

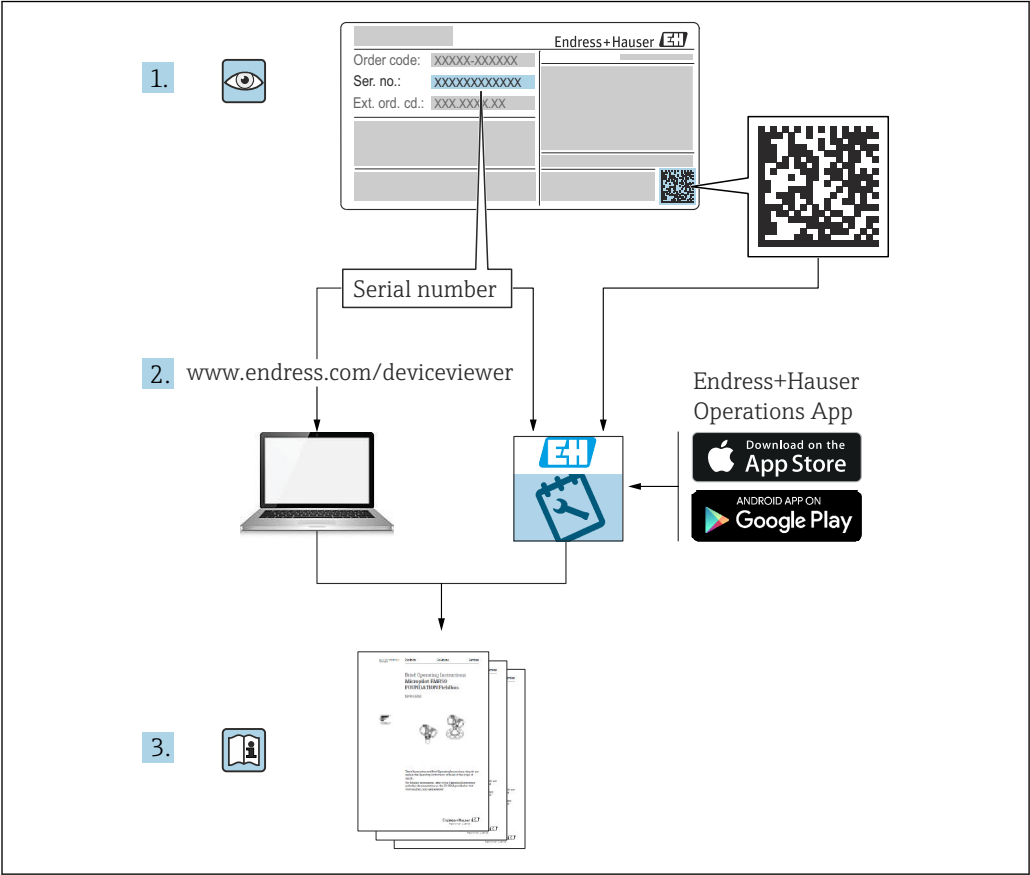
# Operating Instructions

## Micropilot FMR20

### HART

Free space radar  
For bulk solids





A0023555

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# 1 About this document

## 1.1 Document function

These Operating Instructions provide all of the information that is required in various phases of the life cycle of the device including:

- Product identification
- Incoming acceptance
- Storage
- Installation
- Connection
- Operation
- Commissioning
- Troubleshooting
- Maintenance
- Disposal

## 1.2 Symbols used

### 1.2.1 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.

### 1.2.2 Symbols for certain types of information and graphics

#### **Permitted**

Procedures, processes or actions that are permitted

#### **Preferred**

Procedures, processes or actions that are preferred

#### **Forbidden**

Procedures, processes or actions that are forbidden

#### **Tip**

Indicates additional information



Reference to documentation



Reference to graphic



Notice or individual step to be observed

#### **1., 2., 3.**

Series of steps



Result of a step



Operation via operating tool



Write-protected parameter

1, 2, 3, ...

Item numbers

A, B, C, ...

Views



→  **Safety instructions**

Observe the safety instructions contained in the associated Operating Instructions

## 1.3 Documentation

The following documentation types are available in the Downloads area of the Endress+Hauser website ([www.endress.com/downloads](http://www.endress.com/downloads)):



For an overview of the scope of the associated Technical Documentation, refer to the following:

- *W@M Device Viewer* ([www.endress.com/deviceviewer](http://www.endress.com/deviceviewer)): Enter the serial number from nameplate
- *Endress+Hauser Operations App*: Enter the serial number from the nameplate or scan the 2D matrix code (QR code) on the nameplate

### 1.3.1 Technical Information (TI)

#### Planning aid

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.

### 1.3.2 Brief Operating Instructions (KA)

#### Guide that takes you quickly to the 1st measured value

The Brief Operating Instructions contain all the essential information from incoming acceptance to initial commissioning.

### 1.3.3 Safety Instructions (XA)

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



The nameplate indicates the Safety Instructions (XA) that are relevant to the device.

## 1.4 Terms and abbreviations

### BA

Document type "Operating Instructions"

### KA

Document type "Brief Operating Instructions"

### TI

Document type "Technical Information"

### SD

Document type "Special Documentation"

**XA**

Document type "Safety Instructions"

**PN**

Nominal pressure

**MWP**

MWP (Maximum working pressure/max. process pressure)

The MWP can also be found on the nameplate.

**ToF**

Time of Flight

**FieldCare**

Scalable software tool for device configuration and integrated plant asset management solutions

**DeviceCare**

Universal configuration software for Endress+Hauser HART, PROFIBUS, FOUNDATION Fieldbus and Ethernet field devices

**DTM**

Device Type Manager

 **$\epsilon_r$  (Dk value)**

Relative dielectric constant

**Operating tool**

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

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

**BD**

Blocking Distance; no signals are analyzed within the BD.

**PLC**

Programmable logic controller (PLC)

## 1.5 Registered trademarks

**HART®**

Registered trademark of the FieldComm Group, Austin, Texas, USA

**Apple®**

Apple, the Apple logo, iPhone, and iPod touch are trademarks of Apple Inc., registered in the U.S. and other countries. App Store is a service mark of Apple Inc.

**Android®**

Android, Google Play and the Google Play logo are trademarks of Google Inc.

**Bluetooth®**

The *Bluetooth*® word mark and logos are registered trademarks owned by the Bluetooth SIG, Inc. and any use of such marks by Endress+Hauser is under license. Other trademarks and trade names are those of their respective owners.

## 2 Basic safety instructions

### 2.1 Requirements for personnel

The personnel for installation, commissioning, diagnostics and maintenance must fulfill the following requirements:

- ▶ Trained, qualified specialists must have a relevant qualification for this specific function and task.
- ▶ Personnel must be authorized by the plant owner/operator.
- ▶ Be familiar with federal/national regulations.
- ▶ Before starting work: personnel must read and understand the instructions in the manual and supplementary documentation as well as the certificates (depending on the application).
- ▶ Personnel must follow instructions and comply with general policies.

The operating personnel must fulfill the following requirements:

- ▶ Personnel are instructed and authorized according to the requirements of the task by the facility's owner-operator.
- ▶ Personnel follow the instructions in this manual.

### 2.2 Intended use

#### Application and media

The measuring device described in these Operating Instructions is intended for continuous, non-contact level measurement of solids. Because of its operating frequency of approx. 26 GHz, a maximum radiated pulsed power of 5.7 mW and an average power output of 0.015 mW, use outside of closed, metallic vessels is also permitted. If operated outside of closed vessels, the device must be mounted in accordance with the instructions in the "Installation" section. The operation of the devices does not present any health risk.

If the limit values specified in the "Technical data" and the conditions listed in the manual and additional documentation are observed, the measuring device may be used for the following measurements only:

- ▶ Measured process variables: distance
- ▶ Calculable process variables: volume or mass in any shape of vessel

To ensure that the measuring device remains in proper condition for the operation time:

- ▶ Use the measuring device only for media to which the process-wetted materials have an adequate level of resistance.
- ▶ Observe the limit values (see "Technical data").

#### Incorrect use

The manufacturer is not liable for damage caused by improper or non-designated use.

Clarification of borderline cases:

- ▶ With regard to special media and media used for cleaning, please contact the manufacturer. Endress+Hauser will be happy to assist in clarifying the corrosion-resistant properties of wetted materials but does not accept any warranty or liability.

#### Residual risks

Due to heat transfer from the process as well as power dissipation within the electronics, the temperature of the electronics housing and the assemblies contained therein may rise to 80 °C (176 °F) during operation. When in operation, the sensor can reach a temperature close to the medium temperature.

Danger of burns from contact with surfaces!

- ▶ In the event of elevated medium temperatures, ensure protection against contact to prevent burns.

## 2.3 Workplace safety

For work on and with the device:

- ▶ Wear the required personal protective equipment according to federal/national regulations.

## 2.4 Operational safety

Risk of injury!

- ▶ Operate the device only if it is in proper technical condition, free from errors and faults.
- ▶ The operator is responsible for interference-free operation of the device.

### Modifications to the device

Unauthorized modifications to the device are not permitted and can lead to unforeseeable dangers:

- ▶ If modifications are nevertheless required, consult with the manufacturer.

### Repair

To ensure continued operational safety and reliability:

- ▶ Carry out repairs on the device only if they are expressly permitted.
- ▶ Observe federal/national regulations pertaining to the repair of an electrical device.
- ▶ Use only original spare parts and accessories from the manufacturer.

### Hazardous area

To eliminate the risk of danger to persons or the facility when the device is used in the approval-related area (e.g. explosion protection, pressure equipment safety):

- ▶ Check the nameplate to verify if the device ordered can be put to its intended use in the approval-related area.
- ▶ Observe the specifications in the separate supplementary documentation that is an integral part of this manual.

## 2.5 Product safety

This measuring device is designed in accordance with good engineering practice to meet state-of-the-art safety requirements, has been tested, and left the factory in a condition in which it is safe to operate. It meets general safety standards and legal requirements.

### 2.5.1 CE mark

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

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

### 2.5.2 EAC conformity

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

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

## 2.6 IT security

We only provide a warranty if the device is installed and used as described in the Operating Instructions. The device is equipped with security mechanisms to protect it against any inadvertent changes to the device settings.

IT security measures in line with operators' security standards and designed to provide additional protection for the device and device data transfer must be implemented by the operators themselves.

## 2.7 Device-specific IT security

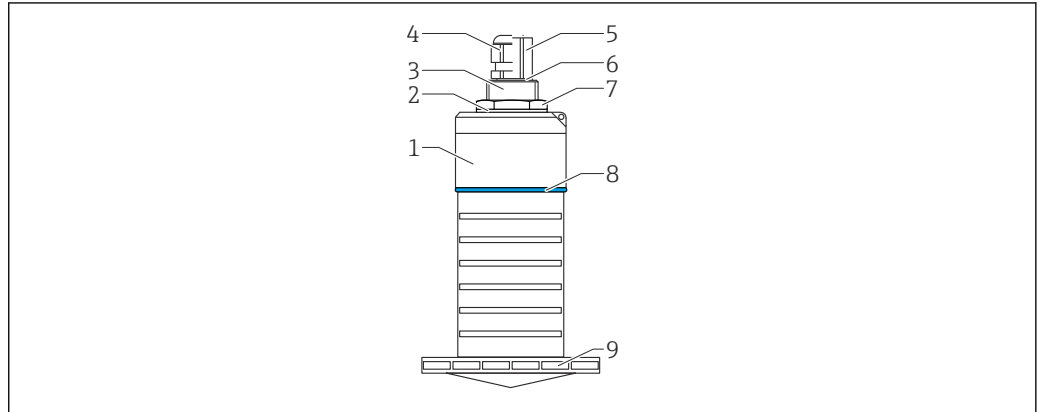
### 2.7.1 Access via Bluetooth® wireless technology

**Signal transmission via Bluetooth® wireless technology uses a cryptographic technique tested by Fraunhofer AISEC**

- The device is not visible via *Bluetooth*® wireless technology without the SmartBlue App
- Only one point-to-point connection between **one** sensor and **one** smartphone or tablet is established
- The *Bluetooth*® wireless technology interface can be disabled via SmartBlue, FieldCare and DeviceCare

## 3 Product description

### 3.1 Product design



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#### 1 Overview of materials

- 80 mm (3 in) antenna
- 1 Sensor housing; PVDF
- 2 Seal; EPDM
- 3 Process connection, rear side; PVDF
- 4 Cable gland; PA
- 5 Conduit adapter; CuZn nickel-plated
- 6 O-ring; EPDM
- 7 Counter nut; PA6.6
- 8 Design ring; PBT-PC
- 9 Process connection, front side; PVDF

## 4 Incoming acceptance and product identification

### 4.1 Goods acceptance

Check the following during goods acceptance:

- Are the order codes on the delivery note and the product sticker identical?
- Are the goods undamaged?
- Do the nameplate data match the ordering information on the delivery note?
- If required (see nameplate): Are the safety instructions (XA) provided?



If one of these conditions is not met, please contact the manufacturer's sales office.

### 4.2 Product identification

The following options are available for the identification of the measuring device:

- Nameplate specifications
- Extended order code with breakdown of the device features on the delivery note
- ▶ Enter the serial number from the nameplates into *W@M Device Viewer* ([www.endress.com/deviceviewer](http://www.endress.com/deviceviewer))
  - ↳ All the information about the measuring device and the scope of the associated Technical Documentation are displayed.
- ▶ Enter the serial number from the nameplate into the *Endress+Hauser Operations App* or use the *Endress+Hauser Operations App* to scan the 2-D matrix code (QR Code) provided on the nameplate
  - ↳ All the information about the measuring device and the scope of the associated Technical Documentation are displayed.

### 4.3 Manufacturer address

Endress+Hauser SE+Co. KG  
Hauptstraße 1  
79689 Maulburg, Germany  
Place of manufacture: See nameplate.

## 4.4 Nameplate

The diagram shows a rectangular nameplate with various fields and symbols. The fields are numbered as follows:

- 1: Manufacturer address
- 2: Device name
- 3: Order code
- 4: Serial number (Ser. no.)
- 5: Extended order code (Ext. ord. cd.)
- 6: Supply voltage
- 7: Signal outputs
- 8: Process pressure
- 9: Permitted ambient temperature ( $T_a$ )
- 10: Maximum process temperature
- 11: Device ID
- 12: Firmware version (FW)
- 13: Device revision (Dev.Rev.)
- 14: CE mark
- 15: Additional information about the device version (certificates, approvals)
- 16: RCM
- 17: Materials in contact with process
- 18: Logo
- 19: Degree of protection: e.g. IP, NEMA
- 20: Certificate symbol
- 21: Certificate- and approval-specific data
- 22: Document number of the Safety Instructions: e.g. XA, ZD, ZE
- 23: Modification mark
- 24: 2-D matrix code (QR code)
- 25: Date of manufacture: year-month

A0029096

 2 Nameplate of Micropilot

- 1 Manufacturer address
- 2 Device name
- 3 Order code
- 4 Serial number (Ser. no.)
- 5 Extended order code (Ext. ord. cd.)
- 6 Supply voltage
- 7 Signal outputs
- 8 Process pressure
- 9 Permitted ambient temperature ( $T_a$ )
- 10 Maximum process temperature
- 11 Device ID
- 12 Firmware version (FW)
- 13 Device revision (Dev.Rev.)
- 14 CE mark
- 15 Additional information about the device version (certificates, approvals)
- 16 RCM
- 17 Materials in contact with process
- 18 Logo
- 19 Degree of protection: e.g. IP, NEMA
- 20 Certificate symbol
- 21 Certificate- and approval-specific data
- 22 Document number of the Safety Instructions: e.g. XA, ZD, ZE
- 23 Modification mark
- 24 2-D matrix code (QR code)
- 25 Date of manufacture: year-month

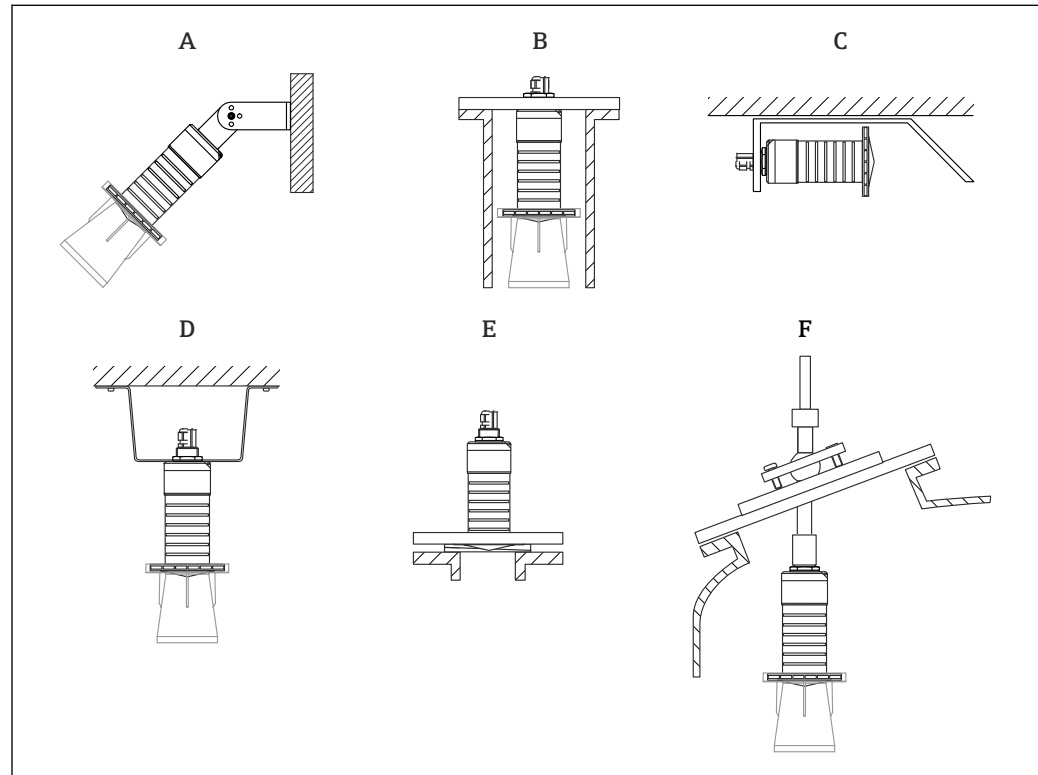
 Up to 33 characters of the extended order code are indicated on the nameplate. If the extended order code contains additional characters, these cannot be displayed.

However, the complete extended order code can also be displayed via the device operating menu: **Extended order code 1 to 3** parameter

## 5 Installation

### 5.1 Installation conditions

#### 5.1.1 Installation types



A0045309

 3 Wall, ceiling or nozzle installation

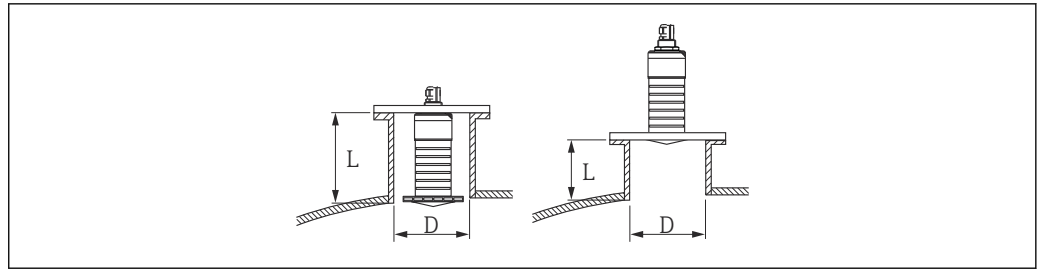
- A Wall or ceiling mounting, adjustable
- B Mounted at rear thread
- C Horizontal installation in cramped spaces
- D Ceiling installation with counter nut (included in delivery)
- E Installation with adjustable flange seal
- F Installation with FAU40 alignment unit

#### Caution!

- The sensor cables are not designed as supporting cables. Do not use them for suspension purposes.
- Always operate the device in a vertical position in free-space applications.

#### 5.1.2 Nozzle installation

The antenna should project out of the nozzle for optimum measurement. The interior of the nozzle must be smooth and may not contain any edges or welded joints. The edge of the nozzle should be rounded if possible.



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4 Nozzle installation

The maximum nozzle length **L** depends on the nozzle diameter **D**.

Please note the limits for the diameter and length of the nozzle.

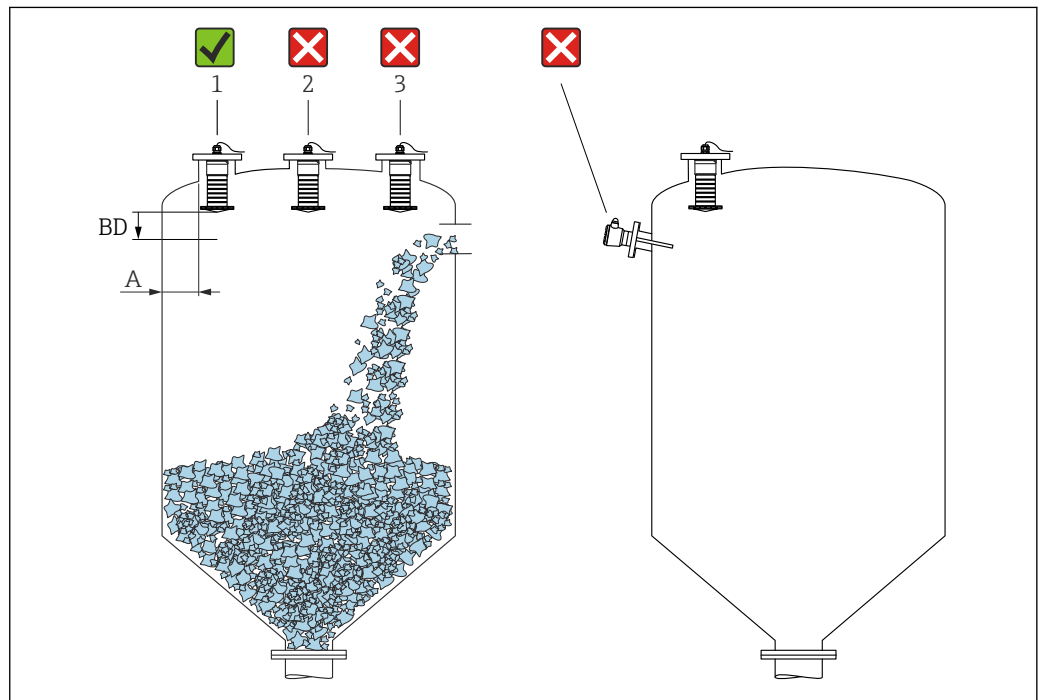
**80 mm (3 in) antenna, installation inside nozzle**

- D: min. 120 mm (4.72 in)
- L: max. 205 mm (8.07 in) +  $D \times 4.5$

**80 mm (3 in) antenna, installation outside nozzle**

- D: min. 80 mm (3 in)
- L: max.  $D \times 4.5$

### 5.1.3 Position for installation on a vessel



A0045323

5 Installation position on a vessel

- If possible install the sensor so that its lower edge is inside the vessel.
- Recommended distance **A** wall - nozzle outer edge:  $\sim \frac{1}{6}$  of the vessel diameter. Under no circumstances should the device be mounted closer than 15 cm (5.91 in) to the vessel wall.
- Do not install the sensor in the middle of the vessel.

- Avoid measurements through the filling curtain.
- Avoid internal fixtures such as limit switches.
- No signals are evaluated within the Blocking distance (BD). It can therefore be used to suppress interference signals (e.g. the effects of condensate) in the vicinity of the antenna.

An automatic Blocking distance of at least 0.1 m (0.33 ft) is configured as standard. However, this can be overwritten manually (0 m (0 ft) is also permitted).

