



Department of Environmental Protection

2600 Blair Stone Road ♦ Tallahassee, Florida 32399-2400

DEP Form: 62-762.901(9)

Form Title: Storage Tank Equipment

Registration Form

Effective Date: July 2019

Incorporated in Rule 62-762.851, F.A.C.

Storage Tank System Equipment Registration Form

Fill out completely

General Information

Company Name:

Contact Name:

Company Address:

City, State:

Zip:

E-mail:

Contact Number:

Product Name:

Product Type:

Model Number(s):

Rule(s) citation that registration is being requested within Chapter 62-761 (UST), and/or 62-762 (AST), F.A.C.:

Write a brief description of equipment registration request including product limitations:

Information Checklist (Choose Yes, No, or N/A - Not Applicable):

Yes No N/A

1. Third-party Certification by a Nationally Recognized Testing Laboratory? (Required)
2. Documentation of third-party evaluation that the equipment meets DEP Rules?
3. Documents included about the qualifications of the Nationally Recognized Testing Laboratory?
4. Technical information and drawings included?
5. Installation instructions included?
6. Annual Operability Testing Requirements (Rules 62-761.500, 62-762.501, & 62-762.502 F.A.C.)?
7. Integrity Testing Requirements (Rules 62-761.700, 62-762.701, & 62-762.702, F.A.C.)?
8. Compatible with fuel blends containing >10% ethanol or >20% biodiesel?
9. Has the product been approved or registered in other countries or states? (If so provide list)
10. Any requirements for company-certified installers or trainers?
11. Was this product(s) previously approved or registered by the Department? If yes, EQ-
12. Any changes or modifications to the equipment since the last submittal to DEP?

Document Information: Provide supporting documents indicated as "Yes" above including this form via email to Tanknotify@floridadep.gov, or documents can be sent to FDEP, Division of Waste Management, 2600 Blair Stone Road, MS 4560, Tallahassee, FL 32399.

Write a brief description of equipment installation and performance in the U.S.:

Equipment Registration Certification:

To the best of my knowledge and belief, all information submitted on this form is true, accurate and complete.

Printed Name and Title

Signature (right click to sign)

Date

For Department Use Only:

Date Application Received:

Application complete:

Yes:

No: Re

EQ-

Date of complete or incomplete letter sent:

Date Equipment Requires Renewal:

Storage tank system equipment requires renewal every 5 years in accordance with subsection 62-762.851(2), F.A.C.

CERTIFICATE OF CONFORMITY



1. HAZARDOUS LOCATION ELECTRICAL EQUIPMENT PER CANADIAN REQUIREMENTS

2. Certificate No: FM25CA0058X
3. Equipment:
(Type Reference and Name) FMR20B/30B Radar Level Device
4. Name of Listing Company: Endress+Hauser SE+Co. KG
5. Address of Listing Company: Hauptstraße 1, Maulburg D-79689, Germany
6. The examination and test results are recorded in confidential report number:

PR471167 dated 7th July 2025

7. FM Approvals LLC, certifies that the equipment described has been found to comply with the following Approval standards and other documents:

CSA C22.2 No. 25:2017 (R2022), CSA C22.2 No. 94.1:2015, CSA C22.2 No. 94.2:2015, CSA C22.2 No. 213:2022, CSA C22.2 No. 60079-0:2019 (R2024), CSA C22.2 No. 60079-11:2014 (R2018), CSA C22.2 No. 60529:R2021, CSA C22.2 No. 61010-1:2019

8. If the sign 'X' is placed after the certificate number, it indicates that the equipment is subject to specific conditions of use specified in the schedule to this certificate.
9. This certificate relates to the design, examination and testing of the products specified herein. The FM Approvals surveillance audit program has further determined that the manufacturing processes and quality control procedures in place are satisfactory to manufacture the product as examined, tested and Approved.

10. Equipment Ratings:

See Annex

11. The marking of the equipment shall include:

See Annex

Certificate issued by:

J.E. Marquedant
VP, Manager - Electrical Systems

05/01/2026

Date

To verify the availability of the Approved product, please refer to www.approvalguide.com

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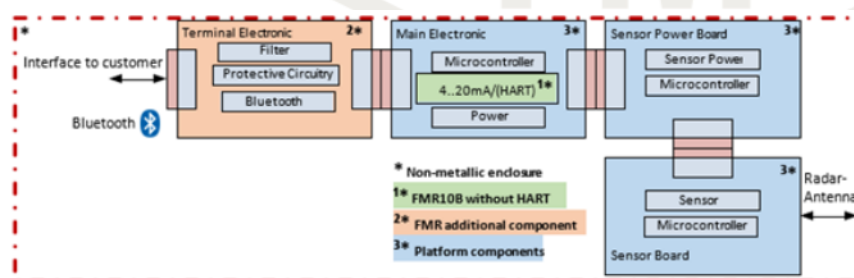
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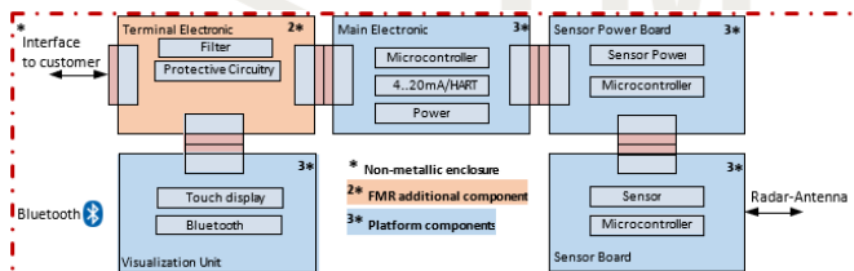
12. Description of Equipment:

General - The FMR 20B/30B is a radar level device which converts a time-of-flight wave signal into an electrical output signal. The environment can be a hazardous area with gas or dust atmosphere. The FMR20B/30B has an 80GHz radar sensor, which transmits the wave signal direct into air. The electronic transforms the time difference between the propagated wave and the received wave into an electrical signal which is evaluated and put out as a digital (HART) measurement value.

The Block diagram below describes the FMR20B. The Compact Platform components are shown below in blue color (Main Electronic), in orange color (Terminal Electronic) and Radar Sensor modules (Sensor Power Board and Sensor Board)



The Block diagram below describes the FMR30B. The Compact Platform components are shown in blue color (Main Electronic), in orange color (Terminal Electronic) and Radar Sensor modules (Sensor Power Board and Sensor Board).



For additional information on the electronics see the following E+H Technical documents:

Component	Component Certificates
Electronic Modules (Main electronic, terminal electronic and Visualization Unit)	FM25CA0056U
Radar Sensor Modules (Sensor Power Board and Sensor Board)	FM25CA0119U

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Construction - For details on enclosure options for Variant 1, Variant 2 and Variant 3, see document no. 961008308-C.

The FMR20B has an Ingress Protection rating of IP66, IP68; Type 4X and 6P

The FMR30B has an Ingress Protection rating of IP66, IP67; Type 4X

Thermal Ratings -

Protection Type	Model Type	Permitted ambient and Process Temperature
Ex ia IIC IS Class I, Division 1, ABCD	FMR20B/30B	-40°C to +70°C
Ex ia IIIB IS Class II, III, Division 1, FG	FMR20B (only Variant 2) FMR30B	-40°C to +55°C
Class I, Division 2, ABCD (NIFW)	FMR20B / FMR30B	-40°C to +70°C
Ex ia IIIC IS Class II, III, Division 1, Groups EFG	FMR20B (Variant 2)	-20°C to +55°C
DIP Class II, III, Division 1, Groups EFG	FMR20B (Variant 2)	-20°C to +55°C

Electrical Ratings -

The device is DC supplied.

The following values for cables are relevant for the FMR30B (all variants) and FMR20B (all variants) for protection type “intrinsically safe”. For FMR30B the cable must be connected by the customer himself. The FMR20B is supplied with a pre-installed cable (length can be ordered up to a maximum of 300m):

Cable Inductance $L_{\text{cable}} = 1 \mu\text{H/m}$

Cable Capacitance $C_{\text{cable}} = 200 \text{ pF/m}$

Designation	4...20mA HART (X100) L+ / L-
Ex ia IIC IS Class I, Division 1, ABCD	$U_i \leq 30\text{V}$ $I_i \leq 100\text{mA}$ $P_i \leq 700\text{mW}$ $C_i = 18\text{nF}$ $L_i = 0\text{H}$

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Ex ia IIIB / Ex ia IIIC IS Class II, III, Division 1, EFG	$U_i \leq 30V$ $I_i \leq 100mA$ $P_i \leq 650mW$ $C_i = 18nF$ $L_i = 0H$
Class I, Division 2, ABCD (NIFW)	$U_i \leq 30V$ $I_i \leq 100mA$ $P_i \leq 700mW$ $C_i = 18nF$ $L_i = 0H$
DIP Class II, III, Division 1, Groups EFG	$U = 12 \text{ to } 30V$ $I = 3.4 \text{ to } 22.5mA$ $P \leq 650mW$

See Annex for Model Codes

13. Specific Conditions of Use:

See Annex

14. Test and Assessment Procedure and Conditions:

This Certificate has been issued in accordance with FM Approvals Canadian Certification Scheme.

15. Schedule Drawings

A copy of the technical documentation has been kept by FM Approvals.

16. Certificate History

Details of the supplements to this certificate are described below:

Date	Description
7 July 2025	Original Issue.
9 January 2026	<u>Supplement 1:</u> Report Reference: PR473554 dated 9 January 2026. Description of the Change(s): 1. Addition of model type 'FB' for FMR20B with new protection types 2. Addition of model type 'FF' for FMR20B with new protection types 3. CSA C22.2 No. 25:2017(R2022) added to Standards List

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Date	Description
11 February 2026	<u>Supplement 2:</u> Report Reference: RR249760 dated 11 February 2026. Description of the Change(s): Update certificate reference for Radar Sensor Modules
1 May 2026	<u>Supplement 3:</u> Report Reference: RR250705 dated 1 May 2026. Description of the Change(s): 1. Terminal Board [TA30-0x] layout updated 2. Document reference update in Description (Section 12)

To verify the availability of the Approved product, please refer to www.approvalguide.com

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ANNEX

FMR20B - aa bb c d ee fff ggg h+(options) Radar Level Device

Equipment Ratings:

Intrinsically Safe for Class I, II, III, Division 1, Groups ABCDFG, T4...T1 when installed in accordance with Control Drawing XA03522F

Intrinsically Safe for Class I, II, III, Division 1, Groups ABCDEFG, T4...T1 when installed in accordance with Control Drawing XA03649F

Intrinsically Safe for Class I, Zone 0, Ex ia IIC T4...T1 Ga when installed in accordance with Control Drawing XA03522F

Intrinsically Safe for Zone 20, Ex ia IIIB T135°C Da when installed in accordance with Control Drawing XA03522F

Intrinsically Safe for Zone 20, Ex ia IIIC T135°C Da when installed in accordance with Control Drawing XA03649F

Nonincendive for Class I, Division 2, Groups ABCD; T4 when installed in accordance with Control Drawing XA03522F

Dust-Ignitionproof for Class II, III, Division 1, Groups EFG, T135°C

Markings:

IS Class I, II, III, Division 1, Groups ABCDFG, T4...T1; Entity - XA03522F

IS Class I, II, III, Division 1, Groups ABCDEFG, T4...T1; Entity - XA03649F

Ex ia IIC T4...T1 Ga; Entity - XA03522F

Ex ia IIIB T135°C Da; Entity - XA03522F

Ex ia IIIC T135°C Da; Entity - XA03649F

Class I, Division 2, Groups ABCD, T4 (NIFW - XA03522F)

DIP Class II, III, Division 1, Groups EFG, T135°C

Description of Equipment:

aa	Approval: FC: FM C/US IS Cl.I Div.1 Gr.A-D T4, AEx/Ex ia IIC T4 Ga FD: FM C/US IS Cl.II,III Div.1 Gr.FG, T135°C , AEx/Ex ia IIIB T135°C Da FE: FM C/US Cl.I Div.2 Gr.A-D T4 (NIFW) FF: FM C/US DIP Cl. II, III, Div. 1 Gr. EFG FB: FM C/US IS Cl. I, II, III, Div. 1, Gr. A-G T4, AEx/Ex ia IIC T4 Ga, AEx/Ex ia IIIC T135°C Da
bb	Output: BA: 2-wire 4-20mA HART
c	Display; Operation: B: LED D:LED + Bluetooth
d	Electrical Connection: T: Pre-installed cable

To verify the availability of the Approved product, please refer to www.approvalguide.com

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Canadian Certificate of Conformity No: FM25CA0058X

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ee	Antenna: BM: PVDF encapsulated, 40mm / 1-1/2" BN: PVDF encapsulated, 80mm / 3"
fff	Process Connection, cable entry: VCG: Thread ASME MNPT1 WDG: Thread G1 ISO228 XQ0: Without, cable entry lateral
ggg	Process Connection, antenna end: VEE: Thread ASME MNPT1-1/2, PVDF WEE: Thread ISO228 G1-1/2, PVDF XR0: Without, prepared for UNI throw flange > accessories
h	Cable Length: A: 5m/16ft B: 10m/32ft C: 15m/49ft D: 20m/65ft E: 30m/98ft F: 50m/164ft 1:...m 2:...ft
(options)	Options: Not relevant for safety

Specific Conditions of Use:

1. To avoid electrostatic charging: Do not rub surfaces with a dry cloth.
2. In the event of additional or alternative special varnishing on the enclosure or other metal parts or for adhesive plates:
 - Observe the danger of electrostatic charging and discharge.
 - Do not install in the vicinity of processes (≤ 0.5 m) generating strong electrostatic charges.
3. Avoid sparks caused by impact and friction.
4. In the case of process connections made of polymeric material or with polymeric coatings, avoid electrostatic charging of the plastic surfaces.
5. The process connection of the device must be installed in such a way that guarantees a sufficiently tight joint (IP66/67).
6. Applications in which the process temperature exceeds the maximum surface temperature limits of the required maximum surface temperature: The ignition hazard posed by hot surfaces on the process connecting parts of the device must be taken into account
7. It is essential for the device to use a power supply that is galvanically isolated from earth.
8. When using an intrinsically safe barrier, the barrier must be connected to the same earth as the device.
9. Refer to the temperature tables for various ambient and process temperature ranges.
10. For IS Class II, III, Div. 1, Group E and Ex ia IIIC: the device corresponds to a low risk of mechanical danger.
11. For DIP Class II, III, Div. 1, Groups E, F, G: The user is required to protect the device with an external fuse with a breaking capacity of 1.5kA
12. For DIP Class II, III, Div. 1, Groups E, F, G: The internal fuse has a breaking capacity of 100A

To verify the availability of the Approved product, please refer to www.approvalguide.com

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SCHEDULE

Canadian Certificate of Conformity No: FM25CA0058X

FMR30B - aa bb c d ee fff ggg h+(options) Radar Level Device

Equipment Ratings:

Intrinsically Safe for Class I, II, III, Division 1, Groups ABCDFG, T4...T1 when installed in accordance with Control Drawing XA03524F

Intrinsically Safe for Class I, Zone 0, Ex ia IIC T4...T1 Ga when installed in accordance with Control Drawing XA03524F

Intrinsically Safe for Zone 20, Ex ia IIIB T135°C Da when installed in accordance with Control Drawing XA03524F

Nonincendive for Class I, Division 2, Groups ABCD; T4 when installed in accordance with Control Drawing XA03524F

Markings:

Class I, II, III, Division 1, Groups ABCDFG, T4...T1; Entity - XA03524F

Ex ia IIC T4...T1 Ga; Entity - XA03524F

Ex ia IIIB T135°C Da; Entity -XA03524F

Class I, Division 2, Groups ABCD, T4 (NIFW - XA03524F)

Description of Equipment:

aa	Approval: FC: FM C/US IS CL.I Div.1 Gr.A-D T4, AEx/Ex ia IIC T4 Ga FD: FM C/US IS CL.II,III Div.1 Gr.FG, , AEx/Ex ia IIIB T135°C Da FE: FM C/US CL.I Div.2 Gr.A-D T4 (NIFW)
bb	Output: BA: 2-wire 4-20mA HART
c	Display; Operation: J: Color Display with Touch Control K:Color Display with Touch Control + Bluetooth
d	Electrical Connection: A: Cable gland M20, plastic, IP66/67; Type 4X H: Thread NPT1/2, IP66/67; Type 4X J: Cable gland M20, plastic blue, IP66/67; Type 4X
ee	Antenna: BM: PVDF encapsulated, 40mm / 1-1/2" BN: PVDF encapsulated, 80mm / 3"
fff	Process Connection, cable entry: XQ0: Without, cable entry on the side
ggg	Process Connection, antenna end: VEE: Thread ASME MNPT1-1/2, PVDF WEE: Thread ISO228 G1-1/2, PVDF XR0: Without, prepared for UNI throw flange > accessories

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h	Cable Length: 3: Without, customer side
(options)	Options: Not relevant for safety

Specific Conditions of Use:

1. To avoid electrostatic charging: Do not rub surfaces with a dry cloth.
2. In the event of additional or alternative special varnishing on the enclosure or other metal parts or for adhesive plates:
 - Observe the danger of electrostatic charging and discharge.
 - Do not install in the vicinity of processes (≤ 0.5 m) generating strong electrostatic charges.
3. Avoid sparks caused by impact and friction.
4. In the case of process connections made of polymeric material or with polymeric coatings, avoid electrostatic charging of the plastic surfaces.
5. The process connection of the device must be installed in such a way that guarantees a sufficiently tight joint (IP66/67).
6. Applications in which the process temperature exceeds the maximum surface temperature limits of the required maximum surface temperature: The ignition hazard posed by hot surfaces on the process connecting parts of the device must be taken into account
7. It is essential for the device to use a power supply that is galvanically isolated from earth.
8. When using an intrinsically safe barrier, the barrier must be connected to the same earth as the device.
9. Refer to the temperature tables for various ambient and process temperature ranges.

To verify the availability of the Approved product, please refer to www.approvalguide.com

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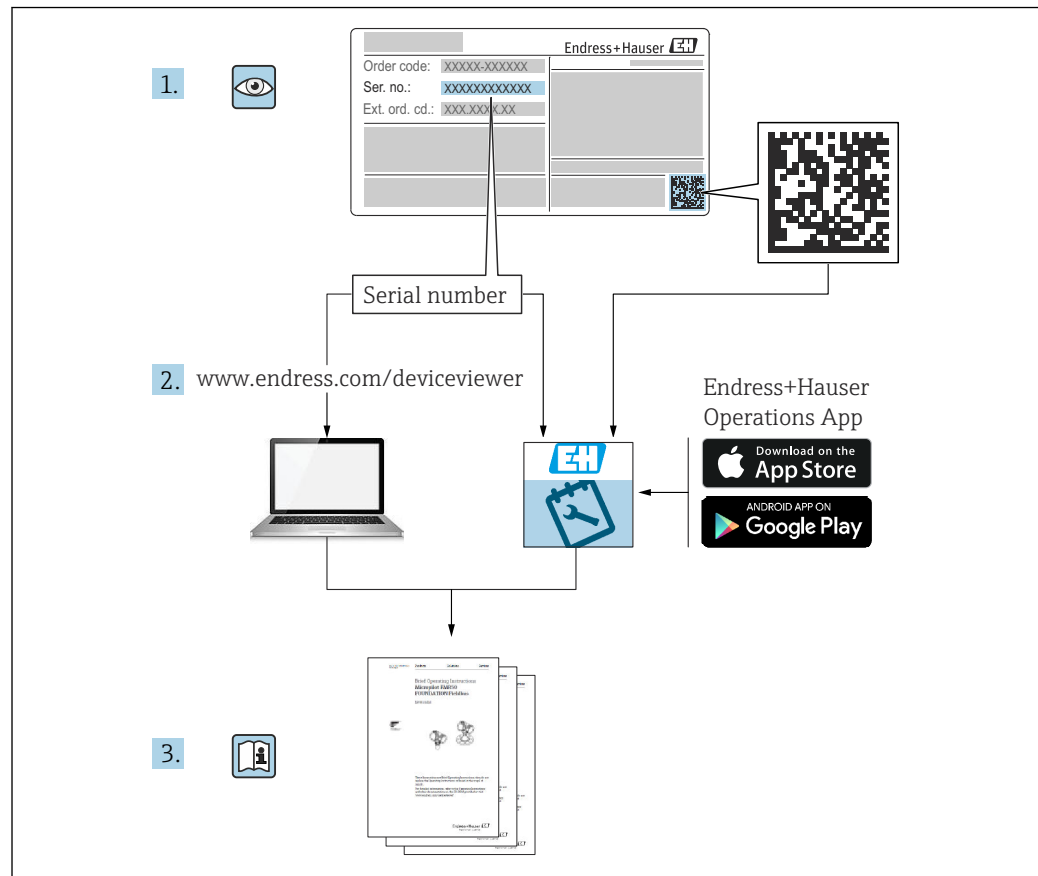


Operating Instructions

Micropilot FMR20B

Free-space radar
HART





A0023555

- 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 potentially dangerous situation. Failure to avoid this situation can result in serious or fatal injury.

CAUTION

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

NOTICE

This symbol alerts you to a potentially harmful situation. Failure to avoid this situation can result in damage to the product or something in its vicinity.

1.2.2 Communication-specific symbols

Bluetooth®:

Wireless data transmission between devices over a short distance via radio technology.

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

ϵ_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): Enter the serial number from the nameplate
- *Endress+Hauser Operations app*: Enter serial number from nameplate or scan matrix code on nameplate.

1.5 Change history

 The firmware version can explicitly be ordered via the product structure. This makes it possible to ensure the compatibility of the firmware version with an existing or planned system integration.

Firmware version: 01.00.01

Initial software

Firmware version: 01.01.00

- Support for Venturi flume HQI520
- Improvements in open channel flow measurements
- Support for connection to FMA90

1.6 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.

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HART®

Registered trademark of the FieldComm Group, Austin, Texas USA

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

Device for continuous, non-contact level measurement of liquids, pastes, sludges and 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 device remains in proper condition for the operation time:

- ▶ Use the device 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 hazardous 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.
- ▶ Comply with the instructions in the separate supplementary documentation, which is an integral part of this manual.

2.5 Product safety

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

The manufacturer 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®).

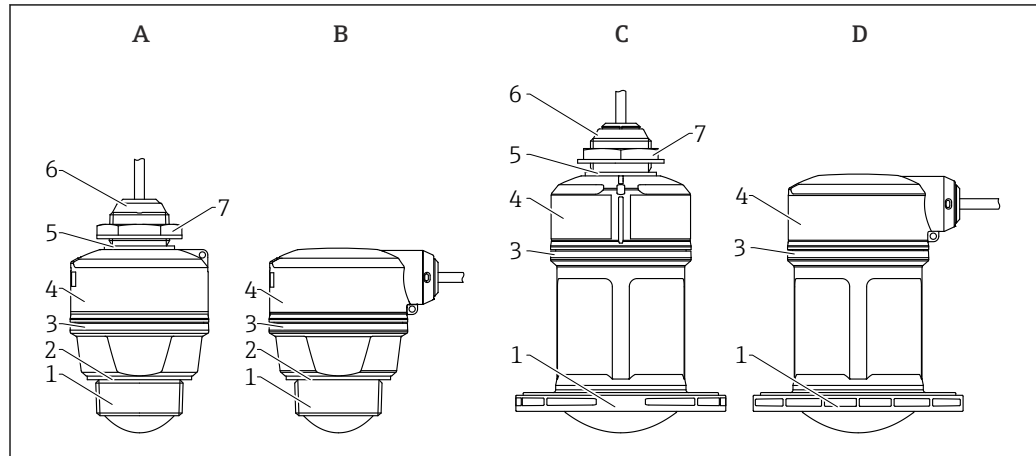
2.7.1 Access via Bluetooth® wireless technology

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



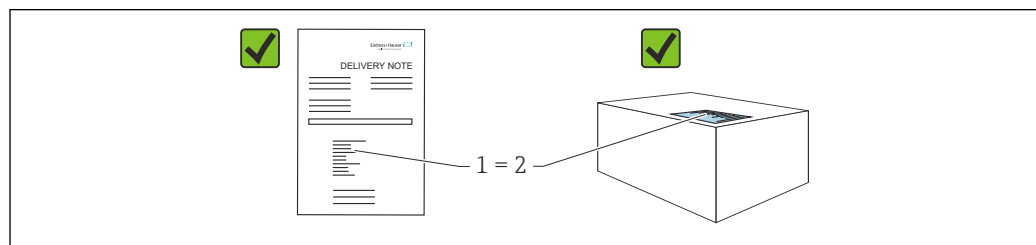
A0055121

1 Device design

- A 40 mm (1.5 in) antenna, cable entry from above
- B 40 mm (1.5 in) antenna, cable entry at the side
- C 80 mm (3 in) antenna, cable entry from above
- D 80 mm (3 in) antenna, cable entry at the side
- 1 Antenna end process connection; PVDF
- 2 EPDM seal (for G 1½" thread)
- 3 PBT/PC design ring
- 4 Sensor housing/Cable entry process connection; PBT/PC (for dust ignition-proof devices: PC)
- 5 EPDM seal
- 6 Cable entry; PBT/PC (for dust ignition-proof devices: PC)
- 7 Counter nut; PA6.6

4 Incoming acceptance and product identification

4.1 Incoming acceptance



A0016870

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): 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 Installation

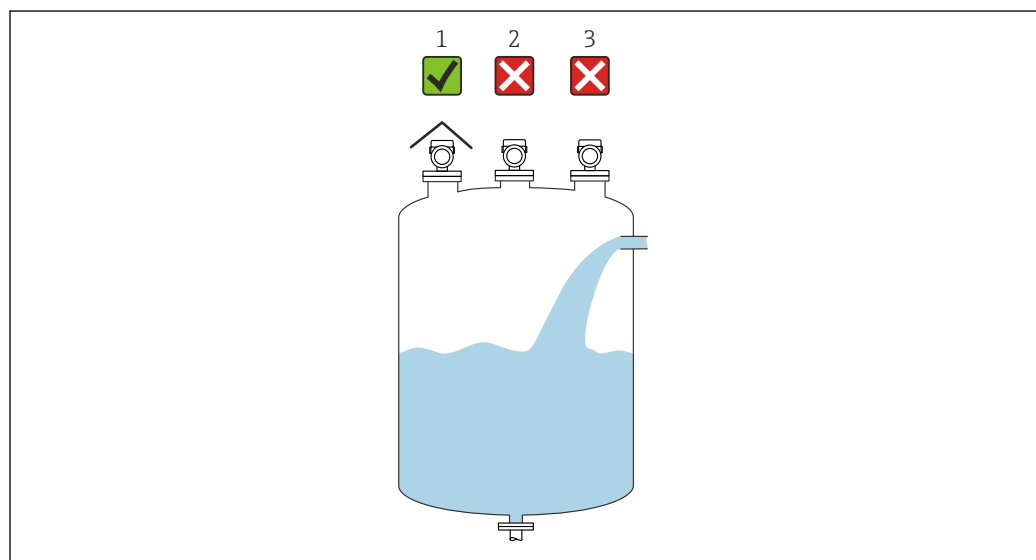
5.1 Installation instructions

i Note the following when installing:

The sealing element used must have a continuous operating temperature corresponding to the maximum process temperature.

