LCR20 HART

Level Radar

Manual

ISO9001

Your automation, our passion.

PEPPERL+FUCHS

With regard to the supply of products, the current issue of the following document is applicable:
The General Terms of Delivery for Products and Services of the Electrical Industry, published by the Central Association of the Electrical Industry (Zentralverband Elektrotechnik und Elektroindustrie (ZVEI) e.V.) in its most recent version as well as the supplementary clause: "Expanded reservation of proprietorship"

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1 Introduction

1.1 Content of this Document

This document contains information that you need in order to use your product throughout the applicable stages of the product life cycle. These can include the following:

- Product identification
- Delivery, transport, and storage
- Mounting and installation
- Commissioning and operation
- Maintenance and repair
- Troubleshooting
- Dismounting
- Disposal

Note

This document does not substitute the instruction manual.

Note

For full information on the product, refer to the instruction manual and further documentation on the Internet at www.pepperl-fuchs.com.

The documentation consists of the following parts:

- Datasheet – product overview
  The datasheet contains the essential technical data for product selection.
- 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.
- Manual (BA), present document – complete information
  The manual contains all information from incoming acceptance to disposal.
- Brief instructions (KA) – guide that takes you quickly to the 1st measured value
  The brief instructions contain all the essential information from incoming acceptance to initial commissioning.
- Instruction manual (SI) – safety-relevant document
  Depending on the approval, the required instruction manuals are supplied with the device.

Additionally, the following parts may belong to the documentation, if applicable:

- EU-type examination certificate
- EU declaration of conformity
- Attestation of conformity
- Certificates
- Control drawings
- Additional documents

1.2 Safety Information

Target Group, Personnel

Responsibility for planning, assembly, commissioning, operation, maintenance, and dismounting lies with the plant operator.

Only appropriately trained and qualified personnel may carry out mounting, installation, commissioning, operation, maintenance, and dismounting of the product. The personnel must have read and understood the instruction manual and the further documentation.

Prior to using the product make yourself familiar with it. Read the document carefully.

1.3 Symbols Used

This document contains symbols for the identification of warning messages and of informative messages.

Warning Messages

You will find warning messages, whenever dangers may arise from your actions. It is mandatory that you observe these warning messages for your personal safety and in order to avoid property damage.

Depending on the risk level, the warning messages are displayed in descending order as follows:

Danger!

This symbol indicates an imminent danger.

Non-observance will result in personal injury or death.

Warning!

This symbol indicates a possible fault or danger.

Non-observance may cause personal injury or serious property damage.

Caution!

This symbol indicates a possible fault.

Non-observance could interrupt the device and any connected systems and plants, or result in their complete failure.

Informative Symbols

Note

This symbol brings important information to your attention.

Action

This symbol indicates a paragraph with instructions. You are prompted to perform an action or a sequence of actions.

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.

Operation

Operation via operating tool

Parameter

Write-protected parameter

1, 2, 3 ... Item numbers

A, B, C, ... Views

2 Documentation

The following document types are available on the Pepperl+Fuchs website:
www.pepperl-fuchs.com → search → model number → product detail page → documents.

2.1 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.

2.2 Manual (BA)

Your reference guide

This document contains all the information that is required in various phases of the life cycle of the device: from product identification, incoming acceptance and storage, to mounting, connection, operation and commissioning through to troubleshooting, maintenance and disposal.

2.3 Brief Instructions (KA)

Guide that takes you quickly to the 1st measured value

This document contains all the essential information from incoming acceptance to initial commissioning.

2.4 Instruction Manual (SI)

Depending on the approval, the following instruction manuals (SI) are supplied with the device. These documents are an integral part of the manual.

Note

The nameplate indicates the instruction manual (SI) that are relevant to the device.

3 Terms and Abbreviations

3.1 Document Types

BA

Document type Manual

KA

Document type Brief Instructions

TI

Document type Technical Information

SI

Document type Instruction manual

3.2 Abbreviations

PN

Nominal pressure

MWP

MWP (**M**aximum **w**orking **p**ressure/max. process pressure)
The MWP can also be found on the nameplate.

ToF

Time **o**f **F**light

PACT*ware*™

Manufacturer independent operating software for field devices
Frame application (FDT – **F**ield **D**evice **T**ool) for running DTMs

DTM

Device **T**ype **M**anager – Device driver component for a device in an FDT environment

ε_r

DK value – relative dielectric constant

Operating tool

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

- PACT*ware*, for operation via HART communication and PC
- P+F Level (app), for operation using an Android or iOS smartphone or tablet

BD

Blocking **D**istance; no signals are analyzed within the BD.

PLC

Programmable **l**ogic **c**ontroller (PLC)

4 Registered Trademarks

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5 Basic Safety Instructions

5.1 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.

5.2 Designated Use

Application and media

The measuring device described in this manual is intended for continuous, non-contact level measurement in liquids. 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. Operation of the devices does not pose a risk to health or the environment.

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

- Measured process variables: distance
- Calculated process variables: volume or mass in vessels of any shape; flow through measuring weirs or channels (calculated from the level by the linearization functionality)

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.

Verification for borderline cases:

- With regard to special media and media used for cleaning, please contact the manufacturer. Pepperl+Fuchs 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 fluid temperatures, ensure protection against contact to prevent burns.

5.3 Workplace Safety

For work on and with the device:

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

5.4 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.

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5.5 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.

5.5.1 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.

Pepperl+Fuchs confirms successful testing of the device by affixing to it the CE mark.

6 Product Description

6.1 Product Design

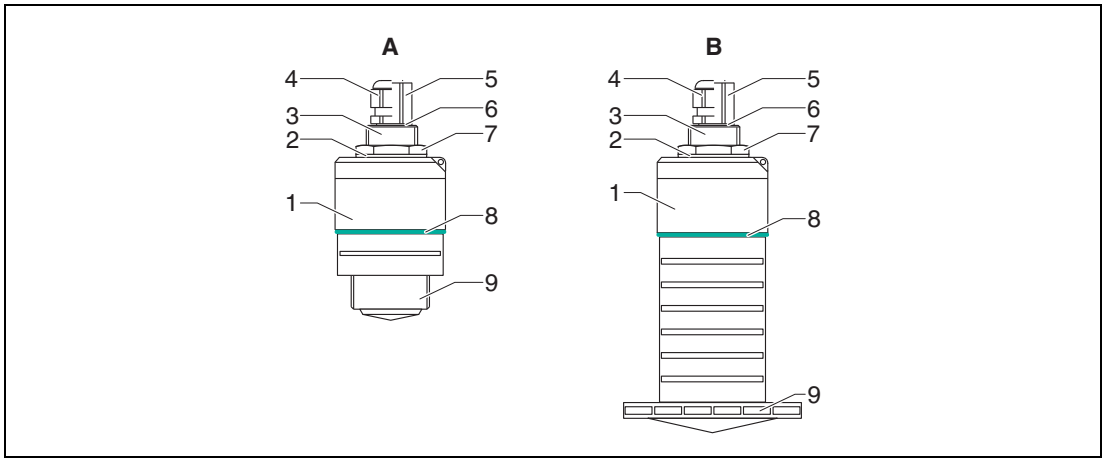

Figure 6.1 Device design

A Device with 40 mm (1,5 inch) antenna
B Device with 80 mm (3 inch) antenna
1 Sensor housing
2 Seal
3 Process connection rear side
4 Cable gland
5 Pipe adapter
6 O-ring
7 Counter nut
8 Design ring
9 Process connection front side

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7 Incoming Acceptance and Product Identification

7.1 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 instruction manuals (SI) provided?

Note

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

7.2 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

7.3 Manufacturer Address

Pepperl+Fuchs Group Lilienthalstraße 200, 68307 Mannheim, Germany
Internet: www.pepperl-fuchs.com

Address of the manufacturing plant: See nameplate.

7.4 Nameplate

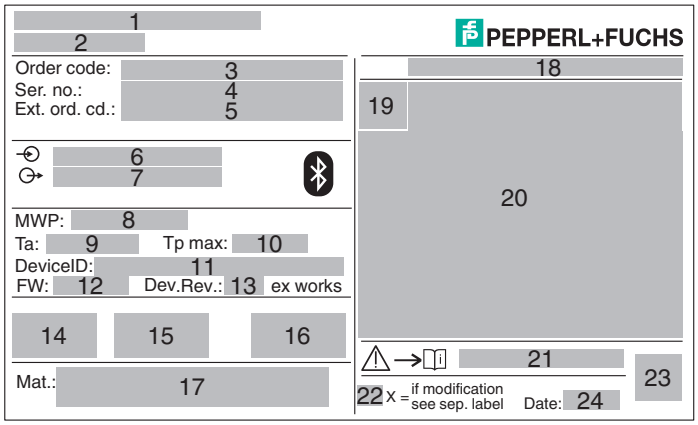

Figure 7.1 Device nameplate

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 Allowable ambient temperature (T_{amb})
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 C-tick
17 Materials in contact with process
18 Degree of protection: e. g. IP, NEMA
19 Certificate symbol
20 Certificate and approval relevant data
21 Document number of the instruction manuals: e. g. SI, ZD, ZE
22 Modification mark
23 2-D matrix code (QR code)
24 Manufacturing date: year-month

Note

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.

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8 Installation

8.1 Installation Conditions

8.1.1 Installation Types

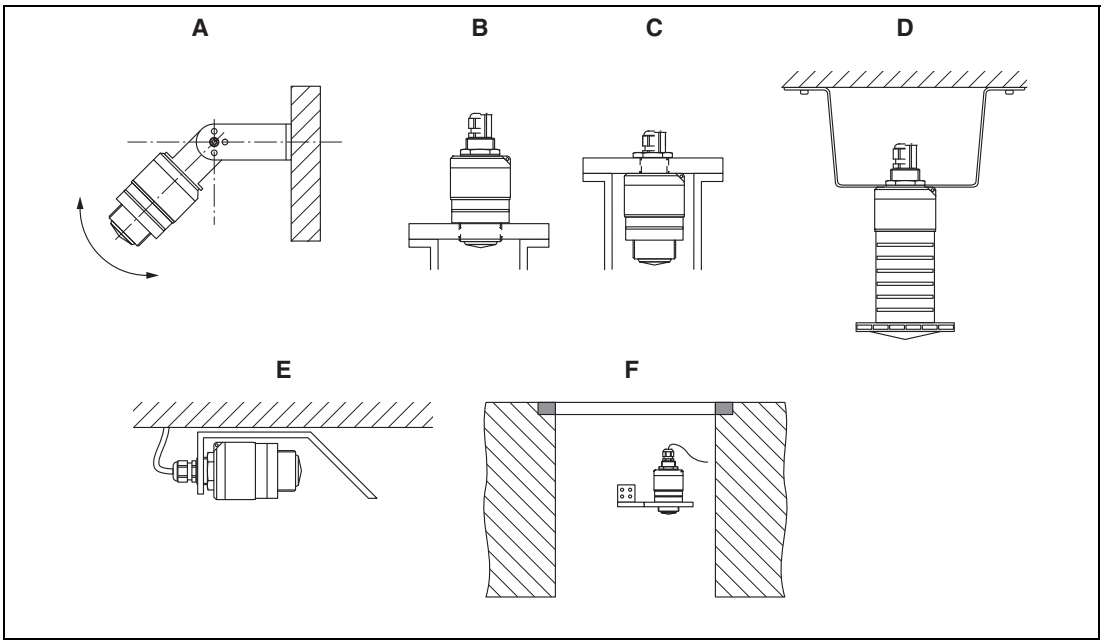

Figure 8.1 Wall, ceiling or nozzle installation

A Wall or ceiling mount, adjustable
B Mounted at front thread
C Mounted at rear thread
D Ceiling installation with counter nut (included in delivery)
E Horizontal installation in confined spaces (sewer shaft)
F Shaft wall mounting

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.

8.1.2 Nozzle Installation

The antenna should be located 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.

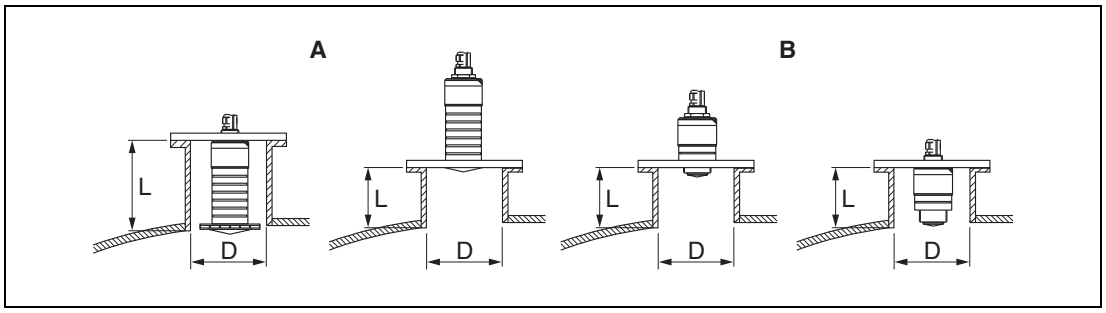

Figure 8.2 Nozzle installation

A 80 mm (3 inch) antenna

B 40 mm (1.5 inch) antenna

The maximum length of the nozzle **L** depends on the nozzle diameter **D**. Please note the limits for the diameter and length of the nozzle.

80 mm (3 inch) antenna, installation inside nozzle

- D: min. 120 mm (4.72 inch)
- L: max. 205 mm (8.07 inch) + D × 4.5

80 mm (3 inch) antenna, installation outside nozzle

- D: min. 80 mm (3 inch)
- L: max. D × 4.5

40 mm (1.5 inch) antenna, installation outside nozzle

- D: min. 40 mm (1.5 inch)
- L: max. D × 1.5

40 mm (1.5 inch) antenna, installation inside nozzle

- D: min. 80 mm (3 inch)
- L: max. 140 mm (5.5 inch) + D × 1.5

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8.1.3 Position for Installation on a Vessel

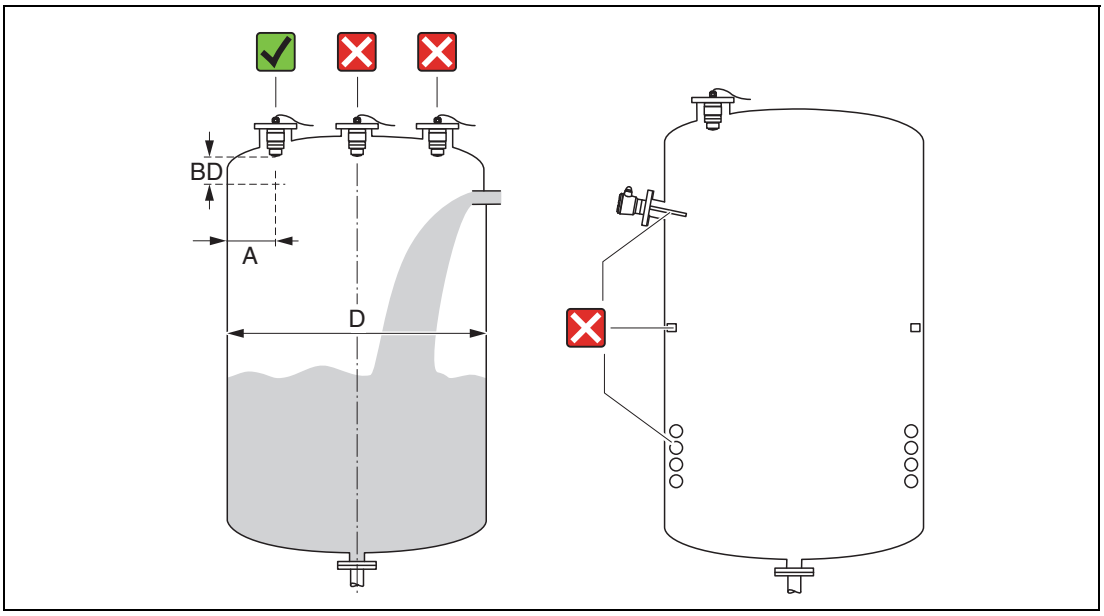

Figure 8.3 Installation position on a vessel

- If possible install the sensor so that its lower edge projects into the vessel.
- Recommended distance **A** wall – nozzle outer edge: ~ 1/6 of the vessel diameter **D**. Under no circumstances should the device be mounted closer than 15 cm (5.91 inch) to the vessel wall.
- Do not install the sensor in the middle of the vessel.
- Avoid measurements through the filling curtain.
- Avoid equipment such as limit switches, temperature sensors, baffles, heating coils etc.
- 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 foot) is configured as standard. However, this can be overwritten manually (0 m (0 foot) is also permitted).

  Automatic calculation:
  Blocking distance = Empty calibration – Full calibration – 0.2 m (0.656 foot).

  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 foot), the Blocking distance of 0.1 m (0.33 foot) will continue to be used.

8.1.4 Device Alignment for Installation on a Vessel

- Align the antenna vertically to the product surface.
- Align the eyelet with lug towards the vessel wall as well as possible.