Automatic calculation:

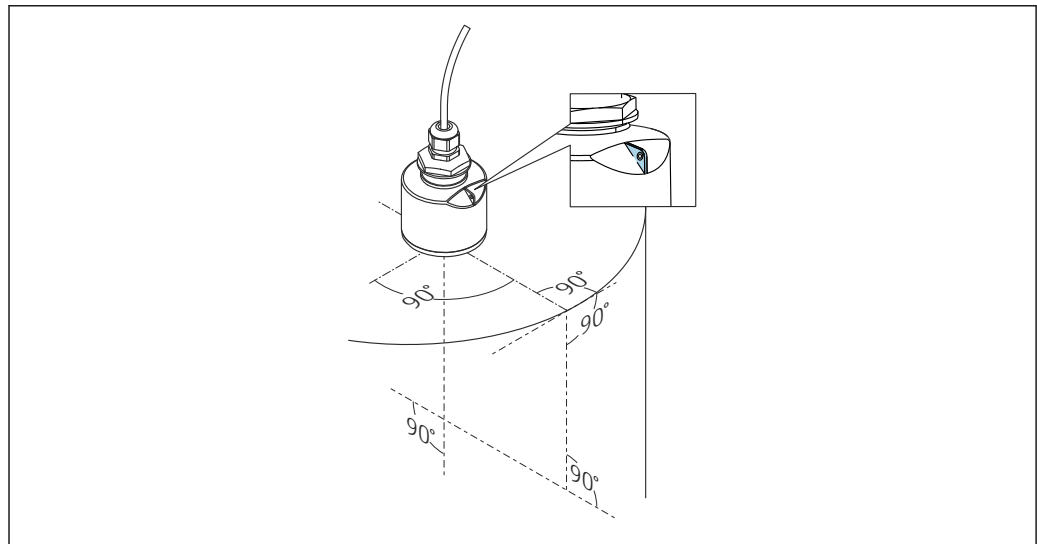
Blocking distance = Empty calibration - Full calibration - 0.2 m (0.656 ft).

Each time a new entry is made in the **Empty calibration** parameter or **Full calibration** parameter, the **Blocking distance** parameter is recalculated automatically using this formula.

If the result of the calculation is a value <0.1 m (0.33 ft), the Blocking distance of 0.1 m (0.33 ft) will continue to be used.

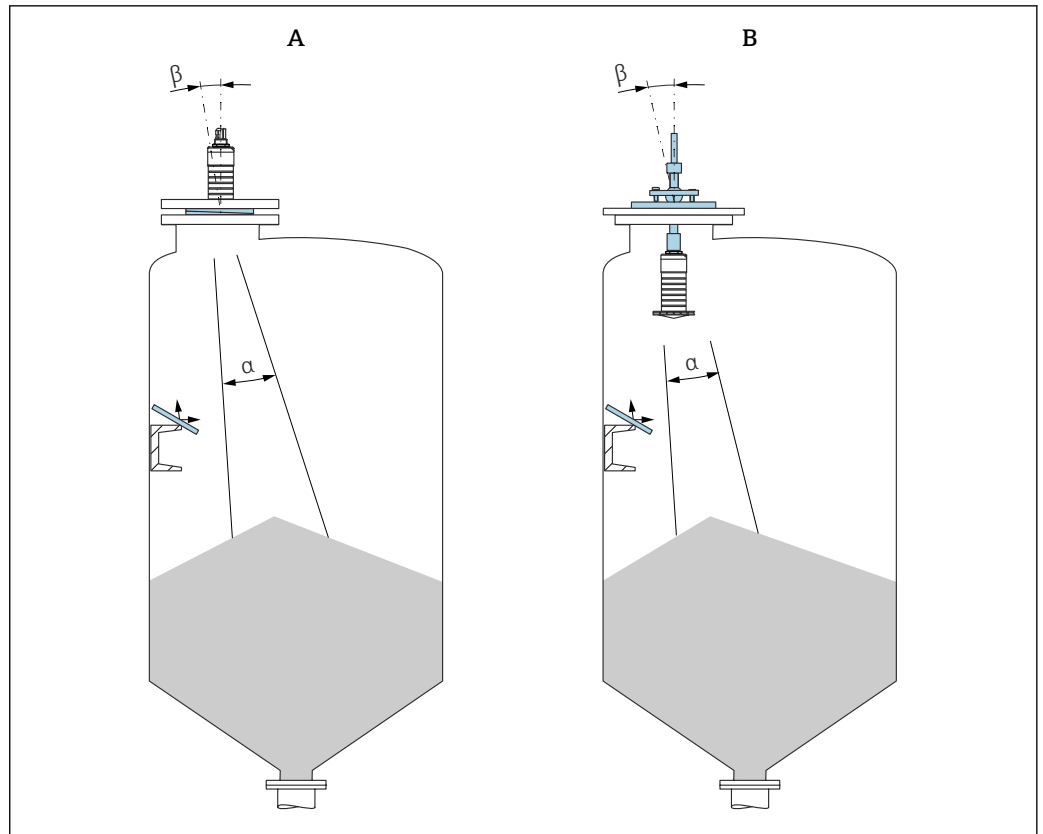
#### 5.1.4 Device alignment for installation on a vessel

- Align the antenna so that it is perpendicular to the product surface
- Align the eyelet with lug towards the vessel wall as well as possible



A0028927

6 Device alignment for installation on a vessel



A0045325

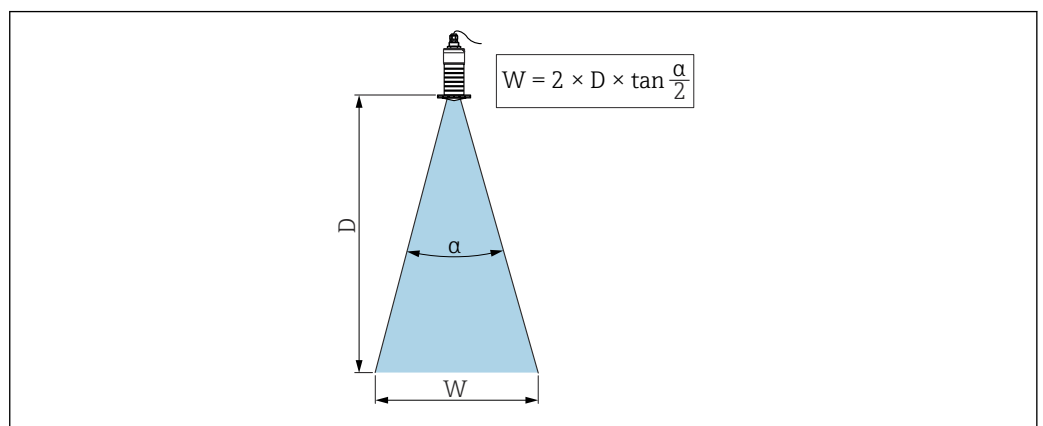
 7 Aligning the sensor with the product cone

A Installation with adjustable flange seal

B Installation with FAU40 alignment unit

 To avoid disturbance echoes, use metal plates installed at an angle (where necessary)

### 5.1.5 Beam angle



A0046285

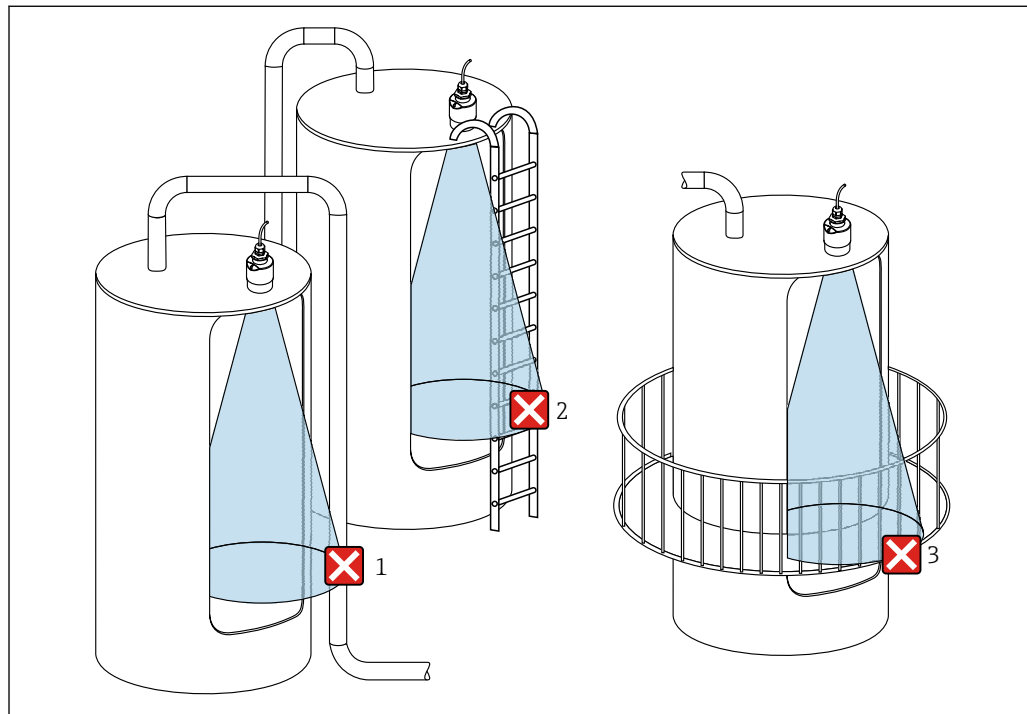
 8 Relationship between beam angle  $\alpha$ , distance  $D$  and beamwidth diameter  $W$

The beam angle is defined as the angle  $\alpha$  at which the power energy of the radar waves reaches half the value of the maximum power density (3dB width). Microwaves are also emitted outside the signal beam and can be reflected off interfering installations.

Beam diameter  $W$  as a function of beam angle  $\alpha$  and distance  $D$ .

80 mm (3 in) antenna with or without a flooding protection tube,  $\alpha 12^\circ$   
 $W = D \times 0.21$

### 5.1.6 Measurement in plastic vessels



A0029540

9 Measurement in a plastic vessel with a metallic, interfering installation outside of the vessel

- 1 Pipe, tubing
- 2 Ladder
- 3 Grate, railing

**i** If the outer wall of the vessel is made of a non-conductive material (e.g. GFR), microwaves can also be reflected by interfering installations outside of the vessel.

#### Optimization options

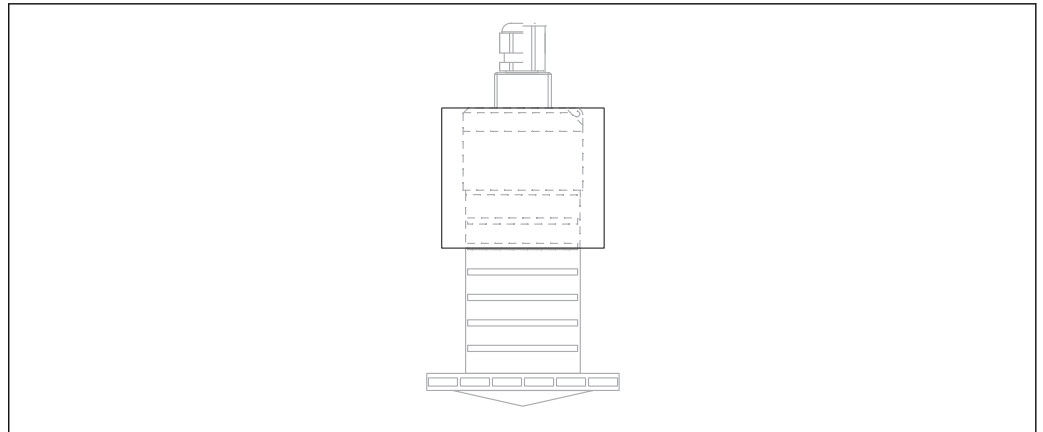
- **Adjustable flange seal:** The device can be aligned with the product surface using the adjustable flange seal.
- **Alignment unit:**  
 In the case of devices with an alignment unit, the sensor can be optimally aligned with the conditions at the vessel. The maximum angle  $\beta$  is  $\pm 15^\circ$ .  
 The purpose of sensor alignment is primarily to:
  - Prevent interference reflections
  - Increase the maximum possible measuring range in conical outlets
- Please ensure there are no interfering installations made of a conductive material in the signal beam (see the beam angle section for information on calculating the beamwidth diameter).

For more information: contact the Endress+Hauser sales organization.

### 5.1.7 Weather protection cover

A weather protection cover is recommended for outdoor use.

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



A0046286

 10 Weather protection cover

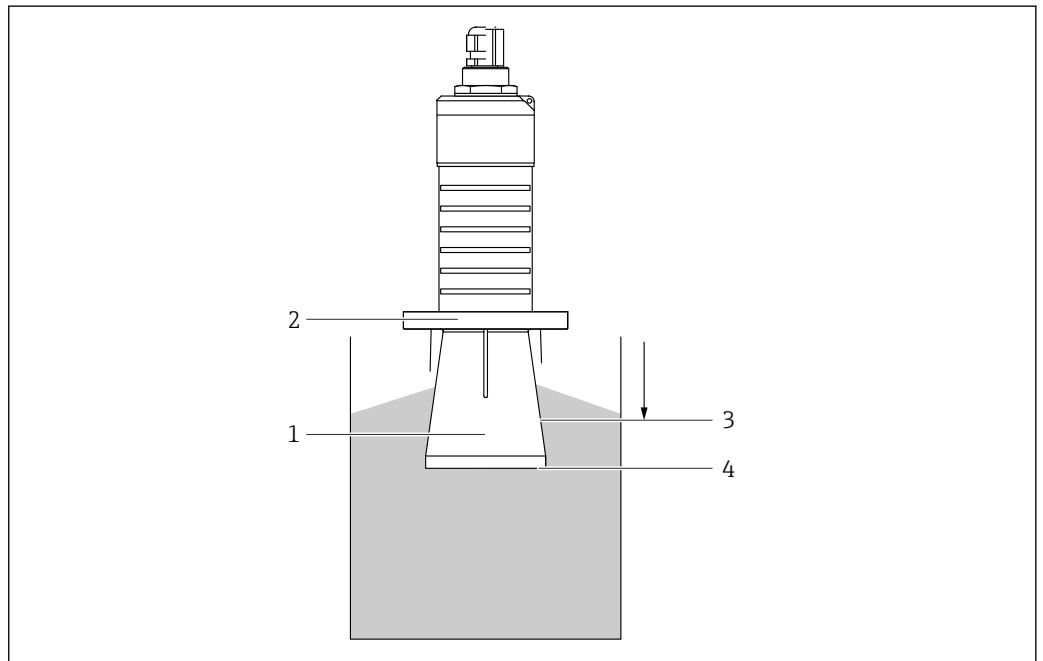
 The sensor is not completely covered by the weather protection cover.

### 5.1.8 Use of flooding protection tube

In free-field installations and/or in applications where there is a risk of flooding, the flooding protection tube must be used.

Optimum results are achieved with coarse-grained material and the use of the flooding protection tube.

The flooding protection tube can be ordered as an accessory or together with the device via the product structure "Accessory enclosed".



A0045326

 11 Function of flooding protection tube

- 1 Empty space
- 2 O-ring (EPDM) seal
- 3 Blocking distance
- 4 Max. level

The tube is screwed directly onto the sensor and seals off the system by means of an O-ring making it air-tight. In the event of flooding, the empty space that develops in the tube

ensures a defined detection of the maximum level directly at the end of the tube. Due to the fact that the Blocking distance is inside the tube, multiple echoes are not analyzed.

### Configuration parameters for flooding protection tube

#### Configuring the blocking distance when using the flooding protection tube

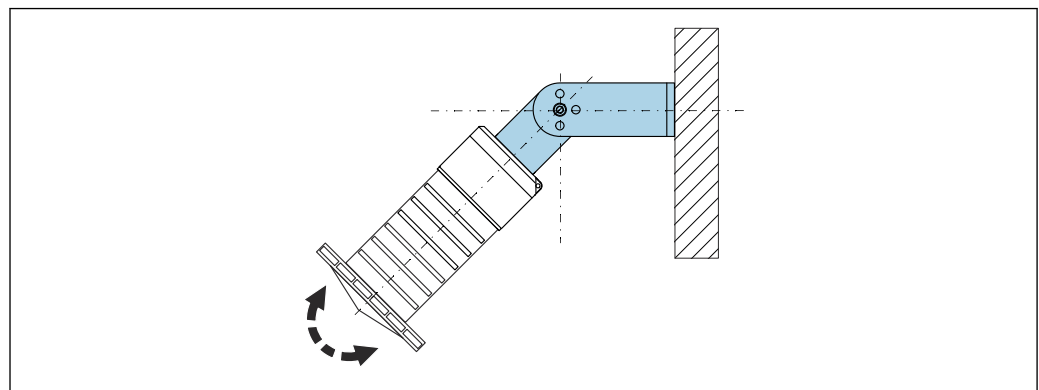
- Navigate to: Main menu → Setup → Advanced setup → Blocking distance
  - ↳ Enter 100 mm (4 in).

#### Perform a mapping after the flooding protection tube has been installed and the blocking distance has been configured

1. Navigate to: Setup → Confirm distance
  - ↳ Compare the distance displayed with the actual value in order to start the recording of an interference echo map.
2. Navigate to: Setup → Mapping end point
  - ↳ This parameter determines the distance up to which the new mapping is to be recorded.
3. Navigate to: Setup → Present mapping
  - ↳ Displays the distance up to which a mapping has already been recorded.

### 5.1.9 Installation with mounting bracket, adjustable

The mounting bracket can be ordered as an accessory or together with the device via the product structure "Accessory enclosed".



A0046287

 12 Installation with mounting bracket, adjustable

- Wall or ceiling installation is possible.
- Using the mounting bracket, position the antenna so that it is perpendicular to the product surface.

#### NOTICE

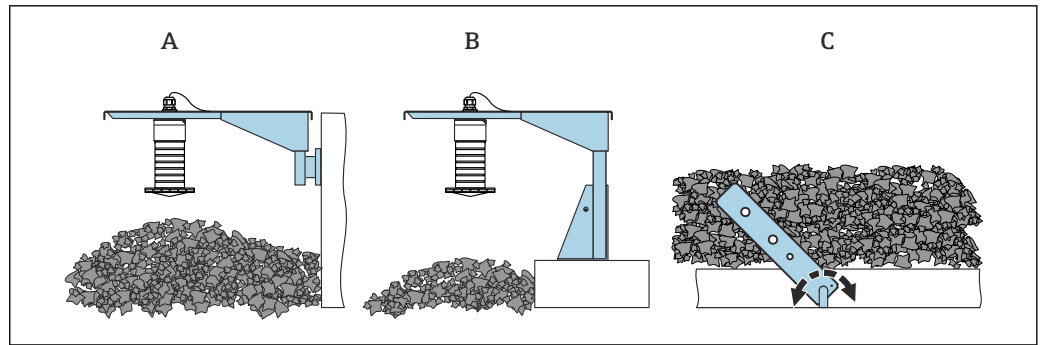
**There is no conductive connection between the mounting bracket and transmitter housing.**

Electrostatic charging possible.

- Integrate the mounting bracket in the local potential equalization system.

### 5.1.10 Cantilever installation, with pivot

The cantilever, wall bracket and mounting frame are available as accessories.



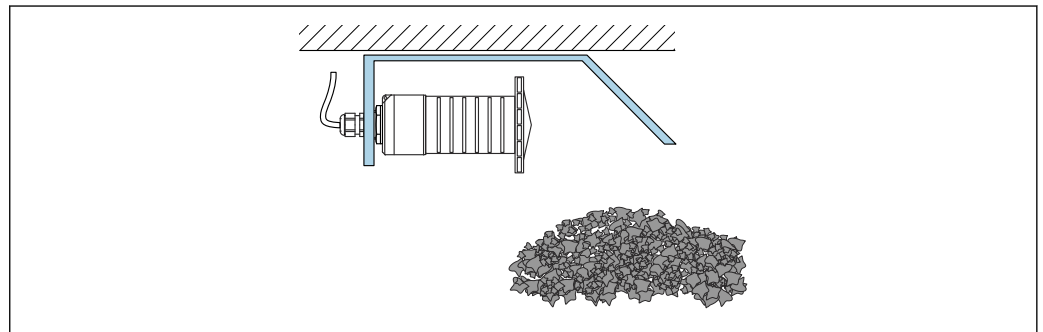
A0045327

13 Cantilever installation, with pivot

- A Cantilever with wall bracket
- B Cantilever with mounting frame
- C Cantilever, pivotable

### 5.1.11 Installation with the horizontal mounting bracket

The mounting bracket can be ordered together with the device via the product structure "Accessory enclosed".

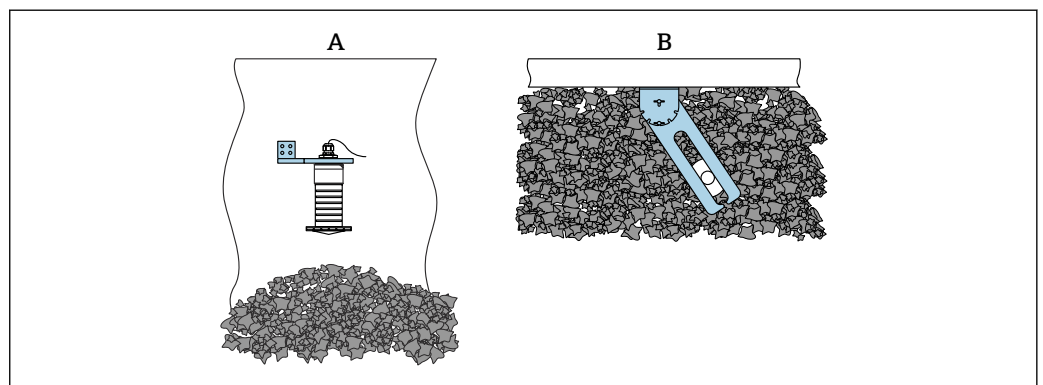


A0045328

14 Installation with the horizontal mounting bracket (without flooding protection tube)

### 5.1.12 Installation with pivotable mounting bracket

The pivotable mounting bracket can be ordered together with the device via the product structure "Accessory enclosed".



A0045329

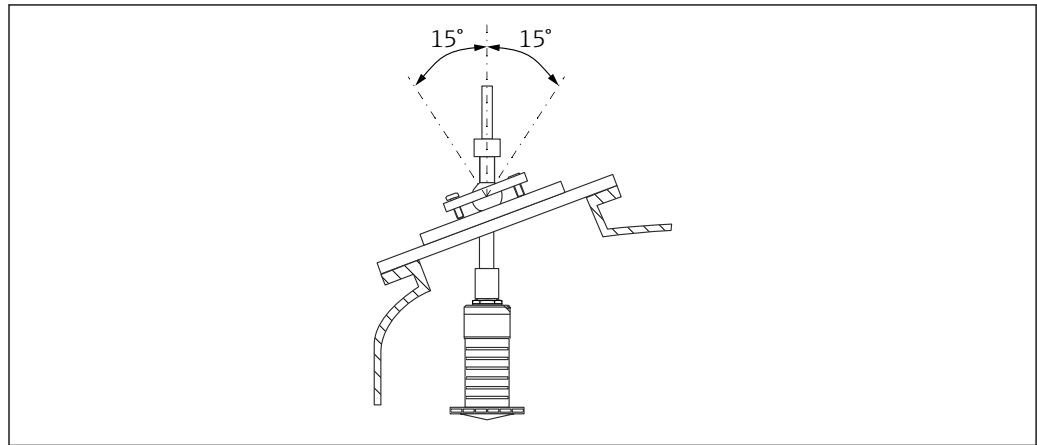
15 Installation, pivotable and adjustable

- A Cantilever with wall bracket
- B Cantilever pivotable and adjustable (to align the device with the medium to be measured)

### 5.1.13 FAU40 alignment unit

An angle of inclination of up to  $15^\circ$  in all directions can be set for the antenna axis using the FAU40 alignment unit. The alignment unit is used to optimally direct the radar beam at the bulk solids.

The FAU40 alignment unit is available as an accessory.



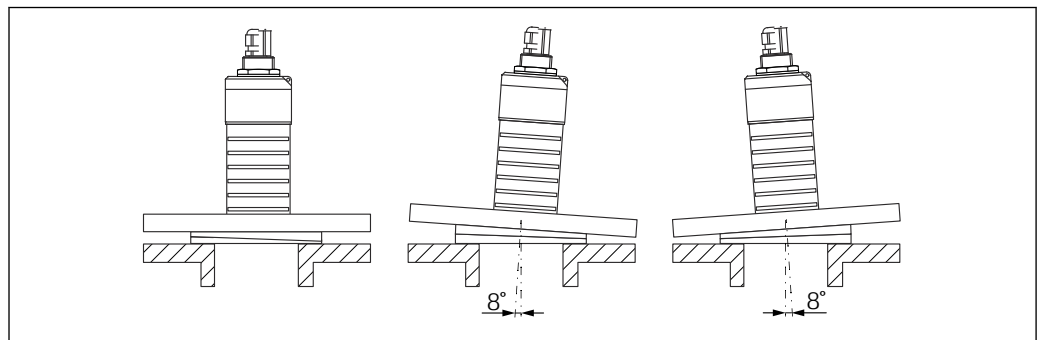
A0045332

16 Micropilot FMR20 with alignment unit

### 5.1.14 Adjustable flange seal

The radar beam can be optimally directed at the bulk solids using the adjustable flange seal.

The adjustable flange seal can be ordered together with the device via the product structure "Accessory enclosed".