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

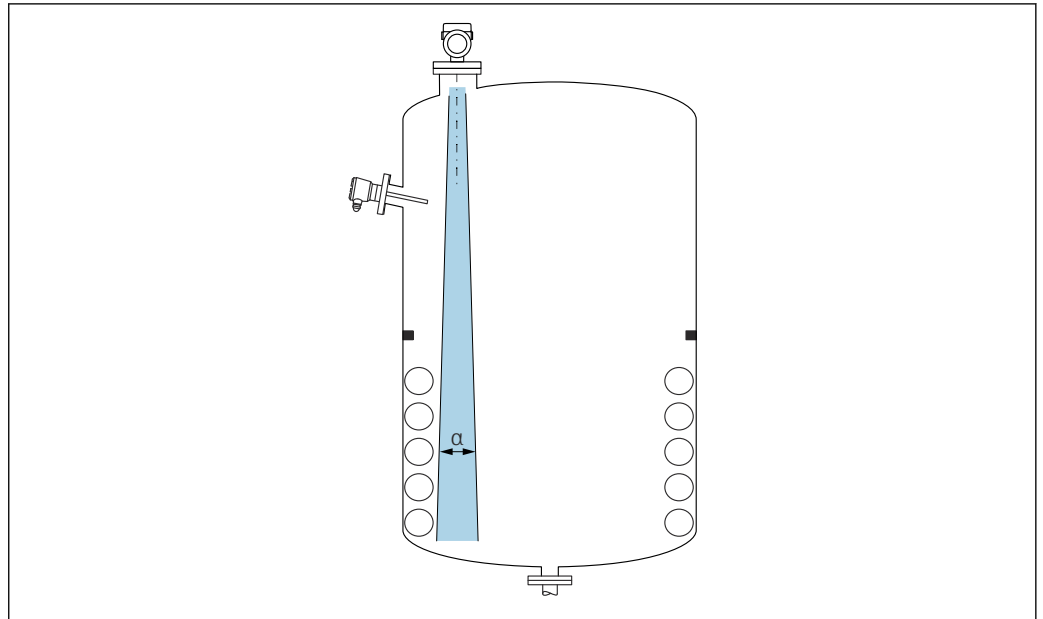
5.2 Mounting location



A0055811

- 1 Use of a weather protection cover; protection from direct sunlight or rain
- 2 Installation not centered: Interferences can lead to incorrect signal analysis
- 3 Do not install above the filling curtain

5.3 Internal vessel fittings



A0031777

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

5.4 Vertical alignment of antenna axis

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



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.

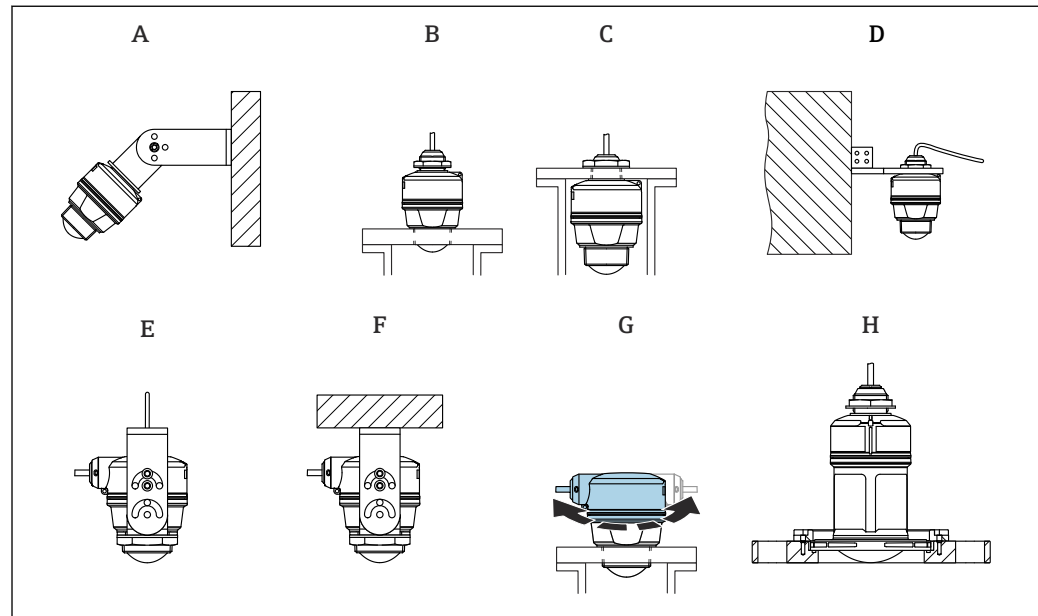
5.5 Optimization options

Mapping

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

5.6 Installing the device

5.6.1 Installation types



A0055150

2 Wall or ceiling mount

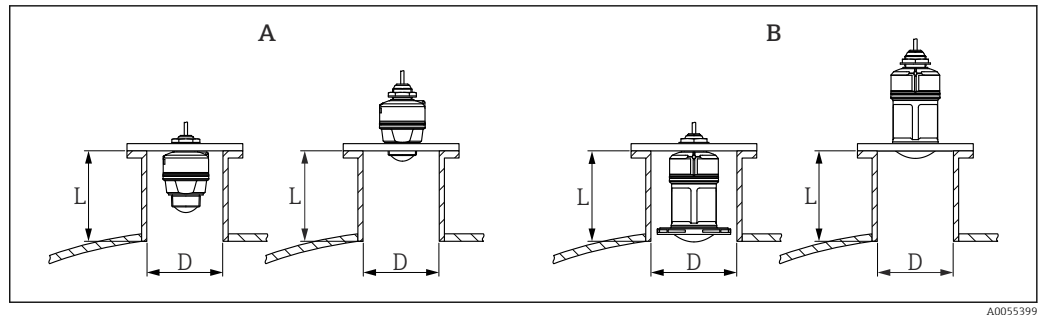
- A Wall mounting adjustable
- B Tightened at antenna end process connection
- C Tightened at cable entry from above process connection
- D Wall mounting with cable entry from above process connection
- E Rope mounting with cable entry at the side
- F Ceiling mounting with cable entry at the side
- G Cable entry at the side, top housing section can be rotated
- H Mounting with UNI slip-on flange

i Please note the following:

- 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.
- For devices with side cable outlet and 80 mm antenna, installation is only possible with a UNI slip-on flange.

5.6.2 Installation instructions

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



3 Nozzle installation

A 40 mm (1.5 in) antenna

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

80 mm (3 in) antenna, installation inside nozzle

- D: min. 120 mm (4.72 in)
- L: max. $140 \text{ mm (5.51 in)} + (D - 50 \text{ mm (2 in)}) \times 12$

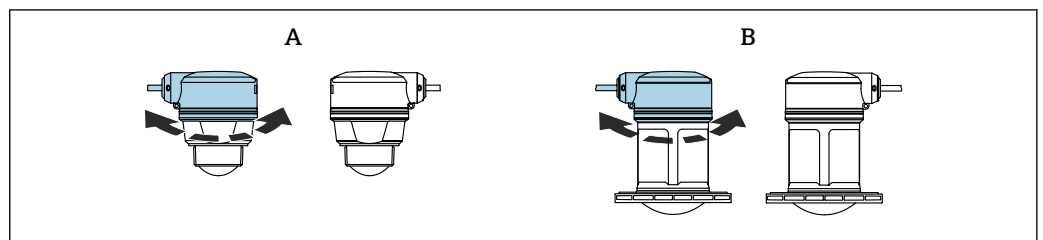
80 mm (3 in) antenna, installation outside nozzle

- D: min. 80 mm (3 in)
- L: max. $(D - 50 \text{ mm (2 in)}) \times 12$

5.6.3 Turning the housing

The housing can be rotated freely with the cable entry at the side.

Easy installation due to optimum alignment of housing.



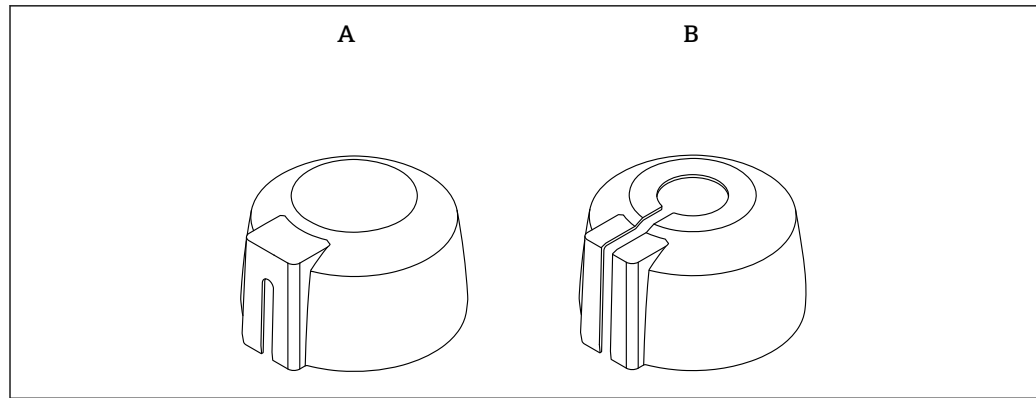
A 40 mm (1.5 in) antenna

B 80 mm (3 in) antenna

5.6.4 Weather protection cover

A weather protective cover is recommended for outdoor use.

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



A0055201

 4 Weather protective cover

A Side cable entry

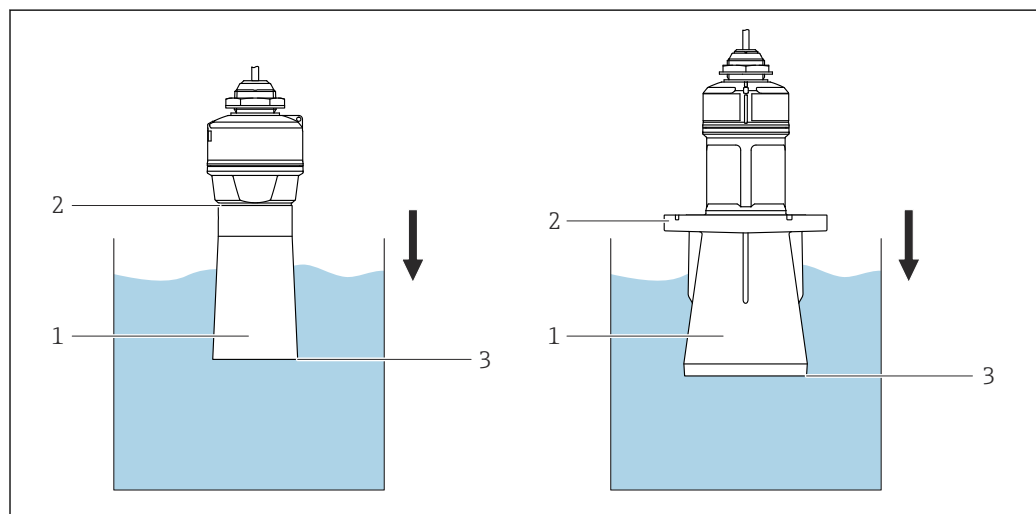
B Cable entry from above

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

5.6.5 Flooding protection tube

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

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



A0055202

 5 Function of flooding protection tube

1 Air pocket

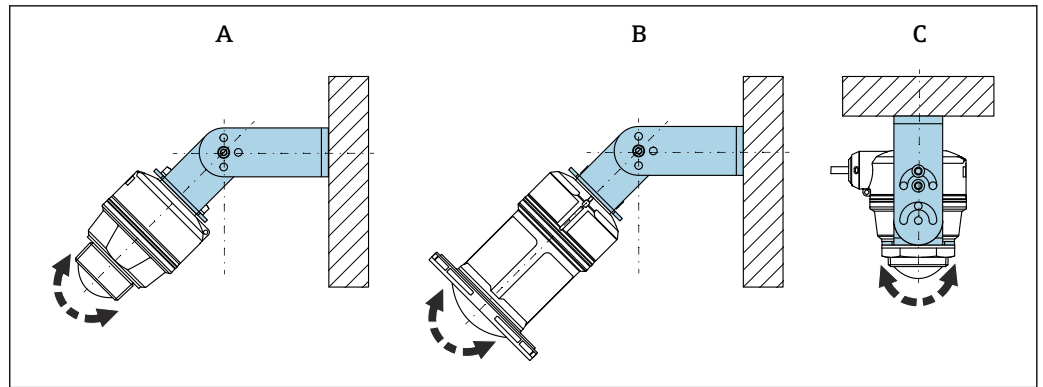
2 O-ring (EPDM) seal

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 case of flooding, the air cushion formed within the sleeve guarantees precise detection of the maximum fill level, located directly at the sleeve's end.

5.6.6 Installation with mounting bracket, adjustable

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



A0055113

6 Installation with mounting bracket, adjustable

- A Mounting bracket adjustable for 40 mm (1.5 in) antenna, wall mounting
- B Mounting bracket adjustable for 80 mm (3 in) antenna, wall mounting
- C Mounting bracket adjustable for 40 mm (1.5 in) antenna, ceiling mounting

- Wall or ceiling mounting is possible
- Align the antenna vertically to the product surface using the mounting bracket

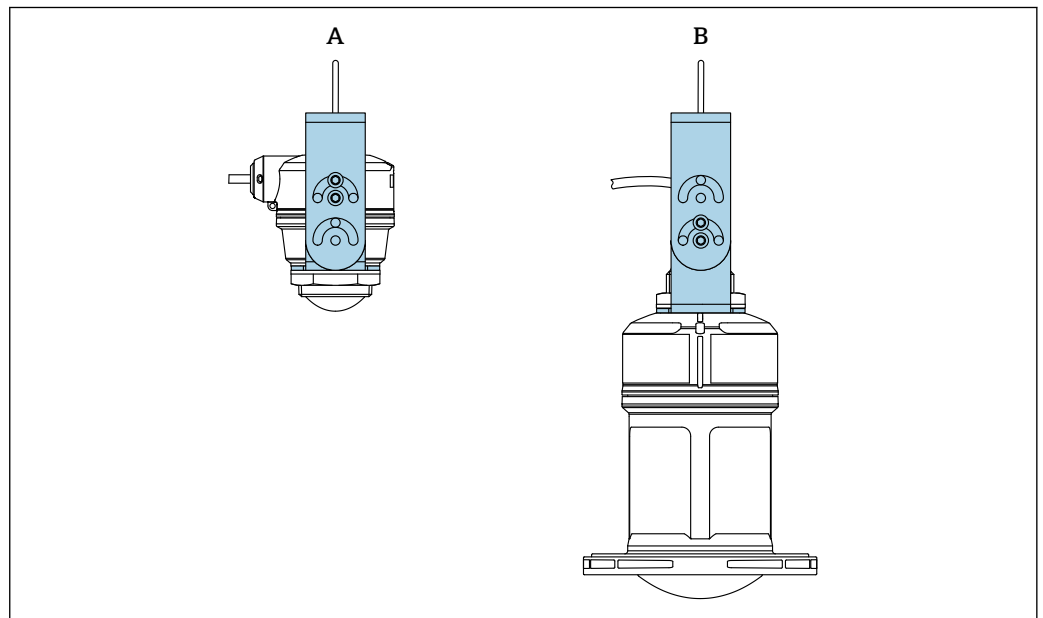
NOTICE

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



A0055397

7 Installation with rope mounting

- A Mounting bracket adjustable for 40 mm (1.5 in) antenna, rope mounting
- B Mounting bracket adjustable for 80 mm (3 in) antenna, rope mounting

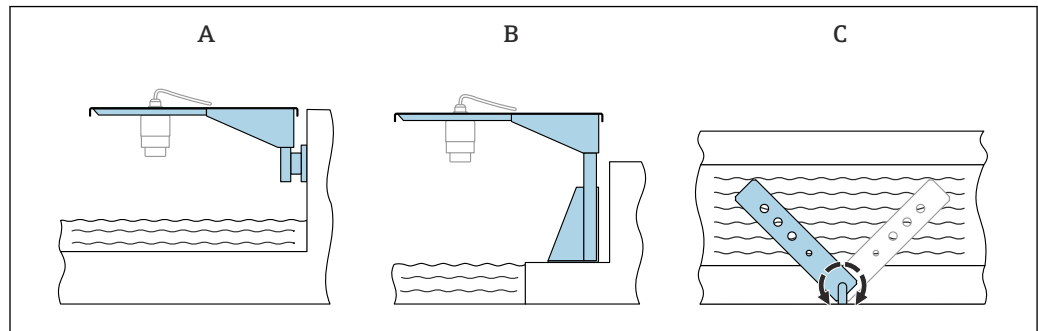
Align the antenna perpendicular to the product surface.



- In the case of rope mounting, the cable must not be used to suspend the device.
Use separate rope.

5.6.7 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

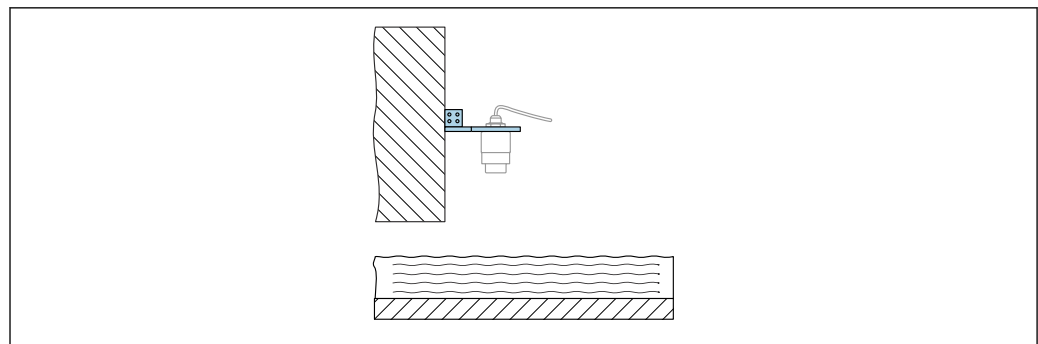
There is no conductive connection between the mounting bracket and transmitter housing.

Electrostatic charging possible.

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

5.6.8 Mounting with a pivotable mounting bracket

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



A0055398

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

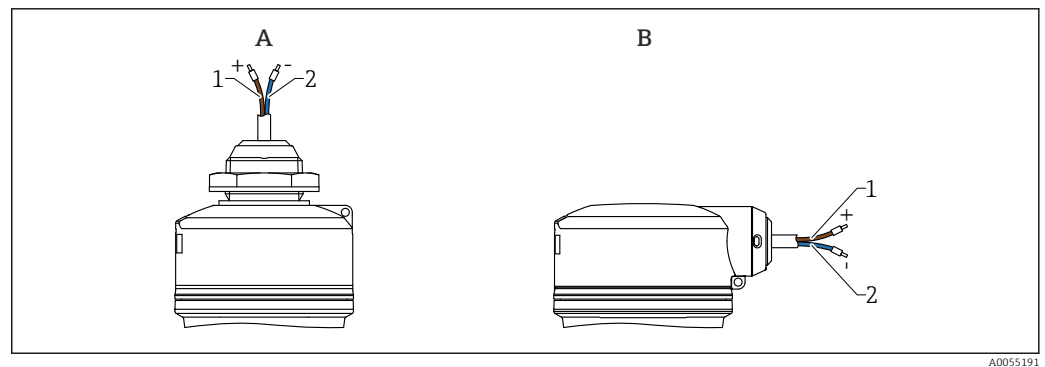
6 Electrical connection

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

- A Cable entry from above
 B Side cable entry
 1 Plus, brown wire
 2 Minus, blue wire

6.1.3 Supply voltage

12 to 30 V DC on a DC 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.

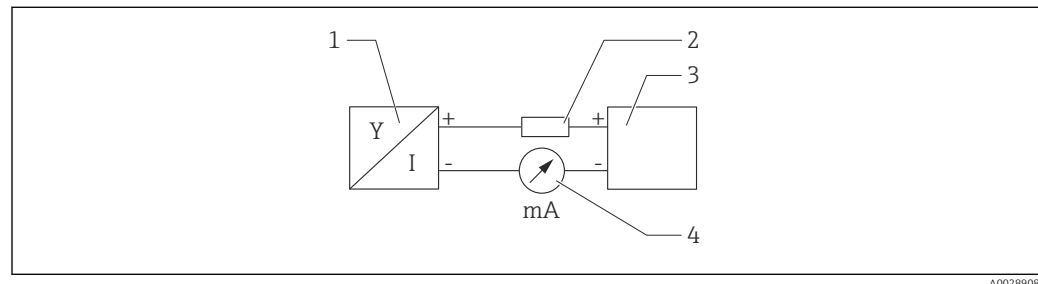
6.1.4 Power consumption

- Non-hazardous area: 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.
- Hazardous area: The maximum current is restricted to $I_i = 100 \text{ mA}$ by the transmitter power supply unit when the device is used in an intrinsically safe circuit (Ex ia).

6.1.5 Connecting the device

Function diagram of 4 to 20 mA HART

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



11 Function diagram of HART connection

- 1 Device with HART communication
- 2 HART resistor
- 3 Power supply
- 4 Multimeter or ammeter

i 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

Function diagram of HART device, connection with RIA15, display only without operation, without communication resistor

i The RIA15 remote display can be ordered together with the device.

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

Terminal assignment RIA15

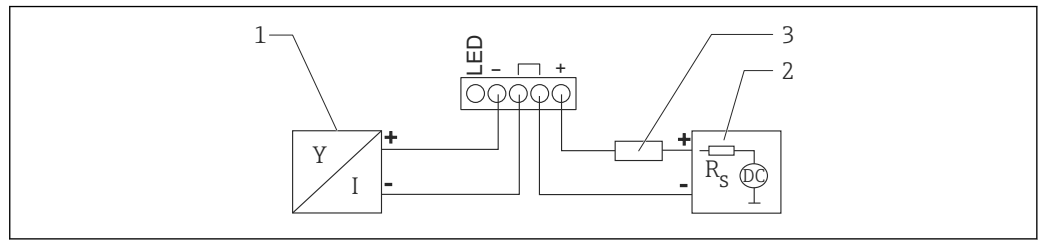
- +
Positive connection, current measurement
- -
Negative connection, current measurement (without backlighting)
- LED
Negative connection, current measurement (with backlighting)
- $\equiv$
Functional grounding: Terminal in housing

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

The voltage drop to be taken into account is:

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

Connection of the HART device and RIA15 without backlighting

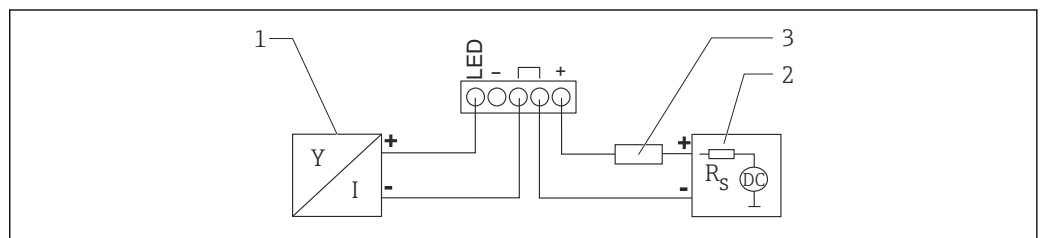


A0019567

12 Function diagram of HART device with RIA15 process indicator without light

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

Connection of the HART device and RIA15 with backlighting



A0019568

13 Function diagram of HART device with RIA15 process indicator with light

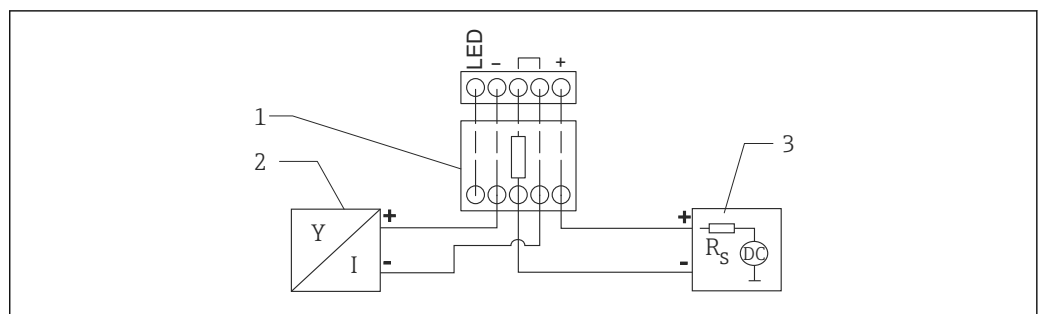
- 1 Device with HART communication
- 2 Current supply
- 3 HART resistor

Function diagram of HART device, RIA15 display with operation, with communication resistor

The voltage drop to be taken into account is:
Max. 7 V

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

Connection of the HART communication resistor module, RIA15 without backlighting

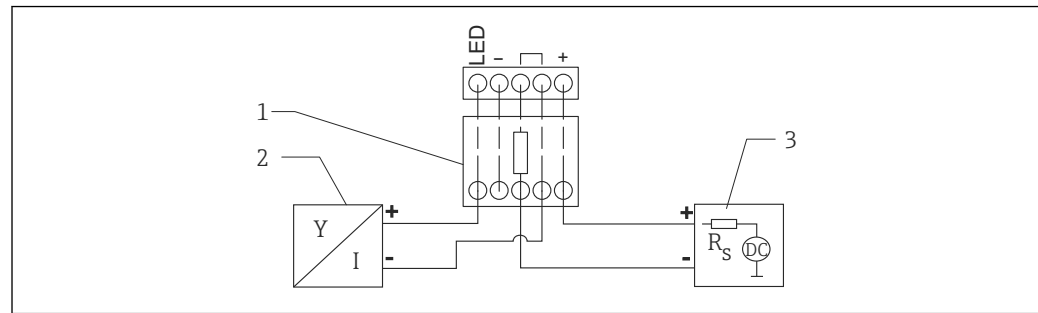


A0020839

14 Function diagram of HART device, RIA15 without light, HART communication resistor module

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

Connection of the HART communication resistor module, RIA15 with backlighting



15 Function diagram of HART device, RIA15 with light, HART communication resistor module

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

6.1.6 Cable specification

Unshielded cable, wire cross-section 0.5 mm²

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

As per IEC 60079-11 section 9.4.4, the cable is designed for a tensile strength of 30 N (6.74 lbf) (over a period of 1 h).