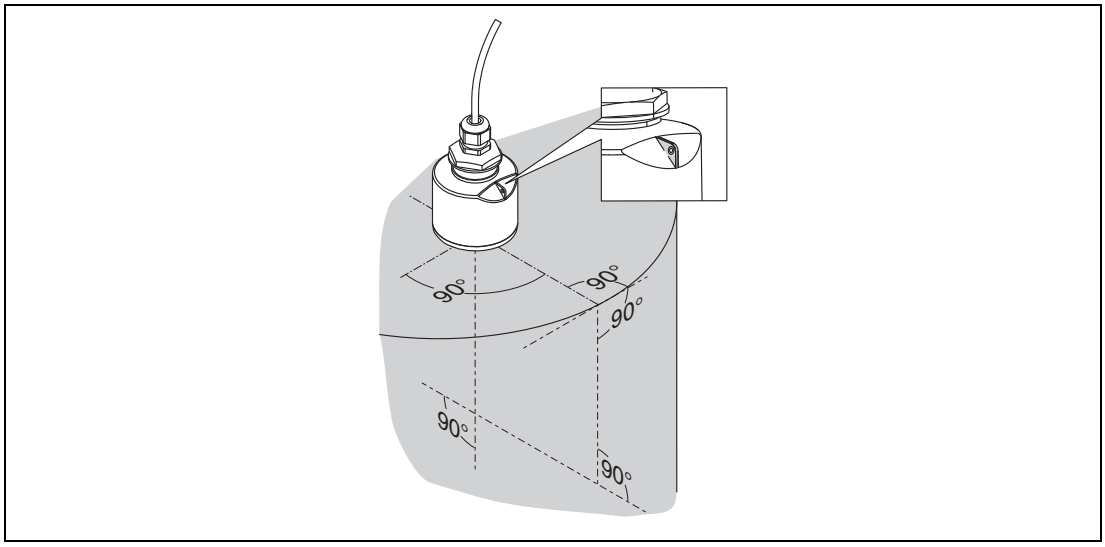

Figure 8.4 Device alignment for installation on a vessel

8.1.5 Beam Angle

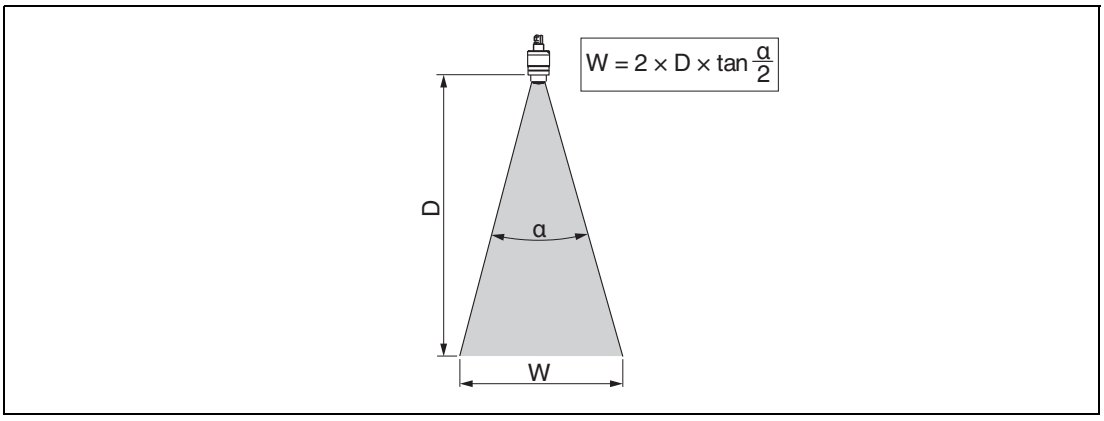

Figure 8.5 Relationship between beam angle α, distance D and beamwidth diameter W

The beam angle is defined as the angle **α**, at which the power density of the radar waves reaches half the value of the maximum power density (3 dB 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 **α** and distance **D**.

40 mm (1.5 inch) antenna, α 30 °

W = D x 0.54

40 mm (1.5 inch) antenna with flooding protection tube, α 12 °

W = D x 0.21

80 mm (3 inch) antenna with or without flooding protection tube, α 12 °

W = D x 0.21

8.1.6 Measurement in Plastic Vessels

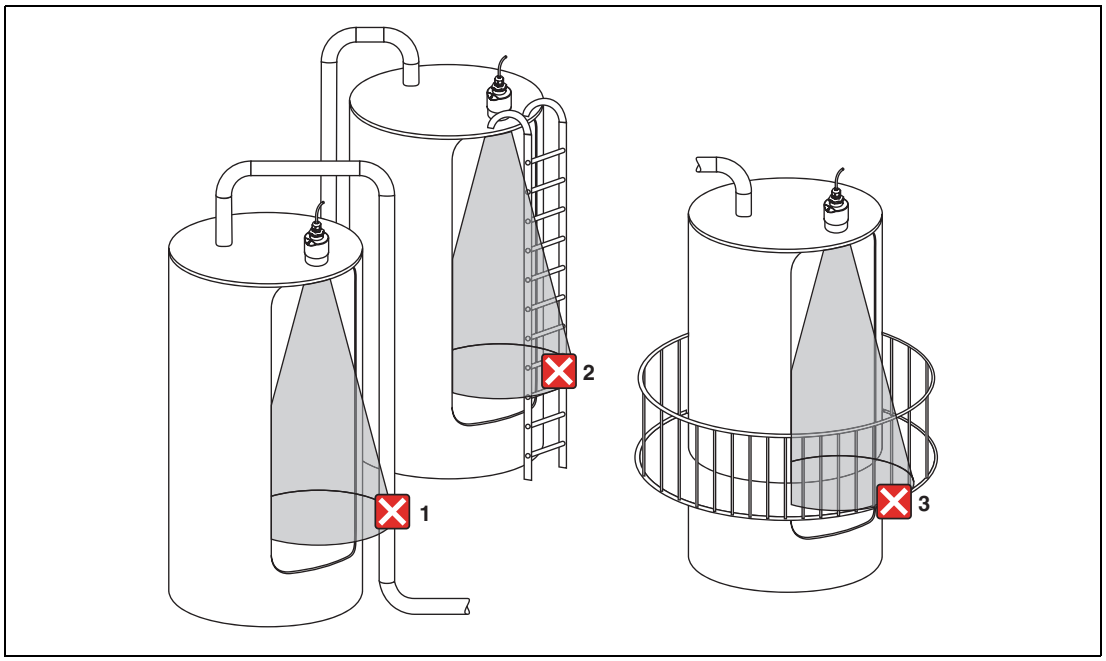

Figure 8.6 Measurement in a plastic vessel with a metallic, interfering installation outside of the vessel

1 Pipe, tubing
2 Ladder
3 Grate, railing

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.

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).

Please contact the manufacturer for further information.

8.1.7 Weather protection cover

For outdoor use, a weather protection cover is recommended.

The weather protection cover can be ordered as an accessory or together with the device via the ordering option **Accessory enclosed**.

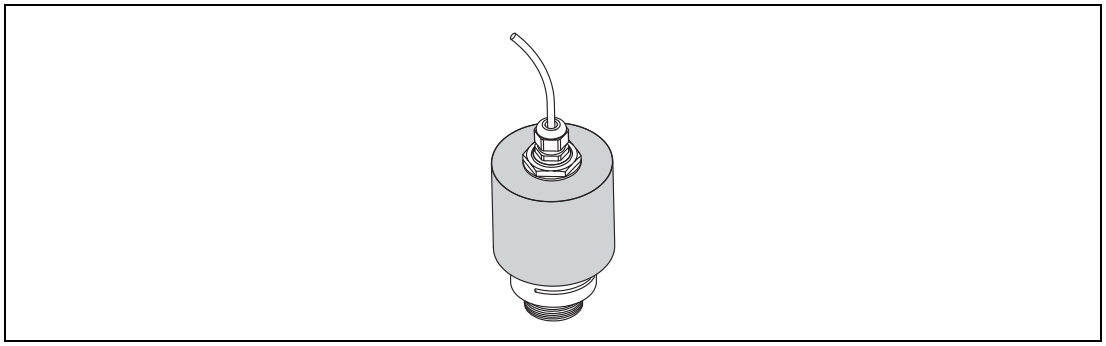

Figure 8.7 Weather protection cover, e. g. with 40 mm (1.5 inch) antenna

Note

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

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8.1.8 Using the Flooding Protection Tube

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

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

The flooding protection tube can be ordered as an accessory or together with the device via the ordering option **Accessory enclosed**.

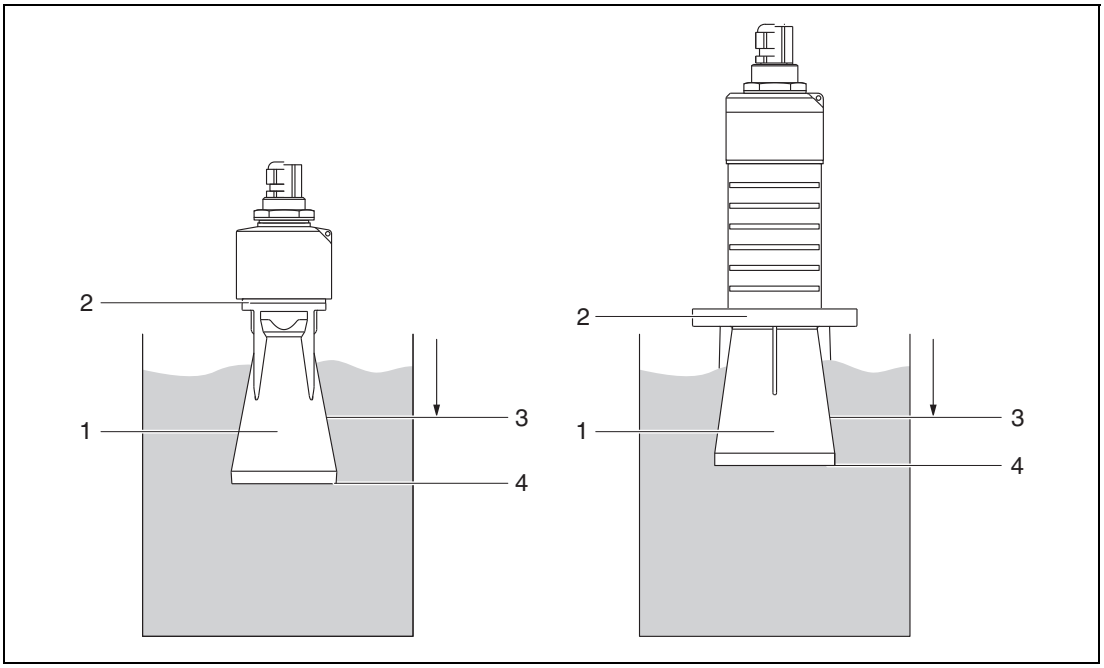

Figure 8.8 Function of flooding protection tube

1 Air pocket
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 air pocket that formed in the tube ensures the measurement of the maximum level 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

Configuring the blocking distance when using the flooding protection tube

Navigate to: Main menu → Setup → Advanced setup → Blocking distance

↳ Enter 100 mm (4 inch).

Perform a mapping

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.

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8.1.9 Installation with Mounting Bracket, Adjustable

The mounting bracket is available as an accessory.

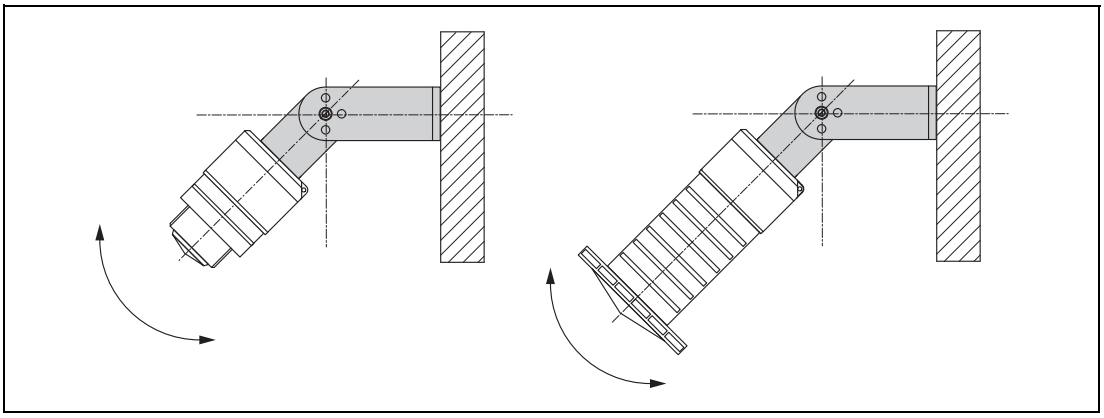

Figure 8.9 Installation with mounting bracket, adjustable

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

Caution!

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.

8.1.10 Cantilever Installation, with Pivot

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

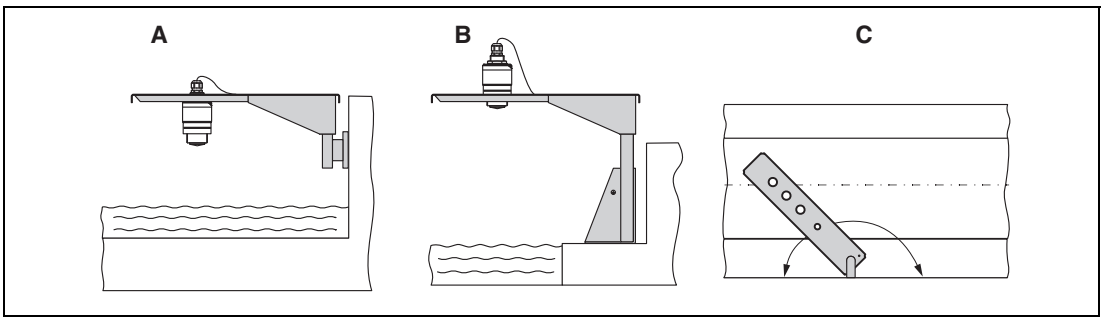

Figure 8.10 Cantilever installation, with pivot

A Cantilever with wall bracket
B Cantilever with mounting frame
C Cantilever can be turned (e. g., in order to position the device over the center of the flume)

8.1.11 Installation of Horizontal Mounting Bracket for Sewer Shafts

The horizontal mounting bracket is available as an accessory.

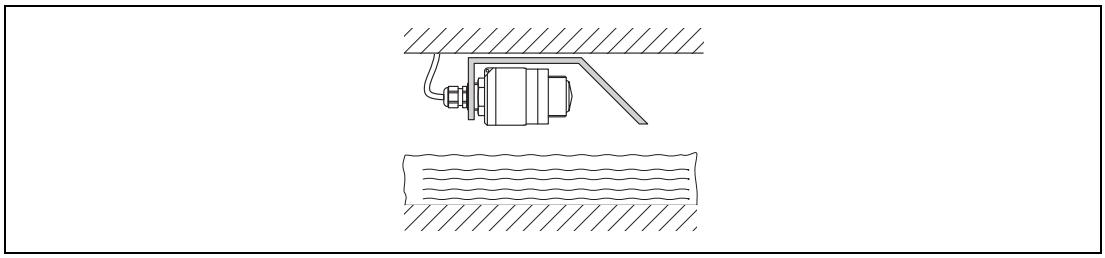

Figure 8.11 Installation of horizontal mounting bracket for sewer shafts

8.1.12 Mounting in a Shaft

The pivoted mounting bracket is available as an accessory.

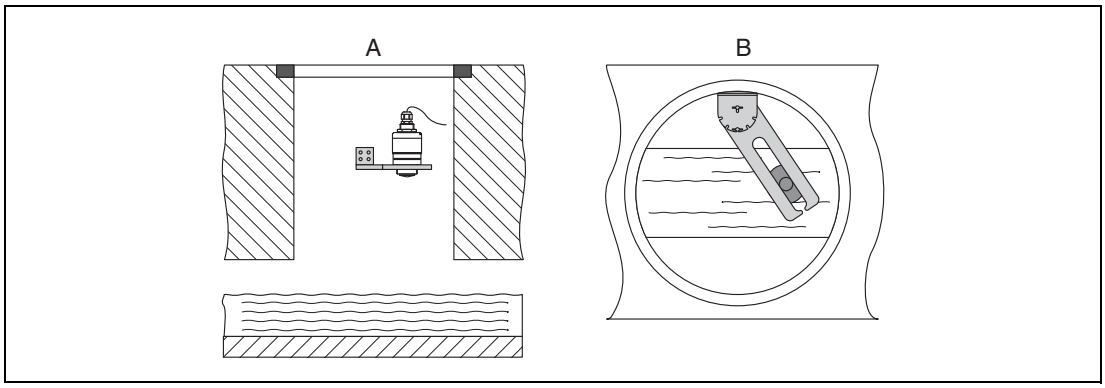

Figure 8.12 Mounting in a shaft, pivotable and adjustable

A Arm with wall bracket

B Pivotable and adjustable arm (e. g. to align the device with the center of a channel)

8.2 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?

