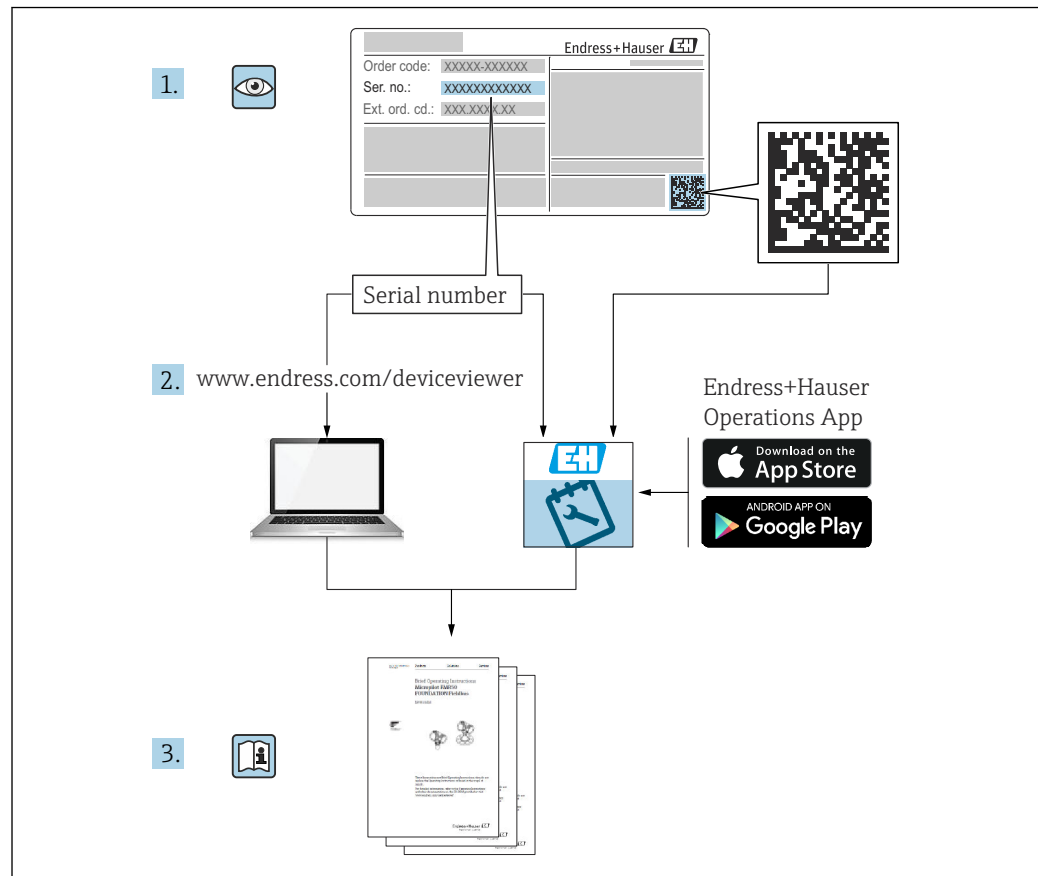


# Operating Instructions

## Micropilot FMR10B

Free-space radar





- Make sure the document is stored in a safe place such that it is always available when working on or with the device
- Avoid danger to individuals or the facility: read the "Basic safety instructions" section carefully, as well as all other safety instructions in the document that are specific to working procedures

The manufacturer reserves the right to modify technical data without prior notice. The Endress+Hauser sales organization will supply you with current information and updates to these instructions.

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# 1 About this document

## 1.1 Document function

These Operating Instructions contain all the information required in the various life cycle phases of the device: from product identification, incoming acceptance and storage, to installation, connection, operation and commissioning, through to troubleshooting, maintenance and disposal.

## 1.2 Symbols

### 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 Communication-specific symbols


**Bluetooth®: **

Wireless data transmission between devices over a short distance.

### 1.2.3 Symbols for certain types of Information

**Permitted: **


Procedures, processes or actions that are permitted.

**Forbidden: **

Procedures, processes or actions that are forbidden.

**Additional information:** 

**Reference to documentation:** 

**Reference to page:** 

**Series of steps:** [1.](#), [2.](#), [3.](#)

**Result of an individual step:** 

## 1.2.4 Symbols in graphics

**Item numbers:** 1, 2, 3 ...

**Series of steps:** [1.](#), [2.](#), [3.](#)

**Views:** A, B, C, ...

## 1.3 List of abbreviations

### **PN**

Nominal pressure

### **MWP**

Maximum working pressure

The MWP is indicated on the nameplate.

### **ToF**

Time of Flight

### **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

### **PLC**

Programmable logic controller (PLC)

## 1.4 Documentation

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

- *Device Viewer* ([www.endress.com/deviceviewer](http://www.endress.com/deviceviewer)): Enter the serial number from the nameplate
- *Endress+Hauser Operations app*: Enter serial number from nameplate or scan matrix code on nameplate.

## 1.5 Registered trademarks

### 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 the 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.
- ▶ Are authorized by the plant owner/operator.
- ▶ Are familiar with federal/national regulations.
- ▶ Before starting work, read and understand the instructions in the manual and supplementary documentation as well as the certificates (depending on the application).
- ▶ Follow instructions and comply with basic conditions.

The operating personnel must fulfill the following requirements:

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

### 2.2 Intended use

#### Application and media

The measuring instrument described in these Operating Instructions is intended for continuous, non-contact level measurement in liquids, pastes, sludges and bulk solids. Due to its operating frequency of approx. 80 GHz, a maximum radiated peak power of <1.5 mW and an average output power of <70 µW, unrestricted use outside of closed, metallic vessels is also permitted (for example over basins or open channels). Operation is completely harmless to humans and animals.

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

- ▶ Measured process variables: level, distance, signal strength
- ▶ Calculated process variables: volume or mass in vessels of any shape; flow rate through measuring weirs or channels (calculated based on the level using the linearization functionality)

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

- ▶ Use the measuring instrument only for media to which the process-wetted materials are sufficiently resistant.
- ▶ Observe the limit values in the "Technical data".

**Incorrect use**

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

Avoid mechanical damage:

- ▶ Do not touch or clean device surfaces with pointed or hard objects.

Clarification of borderline cases:

- ▶ For special fluids and fluids for cleaning, Endress+Hauser is glad to provide assistance in verifying the corrosion resistance of fluid-wetted materials, but does not accept any warranty or liability.

**Residual risks**

Due to heat transfer from the process as well as power loss in the electronics, the temperature of the electronics housing and the assemblies it contains (e.g. display module, main electronics module and I/O electronics module) may rise to 80 °C (176 °F). 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 fluid 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 as per national regulations.
- ▶ Switch off the supply voltage before connecting the device.

## 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 ensuring that the device is in good working order.

**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:

- ▶ Only use original accessories.

**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 hazardous area.
- ▶ Observe the specifications in the separate supplementary documentation included as an integral part of these instructions.

## 2.5 Product security

This state-of-the-art device is designed and tested in accordance with good engineering practice to meet operational safety standards. It left the factory in a condition in which it is safe to operate.



The device fulfills general safety requirements and legal requirements. It also complies with the EU directives listed in the device-specific EU declaration of conformity. Endress+Hauser confirms this fact by affixing the CE mark to the device.

## 2.6 IT security

Our warranty is valid only if the product is installed and used as described in the Operating Instructions. The product is equipped with security mechanisms to protect it against any inadvertent changes to the settings.

IT security measures, which provide additional protection for the product and associated data transfer, must be implemented by the operators themselves in line with their security standards.

## 2.7 Device-specific IT security

The device offers specific functions to support protective measures by the operator. These functions can be configured by the user and guarantee greater in-operation safety if used correctly. The user role can be changed with an access code (applies to operation via Bluetooth®).

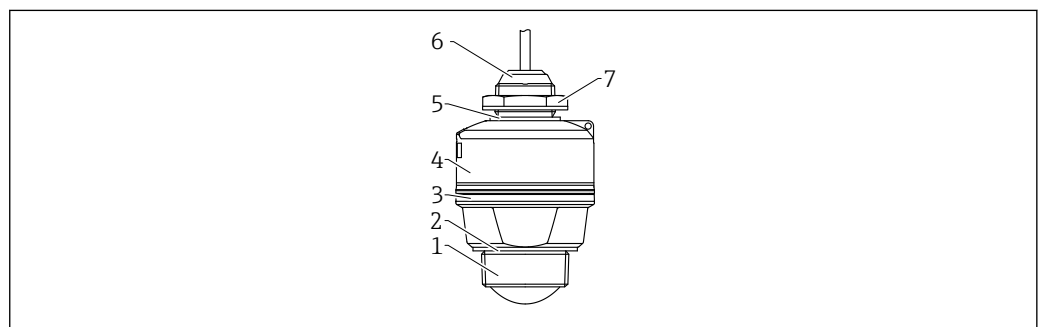
### 2.7.1 Access via Bluetooth® wireless technology

Secure signal transmission via Bluetooth® wireless technology uses an encryption method tested by the Fraunhofer Institute.

- Without the SmartBlue app, the device is not visible via Bluetooth® wireless technology.
- Only one point-to-point connection is established between the device and a smartphone or tablet.
- The Bluetooth® wireless technology interface can be disabled via SmartBlue or an operating tool via digital communication.

## 3 Product description

### 3.1 Product design



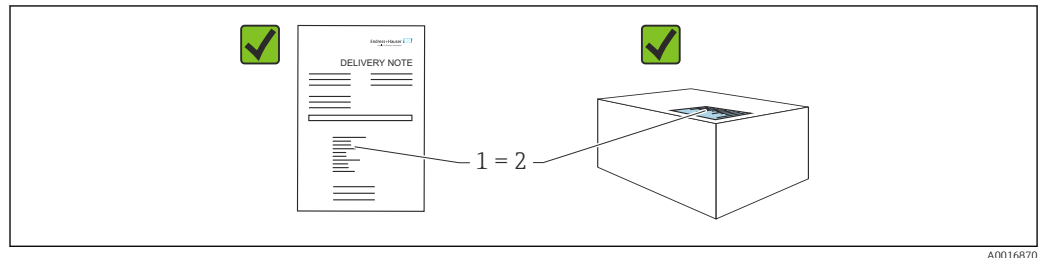
1 Overview of materials; 40 mm (1.5 in) antenna, cable entry thread

- 1 Antenna end process connection; PVDF
- 2 EPDM seal (for G 1½" thread)
- 3 PBT/PC design ring
- 4 PBT/PC sensor housing
- 5 EPDM seal
- 6 Cable entry process connection: PBT/PC
- 7 Counter nut; PA6.6

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## 4 Incoming acceptance and product identification

### 4.1 Incoming acceptance



Check the following during incoming acceptance:

- Is the order code on the delivery note (1) identical to the order code on the product sticker (2)?
- Are the goods undamaged?
- Do the data on the nameplate correspond to the order specifications and the delivery note?
- Is the documentation provided?
- 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 identification of the device:

- Nameplate specifications
- Order code with breakdown of the device features on the delivery note
- Enter the serial numbers from the nameplates in *Device Viewer* ([www.endress.com/deviceviewer](http://www.endress.com/deviceviewer)): all the information about the device is displayed.

#### 4.2.1 Nameplate

The information that is required by law and is relevant to the device is shown on the nameplate, e.g.:

- Manufacturer identification
- Order number, extended order code, serial number
- Technical data, degree of protection
- Firmware version, hardware version
- Approval-related information, reference to Safety Instructions (XA)
- DataMatrix code (information about the device)

Compare the data on the nameplate with your order.

#### 4.2.2 Manufacturer address

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

## 4.3 Storage and transport

### 4.3.1 Storage conditions

- Use the original packaging
- Store the device in clean and dry conditions and protect from damage caused by shocks

#### Storage temperature

-40 to +80 °C (-40 to +176 °F)

### 4.3.2 Transporting the product to the measuring point

#### **⚠ WARNING**

#### Incorrect transport!

The housing or sensor can be damaged or pull off. Risk of injury!

- ▶ Transport the device to the measuring point in its original packaging or by the process connection.

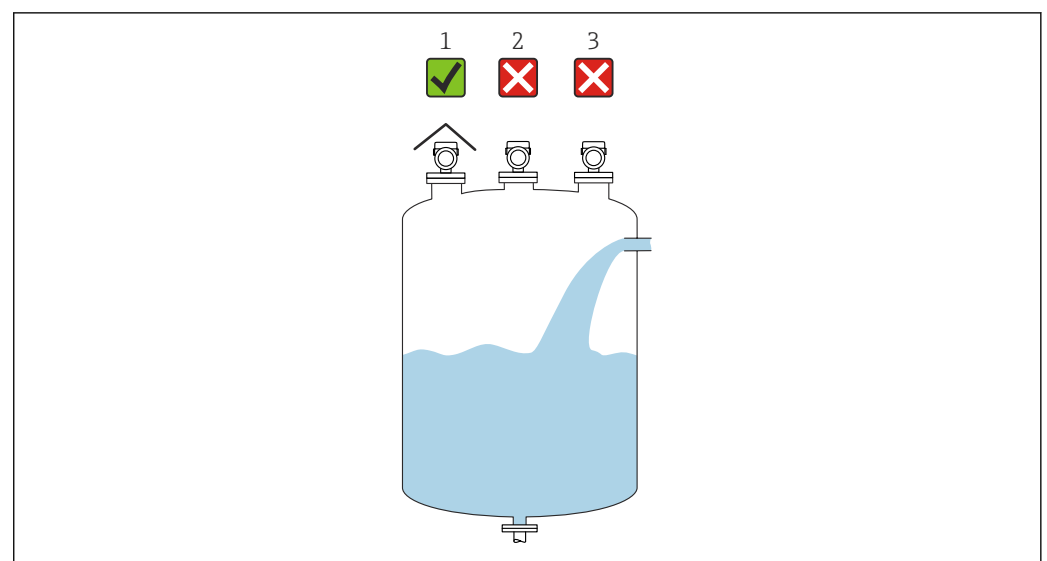
## 5 Mounting

### 5.1 Mounting instructions

**i** During installation, it is important to ensure that the sealing element used has a permanent operating temperature that corresponds to the maximum temperature of the process.

- Devices are suitable for use in wet environments in accordance with IEC/EN 61010-1.
- Protect the housing against impact.

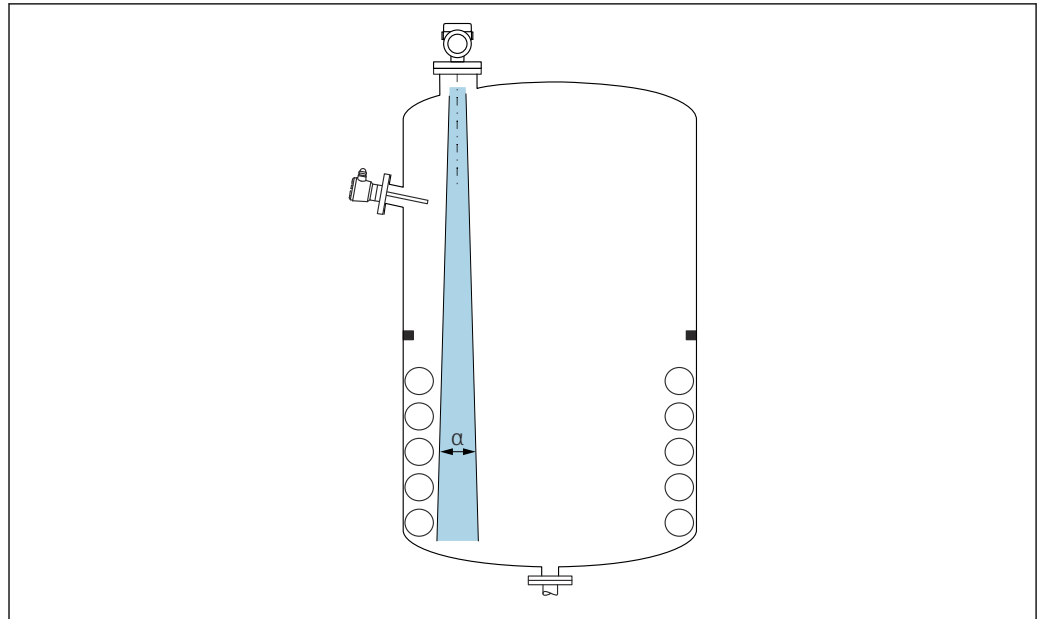
### 5.2 Mounting location



- 1 Use of a weather protection cover; protection from direct sunlight or rain
- 2 Installation in the center, interference can cause incorrect signal evaluation
- 3 Do not install above the filling curtain

A0055811

### 5.3 Internal vessel fittings



A0031777

Avoid internal fittings (point level switches, temperature sensors, struts, vacuum rings, heating coils, baffles etc.) inside the signal beam. Pay attention to the beam angle  $\alpha$ .

### 5.4 Vertical alignment of antenna axis

Align the antenna so that it is perpendicular to the product surface.

**i** The maximum reach of the antenna can be reduced, or additional interference signals can occur, if the antenna is not installed perpendicular to the product.

