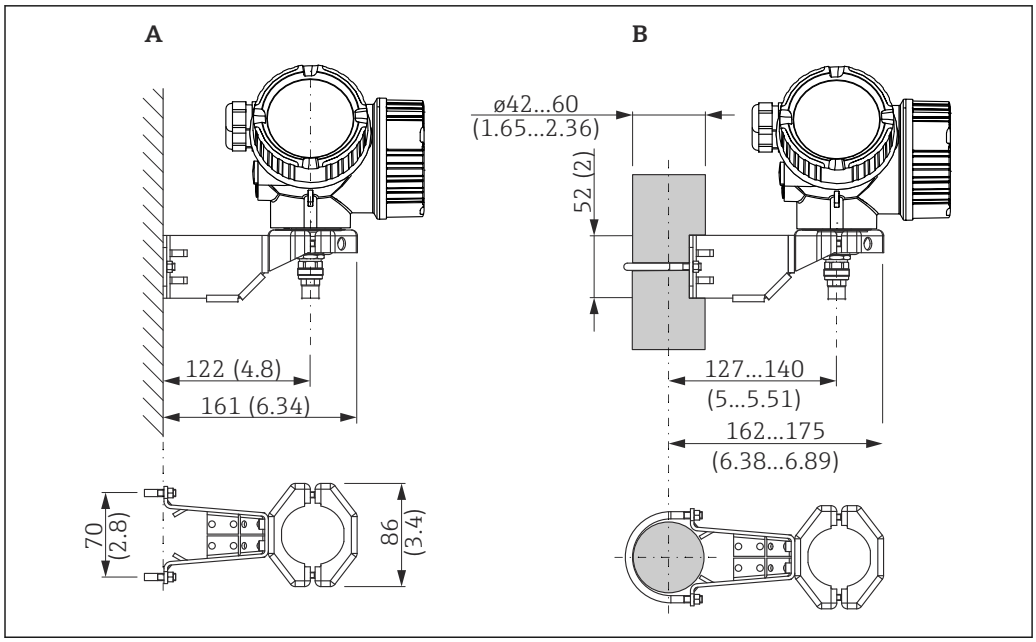

53 *Dimensions. Unit of measurement mm (in)*

**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

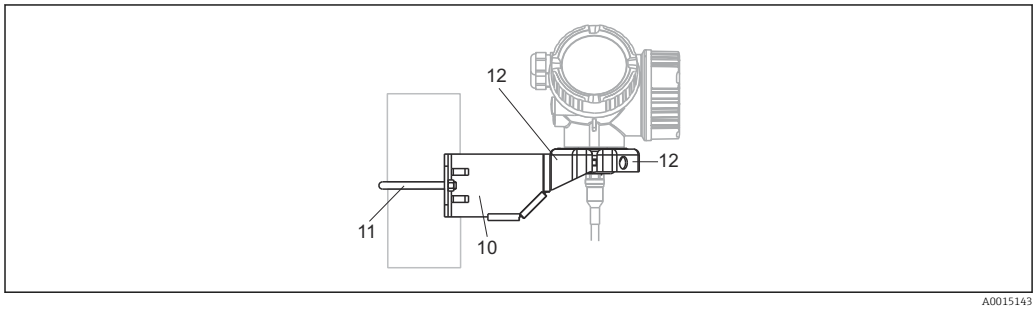
**Mounting bracket for electronics housing**

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 .




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

*A Wall mounting*
*B Post mounting*



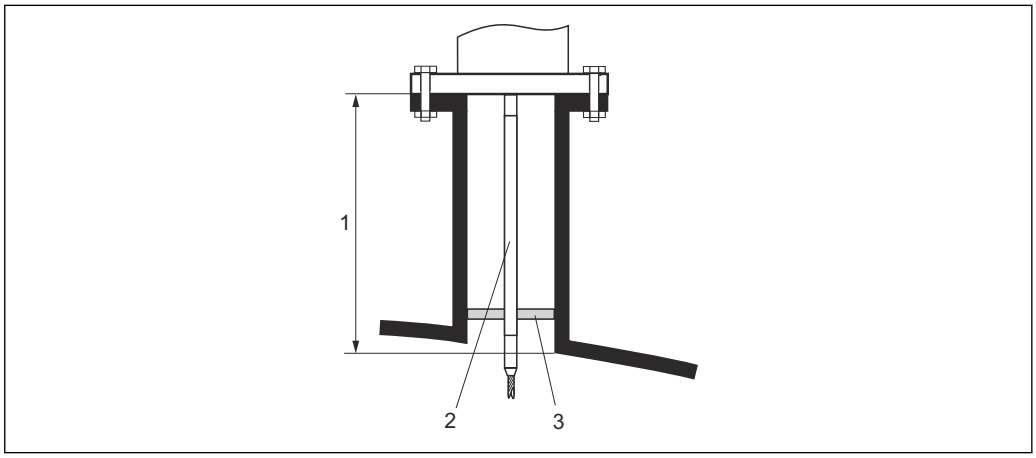

*55 Material; mounting bracket*

*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)