The device is available in cable lengths of 5 m (16 ft), 10 m (32 ft), 15 m (49 ft), 20 m (65 ft), 30 m (98 ft) and 50 m (164 ft).

User-defined lengths up to total length of 300 m (980 ft) are possible in increments of one meter (order option "1") or one foot (order "2").

For devices with marine approval:

- Only available with a length of 10 m (32 ft) and "user-defined"
- Halogen-free as per IEC 60754-1
- No development of corrosive fire gases in accordance with IEC 60754-2
- Low flue gas density in accordance with IEC 61034-2

6.1.7 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.

Devices for the "protection by enclosure" explosion protection are equipped with an integrated overvoltage protection system.

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

Testing according to IEC 60529 and NEMA 250:

- 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® wireless technology
- Operation via Endress+Hauser operating tool
- Operation via handheld, Fieldcare, DeviceCare, AMS and PDM

7.2 Structure and function of the operating menu

The full operating menu, accessible via operating tools (FieldCare, 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

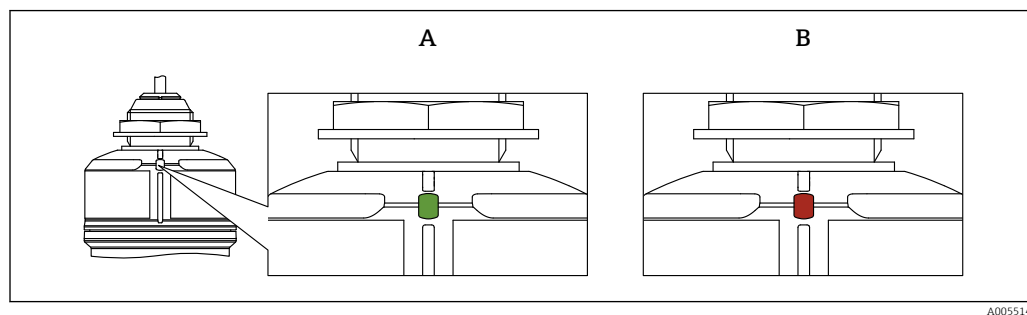
7.3 Operation via Bluetooth® wireless technology (optional)

Prerequisite

- Device with Bluetooth® wireless technology order option
- Smartphone or tablet with Endress+Hauser SmartBlue app or PC with DeviceCare from version 1.07.07 or Field Xpert 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



16 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 HART communication, e.g. Commubox FXA195
- Via Bluetooth® wireless technology (optional) with the SmartBlue app

FieldCare

Function range

FDT-based plant asset management tool from Endress+Hauser. FieldCare can configure all smart field devices in a system and helps you manage them. By using the status information, FieldCare is also a simple but effective way of checking their status and condition.

Access is via digital communication (Bluetooth, HART communication)

Typical functions:

- Configuration of transmitter parameters
- Loading and saving of device data (upload/download)
- Documentation of the measuring point
- Visualization of the measured value memory (line recorder) and event logbook

 For additional information on FieldCare: See Operating Instructions for FieldCare

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

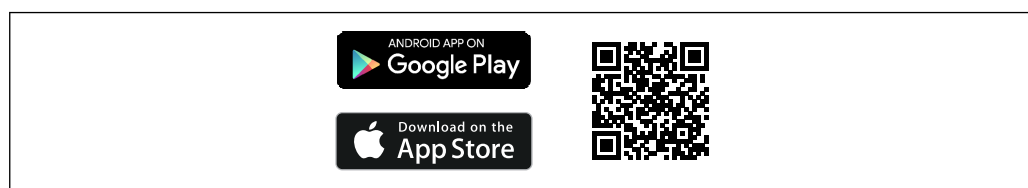
The Field Xpert SMT77 tablet PC for device configuration enables mobile plant asset management in areas categorized as Ex Zone 1.

 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.



 17 QR code for free Endress+Hauser SmartBlue App

A0033202

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
3. Change the password after logging in for the first time



Information on password and reset code

For devices that meet the requirements of IEC 62443-4-1 "Secure product development lifecycle management" ("ProtectBlue"):

- If the user-defined password is lost: refer to the user management instructions and the reset button in the operating manual.
- Refer to the associated Security Manual (SD).

For all other devices (without "ProtectBlue"):

- If the user-defined password is lost, access can be restored via a reset code. The reset code is the serial number of the device in reverse. The original password is once again valid after the reset code has been entered.
- The reset code can also be changed in addition to the password.
- If the user-defined reset code is lost, the password can no longer be reset via the SmartBlue app. Contact Endress+Hauser Service in this case.

8 System integration

8.1 Overview of device description files

- Manufacturer ID: 17 (0x0011)
- Device type ID: 0x11C1
- HART specification: 7.6
- DD files, information and files can be found at:
 - www.endress.com
 - www.fieldcommgroup.org

8.2 Measured variables via HART protocol

The following measured values are assigned to the device variables at the factory:

Device variable	Measured value
Primary variable (PV)	Level linearized
Secondary variable (SV)	Distance

Device variable	Measured value
Tertiary variable (TV)	Absolute echo amplitude
Quaternary variable (QV)	Relative echo amplitude

-  The assignment of the measured values to the device variables can be changed in the following submenu:
Application → HART output → HART output
-  In a HART Multidrop loop, only one device may use the analog current value for signal transmission. For all other devices in **"Loop current mode" parameter**, select **Disable** option.

9 Commissioning

9.1 Preliminaries

WARNING

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

- ▶ Check current output settings.
- ▶ The setting of the current output depends on the setting in the **Assign PV** parameter.

9.2 Post-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

9.3 Overview of commissioning options

- Commissioning with the SmartBlue app
- Commissioning via FieldCare/DeviceCare/Field Xpert
- Commissioning via additional operating tools (AMS, PDM, etc.)
- Operation and settings via RIA15

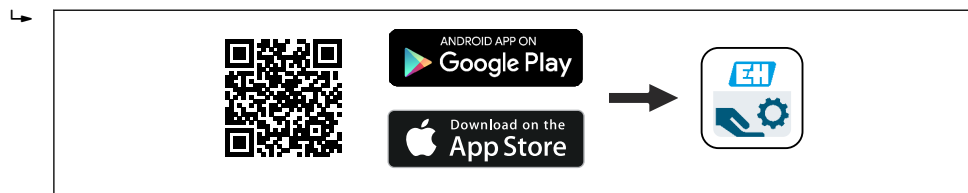
9.4 Commissioning via SmartBlue app

9.4.1 Device requirements

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

9.4.2 SmartBlue App

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



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18 Download link

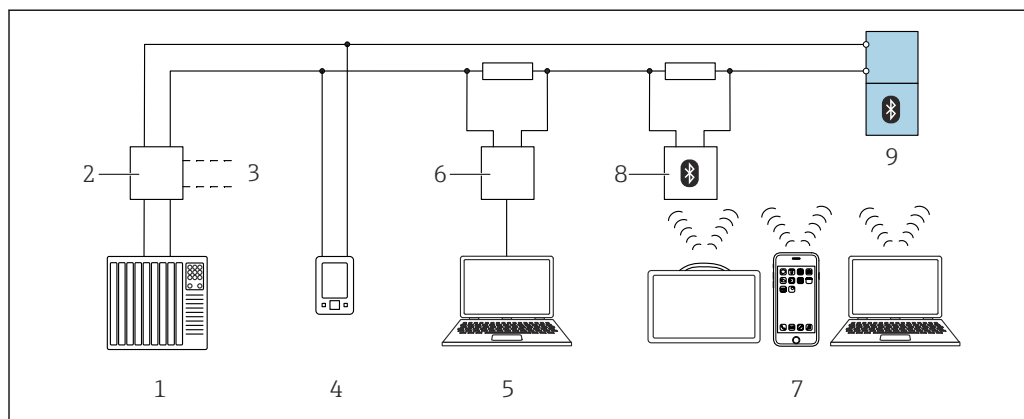
2. Start SmartBlue.
3. Select device from livelist displayed.
4. Enter the login data:
 - ↳ User name: admin
 - Password: serial number of the device
5. Tap the icons for more information.

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

9.5 Commissioning via FieldCare/DeviceCare

1. Download the DTM: <http://www.endress.com/download> -> Device Driver -> Device Type Manager (DTM)
2. Update the catalog.
3. Click the **Guidance** menu and start the **Commissioning** wizard.

9.5.1 Connecting via FieldCare, DeviceCare and FieldXpert



A0044334

19 Options for remote operation via HART protocol

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

9.6 Commissioning via additional operating tools (AMS, PDM, etc.)

Download the device-specific drivers: <https://www.endress.com/en/downloads>

For more details, see the help for the relevant operating tool.

9.7 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.

9.8 Configuring the device address via software

See "HART address" parameter

Enter the address to exchange data via the HART protocol.

- Guidance → Commissioning → HART address
- Application → HART output → Configuration → HART address
- Default HART address: 0

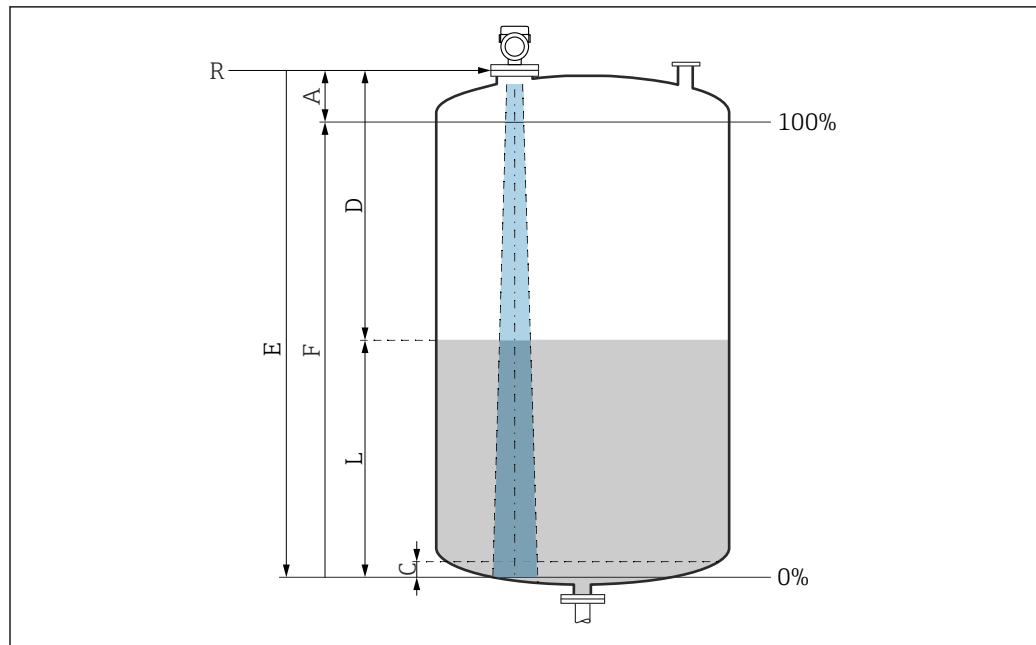
9.9 Configuring the device

 Commissioning via the Commissioning wizard is recommended.

See  "Commissioning with SmartBlue" section

See  "Commissioning via FieldCare/DeviceCare" section

9.9.1 Level measurement in liquids



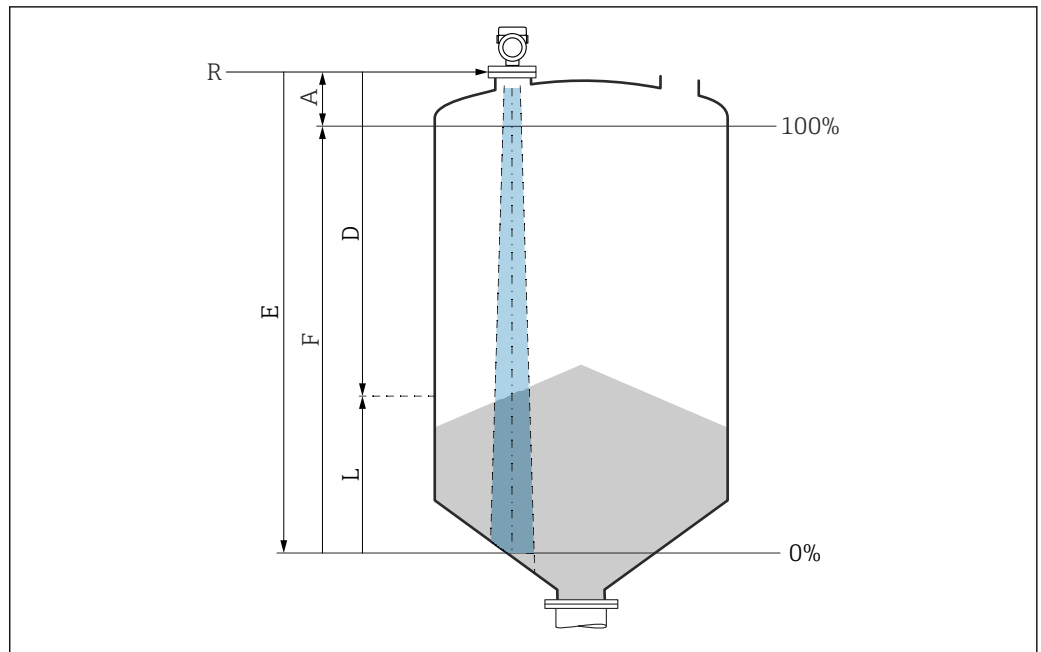
A0016933

20 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).

9.9.2 Level measurement in bulk solids



A0016934

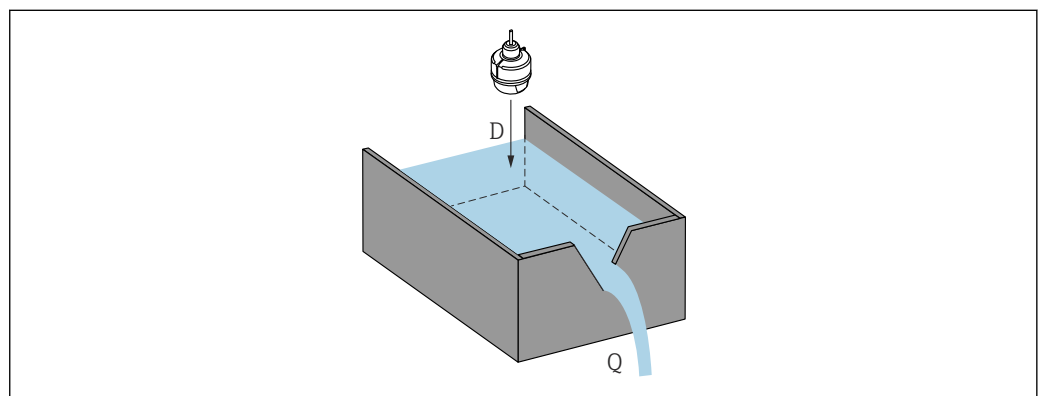
21 Configuration parameters for level measurement in bulk solids

- 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 %)

9.9.3 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



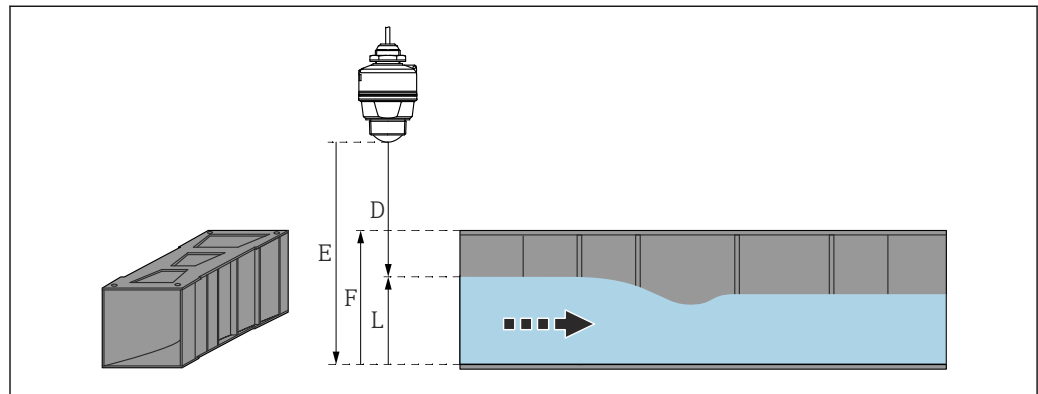
A0055823

22 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

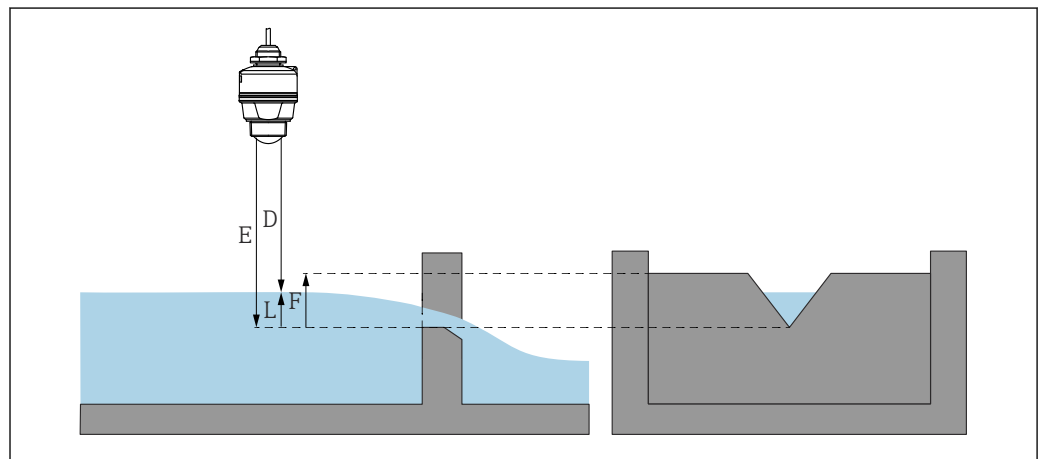
i The value pairs must be entered in ascending order when configuring a linearization table.



A0055824

23 Example: Khafagi-Venturi flume

E "Empty calibration" parameter (= zero point)
F "Full calibration" parameter (= maximum level)
D Distance
L Level



A0055825

24 Example: V-notch weir

E "Empty calibration" parameter (= zero point)
F "Full calibration" parameter (= maximum level)
D Distance
L Level

i If flow measurement has been commissioned using the standard formula, subsequent corrections to the empty and full calibration can lead to incorrect measured values.

Commissioning must be repeated in this case.

9.10 Configuring the "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: Europe, USA, Australia, New Zealand, Canada, Brazil, Japan, South Korea, Taiwan, Thailand, Mexico
- **Mode 3** option: Russia, Kazakhstan
- **Mode 4** option: Not used
- **Mode 5** option: India, Malaysia, South Africa, Indonesia



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).

9.11 "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.

9.12 Protecting settings from unauthorized access

9.12.1 Software locking or unlocking

Locking via password in FieldCare/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 **Maintenance** option. The device parameters can be fully configured 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 **Operator** option under:

System → User management

Deactivating the lock via FieldCare/DeviceCare/SmartBlue App

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

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

10 Operation

10.1 Reading the device locking status

10.1.1 Operating tool

 Operating tool (FieldCare/DeviceCare/FieldXpert/SmartBlue app)

Navigation: System → Device management → Locking status

10.2 Reading off measured values

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

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

10.3 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.

10.4 Heartbeat Technology (optional)

10.4.1 Heartbeat Verification



The **Heartbeat** submenu is only available during operation via FieldCare, DeviceCare or the SmartBlue app. Within this submenu, users can access a wizard provided by the Heartbeat Verification application package.



Documentation on the application package Heartbeat Verification, Endress+Hauser website: www.endress.com → Downloads.

"Heartbeat Verification" wizard

This wizard is used to start an automatic verification of the device functionality. The results can be documented as a verification report.

- The wizard can be used via the operating tools.
- The wizard guides the user through the entire process for creating the verification report.

10.5 Proof test for WHG devices (optional) ¹⁾

The "Proof test" module contains the **Proof test** wizard required at appropriate intervals for the following applications: WHG (German Water Resources Act):

- The wizard can be used via the operating tools (SmartBlue app, DTM).
- The wizard guides the user through the entire process for creating the verification report.
- The verification report can be saved as a PDF file.

1) Only available for devices with WHG approval

11 Diagnostics and troubleshooting

11.1 General troubleshooting

11.1.1 General errors

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

HART communication not working

- Possible cause: Communication resistor missing or incorrectly installed
Remedial action: Install the communication resistor (250 Ω) correctly.
- Possible cause: Commubox is connected incorrectly
Remedial action: Connect Commubox correctly

11.1.2 Fault - SmartBlue operation with Bluetooth® (optional)

Operation via the SmartBlue app is only possible for devices with Bluetooth.

Device is not visible in the live list

- Possible cause: No Bluetooth connection available
Remedial action: Activate Bluetooth in the field device via software tool and/or in the smartphone/tablet
- 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)

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)

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)
- Possible cause: **Operator** option has no authorization
Remedial action: Change to the **Maintenance** option

11.1.3 Measures

For information on measures in the case of an error message: See  "Diagnostic list" section.

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

11.1.4 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.

11.1.5 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).

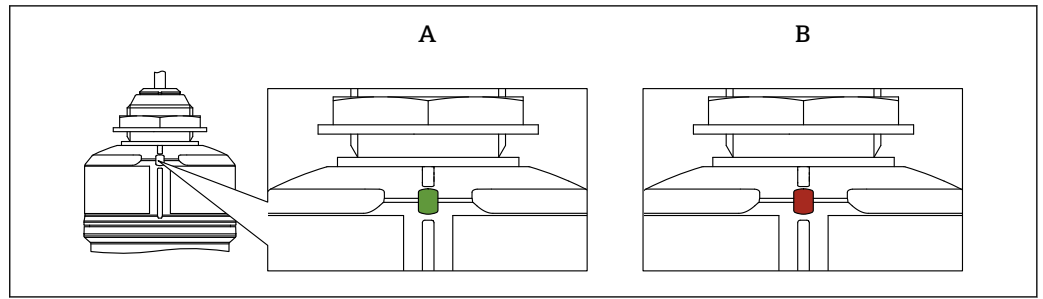
11.1.6 Behavior of the current output in the event of a failure

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.	■ Min. ■ Max.
Failure current	Enter current output value in alarm condition.	21.5 to 23 mA

11.2 Diagnostic information via LED indicator



25 LED indicator on the device

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

11.3 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.

11.4 Adapting the diagnostic information

The event level can be configured:

Navigation: Diagnostics → Diagnostic settings → Configuration

11.5 Pending diagnostic messages

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

Navigation: Diagnostics → Active diagnostics

11.6 Diagnostic list

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

Navigation: Diagnostics → Diagnostic list

11.6.1 List of diagnostic events

 Diagnoses 168, 242, 252, 806 and 952 cannot occur with this device.

Some generic software fixes are not applicable (e.g., the electronics cannot be replaced). The device must be replaced in these cases. Flashing is not possible.

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
Diagnostic of sensor				
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 ¹⁾
Diagnostic of electronic				
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
Diagnostic of configuration				
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
Diagnostic of process				
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. Only with a passive I/O: Check supply voltage of current loop. 2. Check wiring and connections.	M	Warning ¹⁾
807	No Baseline due to insuf. volt. at 20 mA	Increase supply voltage	M	Warning
825	Electronics temperature out of range	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 ¹⁾
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 ¹⁾

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 ¹⁾
952	Foam detected	Check process conditions	S	Warning ¹⁾
968	Level limited	1. Check level 2. Check limit parameters	S	Warning

1) Diagnostic behavior can be changed.

11.7 Event logbook

11.7.1 Event history

The **"Event logbook"** submenu provides a chronological overview of the event messages that have occurred²⁾.

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

11.7.2 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

2) If the device is operated via FieldCare, the event logbook can be displayed using the FieldCare "Event List" function.

11.7.3 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

11.8 Resetting the device

11.8.1 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).

11.8.2 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.

11.9 Device information

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

Navigation: System → Information

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

12 Maintenance

No special maintenance work is required.

12.1 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

12.2 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.

13 Repair

13.1 General notes

13.1.1 Repair concept

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

13.1.2 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 "FieldCare/DeviceCare" software.

13.2 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>
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 provides the best protection.

13.3 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.

14 Accessories

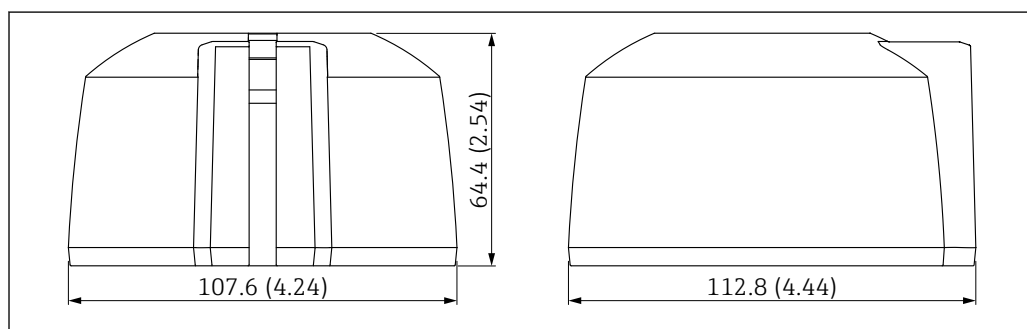
Accessories currently available for the product can be selected via the Product Configurator at www.endress.com:

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.