A0045331

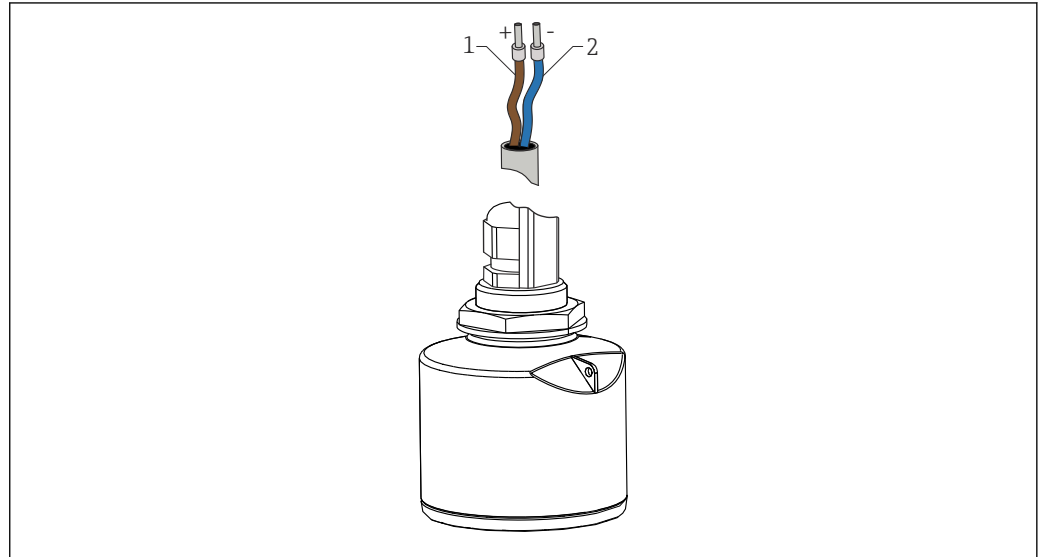
17 Micropilot FMR20 with adjustable flange seal

## 5.2 Post-installation check

- ☐ Is the device or cable undamaged (visual inspection)?
- ☐ Is the device adequately protected from wet conditions and direct sunlight?
- ☐ Is the device properly secured?

## 6 Electrical connection

### 6.1 Cable assignment



A0028954

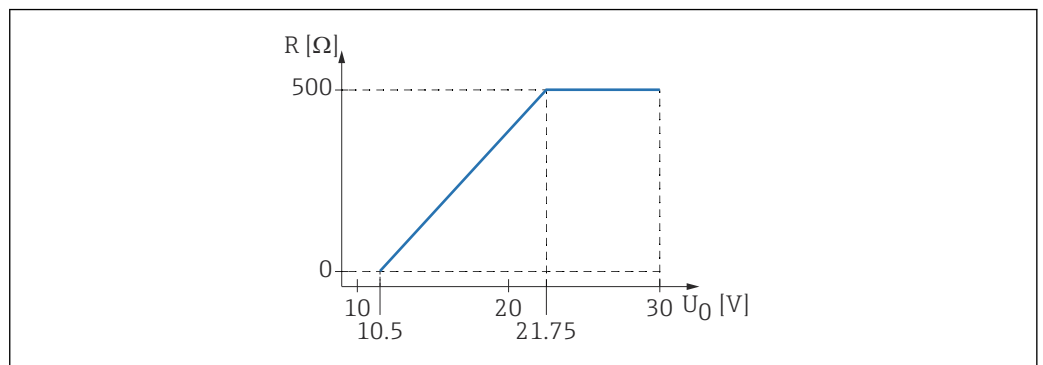
18 Cable assignment

- 1 Plus, brown wire
- 2 Minus, blue wire

### 6.2 Supply voltage

10.5 to 30 V<sub>DC</sub>

An external power supply is necessary.



A0029226

19 Maximum load  $R$ , depending on supply voltage  $U_0$  of power supply unit

#### Battery operation

The sensor's *Bluetooth*® wireless technology communication can be disabled to increase the operating life of the battery.

#### Potential equalization

No special measures for potential equalization are required.

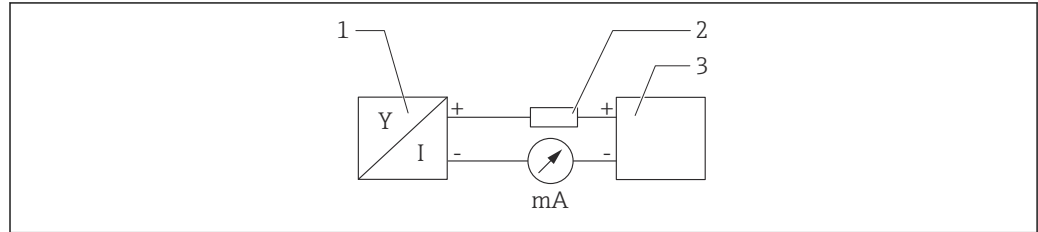


Various power supply units can be ordered as an accessory from Endress+Hauser.

## 6.3 Connecting the device

### 6.3.1 4 to 20 mA HART block diagram

Connection of the device with HART communication, power source and 4 to 20 mA display



 20 Block diagram of HART connection

- 1 Device with HART communication
- 2 HART resistor
- 3 Power supply

 The HART communication resistor of 250  $\Omega$  in the signal line is always necessary in the case of a low-impedance power supply.

**The voltage drop to be taken into account is:**

Max. 6 V for 250  $\Omega$  communication resistor

### 6.3.2 HART device block diagram, connection with RIA15

FMR20 with RIA15 (incl. option for FMR20 basic configuration)

 The RIA15 remote indicator can be ordered together with the device.

**Product structure, feature 620 "Accessory enclosed":**

- Option R4 "Remote indicator RIA15 non-hazardous area, field housing"
- Option R5 "Remote indicator RIA15 with explosion protection approval, field housing"

 Alternatively available as an accessory, for details see Technical Information TI01043K and Operating Instructions BA01170K

#### Terminal assignment RIA15

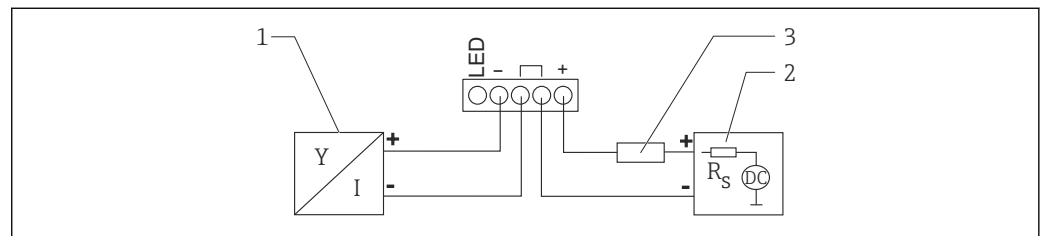
- +  
Positive connection, current measurement
- -  
Negative connection, current measurement (without backlighting)
- LED  
Negative connection, current measurement (with backlighting)
- $\perp$   
Functional grounding: Terminal in housing

 The RIA15 process indicator is loop-powered and does not require any external power supply.

**The voltage drop to be taken into account is:**

- $\leq 1$  V in the standard version with 4 to 20 mA communication
- $\leq 1.9$  V with HART communication
- and an additional 2.9 V if display light is used

#### Connection of the HART device and RIA15 without backlighting

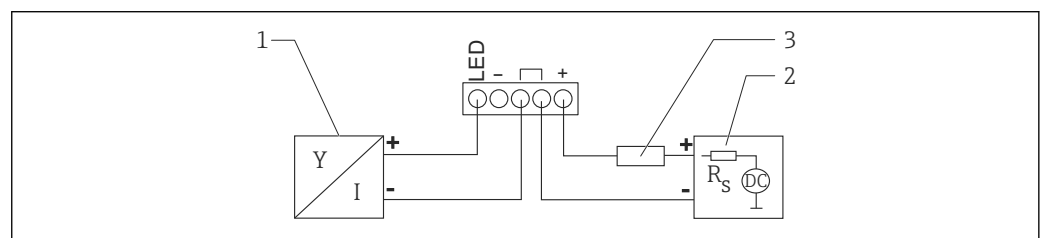


A0019567

 21 Block diagram of HART device with RIA15 process indicator without light

- 1 Device with HART communication
- 2 Power supply
- 3 HART resistor

#### Connection of the HART device and RIA15 with backlighting



A0019568

 22 Block diagram of HART device with RIA15 process indicator with light

- 1 Device with HART communication
- 2 Power supply
- 3 HART resistor

### 6.3.3 Block diagram of HART device, RIA15 with installed HART communication resistor module

 The HART communication module for installation in the RIA15 can be ordered together with the device.

**Product structure, feature 620 "Accessory enclosed":**

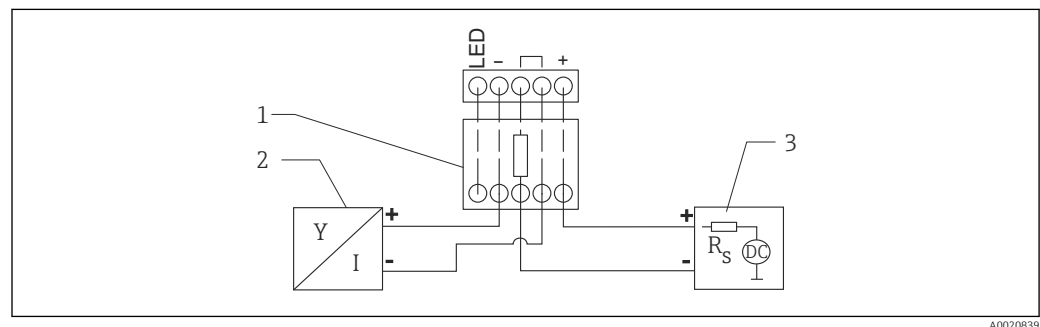
Option R6 "HART communication resistor hazardous / non-hazardous area"

**The voltage drop to be taken into account is:**

Max. 7 V

 Alternatively available as an accessory, for details see Technical Information TI01043K and Operating Instructions BA01170K

#### Connection of the HART communication resistor module, RIA15 without backlighting

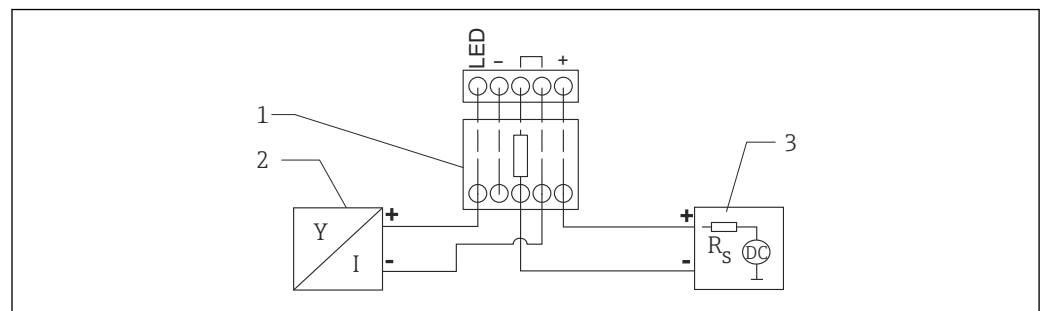


A0020839

 23 Block diagram of HART device, RIA15 without light, HART communication resistor module

- 1 HART communication resistor module
- 2 Device with HART communication
- 3 Power supply

#### Connection of the HART communication resistor module, RIA15 with backlighting



A0020840

 24 Block diagram of HART device, RIA15 with light, HART communication resistor module

- 1 HART communication resistor module
- 2 Device with HART communication
- 3 Power supply

## 6.4 Post-connection check

- ☐ Is the device or cable undamaged (visual inspection)?
- ☐ Do the mounted cables have adequate strain relief?
- ☐ Are the cable glands mounted and firmly tightened?
- ☐ Does the supply voltage match the specifications on the nameplate?
- ☐ No reverse polarity, is terminal assignment correct?

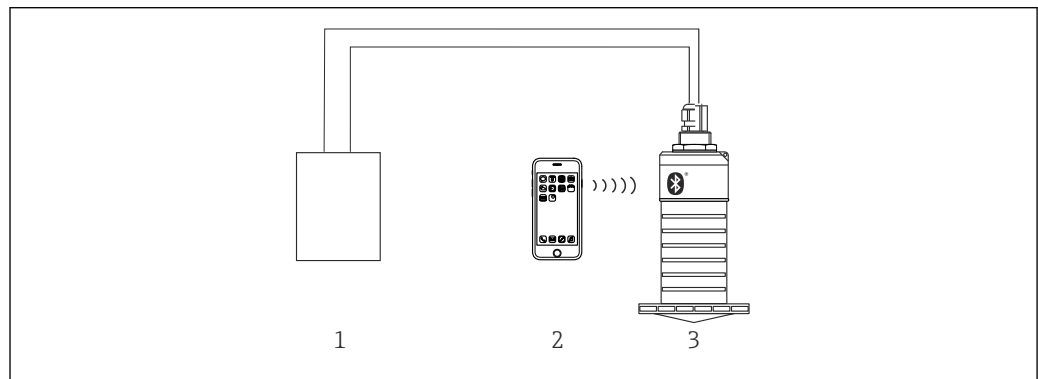
☐ Has the voltage drop across the process indicator and communication resistor been taken into account?

## 7 Operability

### 7.1 Operating concept

- 4 to 20 mA, HART
- Menu guidance with brief explanations of the individual parameter functions in the operating tool
- Optional: SmartBlue (app) via *Bluetooth®* wireless technology

### 7.2 Operation via Bluetooth® wireless technology

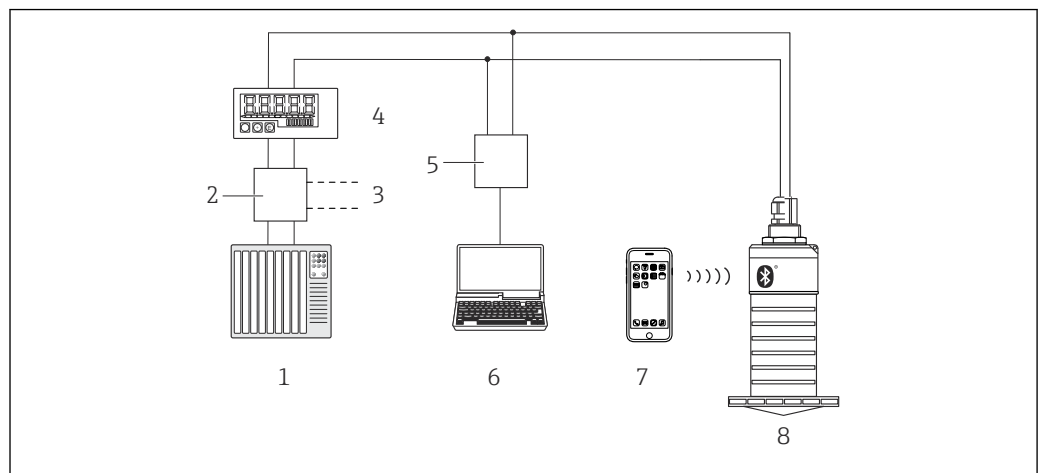


A0046293

25 Possibilities for remote operation via Bluetooth® wireless technology

- 1 Transmitter power supply unit
- 2 Smartphone / tablet with SmartBlue (app)
- 3 Transmitter with Bluetooth® wireless technology

### 7.3 Via HART protocol



A0046294

26 Options for remote operation via HART protocol

- 1 PLC (programmable logic controller)
- 2 Transmitter power supply unit, e.g. RN221N (with communication resistor)
- 3 Connection for Commubox FXA195
- 4 Loop-powered RIA15 process indicator
- 5 Commubox FXA195 (USB)
- 6 Computer with operating tool (FieldCare, DeviceCare)
- 7 Smartphone / tablet with SmartBlue (app)
- 8 Transmitter with Bluetooth® wireless technology

## 8 System integration via HART protocol

### 8.1 Overview of the device description files

**Manufacturer ID**

17 (0x11)

**Device type ID**

44 (0x112c)

**HART specification**

7.0

### 8.2 Measured variables via HART protocol

The following measured values are assigned to the HART variables:

**Primary variable (PV)**

Level linearized (PV)

**Secondary variable (SV)**

Distance (SV)

**Tertiary variable (TV)**

Relative echo amplitude (TV)

**Quaternary variable (QV)**

Temperature (QV)

## 9 Commissioning and operation

### 9.1 Installation and function check

Perform the post-installation check and the post-connection check prior to commissioning.

#### 9.1.1 Post-installation check

- ☐ Is the device or cable undamaged (visual inspection)?
- ☐ Is the device adequately protected from wet conditions and direct sunlight?
- ☐ Is the device properly secured?

#### 9.1.2 Post-connection check

- ☐ Is the device or cable undamaged (visual inspection)?
- ☐ Do the mounted cables have adequate strain relief?
- ☐ Are the cable glands mounted and firmly tightened?
- ☐ Does the supply voltage match the specifications on the nameplate?
- ☐ No reverse polarity, is terminal assignment correct?

### 9.2 Commissioning via SmartBlue (App)

#### 9.2.1 Device requirements

Commissioning via SmartBlue is only possible if the device has Bluetooth capability (Bluetooth module installed at the factory prior to delivery or retrofitted).

#### 9.2.2 SmartBlue system requirements

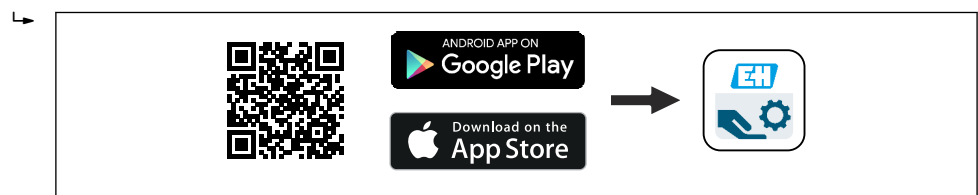
##### SmartBlue system requirements

SmartBlue is available as a download from the Google Play Store for Android devices and from the iTunes Store for iOS devices.

- Devices with iOS:  
iPhone 4S or higher from iOS 9; iPad 2 or higher from iOS 9; iPod touch 5th generation or higher from iOS 9
- Devices with Android:  
From Android 4.4 KitKat and *Bluetooth*® 4.0

#### 9.2.3 SmartBlue App

1. Scan the QR code or enter "SmartBlue" in the search field of the App Store.



A0039186

27 Download link

2. Start SmartBlue.
3. Select device from livelist displayed.

4. Enter the login data:
    - ↳ User name: admin
    - Password: serial number of the device
  5. Tap the icons for more information.
-  After logging in for the first time, change the password!

### 9.2.4 Envelope curve display in SmartBlue

Envelope curves can be displayed and recorded in SmartBlue.

**In addition to the envelope curve, the following values are displayed:**

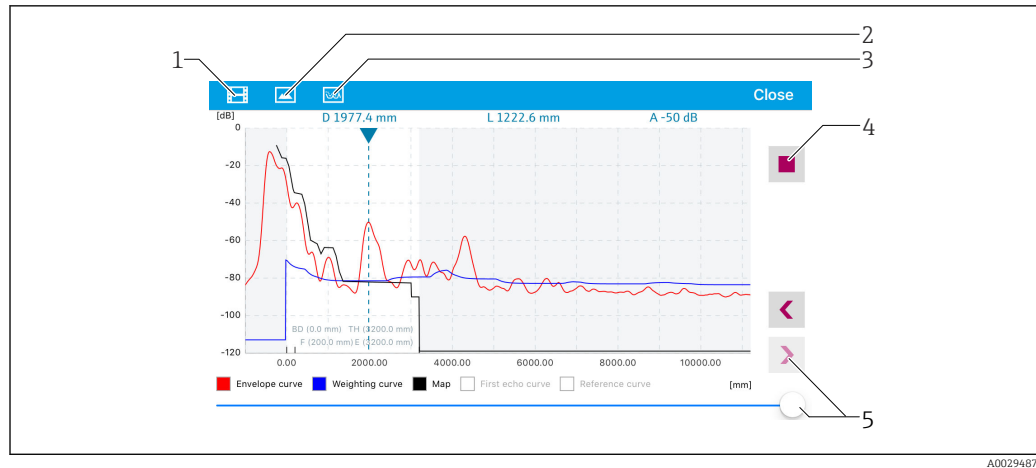
- D = Distance
- L = Level
- A = Absolute amplitude
- With screenshots, the displayed section (zoom function) is saved
- With video sequences, the whole area without zoom function is saved all the time



A0029486

 28 Envelope curve display (sample) in SmartBlue for Android

- 1 Record video
- 2 Create screenshot
- 3 Display mapping menu
- 4 Start/stop video recording
- 5 Move time on time axis

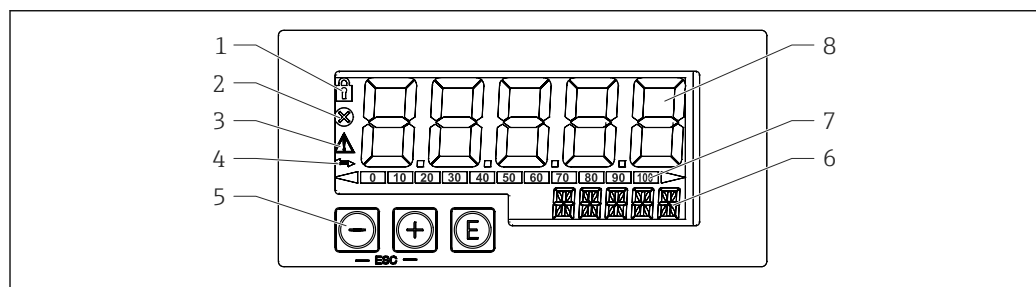


A0029487

29 Envelope curve display (sample) in SmartBlue for iOS

- 1 Record video
- 2 Create screenshot
- 3 Display mapping menu
- 4 Start/stop video recording
- 5 Move time on time axis

### 9.3 Operation and settings via RIA15



A0017719

30 Display and operating elements of the process indicator

- 1 Symbol: operating menu disabled
- 2 Symbol: error
- 3 Symbol: warning
- 4 Symbol: HART communication active
- 5 Operating keys
- 6 14-segment display for unit/TAG
- 7 Bar graph with indicators for under range and over range
- 8 5-digit 7-segment display for measured value, digit height 17 mm (0.67 in)

The device is operated using three operating keys on the front of the housing. The device setup can be disabled with a 4-digit user code. If the setup is disabled, a padlock symbol appears on the display when an operating parameter is selected.



Enter key; calling up the operating menu, confirming the option/setting parameters in the operating menu



Selecting and setting/changing values in the operating menu; pressing the '+' and '-' keys simultaneously takes the user back up a menu level. The configured value is not saved.

### 9.3.1 Operating functions

The operating functions of the process indicator are divided into the following menus. The individual parameters and settings are described in the "Commissioning" section.



If the operating menu is disabled by means of a user code, the individual menus and parameters can be displayed but not changed. To change a parameter, the user code must be entered. As the display unit can only display digits in the 7-segment display and not alphanumeric characters, the procedure for number parameters is different to that for text parameters. If the operating position contains only numbers as parameters, the operating position is displayed in the 14-segment display and the configured parameter is displayed in the 7-segment display. To edit, press the button and then enter the user code. If the operating position contains text parameters, only the operating position is initially displayed in the 14-segment display. If the button is pressed again, the configured parameter is displayed in the 14-segment display. To edit, press the button and then enter the user code.

#### Setup (SETUP)

Basic device settings

#### Diagnostics (DIAG)

Device information, display of error messages

#### Expert (EXPERT)

Expert settings for device setup. The Expert menu is protected from editing by an access code (default 0000).

### 9.3.2 Operating modes

The process indicator can be used in two different operating modes:

#### ■ 4 to 20 mA mode:

In this operating mode, the process indicator is incorporated into the 4 to 20 mA current loop and measures the transmitted current. The variable calculated based on the current value and range limits is displayed in digital form on the 5-digit LCD. In addition, the associated unit and a bar graph can be displayed. In this operating mode, the measured value corresponds to 0 to 100 %

#### ■ HART mode:

The indicator is powered via the current loop.

The device can be adjusted under the "Level" menu (see operating matrix). The measured value displayed corresponds to the distance measured or, if linearization is enabled, to a percentage value.

HART communication operates according to the master/slave principle.

In the HART loop, the process indicator has the option of functioning either as a primary master or as a secondary master (default). When it functions as a master, the device can read process values from the measuring device and display them.

In HART mode, the process indicator can display up to four device variables of a multivariable measuring device. These variables are referred to as the Primary Variable (PV), Secondary Variable (SV), Tertiary Variable (TV) and Quaternary Variable (QV).

These variables are placeholders for measured values that can be retrieved using HART communication.