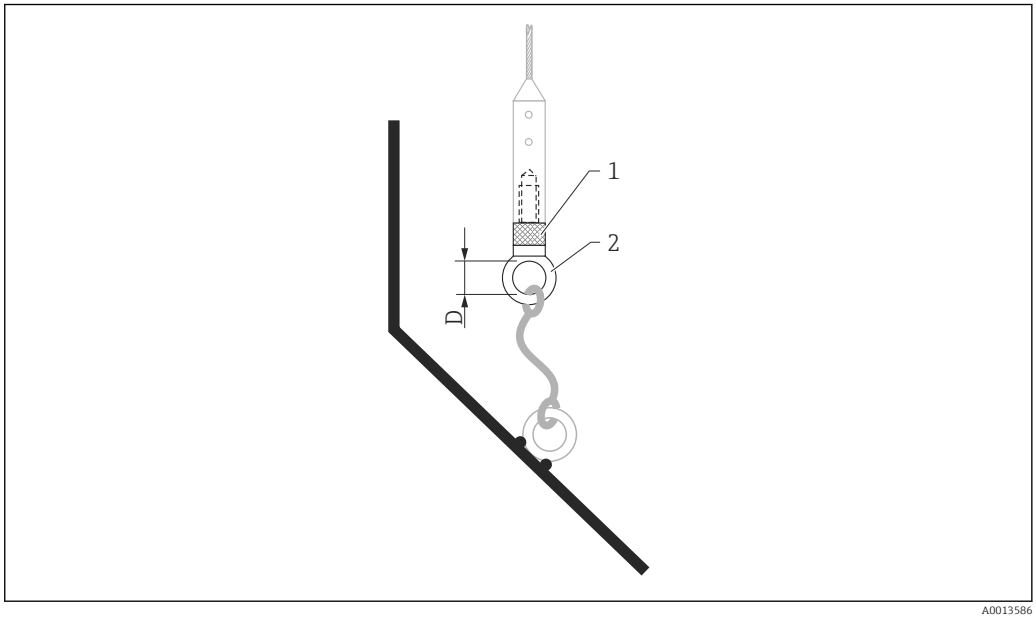
For details, see SD01002F.

### 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:
- FMP56
- FMP57




A0013586

*56 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

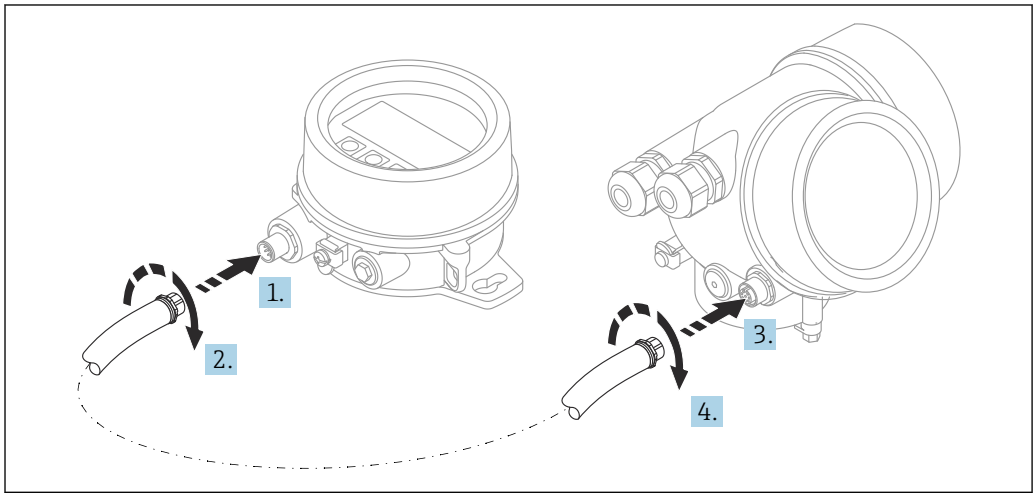
For rope probes 6 mm (¼ in) or 8 mm (⅓ in) with PA > steel:
Diameter D = 25 mm (1 in)