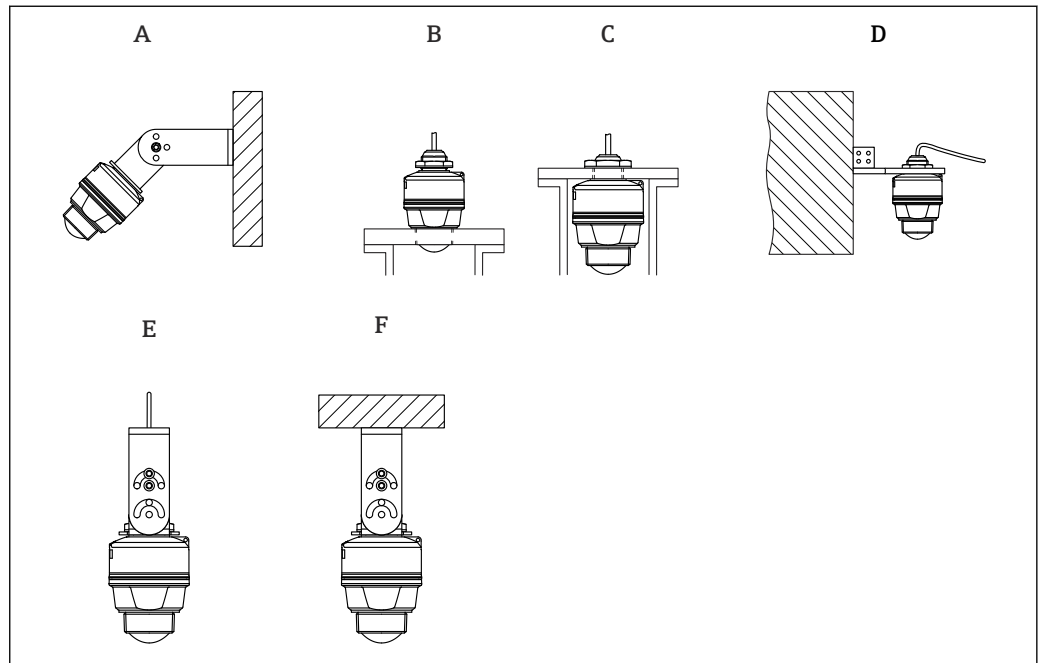
### 5.5 Optimization options


#### Mapping

Measurement can be optimized by electronically suppressing interference echoes. See the **Confirm distance** parameter.

## 5.6 Mounting the device

### 5.6.1 Installation types



 2 Wall or ceiling mount

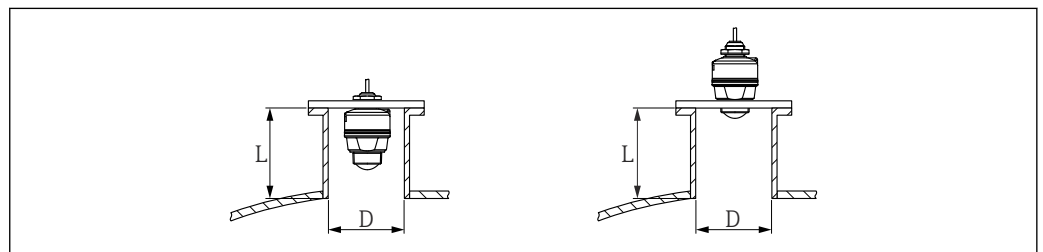
- A Wall mounting adjustable
- B Tightened at antenna end process connection
- C Tightened at cable entry process connection
- D Wall mounting with cable entry process connection
- E Rope mounting
- F Ceiling installation

#### Caution!

- The sensor cables are not designed as supporting cables. Do not use them for suspension purposes.
- For rope mounting, the rope must be provided by the customer.
- Always operate the device in a vertical position in free-space applications.

### 5.6.2 Installation instructions

To ensure optimum measurement, the antenna should protrude from the nozzle. The interior of the nozzle must be smooth and must not contain any edges or welded joints. The edge of the nozzle should be rounded if possible.



 3 Nozzle installation, 40 mm (1.5 in) antenna

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

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

#### 40 mm (1.5 in) antenna, installation outside nozzle

- D: min. 40 mm (1.5 in)
- L: max.  $(D - 30 \text{ mm (1.2 in)}) \times 7.5$

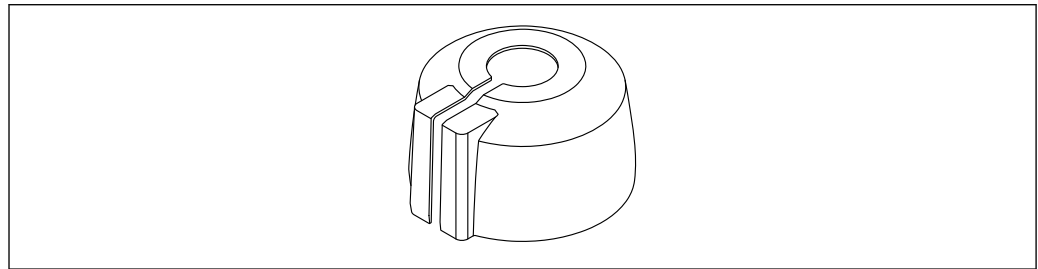
#### 40 mm (1.5 in) antenna, installation inside nozzle

- D: min. 80 mm (3 in)
- L: max.  $100 \text{ mm (3.94 in)} + (D - 30 \text{ mm (1.2 in)}) \times 7.5$


### 5.6.3 Weather protective cover

A weather protective cover is recommended for outdoor use.

It can be ordered as an optional accessory.



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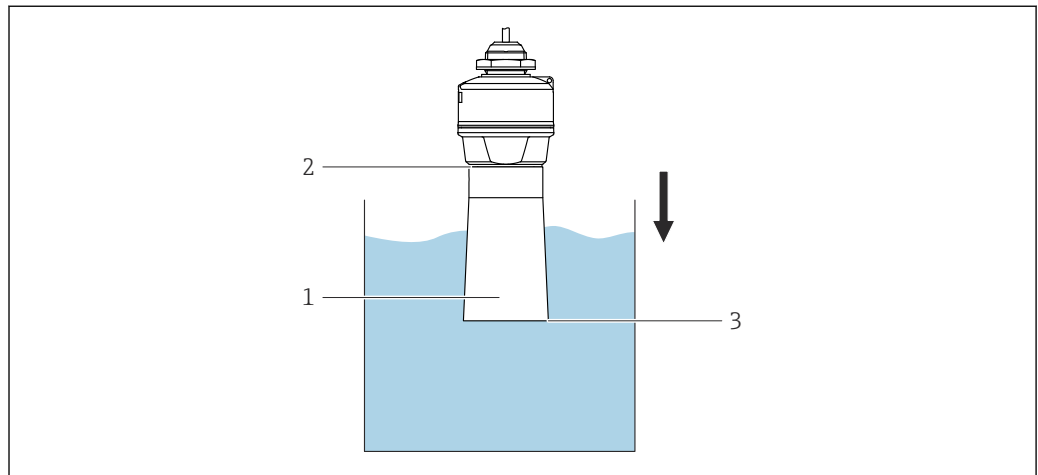
 4 Weather protective cover, cable entry from above

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

### 5.6.4 Flooding protection tube

The flooding protection tube ensures the sensor measures the maximum level even if it is completely flooded.

It can be ordered as an optional accessory.



A0056000

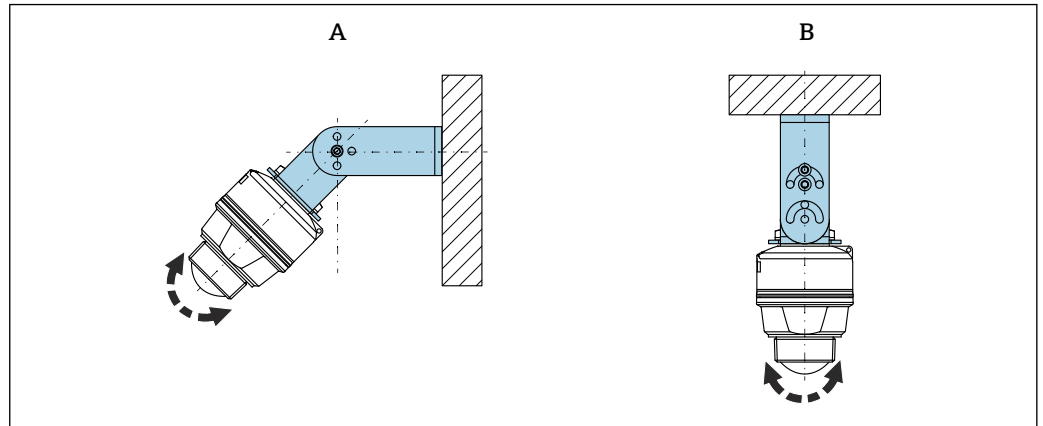
 5 Function of flooding protection tube

- 1 Air pocket
- 2 O-ring (EPDM) seal
- 3 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 air pocket that forms in the tube ensures the measurement of the maximum level at the end of the tube.

### 5.6.5 Installation with mounting bracket, adjustable

The mounting bracket can be ordered as an optional accessory.



A0056001

#### 6 Installation with mounting bracket, adjustable

- A Mounting bracket, adjustable for 40 mm (1.5 in) antenna, wall mounting  
 B Mounting bracket, adjustable for 40 mm (1.5 in) antenna, ceiling mounting

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

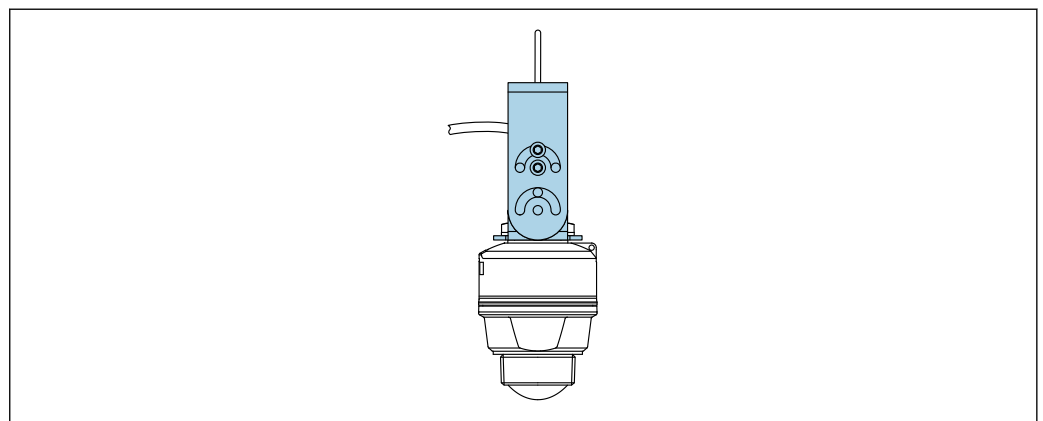
#### NOTICE

**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.

#### Rope mounting



A0056002

#### 7 Installation with rope mounting

Mounting bracket, adjustable for 40 mm (1.5 in) antenna, rope mounting

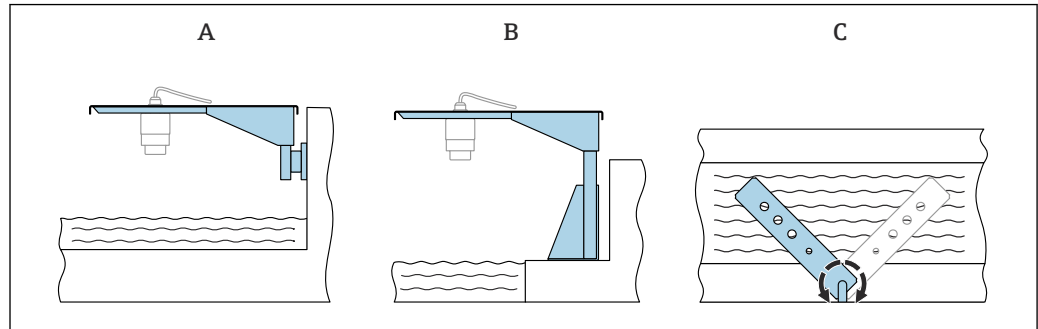
Align the antenna so that it is perpendicular to the product surface.

- i** In the case of rope mounting, note that the cable should not be used to suspend the device.

The use of a separate rope is required.

### 5.6.6 Cantilever installation, with pivot

The cantilever, wall bracket and mounting frame can be ordered as accessories.



A0028412

8 Cantilever installation, with pivot

A Cantilever with wall bracket (side view)

B Cantilever with mounting frame (side view)

C Cantilever can be turned, e.g. in order to position the device over the center of the flume (top view)

#### NOTICE

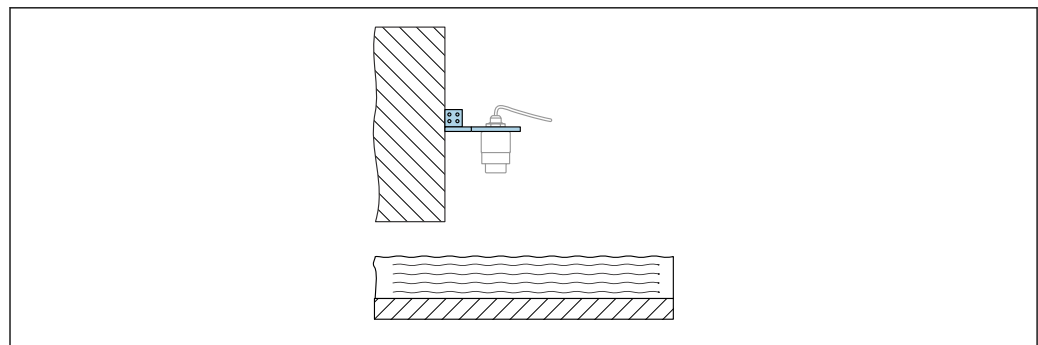
**There is no conductive connection between the mounting bracket and transmitter housing.**

Electrostatic charging possible.

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

### 5.6.7 Mounting with a pivotable mounting bracket

The pivotable mounting bracket can be ordered as an optional accessory.



A005398

9 Pivotable and adjustable cantilever with wall bracket (e.g. to align the device with the center of a flume)

#### 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.

## 5.7 Post-mounting check

- Are the device and cable undamaged (visual check)?
- Are the measuring point identification and labeling correct (visual inspection)?
- Is the device protected from precipitation and direct sunlight?



- Is the device properly secured?
  - Does the device comply with the measuring point specifications?
- For example:
- Process temperature
  - Process pressure
  - Ambient temperature
  - Measuring range

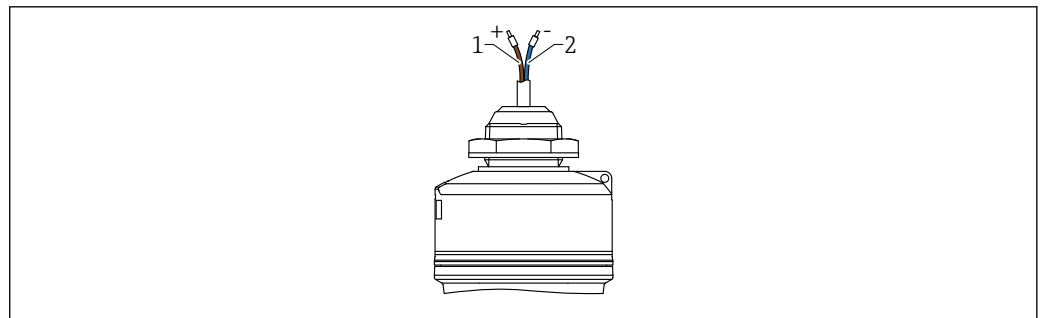
## 6 Electrical connection

### 6.1 Connecting the device

#### 6.1.1 Potential equalization

No special measures for potential equalization are required.

#### 6.1.2 Cable assignment




 10 Cable assignment, cable entry from above

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

#### 6.1.3 Supply voltage

12 to 30 V<sub>DC</sub> on a direct current power unit

 The power unit must be safety-approved (e.g. PELV, SELV, Class 2) and must comply with the relevant protocol specifications.

Protective circuits against reverse polarity, HF influences and overvoltage peaks are installed.

#### 6.1.4 Power consumption

To meet device safety specifications according to the IEC/EN 61010 standard, the installation must ensure that the maximum current is limited to 500 mA.

#### 6.1.5 Cable specification

Unshielded cable, wire cross-section 0.5 mm<sup>2</sup>

- Resistant to UV and weather conditions as per ISO 4892-2
- Flame resistance according to IEC 60332-1-2

The device is available with a cable length of 10 m (32 ft).

### 6.1.6 Overvoltage protection

The device satisfies the IEC/DIN EN 61326-1 product standard (Table 2 Industrial environment). Depending on the type of connection (DC power supply, input line, output line), different test levels are used to prevent transient overvoltages (IEC/DIN EN 61000-4-5 Surge) in accordance with IEC/DIN EN 61326-1: Test level for DC power supply lines and IO lines: 1 000 V wire to ground.

#### Overvoltage category

In accordance with IEC/DIN EN 61010-1, the device is intended for use in networks with overvoltage protection category II.

## 6.2 Ensuring the degree of protection

Test as per IEC 60529 Edition 2.2 2013-08/DIN EN 60529 2014-09 and NEMA 250-2014:

- IP66, NEMA Type 4X
- IP68, NEMA Type 6P (24 h at 1.83 m (6.00 ft) under water)

## 6.3 Post-connection check

- Are the device and cable undamaged (visual check)?
- Does the cable used comply with the requirements?
- Is the mounted cable strain-relieved?
- Is the screw connection properly mounted?
- Does the supply voltage match the specifications on the nameplate?
- No reverse polarity, terminal assignment correct?
- If supply voltage is present: Is the device ready for operation and is the green operating status LED lit?

# 7 Operation options

## 7.1 Overview of operation options

- Operation via Bluetooth®
- Operation via DeviceCare

## 7.2 Structure and function of the operating menu

The full operating menu, accessible via operating tools (DeviceCare, SmartBlue), allows users to make more complex settings on the device.

Wizards help the user to commission the various applications. The user is guided through the individual configuration steps.

## 7.2.1 Overview of the operating menu

### "Guidance" menu

The Guidance main menu contains functions that enable the user to carry out basic tasks quickly, e.g. commissioning. This menu primarily consists of guided wizards and special functions covering multiple areas.

### "Diagnostics" menu

Diagnostic information and settings as well as help for troubleshooting.

### "Application" menu

Functions for detailed adjustment of the process for optimum integration of the device into the application.

### "System" menu

System settings for device management, user administration or safety.

## 7.2.2 User roles and related access authorization

This device supports 2 user roles: **Maintenance** and **Operator**

- The **Maintenance** user role (as delivered to customer) has read/write access.
- The **Operator** user role has read access only.