 As a general rule, the sensor is a slave and transmits information only if a request has been made by the master. A HART loop can have a maximum of two HART masters at any one time. With these HART masters, a distinction is made between the primary master (e.g. the distributed control system) and the secondary master (e.g. handheld terminal for local operation of the measuring devices). The two masters in the loop/in the network cannot be masters of the same type, e.g. they cannot be two "secondary masters". If a third HART master is added to the network, one of the other masters must be disabled; otherwise a collision occurs in the network. If the process indicator (RIA15) is operating as a "secondary master", for example, and another "secondary master" (e.g. a handheld device) is added to the network, the device interrupts HART communication as soon as it detects the presence of another "secondary master". The display alternates between error message C970 "Multi master collision" and "- - -". A measured value is not displayed in this case. The device leaves the HART loop for 30 seconds and then tries to re-establish HART communication once again. Once the additional "secondary master" is removed from the network, the device continues communication and displays the measured values of the sensor/actuator once more.

### 9.3.3 Operating matrix

After power-up:

- Press the  key twice
  - ↳ The "Level" menu is then available

| MENU SETUP -> LEVEL |                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                            |
|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Parameters          | Values                                                                                                                                                                                                                                                                                                                                                                                       | Description                                                                                                                                                                                                                                                                                                                                                |
| UNIT                | m                                                                                                                                                                                                                                                                                                                                                                                            | Select the displayed unit                                                                                                                                                                                                                                                                                                                                  |
|                     | FT                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                            |
| EMPTY               | Numeric value 0 to 100 m, default 2 m                                                                                                                                                                                                                                                                                                                                                        | Empty calibration using keys  ,  , <br>Enter distance from process connection to min. level |
| FULL                | Numeric value 0.001 to 100 m, default 2 m                                                                                                                                                                                                                                                                                                                                                    | Empty calibration using keys  ,  , <br>Enter span from max. level to min. level             |
| DIST                | Measured value (measured distance)                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                            |
| MAP                 | DI OK                                                                                                                                                                                                                                                                                                                                                                                        | To be selected if the distance displayed matches the actual distance. The device then records a mapping.                                                                                                                                                                                                                                                   |
|                     | MAN                                                                                                                                                                                                                                                                                                                                                                                          | To be selected if the range of mapping is to be defined manually in the 'Mapping end point' parameter. A comparison between the distance displayed and the actual distance is not necessary in this case. Mapping becomes active after approx. 20 s.                                                                                                       |
|                     | DI UN                                                                                                                                                                                                                                                                                                                                                                                        | To be selected if the actual distance is unknown. No mapping is recorded.                                                                                                                                                                                                                                                                                  |
|                     | FACT                                                                                                                                                                                                                                                                                                                                                                                         | To be selected if the present mapping curve (if one exists) is to be deleted. The device returns to the "Confirm distance" parameter and a new mapping can be recorded.                                                                                                                                                                                    |
|                     |  The end point of the current mapping is not indicated in the RIA15. If a new mapping is performed ("DI OK" or "MAN"), the new mapping is superimposed on the existing mapping. In order to establish a defined state, perform a factory mapping ("FACT") if required. This deletes any previous mapping. |                                                                                                                                                                                                                                                                                                                                                            |

Using the following operating matrix, a display in percent can be set. To do this, select "Mode" parameter => 4-20 and "Unit" parameter => %

| MENU SETUP |                                                               |             |                                                                                                                                                                                                                                                       |
|------------|---------------------------------------------------------------|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Parameters | Values                                                        | visible at  | Description                                                                                                                                                                                                                                           |
| MODE       | <b>4-20</b><br>HART                                           |             | Select the operating mode for the indicator<br>4-20: The circuit's 4 to 20 mA signal is displayed<br>HART: Up to four HART variables (PV, SV, TV, QV) per sensor/actuator can be displayed in the loop.                                               |
| DECIM      | 0 DEC<br><b>1 DEC</b><br>2 DEC<br>3 DEC<br>4 DEC              | MODE = 4-20 | Number of decimal places for display                                                                                                                                                                                                                  |
| SC__4      | Numerical value<br>-19 999 to 99 999<br>Default: <b>0.0</b>   | MODE = 4-20 | 5-digit value (number of decimal places as configured under DECIM) for scaling the measured value<br>at 4 mA Example: SC__4 = 0.0 => 0.0 displayed for measuring current of 4 mA<br>The unit selected under UNIT is used to display the value.        |
| SC_20      | Numerical value<br>-19 999 to 99 999<br>Default: <b>100.0</b> | MODE = 4-20 | 5-digit value (number of decimal places as configured under DECIM) for scaling the measured value<br>at 20 mA Example: SC__20 = 100.0 => 100.0 displayed for measuring current of 20 mA<br>The unit selected under UNIT is used to display the value. |
| UNIT       | %<br>°C<br>°F<br>K<br>USER                                    | MODE = 4-20 | Use this function to select the unit for displaying the value. If "USER" is selected, a user-defined unit can be entered in the TEXT parameter.                                                                                                       |
| TEXT       | Customized text, 5-digit                                      | MODE = 4-20 | User-defined unit, only visible if the "USER" option has been selected under UNIT.                                                                                                                                                                    |

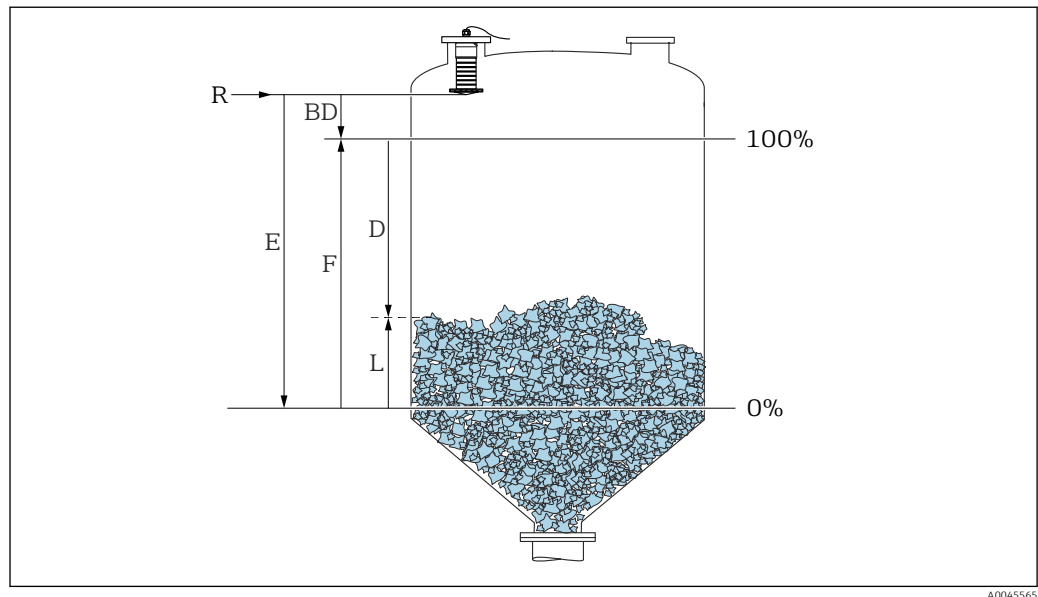


Any additional settings such as linearizations must be made using FieldCare, DeviceCare or SmartBlue



Additional information is available in the RIA15 Operating Instructions BA01170K

## 9.4 Configuring level measurement via operating software



31 Configuration parameters for level measurement in bulk solids

- R Reference point of measurement  
 D Distance  
 L Level  
 E Empty calibration (= zero point)  
 F Full calibration (= span)  
 BD Blocking distance

### 9.4.1 Via SmartBlue

1. Navigate to: Setup → Distance unit
  - ↳ Select unit of length for distance calculation
2. Navigate to: Setup → Empty calibration
  - ↳ Specify empty distance E (distance from reference point R to minimum level)
3. Navigate to: Setup → Full calibration
  - ↳ Specify full distance F (span: max. level - min. level)
4. Navigate to: Setup → Distance
  - ↳ Shows the distance D that is currently measured from the reference point (lower edge of flange / last sensor thread) to the level
5. Navigate to: Setup → Confirm distance
  - ↳ Compare the distance displayed with the actual value in order to start the recording of an interference echo map
6. Navigate to: Setup → Mapping end point
  - ↳ This parameter determines the distance up to which the new mapping is to be recorded
7. Navigate to: Setup → Present mapping
  - ↳ Displays the distance up to which a mapping has already been recorded
8. Setup → Confirm distance
9. Navigate to: Setup → Level
  - ↳ Shows the level L measured
10. Navigate to: Setup → Signal quality
  - ↳ Displays the signal quality of the analyzed level echo

### 9.4.2 Displaying level value as %

With the combination of Full calibration and Empty calibration and with an output signal of 4 to 20 mA, the level value for 4 mA (=empty) and the level value for 20 mA (=full) can be determined directly in the unit of length used.

A standardized signal that is proportionate to the level, e.g. 0 to 100 % level, can be calculated with Full calibration. In turn, the two basic values of 0 % and 100 % can be assigned directly to the analog output values 4 mA and 20 mA.

| X  | Level            | Y  | Output signal as % |
|----|------------------|----|--------------------|
| X1 | 0.00 m (0.00 ft) | Y1 | 0 %                |
| X2 | Value F (=Full)  | Y2 | 100 %              |

#### Configuration using DeviceCare or FieldCare

1. Navigate to: Setup → Advanced setup → Linearization type
  - ↳ Select table as the linearization type
2. Select linearization table
3. X1 = Specify level value in m / ft for 0 %
4. X2 = Specify level value in m / ft for 100 %
5. Confirm table as the linearization type

#### Configuration with SmartBlue

1. Navigate to: Main menu → Setup → Advanced setup → Linearization type
  - ↳ Select table as the linearization type
2. Select linearization table
3. X1 = Specify level value in m / ft for 0 %
4. X2 = Specify level value in m / ft for 100 %
5. Activate linearization table

## 9.5 Data access - Security

### 9.5.1 Software locking via access code in FieldCare / DeviceCare

The configuration data can be write-protected using an access code (software locking)

- Navigate to: Setup → Advanced setup → Administration → Define access code → Confirm access code

You must enter an access code that is different from the last access code and "0000"

-  The access code is only active if a different (wrong) code is entered or the device is deenergized.
- Once the access code has been defined, write-protected devices can only be switched to maintenance mode if the access code is entered in the **Enter access code** parameter. If the factory setting is not changed or if "0000" is entered, the device is in maintenance mode and its configuration data are therefore **not** write-protected and can be changed at any time.

### 9.5.2 Unlocking via FieldCare / DeviceCare

- Navigate to: Setup → Advanced setup → Enter access code

### 9.5.3 Software locking via access code in SmartBlue

The configuration data can be write-protected using an access code (software locking).

- ▶ Navigate to: Setup → Advanced setup → Administration → Administration1 → Define access code → Confirm access code

The new access code must differ from the last access code used and may not be "0000".

-  The access code is only active if a different (wrong) code is entered or the device is deenergized.
- Once the access code has been defined, write-protected devices can only be switched to maintenance mode if the access code is entered in the **Enter access code** parameter. If the factory setting is not changed or if "0000" is entered, the device is in maintenance mode and its configuration data are therefore **not** write-protected and can be changed at any time.

### 9.5.4 Unlocking via SmartBlue

- ▶ Navigate to: Setup → Advanced setup → Access status tooling → Enter access code

### 9.5.5 Bluetooth® wireless technology

**Signal transmission via Bluetooth® wireless technology uses a cryptographic technique tested by the Fraunhofer Institute**

- The device is not visible via *Bluetooth*® wireless technology without the SmartBlue app
- Only one point-to-point connection between **one** sensor and **one** smartphone or tablet is established
- The *Bluetooth*® wireless technology interface can be disabled via SmartBlue, FieldCare and DeviceCare

#### Disabling the Bluetooth® wireless technology interface

- ▶ Navigate to: Setup → Communication → Bluetooth configuration → Bluetooth mode
  - ↳ Switch off the *Bluetooth*® wireless technology interface. "Off" position disables remote access via app

#### Re-enabling the Bluetooth® wireless technology interface

If the *Bluetooth*® wireless technology interface has been disabled, it can be re-enabled via FieldCare / DeviceCare at any time

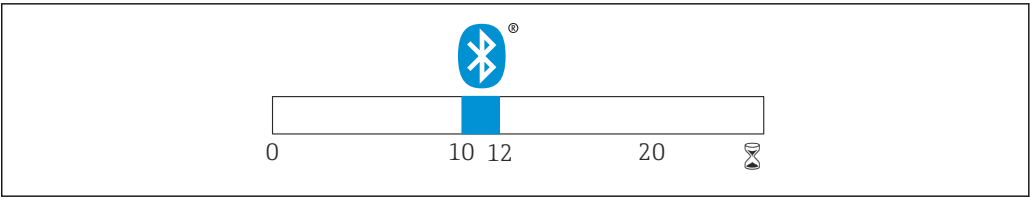
The *Bluetooth*® wireless technology interface is restarted 10 minutes after the device is switched on.

- ▶ Navigate to: Setup → Communication → Bluetooth configuration → Bluetooth mode
  - ↳ Switch on the *Bluetooth*® wireless technology interface. "On" position enables remote access via app

#### *Bluetooth recovery sequence*

The *Bluetooth*® wireless technology interface can be re-enabled after performing the following recovery sequence:

1. Connect device to voltage supply
  - ↳ After a waiting time of 10 minutes, a time window of 2 minutes opens
2. You can re-enable the *Bluetooth*® wireless technology interface of the device using the SmartBlue (app) during this time window
3. Navigate to: Setup → Communication → Bluetooth configuration → Bluetooth mode
  - ↳ Switch on the *Bluetooth*® wireless technology interface. "On" position enables remote access via app



A0028411

32 Timeline for Bluetooth wireless technology recovery sequence, time in minutes

9.5.6 RIA15 locking

The device setup can be locked with a 4-digit user code

 Additional information is available in the Operating Instructions for the RIA15

## 10 Diagnostics and troubleshooting

### 10.1 General errors

| Error                                        | Possible cause                                                   | Solution                                                                                                                                                                                |
|----------------------------------------------|------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Device does not respond                      | Supply voltage does not match the specification on the nameplate | Apply correct voltage                                                                                                                                                                   |
|                                              | The polarity of the supply voltage is wrong                      | Correct the polarity                                                                                                                                                                    |
|                                              | The cables do not contact the terminals properly                 | Ensure electrical contact between the cable and the terminal                                                                                                                            |
| HART communication does not function         | Communication resistor missing or incorrectly installed          | Install the communication resistor (250 Ω) correctly                                                                                                                                    |
|                                              | Commubox is connected incorrectly                                | Connect Commubox correctly                                                                                                                                                              |
|                                              | The communication resistor of the Commubox is switched on or off | Check the communication resistor and connections<br> For details, see Technical Information TI00404F |
| Device measures incorrectly                  | Configuration error                                              | <ul style="list-style-type: none"> <li>Check and correct the parameter configuration</li> <li>Carry out mapping</li> </ul>                                                              |
| Display values not plausible (linearization) | SmartBlue and FieldCare/DeviceCare active at the same time       | Log off FieldCare/DeviceCare and disconnect or<br>Log off SmartBlue and disconnect (connection via SmartBlue has priority)                                                              |
| Linearized output value not plausible        | Linearization error                                              | SmartBlue: Check linearization table<br>FieldCare/DeviceCare: Check linearization table<br>Check the vessel selection in the linearization module                                       |
| RIA15 no display                             | The polarity of the supply voltage is wrong                      | Correct the polarity                                                                                                                                                                    |
|                                              | The cables do not contact the terminals properly                 | Ensure electrical contact between the cable and the terminal                                                                                                                            |
|                                              | RIA15 defective                                                  | Replace RIA15                                                                                                                                                                           |
| RIA15 start sequence keeps running through   | Supply voltage too low                                           | <ul style="list-style-type: none"> <li>Increase supply voltage</li> <li>Switch off backlight</li> </ul>                                                                                 |

### 10.2 Error - SmartBlue operation

| Error                                  | Possible cause                                                 | Solution                                                                                             |
|----------------------------------------|----------------------------------------------------------------|------------------------------------------------------------------------------------------------------|
| Device is not visible in the live list | No Bluetooth connection                                        | Enable Bluetooth function on smartphone or tablet                                                    |
|                                        |                                                                | Bluetooth function of sensor disabled, perform recovery sequence                                     |
| Device is not visible in the live list | The device is already connected with another smartphone/tablet | Only <b>one</b> point-to-point connection is established between a sensor and a smartphone or tablet |

| Error                                                                   | Possible cause                                        | Solution                                                                                                                                                                                                                                                                                                                                       |
|-------------------------------------------------------------------------|-------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Device is visible in the live list but cannot be accessed via SmartBlue | Android end device                                    | Is the location function permitted for the app, was it approved the first time?                                                                                                                                                                                                                                                                |
|                                                                         |                                                       | GPS or positioning function must be activated for certain Android versions in conjunction with Bluetooth                                                                                                                                                                                                                                       |
|                                                                         |                                                       | Activate GPS - close the app fully and restart - enable the positioning function for the app                                                                                                                                                                                                                                                   |
| Device is visible in the live list but cannot be accessed via SmartBlue | Apple end device                                      | Log in as standard<br>Enter user name "admin"<br>Enter initial password (device serial number) paying attention to lower/upper case                                                                                                                                                                                                            |
| Login via SmartBlue not possible                                        | Device is being put into operation for the first time | Enter initial password (device serial number) and change. Pay attention to lower/upper case when entering the serial number.                                                                                                                                                                                                                   |
| Device cannot be operated via SmartBlue                                 | Incorrect password entered                            | Enter correct password                                                                                                                                                                                                                                                                                                                         |
| Device cannot be operated via SmartBlue                                 | Password forgotten                                    | Contact the Endress+Hauser Service department                                                                                                                                                                                                                                                                                                  |
| Device cannot be operated via SmartBlue                                 | The sensor temperature is too high                    | If the ambient temperature results in an elevated sensor temperature of >60 °C (140 °F), Bluetooth communication may be disabled.<br>Shield the device, isolate it and cool it down if necessary.                                                                                                                                              |
| TAG in SmartBlue and HART do not match                                  | System-related                                        | The device ID (TAG) is transferred to the live list via Bluetooth® to facilitate device identification. The tag is abbreviated in the middle since the HART tag can be up to 32 characters long but Bluetooth® can only use 29 characters as the device name:<br>e.g: "FMR20N12345678901234567890123456" becomes "FMR20N12345678~567890123456" |

### 10.3 Diagnostic event in the operating tool

If a diagnostic event is present in the device, the status signal appears in the top left status area of the operating tool along with the corresponding symbol for the event level in accordance with NAMUR NE 107:

- Failure (F)
- Function check (C)
- Out of specification (S)
- Maintenance required (M)

#### Calling up remedial measures

- Navigate to the **Diagnostics** menu
  - ↳ In the **Actual diagnostics** parameter the diagnostic event is shown with event text

### 10.4 Diagnostic event in the RIA15

A diagnostic event of the FMR20 is not directly shown in the RIA15. The fault F911 only appears directly on the RIA15 in the event of an FMR20 alarm.

#### Displaying a FMR20 diagnostic event in the RIA15

1. Navigate to: DIAG/TERR
2. Press 
3. Press 
4. Press 

5. Press  3 times
6. Press 
  - ↳ The diagnostic event from the FMR20 is shown on the RIA15 display.

## 10.5 List of diagnostic events

| Diagnostic number                  | Short text                  | Remedy instructions                                                                                       | Status signal [from the factory] | Diagnostic behavior [from the factory] |
|------------------------------------|-----------------------------|-----------------------------------------------------------------------------------------------------------|----------------------------------|----------------------------------------|
| <b>Diagnostic of electronic</b>    |                             |                                                                                                           |                                  |                                        |
| 270                                | Main electronic failure     | Exchange device                                                                                           | F                                | Alarm                                  |
| 271                                | Main electronic failure     | 1. Restart device<br>2. If failure remains, exchange device.                                              | F                                | Alarm                                  |
| 272                                | Main electronic failure     | 1. Restart device<br>2. Check enviroment for strong EMC fields<br>3. If failure remains, exchange device. | F                                | Alarm                                  |
| 283                                | Memory content              | 1. Transfer data or reset device<br>2. Contact service                                                    | F                                | Alarm                                  |
| <b>Diagnostic of configuration</b> |                             |                                                                                                           |                                  |                                        |
| 410                                | Data transfer               | 1. Check connection<br>2. Retry data transfer                                                             | F                                | Alarm                                  |
| 411                                | Up-/download active         | Up-/download active, please wait                                                                          | C                                | Warning                                |
| 435                                | Linearization               | Check linearization table                                                                                 | F                                | Alarm                                  |
| 438                                | Dataset                     | 1. Check data set file<br>2. Check device configuration<br>3. Up- and download new configuration          | M                                | Warning                                |
| 441                                | Current output 1            | 1. Check process<br>2. Check current output settings                                                      | S                                | Warning                                |
| 491                                | Current output 1 simulation | Deactivate simulation                                                                                     | C                                | Warning                                |
| 585                                | Simulation distance         | Deactivate simulation                                                                                     | C                                | Warning                                |
| 586                                | Record map                  | Recording of mapping please wait                                                                          | C                                | Warning                                |
| <b>Diagnostic of process</b>       |                             |                                                                                                           |                                  |                                        |
| 801                                | Energy too low              | Increase supply voltage                                                                                   | S                                | Warning                                |
| 825                                | Operating temperature       | 1. Check ambient temperature<br>2. Check process temperature                                              | S                                | Warning                                |
| 941                                | Echo lost                   | Check parameter 'Evaluation sensitivity'                                                                  | S                                | Warning                                |
| 941                                | Echo lost                   |                                                                                                           | F                                | Alarm                                  |

## 10.6 Overview of information events

| Info number | Info name         |
|-------------|-------------------|
| I1000       | ----- (Device ok) |

## 11 Maintenance

No special maintenance work is required.

### 11.1 Cleaning the antenna

The antenna may become contaminated depending on the application. Emission and reception of microwaves can thus be potentially hindered. The level of contamination leading to an error depends on the medium and on the reflectivity, mainly determined by the dielectric constant  $\epsilon_r$ .

If the medium tends to cause contamination and buildup, cleaning on a regular basis is recommended.

- ▶ Care must be taken to ensure the device is not damaged in the process of mechanical or hose-down cleaning.
- ▶ Material compatibility must be taken into account if cleaning agents are used!
- ▶ Do not exceed maximum permitted temperatures.

### 11.2 Process seals

The process seals of the sensor (at the process connection) should be replaced periodically. The interval between changes depends on the frequency of the cleaning cycles, the cleaning temperature and the medium temperature.

## 12 Repair

### 12.1 General notes

#### 12.1.1 Repair concept

The Endress+Hauser repair concept is devised in such a way that repairs can only be carried out through device replacement.

#### 12.1.2 Replacing a device

After the device has been replaced, the parameters can be uploaded to the device via FieldCare/DeviceCare.

Condition: The configuration of the old device must have been saved using FieldCare / DeviceCare.

You can continue measuring without performing a new calibration. Only interference echo suppression may need to be carried out once again.

#### 12.1.3 Return

The requirements for safe device return can vary depending on the device type and national legislation.

1. Refer to the website for more information:  
<http://www.endress.com/support/return-material>
2. Return the device if repairs or a factory calibration are required, or if the wrong device was ordered or delivered.