9 Electrical Connection

9.1 Cable Assignment

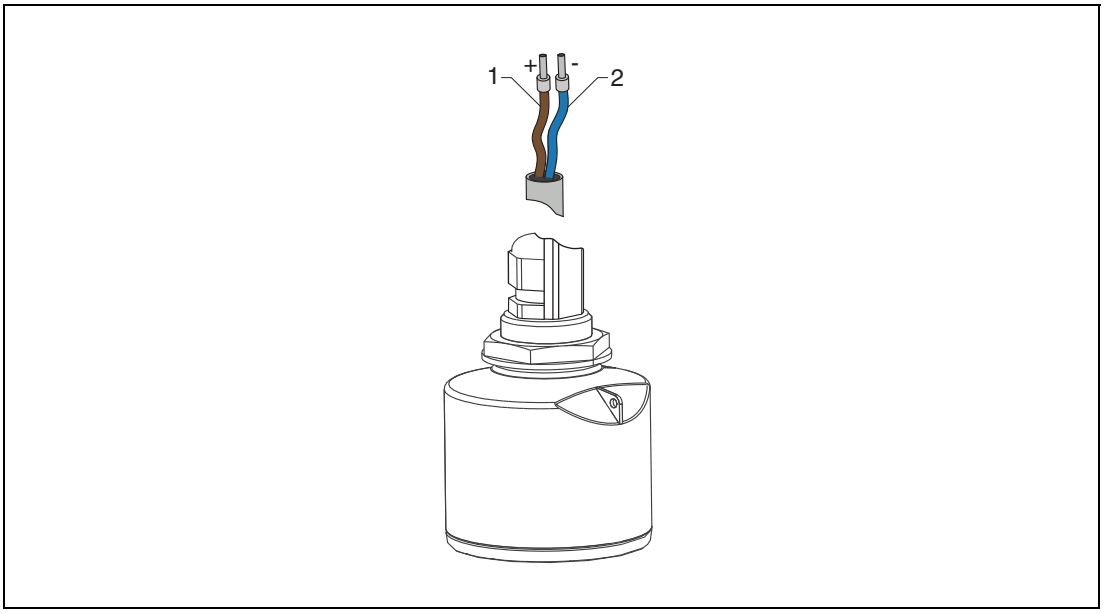

Figure 9.1 Cable assignment

1 Plus, brown wire
2 Minus, blue wire

9.2 Supply Voltage

10.5 to 30 V DC

An external power supply is necessary.

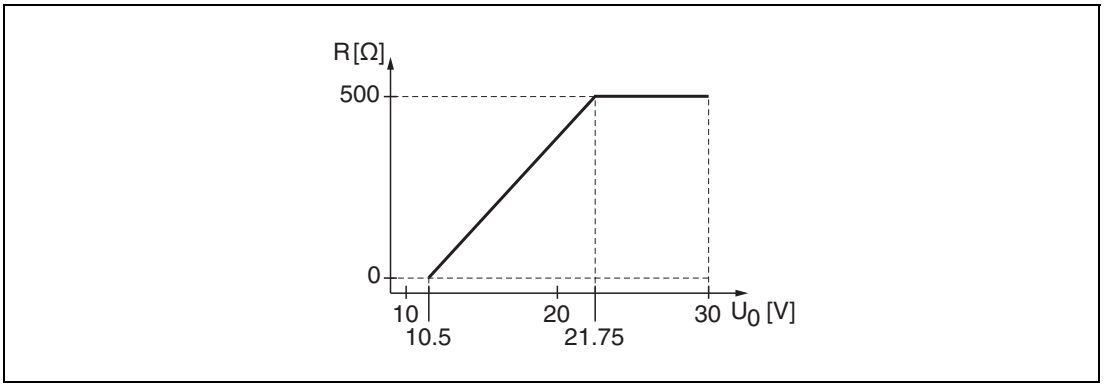

Figure 9.2 Maximum load R, depending on supply voltage U_o of power supply unit

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.

Note

Various power supply units can be ordered as an accessory from Pepperl+Fuchs.

9.3 Connecting the Device

4 to 20 mA HART block diagram

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

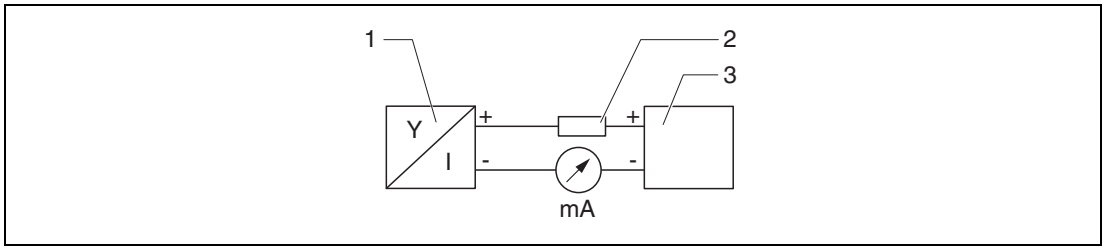

Figure 9.3 Block diagram of HART connection

1 Device with HART communication
2 HART resistor
3 Power supply

Note

The HART communication resistor of 250 Ω 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 Ω communication resistor

9.4 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?

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10 Operability

10.1 Operating Concept

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

10.2 Operation via *Bluetooth*® Wireless Technology

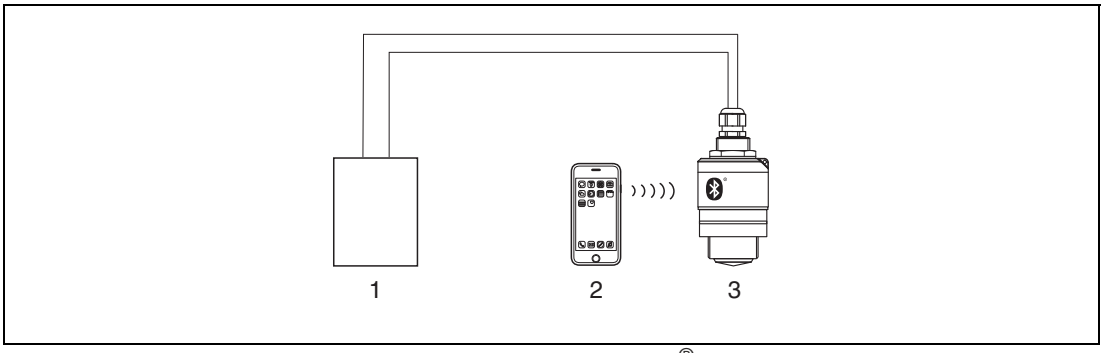

Figure 10.1 Possibilities for remote operation via *Bluetooth*® wireless technology

1 Transmitter power supply
2 Smartphone/Tablet with P+F Level (app)
3 Signal converter with *Bluetooth*® wireless technology

10.3 Operation via HART Protocol

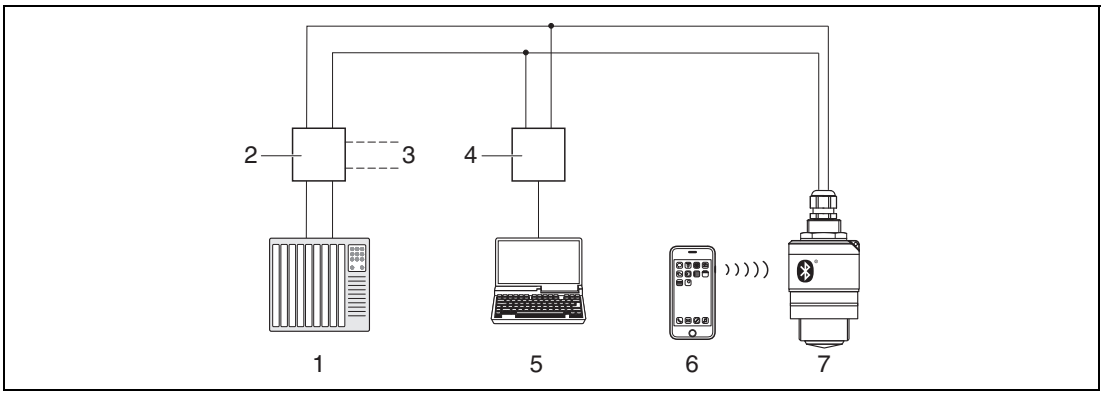

Figure 10.2 Options for remote operation via HART protocol

1 PLC (programmable logic controller)
2 Transmitter power supply with communication resistor
3 Connection for HART modem
4 HART modem
5 Computer with operating tool (PACT*ware*)
6 Smartphone/Tablet with P+F Level (app)
7 Signal converter with *Bluetooth*® wireless technology

11 System Integration via HART Protocol

11.1 Overview of the Device Description Files

Manufacturer ID

0x005D

Device type ID

0x5DD3

HART specification

7.0

11.2 Measured Variables via HART Protocol

The following measured values are assigned to the HART variables:

Primary variable (PV)

Level linearized

Secondary variable (SV)

Distance

Tertiary variable (TV)

Relative echo amplitude

Quarternary variable (QV)

Temperature

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12 Commissioning and Operation

The commissioning and operation of the device is described using the App P+F Level as an example. The commissioning and operation via the operating software PACT*ware* is similar.

Note

Additional information regarding the commissioning and operation of the device via the operating software PACT*ware* can be found in the manual **Installation and Configuration Device Type Manager (DTM)**.

12.1 Installation and Function Check

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

12.1.1 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?

12.1.2 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?

12.2 Commissioning via P+F Level (App)

12.2.1 Device Requirements

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

12.2.2 P+F Level System Requirements

P+F Level 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

12.2.3 Commissioning

Downloading and Installing P+F Level

1. Enter **P+F Level** in the search field of the app store.

Figure 12.1 App stores

2. Install P+F Level.
3. Start P+F Level.
4. Select device from livelist displayed.
5. Enter the login data:

   ↳ User name: admin
   Password: serial number of the device

6. Tap the icons for more information.

Note!

After logging in for the first time, change the password!

12.2.4 Envelope Curve Display in P+F Level

Envelope curves can be displayed and recorded in P+F Level.

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.

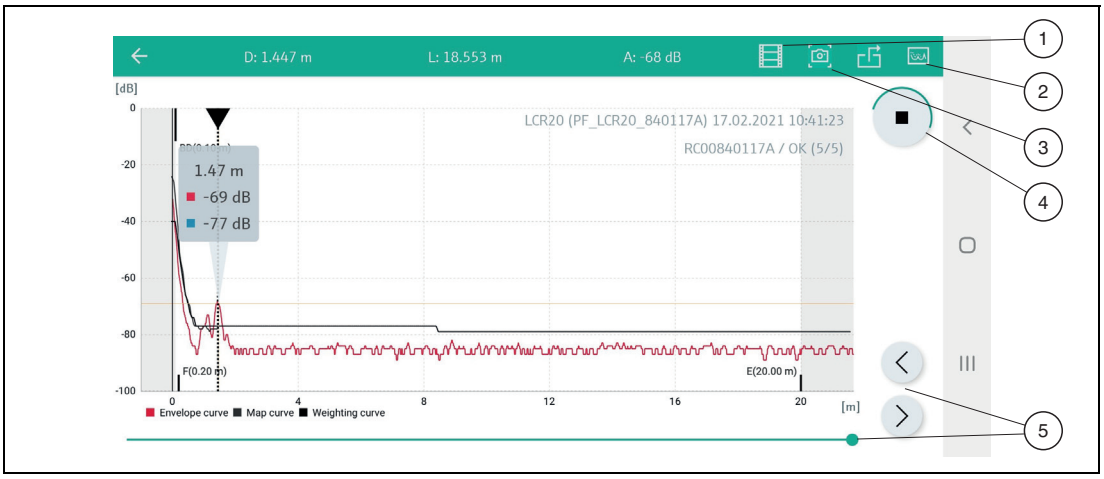

Figure 12.2 Envelope curve display (sample) in P+F Level for Android

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

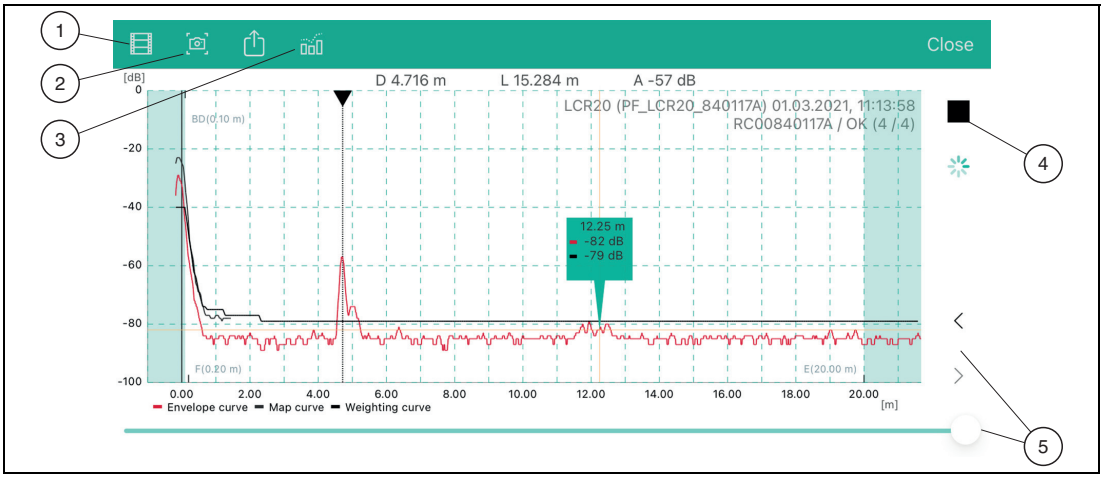

Figure 12.3 Envelope curve display (sample) in P+F Level for iOS

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

12.3 Configuring Level Measurement via Operating Tool

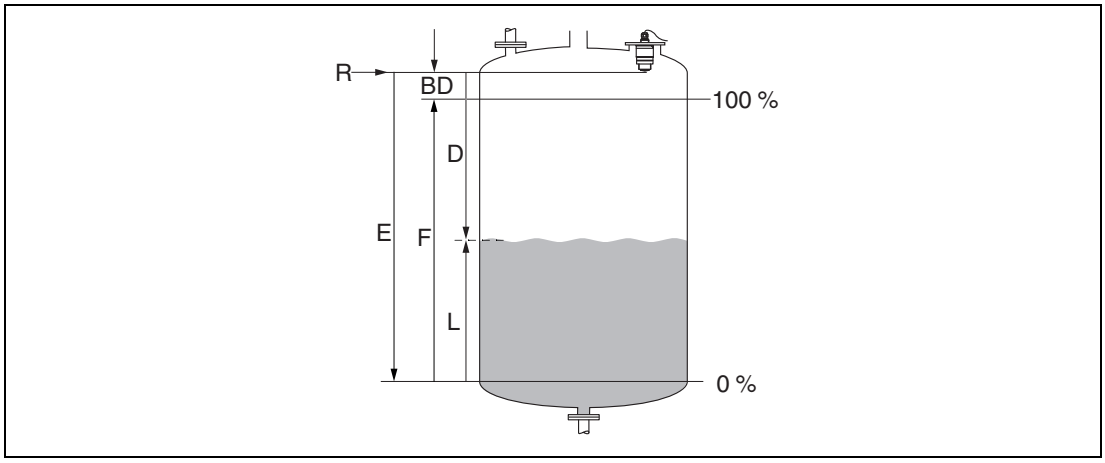

Figure 12.4 Configuration parameters for level measurement in liquids

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

12.3.1 Configuration using P+F Level

Configuring Level Measurement

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

12.3.2 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 foot)	Y1	0 %
X2	Value F (= Full)	Y2	100 %

Table 12.1

Display Definition via P+F Level

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/foot for 0 %.
4. X2 = Specify level value in m/foot for 100 %.
5. Activate linearization type.

12.4 Configuring Flow Measurement via Operating Tool

12.4.1 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.
- It is recommended to use the **flooding protection sleeve** accessory.