The current user role is displayed in the main menu.

The device parameters can be fully configured with the **Maintenance** user role. Afterwards, access to the configuration can be locked by assigning a password. This password acts as an access code and protects device configuration from unauthorized access.

Blocking changes the **Maintenance** user role to the **Operator** user role. The configuration can be accessed again by entering the access code.

If an incorrect access code is entered, the user obtains the access rights of the **Operator** role.

Assign password, change user role:

- ▶ Navigation: System → User management

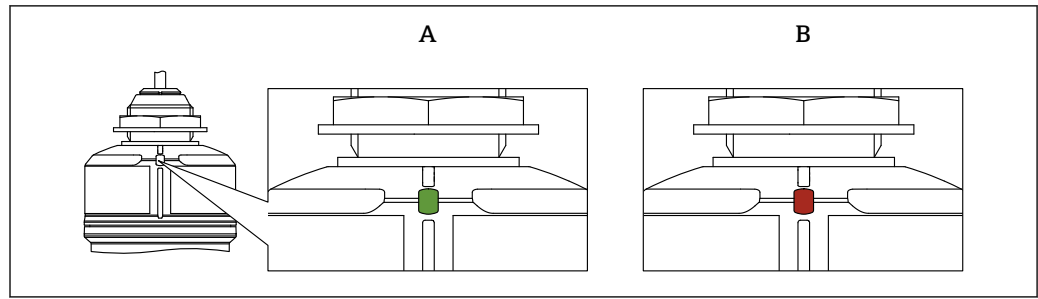
## 7.3 Operation via Bluetooth® wireless technology


Prerequisite:

Smartphone or tablet with Endress+Hauser SmartBlue app or PC with DeviceCare from version 1.07.07 or FieldXpert SMT70/SMT77

The connection has a range of up to 25 m (82 ft). The range can vary depending on environmental conditions such as attachments, walls or ceilings.

## 7.4 LED indicator



 11 LED indicator on the device

A Green LED

B Red LED

### Functions:

- Displays the operating status
  - Operation (green)
  - Fault (red)
- Displays an active Bluetooth connection (flashing)

## 7.5 Access to the operating menu via the operating tool

### 7.5.1 Connecting the operating tool

Access via the operating tool is possible via Bluetooth.

#### DeviceCare

##### Range of functions

Tool to connect and configure Endress+Hauser field devices.



For details, see Innovation Brochure IN01047S.

#### FieldXpert SMT70, SMT77

The Field Xpert SMT70 tablet PC for device configuration enables mobile plant asset management in hazardous (Ex Zone 2) and non-hazardous areas. It is suitable for commissioning and maintenance staff. It manages Endress+Hauser and third-party field instruments with a digital communication interface and documents the progress of the work. The SMT70 is designed as a complete solution. It comes with a pre-installed driver library and is an easy-to-use, touch-enabled tool for managing field devices throughout their entire life cycle.



Technical Information TI01342S

The Field Xpert SMT77 tablet PC for device configuration enables mobile plant asset management in areas categorized as Ex Zone 1.

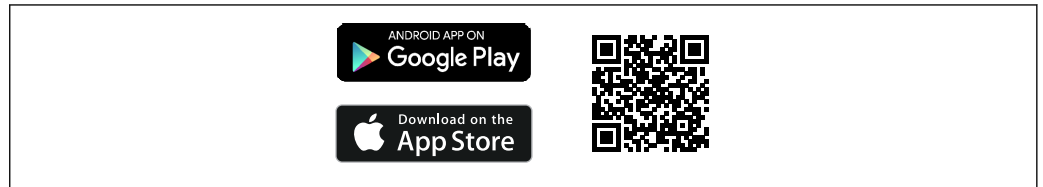


Technical Information TI01418S


### 7.5.2 Operation via SmartBlue App

The device can be operated and configured with the SmartBlue App.

- The SmartBlue App must be downloaded onto a mobile device for this purpose.
- For information on the compatibility of the SmartBlue App with mobile devices, see **Apple App Store (iOS devices)** or **Google Play Store (Android devices)**.
- Incorrect operation by unauthorized persons is prevented by means of encrypted communication and password encryption.
- The Bluetooth® function can be deactivated after initial device setup.





A0033202

 12 QR code for free Endress+Hauser SmartBlue App

Download and installation:

1. Scan the QR code or enter **SmartBlue** in the search field of the Apple App Store (iOS) or Google Play Store (Android).
2. Install and start the SmartBlue App.
3. For Android devices: enable location tracking (GPS) (not required for iOS devices).
4. Select a device that is ready to receive from the device list displayed.

Login:

1. Enter the user name: admin
  2. Enter the initial password: serial number of the device
-  Change the password after logging in for the first time.
-  Forgotten your password? Contact Endress+Hauser Service.

## 8 Commissioning

### 8.1 Preliminaries

#### WARNING

Settings on the current output can result in a safety-related condition (e.g., product overflow)!

- ▶ Check current output settings.

### 8.2 Installation and function check

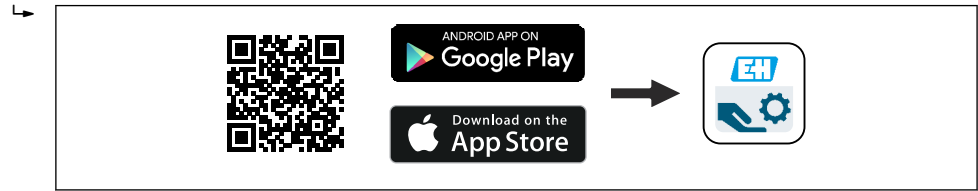
Before commissioning the measuring point, check whether the post-installation and post-connection checks have been performed.

-  Post-mounting check
-  Post-connection check

## 8.3 Commissioning via SmartBlue app

### 8.3.1 SmartBlue App

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



13 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!

## 8.4 Notes on the "Commissioning" wizard

The **Commissioning** wizard allows you to carry out easy, user-guided commissioning.

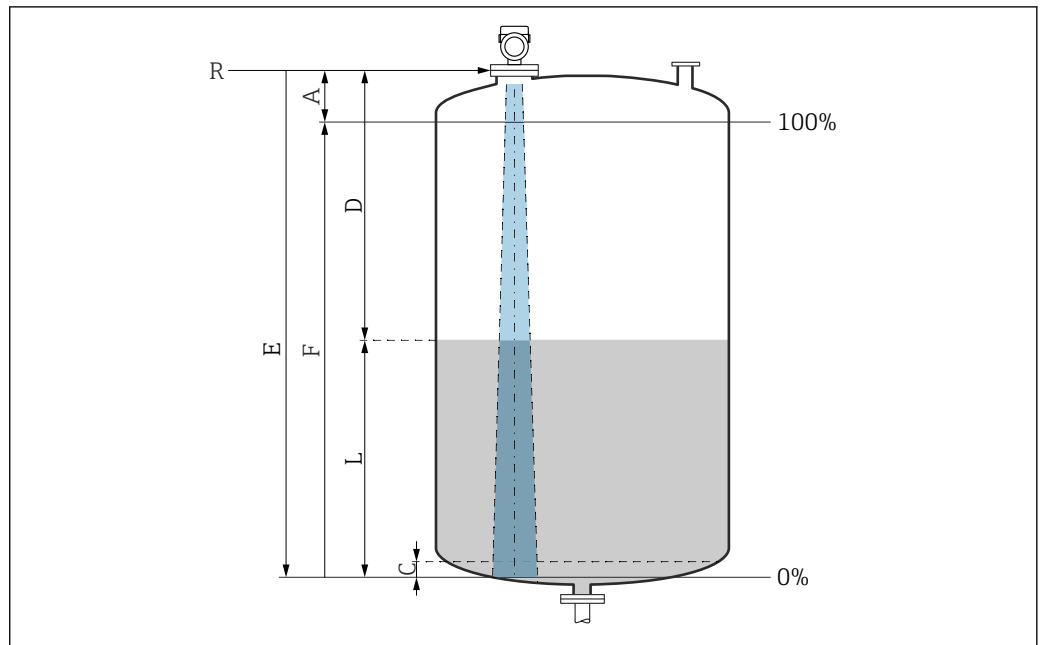
1. Once you have started the **Commissioning** wizard, enter the appropriate value in each parameter or select the appropriate option. These values are written directly to the device.
2. Click "Next" to go to the next page.
3. Once all the pages have been completed, click "End" to close the **Commissioning** wizard.

If the **Commissioning** wizard is cancelled before all necessary parameters have been configured, the device may be in an undefined state. In such situations, it is advisable to reset the device to the factory default settings.

## 8.5 Configuring the device

Commissioning via the Commissioning wizard is recommended.  
See the "Commissioning via the SmartBlue App" section

### 8.5.1 Level measurement in liquids



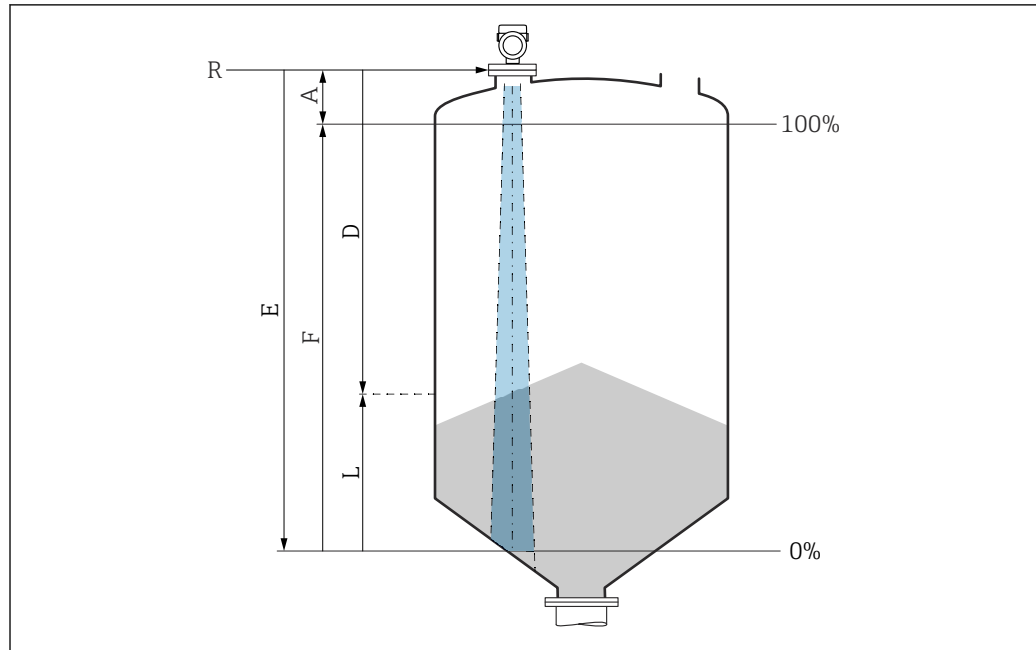
A0016933

14 Configuration parameters for level measurement in liquids

- R Reference point of measurement
- A Length of antenna + 10 mm (0.4 in)
- C 50 to 80 mm (1.97 to 3.15 in); medium  $\epsilon_r < 2$
- D Distance
- L Level
- E "Empty calibration" parameter (= 0 %)
- F "Full calibration" parameter (= 100 %)

In the case of media with a low dielectric constant,  $\epsilon_r < 2$ , the tank floor may be visible through the medium at very low levels (lower than level C). Reduced accuracy must be expected in this range. If this is not acceptable, the zero point should be positioned at a distance C above the tank floor for these applications (see figure).

### 8.5.2 Level measurement in bulk solids



A0016934

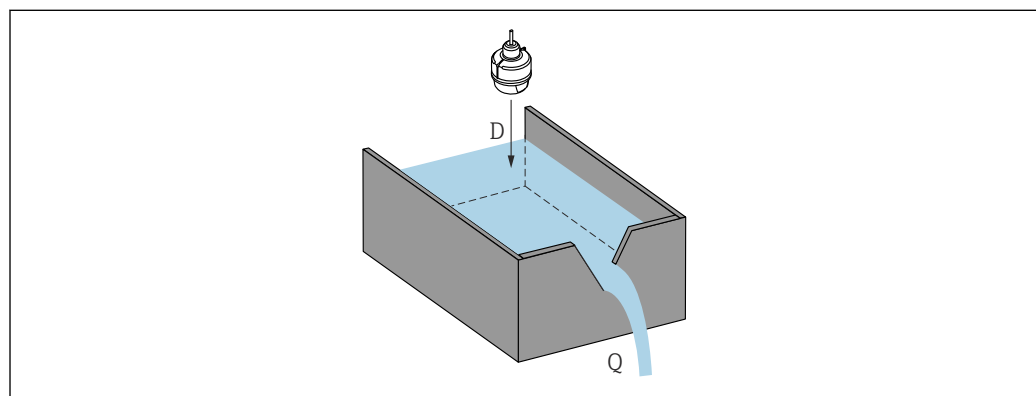
15 Configuration parameters for level measurement in bulk solids

- R Reference point of measurement
- A Length of antenna + 10 mm (0.4 in)
- D Distance
- L Level
- E "Empty calibration" parameter (= 0 %)
- F "Full calibration" parameter (= 100 %)

### 8.5.3 Configuring flow measurement via operating software

#### Installation conditions for flow measurement

- A channel or a weir is required for flow measurement
- Position the sensor in the center of the channel or weir
- Align the sensor so that it is perpendicular to the surface of the water
- Use a weather protection cover to protect the device from sunshine and rain



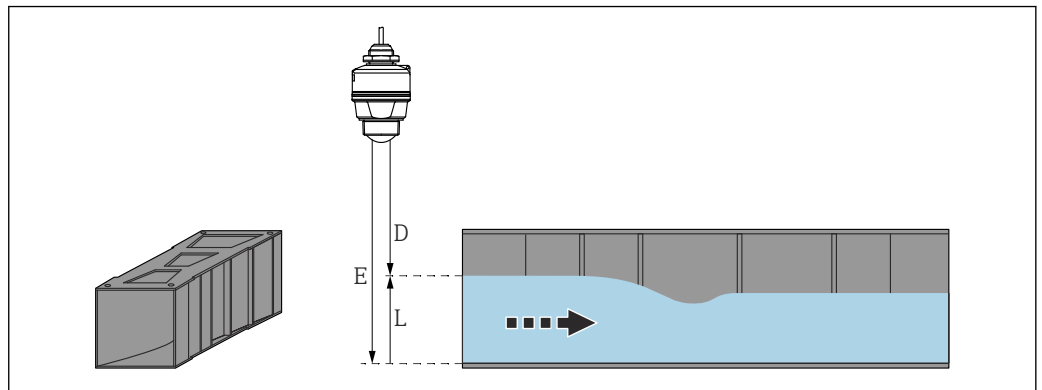
A0055823

16 Configuration parameters for the flow measurement of liquids

- D Distance
- Q Flow rate at measuring weirs or channels (calculated from the level using linearization)



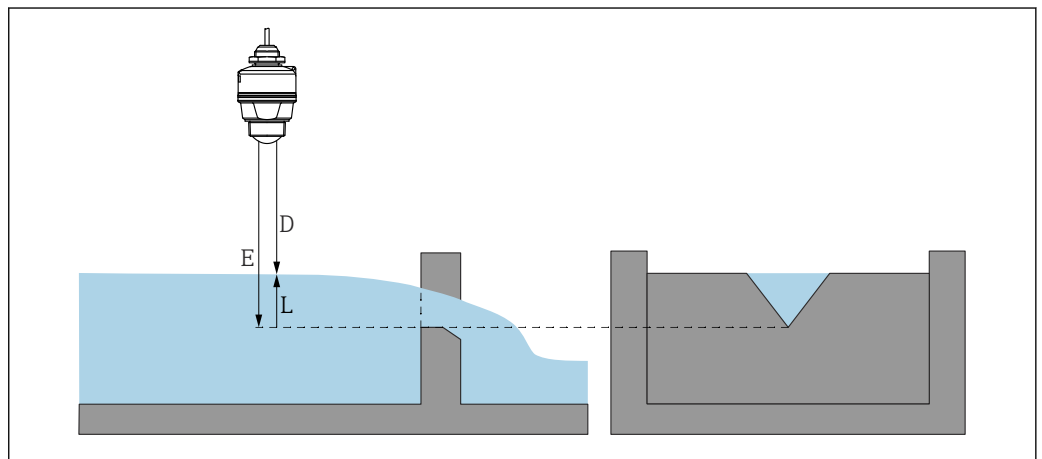
**Flow measurement configuration**



A0055824

17 Example: Khafagi-Venturi flume

- E Empty calibration (= zero point)
- D Distance
- L Level



A0055825

18 Example: Triangular weir

- E Empty calibration (= zero point)
- D Distance
- L Level

**8.6 Configuring "Frequency mode" parameter**

The **Frequency mode** parameter is used to define country or region-specific settings for the radar signals.

**i** The **Frequency mode** parameter must be configured at the start of commissioning in the operating menu using the appropriate operating tool.

Application → Sensor → Advanced settings → Frequency mode

Operating frequency 80 GHz:

- **Mode 2** option: Continent Europe, USA, Australia, New Zealand, Canada, Brazil, Japan, South Korea, Taiwan, Thailand
- **Mode 3** option: Russia, Kazakhstan
- **Mode 4** option: Mexico
- **Mode 5** option: India, Malaysia, South Africa, Indonesia

**i** The metrological properties of the device may vary, depending on the mode set. The specified metrological properties refer to the device as supplied to the customer (**Mode 2** option).

## 8.7 "Simulation" submenu

Process variables and diagnostic events can be simulated with the **Simulation** submenu.

Navigation: Diagnostics → Simulation

During simulation of the switch output or current output, the device issues a warning message for the duration of the simulation.