#### 12.1.4 Disposal



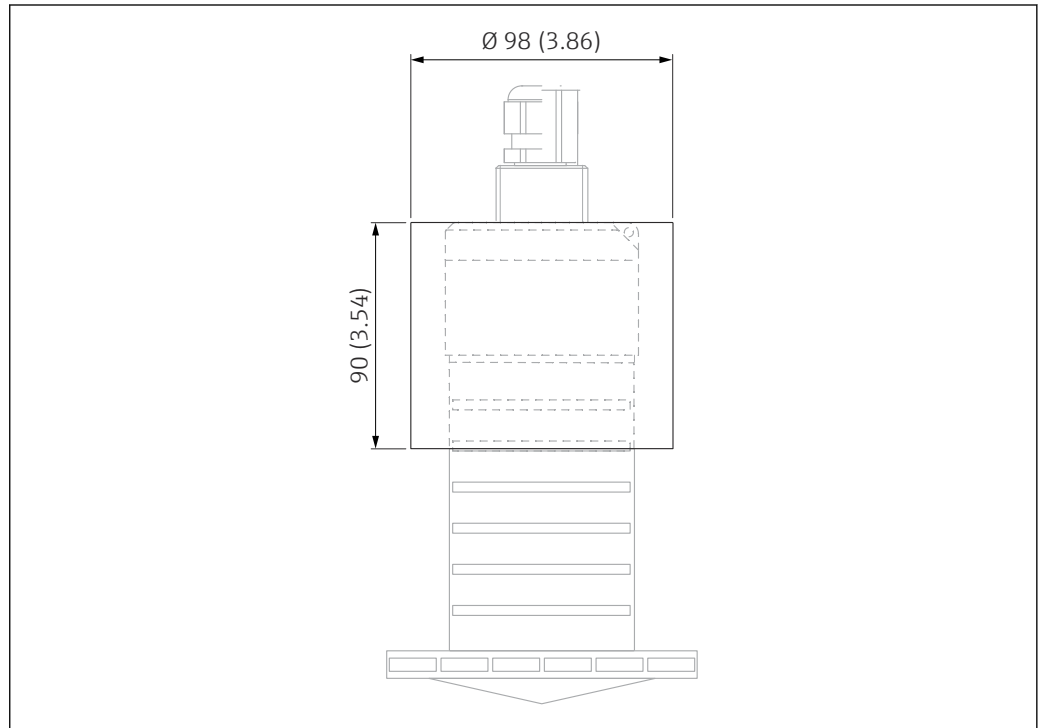
If required by the Directive 2012/19/EU on waste electrical and electronic equipment (WEEE), the product is marked with the depicted symbol in order to minimize the disposal of WEEE as unsorted municipal waste. Do not dispose of products bearing this marking as unsorted municipal waste. Instead, return them to Endress+Hauser for disposal under the applicable conditions.

## 13 Accessories

### 13.1 Device-specific accessories

#### 13.1.1 Weather protection cover

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



33 Dimensions of weather protection cover, engineering unit: mm (in)

#### Material

PVDF

#### Order number

52025686

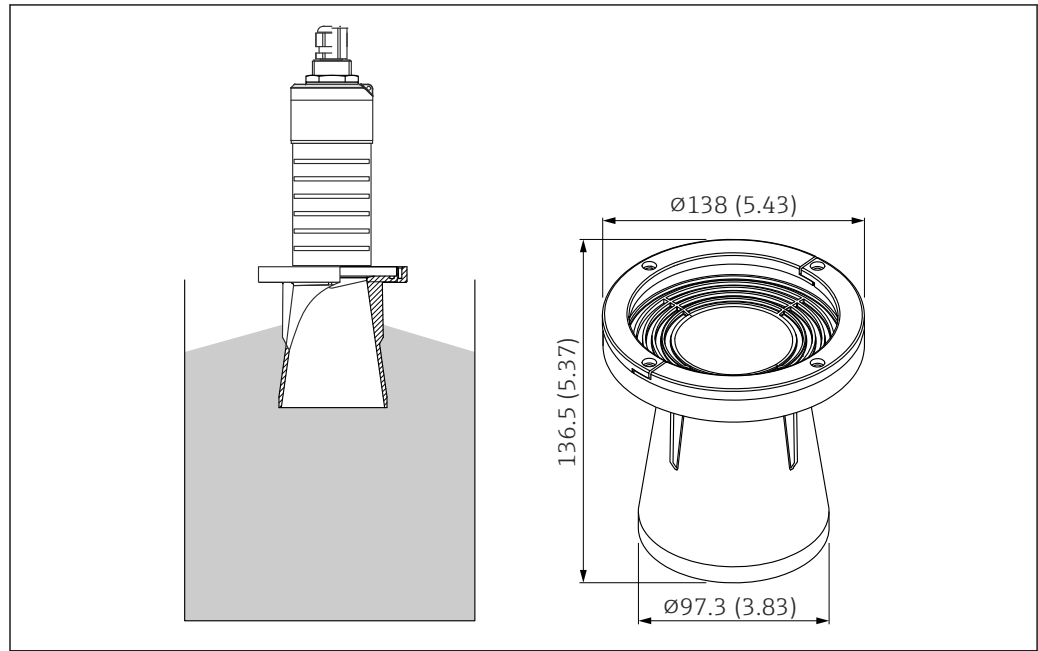


The sensor is not completely covered by the weather protection cover.

### 13.1.2 Flooding protection tube 80 mm (3 in)

Suitable for use with devices with a 80 mm (3 in) antenna and "Mounting customer side w/o flange" process connection.

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



A0045346

34 Dimensions of flooding protection tube 80 mm (3 in), engineering unit: mm (in)

**Material**

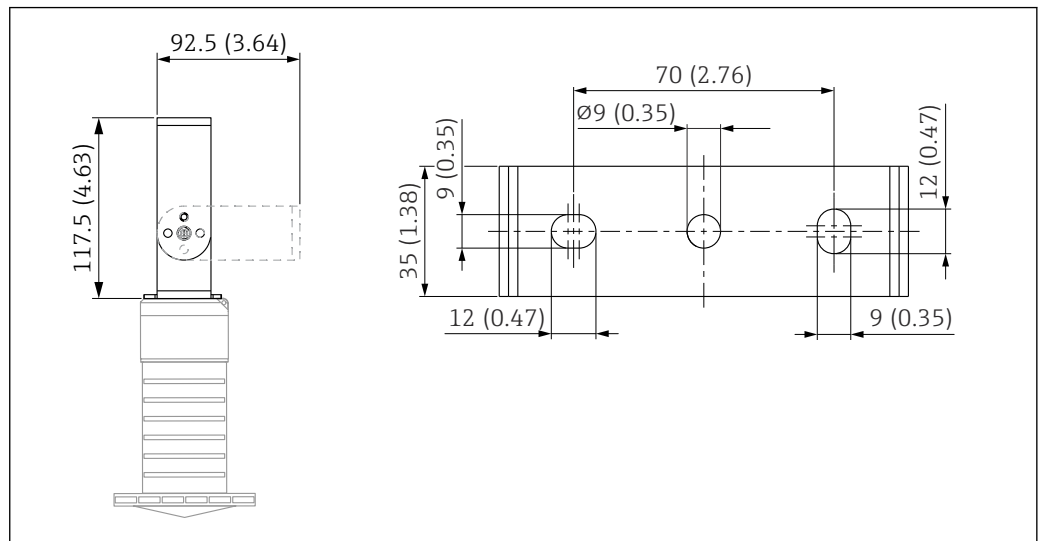
PBT-PC, metalized

**Order number**

71327051

### 13.1.3 Mounting bracket, adjustable

The mounting bracket can be ordered together with the device via the product structure "Accessory enclosed".



35 Dimensions of mounting bracket, engineering unit: mm (in)

Consists of:

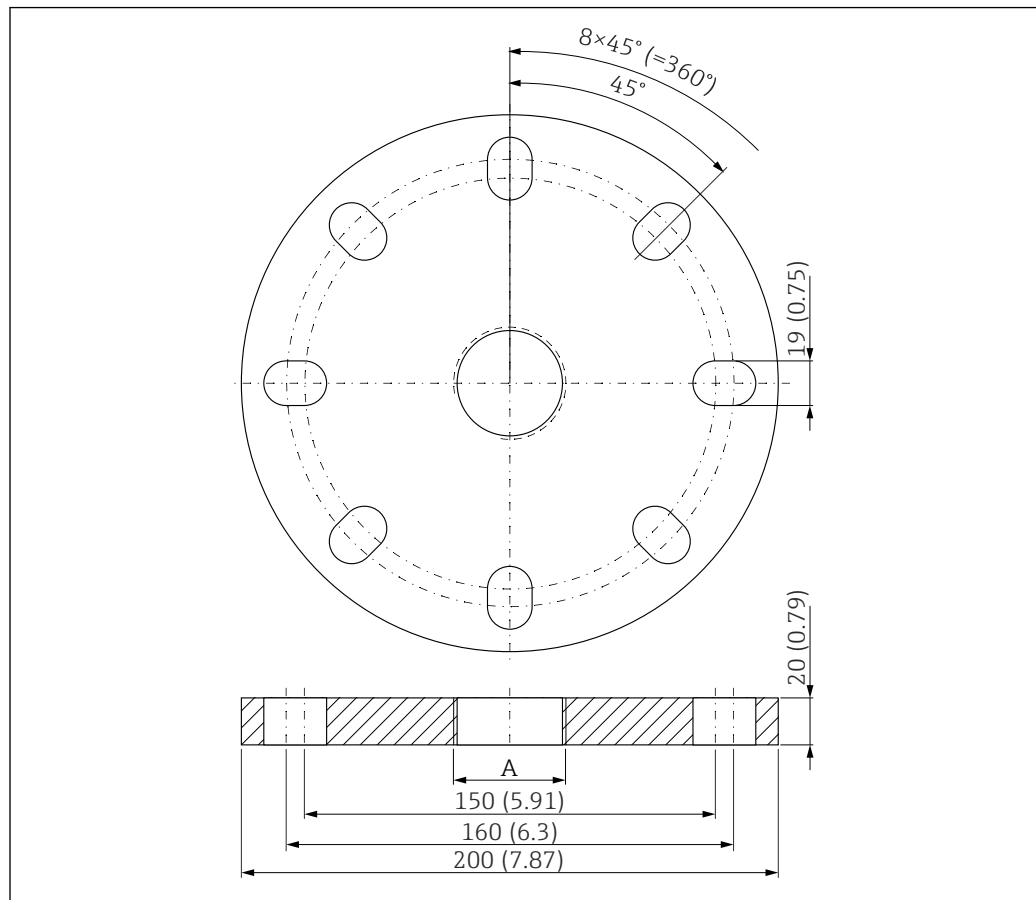
- 1 × mounting bracket, 316L (1.4404)
- 1 × angle bracket, 316L (1.4404)
- 3 × screws, A4
- 3 × securing disks, A4

**Order number**

71325079

### 13.1.4 UNI flange 3"/DN80/80, PP

The UNI flange 3"/DN80/80 can be ordered together with the device via the product structure "Accessory enclosed".



A0037947

36 Dimensions of UNI flange 3"/DN80/80, engineering unit: mm (in)

A Sensor connection in accordance with product structure "Process connection on rear"

#### Material

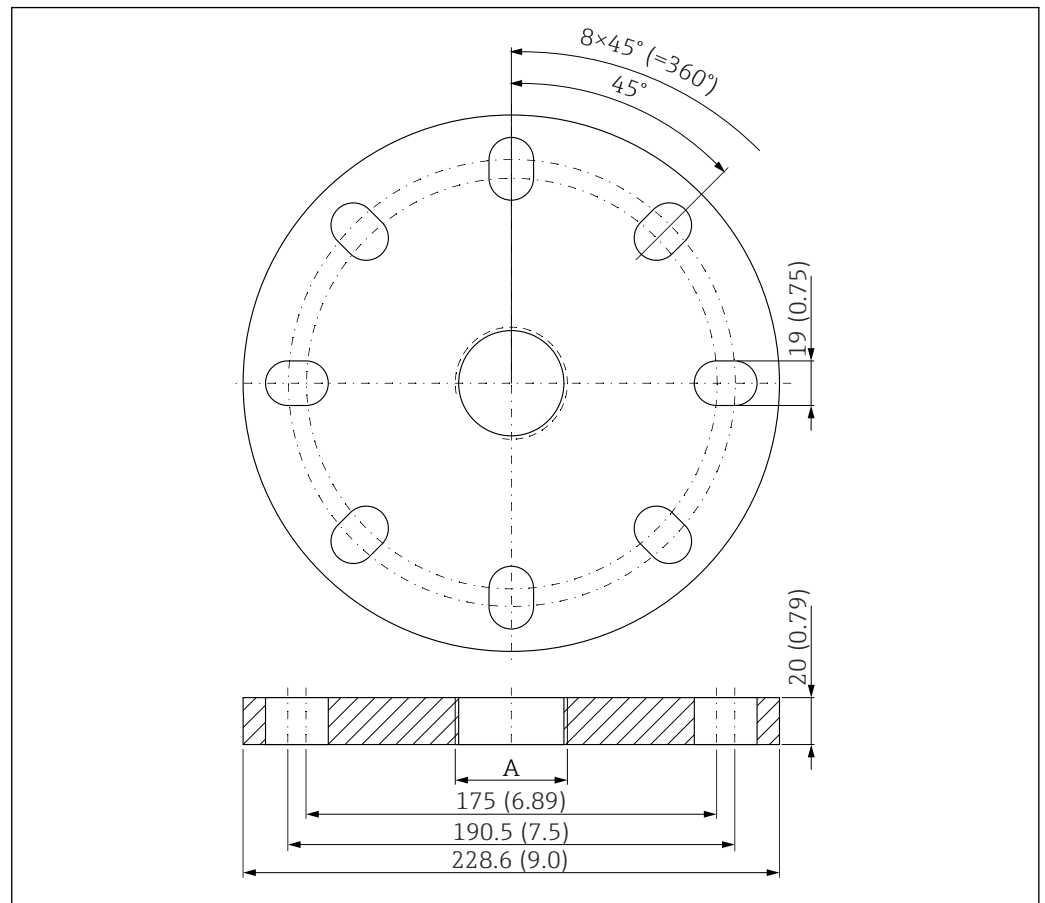
PP

#### Order number

FAX50-####

### 13.1.5 UNI flange 4"/DN100/100, PP

The UNI flange 4"/DN100/100 can be ordered together with the device via the product structure "Accessory enclosed".



37 Dimensions of UNI flange 4"/DN100/100, engineering unit: mm (in)

A Sensor connection in accordance with product structure "Process connection on rear"

#### Material

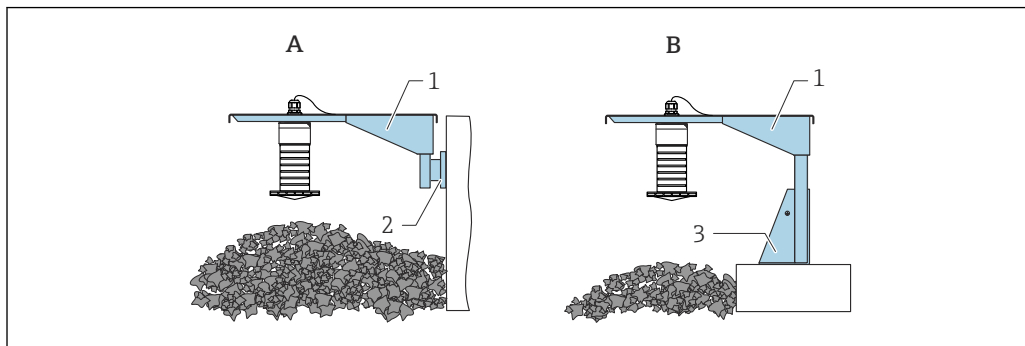
PP

#### Order number

FAX50-####

### 13.1.6 Cantilever, pivotable

#### Sensor installation

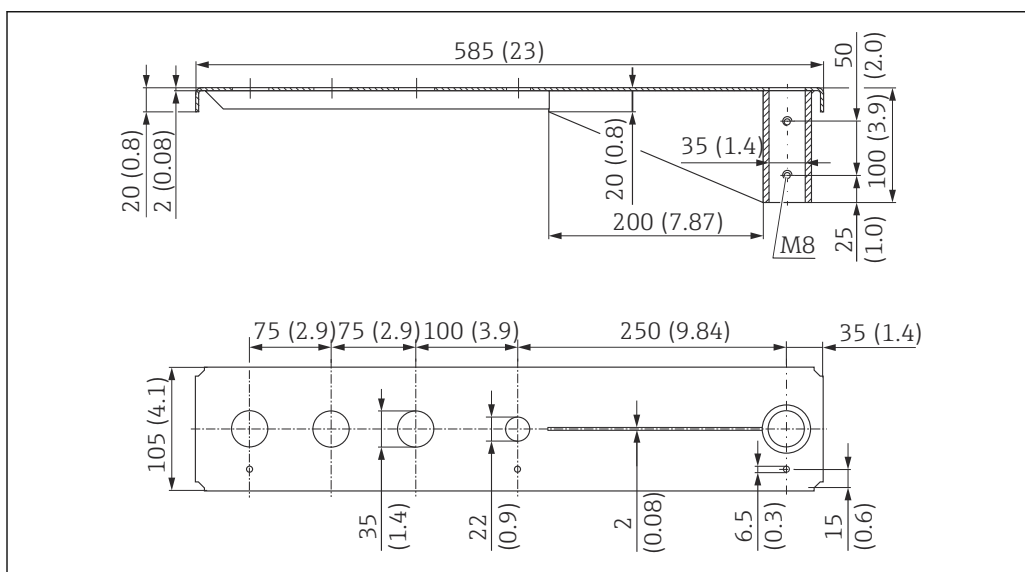


A0045347

38 Installation type sensor process connection rear side

- A Installation with cantilever and wall bracket  
 B Installation with cantilever and mounting frame  
 1 Cantilever  
 2 Wall bracket  
 3 Mounting frame

Cantilever arm 500 mm, for G 1" or MNPT 1" connections on rear



A0037806

39 Dimensions. Unit of measurement mm (in)

#### Weight:

3.0 kg (6.62 lb)

#### Material

316L (1.4404)

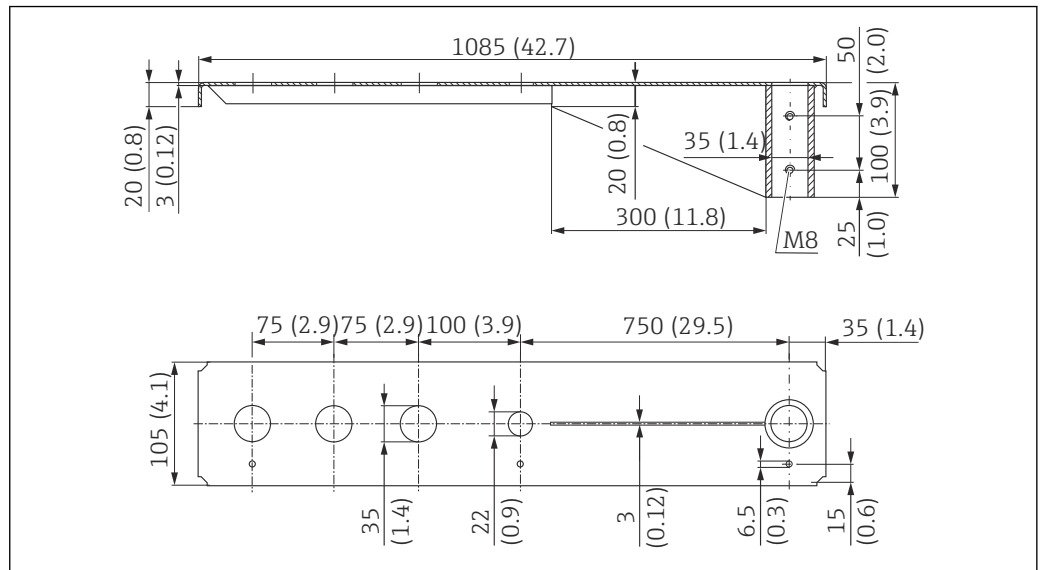
#### Order number

71452315



- 35 mm (1.38 in) openings for all G 1" or MNPT 1" connections on rear
- 22 mm (0.87 in) opening can be used for any additional sensor
- Retaining screws are included in delivery

*Cantilever arm 1 000 mm, for G 1" or MNPT 1" connections on rear*



40 Dimensions. Unit of measurement mm (in)

#### Weight:

5.4 kg (11.91 lb)

#### Material

316L (1.4404)

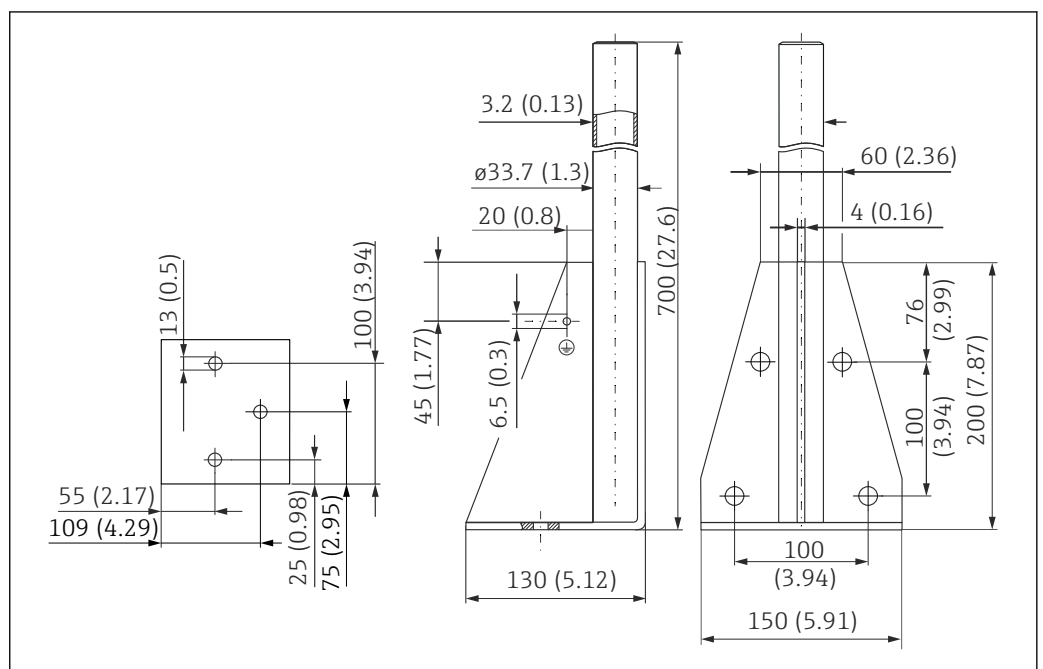
#### Order number

71452316



- 35 mm (1.38 in) openings for all G 1" or MNPT 1" connections on rear
- 22 mm (0.87 in) opening can be used for any additional sensor
- Retaining screws are included in delivery

#### Frame, 700 mm (27.6 in)



41 Dimensions. Unit of measurement mm (in)

**Weight:**

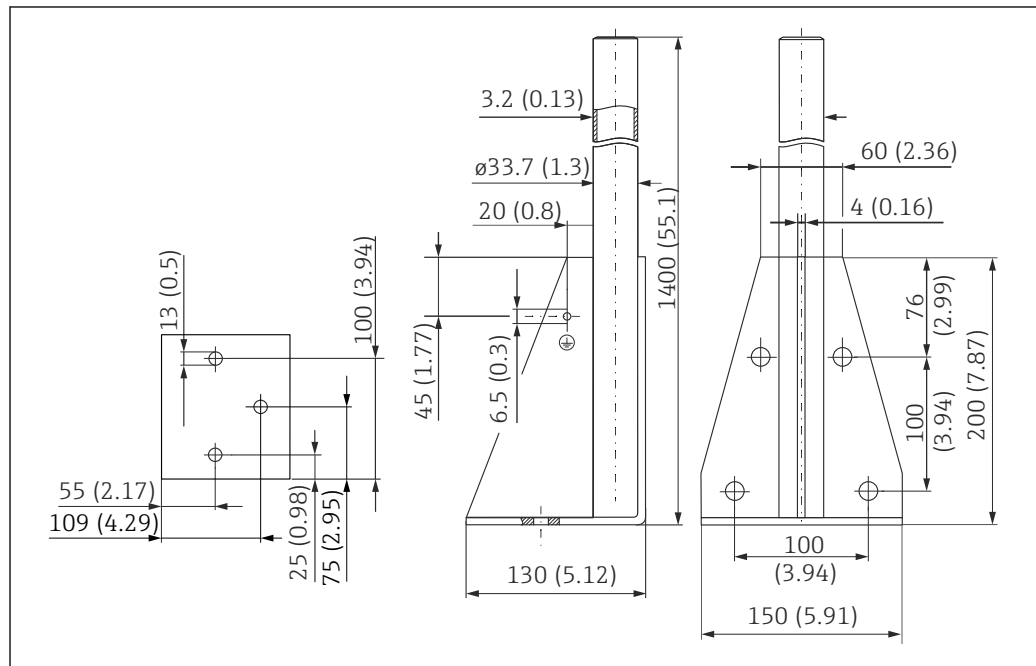
4.0 kg (8.82 lb)

**Material**

316L (1.4404)