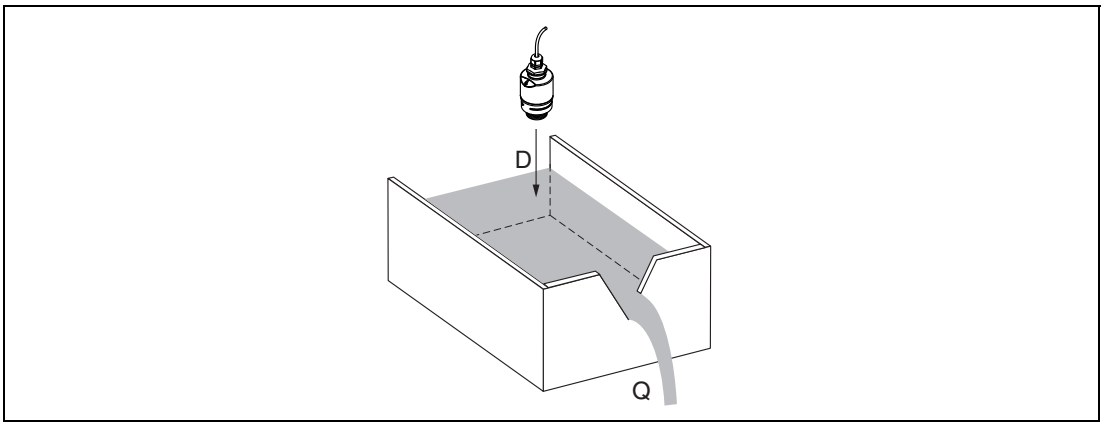

Figure 12.5 Configuration parameters for the flow measurement of liquids

D Distance

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

12.4.2 Flow Measurement Configuration

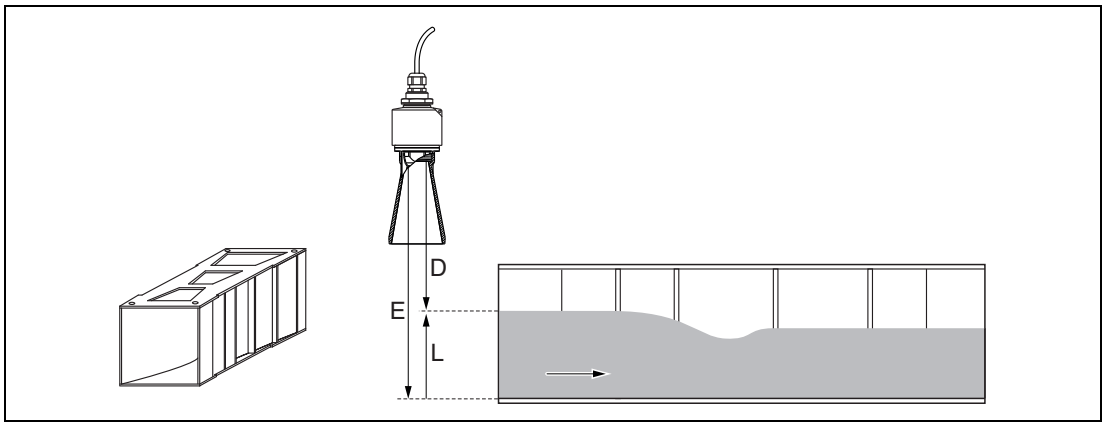

Figure 12.6 Example: Khafagi-Venturi flume

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

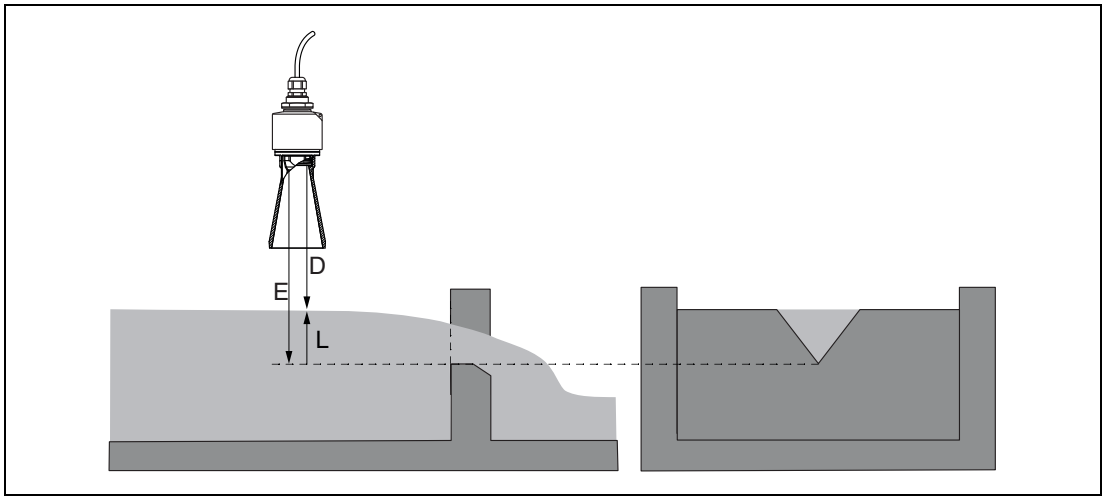

Figure 12.7 Example: Triangular weir

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

Flow Measurement Configuration via P+F Level

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 the zero point of the weir or channel).
   In the case of channels, the zero point is at the narrowest point of the floor.
3. Navigate to: Setup → Full calibration
   ↳ Specify the maximum level (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 sensor) to the level.
5. Navigate to: Setup → Confirm distance
   ↳ Compare the distance displayed with the actual value to start recording 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.

Configuring the Blocking Distance when Using the Flooding Protection Tube

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

Linearization via P+F Level

1. Navigate to: Setup → Advanced setup
   ↳ Linearization table
2. Select the length unit.
3. Select the unit after linearization.
4. Select the linearization type table.
5. Select the **manual** table mode.
6. Enter the value pairs (maximum 32) manually in the table. The table must be in the **disabled** mode in this context.
7. Activate table.

12.5 Data Access – Security

12.5.1 Software Locking via Access Code in P+F Level

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

Locking Access Code

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**.

Note

- The access code is only active if a different (wrong) code is entered or the device is de-energized.
- 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.

12.5.2 Unlocking via P+F Level

Releasing the Lock

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

12.5.3 *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 P+F Level 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 P+F Level and PACT*ware*.

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 PACT*ware* 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

Re-enabling the *Bluetooth*® Wireless Technology Interface Recovery Sequence

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

1. Connect the device to the voltage.
   ↳ 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 P+F Level (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.

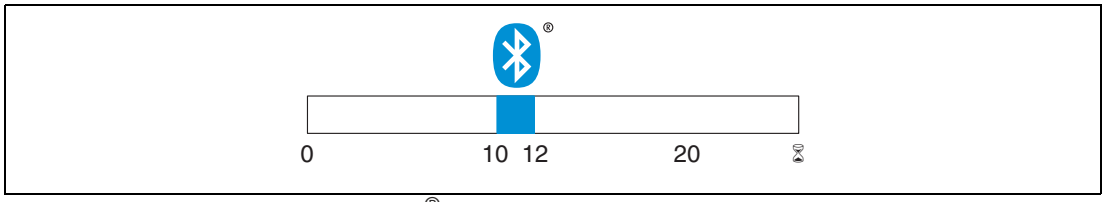

Figure 12.8 Timeline for *Bluetooth*® wireless technology recovery sequence, time in minutes

13 Diagnostics and Troubleshooting

13.1 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.
	HART modem is connected incorrectly.	Connect HART modem correctly.
	The communication resistor of the HART modem is switched on or off.	Check the communication resistor and connections.
Device measures incorrectly.	Configuration error	• Check and correct the parameter configuration. • Carry out mapping.
Display values not plausible (linearization).	P+F Level and PACT*ware* active at the same time.	Log off PACT*ware* and disconnect or Log off P+F Level and disconnect (connection via P+F Level has priority).
Linearized output value not plausible.	Linearization error	PACT*ware*: Check linearization table. P+F Level: Check linearization table. Check the vessel selection in the linearization module.

Table 13.1

13.2 Error – P+F Level Operation

Error	Possible case	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.
	The device is already connected with another smartphone/tablet.	Only **one** point-to-point connection is established between a sensor and a smartphone or tablet.
Device is visible in the live list but cannot be accessed via P+F Level.	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 P+F Level.	Apple end device	Log in as standard. Enter user name **admin.** Enter initial password (device serial number) paying attention to lower/upper case.
Login via P+F Level 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 P+F Level.	Incorrect password entered.	Enter correct password.
Device cannot be operated via P+F Level.	Password forgotten.	Contact the Pepperl+Fuchs service department.
Device cannot be operated via P+F Level.	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. Shield the device, isolate it and cool it down if necessary.
TAG in P+F Level 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 since the HART tag can be up to 32 characters long but *Bluetooth*® can only use 29 characters as the device name: Example: **LCR20N12345678901234567890123456** becomes **LCR20N12345678~567890123456**

Table 13.2

13.3 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.

13.4 List of Diagnostic Events

Diagnostic number	Short text	Remedy instructions	Status signal (from the factory)	Diagnostic behavior (from the factoryk)
Diagnostic of electronic				
270	Main electronic failure	Exchange device.	F	Alarm
271	Main electronic failure	1. Restart device. 2. If failure remains, exchange device.	F	Alarm
272	Main electronic failure	1. Restart device. 2. Check environment for strong EMC fields. 3. If failure remains, exchange device.	F	Alarm
283	Memory content	1. Transfer data or reset device. 2. Contact service.	F	Alarm
Diagnostic of configuration				
410	Data transfer	1. Check connection. 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. 2. Check device configuration. 3. Up- and download new configuration.	M	Warning
441	Current output 1	1. Check process. 2. Check current output settings.	S	Warning
491	Current output 1 simulation	Deactivate simulation.	C	Warning
585	Distance simulation	Deactivate simulation.	C	Warning
586	Record mapg	Recording of mapping, please wait.	C	Warning
Diagnostic of process				
801	Energy too low	Increase supply voltage.	S	Warning
825	Operating temperature	1. Check ambient temperature. 2. Check process temperature.	S	Warning
941	Echo lost	Check parameter **Evaluation sensitivity**.	S	Warning
941	Echo lost		F	Alarm

Table 13.3

13.5 Overview of Information Events

Information number	Info name
I1000	-------- (Device OK)

Table 13.4

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14 Maintenance

No special maintenance work is required.

14.1 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 ε_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.

14.2 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.

15 Repair

15.1 General notes

15.1.1 Repair concept

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

15.1.2 Replacing a device

After the device has been replaced, the parameters can be uploaded to the device via PACT*ware*.

Condition: The configuration of the old device must have been saved using PACT*ware*.

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

15.1.3 Return

The measuring device must be returned if repairs or a factory calibration are required, or if the wrong measuring device has been ordered or delivered. According to legal regulations, Pepperl+Fuchs, as an ISO-certified company, is required to follow certain procedures when handling returned products that are in contact with medium.

To ensure swift, safe and professional device returns, please read the return procedures and conditions on the Pepperl+Fuchs website at (www.pepperl-fuchs.com).

15.1.4 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 Pepperl+Fuchs for disposal under the applicable conditions.

16 Accessories

16.1 Enclosed Accessories

These accessories can be ordered together with the device via the ordering option **Accessory enclosed**.

16.1.1 Device-Specific Accessories

Weather protection cover

The weather protection cover can be ordered together with the device via the ordering option **Accessory enclosed**.

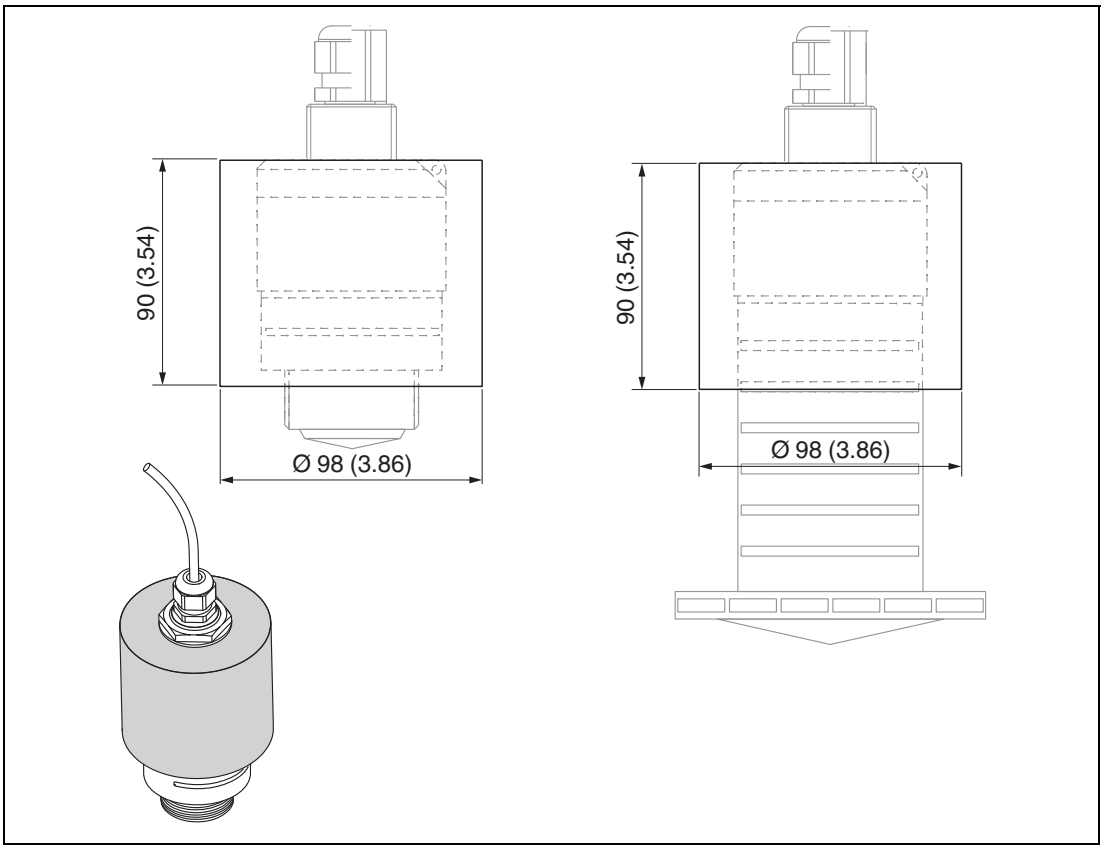

Figure 16.1 Dimensions of weather protection cover, engineering unit: mm (inch)

Material: PVDF

Option: R1

Note

The sensor is not completely covered in the case of the 40 mm (1.5 inch) antenna or the 80 mm (3 inch) antenna.

Flooding protection tube 40 mm (1.5 inch)

Suitable for use with devices with a 40 mm (1.5 inch) antenna and G1-1/2 process connection on front.

The flooding protection tube can be ordered together with the device via the ordering option **Accessory enclosed**.

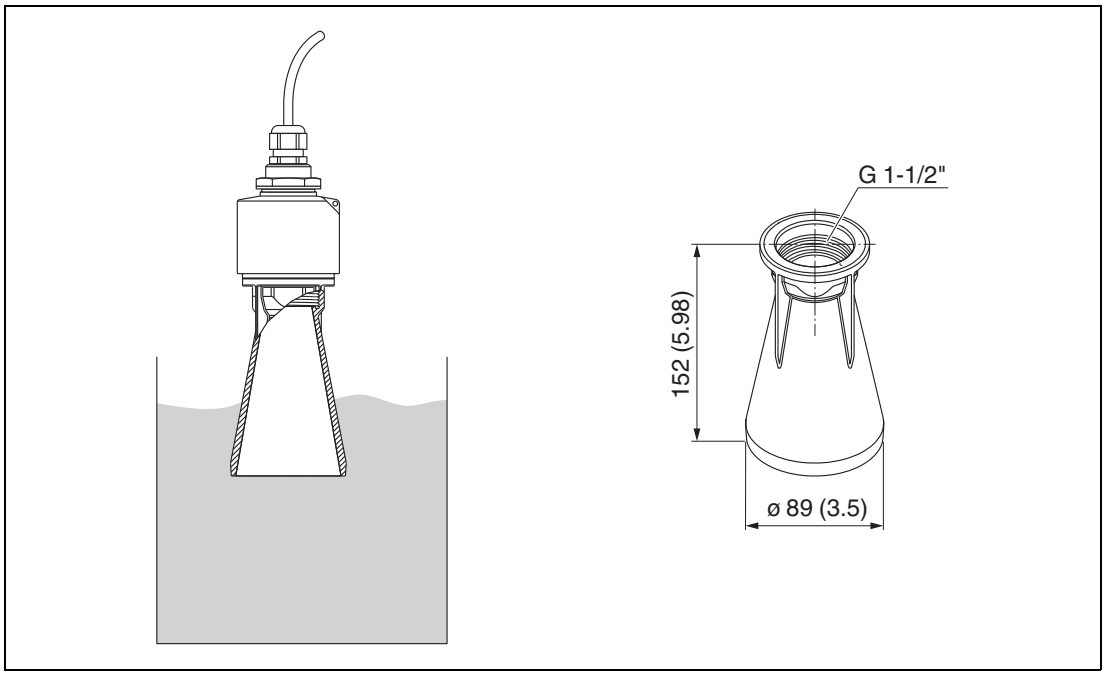

Figure 16.2 Dimensions of 40 mm (1.5 inch) flooding protection tube, engineering unit: mm (inch)

Material: PBT-PC, metalized

Option: R7

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Flooding protection tube 80 mm (3 inch)

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

The flooding protection tube can be ordered together with the device via the ordering option **Accessory enclosed**.