## 8.8 Protecting settings from unauthorized access

### 8.8.1 Software locking or unlocking

#### Locking via password in DeviceCare/SmartBlue app

Access to parameter configuration of the device can be locked by assigning a password. When the device is delivered from the factory, the user role is set to the **Maintenance** option. The device can be configured completely with the **Maintenance** option user role. Afterwards, access to the configuration can be locked by assigning a password. The **Maintenance** option switches to the **Operator** option as a result of this locking. The configuration can be accessed by entering the password.

The password is defined under:

**System** menu **User management** submenu

The user role is changed from the **Maintenance** option to the **Operator** option under:

System → User management

#### Deactivating the lock via DeviceCare/SmartBlue app

After entering the password, you can enable parameter configuration of the device as the **Operator** option with the password. The user role then changes to the **Maintenance** option.

If necessary, the password can be deleted in User management: System → User management

## 9 Operation

### 9.1 Reading the device locking status

#### 9.1.1 Operating tool

 Operating tool (DeviceCare/FieldXpert/SmartBlue app)

Navigation: System → Device management → Locking status

### 9.2 Reading measured values

All measured values can be read using the **Measured values** submenu.

Navigation: **Application** menu → **Measured values** submenu

## 9.3 Adapting the device to process conditions

The following menus are available for this purpose:

- Basic settings in the **Guidance** menu
- Advanced settings in:
  - **Diagnostics** menu
  - **Application** menu
  - **System** menu



For details, see the "Description of device parameters" documentation.

# 10 Diagnostics and troubleshooting

## 10.1 General troubleshooting

### 10.1.1 General faults

#### Device fails to start

- Possible cause: Supply voltage does not match the specification on the nameplate  
Remedial action: Apply the correct voltage
- Possible cause: The polarity of the supply voltage is wrong  
Remedial action: Correct the polarity
- Possible cause: Load resistance too high  
Remedial action: Increase the supply voltage to reach the minimum terminal voltage

### 10.1.2 Fault - SmartBlue operation with Bluetooth®

#### Device is not visible in the live list

- Possible cause: Bluetooth signal outside range  
Remedial action: Reduce distance between field device and smartphone/tablet  
The connection has a range of up to 25 m (82 ft)  
Operating radius with intervisibility 10 m (33 ft)
- Possible cause: Geopositioning is not enabled on Android devices or is not permitted for the SmartBlue app  
Remedial action: Enable/permit the geopositioning service on Android device for the SmartBlue app

#### Device appears in the live list but a connection cannot be established

- Possible cause: The device is already connected with another smartphone/tablet via Bluetooth  
Only one point-to-point connection is permitted  
Remedial action: Disconnect the smartphone/tablet from the device
- Possible cause: Incorrect user name and password  
Remedial action: The standard user name is "admin" and the password is the device serial number indicated on the device nameplate (only if the password was not changed by the user beforehand)  
If the password has been forgotten, contact Endress+Hauser Service ([www.addresses.endress.com](http://www.addresses.endress.com))

#### Connection via SmartBlue not possible

- Possible cause: Incorrect password entered  
Remedial action: Enter the correct password, paying attention to lower/upper case
- Possible cause: Forgotten password  
If the password has been forgotten, contact Endress+Hauser Service ([www.addresses.endress.com](http://www.addresses.endress.com))


**Login via SmartBlue not possible**

- Possible cause: Device is being put into operation for the first time  
Remedial action: Enter the user name "admin" and the password (device serial number), paying attention to lower/upper case
- Possible cause: The electric current and voltage are not correct.  
Remedial action: Increase the supply voltage.

**Device cannot be operated via SmartBlue**

- Possible cause: Incorrect password entered  
Remedial action: Enter the correct password, paying attention to lower/upper case
- Possible cause: Forgotten password  
If the password has been forgotten, contact Endress+Hauser Service ([www.addresses.endress.com](http://www.addresses.endress.com))
- Possible cause: **Operator** option has no authorization  
Remedial action: Change to the **Maintenance** option

**10.1.3 Measures**

For information on measures in the case of an error message: See  "Pending diagnostic messages" section.

If the measures do not rectify the problem, contact your Endress+Hauser office.

**10.1.4 Additional tests**

If no clear cause of the error can be identified or the source of the problem can be both the device and the application, the following additional tests can be performed:

1. Check digital value.
2. Check that the device concerned is functioning correctly. Replace the device if the digital value does not correspond to the expected value.
3. Switch on simulation and check the current output. Replace the device if the current output does not correspond to the simulated value.
4. Reset the device to the factory setting.

**10.1.5 Behavior of the device in the event of a power outage**

In the event of an unexpected power outage, the dynamic data are stored permanently (according to NAMUR NE 032).

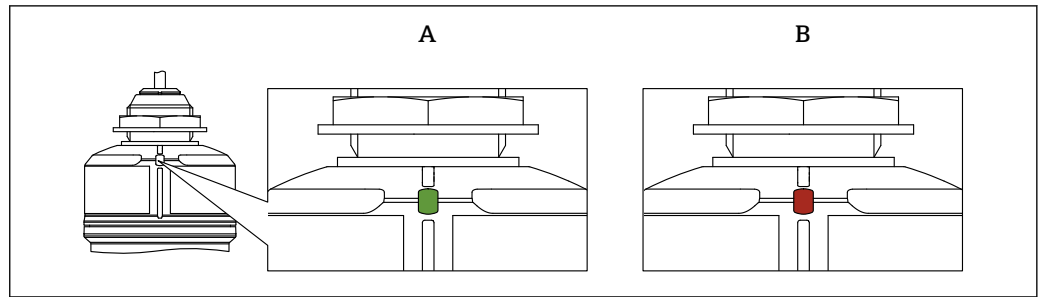
**10.1.6 Behavior of the current output in the event of a failure**

The behavior of the current output in the event of failures is defined by the **Failure behavior current output** parameter.

**Parameter overview with brief description**

Parameter	Description	Selection / User entry
Failure behavior current output	Defines which current the output assumes in the case of an error. Min: < 3.6 mA Max: >21.5 mA  Note: The hardware DIP Switch for alarm current (if available) has priority over software setting.	<ul style="list-style-type: none"> <li>■ Min.</li> <li>■ Max.</li> </ul>
Failure current	Enter current output value in alarm condition	21.5 to 23 mA

## 10.2 Diagnostic information via LED indicator



19 LED indicator on the device

- Operating status LED is continuously lit in green: everything is OK
- Operating status LED is continuously lit in red: diagnosis type "Alarm" is active
- During Bluetooth connection: LED operating status flashes while the function is being executed  
LED flashes independently of the LED color

## 10.3 Diagnostic event in the operating tool

If a diagnostic event has occurred in the device, the status signal appears in the top left status area of the operating tool together with the corresponding symbol for the event level according to NAMUR NE 107:

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

Click the status signal to see the detailed status signal.

The diagnostic events and remedial measures can be printed from the **Diagnostic list** submenu.

## 10.4 Adapting the diagnostic information

The event level can be configured:

Navigation: Diagnostics → Diagnostic settings → Configuration

## 10.5 Pending diagnostic messages

Pending diagnostic messages can be displayed in the **Active diagnostics** parameter.

Navigation: Diagnostics → Active diagnostics

## 10.6 Diagnostic list

All of the diagnostic messages currently pending can be displayed in the **Diagnostic list** submenu.

Navigation: Diagnostics → Diagnostic list

### 10.6.1 List of diagnostic events

 Diagnoses 168, 203, 204, 242, 252, 420, 421, 806, 846, 847, 848 and 952 cannot occur with this device.

For diagnoses 270, 273 and 805: The device must be replaced if the electronics are replaced.

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
<b>Diagnostic of sensor</b>				
062	Sensor connection faulty	Check sensor connection	F	Alarm
151	Sensor electronic failure	1. Restart device 2. Contact service	F	Alarm
168	Buildup detected	Check process conditions	M	Warning <sup>1)</sup>
<b>Diagnostic of electronic</b>				
203	HART Device Malfunction	Check device specific diagnosis.	S	Warning
204	HART Electronic Defect	Check device specific diagnosis.	F	Alarm
242	Firmware incompatible	1. Check software 2. Flash or change main electronic module	F	Alarm
252	Module incompatible	1. Check if correct electronic module is plugged 2. Replace electronic module	F	Alarm
270	Main electronics defective	Replace main electronics or device.	F	Alarm
272	Main electronics faulty	1. Restart device 2. Contact service	F	Alarm
273	Main electronics defective	Replace main electronics or device.	F	Alarm
282	Data storage inconsistent	Restart device	F	Alarm
283	Memory content inconsistent	1. Restart device 2. Contact service	F	Alarm
287	Memory content inconsistent	1. Restart device 2. Contact service	M	Warning
388	Electronics and HistoROM defective	1. Restart device 2. Replace electronics and HistoROM 3. Contact service	F	Alarm
<b>Diagnostic of configuration</b>				
410	Data transfer failed	1. Retry data transfer 2. Check connection	F	Alarm
412	Processing download	Download active, please wait	C	Warning
420	HART Device Configuration Locked	Check device locking configuration.	S	Warning
421	HART Loop Current fixed	Check Multi-drop mode or current simulation.	S	Warning
430	Configuration faulty	1. Check configuration 2. Adapt configuration	F	Alarm
431	Trim required	Carry out trim	C	Warning
435	Linearization faulty	Check linearization table	F	Alarm

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
437	Configuration incompatible	1. Update firmware 2. Execute factory reset	F	Alarm
438	Dataset different	1. Check dataset file 2. Check device parameterization 3. Download new device parameterization	M	Warning
441	Current output 1 saturated	1. Check process 2. Check current output settings	S	Warning
452	Calculation error detected	1. Check device configuration 2. Up- and download new configuration	F	Alarm
484	Failure mode simulation active	Deactivate simulation	C	Alarm
485	Process variable simulation active	Deactivate simulation	C	Warning
491	Current output simulation active	Deactivate simulation	C	Warning
495	Diagnostic event simulation active	Deactivate simulation	S	Warning
538	Configuration Sensor Unit invalid	1. Check sensor configuration 2. Check device configuration	F	Alarm
585	Simulation distance	Deactivate simulation	C	Warning
586	Record map	Recording of mapping please wait	C	Warning
<b>Diagnostic of process</b>				
801	Supply voltage too low	Increase supply voltage	F	Alarm
802	Supply voltage too high	Decrease supply voltage	S	Warning
805	Loop current faulty	1. Check wiring 2. Replace electronics or device	F	Alarm
806	Loop diagnostics	1. Check supply voltage 2. Check wiring and terminals	M	Warning <sup>1)</sup>
807	No Baseline due to insuf. volt. at 20 mA	Increase supply voltage	M	Warning
825	Electronics temperature	1. Check ambient temperature 2. Check process temperature	S	Warning
826	Sensor temperature out of range	1. Check ambient temperature 2. Check process temperature	S	Warning
843	Process value above limit	1. Decrease process value 2. Check application 3. Check sensor	F	Alarm
844	Process value out of specification	1. Check process value 2. Check application 3. Check sensor	S	Warning <sup>1)</sup>
846	HART Non-Primary Variable Out of Limit	Check device specific diagnosis.	S	Warning
847	HART Primary Variable Out of Limit	Check device specific diagnosis.	S	Warning
848	HART Device Variable Alert	Check device specific diagnosis.	S	Warning
941	Echo lost	Check parameter "DC value"	S	Warning <sup>1)</sup>

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
942	In safety distance	1. Check level 2. Check safety distance 3. Reset self holding	S	Warning <sup>1)</sup>
952	Foam detected	Check process conditions	S	Warning <sup>1)</sup>
968	Level limited	1. Check level 2. Check limit parameters	S	Warning

1) Diagnostic behavior can be changed.

## 10.7 Event logbook

### 10.7.1 Event history

The "**Event logbook**" submenu provides a chronological overview of the event messages that have occurred<sup>1)</sup>.

Navigation: Diagnostics → Event logbook

A maximum of 100 event messages can be displayed in chronological order.

The event history includes entries for:

- Diagnostic events
- Information events

In addition to the operating time when the event occurred, each event is also assigned a symbol that indicates whether the event has occurred or is finished:

- Diagnostic event
  - ☺: Occurrence of the event
  - ☹: End of the event
- Information event
  - ☺: Occurrence of the event

### 10.7.2 Filtering the event logbook

Filters can be used to determine which category of event messages is displayed in the **Event logbook** submenu.

Navigation: Diagnostics → Event logbook

#### Filter categories

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

1) If the device is operated via FieldCare, the event list can be displayed via the FieldCare "Event List" function.



### 10.7.3 Overview of information events


Info number	Info name
I1000	------(Device ok)
I1079	Sensor changed
I1089	Power on
I1090	Configuration reset
I1091	Configuration changed
I11074	Device verification active
I1110	Write protection switch changed
I11104	Loop diagnostics
I1151	History reset
I1154	Reset terminal voltage min/max
I1155	Reset electronics temperature
I1157	Memory error event list
I1256	Display: access status changed
I1264	Safety sequence aborted
I1335	Firmware changed
I1397	Fieldbus: access status changed
I1398	CDI: access status changed
I1440	Main electronic module changed
I1444	Device verification passed
I1445	Device verification failed
I1461	Sensor verification failed
I1512	Download started
I1513	Download finished
I1514	Upload started
I1515	Upload finished
I1551	Assignment error fixed
I1552	Failed: Main electronic verification
I1554	Safety sequence started
I1555	Safety sequence confirmed
I1556	Safety mode off
I1956	Reset

## 10.8 Resetting the device

### 10.8.1 Reset via digital communication

The device can be reset with the **Device reset** parameter.


Navigation: System → Device management

 Any customer-specific configuration carried out at the factory is not affected by a reset (customer-specific configuration remains).

## 10.8.2 Resetting the password via the operating tool

Enter a code to reset the current 'Maintenance' password.  
The code is delivered by your local support.


Navigation: System → User management → Reset password → Reset password

 For details see the "Description of device parameters" documentation.

## 10.9 Device information

All device information is contained in the **Information** submenu.

Navigation: System → Information

 For details see the "Description of device parameters" documentation.

## 10.10 Firmware history

### 10.10.1 Version

**01.00.00**

Initial software

## 11 Maintenance


No special maintenance work is required.

### 11.1 Exterior cleaning

#### Notes on cleaning

- The cleaning agents used should not corrode the surfaces and the seals
- Observe the degree of protection of the device

### 11.2 Seals

 The process seals, located on the process connection of the device, 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 information

#### 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 is replaced, previously saved parameters can be copied to the newly installed device.


After an entire device has been replaced, the parameters can be downloaded to the device again via the communication interface. The data must have been uploaded to the PC or the SmartBlue app beforehand using the "DeviceCare" software.

### 12.2 Return

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

1. Refer to the web page for information:  
<https://www.endress.com/support/return-material>  
↳ Select the region.
2. If returning the device, pack the device in such a way that it is reliably protected against impact and external influences. The original packaging offers the best protection.


## 12.3 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 the manufacturer for disposal under the applicable conditions.


## 13 Accessories

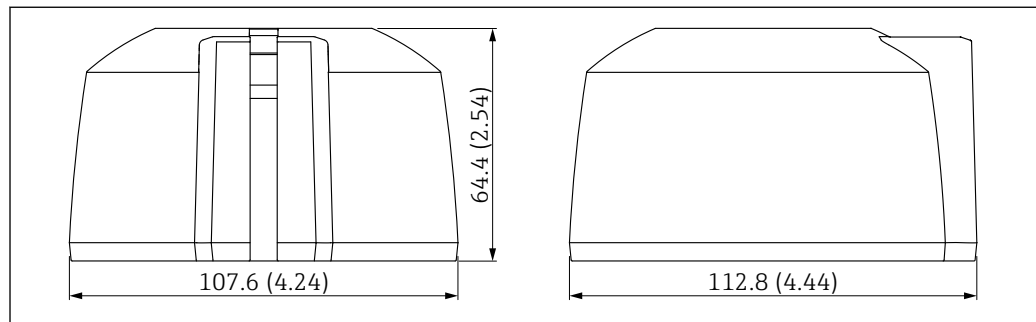
Accessories currently available for the product can be selected via the Product Configurator at [www.endress.com](http://www.endress.com):

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

 The accessories can be partially ordered via the "Accessory enclosed" product structure.

### 13.1 Weather protective cover for device with cable entry from above

 The sensor is not completely covered.



 20 Dimensions for weather protective cover G1/NPT1, cable entry from above. Unit of measurement mm (in)

#### Material

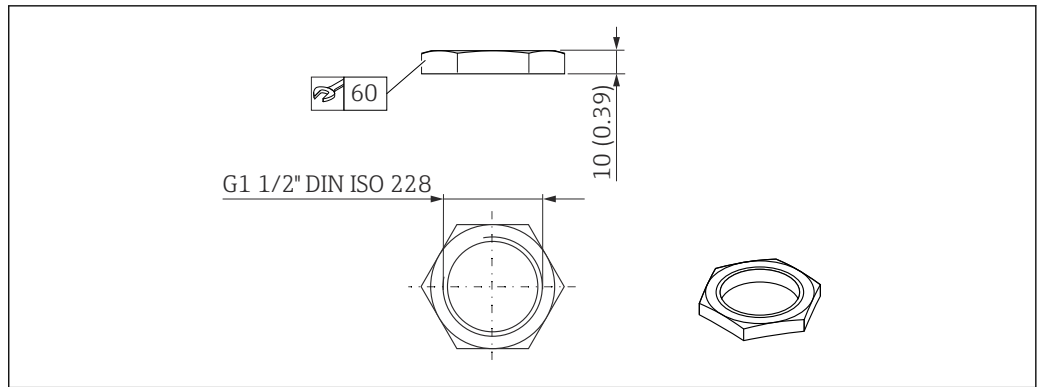
PBT/PC

#### Order code

71662413

### 13.2 Securing nut G 1½"

Suitable for devices with G 1½" and MNPT 1½" process connection.