**Order number**

71452327

**Frame, 1400 mm (55.1 in)**

A0037800

42 Dimensions. Unit of measurement mm (in)

**Weight:**

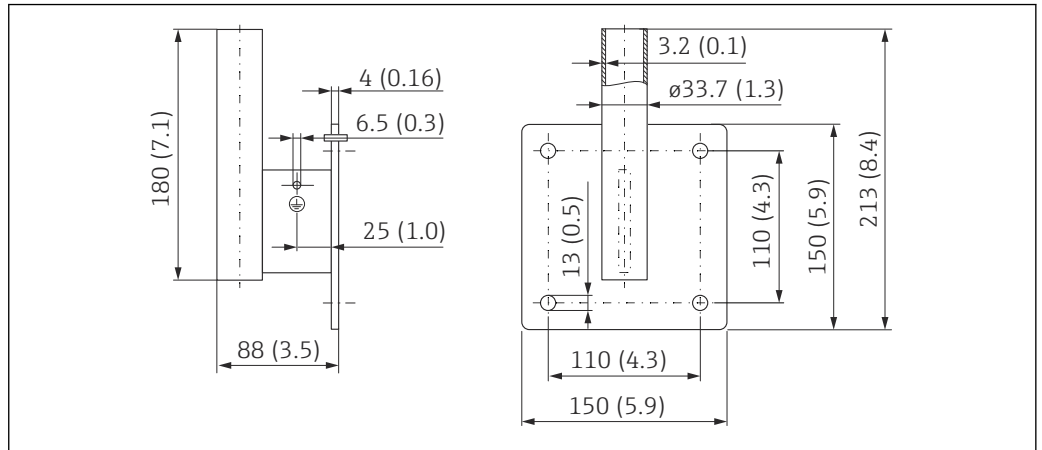
6.0 kg (13.23 lb)

**Material**

316L (1.4404)

**Order number**

71452326

**Wall bracket for cantilever with pivot**

A0019350

43 Dimensions of the wall bracket. Unit of measurement mm (in)

**Weight**

1.21 kg (2.67 lb)

**Material**

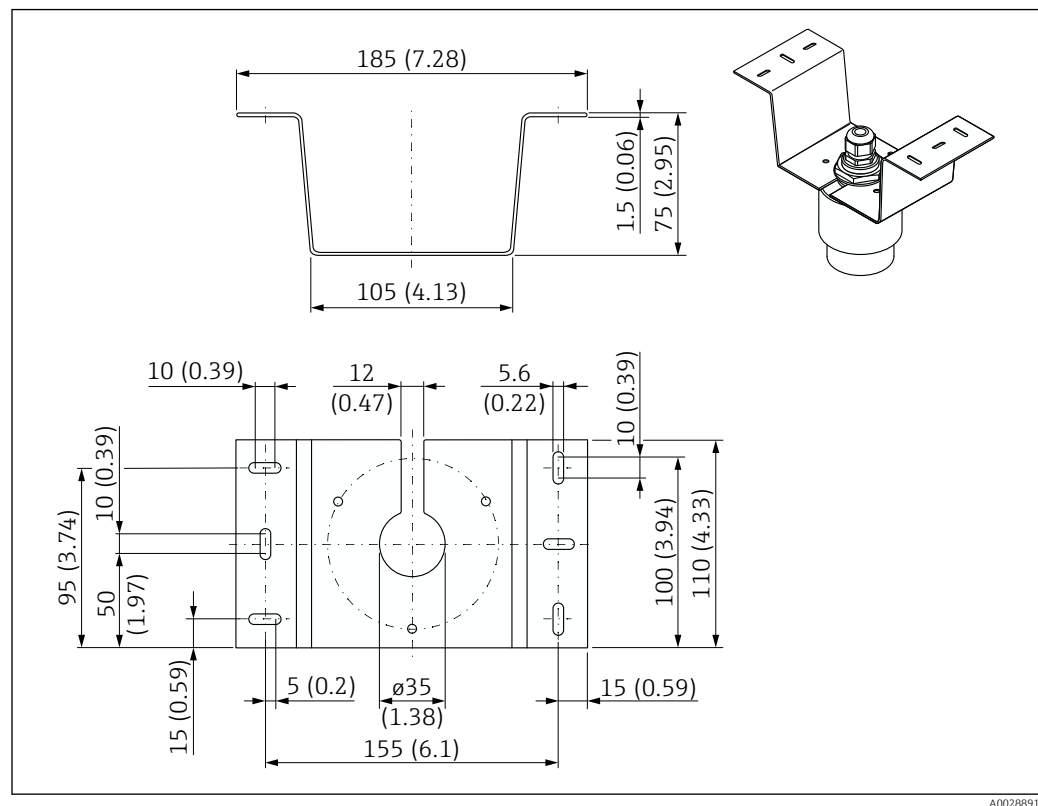
316L (1.4404)

**Order number**

71452323

### 13.1.7 Ceiling mounting bracket

The ceiling mounting bracket can be ordered together with the device via the product structure "Accessory enclosed".



 44 Dimensions of ceiling mounting bracket. Unit of measurement mm (in)

## Material

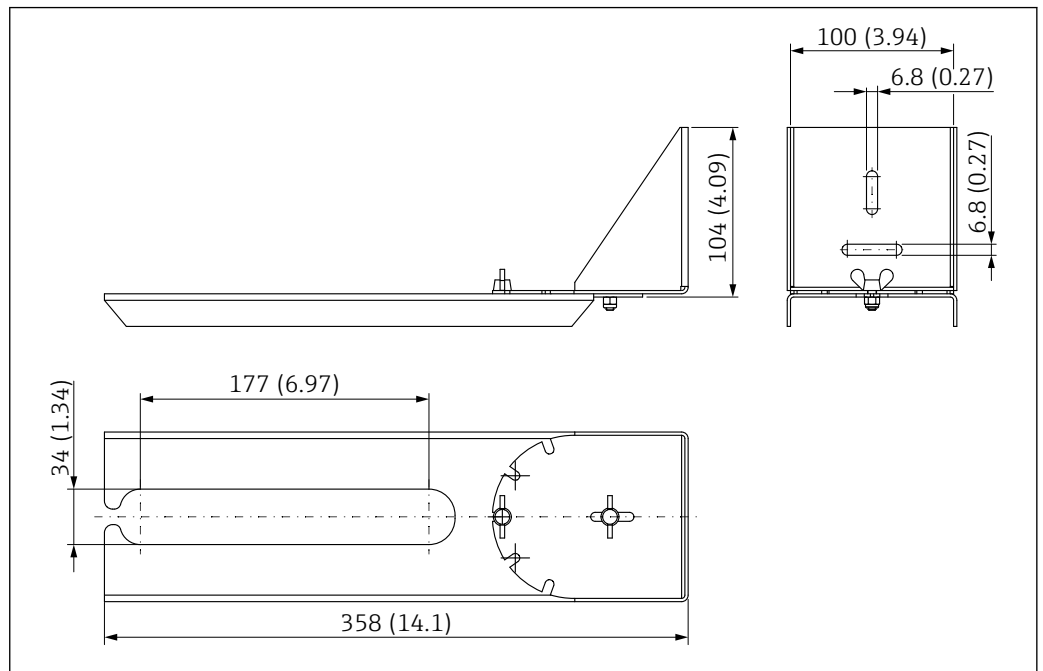
316L (1.4404)

## Order number

71093130

### 13.1.8 Pivotal mounting bracket

The mounting bracket can be ordered together with the device via the product structure "Accessory enclosed".



45 Dimensions of pivotal mounting bracket. Unit of measurement mm (in)

**Material**

316L (1.4404)

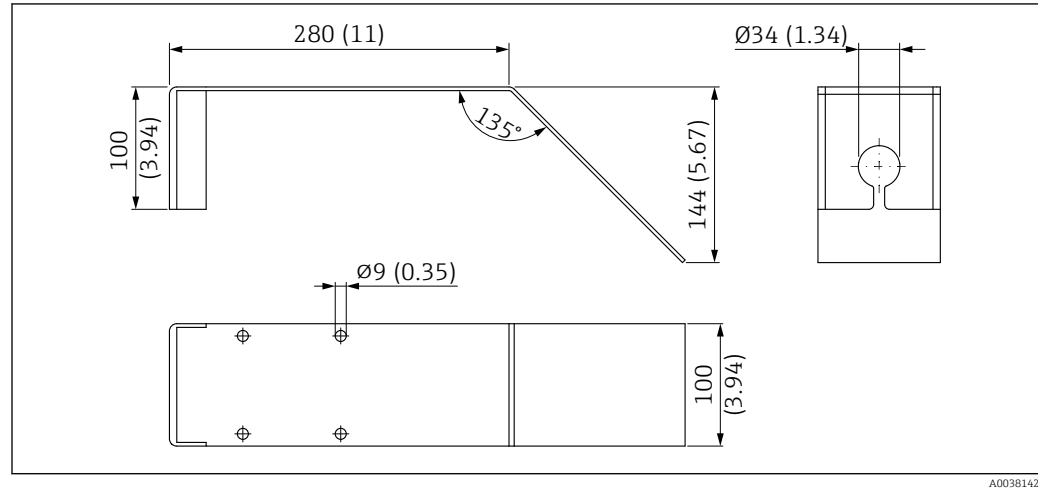
**Order number**

71429910

### 13.1.9 Horizontal mounting bracket

The horizontal mounting bracket is used to install the device in confined spaces.

The mounting bracket can be ordered together with the device via the product structure "Accessory enclosed".



46 Dimensions of the horizontal mounting bracket. Unit of measurement mm (in)

#### Material

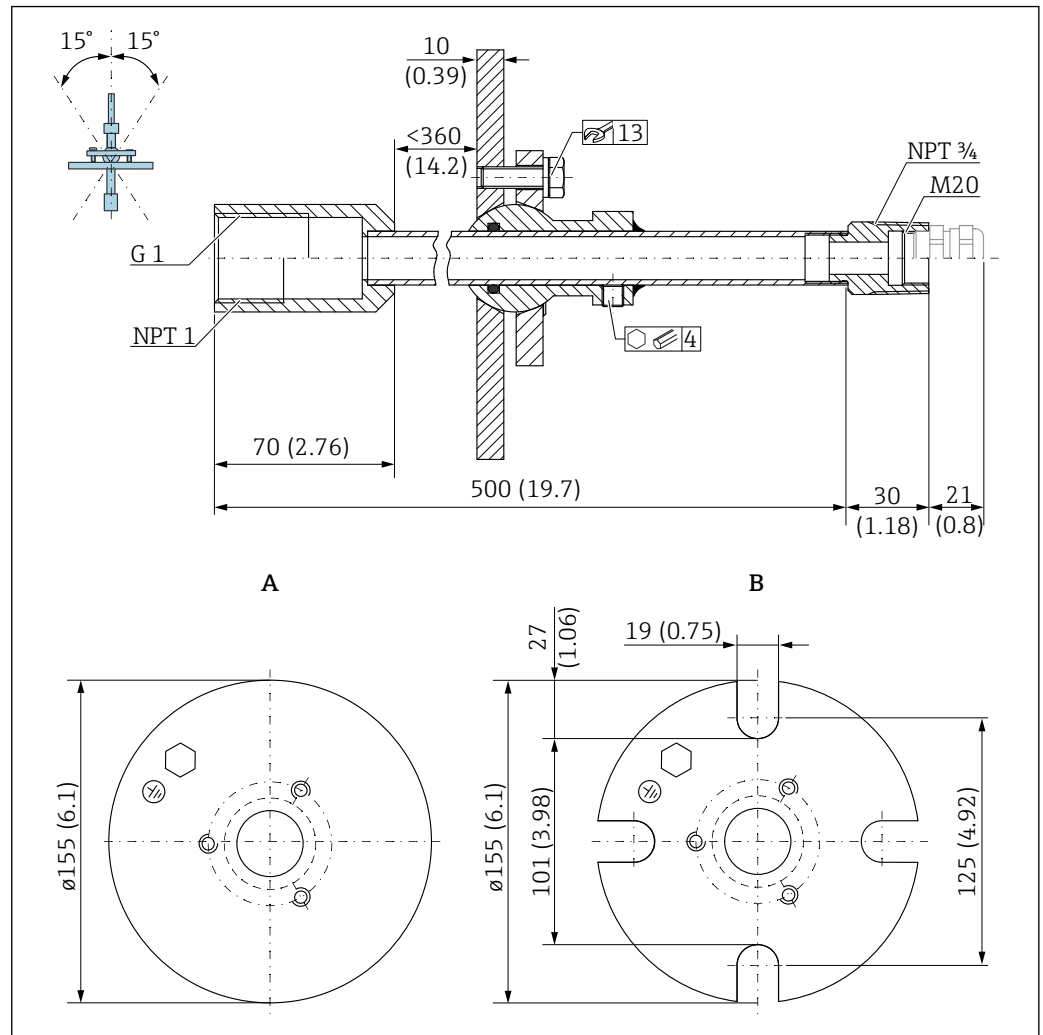
316L (1.4404)

#### Order number

71429905

### 13.1.10 FAU40 alignment unit

The alignment unit is used to optimally align the sensor with the bulk solids.



47 Dimensions. Unit of measurement mm (in)

A Welding flange

B UNI flange

#### Material

- Flange: 304
- Pipe: steel, galvanized
- Cable gland: 304 or steel, galvanized

#### Order number

FAU40-##

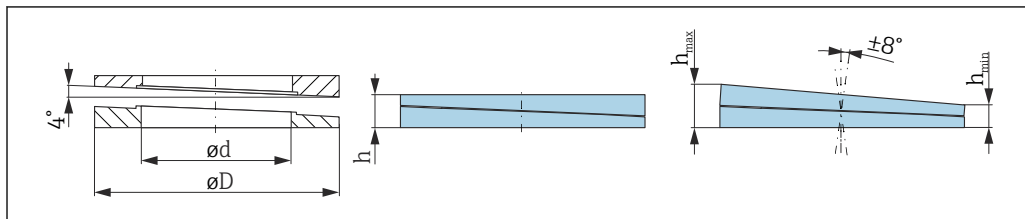
 Can be used for all rear sensor connections G1" or MNPT1, male thread, and connecting cable max. Ø10 mm (0.43 in), minimum length 600 mm (23.6 in).

 Technical Information TI00179F

### 13.1.11 Adjustable flange seal

The adjustable flange seal is used to align the FMR20

The adjustable flange seal can be ordered together with the device via the product structure "Accessory enclosed".

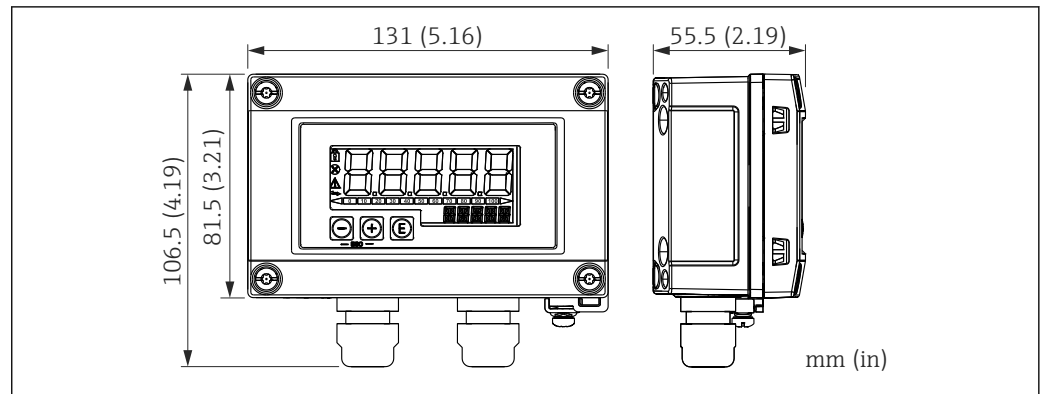


A0045324

48 Dimensions

| Technical data: version DN/JIS   |                                                                                       |                   |                                                                                       |
|----------------------------------|---------------------------------------------------------------------------------------|-------------------|---------------------------------------------------------------------------------------|
| Order number                     | 71074263                                                                              | 71074264          | 71074265                                                                              |
| Compatible with                  | DN80 PN10/40                                                                          | DN100 PN10/16     | <ul style="list-style-type: none"> <li>DN150 PN10/16</li> <li>JIS 10K 150A</li> </ul> |
| Recommended screw length         | 100 mm (3.9 in)                                                                       | 100 mm (3.9 in)   | 110 mm (4.3 in)                                                                       |
| Recommended screw size           | M14                                                                                   | M14               | M18                                                                                   |
| Material                         | EPDM                                                                                  |                   |                                                                                       |
| Process pressure                 | -0.1 to 0.1 bar (-1.45 to 1.45 psi)                                                   |                   |                                                                                       |
| Process temperature              | -40 to +80 °C (-40 to +176 °F)                                                        |                   |                                                                                       |
| D                                | 142 mm (5.59 in)                                                                      | 162 mm (6.38 in)  | 218 mm (8.58 in)                                                                      |
| d                                | 89 mm (3.5 in)                                                                        | 115 mm (4.53 in)  | 169 mm (6.65 in)                                                                      |
| h                                | 22 mm (0.87 in)                                                                       | 23.5 mm (0.93 in) | 26.5 mm (1.04 in)                                                                     |
| h <sub>min</sub>                 | 14 mm (0.55 in)                                                                       | 14 mm (0.55 in)   | 14 mm (0.55 in)                                                                       |
| h <sub>max</sub>                 | 30 mm (1.18 in)                                                                       | 33 mm (1.3 in)    | 39 mm (1.45 in)                                                                       |
| Technical data: version ASME/JIS |                                                                                       |                   |                                                                                       |
| Order number                     | 71249070                                                                              | 71249072          | 71249073                                                                              |
| Compatible with                  | <ul style="list-style-type: none"> <li>ASME 3" 150lbs</li> <li>JIS 80A 10K</li> </ul> | ASME 4" 150lbs    | ASME 6" 150lbs                                                                        |
| Recommended screw length         | 100 mm (3.9 in)                                                                       | 100 mm (3.9 in)   | 110 mm (4.3 in)                                                                       |
| Recommended screw size           | M14                                                                                   | M14               | M18                                                                                   |
| Material                         | EPDM                                                                                  |                   |                                                                                       |
| Process pressure                 | -0.1 to 0.1 bar (-1.45 to 1.45 psi)                                                   |                   |                                                                                       |
| Process temperature              | -40 to +80 °C (-40 to +176 °F)                                                        |                   |                                                                                       |
| D                                | 133 mm (5.2 in)                                                                       | 171 mm (6.7 in)   | 219 mm (8.6 in)                                                                       |
| d                                | 89 mm (3.5 in)                                                                        | 115 mm (4.53 in)  | 168 mm (6.6 in)                                                                       |
| h                                | 22 mm (0.87 in)                                                                       | 23.5 mm (0.93 in) | 26.5 mm (1.04 in)                                                                     |
| h <sub>min</sub>                 | 14 mm (0.55 in)                                                                       | 14 mm (0.55 in)   | 14 mm (0.55 in)                                                                       |
| h <sub>max</sub>                 | 30 mm (1.18 in)                                                                       | 33 mm (1.3 in)    | 39 mm (1.45 in)                                                                       |

### 13.1.12 RIA15 in the field housing



A0017722

49 Dimensions of RIA15 in field housing, engineering unit: mm (in)

**i** The RIA15 remote indicator can be ordered together with the device. Product structure, feature 620 "Accessories enclosed":

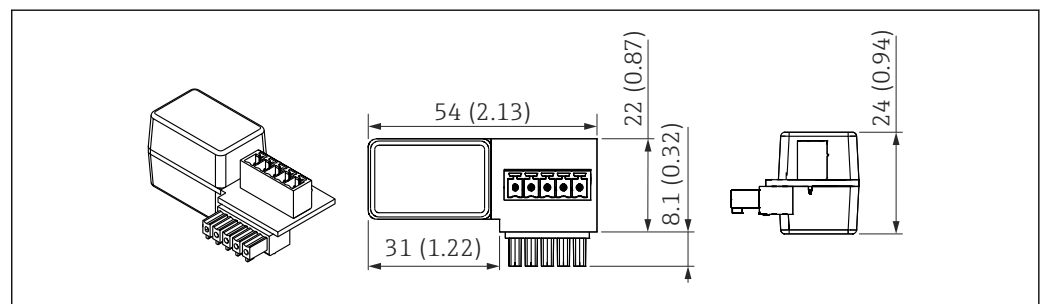
- Option R4 "Remote indicator RIA15 non-hazardous area, field housing"
- Option R5 "Remote indicator RIA15 Ex= explosion protection approval, field housing"

Field housing material: Plastic (PBT with steel fibers, antistatic)

Other housing versions are available via the RIA15 product structure.

**b** Alternatively available as an accessory, for details see Technical Information TI01043K and Operating Instructions BA01170K

### 13.1.13 HART communication resistor



A0020858

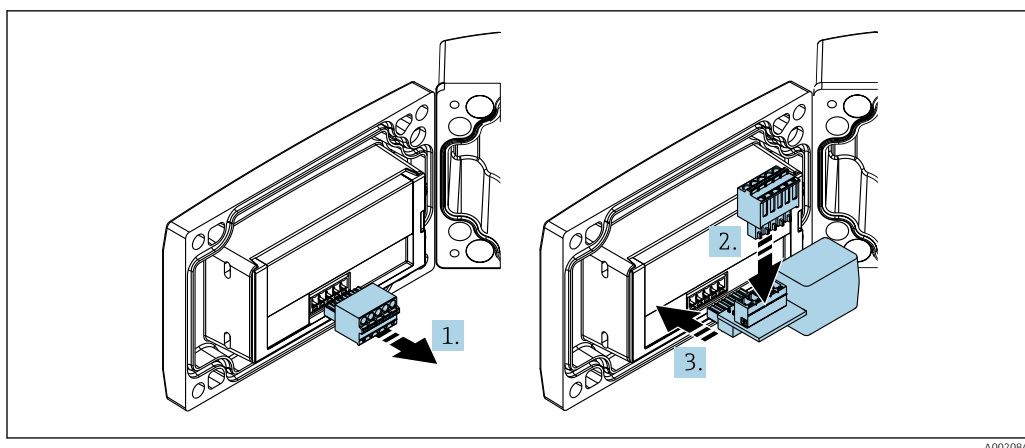
50 Dimensions of HART communication resistor, engineering unit: mm (in)

**i** A communication resistor is required for HART communication. If this is not already present (e.g. in the power supply RMA, RN221N, RNS221, ...), it can be ordered with the device via the product structure, feature 620 "Accessories enclosed": option R6 "HART communication resistor hazardous / non-hazardous area".

Alternatively, it is available as an accessory; order number "RK01-BC"

**b** Alternatively available as an accessory, for details see Technical Information TI01043K and Operating Instructions BA01170K

The HART communication resistor is specially designed for use with the RIA15 and can be attached easily.



1. Disconnect plug-in terminal block.
2. Insert the terminal block into the slot provided on the HART communication resistor module.
3. Insert the HART communication resistor in the slot in the housing.

## 13.2 Communication-specific accessories

### Commubox FXA195 HART

For intrinsically safe HART communication with FieldCare / DeviceCare via the USB interface.



For details, see Technical Information TI00404F

### 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

## 13.3 Service-specific accessories

### Applicator

Software for selecting and sizing Endress+Hauser measuring devices:

- Calculation of all the necessary data for identifying the optimum measuring device: e.g. pressure loss, accuracy or process connections.
- Graphic illustration of the calculation results

Administration, documentation and access to all project-related data and parameters over the entire life cycle of a project.

Applicator is available:

<https://portal.endress.com/webapp/applicator>

### Configurator

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

The Configurator is available on the Endress+Hauser website: [www.endress.com](http://www.endress.com) -> Click "Corporate" -> Select your country -> Click "Products" -> Select the product using the filters and the search field -> Open the product page -> The "Configure" button to the right of the product image opens the Product Configurator.

### DeviceCare SFE100

Configuration tool for HART, PROFIBUS and FOUNDATION Fieldbus field devices

DeviceCare is available for download at [www.software-products.endress.com](http://www.software-products.endress.com). You need to register in the Endress+Hauser software portal to download the application.



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

**W@M**

Life cycle management for your plant

W@M supports you with a wide range of software applications over the entire process: from planning and procurement, to the installation, commissioning and operation of the measuring devices. All the relevant device information, such as the device status, spare parts and device-specific documentation, is available for every device over the entire life cycle.

The application already contains the data of your Endress+Hauser device. Endress+Hauser also takes care of maintaining and updating the data records.

W@M is available:

[www.endress.com/lifecyclemanagement](http://www.endress.com/lifecyclemanagement)

## 13.4 System components

**Memograph M graphic data manager**

The Memograph M graphic data manager provides information on all the relevant process variables. Measured values are recorded correctly, limit values are monitored and measuring points analyzed. The data are stored in the 256 MB internal memory and also on an SD card or USB stick.



For details, see Technical Information TI01180R and Operating Instructions BA01338R

**RNS221**

Supply unit for powering two 2-wire measuring devices. Bidirectional communication is possible via the HART communication jacks.



For details, see Technical Information TI00081R and Brief Operating Instructions KA00110R

**RN221N**

Active barrier with power supply for safe separation of 4 to 20 mA standard signal circuits. Bidirectional HART communication is possible via integrated communication jacks (R=250 Ω).