14.1 Weather protective cover for device with cable entry from above

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



A0055295

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

Material

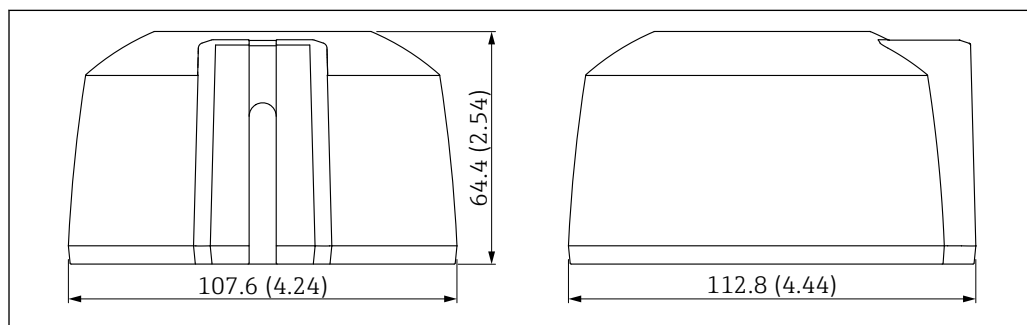
PBT/PC

Order code

71662413

14.2 Weather protective cover for device with cable entry at side

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



A0055293

 27 Dimensions for protective cover with cable entry at the side. Unit of measurement mm (in)

Material

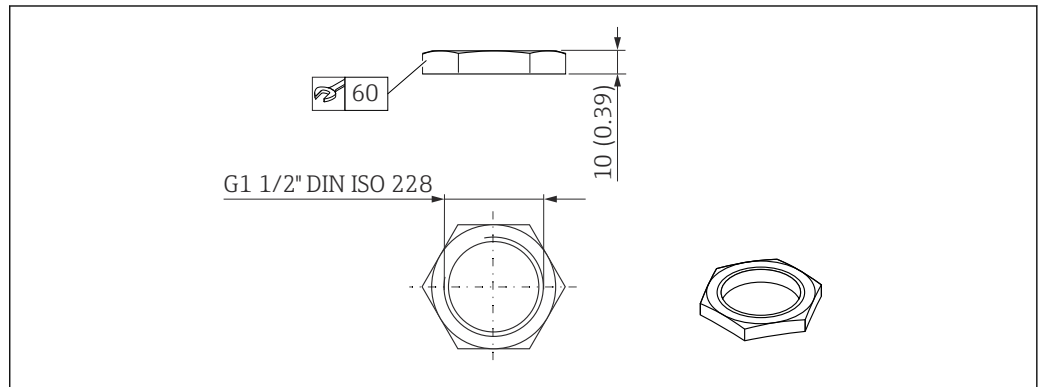
PBT/PC

Order code

71662414

14.3 Securing nut G 1½"

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



A0028849

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

Material

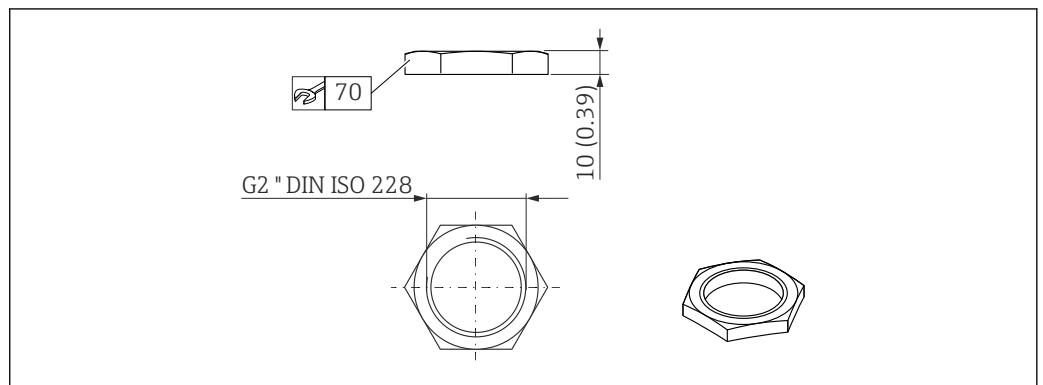
PC

Order code

52014146

14.4 Securing nut G 2"

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



A0029101

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

Material

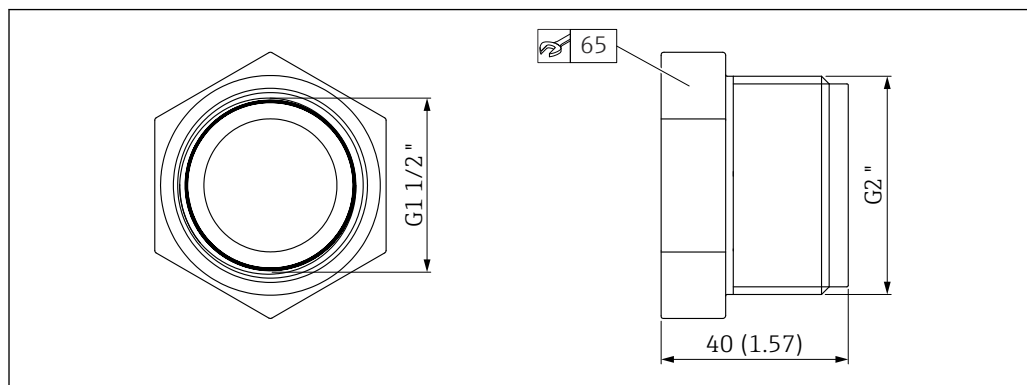
PC

Order code

52000598

14.5 Uni adapter G 1½" > G 2"

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



A0055848

 30 Dimensions of Uni adapter

Material

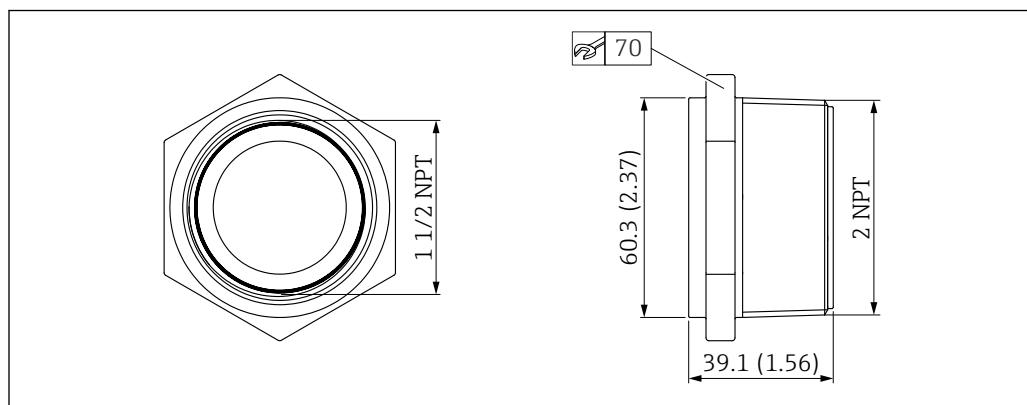
PVC

Order code

71662415

14.6 Uni adapter MNPT 1½" > MNPT 2"

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



A0055847

 31 Dimensions of Uni adapter

Material

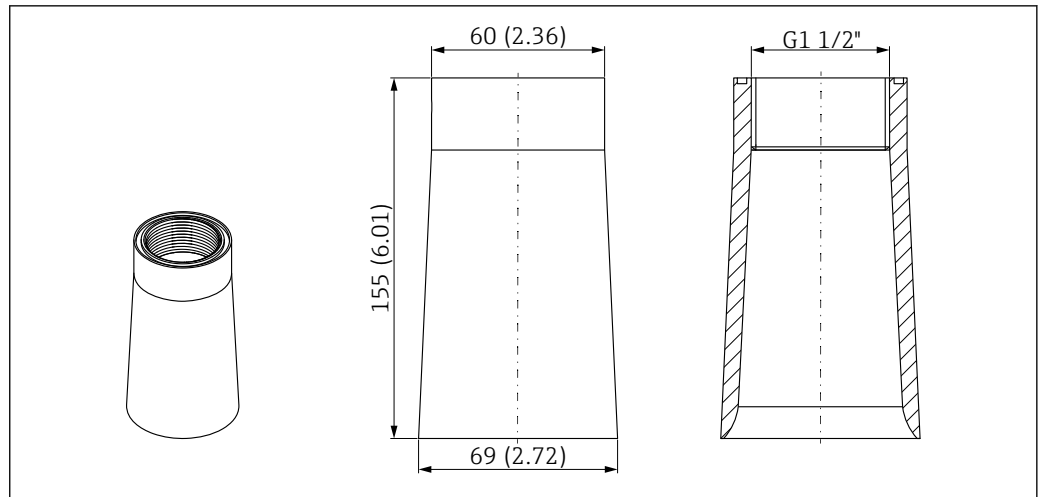
PP

Order code

71668921

14.7 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



A0055301

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

Material

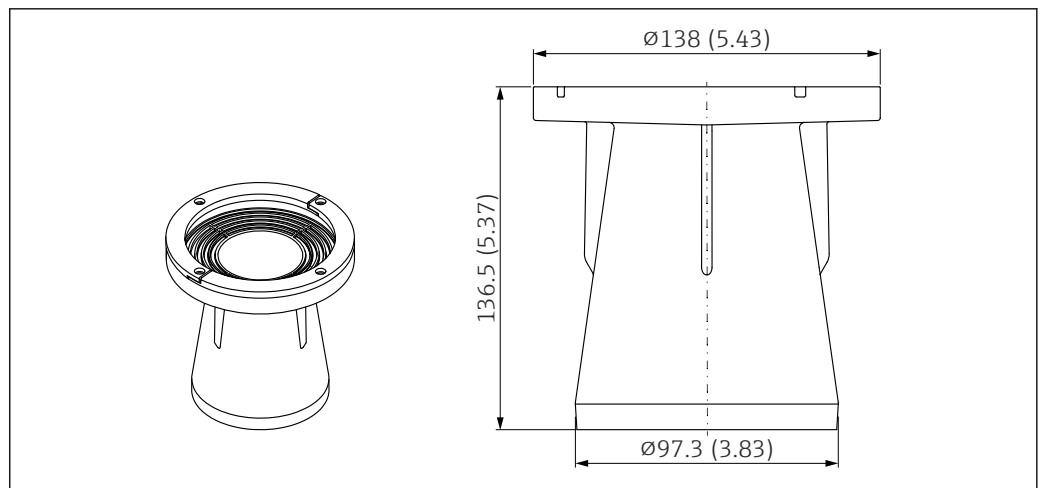
PP

Order code

71091216

14.8 Flooding protection tube 80 mm (3 in)

Suitable for use with devices with a 80 mm (3 in) antenna and antenna end process connection, "without, prepared for UNI slip-on flange > Accessories".



A0031094

33 Flooding protection tube dimensions 80 mm (3 in). Unit of measurement mm (in)

Material

PBT/PC

Order code

71662270

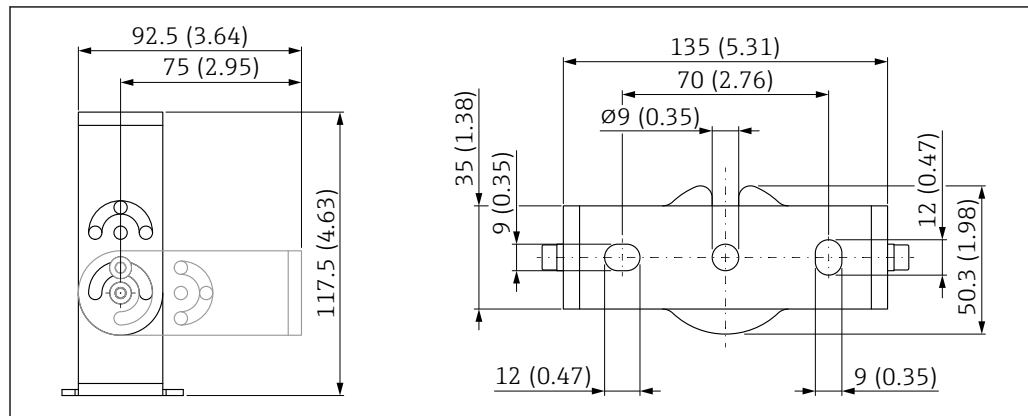
14.9 Mounting bracket, adjustable, wall/rope/ceiling, 75 mm

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"

14.9.1 Cable entry process connection G 1"/NPT 1"



A0055384

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

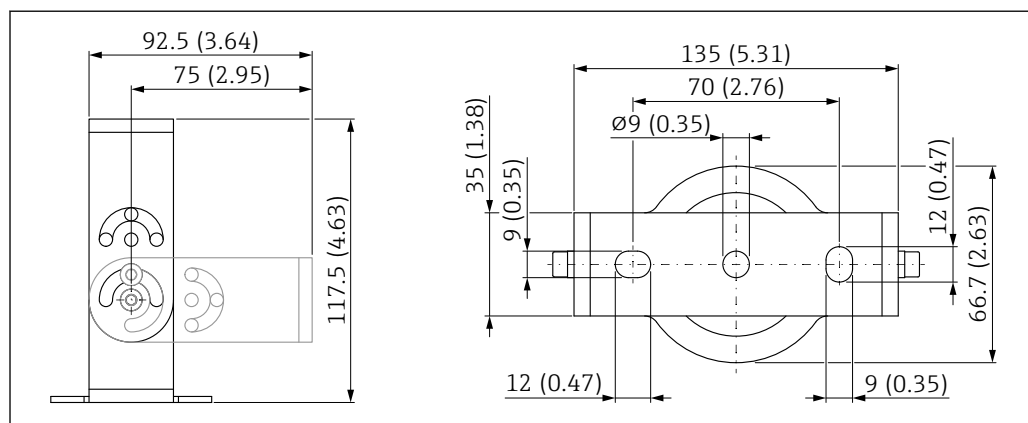
Consists of:

- 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

14.9.2 Antenna end process connection G 1½"/NPT 1½"



A0055372

35 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

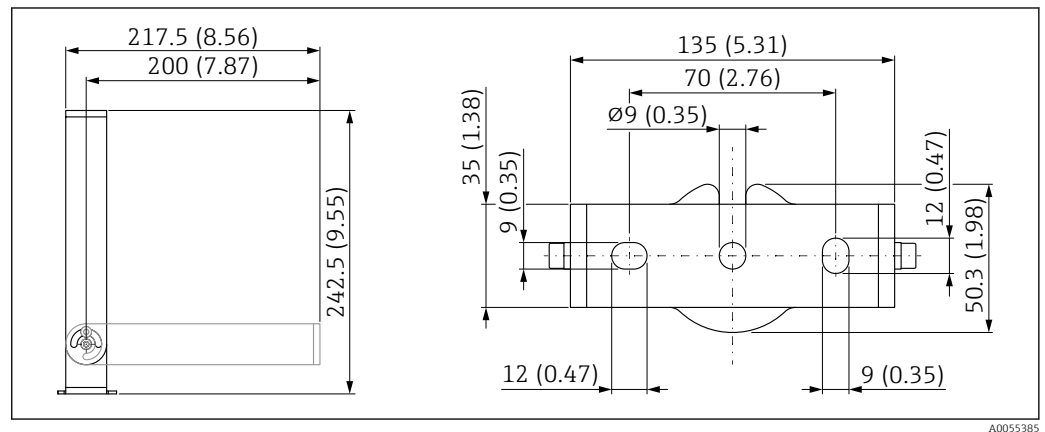
14.10 Mounting bracket, adjustable, wall, 200 mm

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"

14.10.1 Cable entry process connection G 1"/NPT 1"



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

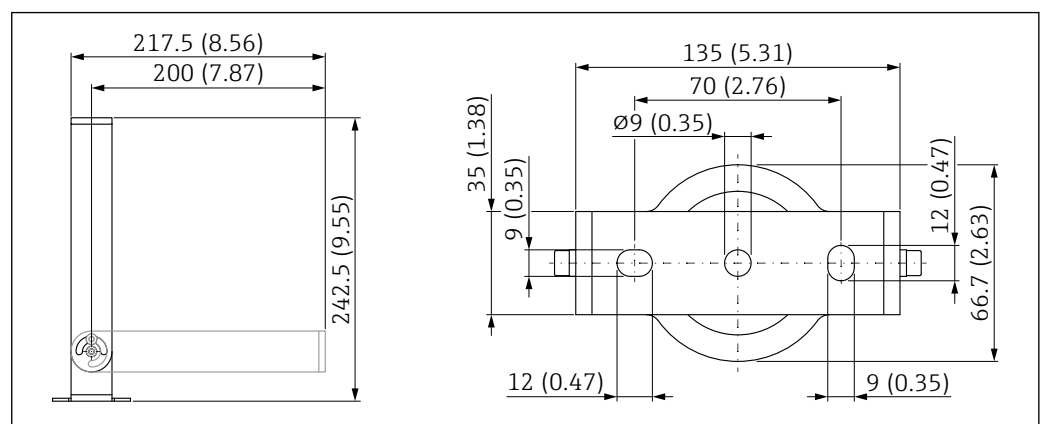
Consists of:

- 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

14.10.2 Antenna end process connection G 1½"/NPT 1½"



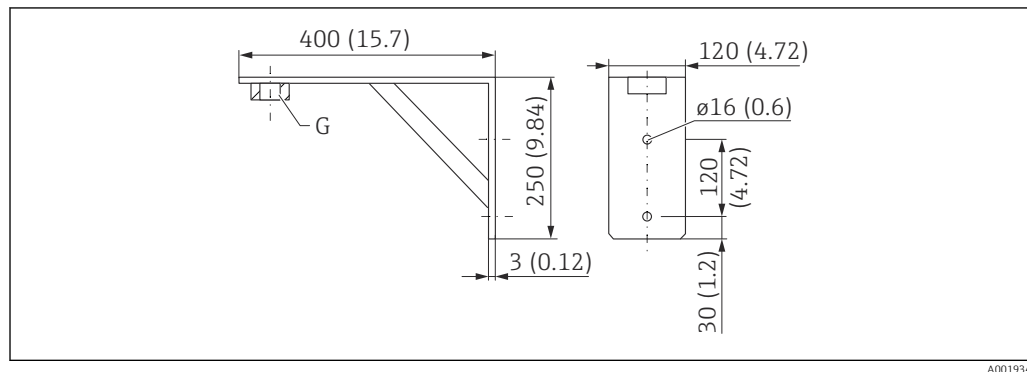
37 Dimensions of mounting bracket. Unit of measurement mm (in)

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

14.11 Angle bracket for wall mounting



 38 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"

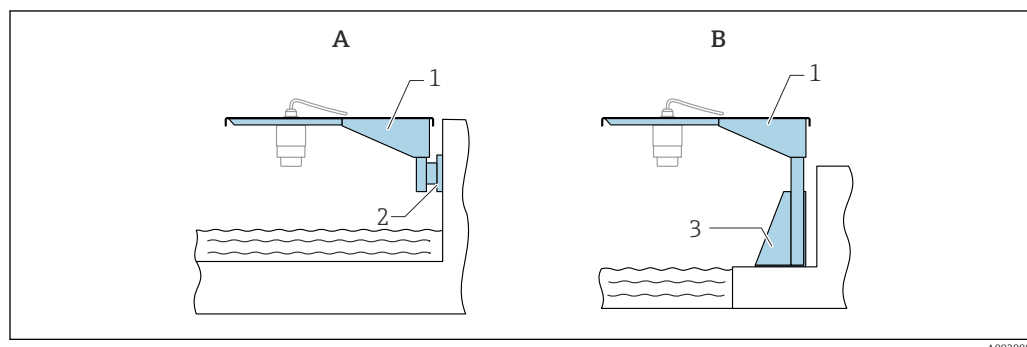
Order number for G 2" process connection

71452325

Also suitable for MNPT 2"

14.12 Cantilever with pivot

14.12.1 Installation type sensor cable entry process connection



 39 Installation type sensor cable entry process connection

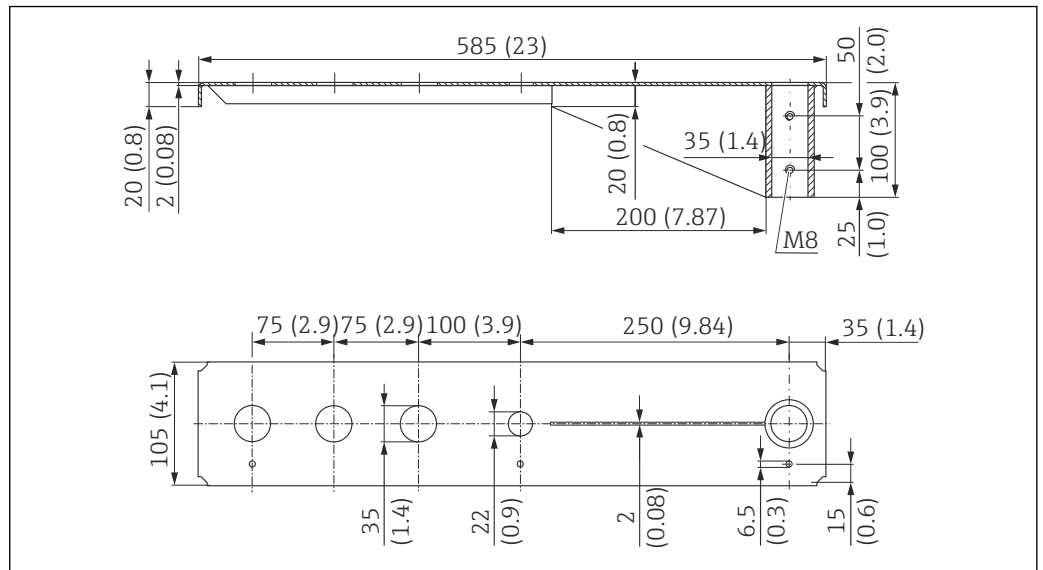
A Installation with cantilever and wall bracket

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

40 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

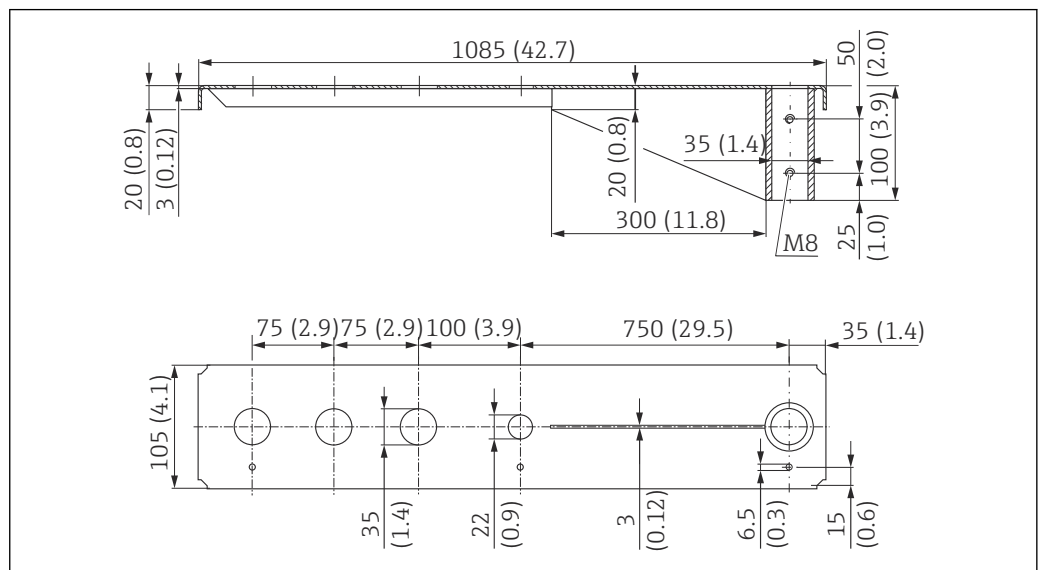
316L (1.4404)

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

1 000 mm cantilever with pivot, sensor cable entry process connection

41 Dimensions of 1 000 mm cantilever with pivot, for sensor cable entry process connection. Unit of measurement mm (in)

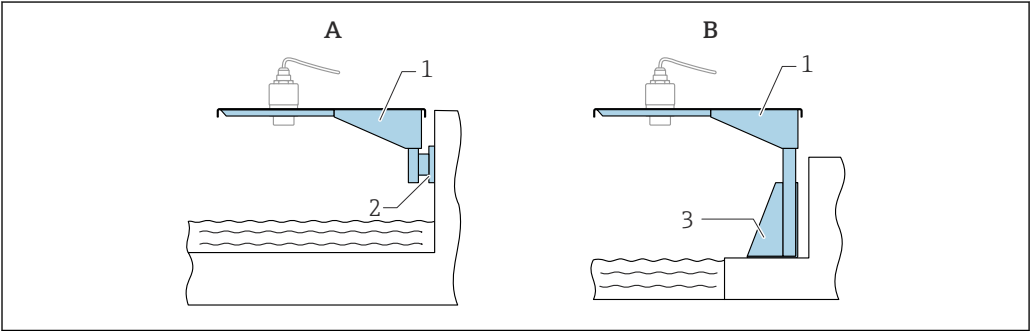
Weight:
4.5 kg (9.92 lb)

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

14.12.2 Installation type sensor antenna end process connection

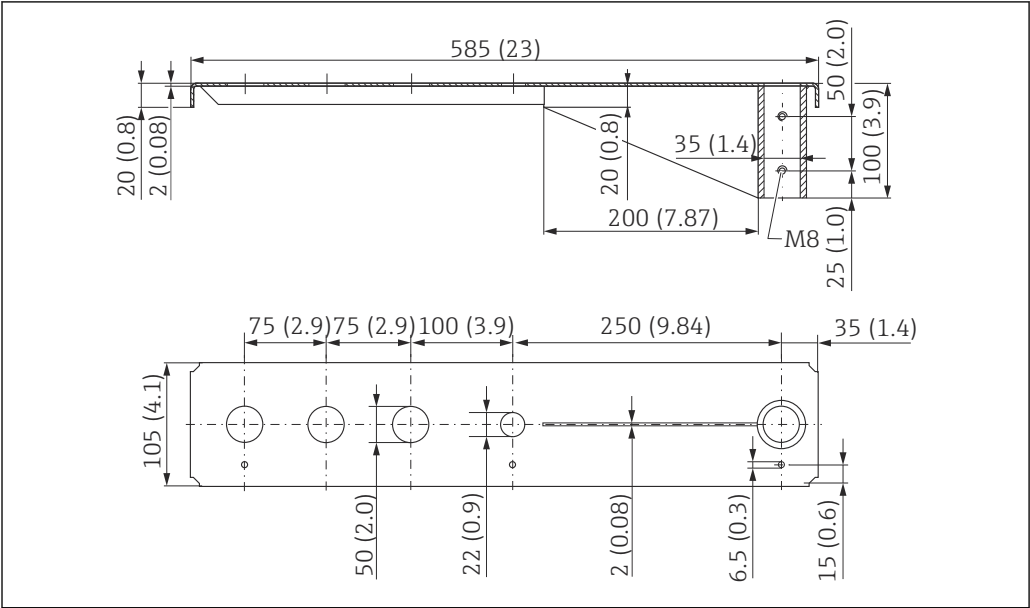


A0028886

42 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

43 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)