A0028849

21 Dimensions of securing nut. Unit of measurement mm (in)

**Material**

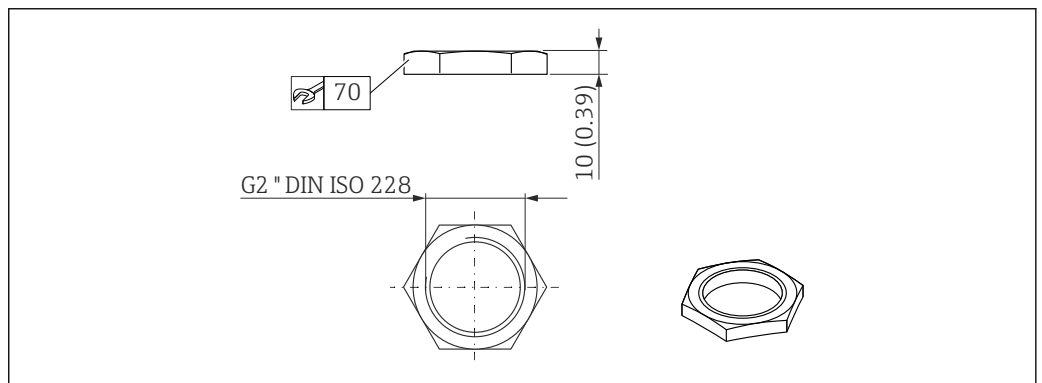
PC

**Order code**

52014146

### 13.3 Securing nut G 2"

Suitable for devices with G 2" and MNPT 2" antenna end process connection.



A0029101

22 Dimensions of securing nut. Unit of measurement mm (in)


**Material**

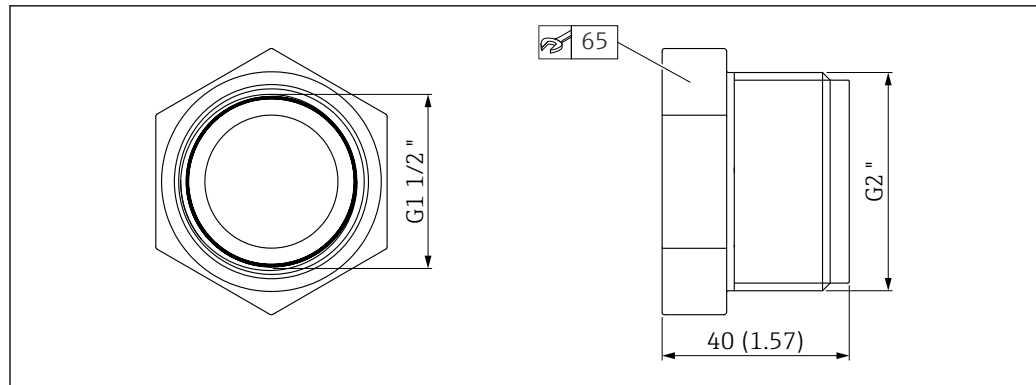
PC

**Order code**

52000598

### 13.4 Uni adapter G 1½" > G 2"

 Temperature range -40 to 45 °C (-40 to 113 °F)



A0055848

23 Dimensions of Uni adapter

#### Material

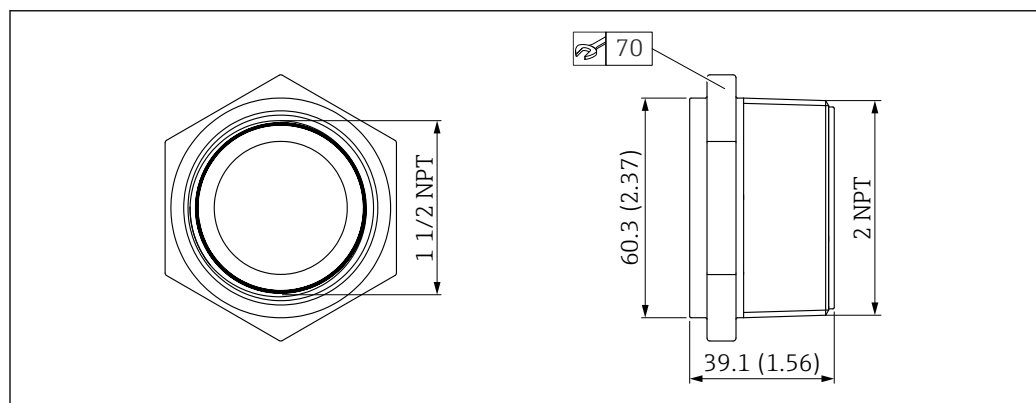
PVC

#### Order code

71662415

### 13.5 Uni adapter MNPT 1½" > MNPT 2"

**i** Temperature range -40 to 65 °C (-40 to 150 °F)



A0055847

24 Dimensions of Uni adapter

#### Material

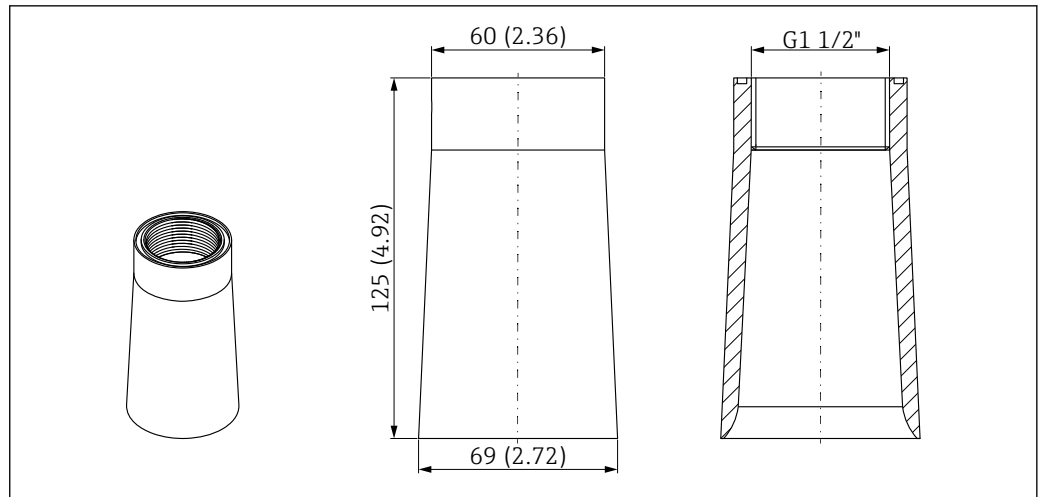
PP

#### Order code

71666515

### 13.6 Flooding protection tube 40 mm (1.5 in)

Suitable for use with devices with a 40 mm (1.5 in) antenna and G 1½" antenna end thread process connection



25 Flooding protection tube dimensions 40 mm (1.5 in). Unit of measurement mm (in)

**Material**

PP

**Order code**

71091216

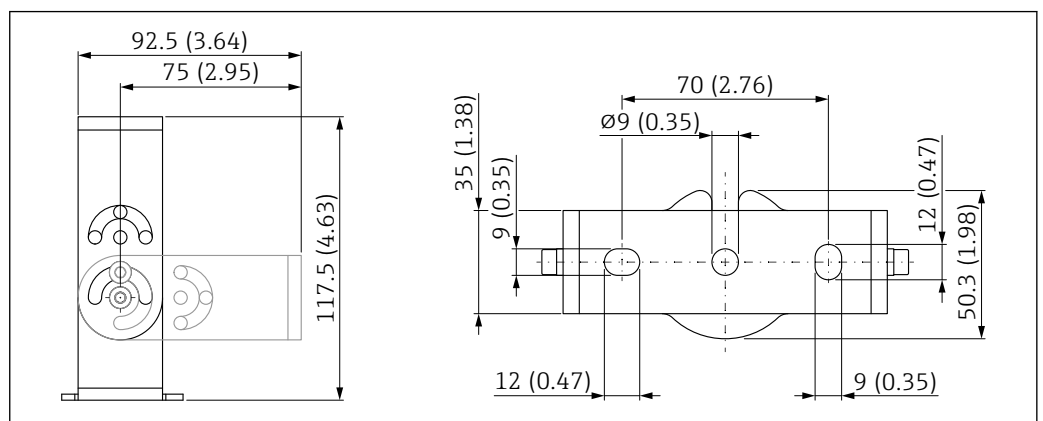
**13.7 Mounting bracket, adjustable, wall/rope/ceiling, 75 mm**

The mounting bracket can be used for mounting on a wall, a rope or a ceiling.

Two versions are available:

- Cable entry process connection G 1"/NPT 1"
- Antenna end process connection G 1½"/NPT 1½"

**13.7.1 Cable entry process connection G 1"/NPT 1"**



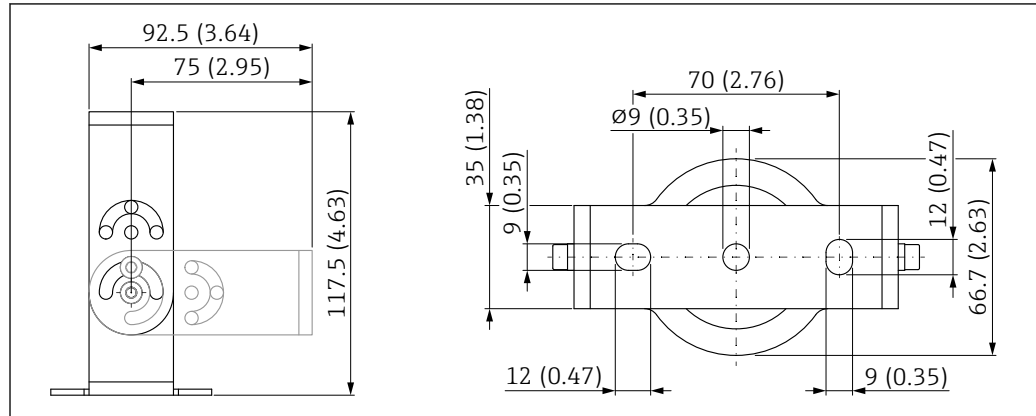
26 Dimensions of mounting bracket. Unit of measurement mm (in)

Consists of:

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

**Order number (G 1"/NPT 1")**  
71325079

### 13.7.2 Antenna end process connection G 1½"/NPT 1½"



27 Dimensions of mounting bracket. Unit of measurement mm (in)

Consists of:

- 1 × mounting bracket, 316L (1.4404)
- 1 × angle bracket, 316L (1.4404)
- 3 × screws, A4
- 3 × securing disks, A4
- 1 × securing nut G 1½"

**Order number (G 1½"/NPT 1½")**  
71662419

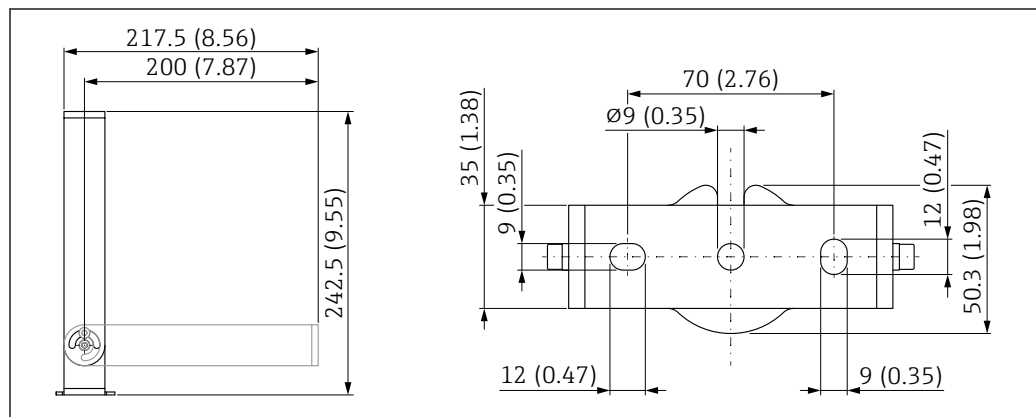
## 13.8 Mounting bracket, adjustable, wall, 200 mm

The mounting bracket can be used for mounting on a wall.

Two versions are available:

- Cable entry process connection G 1"/NPT 1"
- Antenna end process connection G 1½"/NPT 1½"

### 13.8.1 Cable entry process connection G 1"/NPT 1"



28 Dimensions of mounting bracket. Unit of measurement mm (in)



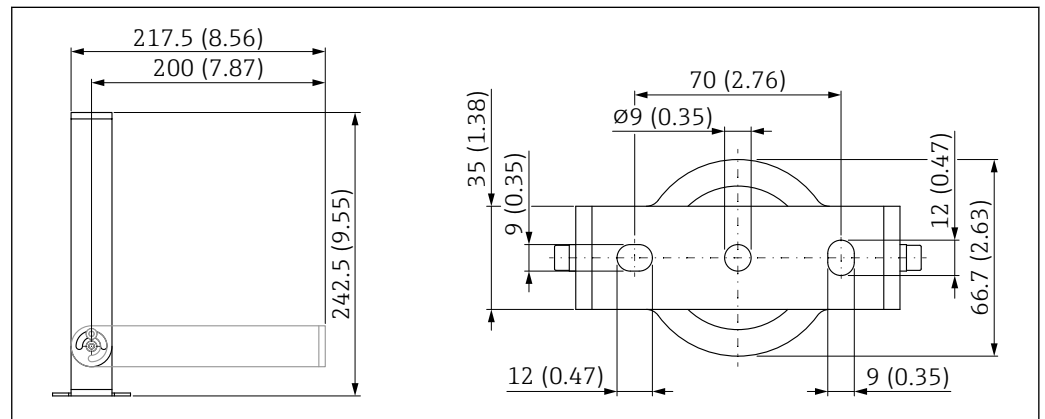
Consists of:

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

**Order number (G 1"/NPT 1")**

71662421

### 13.8.2 Antenna end process connection G 1½"/NPT 1½"



A0055373

29 Dimensions of mounting bracket. Unit of measurement mm (in)

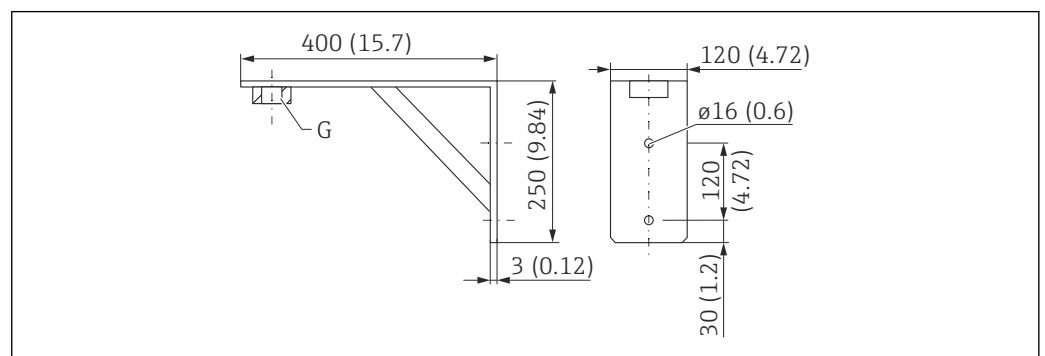
Consists of:

- 1 × mounting bracket, 316L (1.4404)
- 1 × angle bracket, 316L (1.4404)
- 3 × screws, A4
- 3 × securing disks, A4
- 1 × securing nut G 1½"

**Order number (G 1½"/NPT 1½")**

71662423

### 13.9 Angle bracket for wall mounting



A0019346

30 Dimensions of mounting bracket. Unit of measurement mm (in)

G Sensor connection in accordance with the product structure "Antenna end process connection"

**Weight**

3.4 kg (7.5 lb)

**Material**

316L (1.4404)

**Order number for G 1½" process connection**

71452324

Also suitable for MNPT 1½"

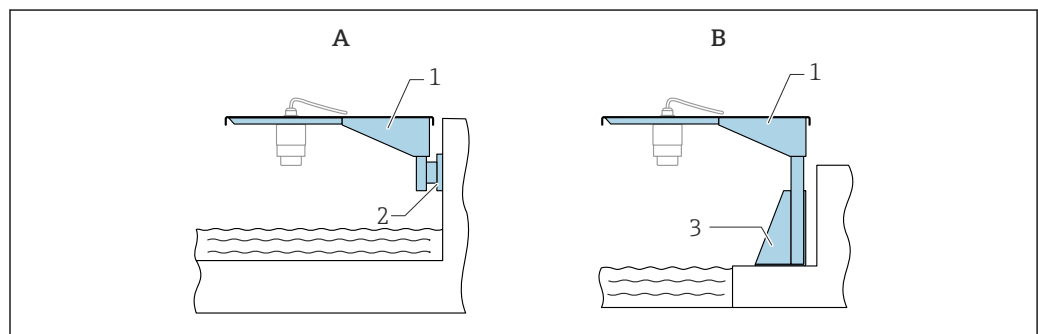
**Order number for G 2" process connection**

71452325

Also suitable for MNPT 2"

**13.10 Cantilever, pivotable**

**13.10.1 Installation type sensor cable entry process connection**



A0028885

31 Installation type sensor cable entry process connection

A Installation with cantilever and wall bracket

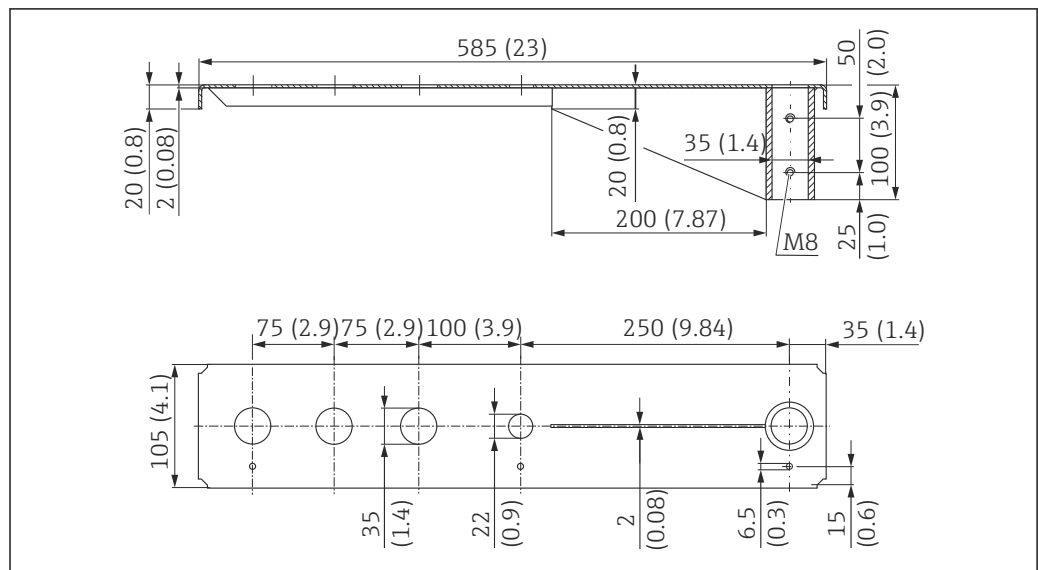
B Installation with cantilever and mounting frame