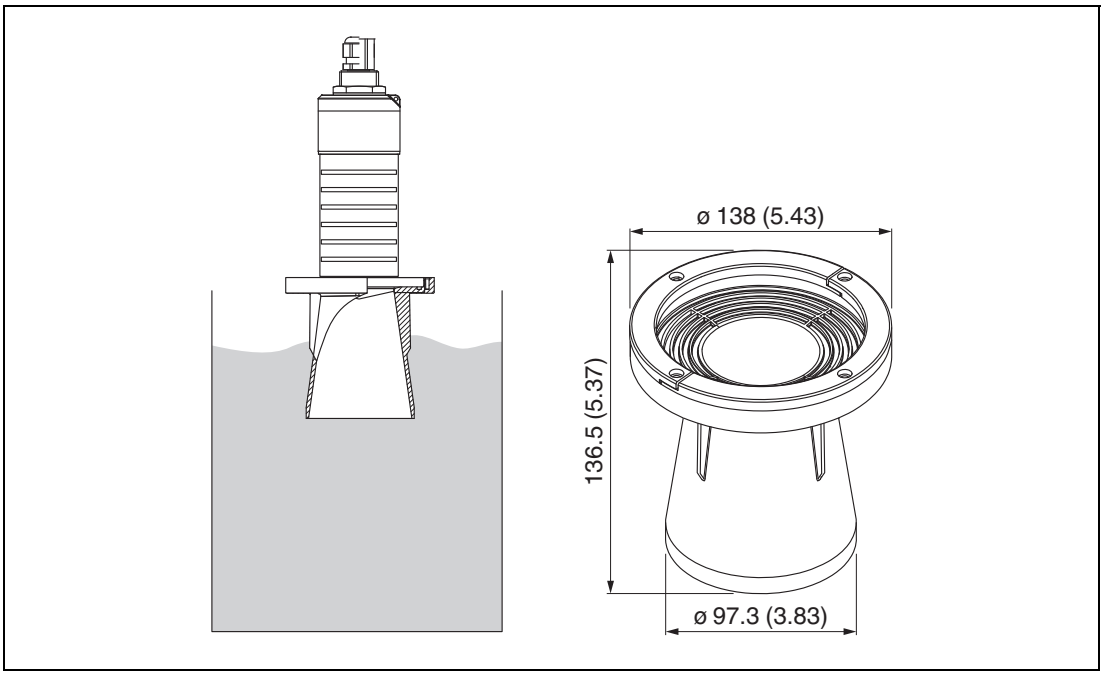

Figure 16.3 Dimensions of 80 mm (3 inch) flooding protection tube, engineering unit: mm (inch)

Material: PBT-PC, metalized

Order number: R8

UNI flange 2 inch/DN50/50, PP

The UNI flange can be ordered together with the device via the ordering option **Accessory enclosed**.

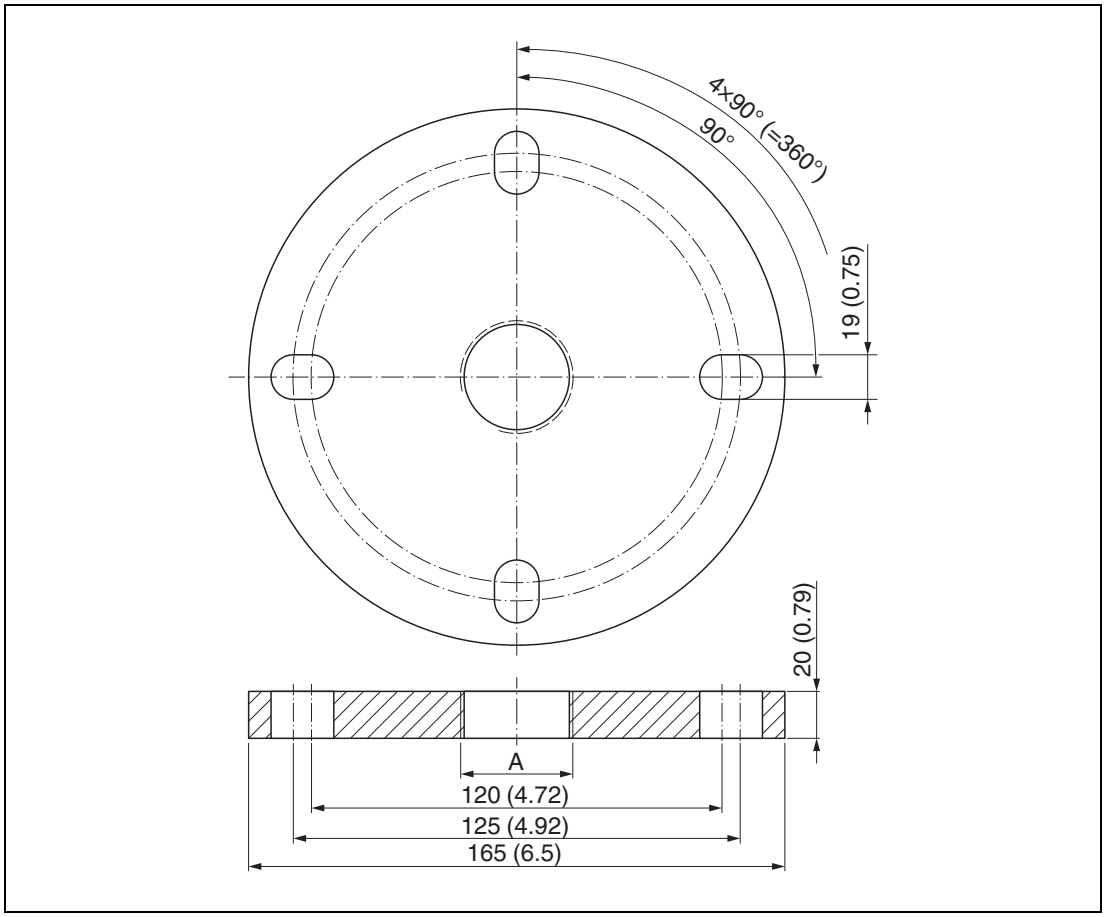

Figure 16.4 Dimensions of UNI flange 2 inch/DN50/50, engineering unit: mm (inch)

A Sensor connection in accordance with ordering option **Process connection front side** or **Process connection rear side**

Material: PP

Option:

- UNI flange 2 inch/DN50/50, PP, front side: RA
- UNI flange 2 inch/DN50/50, PP, rear side: RB

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UNI flange 3 inch/DN80/80, PP

The UNI flange can be ordered together with the device via the ordering option **Accessory enclosed**.

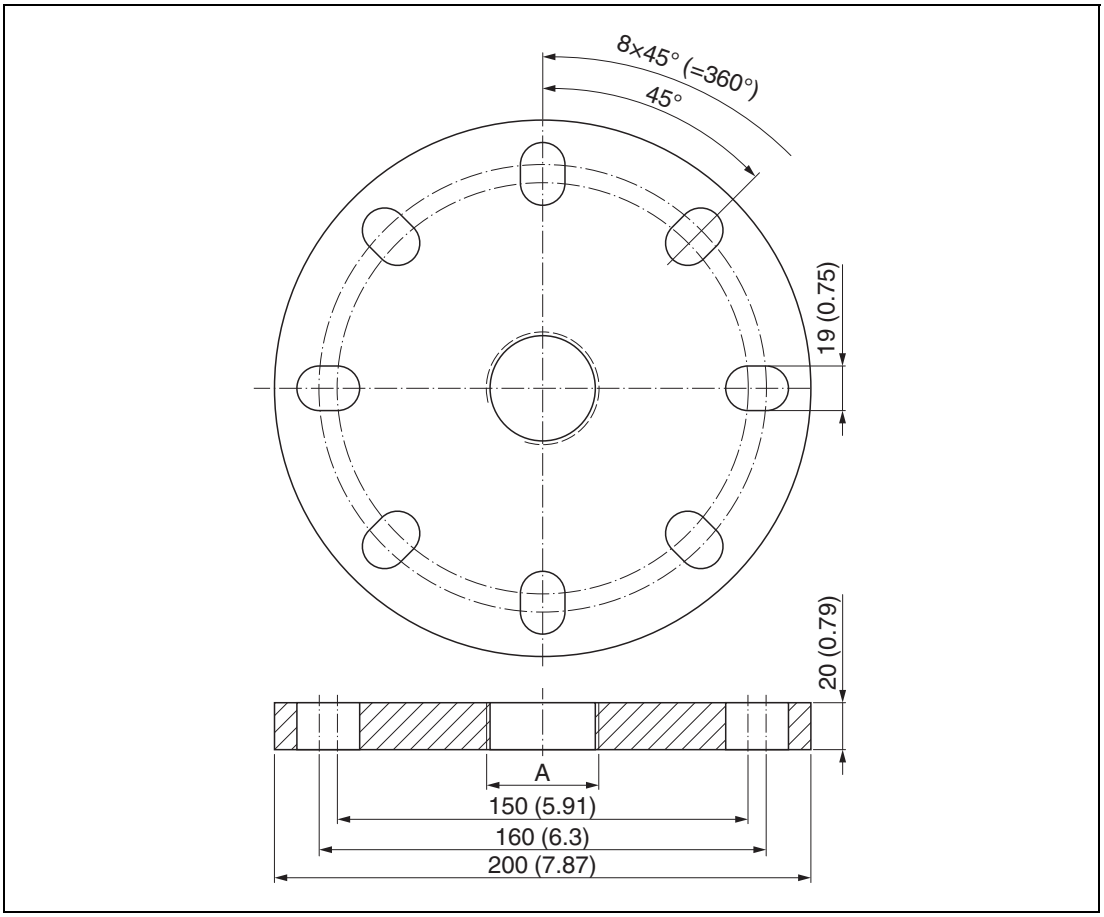

Figure 16.5 Dimensions of UNI flange 3 inch/DN80/80, engineering unit: mm (inch)

A Sensor connection in accordance with ordering option **Process connection front side** or **Process connection rear side**

Material: PP

Option:

- UNI flange 3 inch/DN80/80, PP, front side: RD
- UNI flange 3 inch/DN80/80, PP, rear side: RE

UNI flange 4 inch/DN100/100, PP

The UNI flange can be ordered together with the device via the ordering option **Accessory enclosed**.

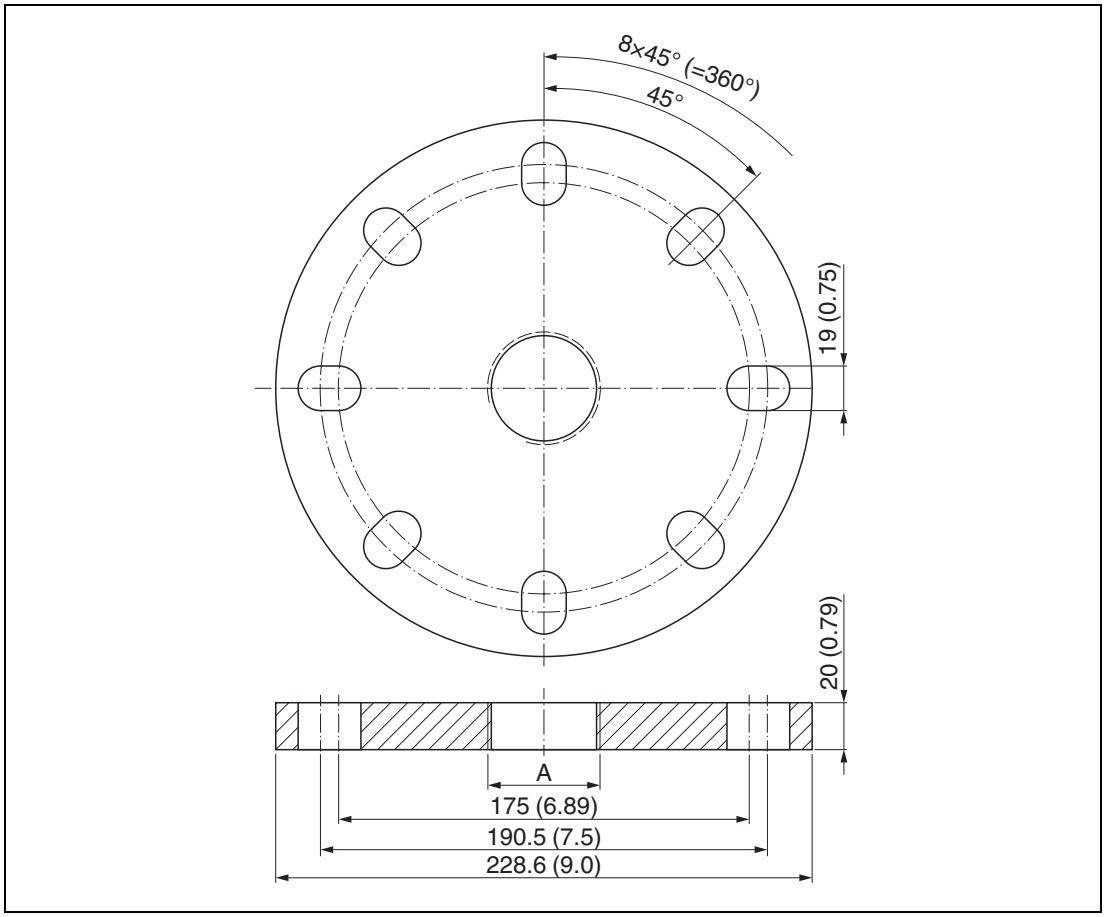

Figure 16.6 Dimensions of UNI flange 4 inch/DN100/100, engineering unit: mm (inch)

A Sensor connection in accordance with ordering option **Process connection front side** or **Process connection rear side**

Material: PP

Option:

- UNI flange 4 inch/DN100/100, PP, front side: RG
- UNI flange 4 inch/DN100/100, PP, rear side: RH

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16.2 Further Accessories

These accessories can be ordered separately.

16.2.1 Device-Specific Accessories

Securing nut G1-1/2

Suitable for devices with G1-1/2 and MNPT1-1/2 process connection.

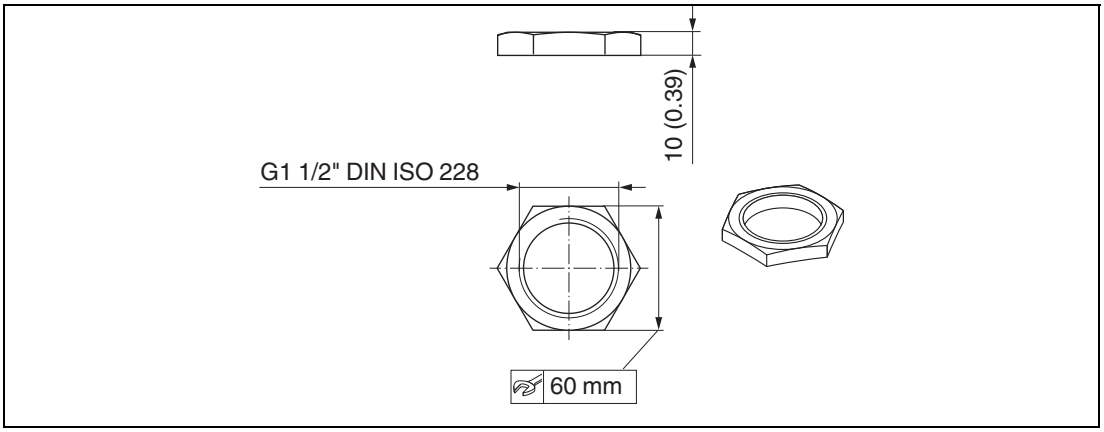

Figure 16.7 Dimensions of securing nut, engineering unit: mm (inch)

Material: PC

Order number: 52014146

Securing nut G 2

Suitable for devices with G2 and MNPT2 process connection on front.

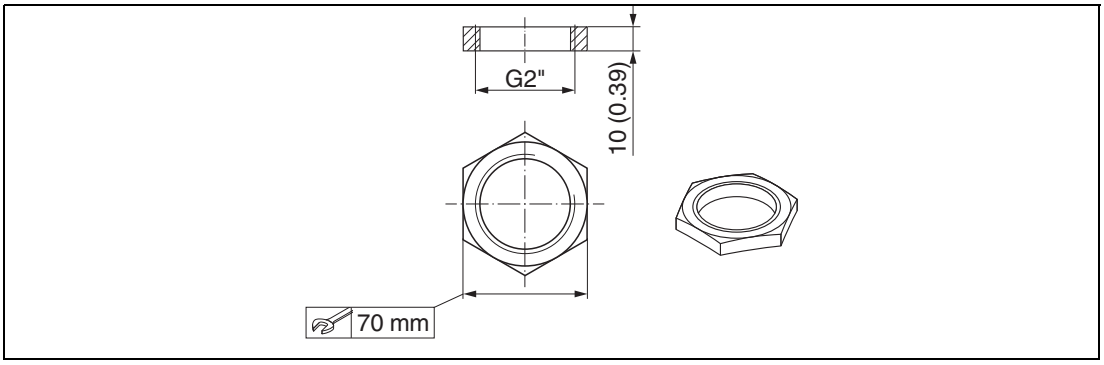

Figure 16.8 Dimensions of securing nut, engineering unit: mm (inch)

Material: PC

Order number: 52000598

Mounting bracket, adjustable

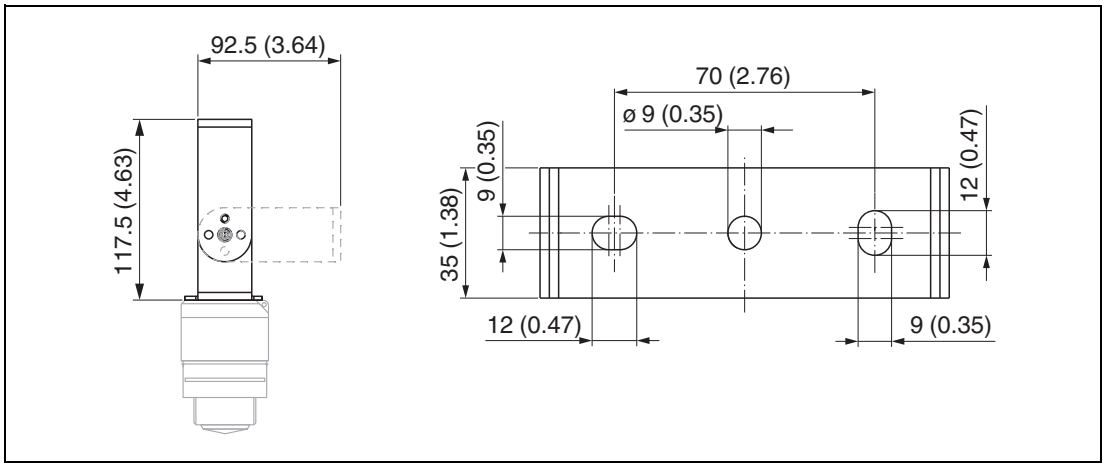

Figure 16.9 Dimensions of mounting bracket, engineering unit: mm (inch)