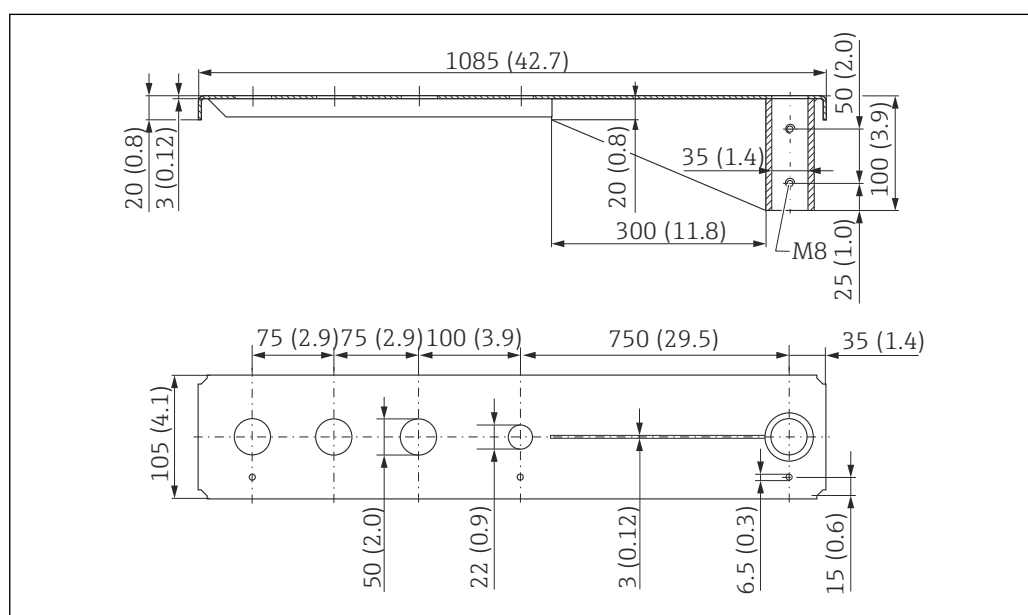
Order code

71452318



- 50 mm (2.0 in) openings for all G 1½" or MNPT 1½" antenna end thread process connections
- 22 mm (0.87 in) opening can be used for an additional sensor
- Retaining screws are included in delivery

1 000 mm cantilever with pivot, sensor antenna end process connection G 1½"



44 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)

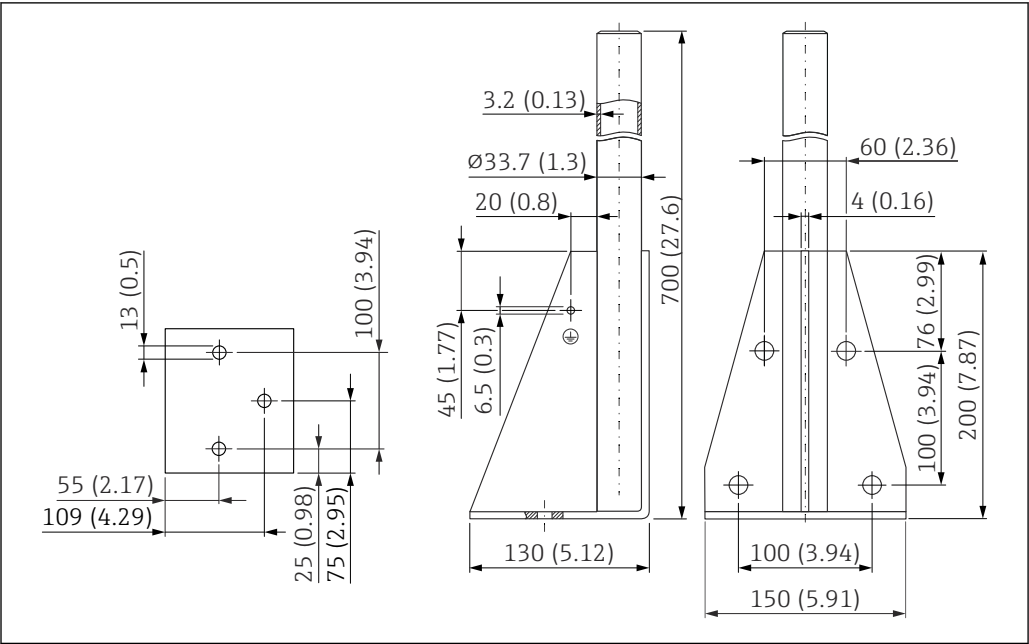
Order code

71452319



- 50 mm (2.0 in) openings for all G 1½" or MNPT 1½" antenna end thread process connections
- 22 mm (0.87 in) opening can be used for an additional sensor
- Retaining screws are included in delivery

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



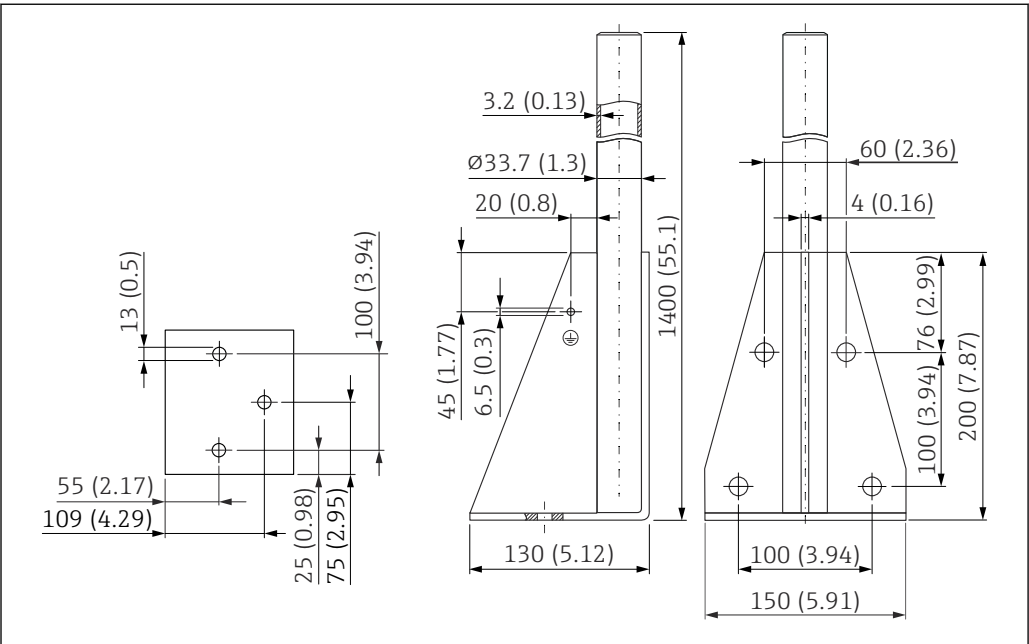
45 Dimensions. Unit of measurement mm (in)

Weight:
4.2 kg (9.26 lb)

Material
316L (1.4404)

Order code
71452327

14.12.4 Mounting stand, 1 400 mm (55.1 in) for cantilever with pivot



46 Dimensions. Unit of measurement mm (in)

Weight:

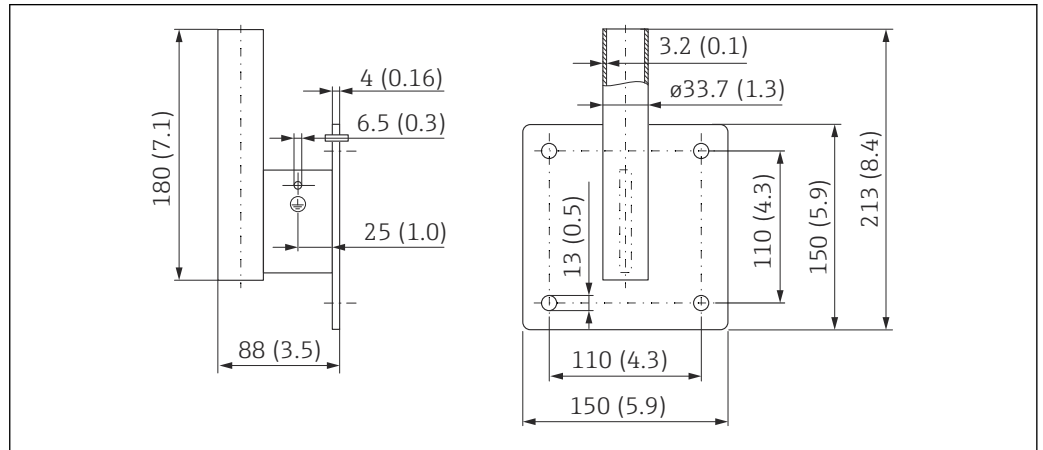
6 kg (13.23 lb)

Material

316L (1.4404)

Order code

71452326

14.12.5 Wall bracket for cantilever with pivot

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

Weight

1.2 kg (2.65 lb)

Material

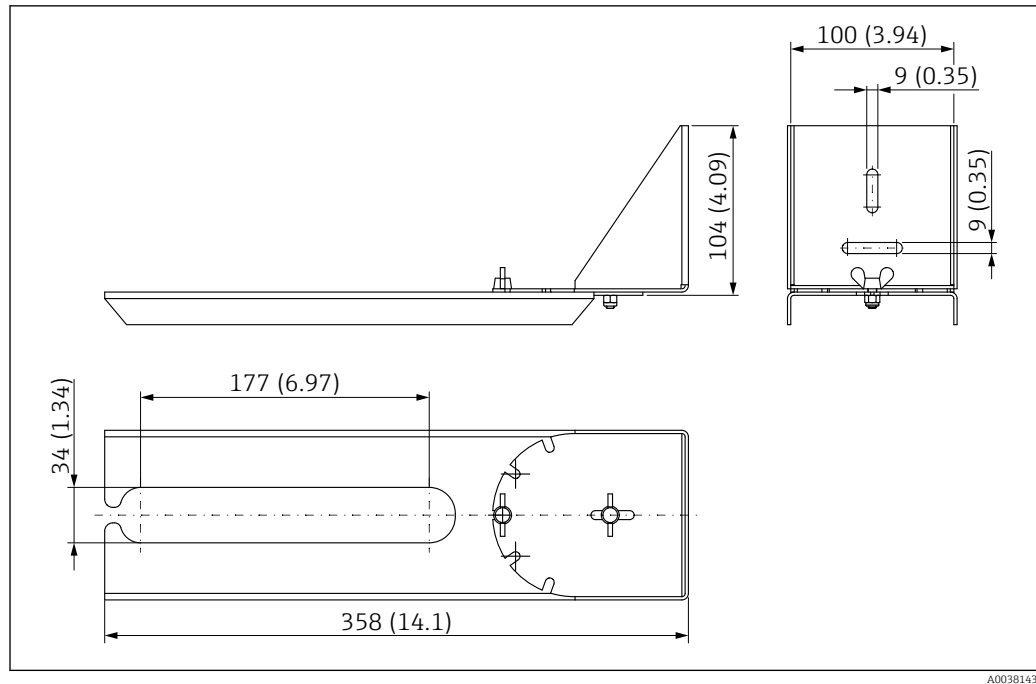
316L (1.4404)

Order number

71452323

14.13 Pivotal mounting bracket

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



48 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

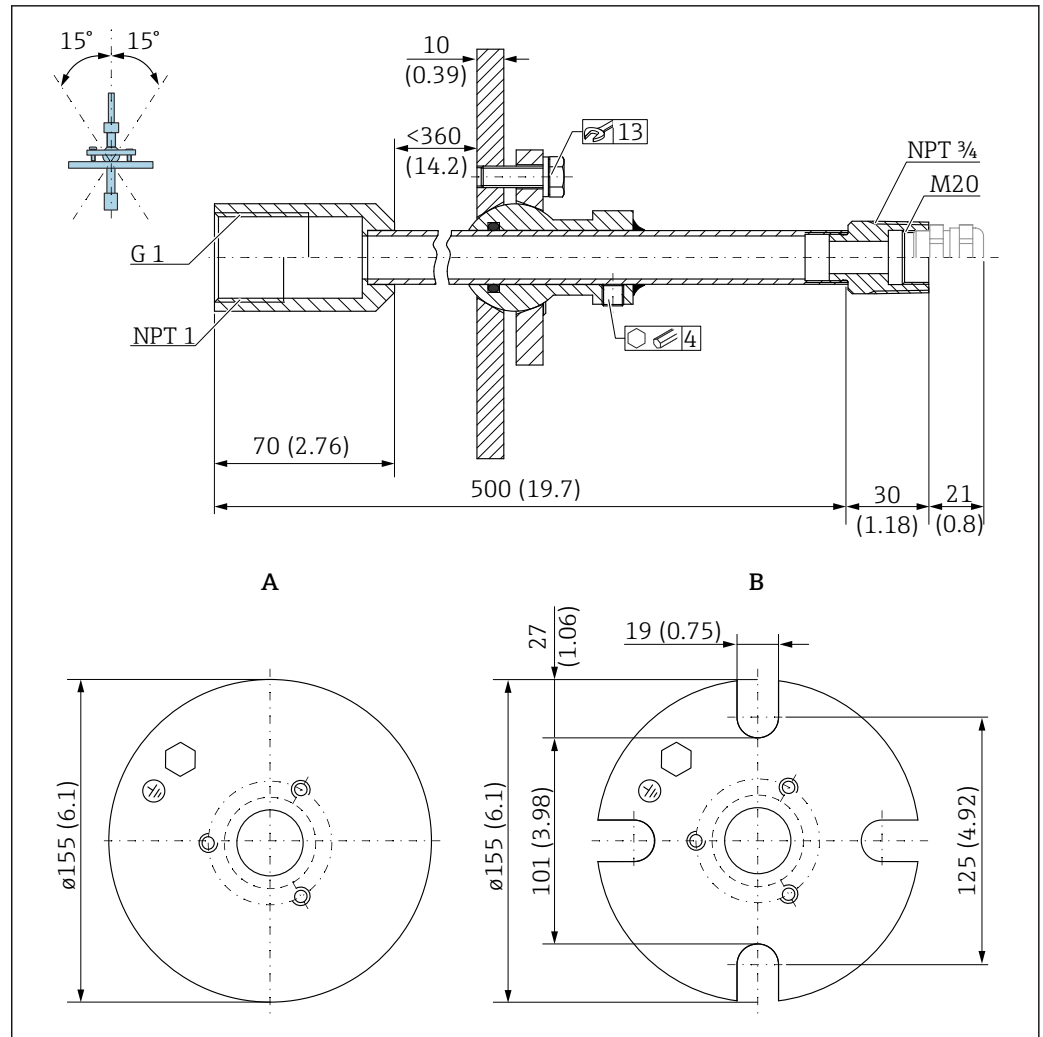
316L (1.4404)

Order code

71429910

14.14 FAU40 alignment unit

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



49 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-##

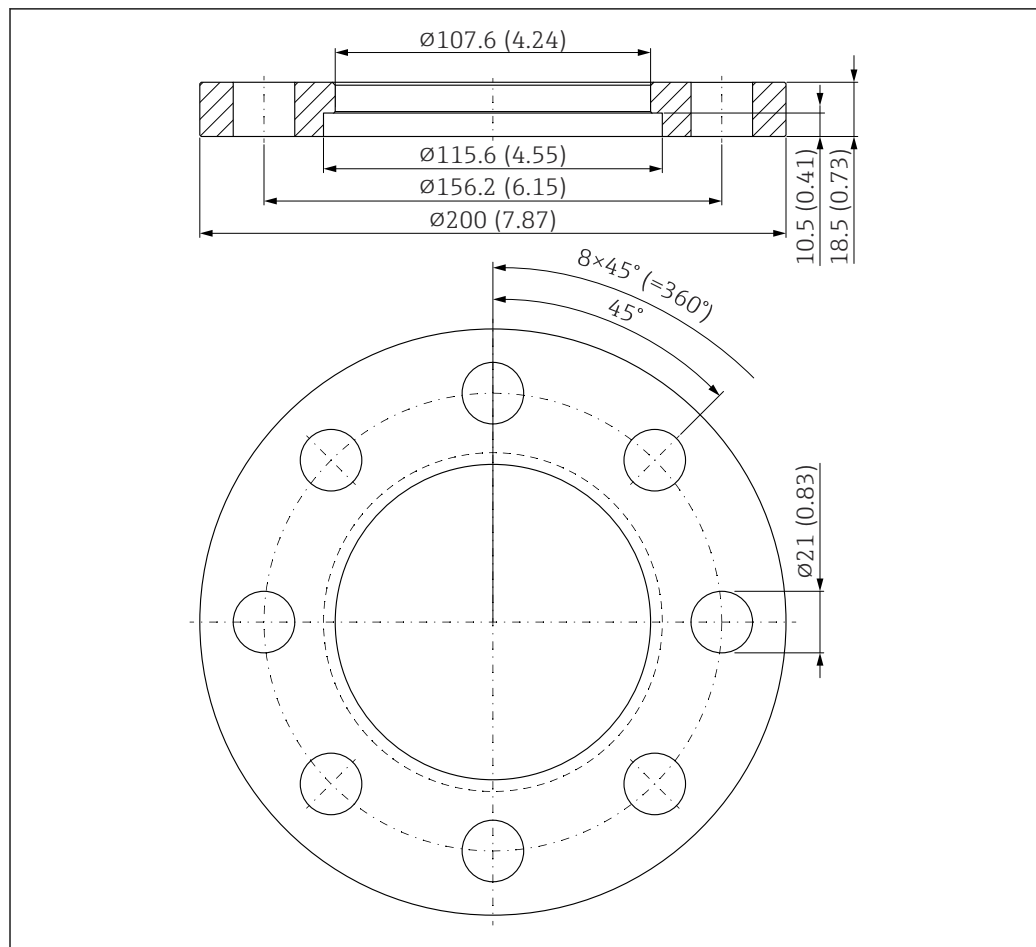


For use in all G 1" or MNPT 1" cable entry thread process connections and connection cables max. dia. 10 mm (0.43 in), min. length 600 mm (23.6 in).



Technical Information TI00179F

14.15 UNI slip-on flange 3"/DN80/80, PP



A0055501

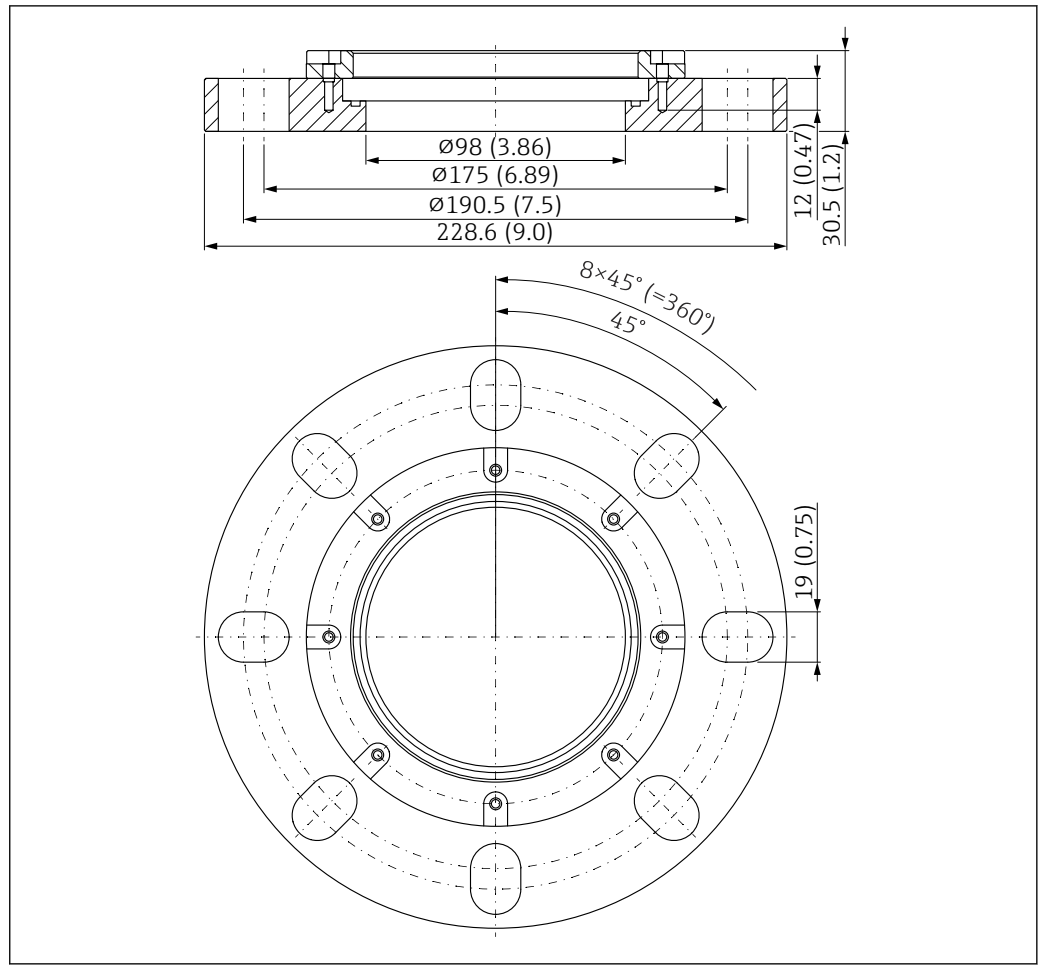
50 Dimensions of UNI slip-on flange 3"/DN80/80. Unit of measurement mm (in)

A Sensor connection in accordance with the product structure "Antenna end process connection; without; prepared for UNI slip-on flange > Accessories"

Material
PP

Order code
71162777

14.16 UNI slip-on flange 4"/DN100/100, PP



A0055502

51 Dimensions of UNI slip-on flange 4"/DN100/100. Unit of measurement mm (in)

A Sensor connection in accordance with the product structure "Antenna end process connection; without; prepared for UNI slip-on flange > Accessories"

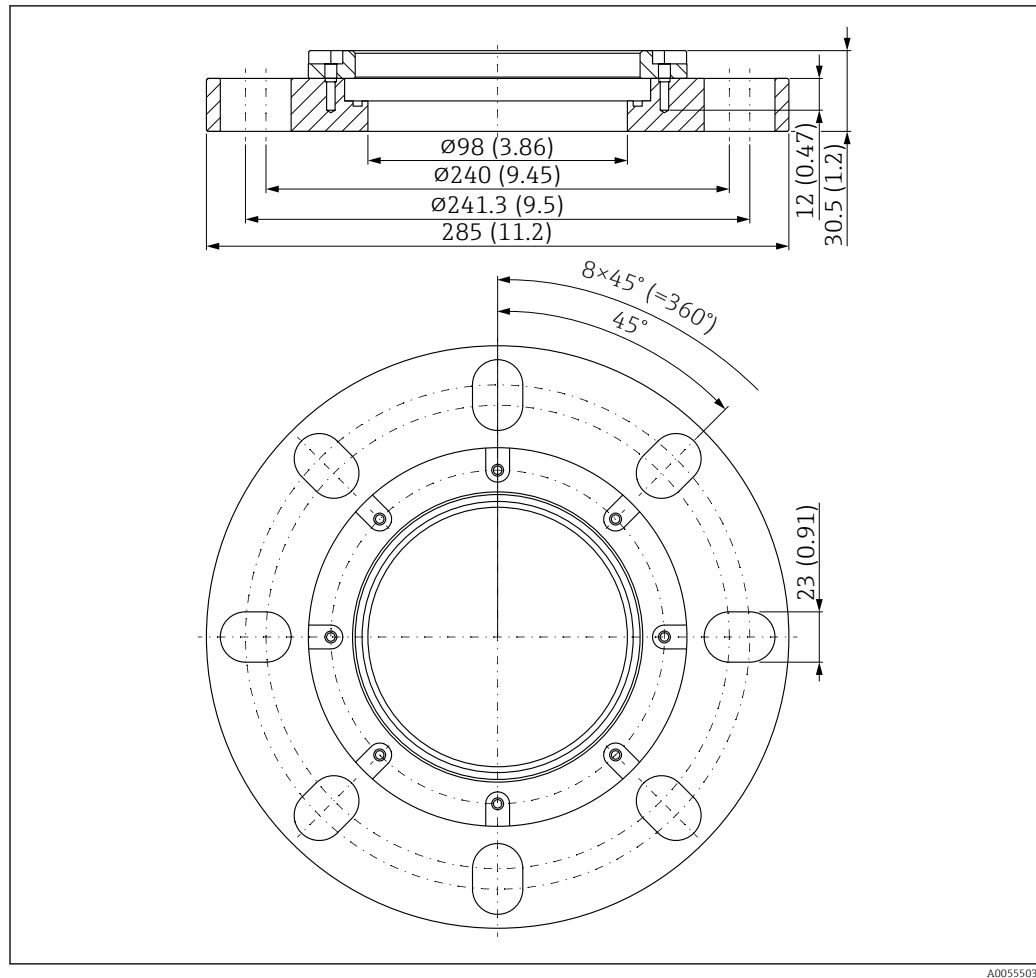
Material

PP

Order code

71162778

14.17 UNI slip-on flange 6"/DN150/150, PP



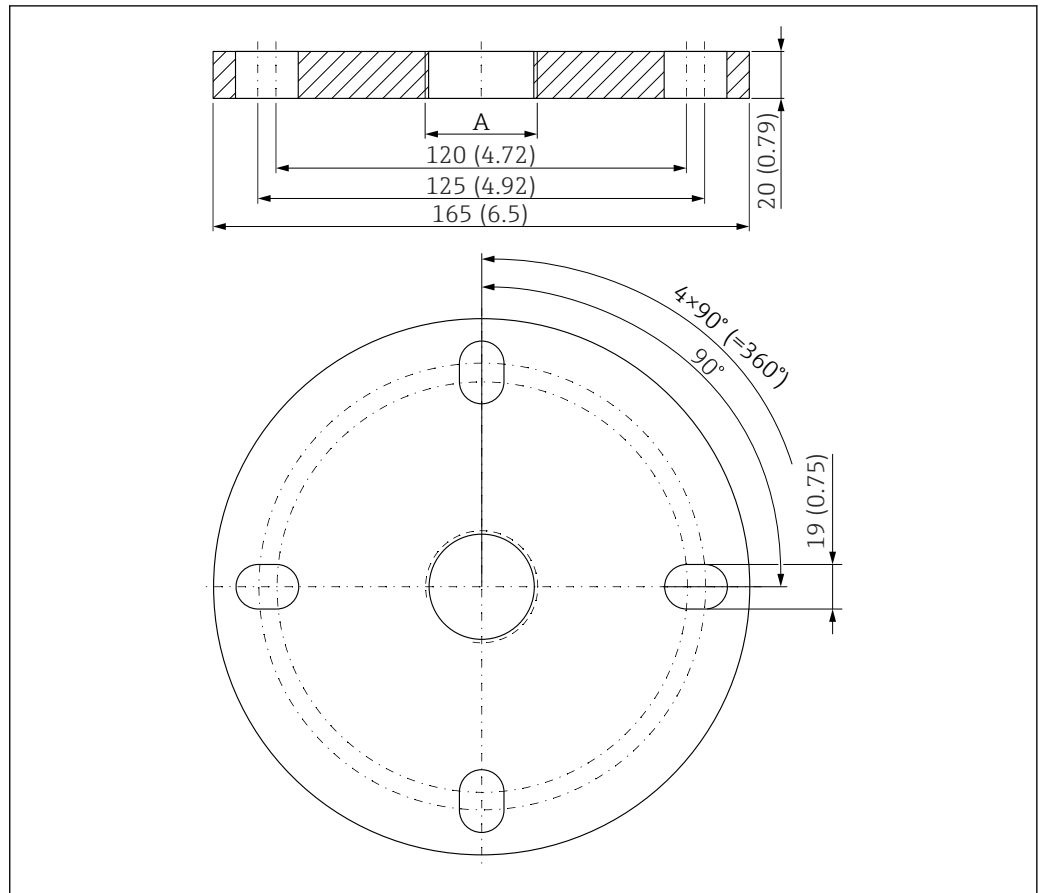
52 Dimensions of UNI slip-on flange 6"/DN150/150. Unit of measurement mm (in)