1 Cantilever

2 Wall bracket

3 Mounting frame

**500 mm cantilever with pivot, sensor cable entry process connection**




A0037806

32 Dimensions of 500 mm cantilever with pivot, for sensor cable entry process connection. Unit of measurement mm (in)

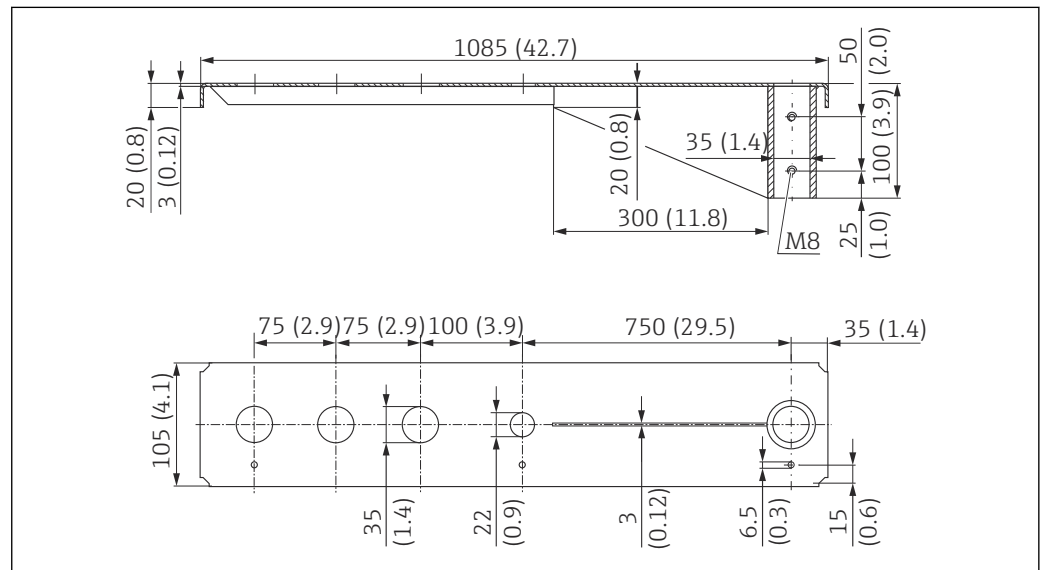
**Weight:**  
2.1 kg (4.63 lb)


**Material**  
316L (1.4404)

**Order number**  
71452315

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

**1000 mm cantilever with pivot, sensor cable entry process connection**




 33 Dimensions of 1000 mm cantilever with pivot, for sensor cable entry process connection. Unit of measurement mm (in)

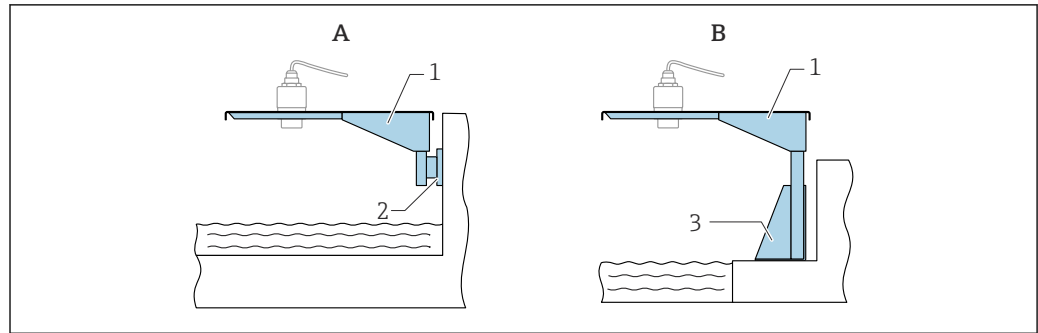
**Weight:**  
4.5 kg (9.92 lb)

**Material**  
316L (1.4404)

**Order number**  
71452316

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

### 13.10.2 Installation type sensor antenna end process connection

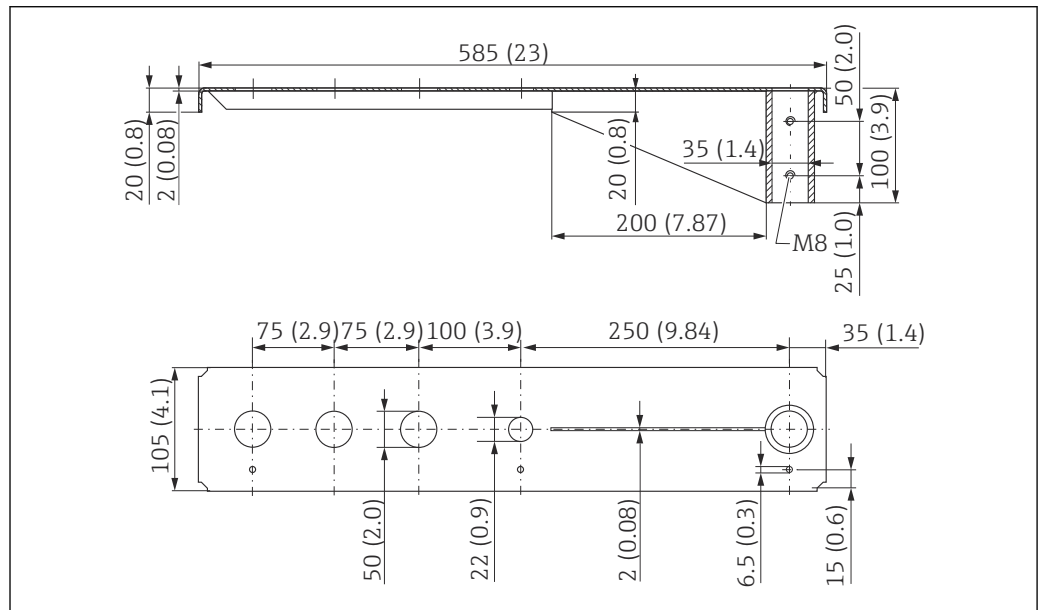


A0028886

34 Installation type sensor antenna end process connection

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

### 500 mm cantilever with pivot, sensor antenna end process connection G 1½"



A0037802

35 Dimensions of 500 mm cantilever with pivot, for sensor antenna end process connection G 1½". Unit of measurement mm (in)

**Weight:**

1.9 kg (4.19 lb)

**Material**

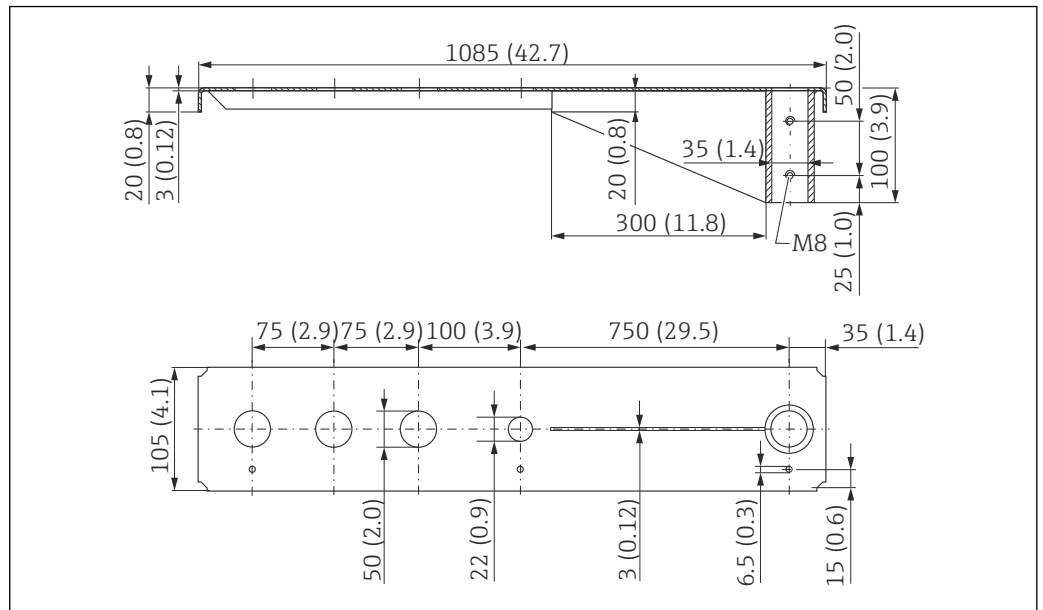
316L (1.4404)

**Order number**

71452318

- i** 50 mm (2.17 in) openings for all G 1½" or MNPT 1½" antenna end thread process connections
- 22 mm (0.87 in) opening can be used for any additional sensor
- Retaining screws are included in delivery

### 1000 mm cantilever with pivot, sensor antenna end process connection G 1½"



36 Dimensions of 1000 mm cantilever with pivot, for sensor antenna end process connection G 1½". Unit of measurement mm (in)

#### Weight:

4.4 kg (9.7 lb)

#### Material

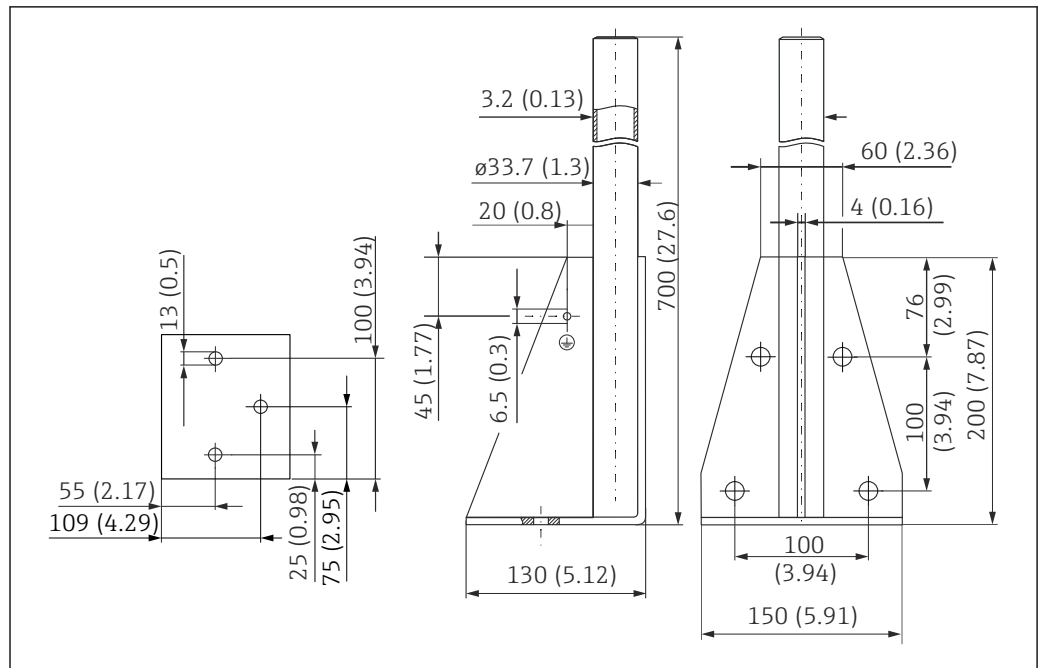
316L (1.4404)

#### Order code

71452319

- i 50 mm (2.17 in) openings for all G 1½" or MNPT 1½" antenna end thread process connections
- 22 mm (0.87 in) opening can be used for any additional sensor
- Retaining screws are included in delivery

### 13.10.3 Mounting stand, 700 mm (27.6 in) for cantilever with pivot



A0037799

37 Dimensions. Unit of measurement mm (in)

**Weight:**

4.2 kg (9.26 lb)

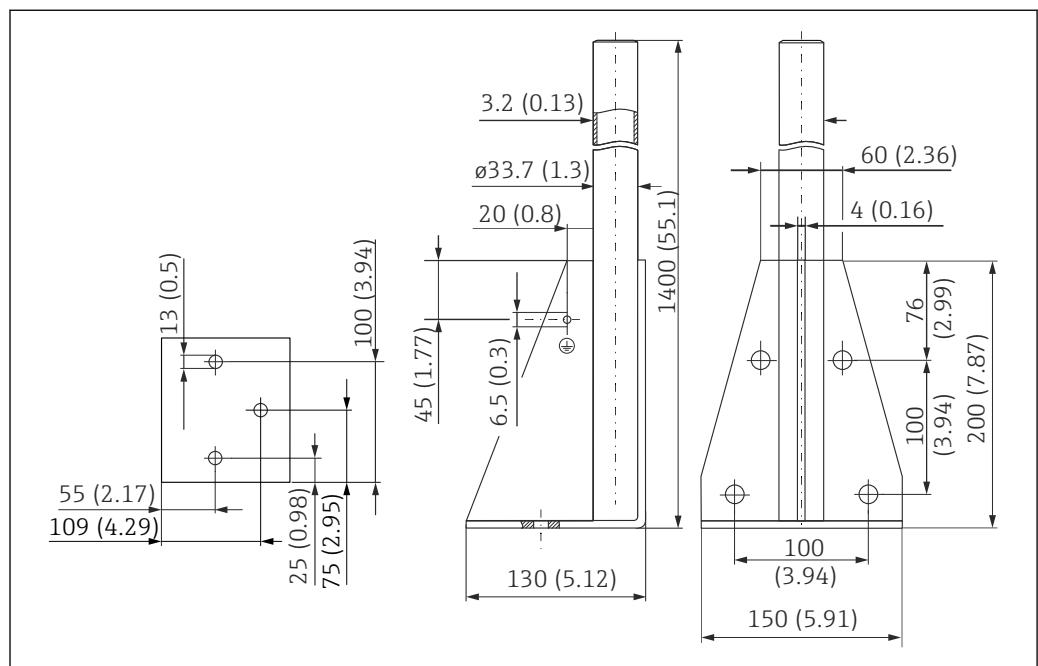
**Material**

316L (1.4404)

**Order number**

71452327

### 13.10.4 Mounting stand, 1400 mm (55.1 in) for cantilever with pivot



A0037800

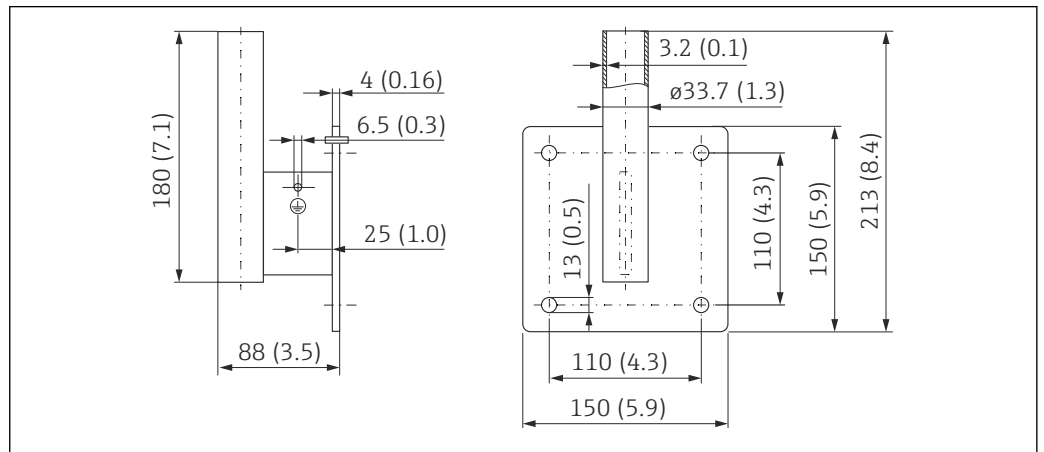
38 Dimensions. Unit of measurement mm (in)

**Weight:**  
6 kg (13.23 lb)

**Material**  
316L (1.4404)

**Order number**  
71452326

### 13.10.5 Wall bracket for cantilever with pivot



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

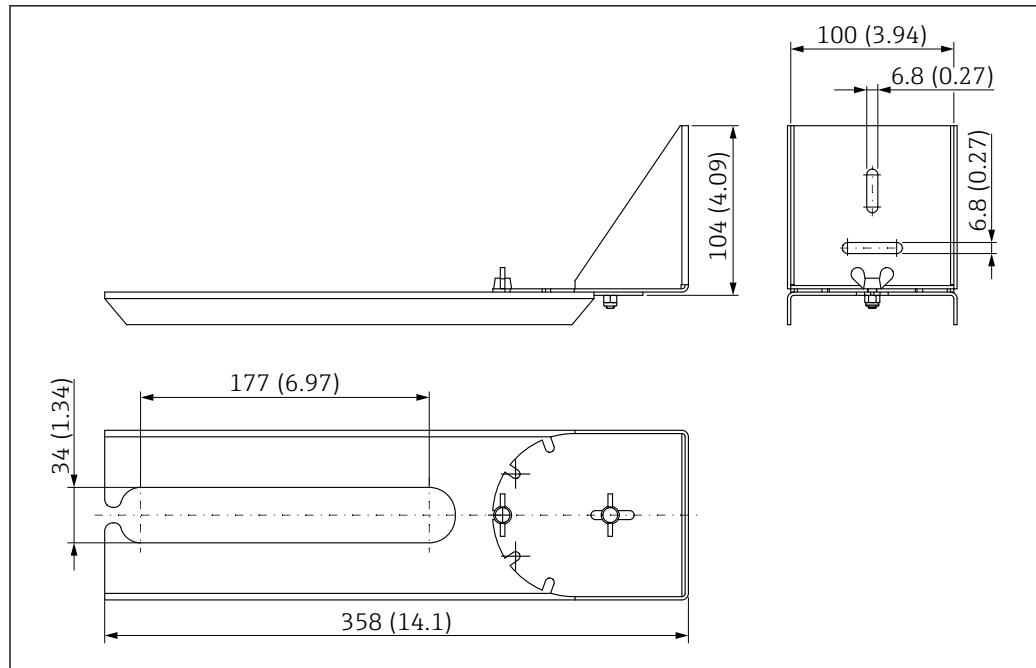
**Weight**  
1.2 kg (2.65 lb)

**Material**  
316L (1.4404)

**Order number**  
71452323

### 13.11 Pivotal mounting bracket

The pivotal mounting bracket is used, for example, to install the device in a manhole over a sewer channel.