Consists of:

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

Order number: 71325079

Angle bracket for wall mounting

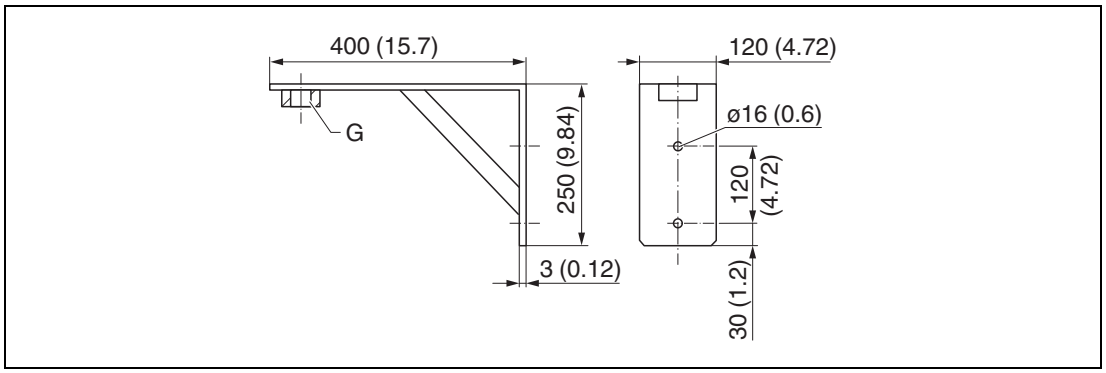

Figure 16.10 Dimensions of angle bracket, engineering unit: mm (inch)

G Sensor connection in accordance with ordering option **Process connection front side**

Weight: 3.4 kg (7.5 lb)

Material: 316L (1.4404)

Order number

- Angle bracket for G1-1/2 process connection: 71452324, also suitable for MNPT1-1/2
- Angle bracket for G2 process connection: 71452325, also suitable for MNPT2

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Cantilever with pivot

Installation type sensor process connection rear side

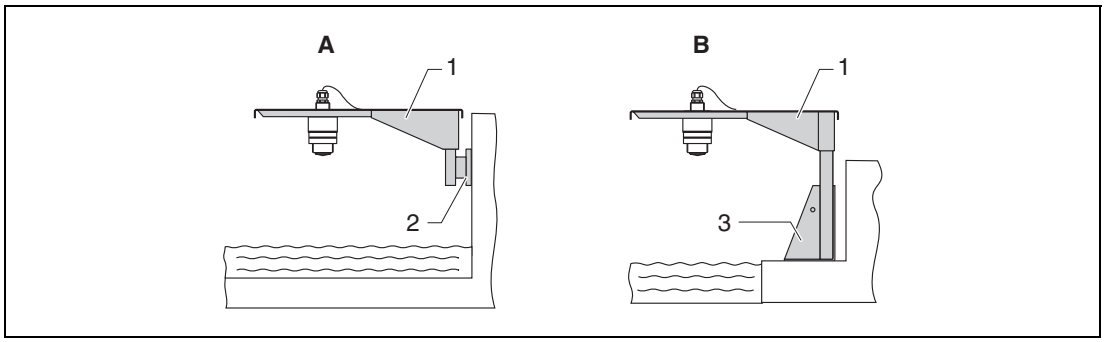

Figure 16.11 Installation type sensor process connection rear side

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

Cantilever (short) with pivot, sensor process connection on rear

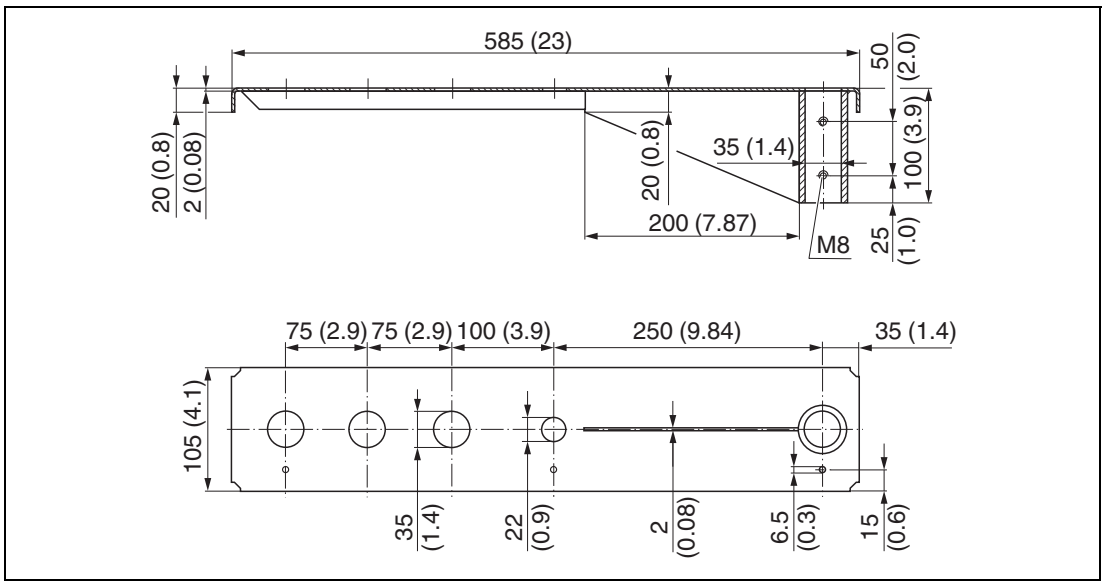

Figure 16.12 Dimensions of cantilever (short) with pivot for sensor process connection on rear, engineering unit: mm (inch)

Weight: 2.1 kg (4.63 lb)

Material: 316L (1.4404)

Order number: 71452315

Note

- 35 mm (1.38 inch) openings for all G1 or MNPT1 connections on rear
- 22 mm (0.87 inch) opening can be used for an additional sensor.
- Retaining screws are included in delivery.

Cantilever (long) with pivot, sensor process connection on rear

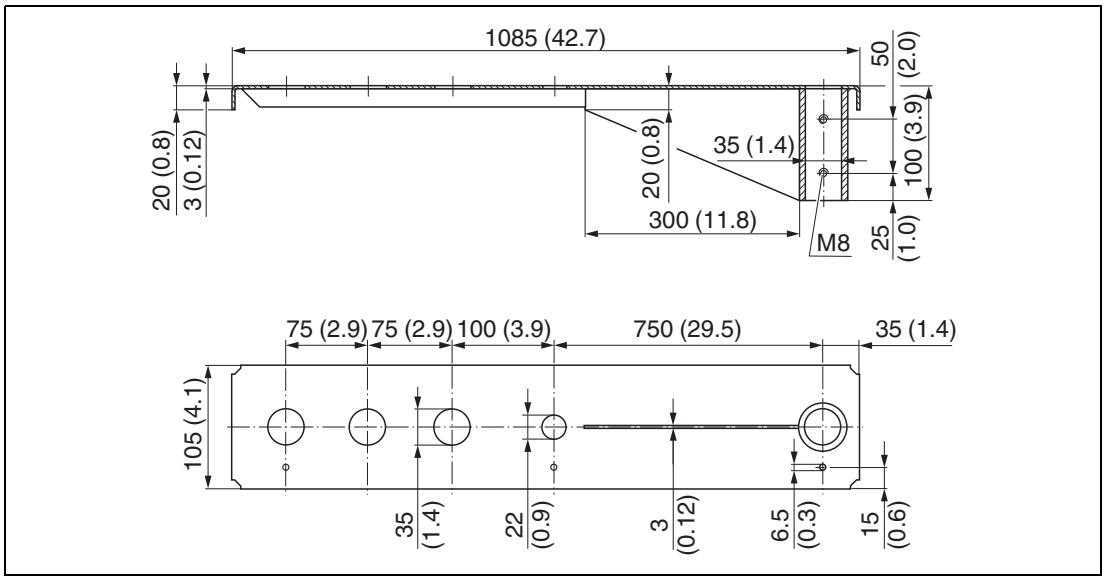

Figure 16.13 Dimensions of cantilever (long) with pivot for sensor process connection on rear, engineering unit: mm (inch)

Weight: 4.5 kg (9.92 lb)

Material: 316L (1.4404)

Order number: 71452316

Note

- 35 mm (1.38 inch) openings for all G1 or MNPT1 connections on rear
- 22 mm (0.87 inch) opening can be used for an additional sensor.
- Retaining screws are included in delivery.

Installation type sensor process connection front side

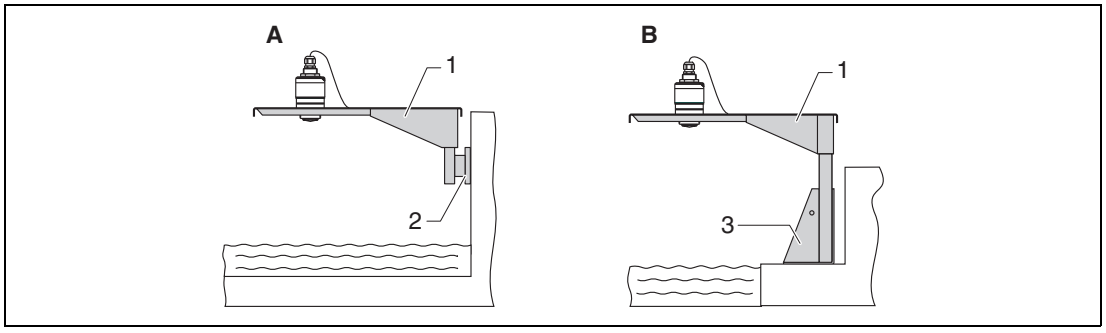

Figure 16.14 Installation type sensor process connection front side

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

Cantilever (short) with pivot, G1-1/2 sensor process connection on front

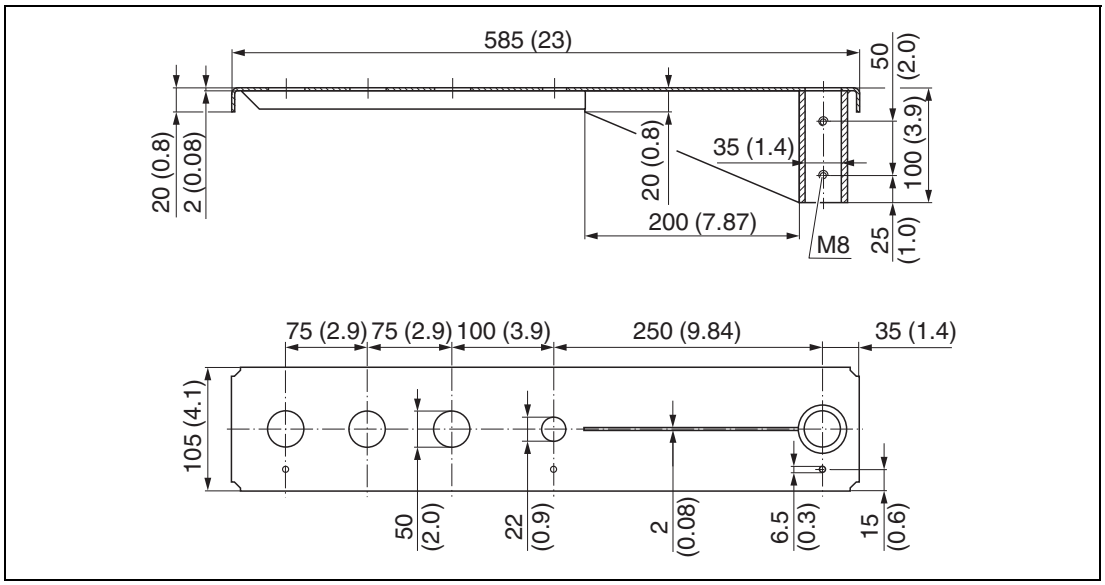

Figure 16.15 Dimensions of cantilever (short) with pivot for G1-1/2 sensor process connection on front, engineering unit: mm (inch)

Weight: 1.9 kg (4.19 lb)

Material: 316L (1.4404)

Order number: 71452318

Note

- 50 mm (2.17 inch) openings for all G1-1/2 (MNPT1-1/2) connections on front
- 22 mm (0.87 inch) opening can be used for an additional sensor.
- Retaining screws are included in delivery.

Cantilever (long) with pivot, G1-1/2 sensor process connection on front

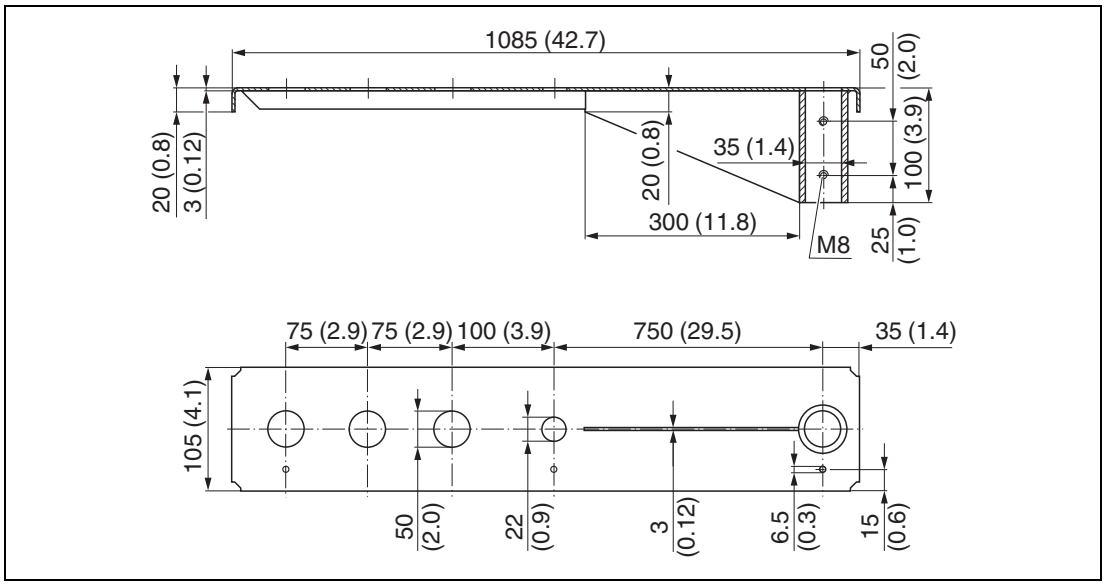

Figure 16.16 Dimensions of cantilever (long) with pivot for G1-1/2 sensor process connection on front, engineering unit: mm (inch)

Weight: 4.4 kg (9.7 lb)

Material: 316L (1.4404)

Order number: 571452319

Note

- 50 mm (2.17 inch) openings for all G1-1/2 (MNPT1-1/2) connections on front
- 22 mm (0.87 inch) opening can be used for an additional sensor.
- Retaining screws are included in delivery.

Cantilever (short) with pivot, G2 sensor process connection on front

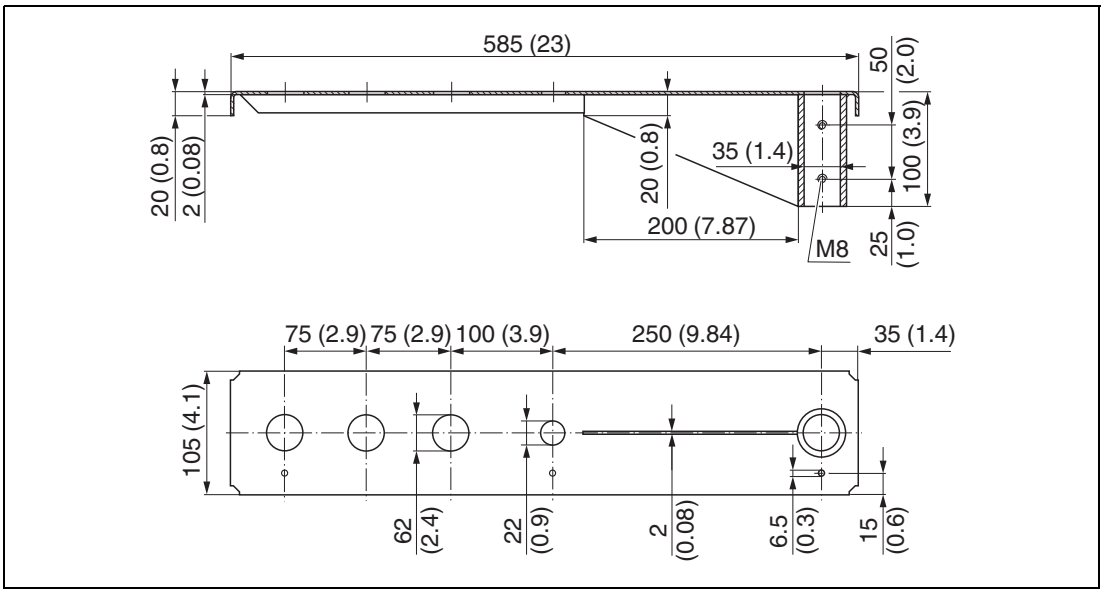

Figure 16.17 Dimensions of cantilever (short) with pivot for G2 sensor process connection on front, engineering unit: mm (inch)

Weight: 1.9 kg (4.19 lb)

Material: 316L (1.4404)

Order number: 71452321

Note

- 62 mm (2.44 inch) openings for all G2 (MNPT2) connections on front
- 22 mm (0.87 inch) opening can be used for an additional sensor.
- Retaining screws are included in delivery.