A Sensor connection in accordance with the product structure "Antenna end process connection; without; prepared for UNI slip-on flange > Accessories"

Material
PP

Order code
71162780

14.18 UNI flange 2"/DN50/50, PP



A0037946

53 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"

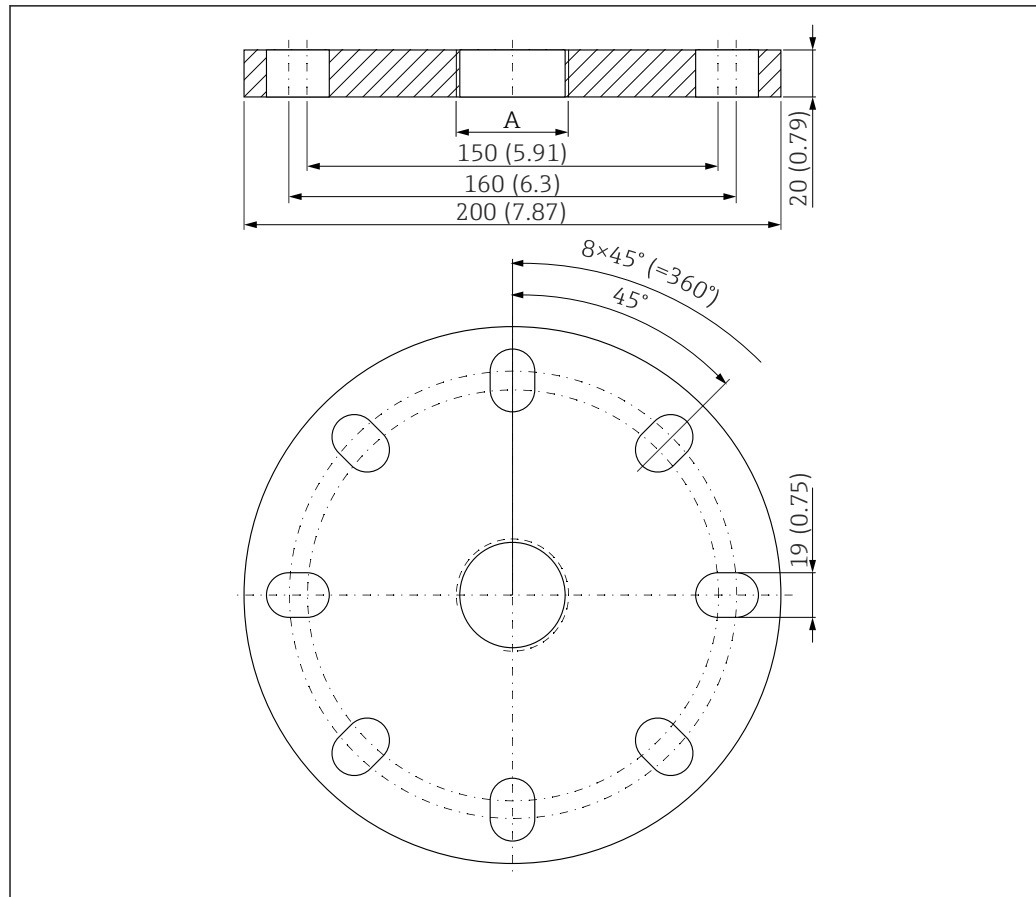
Material

PP

Order code

FAX50-####

14.19 UNI flange 3"/DN80/80, PP



A0037947

54 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"

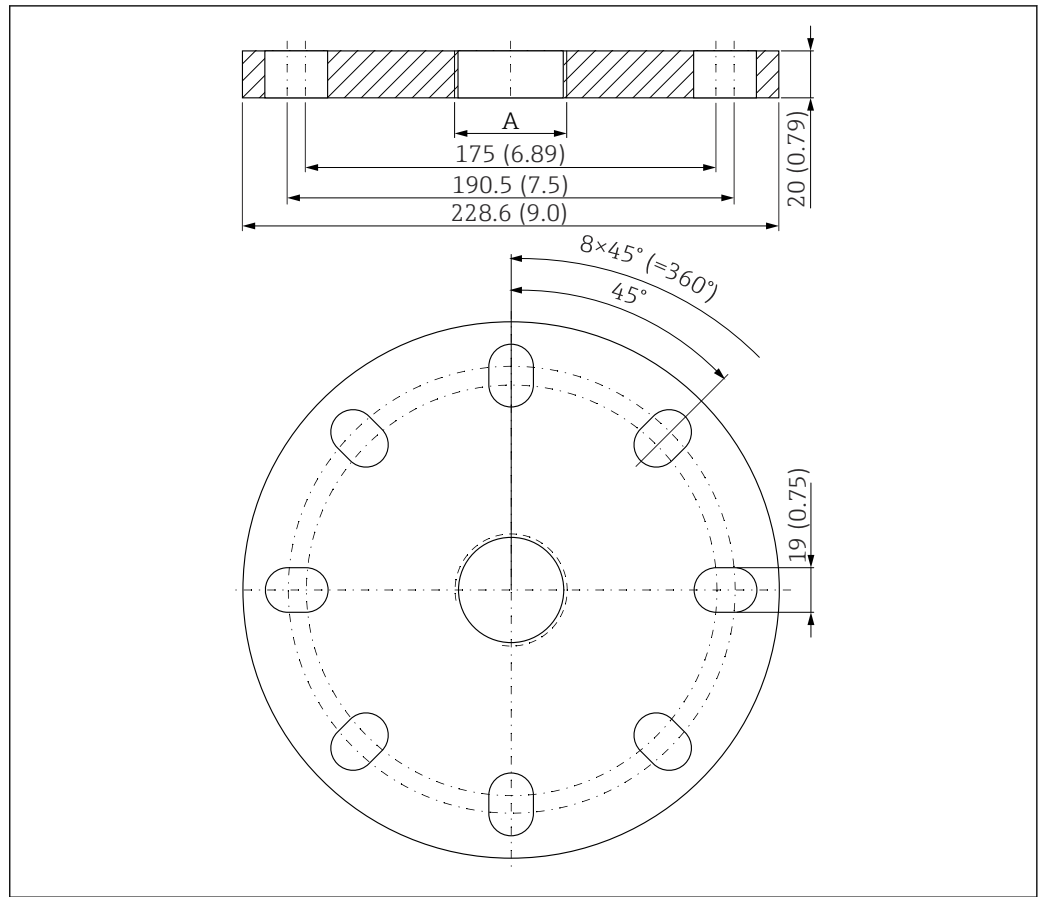
Material

PP

Order code

FAX50-####

14.20 UNI flange 4"/DN100/100, PP



A0037948

55 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

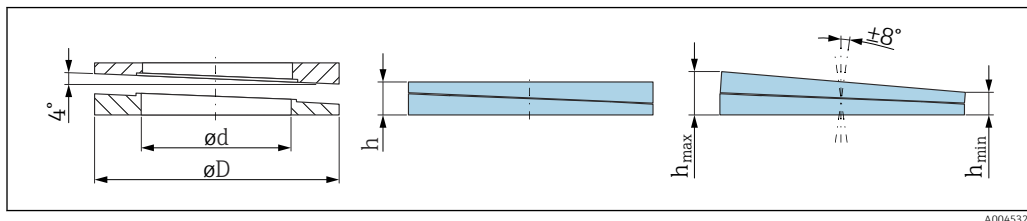
PP

Order code

FAX50-####

14.21 Adjustable flange seal

The adjustable flange seal is used to align the sensor.

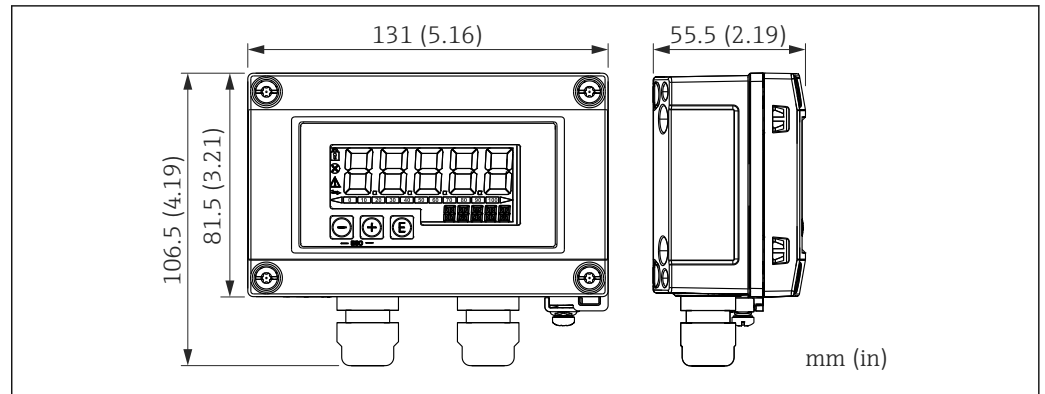


A0045324

56 Dimensions

Technical data: version DN/JIS			
Order code	71074263	71074264	71074265
Compatible with	DN80 PN10/40	DN100 PN10/16	- DN150 PN10/16 - JIS 10K 150A
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 _{min}	14 mm (0.55 in)	14 mm (0.55 in)	14 mm (0.55 in)
h _{max}	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	- ASME 3" 150 lbs - JIS 80A 10K	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 _{min}	14 mm (0.55 in)	14 mm (0.55 in)	14 mm (0.55 in)
h _{max}	30 mm (1.18 in)	33 mm (1.3 in)	39 mm (1.45 in)

14.22 RIA15 in the field housing



A0017722

57 Dimensions of RIA15 in the field housing. Unit of measurement mm (in)

i Older device versions before February 2025 can only be connected via the 4 to 20 mA current output.

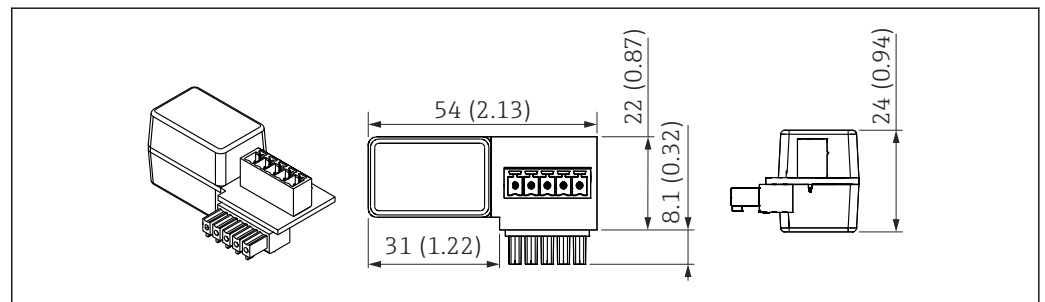
i The remote display RIA15 can be ordered with or without operation via the product structure "Accessory enclosed".

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

Other housing versions are available via the RIA15 product structure.

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

14.23 HART communication resistor

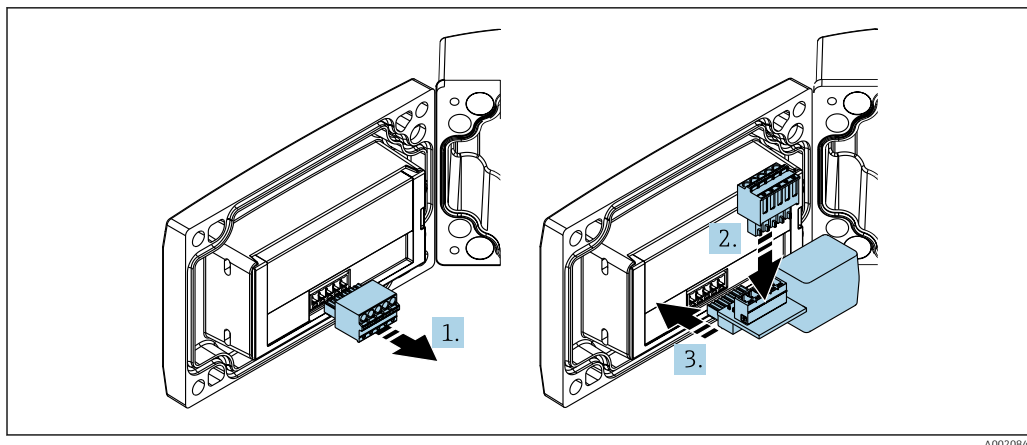


A0020858

58 Dimensions of HART communication resistor. Unit of measurement mm (in)

The HART communication resistor is required for operation of the RIA15 and is supplied with "remote display RIA15, with operation via HART" when ordering.

i Document Technical Information TI01043K and Operating Instructions BA01170K



 In order to operate the RIA15, the HART communication resistor must be integrated.

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

14.24 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. You need to register in the Endress+Hauser software portal to download the application.

 Technical Information TI01134S

14.25 FieldCare SFE500

FDT-based plant asset management tool

It can configure all intelligent field units in your system and helps you manage them. By using the status information, it is also a simple but effective way of checking their status and condition.

 Technical Information TI00028S

14.26 Device Viewer

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

14.27 Commubox FXA195 HART

For intrinsically safe HART communication with FieldCare via the USB interface

 Technical Information TI00404F

14.28 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

14.29 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

14.30 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

14.31 Field Xpert SMT77

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



For details, see "Technical Information" TI01418S

14.32 SmartBlue app

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

14.33 RMA42

Digital process transmitter for monitoring and displaying analog measured values



For details, see Technical Information TI00150R and Operating Instructions BA00287R

15 Technical data

15.1 Input

15.1.1 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.

15.1.2 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 depends on the antenna size.

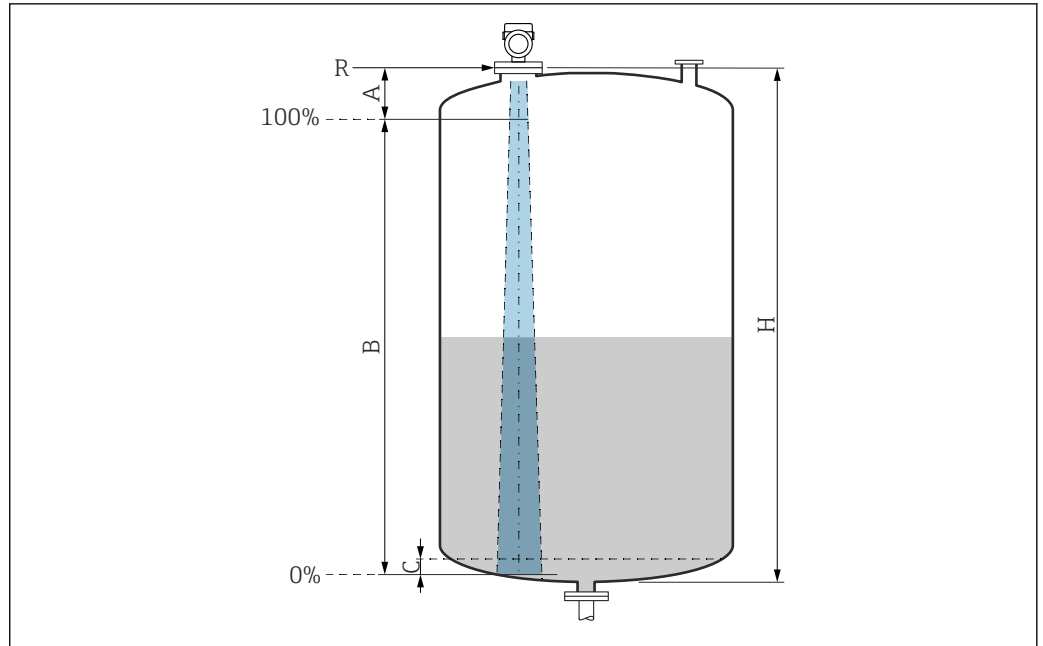
Antenna	Maximum measuring range
40 mm (1.5 in)	20 m (65.6 ft)
80 mm (3 in)	30 m (98.4 ft)

Usable measuring range

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

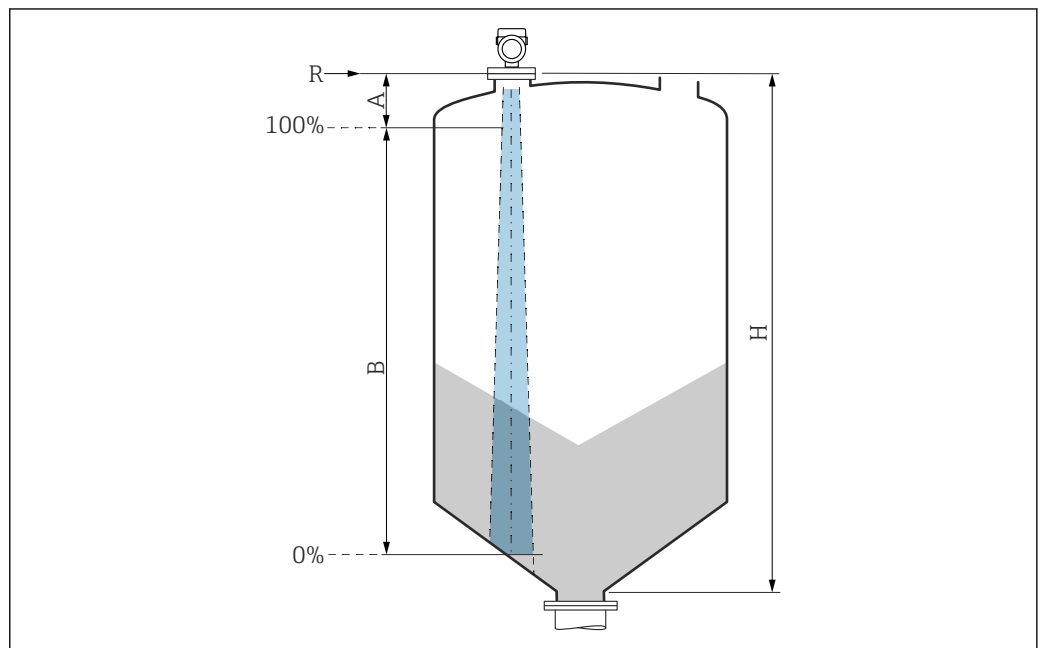
In principle, measurement is possible up to the tip of the antenna.

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 the measurement, varies depending on the antenna system (see section on Mechanical construction)



A0051659

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

In the case of media with a low dielectric constant $\epsilon_r < 2$, the tank bottom may be visible through the medium when levels are very low (less 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** (ϵ_r 1.4 to 1.9)
Non-conductive liquids, e.g. liquefied gas
- **B** (ϵ_r 1.9 to 4)
Non-conductive liquids, e.g. gasoline, oil, toluene, etc.
- **C** (ϵ_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

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

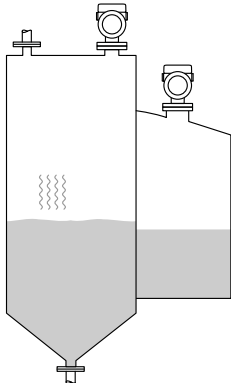
- Relative permittivity (ϵ_r value), Compendium CP01076F
- The Endress+Hauser "DC Values app" (available for Android and iOS)

Measurement in storage vessel

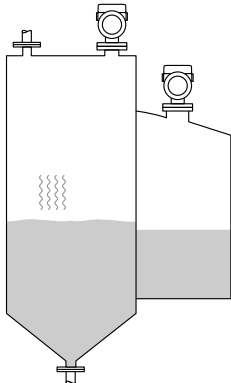
Storage vessel - measuring conditions

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 (ϵ_r 1.4 to 1.9)	10 m (33 ft)
	B (ϵ_r 1.9 to 4)	20 m (65.6 ft)
	C (ϵ_r 4 to 10)	20 m (65.6 ft)
	D ($\epsilon_r >10$)	20 m (65.6 ft)

80 mm (3 in) antenna in storage vessel

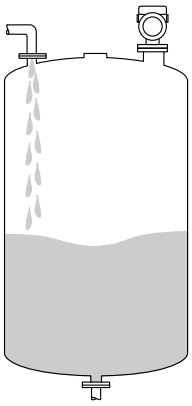
	Media group	Measuring range
	A (ϵ_r 1.4 to 1.9)	12 m (39 ft)
	B (ϵ_r 1.9 to 4)	23 m (75 ft)
	C (ϵ_r 4 to 10)	30 m (98 ft)
	D ($\epsilon_r >10$)	30 m (98 ft)

Measurement in buffer vessel

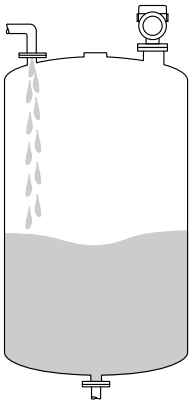
Buffer vessel - measuring conditions

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 (ϵ_r 1.4 to 1.9)	7 m (23 ft)
	B (ϵ_r 1.9 to 4)	13 m (43 ft)
	C (ϵ_r 4 to 10)	20 m (65.6 ft)
	D ($\epsilon_r > 10$)	20 m (65.6 ft)

80 mm (3 in) antenna in buffer vessel

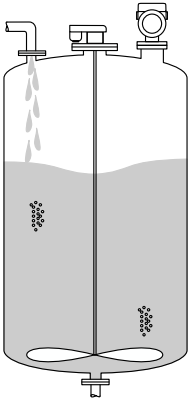
	Media group	Measuring range
	A (ϵ_r 1.4 to 1.9)	7.5 m (25 ft)
	B (ϵ_r 1.9 to 4)	15 m (49 ft)
	C (ϵ_r 4 to 10)	28 m (92 ft)
	D ($\epsilon_r > 10$)	30 m (98 ft)

Measurement in vessel with agitator

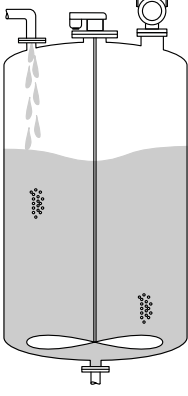
Vessel with agitator - measuring conditions

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 (ϵ_r 1.4 to 1.9)	4 m (13 ft)
	B (ϵ_r 1.9 to 4)	5 m (16.4 ft)
	C (ϵ_r 4 to 10)	13 m (43 ft)
	D (ϵ_r >10)	20 m (65.6 ft)

80 mm (3 in) antenna in vessel with agitator

	Media group	Measuring range
	A (ϵ_r 1.4 to 1.9)	4 m (13 ft)
	B (ϵ_r 1.9 to 4)	7 m (23 ft)
	C (ϵ_r 4 to 10)	15 m (49 ft)
	D (ϵ_r >10)	25 m (82 ft)

15.1.3 **Operating frequency**

approx. 80 GHz

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

15.1.4 **Transmission power**

- Peak power: <1.5 mW
- Average output power: <70 μ W

15.2 **Output**

15.2.1 **Output signal**

- 4 to 20 mA with superimposed digital communication protocol HART, 2-wire
- 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

15.2.2 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)

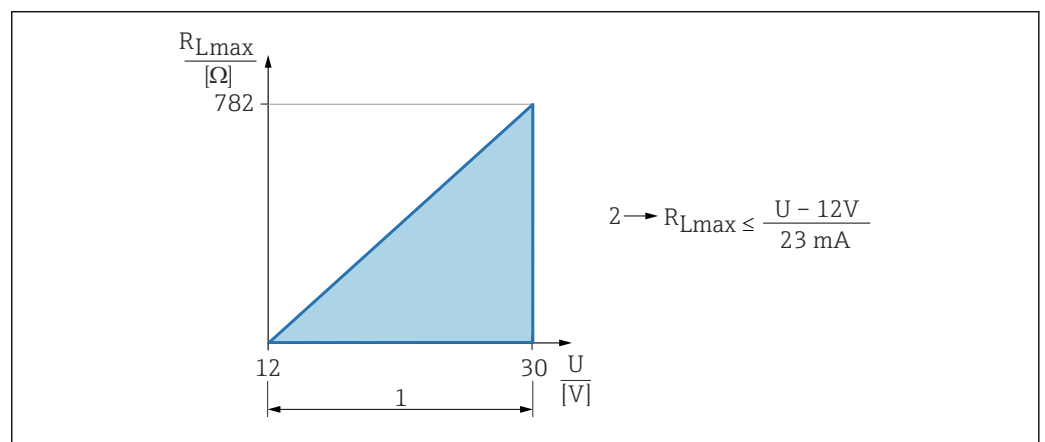
Operating tool via digital communication

Status signal (according to NAMUR Recommendation NE 107):

Plain text display

15.2.3 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.

15.2.4 Damping

Damping affects all continuous outputs.

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

15.2.5 Ex connection data

 See the separate technical documentation (Safety Instructions (XA)) on www.endress.com/download.

15.2.6 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)
 - V-notch thin-plate weir (ISO 1438)
- Standard formula

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



For further information on flow measurement over open channels and weirs, see SD03445F.

15.2.7 Totalizer

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

15.2.8 Protocol-specific data

Manufacturer ID:

17(0x0011)

Device type ID:

0x11DE

Device revision:

2

HART specification:

7.6

DD version:

1

Device description files (DTM, DD)

Information and files at:

- www.endress.com

On the product page for the device: Documents/Software → Device drivers

- www.fieldcommgroup.org

HART load:

Min. 250 Ω

The following measured values are assigned to the device variables at the factory:

Device variable	Measured value
Primary variable (PV) ¹⁾	Level linearized
Secondary variable (SV)	Distance
Tertiary variable (TV)	Absolute echo amplitude
Quaternary variable (QV)	Relative echo amplitude

1) The PV is always applied to the current output.