A0038143

40 Dimensions of pivotable mounting bracket. Unit of measurement mm (in)

**i** 34 mm (1.34 in) openings for all G 1" or MNPT 1" cable entry thread process connections

**Material**

316L (1.4404)

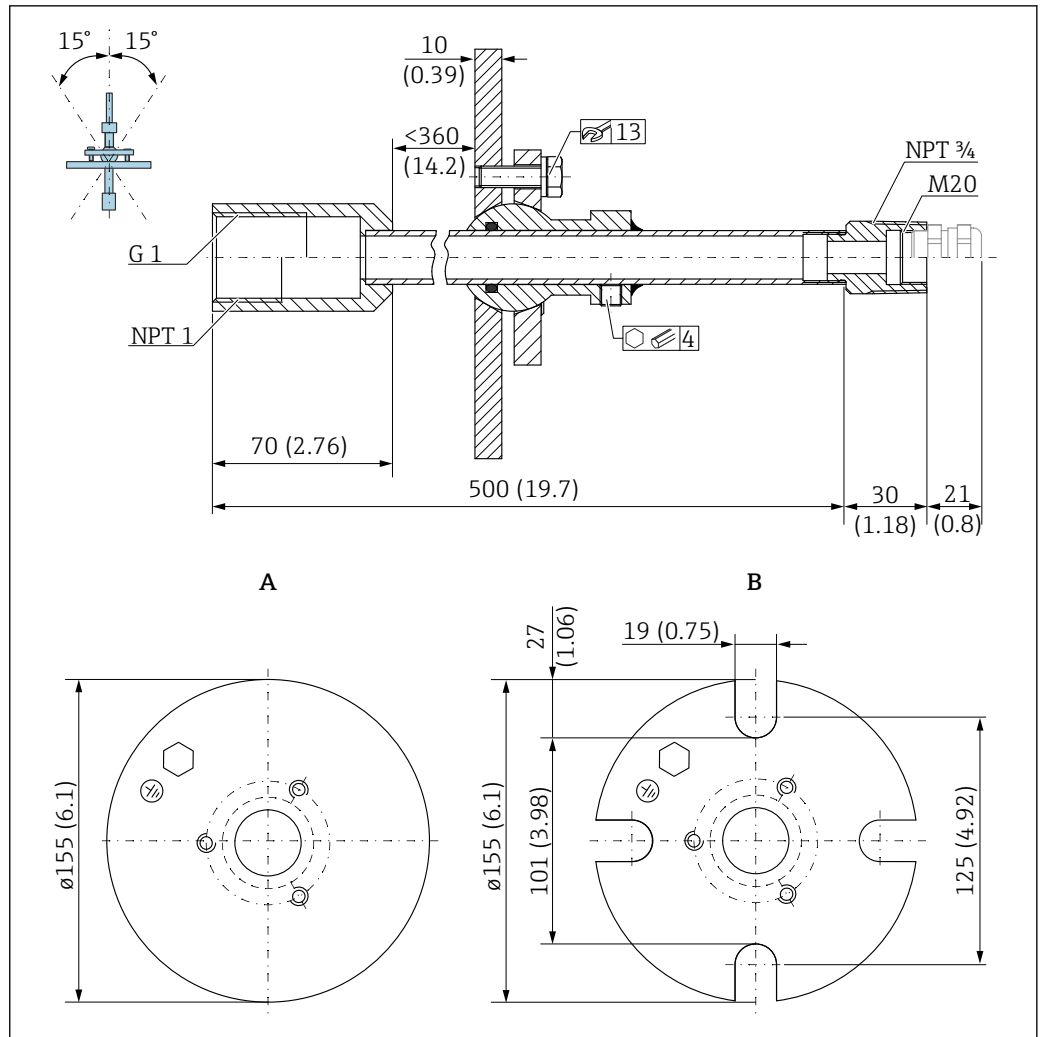
**Order code**

71429910

### 13.12 FAU40 alignment unit

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





A0045330

41 Dimensions. Unit of measurement mm (in)

A Welding flange

B UNI flange

**Material**

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

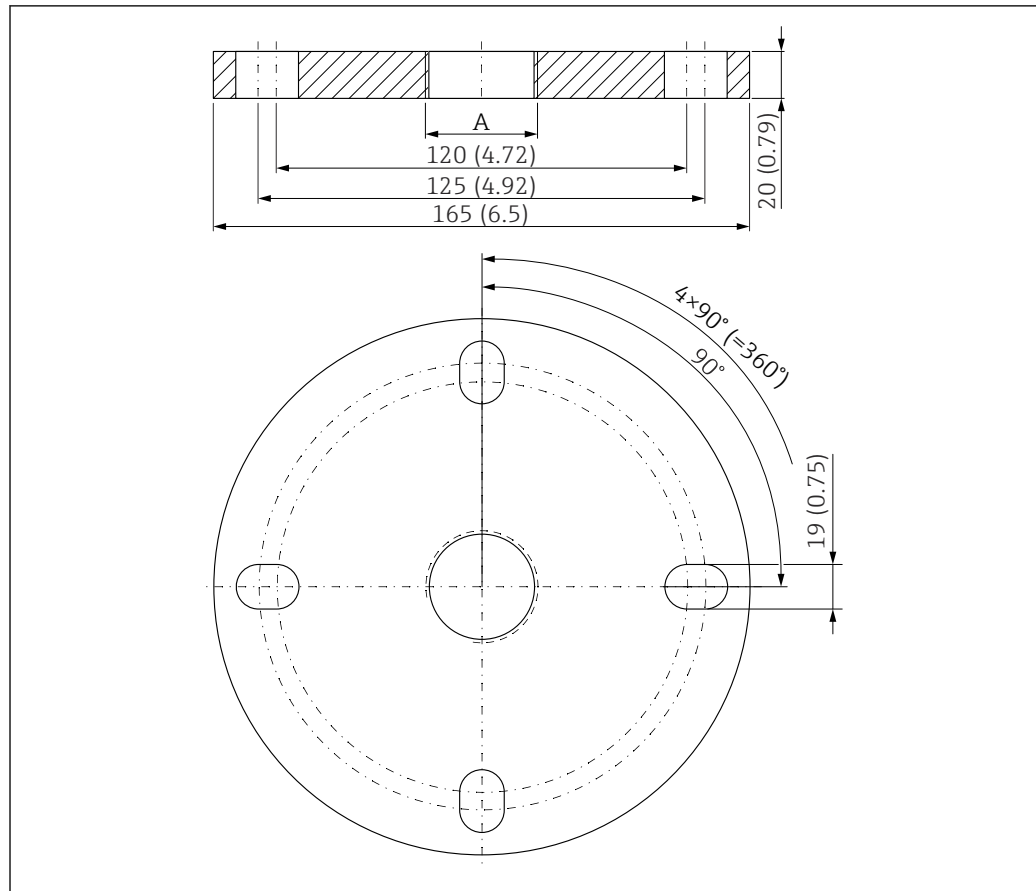
**Order number**

FAU40-##

**i** For use in all G 1" or MNPT 1" cable entry thread process connections and connection cables max. dia. 10 mm (0.43 in), min. length 600 mm (23.6 in).

**T** Technical Information TI00179F

### 13.13 UNI flange 2"/DN50/50, PP



A0037946

42 Dimensions of UNI flange 2"/DN50/50. Unit of measurement mm (in)

A Sensor connection in accordance with the product structure "Antenna end process connection"

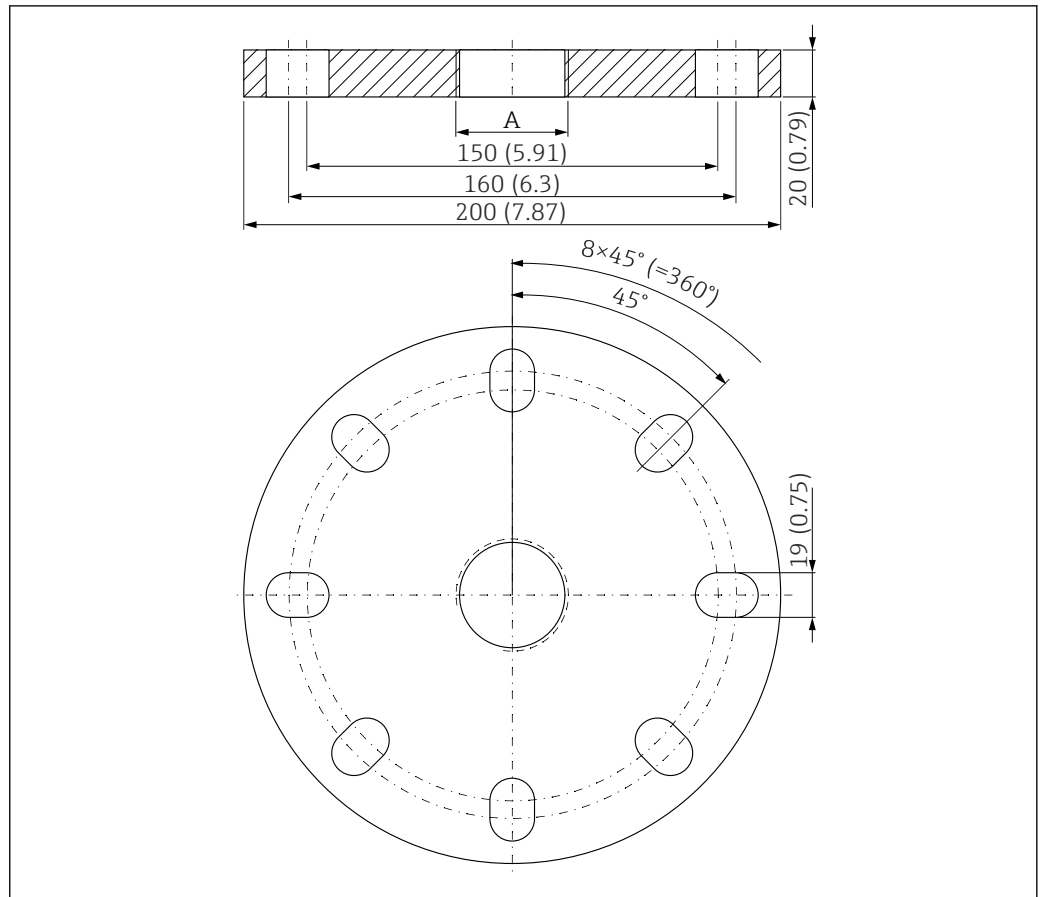
#### Material

PP

#### Order code

FAX50-####

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



43 Dimensions of UNI flange 3"/DN80/80. Unit of measurement mm (in)

A Sensor connection in accordance with the product structure "Antenna end process connection" or "Cable entry process connection"

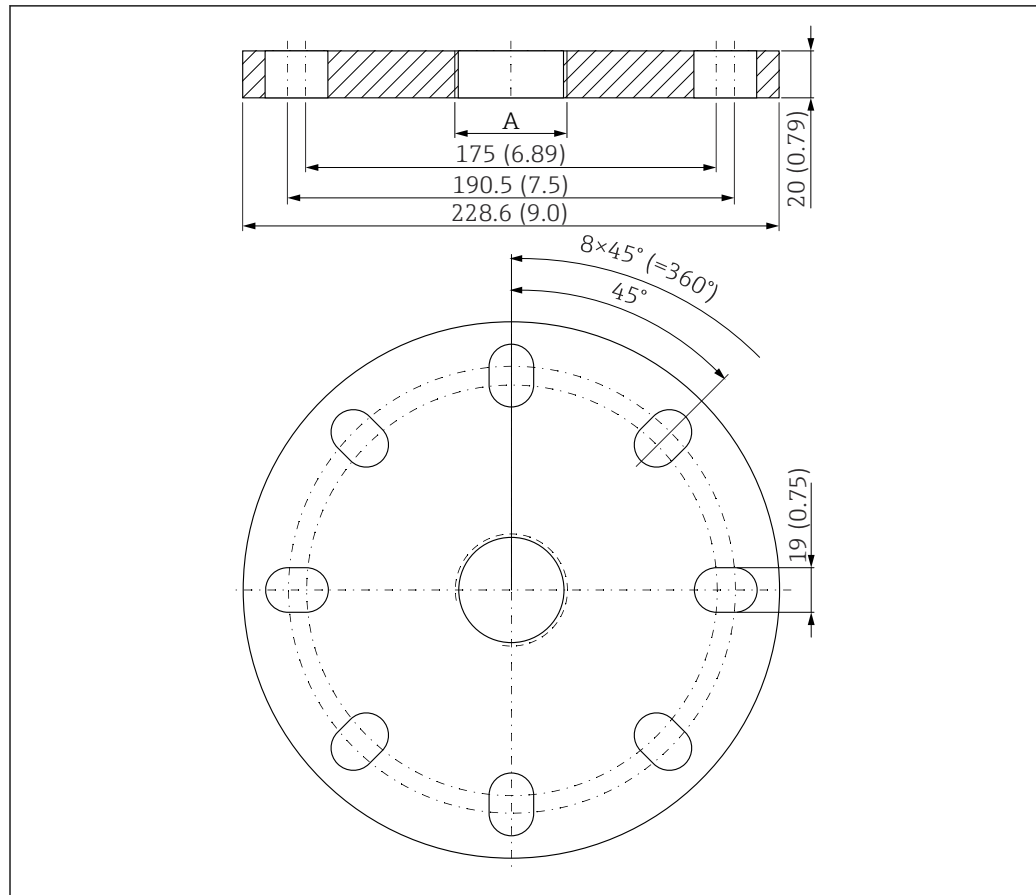
**Material**

PP

**Order code**

FAX50-####

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



A0037948

44 Dimensions of UNI flange 4"/DN100/100. Unit of measurement mm (in)

A Sensor connection in accordance with the product structure "Antenna end process connection" or "Cable entry process connection"

#### Material

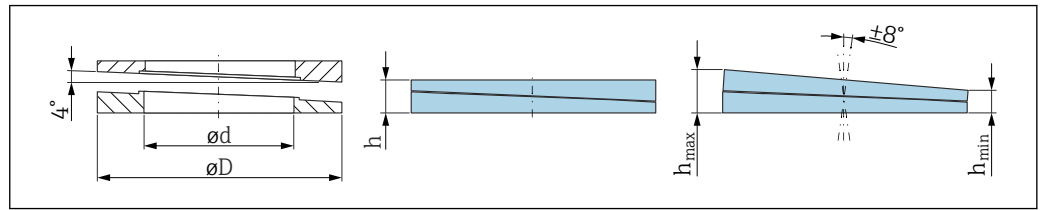
PP

#### Order code

FAX50-####

### 13.16 Adjustable flange seal

The adjustable flange seal is used to align the sensor.



A0045324

45 Dimensions

Technical data: version DN/JIS			
Order code	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 code	71249070	71249072	71249073
Compatible with	<ul style="list-style-type: none"> <li>■ ASME 3" 150 lbs</li> <li>■ JIS 80A 10K</li> </ul>	ASME 4" 150 lbs	ASME 6" 150 lbs
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)

### 13.17 DeviceCare SFE100

Configuration tool for IO-Link, HART, PROFIBUS and FOUNDATION Fieldbusfield devices  
DeviceCare is available for download free of charge 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

### 13.18 Device Viewer

All the spare parts for the device, along with the order code, are listed in the *Device Viewer* ([www.endress.com/deviceviewer](http://www.endress.com/deviceviewer)).

### 13.19 RN22

Single or two-channel active barrier for safe electrical isolation of 4 to 20 mA standard signal circuits, HART transparent



Technical Information TI01515K and Operating Instructions BA02004K

### 13.20 RN42

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



Technical Information TI01584K and Operating Instructions BA02090K

### 13.21 Field Xpert SMT70

Universal, high-performance tablet PC for device configuration in Ex Zone 2 and non-Ex areas



For details, see "Technical Information" TI01342S

### 13.22 Field Xpert SMT77

Universal, high-performance tablet PC for device configuration in Ex Zone 1 areas



For details, see "Technical Information" TI01418S

### 13.23 SmartBlue app

Mobile app for easy configuration of devices on site via Bluetooth wireless technology

## 14 Technical data

### 14.1 Input

#### 14.1.1 Measured variable

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

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

#### 14.1.2 Measuring range

The measuring range starts at the point where the beam hits the tank floor. Levels below this point cannot be measured, particularly in the case of spherical bases or conical outlets.