Cantilever (long) with pivot, G2 sensor process connection on front

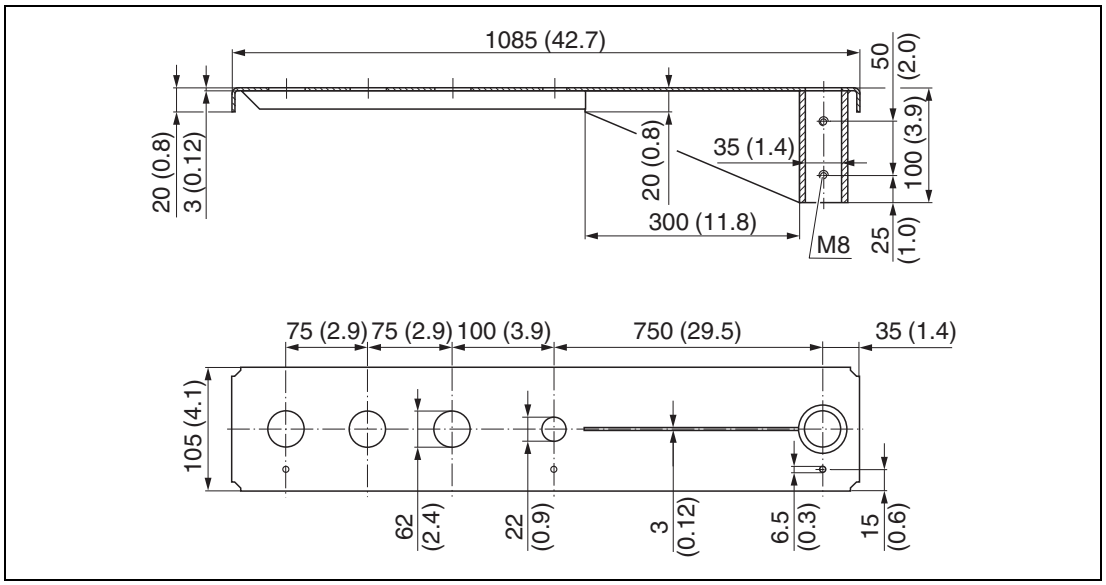

Figure 16.18 Dimensions of cantilever (long) with pivot for G1-1/2 sensor process connection on front, engineering unit: mm (inch)

Weight: 4.4 kg (9.7 lb)

Material: 316L (1.4404)

Order number: 71452322

Note

- 62 mm (2.44 inch) openings for all G2 (MNPT2) connections on front
- 22 mm (0.87 inch) opening can be used for an additional sensor.
- Retaining screws are included in delivery.

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Mounting frame (short) for cantilever with pivot

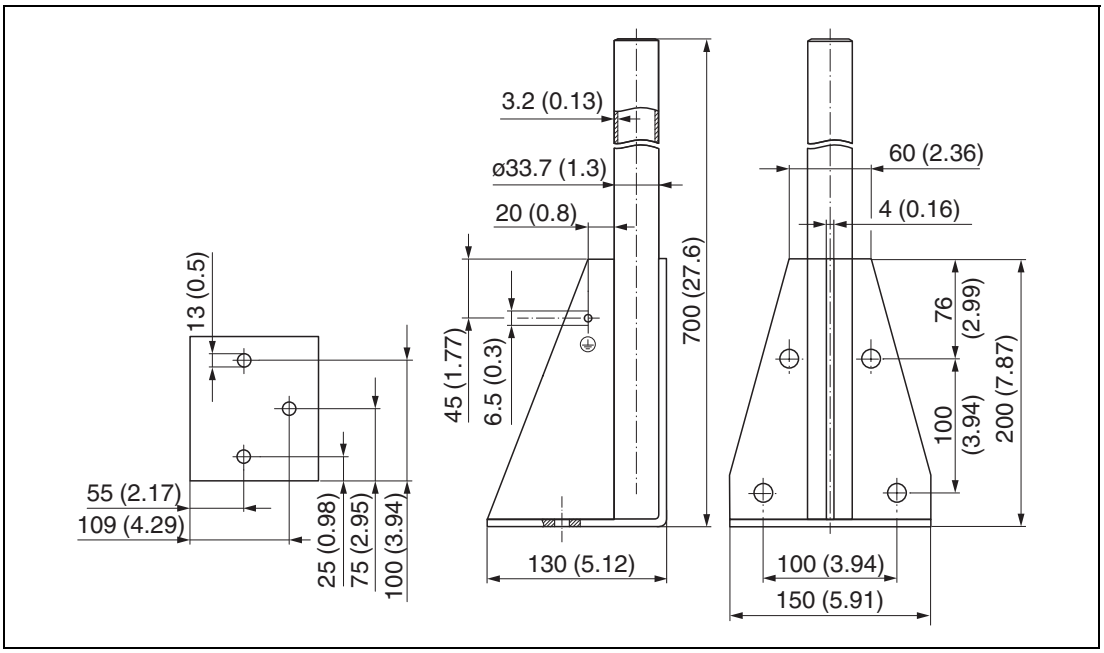

Figure 16.19 Dimensions of mounting frame (short), engineering unit: mm (inch)

Weight: 3.2 kg (7.06 lb)

Material: 316L (1.4404)

Order number: 71452327

Mounting frame (long) for cantilever with pivot

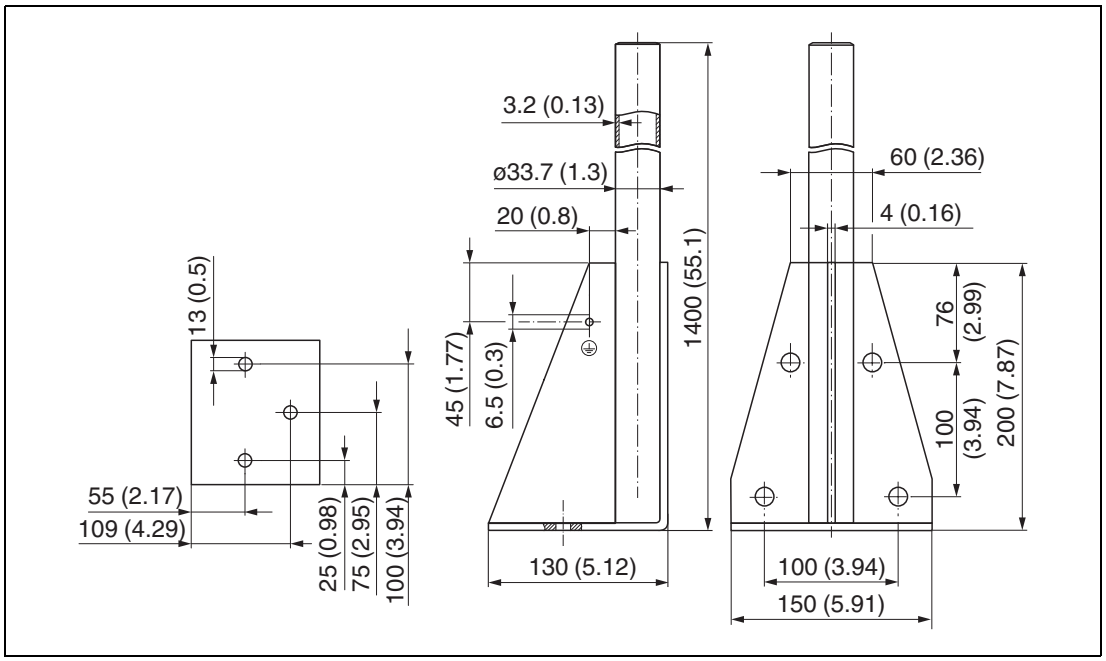

Figure 16.20 Dimensions of mounting frame (long), engineering unit: mm (inch)

Weight: 4.9 kg (10.08 lb)

Material: 316L (1.4404)

Order number: 71452326

Wall bracket for cantilever with pivot

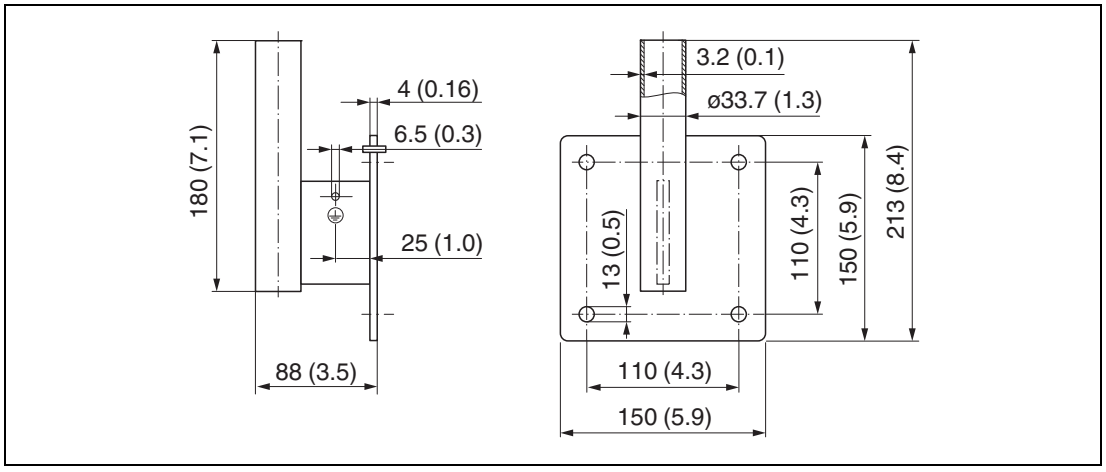

Figure 16.21 Dimensions of wall bracket, engineering unit: mm (inch)

Weight: 1.4 kg (3.09 lb)

Material: 316L (1.4404)

Order number: 71452323

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Ceiling mounting bracket

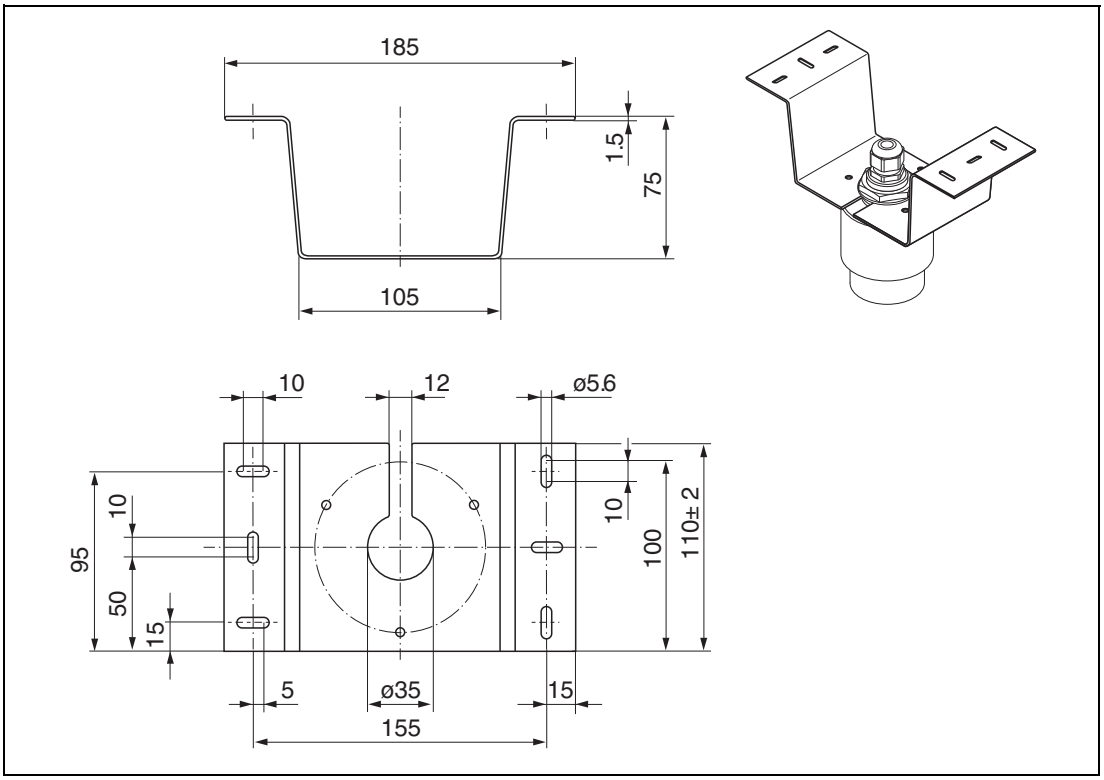

Figure 16.22 Dimensions of ceiling mounting bracket, engineering unit: mm (inch)

Material: 316L (1.4404)

Order number: 71093130

Pivoted mounting bracket for sewer channel

The pivotable mounting bracket is used to install the device in a manhole over a sewer channel.

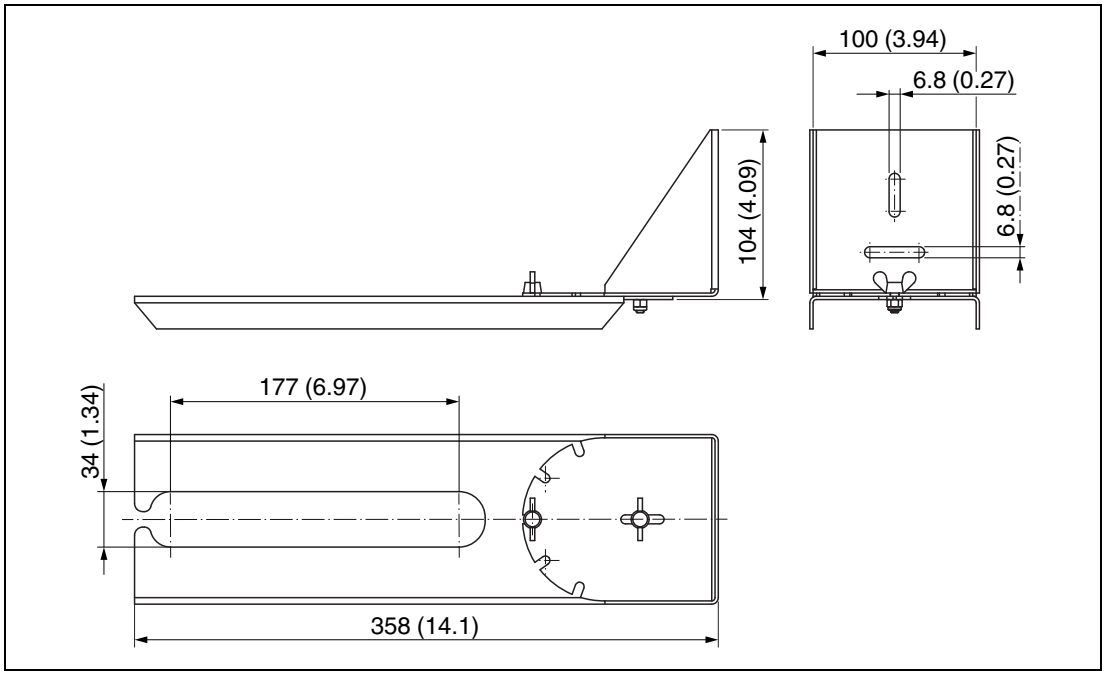

Figure 16.23 Dimensions of the pivotable mounting bracket, engineering unit: mm (inch)

Material: 316L (1.4404)

Order number: 71429910

Horizontal mounting bracket for sewer shafts

The Horizontal mounting bracket for sewer shafts is used for installation in confined spaces.

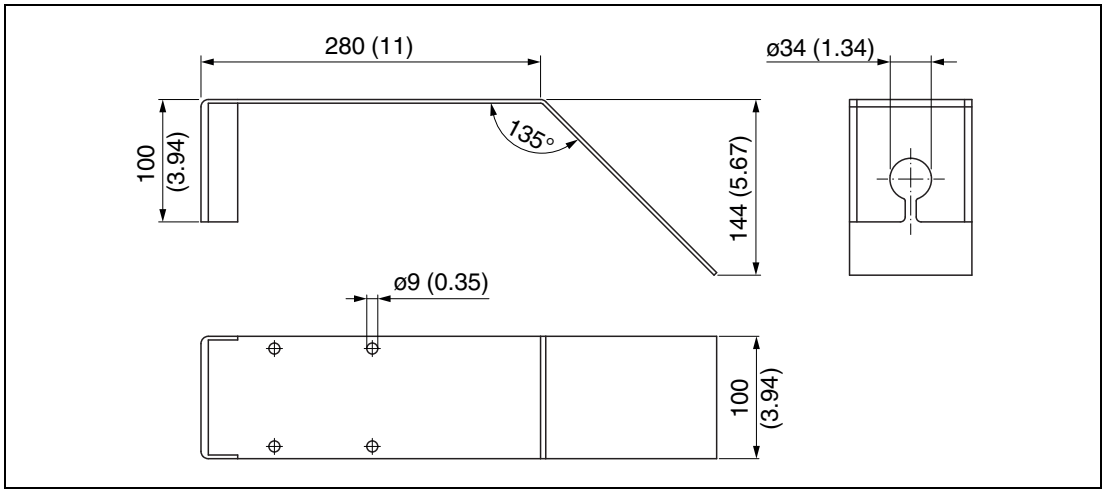

Figure 16.24 Dimensions of horizontal mounting bracket for sewer shafts, engineering unit: mm (inch)

Material: 316L (1.4404)

Order number: 71429905

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16.2.2 Communication-Specific Accessories

HART Modem

For intrinsically safe HART communication with PACT*ware* via the USB interface.