Choice of HART device variables

- Level linearized
- Distance
- Electronics temperature
- Sensor temperature
- Absolute echo amplitude
- Relative echo amplitude
- Area of incoupling
- Percent of range
- Loop current
- Flow
- Totalizer value
- Not used

Supported functions

- Burst mode
- Additional transmitter status
- Device locking

15.2.9 Wireless HART data

Minimum start-up voltage:

12 V

Start-up current:

< 3.6 mA

Starting time:

< 15 s

Minimum operating voltage:

12 V

Multidrop current:

4 mA

Time to establish connection:

< 30 s

15.3 Environment

15.3.1 Ambient temperature range

-40 to +80 °C (-40 to +176 °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.

15.3.2 Storage temperature

–40 to +80 °C (–40 to +176 °F)

15.3.3 Climate class

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

15.3.4 Operating height

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

15.3.5 Degree of protection

Testing according to IEC 60529 and NEMA 250:

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

15.3.6 Vibration resistance

- Stochastic noise (random sweep) as per 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

15.3.7 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).

15.4 Process

15.4.1 Process temperature, process pressure

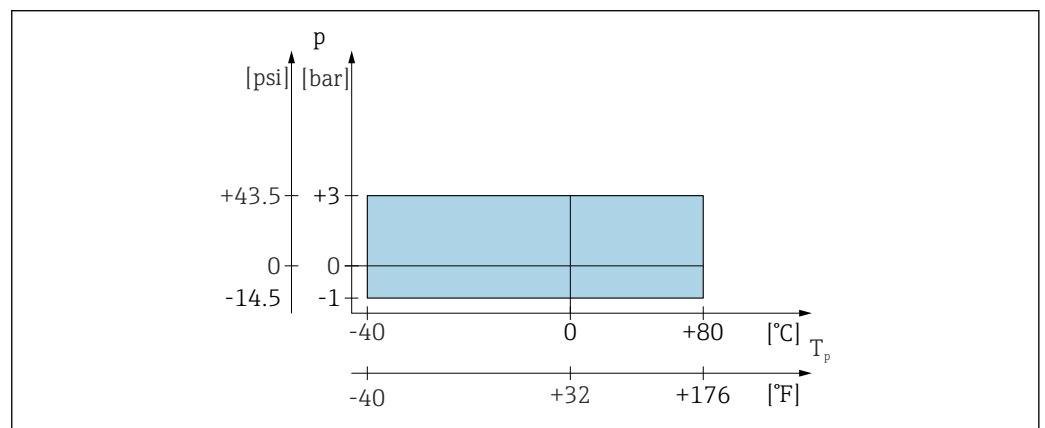
i The maximum pressure for the device depends on the lowest-rated element with regard to pressure.

Components are: process connection, optional mounting parts, or accessories.

⚠ WARNING

Incorrect design or use of the device may cause injury due to bursting parts!

- ▶ 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. Observe the temperature dependency of the maximum working pressure. 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). Maximum working pressure 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.



A0056003

59 Permitted range for process temperature and process pressure

Process temperature range

–40 to +80 °C (–40 to +176 °F)

Process pressure range, 40 mm (1.5 in) antenna

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

Process pressure range, 80 mm (3 in) antenna with UNI slip-on flange 3", 4"

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

Process pressure range, 80 mm (3 in) antenna with UNI slip-on flange 6"

For unpressurized applications

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

15.4.2 Relative permittivity

For liquids

- $\epsilon_r \geq 1.8$
- Contact Endress+Hauser for lower ϵ_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 (ϵ_r values) of many media commonly used in industry, please refer to:

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

15.5 Additional technical data



Current Technical Information: Endress+Hauser website: www.endress.com → Downloads.

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www.addresses.endress.com

Technical Information

Micropilot FMR20B

Free-space radar
HART

Level measurement in liquids and bulk solids



Application

- Continuous, non-contact level measurement of liquids and bulk solids
- Degree of protection: IP66/68 / NEMA Type 4X/6P
- Maximum measuring range up to 30 m (98 ft)
- Process temperature: -40 to 80 °C (-40 to 176 °F)
- Process pressure: -1 to 3 bar (-14 to 43 psi)
- Accuracy: Up to ± 2 mm (0.08 in)
- International explosion protection certificates

Your benefits

- LED indicator for fast status detection
- Easy, guided commissioning with intuitive user interface
- Radar measuring device with *Bluetooth*® wireless technology and HART communication
- Easy, reliable and encrypted wireless remote access – ideal for difficult-to-reach installations, even in hazardous areas
- Commissioning, operation and maintenance via free iOS/Android app SmartBlue – saves time and reduces costs
- Flow measurement in open channels or weirs with totalizer

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About this document

Symbols	Safety symbols  DANGER This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.  WARNING This symbol alerts you to a potentially dangerous situation. Failure to avoid this situation can result in serious or fatal injury.  CAUTION This symbol alerts you to a potentially dangerous situation. Failure to avoid this situation can result in minor or medium injury.  NOTICE This symbol alerts you to a potentially harmful situation. Failure to avoid this situation can result in damage to the product or something in its vicinity. Communication-specific symbols Bluetooth®:  Wireless data transmission between devices over a short distance via radio technology. Symbols for certain types of information <i>Permitted:</i>  Procedures, processes or actions that are permitted. <i>Forbidden:</i>  Procedures, processes or actions that are forbidden. <i>Additional information:</i>  <i>Reference to documentation:</i>  <i>Reference to page:</i>  <i>Series of steps:</i>    <i>Result of an individual step:</i>  Symbols in graphics <i>Item numbers:</i> 1, 2, 3 ... <i>Series of steps:</i>    <i>Views:</i> A, B, C, ...
List of abbreviations	PN Nominal pressure MWP Maximum working pressure The maximum working pressure is indicated on the nameplate. ToF Time of Flight DTM Device Type Manager ϵ_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, IO-Link communication and PC
- SmartBlue app for operation using an Android or iOS smartphone or tablet

PLC

Programmable logic controller (PLC)

Graphic conventions

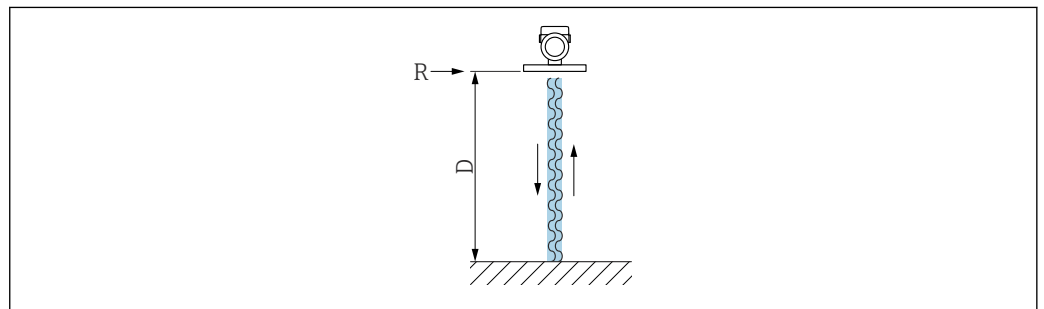


- Installation, explosion and electrical connection drawings are presented in simplified format
- Devices, assemblies, components and dimensional drawings are presented in reduced-line format
- Dimensional drawings are not to-scale representations; the dimensions indicated are rounded off to 2 decimal places
- Unless otherwise described, flanges are presented with sealing surface form EN 1092-1; ASME B16.5, RF.

Function and system design

Measuring principle

The Micropilot is a "downward-looking" measuring system, operating based on the frequency modulated continuous wave method (FMCW). The antenna emits an electromagnetic wave at a continuously varying frequency. This wave is reflected by the product and received again by the antenna.



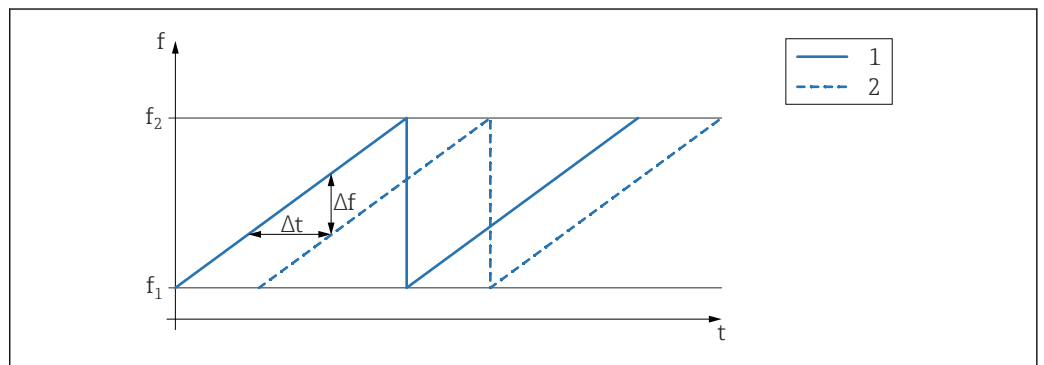
A0032017

1 FMCW principle: Transmission and reflection of the continuous wave

R Reference point of measurement

D Distance between reference point and product surface

The frequency of this wave is modulated in the form of a sawtooth signal between two limit frequencies f_1 and f_2 :



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2 FMCW principle: Result of frequency modulation

1 Transmitted signal

2 Received signal

This results in the following difference frequency at any time between the transmitted signal and the received signal:

$$\Delta f = k \Delta t$$

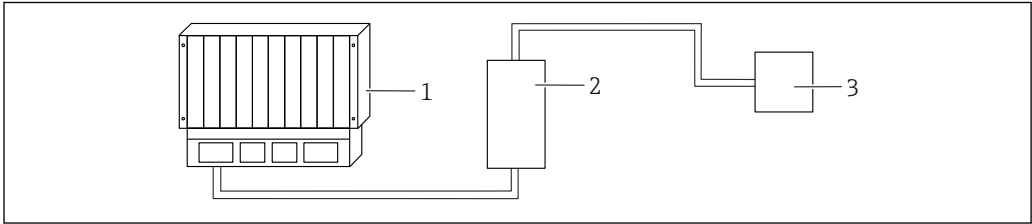
where Δt is the run time and k is the specified increase in frequency modulation.

Δt is given by the distance D between the reference point R and the product surface:

$$D = (c \Delta t) / 2$$

where c is the wave velocity.

In summary, D can be calculated from the measured difference frequency Δf . D is then used to determine the fill level or flow rate.

Measuring system	A complete measuring system comprises:  A0053220 1 PLC (programmable logic controller) 2 RMA42/RIA45 (if necessary) 3 Device
------------------	---

Communication and data processing	■ 4 to 20 mA with superimposed digital communication protocol HART, 2-wire ■ Bluetooth® wireless technology (optional)
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Dependability	IT security The manufacturer 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. 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® wireless technology or FieldCare, DeviceCare, Asset Management Tools (e.g. AMS, PDM)). <i>Access via Bluetooth® wireless technology</i> 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® interface can be disabled via SmartBlue or an operating tool via digital communication.
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Input

Measured variable	The measured variable is the distance between the reference point and the product surface. The level is calculated based on E, the empty distance entered.
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 depends on the antenna size.

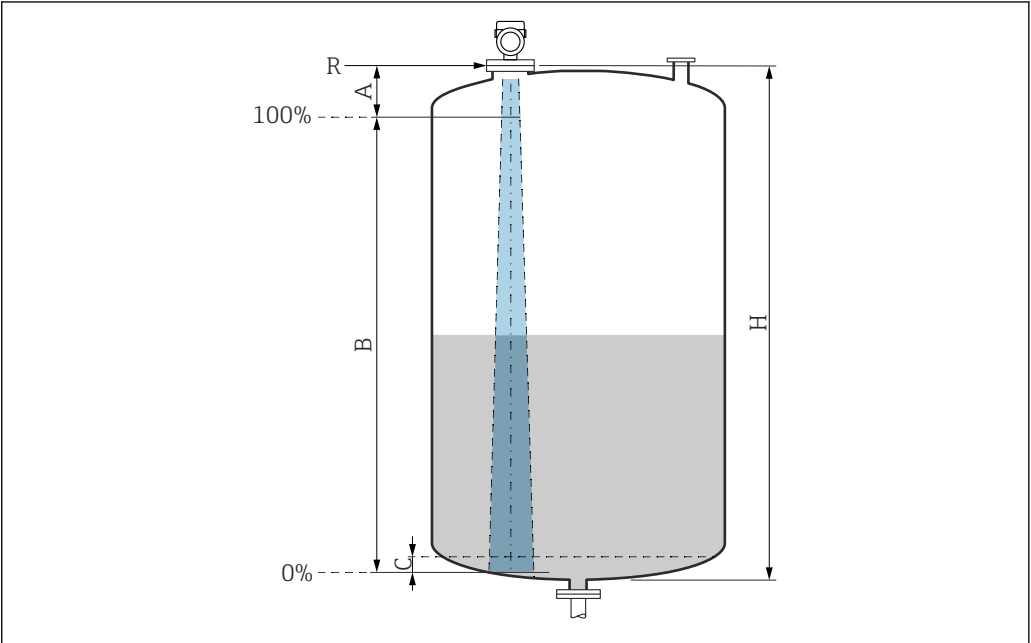
Antenna	Maximum measuring range
40 mm (1.5 in)	20 m (65.6 ft)
80 mm (3 in)	30 m (98.4 ft)

Usable measuring range

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

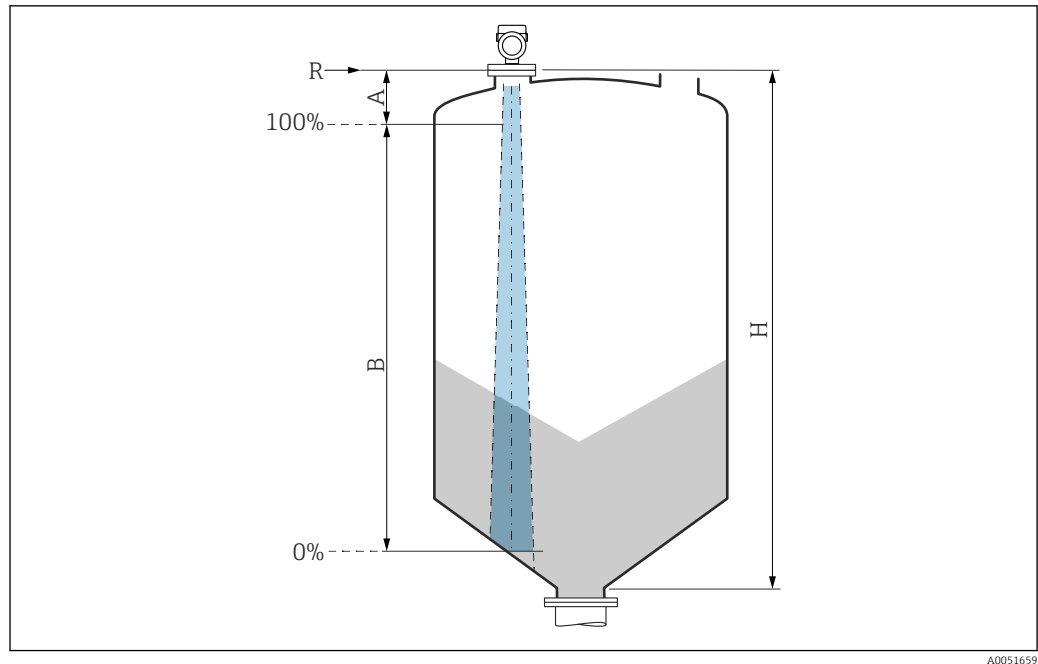
In principle, measurement is possible up to the tip of the antenna.

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 the measurement, varies depending on the antenna system (see section on Mechanical construction)



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

In the case of media with a low dielectric constant $\epsilon_r < 2$, the tank bottom may be visible through the medium when levels are very low (less 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** (ϵ_r 1.4 to 1.9)
Non-conductive liquids, e.g. liquefied gas
- **B** (ϵ_r 1.9 to 4)
Non-conductive liquids, e.g. gasoline, oil, toluene, etc.
- **C** (ϵ_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



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

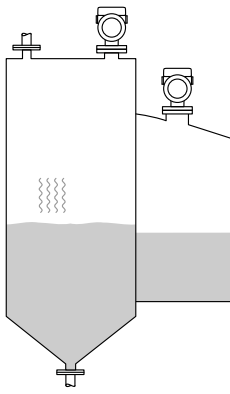
- Relative permittivity (ϵ_r value), Compendium CP01076F
- The Endress+Hauser "DC Values app" (available for Android and iOS)

Measurement in storage vessel

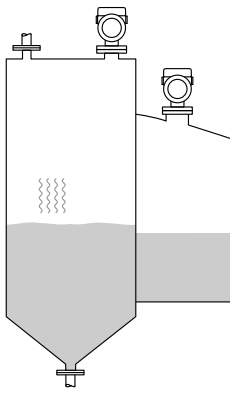
Storage vessel - measuring conditions

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 (ϵ_r 1.4 to 1.9)	10 m (33 ft)
	B (ϵ_r 1.9 to 4)	20 m (65.6 ft)
	C (ϵ_r 4 to 10)	20 m (65.6 ft)
	D (ϵ_r >10)	20 m (65.6 ft)

80 mm (3 in) antenna in storage vessel

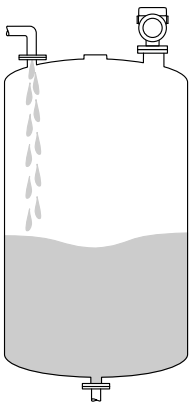
	Media group	Measuring range
	A (ϵ_r 1.4 to 1.9)	12 m (39 ft)
	B (ϵ_r 1.9 to 4)	23 m (75 ft)
	C (ϵ_r 4 to 10)	30 m (98 ft)
	D (ϵ_r >10)	30 m (98 ft)

Measurement in buffer vessel

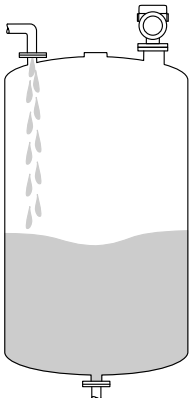
Buffer vessel - measuring conditions

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 (ϵ_r 1.4 to 1.9)	7 m (23 ft)
	B (ϵ_r 1.9 to 4)	13 m (43 ft)
	C (ϵ_r 4 to 10)	20 m (65.6 ft)
	D (ϵ_r >10)	20 m (65.6 ft)

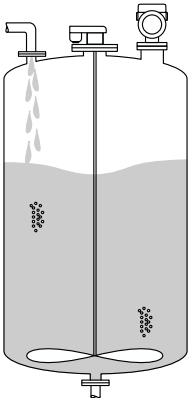
80 mm (3 in) antenna in buffer vessel

	Media group	Measuring range
	A (ϵ_r 1.4 to 1.9)	7.5 m (25 ft)
	B (ϵ_r 1.9 to 4)	15 m (49 ft)
	C (ϵ_r 4 to 10)	28 m (92 ft)
	D ($\epsilon_r > 10$)	30 m (98 ft)

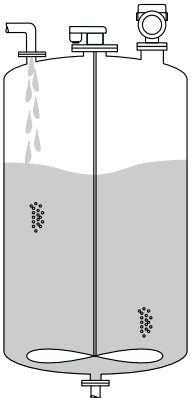
*Measurement in vessel with agitator***Vessel with agitator - measuring conditions**

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 (ϵ_r 1.4 to 1.9)	4 m (13 ft)
	B (ϵ_r 1.9 to 4)	5 m (16.4 ft)
	C (ϵ_r 4 to 10)	13 m (43 ft)
	D ($\epsilon_r > 10$)	20 m (65.6 ft)

80 mm (3 in) antenna in vessel with agitator

	Media group	Measuring range
	A (ϵ_r 1.4 to 1.9)	4 m (13 ft)
	B (ϵ_r 1.9 to 4)	7 m (23 ft)
	C (ϵ_r 4 to 10)	15 m (49 ft)
	D ($\epsilon_r > 10$)	25 m (82 ft)

Operating frequency

approx. 80 GHz

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

Transmission power

- Peak power: <1.5 mW
- Average output power: <70 µW

Output

Output signal

- 4 to 20 mA with superimposed digital communication protocol HART, 2-wire
- 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

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)

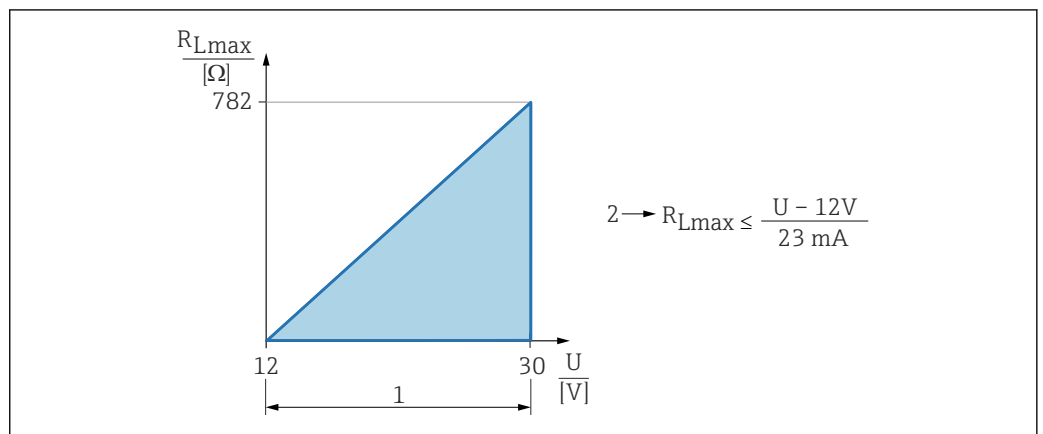
Operating tool via digital communication

Status signal (according to NAMUR Recommendation NE 107):

Plain text display

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.

Damping

Damping affects all continuous outputs.
 Factory setting: 0 s (can be set from 0 to 999 s)

Ex connection data

See the separate technical documentation (Safety Instructions (XA)) on www.endress.com/download.

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)
 - V-notch thin-plate weir (ISO 1438)
- Standard formula

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



For further information on flow measurement over open channels and weirs, see SD03445F.

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

Protocol-specific data

Manufacturer ID:

17(0x0011)

Device type ID:

0x11DE

Device revision:

2

HART specification:

7.6

DD version:

1

Device description files (DTM, DD)

Information and files at:

- www.endress.com
On the product page for the device: Documents/Software → Device drivers
- www.fieldcommgroup.org

HART load:

Min. 250 Ω

The following measured values are assigned to the device variables at the factory:

Device variable	Measured value
Primary variable (PV) ¹⁾	Level linearized
Secondary variable (SV)	Distance
Tertiary variable (TV)	Absolute echo amplitude
Quaternary variable (QV)	Relative echo amplitude

1) The PV is always applied to the current output.

Choice of HART device variables

- Level linearized
- Distance
- Electronics temperature
- Sensor temperature
- Absolute echo amplitude
- Relative echo amplitude
- Area of incoupling
- Percent of range
- Loop current
- Flow
- Totalizer value
- Not used

Supported functions

- Burst mode
- Additional transmitter status
- Device locking

Wireless HART data**Minimum start-up voltage:**

12 V

Start-up current:

< 3.6 mA

Starting time:

< 15 s

Minimum operating voltage:

12 V

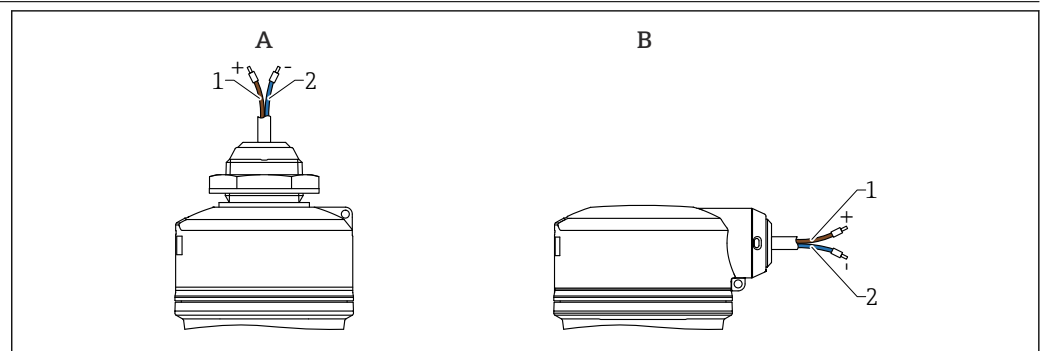
Multidrop current:

4 mA

Time to establish connection:

< 30 s

Power supply

Cable assignment

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3 Cable assignment*A Cable entry from above**B Side cable entry**1 Plus, brown wire**2 Minus, blue wire***Supply voltage**

12 to 30 V DC on a DC power unit

i 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.

Power consumption

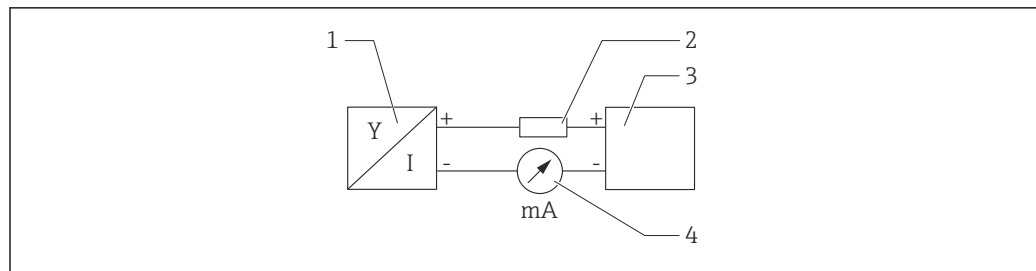
- Non-hazardous area: To meet device safety specifications according to the IEC 61010 standard, the installation must ensure that the maximum current is limited to 500 mA.
- Hazardous area: The maximum current is restricted to $I_i = 100$ mA by the transmitter power supply unit when the measuring instrument is used in an intrinsically safe circuit (Ex ia).

Potential equalization

No special measures for potential equalization are required.

Connecting the device**Function diagram of 4 to 20 mA HART**

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



A0028908

4 Function diagram of HART connection

- 1 Device with HART communication
- 2 HART resistor
- 3 Power supply
- 4 Multimeter or ammeter

i 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

Function diagram of HART device, connection with RIA15, display only without operation, without communication resistor

i The RIA15 remote display can be ordered together with the device.