##### Maximum measuring range

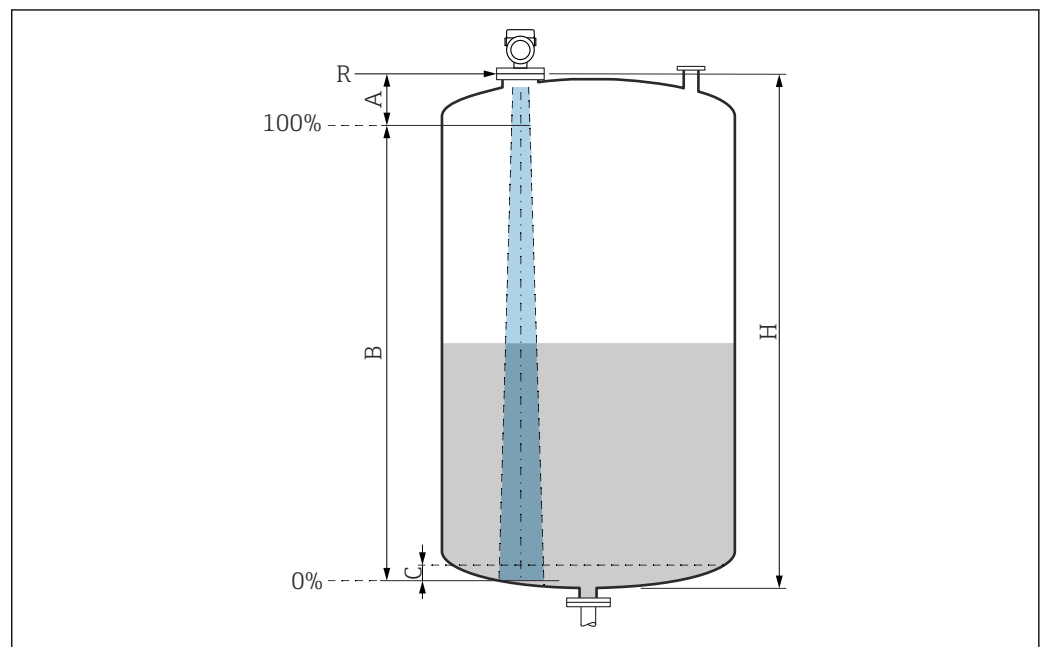
The maximum measuring range is 10 m (33 ft).

##### Usable measuring range

The usable measuring range depends on the medium's reflective properties, the installation position and any possible interference echoes.

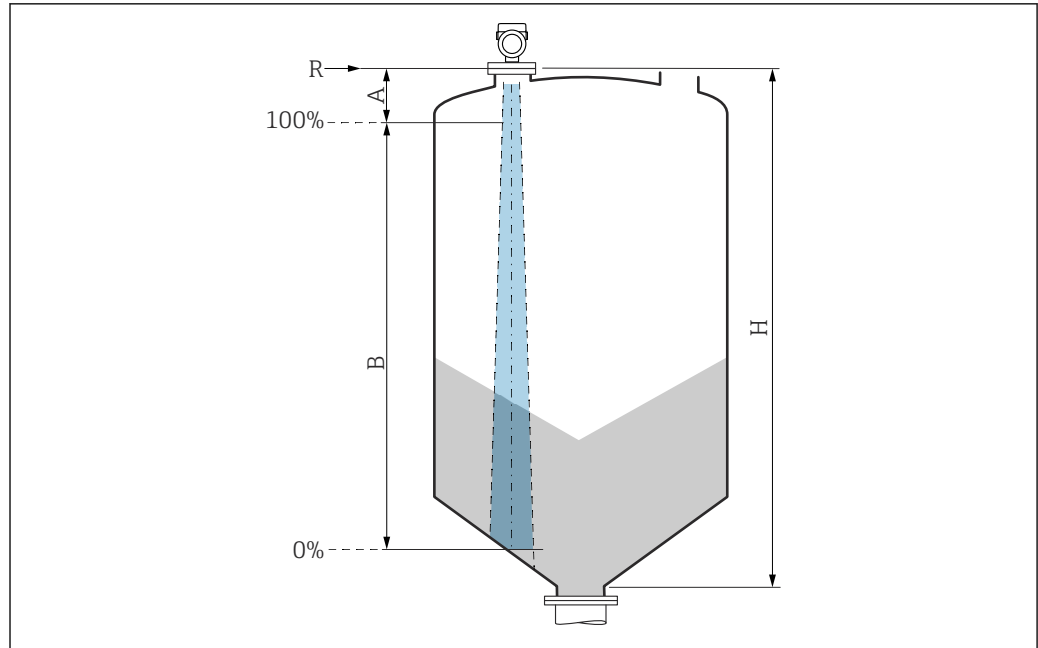
In principle, measurement is possible up to the tip of the antenna.

Depending on the position of the product (angle of repose for solids) and to avoid any material damage from corrosive or aggressive media or deposit buildup on the antenna, the end of the measuring range should be selected 10 mm (0.4 in) before the tip of the antenna.



A0051658

- A Antenna tip + 10 mm (0.4 in)
- B Usable measuring range
- C 50 to 80 mm (1.97 to 3.15 in); medium  $\epsilon_r \leq 2$
- H Vessel height
- R Reference point of measurement, varies depending on the antenna system (see mechanical construction section)



A0051659

- A Antenna tip + 10 mm (0.4 in)
- B Usable measuring range
- H Vessel height
- R Reference point of measurement, varies depending on the antenna system (see mechanical construction section)

In the case of media with a low relative permittivity,  $\epsilon_r < 2$ , the tank floor may be visible through the medium at very low levels (lower than level C). Reduced accuracy must be expected in this range. If this is not acceptable, the zero point should be positioned at a distance C above the tank bottom for these applications (see figure).

The media groups and the possible measuring range are described as a function of the application and media group in the following section. If the relative permittivity of the medium is not known, to ensure a reliable measurement assume the medium belongs to group B.

**Media groups**

- **A** ( $\epsilon_r$  1.4 to 1.9)  
Non-conductive liquids, e.g. liquefied gas
- **B** ( $\epsilon_r$  1.9 to 4)  
Non-conductive liquids, e.g. gasoline, oil, toluene, etc.
- **C** ( $\epsilon_r$  4 to 10)  
e.g. concentrated acid, organic solvents, ester, aniline, etc.
- **D** ( $\epsilon_r > 10$ )  
Conductive liquids, aqueous solutions, diluted acids, bases and alcohol

**i** For the relative permittivity values ( $\epsilon_r$  values) of many media commonly used in industry, please refer to:

- Relative permittivity ( $\epsilon_r$  value), Compendium CP01076F
- The Endress+Hauser "DC Values app" (available for Android and iOS)

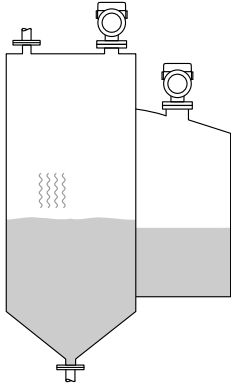
*Measurement in storage vessel*

**Storage vessel - measuring conditions**

Calm medium surface (e.g. bottom filling, filling via immersion tube or rare filling from above)



40 mm (1.5 in) antenna in storage vessel

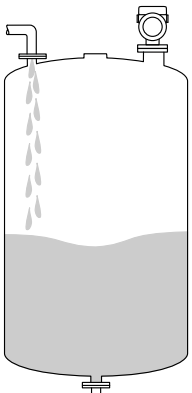
	Media group	Measuring range
	A ( $\epsilon_r$ 1.4 to 1.9)	10 m (33 ft)
	B ( $\epsilon_r$ 1.9 to 4)	10 m (33 ft)
	C ( $\epsilon_r$ 4 to 10)	10 m (33 ft)
	D ( $\epsilon_r$ >10)	10 m (33 ft)

Measurement in buffer vessel

**Buffer vessel - measuring conditions**

Moving medium surface (e.g. permanent free filling from above, mixing jets)

40 mm (1.5 in) antenna in buffer vessel

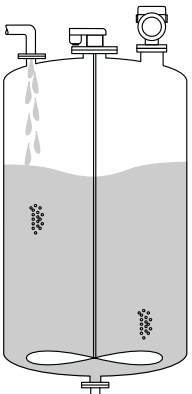
	Media group	Measuring range
	A ( $\epsilon_r$ 1.4 to 1.9)	7 m (23 ft)
	B ( $\epsilon_r$ 1.9 to 4)	10 m (33 ft)
	C ( $\epsilon_r$ 4 to 10)	10 m (33 ft)
	D ( $\epsilon_r$ >10)	10 m (33 ft)

Measurement in vessel with single-stage propeller agitator

**Vessel with agitator - measuring conditions**

Turbulent medium surface (e.g. from filling from above, stirrers and baffles)

40 mm (1.5 in) antenna in vessel with agitator

	Media group	Measuring range
	A ( $\epsilon_r$ 1.4 to 1.9)	4 m (13 ft)
	B ( $\epsilon_r$ 1.9 to 4)	5 m (16.4 ft)

	Media group	Measuring range
	C ( $\epsilon_r$ 4 to 10)	10 m (33 ft)
	D ( $\epsilon_r >10$ )	10 m (33 ft)

### 14.1.3 Operating frequency

approx. 80 GHz

Up to eight devices can be installed in a tank without the devices mutually influencing one another.

### 14.1.4 Transmission power

- Peak power: <1.5 mW
- Average output power: <70  $\mu$ W

## 14.2 Output

### 14.2.1 Output signal

- 4 to 20 mA
- The current output offers a choice of three different operating modes:
  - 4 to 20.5 mA
  - NAMUR NE 43: 3.8 to 20.5 mA (factory setting)
  - US mode: 3.9 to 20.5 mA

### 14.2.2 Signal on alarm for devices with current output

#### Current output

Signal on alarm in accordance with NAMUR recommendation NE 43.

- Max. alarm: can be set from 21.5 to 23 mA
- Min. alarm: < 3.6 mA (factory setting)

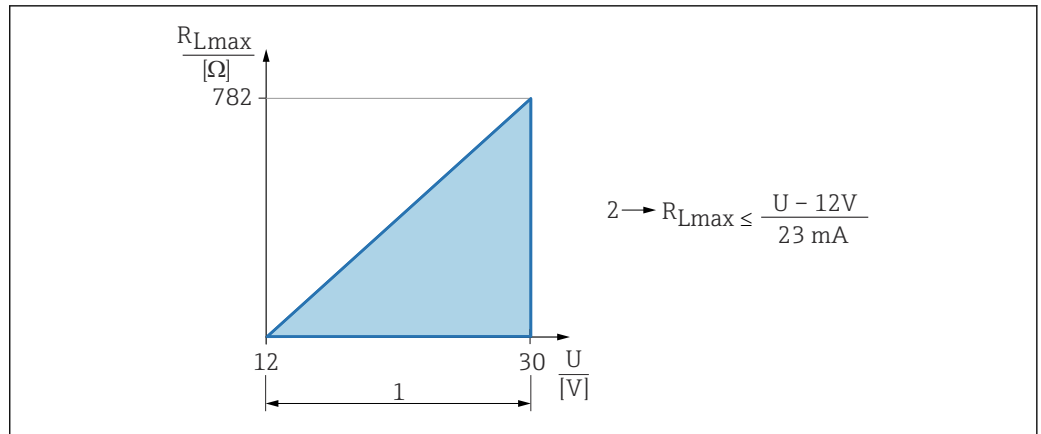
#### Operating tool via digital communication

Status signal (according to NAMUR Recommendation NE 107):

Plain text display

### 14.2.3 Load

In order to guarantee sufficient terminal voltage, a maximum load resistance  $R_L$  (including line resistance) must not be exceeded, depending on the supply voltage  $U$  of the supply unit.




A0052602

- 1 Power supply 12 to 30 V  
 2  $R_{Lmax}$  maximum load resistance  
 U Supply voltage

If load is too great:

- Failure current is indicated and error message is displayed (indication: MIN alarm current)
- Periodic checking to establish if it is possible to quit fault state

 Operation via handheld terminal or PC with operating program: take minimum communication resistor of 250 Ω into consideration.

#### 14.2.4 Damping

Damping affects all continuous outputs.

Factory setting: 0 s (can be set from 0 to 999 s)

#### 14.2.5 Linearization

The linearization function of the device allows the conversion of the measured value into any unit of length, weight, flow or volume.

##### Pre-programmed linearization curves

Linearization tables for calculating the volume in the following vessels are pre-programmed into the device:

- Pyramid bottom
- Conical bottom
- Angled bottom
- Horizontal cylinder
- Sphere

Linearization tables for calculating the flow rate are pre-programmed into the device and include the following:

- Flumes
  - Khafagi-Venturi flume
  - Venturi flume
  - Parshall flume
  - Palmer-Bowlus flume
  - Trapezoidal flume (ISO 4359)
  - Rectangular flume (ISO 4359)
  - U-shaped flume (ISO 4359)
- Weirs
  - Trapezoidal weir
  - Rectangular broad-crested weir (ISO 3846)
  - Rectangular thin-plate weir (ISO 1438)
  - Triangular thin-plate weir (ISO 1438)
- Standard formula

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

### 14.2.6 Totalizer

The device offers a totalizer which adds up the flow rate. The totalizer cannot be reset.

## 14.3 Environment

### 14.3.1 Ambient temperature range

Measuring instrument: -40 to +60 °C (-40 to +140 °F)

If operating outdoors in strong sunlight:

- Mount the device in the shade.
- Avoid direct sunlight, particularly in warmer climatic regions.
- Use a weather protective cover.

### 14.3.2 Storage temperature

-40 to +80 °C (-40 to +176 °F)

### 14.3.3 Climate class

According to IEC 60068-2-38 test Z/AD (relative humidity 4 to 100 %).

### 14.3.4 Operating height

Up to 5 000 m (16 404 ft) above sea level

### 14.3.5 Degree of protection

Test as per IEC 60529 Edition 2.2 2013-08/DIN EN 60529 2014-09 and NEMA 250-2014:

- IP66, NEMA Type 4X
- IP68, NEMA Type 6P (24 h at 1.83 m (6.00 ft) under water)

### 14.3.6 Vibration resistance

- Stochastic noise (random sweep) as per DIN EN 60068-2-64 Case 2/  
IEC 60068-2-64 Case 2
- Guaranteed for 5 to 2 000 Hz:  $1.25 \text{ (m/s}^2\text{)}^2\text{/Hz}$ , ~ 5 g

### 14.3.7 Electromagnetic compatibility (EMC)

- Electromagnetic compatibility as per EN 61326 series and NAMUR recommendation EMC (NE21)
- Maximum measured error during EMC testing: < 0.5 % of the span.

For more details, refer to the EU Declaration of Conformity ([www.endress.com/downloads](http://www.endress.com/downloads)).

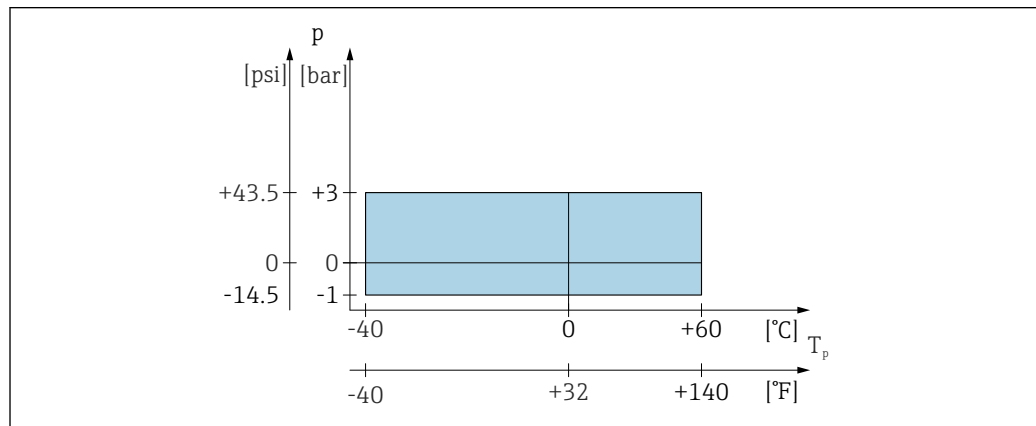
## 14.4 Process

### 14.4.1 Process temperature, process pressure

**⚠ WARNING**

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

- ▶ Only operate the device within the specified limits for the components!
- ▶ MWP (Maximum Working Pressure): The MWP is specified on the nameplate. This value refers to a reference temperature of +20 °C (+68 °F) and may be applied to the device for an unlimited time. Note temperature dependence of MWP. For flanges, refer to the following standards for the permitted pressure values at higher temperatures: EN 1092-1 (with regard to their stability/temperature property, the materials 1.4435 and 1.4404 are grouped together under EN 1092-1; the chemical composition of the two materials can be identical), ASME B16.5, JIS B2220 (the latest version of the standard applies in each case). MWP data that deviate from this are provided in the relevant sections of the Technical Information.
- ▶ The Pressure Equipment Directive (2014/68/EU) uses the abbreviation **PS**. This corresponds to the maximum working pressure (MWP) of the device.



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46 Permitted range for process temperature and process pressure

#### Process temperature range

-40 to +60 °C (-40 to +140 °F)

#### Process pressure range, 40 mm (1.5 in) antenna

- $p_{\text{gauge}} = -1 \text{ to } 3 \text{ bar} (-14.5 \text{ to } 43.5 \text{ psi})$
- $p_{\text{abs}} < = 4 \text{ bar} (58 \text{ psi})$

**i** The pressure range may be further restricted in the case of a CRN approval.

### 14.4.2 Relative permittivity

#### For liquids

- $\epsilon_r \geq 1.8$
- Contact Endress+Hauser for lower  $\epsilon_r$  values

#### For bulk solids

$\epsilon_r \geq 1.6$

For applications with a lower relative permittivity than indicated, contact Endress+Hauser.



For the relative permittivity values ( $\epsilon_r$  values) of many media commonly used in industry, please refer to:

- Relative permittivity ( $\epsilon_r$  value), Compendium CP01076F
- The Endress+Hauser "DC Values app" (available for Android and iOS)

## 14.5 Additional technical data



Current Technical Information: Endress+Hauser website: [www.endress.com](http://www.endress.com) → Downloads.

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