For details, see Technical Information TI073R and Operating Instructions BA202R

**RMA42**

Digital process transmitter for monitoring and displaying analog measured values



For details, see Technical Information TI00150R and Operating Instructions BA00287R

**RIA452**

RIA452 digital process indicator, panel mounted housing for monitoring and displaying analog measured values with batch and pump control functions and flow calculation



For details, see Technical Information TI113R and Operating Instructions BA00254R

**HAW562**

Overvoltage protection device for DIN rail as per IEC 60715, suitable for protecting electronics against destruction as a result of overvoltage.



For details, see Technical Information TI01012K

## 14 Technical data

### 14.1 Input

|                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|---------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Measured variable   | <p>The measured variable is the distance between the reference point and the product surface.</p> <p>The level is calculated based on <b>E</b>, the empty distance entered.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Measuring range     | <p><b>Maximum measuring range</b></p> <p>10 m (32.8 ft)</p> <p><b>Installation requirements</b></p> <ul style="list-style-type: none"> <li>■ No agitators</li> <li>■ No buildup</li> <li>■ Relative dielectric constant <math>\epsilon_r &gt; 2</math><br/>Contact Endress+Hauser for lower <math>\epsilon_r</math> values</li> </ul> <p><b>Usable measuring range</b></p> <p>The usable measuring range depends on the medium's reflective properties, the installation position and any possible interference reflections.</p> <p>Optimum results are achieved with coarse-grained material and the use of the flooding protection tube.</p> <p>Reduction of the max. possible measuring range by:</p> <ul style="list-style-type: none"> <li>■ Media with bad reflective properties (= low <math>\epsilon_r</math> value)</li> <li>■ Product cone</li> <li>■ Extremely loose surfaces of bulk solids, e.g. bulk solids with low bulk weight in the case of pneumatic filling.</li> <li>■ Formation of buildup, particularly of moist products.</li> </ul> <p> For dielectric constants (DC values) of many media commonly used in various industries refer to:</p> <ul style="list-style-type: none"> <li>■ the Endress+Hauser DC manual (CP01076F)</li> <li>■ the Endress+Hauser "DC Values App" (available for Android and iOS)</li> </ul> |
| Operating frequency | K-band (~ 26 GHz)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Transmission power  | <p><b>Mean power density in the direction of the beam</b></p> <ul style="list-style-type: none"> <li>■ At a distance of 1 m (3.3 ft): &lt; 12 nW/cm<sup>2</sup></li> <li>■ At a distance of 5 m (16 ft): &lt; 0.4 nW/cm<sup>2</sup></li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |

### 14.2 Output

|                |                                                                                                                                                                                         |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Output signal  | <p><b>4 to 20 mA</b></p> <p>An 4 to 20 mA interface is used for measured value output and to power to the device.</p>                                                                   |
| Digital output | <p><b>HART®</b></p> <ul style="list-style-type: none"> <li>■ Signal encoding; FSK <math>\pm 0.5</math> mA over current signal</li> <li>■ Data transmission rate; 1 200 Bit/s</li> </ul> |

**Bluetooth® wireless technology (available as an optional extra)**

The device has a *Bluetooth*® wireless technology interface and can be operated and configured via this interface using the SmartBlue app.

- The range under reference conditions is 25 m (82 ft)
- Incorrect operation by unauthorized persons is prevented by means of encrypted communication and password encryption
- The *Bluetooth*® wireless technology interface can be deactivated

**Signal on alarm**

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

- Current output  
Alarm current: 22.5 mA (in accordance with NAMUR recommendation NE 43)
- Operating tool via digital communication (HART) or SmartBlue (app)
  - Status signal (as per NAMUR Recommendation NE 107)
  - Plain text display with remedial action

**Linearization**

The device's linearization function allows the user to convert the measured value to any units of length, weight or volume. In DeviceCare and FieldCare, there are pre-programmed linearization tables for volume calculation in vessels.

**Pre-programmed linearization curves**

- Horizontal cylindrical tank
- Spherical tank
- Tank with pyramid bottom
- Tank with conical bottom
- Tank with flat bottom

Other linearization tables of up to 32 value pairs can be entered manually.

## 14.3 Performance characteristics

**Reference operating conditions**

- Temperature = +24 °C (+75 °F) ±5 °C (±9 °F)
- Pressure = 960 mbar abs. (14 psia) ±100 mbar (±1.45 psi)
- Humidity = 60 % ±15 %
- Reflector: metal plate with diameter ≥ 1 m (40 in)
- No major interference reflections inside the signal beam

**Maximum measured error**

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

**Output, digital**

(HART, SmartBlue (app))

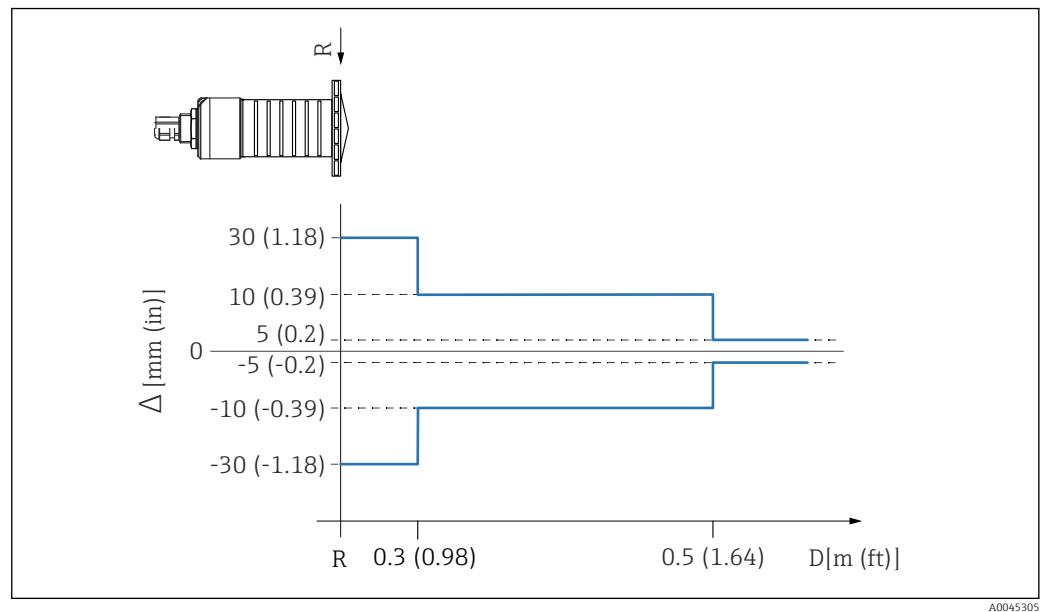
- Sum of non-linearity, non-repeatability and hysteresis: ±5 mm (±0.2 in)
- Offset/zero point: ±4 mm (±0.16 in)

**Output, analog**

Only relevant for 4-20mA current output; add error of the analog value to the digital value

- Sum of non-linearity, non-repeatability and hysteresis: ±0.02 %
- Offset/zero point: ±0.03 %

## Differing values in near-range applications



51 Maximum measured error in near-range applications; values for standard version

$\Delta$  Maximum measured error

$R$  Reference point of the distance measurement

$D$  Distance from reference point of antenna

Measured value resolution Dead band as per EN61298-2:

- Digital: 1 mm (0.04 in)
- Analog: 4  $\mu$ A

Response time

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

**Tank height**

<10 m (32.8 ft)

**Sampling rate**

1 s<sup>-1</sup>

**Response time**

<3 s



In accordance with DIN EN 61298-2, 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.

Influence of ambient temperature

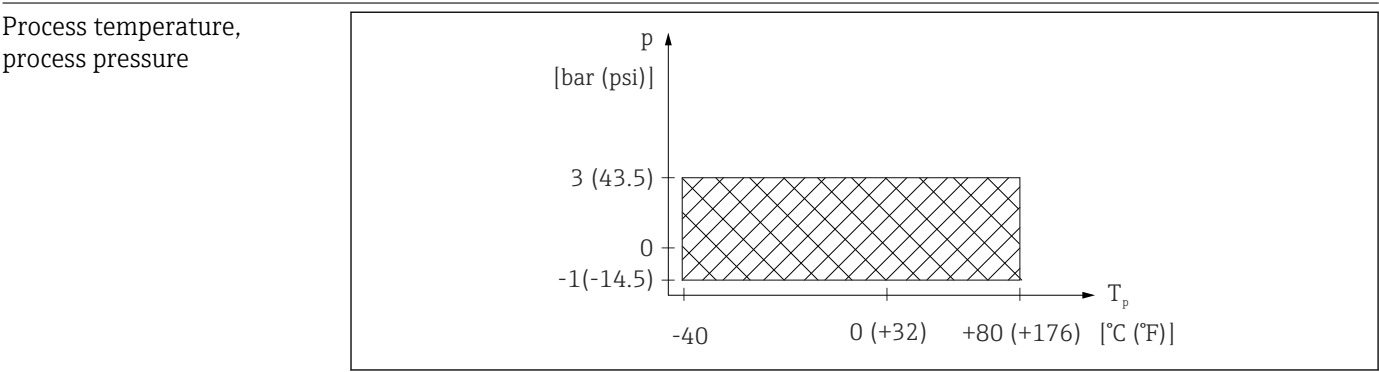
**The measurements are carried out in accordance with EN 61298-3**

- Digital (HART, Bluetooth® wireless technology):  
Standard version: average  $T_C = \pm 3$  mm ( $\pm 0.12$  in)/10 K
- Analog (current output):
  - Zero point (4 mA): average  $T_K = 0.02$  %/10 K
  - Span (20 mA): average  $T_K = 0.05$  %/10 K

14.4 Environment

|                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|--------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Ambient temperature range                  | Measuring device: -40 to +80 °C (-40 to +176 °F)<br><div> It may not be possible to use the Bluetooth connection at ambient temperatures &gt; 60 °C (140 °F).<br/><br/>Outdoor operation in strong sunlight:<ul style="list-style-type: none"><li>■ Mount the device in the shade.</li><li>■ Avoid direct sunlight, particularly in warm climatic regions.</li><li>■ Use a weather protection cover.</li></ul></div> |
| Storage temperature                        | -40 to +80 °C (-40 to +176 °F)                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Climate class                              | DIN EN 60068-2-38 (test Z/AD)                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Operating altitude as per IEC 61010-1 Ed.3 | Generally up to 2 000 m (6 600 ft) above sea level.                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Degree of protection                       | Tested acc. to: <ul style="list-style-type: none"><li>■ IP66, NEMA 4X</li><li>■ IP68, NEMA 6P (24 h at 1.83 m (6.00 ft) 1.83 m under water)</li></ul>                                                                                                                                                                                                                                                                                                                                                 |
| Vibration resistance                       | DIN EN 60068-2-64/IEC 60068-2-64: 20 to 2 000 Hz, 1 (m/s <sup>2</sup> ) <sup>2</sup> /Hz                                                                                                                                                                                                                                                                                                                                                                                                              |
| Electromagnetic compatibility (EMC)        | Electromagnetic compatibility in accordance with all of the relevant requirements outlined in the EN 61000 series and NAMUR Recommendation EMC (NE 21). Details are provided in the Declaration of Conformity ( <a href="http://www.endress.com/downloads">www.endress.com/downloads</a> ).                                                                                                                                                                                                           |

14.5 Process



52 FMR20: Permitted range for process temperature and process pressure

- Process temperature range**  
-40 to +80 °C (-40 to +176 °F)
- Process pressure range, threaded process connection**
- $p_{\text{gauge}} = -1 \text{ to } 3 \text{ bar } (-14.5 \text{ to } 43.5 \text{ psi})$
  - $p_{\text{abs}} < 4 \text{ bar } (58 \text{ psi})$

**Process pressure range, UNI flange process connection**

- $p_{\text{gauge}} = -1 \text{ to } 1 \text{ bar}$  ( $-14.5 \text{ to } 14.5 \text{ psi}$ )
- $p_{\text{abs}} < 2 \text{ bar}$  (29 psi)



The pressure range may be further restricted in the event of a CRN approval.

## Dielectric constant

**For solids**

- $\epsilon_r \geq 2$
- Contact Endress+Hauser for lower  $\epsilon_r$  values



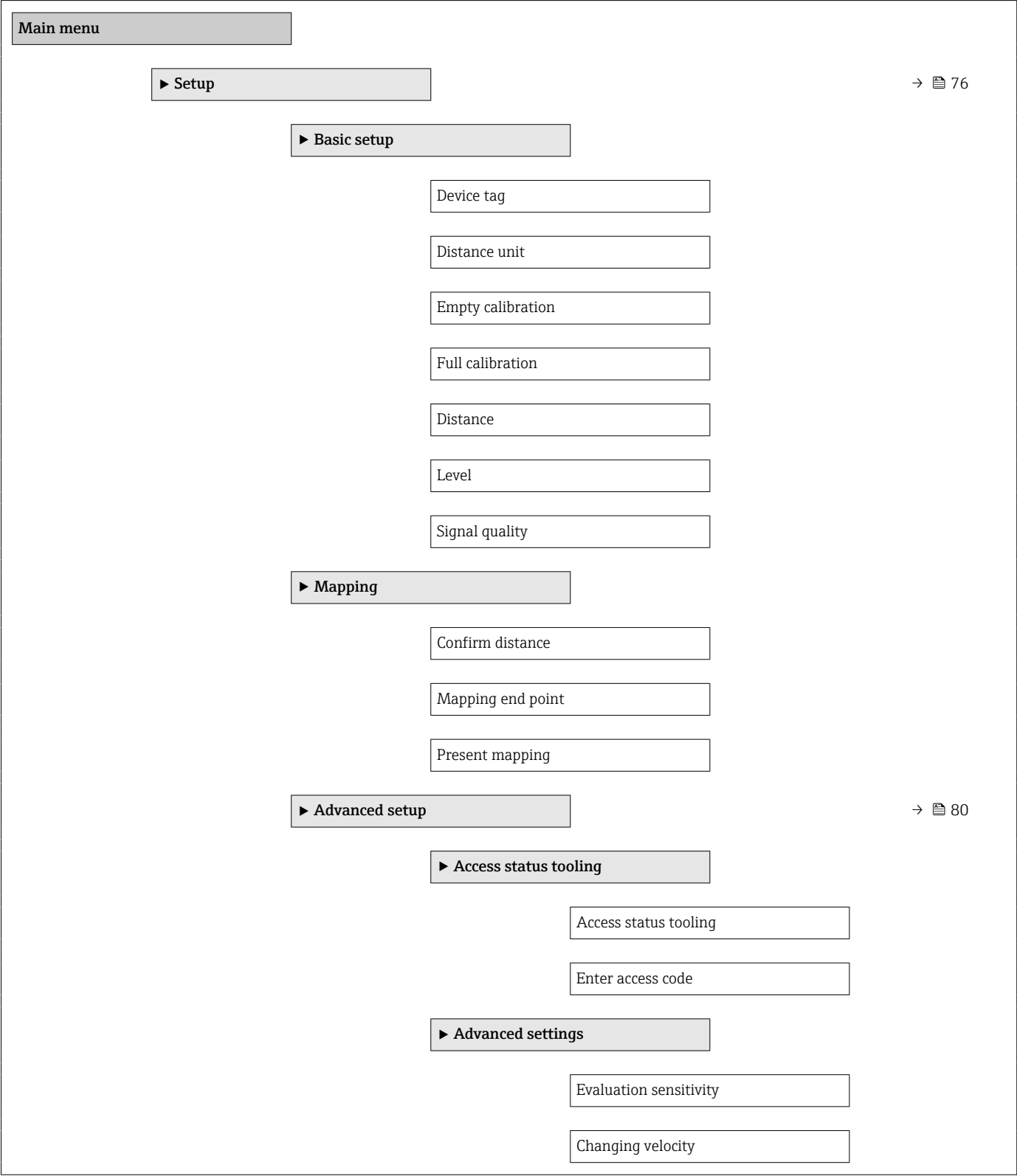
For dielectric constants (DC values) of many media commonly used in various industries refer to:

- the Endress+Hauser DC manual (CP01076F)
- the Endress+Hauser "DC Values App" (available for Android and iOS)

# 15     Operating menu

## 15.1    Overview of the operating menu (SmartBlue)

Navigation         Operating menu



|                        |      |
|------------------------|------|
| First Echo sensitivity |      |
| Output mode            |      |
| Blocking distance      |      |
| Level correction       |      |
| Evaluation distance    |      |
| Linearization type     |      |
| Level linearized       |      |
| ► Safety settings      | → 84 |
| Delay time echo lost   | → 84 |
| Diagnostics echo lost  | → 84 |
| ► Current output       | → 85 |
| Output current         | → 85 |
| Damping output         | → 85 |
| Turn down              | → 85 |
| 4 mA value             | → 86 |
| 20 mA value            | → 86 |
| Trim                   | → 87 |
| Trim value high        | → 87 |
| Trim value low         | → 87 |
| ► Administration       | → 88 |
| ► Administration 1     |      |
| Define access code     | → 88 |
| Confirm access code    | → 88 |

|                      |                       |      |
|----------------------|-----------------------|------|
|                      | Device reset          | → 88 |
|                      | Free field special    | → 89 |
| ► Communication      |                       | → 90 |
| ► HART configuration |                       |      |
|                      | HART short tag        |      |
|                      | HART address          |      |
|                      | No. of preambles      |      |
| ► HART info          |                       |      |
|                      | Device type           |      |
|                      | Device revision       |      |
|                      | Device ID             |      |
|                      | HART revision         |      |
|                      | HART descriptor       |      |
|                      | HART message          |      |
|                      | Hardware revision     |      |
|                      | Software revision     |      |
|                      | HART date code        |      |
| ► Hart output        |                       |      |
|                      | Level linearized (PV) |      |
|                      | Distance (SV)         |      |

|                              |      |
|------------------------------|------|
| Relative echo amplitude (TV) |      |
| Temperature (QV)             |      |
| ► Bluetooth configuration    | → 93 |
| Bluetooth mode               | → 93 |
| ► Diagnostics                | → 94 |
| ► Diagnostics                | → 94 |
| Actual diagnostics           | → 94 |
| Previous diagnostics         | → 94 |
| Delete previous diagnostic   | → 94 |
| Signal quality               | → 77 |
| ► Device information         | → 96 |
| Device name                  | → 96 |
| Firmware version             | → 96 |
| Extended order code 1        | → 96 |
| Extended order code 2        | → 96 |
| Extended order code 3        | → 97 |
| Order code                   | → 97 |
| Serial number                | → 97 |
| ENP version                  | → 97 |
| ► Simulation                 | → 98 |
| Simulation                   | → 98 |
| Value current output 1       | → 98 |
| Process variable value       | → 98 |

# 15.2 Overview of operating menu (FieldCare / DeviceCare)

Navigation  Operating menu

|                        |                                                                                            |
|------------------------|--------------------------------------------------------------------------------------------|
| Main menu              |                                                                                            |
| ▶ Setup                | →  76   |
| Device tag             | →  76   |
| Distance unit          | →  76   |
| Empty calibration      | →  76   |
| Full calibration       | →  76   |
| Distance               | →  77   |
| Level                  | →  77   |
| Signal quality         | →  77   |
| Confirm distance       | →  78 |
| Mapping end point      | →  78 |
| Present mapping        | →  78 |
| ▶ Advanced setup       | →  80 |
| Access status tooling  | →  80 |
| Enter access code      | →  80 |
| Evaluation sensitivity | →  80 |
| Changing velocity      | →  81 |
| First Echo sensitivity | →  81 |
| Output mode            | →  81 |
| Blocking distance      | →  82 |
| Level correction       | →  82 |
| Evaluation distance    | →  82 |
| Linearization type     | →  83 |

|                       |      |
|-----------------------|------|
| Level linearized      | → 83 |
| ► Safety settings     | → 84 |
| Delay time echo lost  | → 84 |
| Diagnostics echo lost | → 84 |
| ► Current output      | → 85 |
| Output current        | → 85 |
| Damping output        | → 85 |
| Turn down             | → 85 |
| 4 mA value            | → 86 |
| 20 mA value           | → 86 |
| Trim                  | → 87 |
| Trim value high       | → 87 |
| Trim value low        | → 87 |
| ► Administration      | → 88 |
| Define access code    | → 88 |
| Confirm access code   | → 88 |
| Device reset          | → 88 |
| Free field special    | → 89 |
| ► Communication       | → 90 |
| HART short tag        | → 90 |
| HART address          | → 90 |
| No. of preambles      | → 90 |
| Device type           | → 90 |
| Device revision       | → 91 |
| Device ID             | → 91 |

|               |                              |                                                                                            |
|---------------|------------------------------|--------------------------------------------------------------------------------------------|
|               | HART revision                | →  91   |
|               | HART descriptor              | →  91   |
|               | HART message                 | →  91   |
|               | Hardware revision            | →  92   |
|               | Software revision            | →  92   |
|               | HART date code               | →  92   |
|               | Level linearized (PV)        | →  92   |
|               | Distance (SV)                | →  92   |
|               | Relative echo amplitude (TV) | →  93   |
|               | Temperature (QV)             | →  93   |
|               | ► Bluetooth configuration    | →  93  |
|               | Bluetooth mode               | →  93 |
| ► Diagnostics |                              | →  94 |
|               | Actual diagnostics           | →  94 |
|               | Previous diagnostics         | →  94 |
|               | Delete previous diagnostic   | →  94 |
|               | Signal quality               | →  77 |
|               | ► Device information         | →  96 |
|               | Device name                  | →  96 |
|               | Firmware version             | →  96 |
|               | Extended order code 1        | →  96 |
|               | Extended order code 2        | →  96 |
|               | Extended order code 3        | →  97 |
|               | Order code                   | →  97 |

|                        |      |
|------------------------|------|
| Serial number          | → 97 |
| ENP version            | → 97 |
| ► Simulation           | → 98 |
| Simulation             | → 98 |
| Value current output 1 | → 98 |
| Process variable value | → 98 |

15.3 "Setup" menu

- ▪  : Indicates navigation to the parameter via operating tools
-  : Indicates parameters that can be locked via the access code.