**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").

**Remote display FHX50**




A0019128

**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.

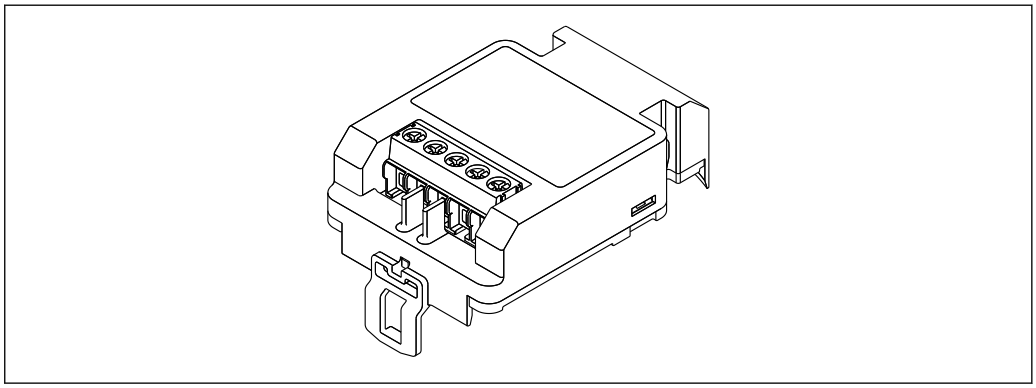
Retrofitting is not possible on transmitters with:
- An approval for use in areas with flammable dust (dust ignition-proof approval)
- Type of protection Ex nA

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

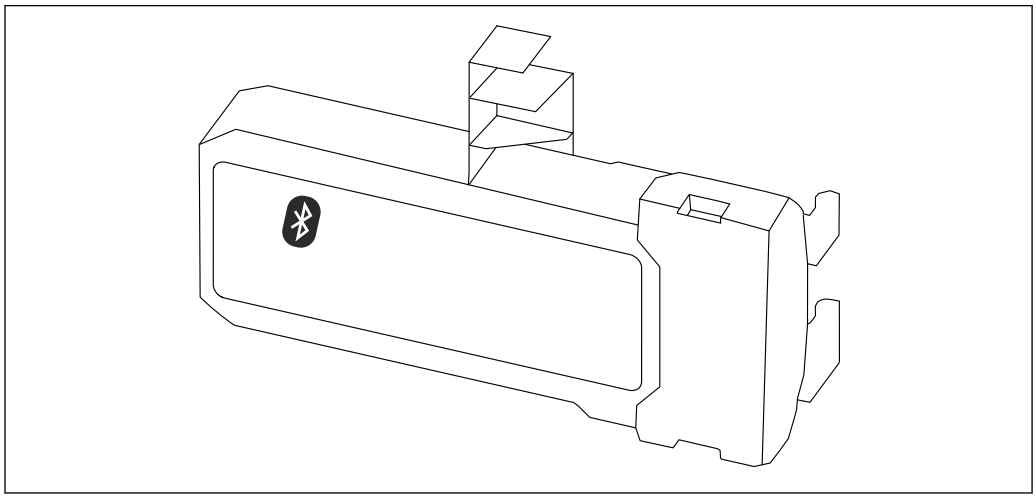
- Resistance per channel: 2 × 0.5 $\Omega_{max}$
- Threshold DC voltage: 400 to 700 V
- Threshold surge voltage: < 800 V
- Capacitance at 1 MHz: < 1.5 pF
- Nominal leakage current (8/20 µs): 10 kA
- Suitable for conductor cross-sections: 0.2 to 2.5 $mm^2$ (24 to 14 AWG)

**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

For an overview of the scope of the associated Technical Documentation, refer to the following:
- *Device Viewer* (www.endress.com/deviceviewer): Enter the serial number from the nameplate
- *Endress+Hauser Operations app*: Enter serial number from nameplate or scan matrix code on nameplate.

The following documentation may be available depending on the device version ordered:

| Document type | Purpose and content of the document |
|---|---|
| Technical Information (TI) | **Planning aid for your device**<br>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**<br>The Brief Operating Instructions contain all the essential information from incoming acceptance to initial commissioning. |
| Operating Instructions (BA) | **Your reference document**<br>These Operating Instructions contain all the information that is required in the various life cycle phases 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**<br>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. The Safety Instructions are a constituent part of the Operating Instructions.<br>Information on the Safety Instructions (XA) that are relevant for the device is provided on the nameplate. |
| 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. |

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