HART Loop Converter KFD2-HLC-Ex1.D.**

This isolated barrier is used for intrinsic safety applications.

The device is a HART loop converter that provides power to transmitters or can be connected to existing HART loops in parallel.

The devcie used to evaluate and convert dynamic HART process variables to analog current signals or limit values.

Note

For details see data sheet at www.pepperl-fuchs.com.

16.2.3 Service-Specific accessories

PACT*ware*™

PACT*ware* is a graphically supported operating software (MS Windows) for intelligent measuring instruments with the communication protocols HART and PROFIBUS PA. PACT*ware* is a frame application (FDT) in which DTMs run.

DTM

Device driver component for a device in an FDT environment. A DTM can represent the functionality of a device via a graphical user interface.

Note

For details see data sheet at www.pepperl-fuchs.com.

Note

Additional information regarding the operating software PACT*ware* and the DTM can be found in the manual **Installation and Configuration Device Type Manager (DTM)**.

16.2.4 System Components

KFD2-STC5-Ex1

This isolated barrier is used for intrinsic safety applications.

The device supplies 2-wire and 3-wire SMART transmitters, and can also be used with 2-wire SMART current sources.

The device transfers the analog input signal to the safe area as an isolated current value. Digital signals may be superimposed on the input signal in the hazardous or non-hazardous area and are transferred bidirectionally.

The device has bidirectional HART communication.

KFD2-STC5-1

This signal conditioner provides the galvanic isolation between field circuits and control circuits.

The device supplies 2-wire and 3-wire SMART transmitters, and can also be used with 2-wire SMART current sources.

The device transfers the analog input signal as an isolated current value. Digital signals may be superimposed on the input signal on the field side or on the control side and are transferred bidirectionally.

The device has bidirectional HART communication.

M-LB-2000, M-LB-5000

Surge protection barriers for DIN mounting rail as per IEC 60715, suitable for protecting electronics against destruction as a result of overvoltage.

- M-LB-2000: surge protection system for the hazardous or non-hazardous area
- M-LB-5000: modular surge protection system with or without diagnostic function for the hazardous or non-hazardous area

Note

For details see data sheet at www.pepperl-fuchs.com.

17 Operating Menu

The operation of the device is described using the App P+F Level as an example.
The operation via the operating software PACT*ware* is similar.

Note

Additional information regarding the operation and diagnostic options of the device via the operating software PACT*ware* can be found in the manual **Installation and Configuration Device Type Manager (DTM)**.

17.1 Overview of the Operating Menu (P+F Level)

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17.2 Setup Menu

Note

- 🖳: Indicates navigation to the parameter via operating tools (e. g. P+F Level).
- 🔒: Indicates parameters that can be locked via the access code.

Navigation 🖳 Setup

Device tag

Blocking 🔒
Navigation 🖳 Setup → Device tag
Description Enter a unique name for the measuring point to identify the device quickly within the plant.
Factory setting PF_LCR20_XXXXXXX (last 7 digits of the device serial number)

Distance unit

Blocking 🔒
Navigation 🖳 Setup → Distance unit
Description Used for the basic calibration (Empty/Full).
Selection

SI units	US units
m	foot

Factory setting m

Empty calibration

Blocking 🔒
Navigation 🖳 Setup → Empty calibration
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

Blocking 🔒
Navigation 🖳 Setup → Full calibration
Description Distance between minimum level (0 %) and maximum level (100 %).
User entry 0.0 to 20 m
Factory setting Depends on the antenna version

Distance

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

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Level

Navigation Setup → Level

Description Displays the measured level L (before linearization). The unit is defined in the **Distance unit** parameter (factory setting = m).

User interface -99999.9 to 200000.0 m

Factory setting 0.0 m

Signal quality

Navigation Setup → 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

Confirm distance

Blocking

Navigation Setup → Confirm distance

Description Does the measured distance match the real distance? Select one of the options:
- Manual map: 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.
- Distance OK: To be selected if the measured distance matches the actual distance. The device performs a mapping.
- Distance unknown: To be selected if the actual distance is unknown. A mapping can not be performed in this case.
- Factory map: 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.

Selection
- Manual map
- Distance OK
- Distance unknown
- Factory map

Factory setting Distance unknown

Mapping end point

Blocking	
Navigation	Setup → Mapping end point
Description	This parameter defines up to which distance the new mapping is to be recorded. The distance is measured from the reference point, i. e. from the lower edge of the mounting flange or sensor.
User entry	0 to 21.8 m
User interface	0 m

Present mapping

Navigation	Setup → Present mapping
Description	Indicates up to which distance a mapping has already been recorded.
User entry	0 to 100 m

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17.2.1 Advanced Setup Submenu

Navigation Setup → Advanced setup

Access status tooling

Navigation Setup → Advanced setup → Access status tooling

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

Enter access code

Navigation Setup → Advanced setup → Enter 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 Pepperl+Fuchs sales center.

User entry 0 to 9999

Factory setting 0

Evaluation sensitivity

Blocking

Navigation Setup → Advanced setup → Evaluation sensitivity

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

Selection
- Low
- Medium
- High

Factory setting Medium

Changing velocity

Blocking

Navigation Setup → Advanced setup → Changing velocity

Description Selection of the expected draining or filling speed of the measured level.

Selection
- Slow < 10 cm (0.4 inch)/min
- Standard < 1 m (40 inch)/min
- Fast > 1 m (40 inch)/min
- No filter/test

Factory setting Standard < 1 m (40 inch)/min

First echo sensitivity

Blocking	
Navigation	Setup → Advanced setup → First echo sensitivity
Description	This parameter describes the band for first echo evaluation. Is measured/calculated down from the peak of the current level echo. Options to select from: • Low: 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. • Medium: The band for the first echo evaluation has an average width. • High: The band for the first echo evaluation is broad. The evaluation jumps earlier to the next echo or distortion signal.
Selection	• Low • Medium • High
Factory setting	Medium

Output mode

Blocking	
Navigation	Setup → Advanced setup → Output mode
Description	Select output mode between: • Ullage = The remaining space in the tank or silo is indicated. • Level linearized = The level is indicated (more precisely: the linearized value if a linearization has been activated).
Selection	• Ullage • Level linearized
Factory setting	Level linearized

Blocking distance

Blocking	
Navigation	Setup → Advanced setup → Blocking distance
Description	Specify blocking distance (BD). No signals are evaluated within the blocking distance. Therefore, BD can be used to suppress interference signals in the vicinity of the antenna. Note: The measuring range should not overlap with the blocking distance.
User entry	0 to 20 m
Factory setting	An automatic Blocking distance of at least 0.1 m (0.33 foot) is configured as standard. However, this can be overwritten manually (0 m (0 foot) is also permitted). Automatic calculation of the **Blocking distance = Empty calibration – Full calibration – 0.2 m (0.656 foot)**. 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 foot), the Blocking distance of 0.1 m (0.33 foot) will continue to be used.

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Level correction

Blocking	
Navigation	Setup → Advanced setup → Level correction
Description	The measured level is corrected by this value to compensate for a constant level error. • Level correction > 0: The level is increased by this value. • Level correction < 0: The level is decreased by this value.
User entry	-25 to 25 m
Factory setting	0.0 m

Evaluation distance

Blocking	
Navigation	Setup → Advanced setup → Evaluation distance
Description	Extended signal search area. Is generally greater than the empty distance. If the signal is found below the empty distance, **0** (empty) is indicated as measured value. Only for signals, detected below the **Evaluation distance**, the error **Echo Lost** is issued. e. g. flow measurement in overflow weirs.
User entry	0 to 21,8 m
Factory setting	21.8 m

Linearization type

Blocking	
Navigation	Setup → Advanced setup → Linearization type
Description	**Linearization types** Meaning of the options: • None: The level is output in the level unit without being converted (linearized) beforehand. • Table: 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**. Note: Please use the DTM module to create/modify a linearization table.
Selection	• None • Table
Factory setting	None

Level linearized

Navigation	Setup → Advanced setup → Level linearized
Description	Currently measured level.
User interface	Signed floating-point number

17.2.1.1 Safety Settings Submenu

Navigation Setup → Advanced setup → Safety settings

Delay time echo lost

Blocking

Navigation Setup → Advanced setup → Safety settings → Delay time 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

Factory setting 0 s

Diagnostics echo lost

Blocking

Navigation Setup → Advanced setup → Safety settings → Diagnostics 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

Factory setting Warning

17.2.1.2 Current Output Submenu

Navigation Setup → Advanced setup → Current output

Output current

Navigation Setup → Advanced setup → Current output → Output current

Description Shows the actual calculated value of the output current.

User interface 3.59 to 22.5 mA

Damping output

Blocking

Navigation Setup → Advanced setup → Current output → Damping output

Description Define time constant τ for the damping of the output current. Fluctuations of the measured value affect the output current with an exponential delay, the time constant τ 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 τ = 0 there is no damping.

User entry 0.0 to 300 s

Factory setting 1.0 s

Turn down

Blocking

Navigation Setup → Advanced setup → Current 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 to 20 mA). 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 20 mA).

Selection
- Off
- On

Factory setting Off

4 mA value

Blocking

Navigation Setup → Advanced setup → Current output → 4 mA value

Description Value for 4 mA at **Turn down parameter = On**. 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 to 20 mA). 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).
Note: 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.

User entry Signed floating-point number

Factory setting 0 m

20 mA value

Blocking	
Navigation	Setup → Advanced setup → Current output → 20 mA value
Description	Value for 4 mA at **Turn down parameter = On**. 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 to 20 mA). 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). Note: 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.
User entry	Signed floating-point number
Factory setting	20 m

Trim

Blocking	
Navigation	Setup → Advanced setup → Current output → Trim
Description	Select action for the recalibration of the current output. 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). Steps of the trim: 1. 1. **Select Trim = 4 mA**. 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. 3. Select **Trim = 20 mA**. 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. 5. Select **Trim = Calculate**. The device calculates the new scaling of the output current and stores it in the RAM.
Selection	• Off • 4 mA • 20 mA • Calculate • Reset
Factory setting	Off

Trim value high

Blocking	
Navigation	Setup → Advanced setup → Current output → Trim value high
Description	Enter upper measured value for the trim (around 20 mA). After this value has been entered: Select **Trim = Calculate**. This initiates the recalibration of the current output.
User entry	18.0 to 22.0 mA
Factory setting	20.0 mA

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Trim value low

Blocking	
Navigation	Setup → Advanced setup → Current output → Trim value low
Description	Enter upper measured value for the trim (around 4 mA). After this value has been entered: Select **Trim = Calculate**. This initiates the recalibration of the current output.
User entry	3.0 to 5.0 mA
Factory setting	4.0 mA

17.2.1.3 Administration Submenu

Navigation Setup → Advanced setup → Administration

Define access code

Blocking

Navigation Setup → Advanced setup → Administration → Define 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 Pepperl+Fuchs sales center if you lose your access code.

User entry 0 to 9999

Factory setting 0

Confirm access code

Blocking

Navigation Setup → Advanced setup → Administration → Confirm access code

Description Re-enter the entered access code to confirm.

User entry 0 to 9999

Factory setting 0

Device reset

Blocking

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

Factory setting Cancel

Free field special

Blocking

Navigation Setup → Advanced setup → Administration → Free field special

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

Factory setting Off

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17.2.2 Communication Submenu

Navigation Setup → Communication

HART short tag

Blocking

Navigation Setup → Communication → HART short tag

Description Short description of the measuring point

User entry Max. 8 characters:
A to Z, 0 to 9 and some special characters (for example, punctuation marks, @, %)

Factory setting SHORTTAG

HART address

Blocking

Description Setup → Communication → HART address

User entry 0 to 63

Factory setting 0

No. of preambles

Blocking

Navigation Setup → Communication → No. of preambles

Description Defines the number o preambles in the HART telegram.

User entry 5 to 20

Factory setting 5

Device type

Navigation Setup → Communication → Device type

Description Shows the device type with which the measuring device is registered with the HART Communication Foundation.

Device revision

Navigation Setup → Communication → Device revision

Description Shows the device revision with which the device is registered with the HART Communication Foundation.

Device ID

Navigation Setup → Communication → Device ID

Description Shows the device ID for identifying the device in a HART network.

HART revision

Navigation Setup → Communication → HART revision

Description Indicates HART revision of the device

HART descriptor

Blocking	
Navigation	Setup → Communication → HART descriptor
Description	Enter descriptor for the measuring point.
Factory setting	Descriptor

HART message

Blocking	
Navigation	Setup → Communication → HART message
Description	Define HART message which is sent via the HART protocol if requested by the master
Factory setting	Message

Hardware revision

Navigation	Setup → Communication → Hardware revision
Description	Indicates hardware revision of the device.

Software revision

Navigation	Setup → Communication → Software revision
Description	Indicates software revision of the device.

HART date code

Blocking	
Navigation	Setup → Communication → HART date code
Description	Enter date of the last configuration change.
Additional information	Date format: YYYY-MM-DD

Level linearized(PV)

Navigation	Setup → Communication → Level linearized (PV)
Description	Displays linearized level.
User interface	Signed floating-point number
Factory setting	0 m
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
Factory setting	0 m

Relative echo amplitude (TV)

Navigation	Setup → Communication → Relative echo amplitude (TV)
User interface	Signed floating-point number
Factory setting	0 dB

Temperature (QV)

Navigation	Setup → Communication → Temperature (QV)
User interface	Signed floating-point number
Factory setting	-273.15 °C

17.2.2.1 Bluetooth Configuration Submenu

Navigation Setup → Communication → Bluetooth configuration

Bluetooth mode

Blocking

Navigation Setup → Communication → Bluetooth configuration → Bluetooth mode

Description Enable or disable Bluetooth function.
Remark: 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.

Selection
- Off
- On

Factory setting On

17.3 Diagnostics Menu

Navigation Diagnostics

Actual diagnostics

Navigation Diagnostics → Actual diagnostics

Description Displays current diagnostic message. If several messages are active at the same time, the messages with the highest priority is displayed.

Previous diagnostics

Navigation Diagnostics → Previous diagnostics

Description Displays the last diagnostic message, with its diagnostic information, which has been active before the current message. The condition displayed may still apply.

Delete previous diagnostic

Blocking

Navigation Diagnostics → Delete previous diagnostic

Description Delete previous diagnostic message? It is possible that the diagnostic message remains valid.

Selection
- No
- Yes

Factory setting No

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

17.3.1 Device Information Submenu

Navigation Diagnostics → Device information

Device name

Navigation Diagnostics → Device information → Device name
Description Shows the name of the device.
Factory setting Level radar LCR20

Firmware version

Navigation Diagnostics → Device information → Firmware version
Description Shows the device firmware version installed.

Extended order code 1

Navigation Diagnostics → Device information → Extended order code 1
Description Shows the 1st part of the extended order code.

Extended order code 2

Navigation Diagnostics → Device information → Extended order code 2
Description Shows the 2nd part of the extended order code.

Extended order code 3

Navigation Diagnostics → Device information → Extended order code 3
Description Shows the 3rd part of the extended order code.

Order code

Navigation Diagnostics → Device information → Order code
Description Shows the device order code.

Serial number

Navigation Diagnostics → Device information → Serial number
Description Shows the serial number of the device.

ENP version

Navigation Diagnostics → Device information → ENP version
Description Shows the version of the electronic nameplate (ENP).

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17.3.2 Simulation Submenu

Navigation Diagnostics → Simulation

Simulation

Blocking

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

Factory setting Off

Value current output

Blocking

Navigation Diagnostics → Simulation → Value current output

Description Defines the value of the simulated output current.

User entry 3.59 to 22.5 mA

Factory setting 3.59 mA

Process variable value

Blocking

Navigation Diagnostics → Simulation → Process variable 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

Factory setting 0 m

Numerics

A

B

C

D

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E

F

H

I

L

M

N

O

P

R

S

T

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V

W

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- Intrinsic Safety Barriers
- Signal Conditioners
- FieldConnex® Fieldbus
- Remote I/O Systems
- Electrical Ex Equipment
- Purge and Pressurization
- Industrial HMI
- Mobile Computing and Communications
- HART Interface Solutions
- Surge Protection
- Wireless Solutions
- Level Measurement

Industrial Sensors

- Proximity Sensors
- Photoelectric Sensors
- Industrial Vision
- Ultrasonic Sensors
- Rotary Encoders
- Positioning Systems
- Inclination and Acceleration Sensors
- Fieldbus Modules
- AS-Interface
- Identification Systems
- Displays and Signal Processing
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