Navigation  Setup

Device tag 

|                 |                                                                                                      |
|-----------------|------------------------------------------------------------------------------------------------------|
| Navigation      |  Setup → Device tag |
| Description     | Enter a unique name for the measuring point to identify the device quickly within the plant.         |
| User entry      | Character string comprising numbers, letters and special characters (#32)                            |
| Factory setting | EH_FMR20_##### (last 7 digits of the device serial number)                                           |

Distance unit 

|             |                                                                                                           |
|-------------|-----------------------------------------------------------------------------------------------------------|
| Navigation  |  Setup → Distance unit |
| Description | Used for the basic calibration (Empty / Full).                                                            |
| Selection   | <div><div>SI units</div><div>US units</div><div>m</div><div>ft</div></div>                                |

Empty calibration 

|                 |                                                                                                           |
|-----------------|-----------------------------------------------------------------------------------------------------------|
| Navigation      |  Setup → Empty calibr. |
| Description     | Distance between process connection and minimum level (0%).                                               |
| User entry      | 0.0 to 20 m                                                                                               |
| Factory setting | Depends on the antenna version                                                                            |

Full calibration 

|             |                                                                                                          |
|-------------|----------------------------------------------------------------------------------------------------------|
| Navigation  |  Setup → Full calibr. |
| Description | Distance between minimum level (0%) and maximum level (100%).                                            |

|                        |                                |
|------------------------|--------------------------------|
| <b>User entry</b>      | 0.0 to 20 m                    |
| <b>Factory setting</b> | Depends on the antenna version |

---

**Distance**


---

|                       |                                                                                                                                       |
|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>     |  Setup → Distance                                    |
| <b>Description</b>    | Shows the distance D that is currently measured from the reference point (lower edge of flange / last thread of sensor) to the level. |
| <b>User interface</b> | 0.0 to 20 m                                                                                                                           |

---

**Level**


---

|                       |                                                                                                                                      |
|-----------------------|--------------------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>     |  Setup → Level                                      |
| <b>Description</b>    | Displays the measured level L (before linearization).<br>The unit is defined in the 'Distance unit' parameter (factory setting = m). |
| <b>User interface</b> | -99 999.9 to 200 000.0 m                                                                                                             |

---

**Signal quality**


---

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>  |  Setup → Signal quality                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Description</b> | <p>Displays the signal quality of the level echo.</p> <p>Meaning of the display options</p> <ul style="list-style-type: none"> <li>- Strong:<br/>The evaluated echo exceeds the threshold by at least 10 dB.</li> <li>- Medium:<br/>The evaluated echo exceeds the threshold by at least 5 dB.</li> <li>- Weak:<br/>The evaluated echo exceeds the threshold by less than 5 dB.</li> <li>- No signal:<br/>The device does not find an usable echo.</li> </ul> <p>The signal quality indicated in this parameter always refers to the currently evaluated echo, either the level echo or the tank bottom echo.</p> <p>In case of a lost echo ('Signal quality' = No signal) the device generates the following error message:<br/>'Diagnostic echo lost' = Warning (factory setting) or Alarm, if the other option has been selected in 'Diagnostic echo lost'.</p> |

|                       |                                                                                                                   |
|-----------------------|-------------------------------------------------------------------------------------------------------------------|
| <b>User interface</b> | <ul style="list-style-type: none"> <li>■ Strong</li> <li>■ Medium</li> <li>■ Weak</li> <li>■ No signal</li> </ul> |
|-----------------------|-------------------------------------------------------------------------------------------------------------------|

---

**Confirm distance**


|                   |                          |
|-------------------|--------------------------|
| <b>Navigation</b> | Setup → Confirm distance |
|-------------------|--------------------------|

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Description</b> | <p>Does the measured distance match the real distance?</p> <p>Select one of the options:</p> <ul style="list-style-type: none"> <li>- Manual map<br/>To be selected if the range of mapping is to be defined manually in the 'Mapping end point' parameter. A comparison between actual and indicated distance is not required in this case.</li> <li>- Distance ok<br/>To be selected if the measured distance matches the actual distance. The device performs a mapping.</li> <li>- Distance unknown<br/>To be selected if the actual distance is unknown. A mapping can not be performed in this case.</li> <li>- Factory map<br/>To be selected if the present mapping curve (if one exists) is to be deleted. The device returns to the 'Confirm distance' parameter and a new mapping can be recorded.</li> </ul> |
| <b>Selection</b>   | <ul style="list-style-type: none"> <li>■ Manual map</li> <li>■ Distance ok</li> <li>■ Distance unknown</li> <li>■ Factory map</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

---

**Mapping end point**


|                   |                        |
|-------------------|------------------------|
| <b>Navigation</b> | Setup → Map. end point |
|-------------------|------------------------|

|                    |                                                                                                                                                                                                            |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Description</b> | <p>This parameter defines up to which distance the new mapping is to be recorded.</p> <p>The distance is measured from the reference point, i.e. from the lower edge of the mounting flange or sensor.</p> |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                   |             |
|-------------------|-------------|
| <b>User entry</b> | 0 to 21.8 m |
|-------------------|-------------|

---

**Present mapping**

|                   |                         |
|-------------------|-------------------------|
| <b>Navigation</b> | Setup → Present mapping |
|-------------------|-------------------------|

|                    |                                                                     |
|--------------------|---------------------------------------------------------------------|
| <b>Description</b> | Indicates up to which distance a mapping has already been recorded. |
|--------------------|---------------------------------------------------------------------|

**User interface**                      0 to 100 m

15.3.1 "Advanced setup" submenu

Navigation  Setup → Advanced setup

Access status tooling

Navigation  Setup → Advanced setup → Access stat.tool

Description Shows the access authorization to the parameters via the operating tool.

Enter access code

Navigation  Setup → Advanced setup → Ent. access code

Description The customer-specific access code, which has been defined in the **Define access code** parameter, must be entered to change from the Operator to the Maintenance mode. The device remains in the Operator mode if an incorrect access code is entered. If you lose the access code, please contact your Endress+Hauser sales center.

User entry 0 to 9 999

Evaluation sensitivity



Navigation  Setup → Advanced setup → Evaluation sens.

Description Selection of the evaluation sensitivity  
Options to select from:  
- Low  
The weighting curve is high for low evaluation sensitivity. Interferers but also small level signals are not recognized.  
- Medium  
The weighting curve is in a medium region.  
- High  
The weighting curve is low for high evaluation sensitivity. Interferers but also small level signals can be reliably detected.

Selection

- Low
- Medium
- High

---

**Changing velocity**


|                    |                                                                                                                                                                                         |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>  | Setup → Advanced setup → Changing vel.                                                                                                                                                  |
| <b>Description</b> | Selection of the expected draining or filling speed of the measured level.                                                                                                              |
| <b>Selection</b>   | <ul style="list-style-type: none"> <li>■ Slow &lt;10 cm (0,4 in)/min</li> <li>■ Standard &lt;1 m (40 in)/min</li> <li>■ Fast &gt;1 m (40 in)/min</li> <li>■ No filter / test</li> </ul> |

---

**First Echo sensitivity**


|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>  | Setup → Advanced setup → First Echo sens.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Description</b> | <p>This parameter describes the band for First Echo evaluation.<br/>Is measured / calculated down from the peak of the current level echo.</p> <p>Options to select from:</p> <ul style="list-style-type: none"> <li>- Low<br/>The band for the first echo evaluation is very narrow. The evaluation stays longer at the found echo respectively does not jump to the next Echo or distortion signal.</li> <li>- Medium<br/>The band for the first echo evaluation has an average width.</li> <li>- High<br/>The band for the first echo evaluation is broad. The evaluation jumps earlier to the next echo or distortion signal.</li> </ul> |
| <b>Selection</b>   | <ul style="list-style-type: none"> <li>■ Low</li> <li>■ Medium</li> <li>■ High</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

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**Output mode**


|                    |                                                                                                                                                                                                                                                           |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>  | Setup → Advanced setup → Output mode                                                                                                                                                                                                                      |
| <b>Description</b> | <p>Select output mode between:</p> <p>Ullage =<br/>The remaining space in the tank or silo is indicated.</p> <p>or</p> <p>Level linearized =<br/>The level is indicated (more precisely: the linearized value if a linearization has been activated).</p> |
| <b>Selection</b>   | <ul style="list-style-type: none"> <li>■ Ullage</li> <li>■ Level linearized</li> </ul>                                                                                                                                                                    |

| Blocking distance      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|-----------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>                                                                                         |  Setup → Advanced setup → Blocking dist.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Description</b>                                                                                        | <p>Specify blocking distance (BD).</p> <p>No signals are evaluated within the blocking distance. Therefore, BD can be used to suppress interference signals in the vicinity of the antenna.</p> <p>Note:<br/>The measuring range should not overlap with the blocking distance.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>User entry</b>                                                                                         | 0.0 to 20 m                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Factory setting</b>                                                                                    | <p>An automatic Blocking distance (→  82) of at least 0.1 m (0.33 ft) is configured as standard. However, this can be overwritten manually (0 m (0 ft) is also permitted).<br/>Automatic calculation of the Blocking distance = Empty calibration - Full calibration - 0.2 m (0.656 ft).<br/>Each time a new entry is made in the <b>Empty calibration</b> parameter or <b>Full calibration</b> parameter, the <b>Blocking distance</b> parameter is recalculated automatically using this formula.<br/>If the result of the calculation is a value &lt; 0.1 m (0.33 ft), the Blocking distance of 0.1 m (0.33 ft) will continue to be used.</p> |
| Level correction     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Navigation</b>                                                                                         |  Setup → Advanced setup → Level correction                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Description</b>                                                                                        | <p>The measured level is corrected by this value to compensate for a constant level error.</p> <p>Level correction &gt; 0:<br/>The level is increased by this value.</p> <p>Level correction &lt; 0:<br/>The level is decreased by this value.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>User entry</b>                                                                                         | -25 to 25 m                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Evaluation distance  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Navigation</b>                                                                                         |  Setup → Advanced setup → Evaluation dist.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Description</b>                                                                                        | <p>Extended signal search area.<br/>Is generally greater than the empty distance.<br/>If the signal is found below the empty distance, '0' (empty) is indicated as measured value.<br/>Only for signals, detected below the 'Evaluation distance', the error 'Echo Lost' is issued.<br/>e.g. flow measurement in overflow weirs</p>                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>User entry</b>                                                                                         | 0 to 21.8 m                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Factory setting</b>                                                                                    | 21.8 m                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

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Linearization type

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|             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Navigation  | <div></div> Setup → Advanced setup → Lineariz. type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Description | <p><b>Linearization types</b></p> <p>Meaning of the options:</p> <ul style="list-style-type: none"><li>■ None:<br/>The level is output in the level unit without being converted (linearized) beforehand.</li><li>■ Table:<br/>The relationship between the measured level L and the output value (volume/flow/weight) is defined by a linearization table. This table consists of up to 32 value pairs, i.e. "level - volume" or "level - flow" or "level - weight".</li><li>■ Note:<br/>Please use the DTM module to create/modify a linearization table.</li></ul> |
| Selection   | <ul style="list-style-type: none"><li>■ None</li><li>■ Table</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

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Level linearized

---

|                |                                                       |
|----------------|-------------------------------------------------------|
| Navigation     | <div></div> Setup → Advanced setup → Level linearized |
| Description    | Currently measured level                              |
| User interface | Signed floating-point number                          |

"Safety settings" submenu

Navigation  Setup → Advanced setup → Safety sett.

---

Delay time echo lost 

---

Navigation  Setup → Advanced setup → Safety sett. → Delay echo lost

Description Define the delay time in the case of an echo loss.  
After an echo loss, the device waits for the time specified in this parameter before reacting as specified in the Diagnostic echo lost parameter. This helps to avoid interruptions of the measurement by short-term interferences.

User entry 0 to 600 s

---

Diagnostics echo lost 

---

Navigation  Setup → Advanced setup → Safety sett. → Diagn. echo lost

Description At this parameter it can be set if in case of a lost echo a warning or an alarm is issued.

- Selection
- Warning
  - Alarm

**"Current output" submenu**

*Navigation*  Setup → Advanced setup → Curr.output

**Output current**

**Navigation**  Setup → Advanced setup → Curr.output → Output curr.

**Description** Shows the actual calculated value of the output current.

**User interface** 3.59 to 22.5 mA

**Damping output**

**Navigation**  Setup → Advanced setup → Curr.output → Damping out.

**Description** Define time constant  $\tau$  for the damping of the output current.  
Fluctuations of the measured value affect the output current with an exponential delay, the time constant  $\tau$  of which is defined in this parameter. With a small time constant the output reacts immediately to changes of the measured value. With a big time constant the reaction of the output is more delayed.  
For  $\tau = 0$  there is no damping.

**User entry** 0.0 to 300 s

**Turn down**

**Navigation**  Setup → Advanced setup → Curr.output → Turn down

**Description** Using the turn down functionality it is possible to map a section of the measuring range to the total range of the output current (4-20mA).  
The section is defined by the '4 mA value' and '20 mA value' parameters.  
Without the turn down, the complete measuring range (0 to 100%) is mapped to the current output (4 to 20mA).

**Selection**

- Off
- On

| 4 mA value   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|-------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>                                                                               |  Setup → Advanced setup → Curr.output → 4 mA value                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Description</b>                                                                              | <p>Value for 4-mA at 'Turn down parameter' = On</p> <p>Using the turn down functionality it is possible to map a section of the measuring range to the total range of the output current (4-20mA). The section is defined by the '4 mA value' and '20 mA value' parameters.</p> <p>Without the turn down, the complete measuring range (0 to 100%) is mapped to the current output (4 to 20mA).</p> <p>Note:</p> <p>If '20 mA value' is smaller than '4 mA value', the current output is inverted, which means that an increase of the process variable results in a decrease of the output current.</p>  |
| <b>User entry</b>                                                                               | Signed floating-point number                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 20 mA value  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Navigation</b>                                                                               |  Setup → Advanced setup → Curr.output → 20 mA value                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Description</b>                                                                              | <p>Value for 20-mA at 'Turn down' parameter = On</p> <p>Using the turn down functionality it is possible to map a section of the measuring range to the total range of the output current (4-20mA). The section is defined by the '4 mA value' and '20 mA value' parameters.</p> <p>Without the turn down, the complete measuring range (0 to 100%) is mapped to the current output (4 to 20mA).</p> <p>Note:</p> <p>If '20 mA value' is smaller than '4 mA value', the current output is inverted, which means that an increase of the process variable results in a decrease of the output current.</p> |
| <b>User entry</b>                                                                               | Signed floating-point number                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Factory setting</b>                                                                          | <p>FMR20: 20 m</p> <p>FMR20 for bulk solids: 10 m</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |

| Trim               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>  |  Setup → Advanced setup → Curr.output → Trim                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Description</b> | <p>Select action for the recalibration of the current output.</p> <p>The trim can be used to compensate a drift of the current output (which might be caused by very long cables or by a connected Ex barrier, for example).</p> <p>Steps of the trim:</p> <ol style="list-style-type: none"> <li>1. Select 'Trim' = 4 mA.</li> <li>2. Measure the output current with a gauged multimeter. If it is not equal to 4 mA: Enter measured value in the 'Trim value low' parameter.</li> <li>3. Select 'Trim' = 20 mA.</li> <li>4. Measure the output current with a gauged multimeter. If it is not equal to 20 mA: Enter the measured current into the 'Trim value high' parameter.</li> <li>5. Select 'Trim' = Calculate. The device calculates the new scaling of the output current and stores it in the RAM.</li> </ol> |
| <b>Selection</b>   | <ul style="list-style-type: none"> <li>■ Off</li> <li>■ 4 mA</li> <li>■ 20 mA</li> <li>■ Calculate</li> <li>■ Reset</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Trim value high    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Navigation</b>  |  Setup → Advanced setup → Curr.output → Trim value high                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Description</b> | <p>Enter upper measured value for the trim (around 20 mA).</p> <p>After this value has been entered:<br/>Select 'Trim' = Calculate.<br/>This initiates the recalibration of the current output.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>User entry</b>  | 18.0 to 22.0 mA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Trim value low     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Navigation</b>  |  Setup → Advanced setup → Curr.output → Trim value low                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Description</b> | <p>Enter lower measured value for the trim (around 4 mA).</p> <p>After this value has been entered:<br/>Select 'Trim' = Calculate.<br/>This initiates the recalibration of the current output.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>User entry</b>  | 3.0 to 5.0 mA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

**"Administration" submenu**

*Navigation*  Setup → Advanced setup → Administration

**Define access code** 

**Navigation**  Setup → Advanced setup → Administration → Def. access code

**Description** Define release code for changing device operation mode.  
 If the factory setting is not changed or 0000 is defined as the access code, the device works in maintenance mode without write-protection and the configuration data of the device can then always be modified.  
 Once the access code has been defined, write-protected devices can only be changed to maintenance mode if the access code is entered in the 'Enter access code' parameter. The new access code is only valid after it has been confirmed in the 'Confirm access code' parameter.  
 Please contact your Endress+Hauser Sales Center if you lose your access code.

**User entry** 0 to 9 999

**Confirm access code** 

**Navigation**  Setup → Advanced setup → Administration → Confirm code

**Description** Re-enter the entered access code to confirm.

**User entry** 0 to 9 999

**Device reset** 

**Navigation**  Setup → Advanced setup → Administration → Device reset

**Description** Reset the device configuration - either entirely or in part - to a defined state.

**Selection**

- Cancel
- To factory defaults

---

**Free field special**

---



**Navigation**

 Setup → Advanced setup → Administration → Free field spec.

**Description**

Switch the free field option on or off.  
This parameter can be switched on for free field applications (e.g. below bridges).  
Caution:  
The customer map (if one exists) is reset to the factory map!

**Selection**

- Off
- On

15.3.2 "Communication" submenu

Navigation  Setup → Communication

HART short tag 

|             |                                                                                                                          |
|-------------|--------------------------------------------------------------------------------------------------------------------------|
| Navigation  |  Setup → Communication → HART short tag |
| Description | Short description of the measuring point                                                                                 |
| User entry  | Max. 8 characters: A ... Z, 0 ... 9 and some special characters (for example, punctuation marks, @,%)                    |

HART address 

|            |                                                                                                                        |
|------------|------------------------------------------------------------------------------------------------------------------------|
| Navigation |  Setup → Communication → HART address |
| User entry | 0 to 63                                                                                                                |

No. of preambles 

|             |                                                                                                                              |
|-------------|------------------------------------------------------------------------------------------------------------------------------|
| Navigation  |  Setup → Communication → No. of preambles |
| Description | Defines the number o preambles in the HART telegram.                                                                         |
| User entry  | 5 to 20                                                                                                                      |

Device type

|                        |                                                                                                                         |
|------------------------|-------------------------------------------------------------------------------------------------------------------------|
| Navigation             |  Setup → Communication → Device type |
| Description            | Shows the device type with which the measuring device is registered with the HART Communication Foundation.             |
| Additional information |                                                                                                                         |

---

**Device revision**


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|                    |                                                                                                                           |
|--------------------|---------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>  |  Setup → Communication → Device revision |
| <b>Description</b> | Shows the device revision with which the device is registered with the HART Communication Foundation.                     |

---

**Device ID**


---

|                    |                                                                                                                     |
|--------------------|---------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>  |  Setup → Communication → Device ID |
| <b>Description</b> | Shows the device ID for identifying the device in a HART network.                                                   |

---

**HART revision**


---

|                    |                                                                                                                         |
|--------------------|-------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>  |  Setup → Communication → HART revision |
| <b>Description</b> | Indicates HART revision of the device                                                                                   |

---

**HART descriptor**


---



|                    |                                                                                                                             |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>  |  Setup → Communication → HART descriptor |
| <b>Description</b> | Enter descriptor for the measuring point                                                                                    |
| <b>User entry</b>  | Character string comprising numbers, letters and special characters (#16)                                                   |

---

**HART message**


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|                    |                                                                                                                          |
|--------------------|--------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>  |  Setup → Communication → HART message |
| <b>Description</b> | Define HART message which is sent via the HART protocol if requested by the master                                       |
| <b>User entry</b>  | Character string comprising numbers, letters and special characters (#32)                                                |

---

**Hardware revision**

---

**Navigation**  Setup → Communication → Hardware rev.

**Description** Indicates hardware revision of the device

---

**Software revision**

---

**Navigation**  Setup → Communication → Software rev.

**Description** Indicates software revision of the device

---

**HART date code**

---



**Navigation**  Setup → Communication → HART date code

**Description** Enter date of the last configuration change

**User entry** Character string comprising numbers, letters and special characters (#10)

**Additional information** Date format: YYYY-MM-DD

---

**Level linearized (PV)**

---

**Navigation**  Setup → Communication → Level lin. (PV)

**Description** Displays linearized level

**User interface** Signed floating-point number

**Additional information** The unit is defined by the Unit after linearization parameter

---

**Distance (SV)**

---

**Navigation**  Setup → Communication → Distance (SV)

**User interface** Signed floating-point number

---

**Relative echo amplitude (TV)**

---

|                       |                                                                                                                            |
|-----------------------|----------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>     |  Setup → Communication → Rel.echoampl(TV) |
| <b>User interface</b> | Signed floating-point number                                                                                               |

---

**Temperature (QV)**

---

|                       |                                                                                                                            |
|-----------------------|----------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>     |  Setup → Communication → Temperature (QV) |
| <b>User interface</b> | Signed floating-point number                                                                                               |

**"Bluetooth configuration" submenu**

*Navigation*        Setup → Communication → Bluetooth conf.

---

**Bluetooth mode**

---

|                    |                                                                                                                                                                                                                                                 |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>  |  Setup → Communication → Bluetooth conf. → Bluetooth mode                                                                                                    |
| <b>Description</b> | Enable or disable Bluetooth function..<br><br>Remark:<br>Switching to position 'Off' will disable remote access via the app with immediate effect. To re-establish a Bluetooth connection via the app: Please follow the advices in the manual. |
| <b>Selection</b>   | <ul style="list-style-type: none"><li>■ Off</li><li>■ On</li></ul>                                                                                                                                                                              |

## 15.4 "Diagnostics" submenu

Navigation  Diagnostics

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### Actual diagnostics

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|             |                                                                                                                                               |
|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| Navigation  |  Diagnostics → Actual diagnos.                               |
| Description | Displays current diagnostic message.<br>If several messages are active at the same time, the messages with the highest priority is displayed. |

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### Previous diagnostics

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|             |                                                                                                                                                                      |
|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Navigation  |  Diagnostics → Prev.diagnostics                                                     |
| Description | Displays the last diagnostic message, with its diagnostic information, which has been active before the current message.<br>The condition displayed may still apply. |

---

### Delete previous diagnostic

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|             |                                                                                                                    |
|-------------|--------------------------------------------------------------------------------------------------------------------|
| Navigation  |  Diagnostics → Del. prev. diag. |
| Description | Delete previous diagnostic message?<br>It is possible that the diagnostic message remains valid.                   |
| Selection   | <ul style="list-style-type: none"><li>■ No</li><li>■ Yes</li></ul>                                                 |

---

**Signal quality**

---

**Navigation** Diagnostics → Signal quality**Description**

Displays the signal quality of the level echo.

Meaning of the display options

- Strong:

The evaluated echo exceeds the threshold by at least 10 dB.

- Medium:

The evaluated echo exceeds the threshold by at least 5 dB.

- Weak:

The evaluated echo exceeds the threshold by less than 5 dB.

- No signal:

The device does not find an usable echo.

The signal quality indicated in this parameter always refers to the currently evaluated echo, either the level echo or the tank bottom echo.

In case of a lost echo ('Signal quality' = No signal) the device generates the following error message:

'Diagnostic echo lost' = Warning (factory setting) or Alarm, if the other option has been selected in 'Diagnostic echo lost'.

**User interface**

- Strong
- Medium
- Weak
- No signal

15.4.1 "Device information" submenu

Navigation  Diagnostics → Device info

Device name

|                |                                                                                                                           |
|----------------|---------------------------------------------------------------------------------------------------------------------------|
| Navigation     |  Diagnostics → Device info → Device name |
| Description    | Shows the name of the transmitter.                                                                                        |
| User interface | Character string comprising numbers, letters and special characters (#16)                                                 |

Firmware version

|                |                                                                                                                                |
|----------------|--------------------------------------------------------------------------------------------------------------------------------|
| Navigation     |  Diagnostics → Device info → Firmware version |
| Description    | Shows the device firmware version installed.                                                                                   |
| User interface | Character string comprising numbers, letters and special characters (#8)                                                       |

Extended order code 1

|                |                                                                                                                                  |
|----------------|----------------------------------------------------------------------------------------------------------------------------------|
| Navigation     |  Diagnostics → Device info → Ext. order cd. 1 |
| Description    | Shows the 1st part of the extended order code.                                                                                   |
| User interface | Character string comprising numbers, letters and special characters (#20)                                                        |

Extended order code 2

|                |                                                                                                                                  |
|----------------|----------------------------------------------------------------------------------------------------------------------------------|
| Navigation     |  Diagnostics → Device info → Ext. order cd. 2 |
| Description    | Shows the 2nd part of the extended order code.                                                                                   |
| User interface | Character string comprising numbers, letters and special characters (#20)                                                        |

---

**Extended order code 3**

---

|                       |                                                                                                                                |
|-----------------------|--------------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>     |  Diagnostics → Device info → Ext. order cd. 3 |
| <b>Description</b>    | Shows the 3rd part of the extended order code.                                                                                 |
| <b>User interface</b> | Character string comprising numbers, letters and special characters (#20)                                                      |

---

**Order code**

---

|                       |                                                                                                                          |
|-----------------------|--------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>     |  Diagnostics → Device info → Order code |
| <b>Description</b>    | Shows the device order code.                                                                                             |
| <b>User interface</b> | Character string comprising numbers, letters and special characters (#20)                                                |

---

**Serial number**

---

|                       |                                                                                                                               |
|-----------------------|-------------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>     |  Diagnostics → Device info → Serial number |
| <b>Description</b>    | Shows the serial number of the measuring device.                                                                              |
| <b>User interface</b> | Character string comprising numbers, letters and special characters (#11)                                                     |

---

**ENP version**

---

|                       |                                                                                                                             |
|-----------------------|-----------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>     |  Diagnostics → Device info → ENP version |
| <b>Description</b>    | Shows the version of the electronic nameplate (ENP).                                                                        |
| <b>User interface</b> | Character string comprising numbers, letters and special characters (#16)                                                   |

15.4.2 "Simulation" submenu

Navigation   Diagnostics → Simulation

Simulation 

Navigation  Diagnostics → Simulation → Simulation

Description Select process variable to be simulated.  
The Simulation is used to simulate specific measuring values or other conditions. This helps to check the correct configuration of the device and connected control units.

- Selection
- Off
  - Current output
  - Distance

Value current output 

Navigation  Diagnostics → Simulation → Value curr.out 1

Description Defines the value of the simulated output current.

User entry 3.59 to 22.5 mA

Process variable value 

Navigation  Diagnostics → Simulation → Proc. var. value

Description Value of the simulated process variable.  
Downstream measured value processing and the signal output use this simulation value. In this way, users can verify whether the measuring device has been configured correctly.

User entry 0 to 21.8 m

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