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

Terminal assignment RIA15

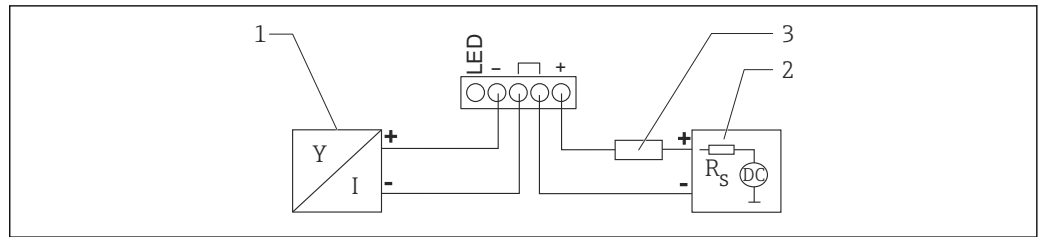
- +
Positive connection, current measurement
- -
Negative connection, current measurement (without backlighting)
- LED
Negative connection, current measurement (with backlighting)
- $\perp$
Functional grounding: Terminal in housing

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

The voltage drop to be taken into account is:

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

Connection of the HART device and RIA15 without backlighting

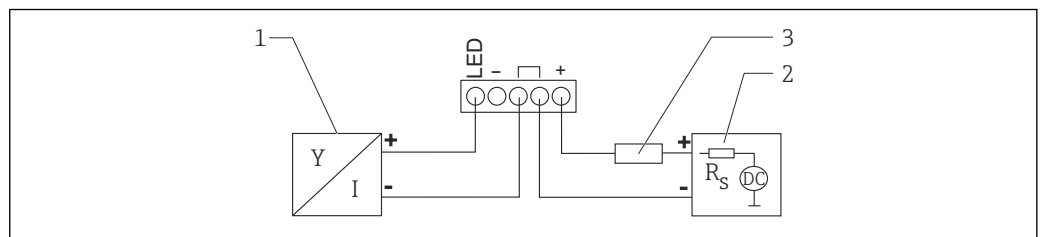


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5 Function diagram of HART device with RIA15 process indicator without light

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

Connection of the HART device and RIA15 with backlighting



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6 Function diagram of HART device with RIA15 process indicator with light

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

Function diagram of HART device, RIA15 display with operation, with communication resistor

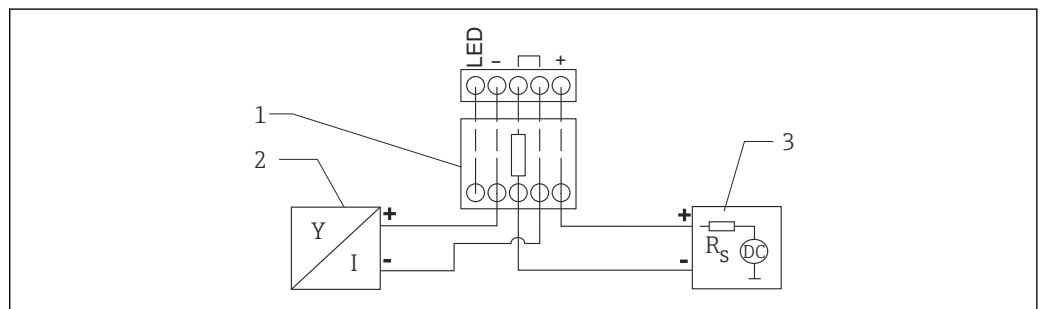


The voltage drop to be taken into account is:
Max. 7 V



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

Connection of the HART communication resistor module, RIA15 without backlighting

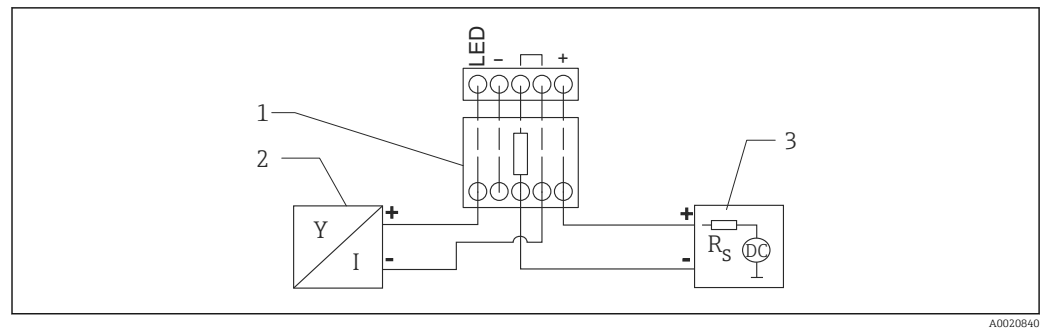


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7 Function diagram of HART device, RIA15 without light, HART communication resistor module

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

Connection of the HART communication resistor module, RIA15 with backlighting



8 Function diagram of HART device, RIA15 with light, HART communication resistor module

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

Cable specification

Unshielded cable, wire cross-section 0.5 mm²

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

As per IEC 60079-11 section 9.4.4, the cable is designed for a tensile strength of 30 N (6.74 lbf) (over a period of 1 h).

The device is available in cable lengths of 5 m (16 ft), 10 m (32 ft), 15 m (49 ft), 20 m (65 ft), 30 m (98 ft) and 50 m (164 ft).

User-defined lengths up to total length of 300 m (980 ft) are possible in increments of one meter (order option "1") or one foot (order "2").

For devices with marine approval:

- Only available with a length of 10 m (32 ft) and "user-defined"
- Halogen-free as per IEC 60754-1
- No development of corrosive fire gases in accordance with IEC 60754-2
- Low flue gas density in accordance with IEC 61034-2

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.

Devices for the "protection by enclosure" explosion protection are equipped with an integrated overvoltage protection system.

Overvoltage category

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

Performance characteristics

Reference operating conditions

- As per IEC 62828-1/IEC 62828-4
- Ambient temperature T_A = constant, in the range of +21 to +33 °C (+70 to +91 °F)
- Humidity ϕ = constant, in the range of: 5 to 80 % RH $\pm$ 5 %
- Atmospheric pressure p_U = constant, in the range of: 860 to 1 060 mbar (12.47 to 15.37 psi)
- Load with HART: 250 Ω
- Supply voltage: DC 24 V $\pm$ 3 V
- Reflector: metal plate with diameter $\geq$ 1 m (40 in)
- No major interference echoes inside the signal beam

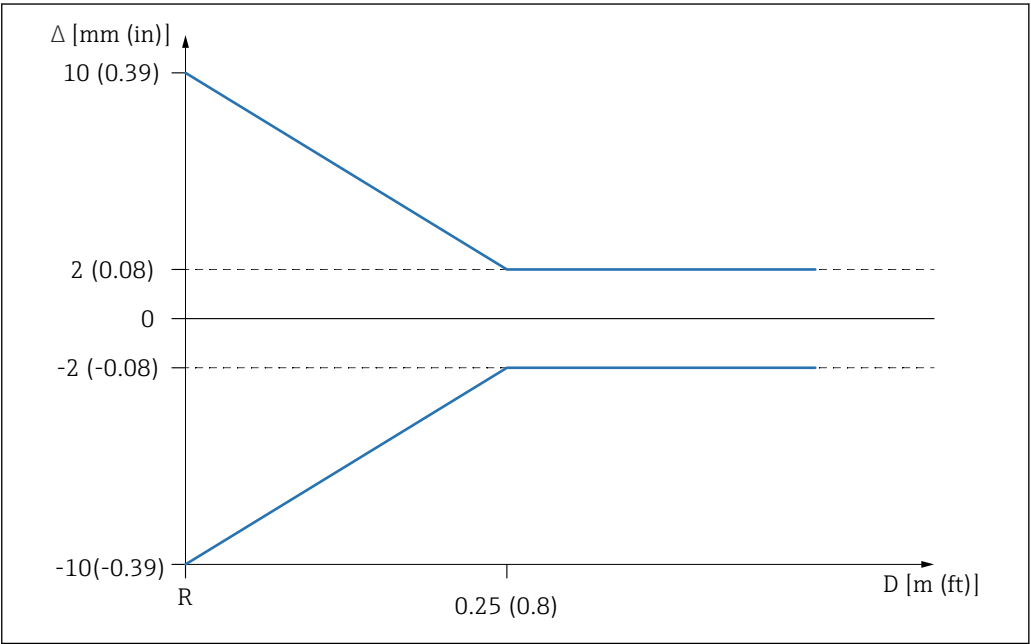
Response time

- HART: acyclic: min. 330 ms, typically 590 ms (depending on commands and number of preambles)
- HART: cyclic (burst): min. 160 ms, typically 350 ms (depending on commands and number of preambles)

Resolution	Current output: < 1 μ A Digital: 1 mm (0.04 in)
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Maximum measurement error	Reference accuracy Accuracy The accuracy is the sum of the non-linearity, non-repeatability and hysteresis. For liquids: ■ Measuring distance up to 0.25 m (0.82 ft): max. ± 10 mm (± 0.39 in) ■ Measuring distance > 0.25 m (0.82 ft): ± 2 mm (± 0.08 in) For solids: ■ Measuring distance up to 0.8 m (2.6 ft): max. ± 20 mm (± 0.79 in) ■ Measuring distance > 0.8 m (2.6 ft): ± 4 mm (± 0.16 in) Non-repeatability Non-repeatability is already included in the accuracy. ≤ 1 mm (0.04 in)  If conditions deviate from the reference operating conditions, the offset/zero point that results from the installation conditions can be up to ± 4 mm (± 0.16 in). This additional offset/zero point can be eliminated by entering a correction (Level correction parameter) during commissioning.
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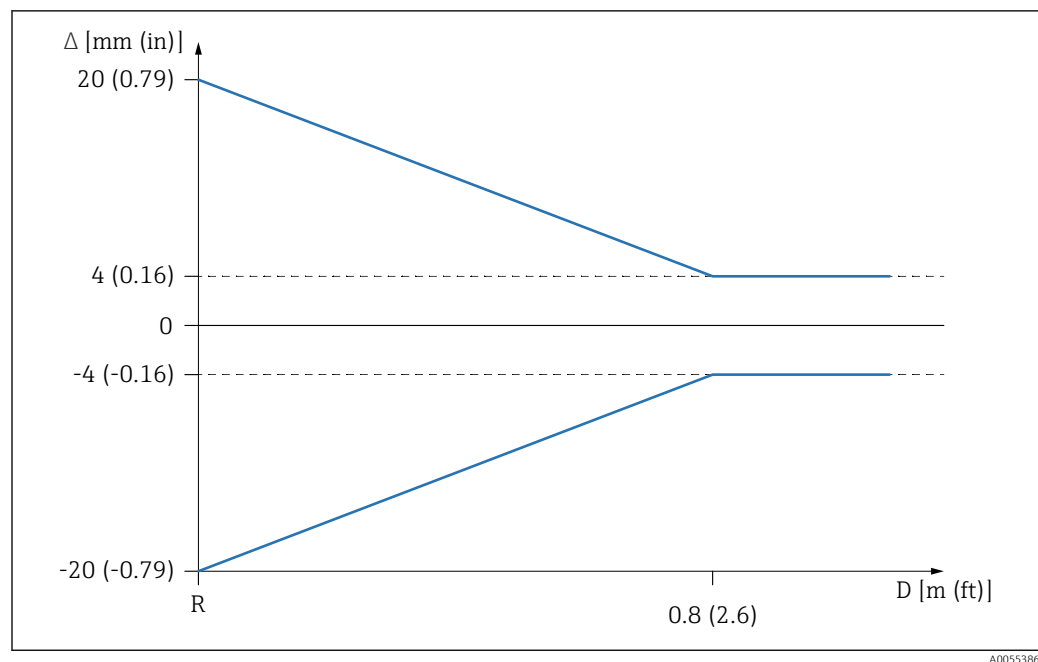
Differing values in near-range applications for liquids



 9 Maximum measurement error in near-range applications

- Δ Maximum measurement error
- R Reference point of the distance measurement
- D Distance from reference point of antenna

Differing values in near-range applications for solids



10 Maximum measurement error in near-range applications

Δ Maximum measurement error

R Reference point of the distance measurement

D Distance from reference point of antenna

Influence of ambient temperature

The output changes due to the effect of the ambient temperature with respect to the reference temperature.

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

Digital output (HART)

Average $T_C = \pm 2 \text{ mm } (\pm 0.08 \text{ in}) / 10 \text{ K}$

Analog (current output)

- Zero point (4 mA): average $T_C = 0.02 \% / 10 \text{ K}$
- Span (20 mA): average $T_C = 0.05 \% / 10 \text{ K}$

Reaction time

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

The response time can be configured.

The following step response times apply (in accordance with IEC 61298-2/IEC 60770-1) when damping is switched off:

- Measuring rate $\leq 250 \text{ ms}$ at operating voltage 24 V
- Step response time $< 1 \text{ s}$

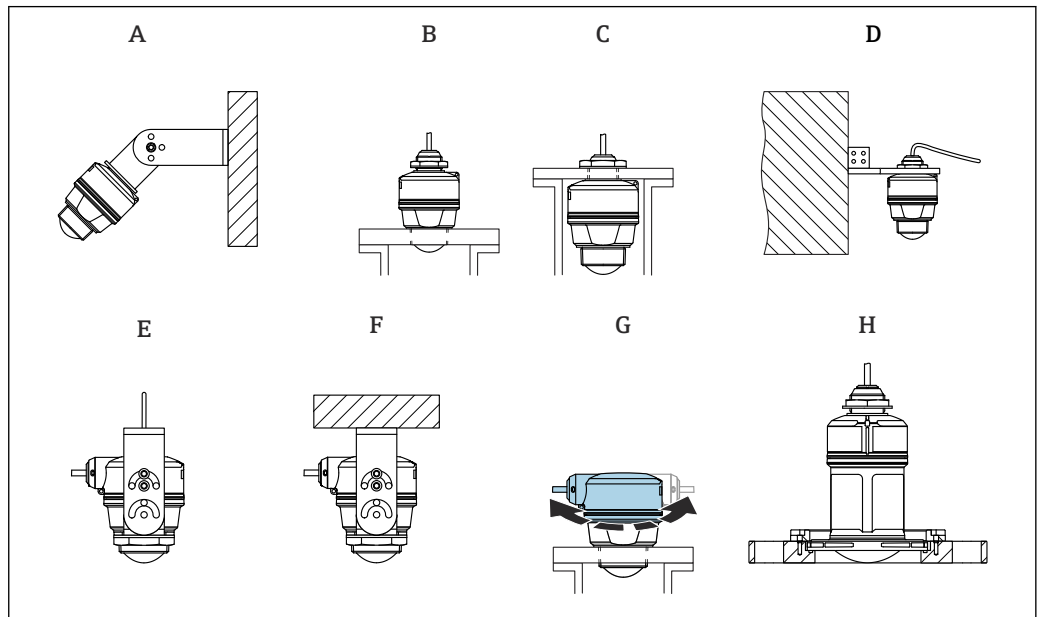
Warm-up time

The warm-up time (in accordance with IEC 62828-4) indicates the time required for the device to reach its maximum accuracy or performance after the supply voltage is energized.

Warm-up time: $\leq 15 \text{ s}$

Installation

Installation types



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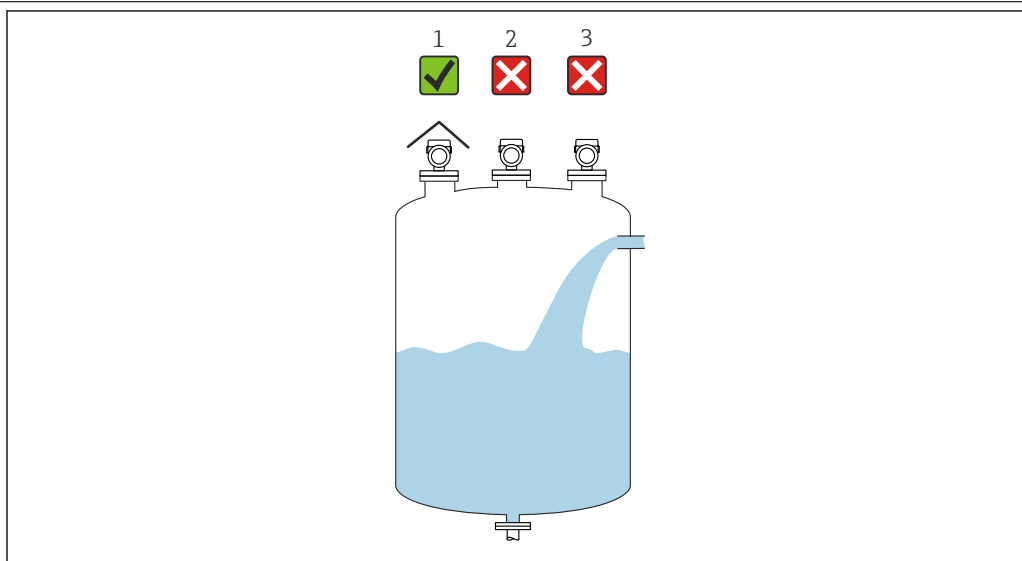
11 Wall or ceiling mount

- A Wall mounting adjustable
- B Tightened at antenna end process connection
- C Tightened at cable entry from above process connection
- D Wall mounting with cable entry from above process connection
- E Rope mounting with cable entry at the side
- F Ceiling mounting with cable entry at the side
- G Cable entry at the side, top housing section can be rotated
- H Mounting with UNI slip-on flange



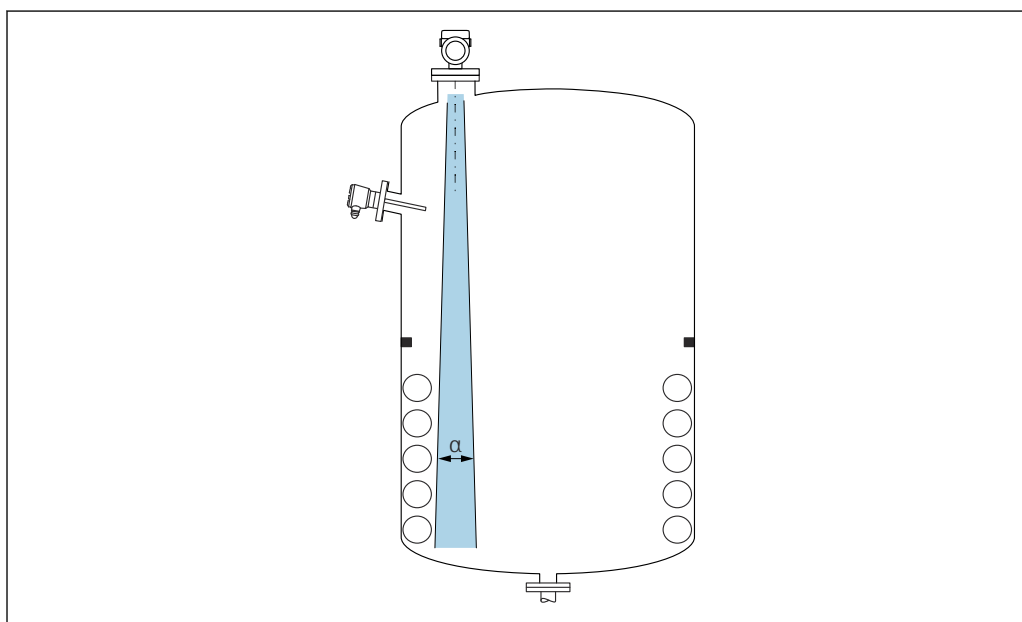
Please note the following:

- 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.
- For devices with side cable outlet and 80 mm antenna, installation is only possible with a UNI slip-on flange.

Mounting location

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- 1 Use of a weather protection cover; protection from direct sunlight or rain
- 2 Installation not centered: Interferences can lead to incorrect signal analysis
- 3 Do not install above the filling curtain

Orientation**Internal vessel fittings**

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

Vertical alignment of antenna axis

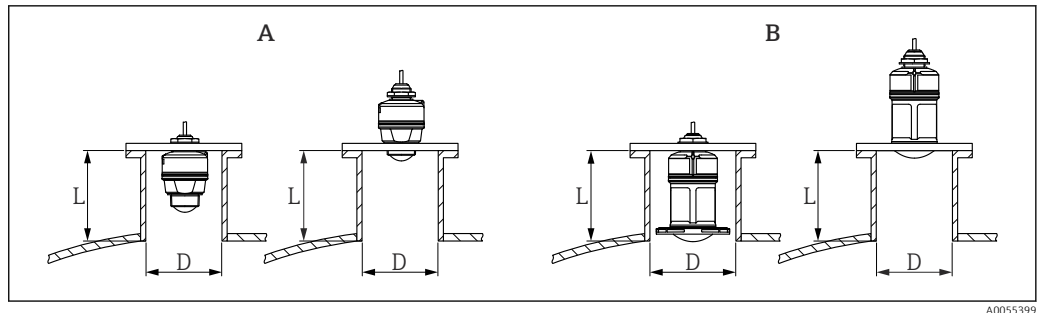
Align the antenna so that it is perpendicular to the product surface.



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.

Installation instructions

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



12 Nozzle installation

- A 40 mm (1.5 in) antenna
B 80 mm (3 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. $100 \text{ mm (3.94 in)} + (D - 30 \text{ mm (1.2 in)}) \times 7.5$

80 mm (3 in) antenna, installation inside nozzle

- D: min. 120 mm (4.72 in)
- L: max. $140 \text{ mm (5.51 in)} + (D - 50 \text{ mm (2 in)}) \times 12$

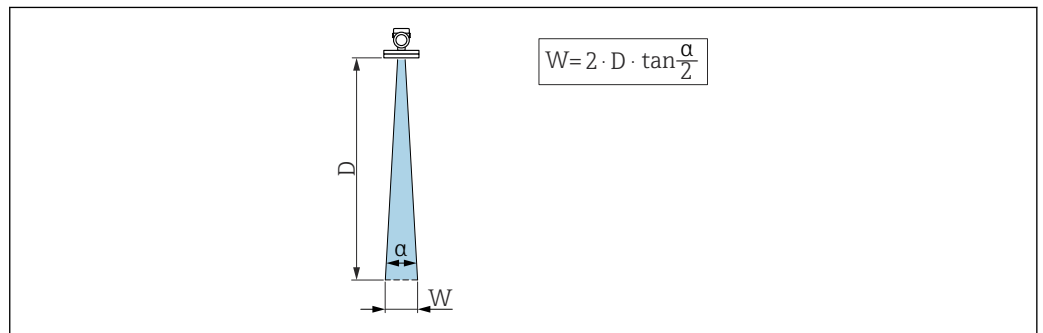
80 mm (3 in) antenna, installation outside nozzle

- D: min. 80 mm (3 in)
- L: max. $(D - 50 \text{ mm (2 in)}) \times 12$

Beam angle

Calculation

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

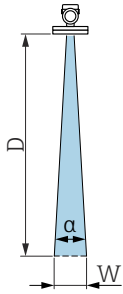


13 Relationship between beam angle α , distance **D** and beamwidth diameter **W**

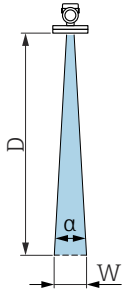


The beamwidth diameter **W** depends on the beam angle α and the distance **D**.

Antenna 40 mm (1.5 in), $\alpha = 8^\circ$

$W = D \times 0.14$	D	W
	5 m (16 ft)	0.70 m (2.29 ft)
	10 m (33 ft)	1.40 m (4.58 ft)
	15 m (49 ft)	2.09 m (6.87 ft)
	20 m (66 ft)	2.79 m (9.16 ft)

Antenna 80 mm (3 in), $\alpha = 4^\circ$

$W = D \times 0.07$	D	W
	5 m (16 ft)	0.35 m (1.15 ft)
	10 m (33 ft)	0.70 m (2.30 ft)
	15 m (49 ft)	1.05 m (3.45 ft)
	20 m (66 ft)	1.40 m (4.59 ft)
	25 m (82 ft)	1.75 m (5.74 ft)
	30 m (98 ft)	2.10 m (6.89 ft)

Special installation instructions**External measurement through plastic cover or dielectric windows**

- Dielectric constant of medium: $\epsilon_r \geq 10$
- The distance from the tip of the antenna to the tank should be approx. 100 mm (4 in).
- Avoid installation positions where condensate or buildup can form between the antenna and the vessel
- In the case of outdoor installations, ensure that the area between the antenna and the tank is protected from the weather
- Do not install any fittings or attachments between the antenna and the tank that could reflect the signal

The thickness of the tank ceiling or the dielectric window depends on the ϵ_r of the material.

The material thickness can be a full multiple of the optimum thickness (table); it is important to note, however, that the microwave transparency decreases significantly with increasing material thickness.

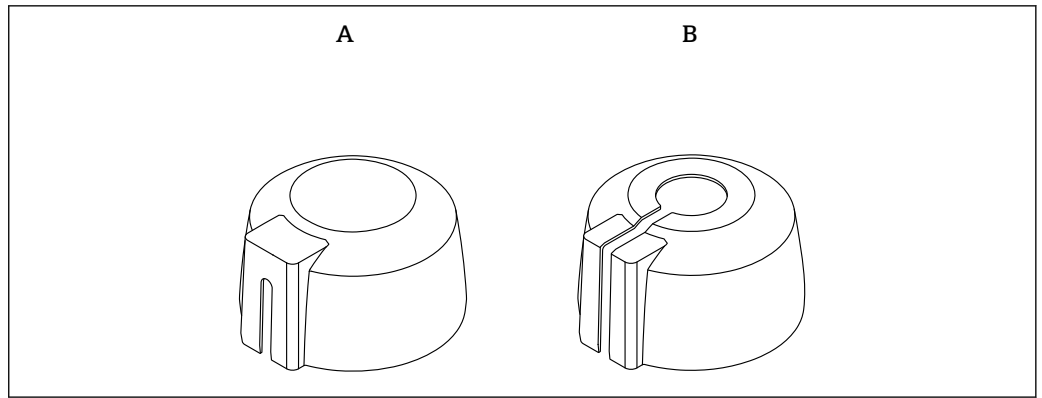
Optimum material thickness

Material	Optimum material thickness
PE; ϵ_r 2.3	1.25 mm (0.049 in)
PTFE; ϵ_r 2.1	1.30 mm (0.051 in)
PP; ϵ_r 2.3	1.25 mm (0.049 in)
Perspex; ϵ_r 3.1	1.10 mm (0.043 in)

Weather protection cover

A weather protective cover is recommended for outdoor use.

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



A0055201

 14 Weather protective cover

A Side cable entry

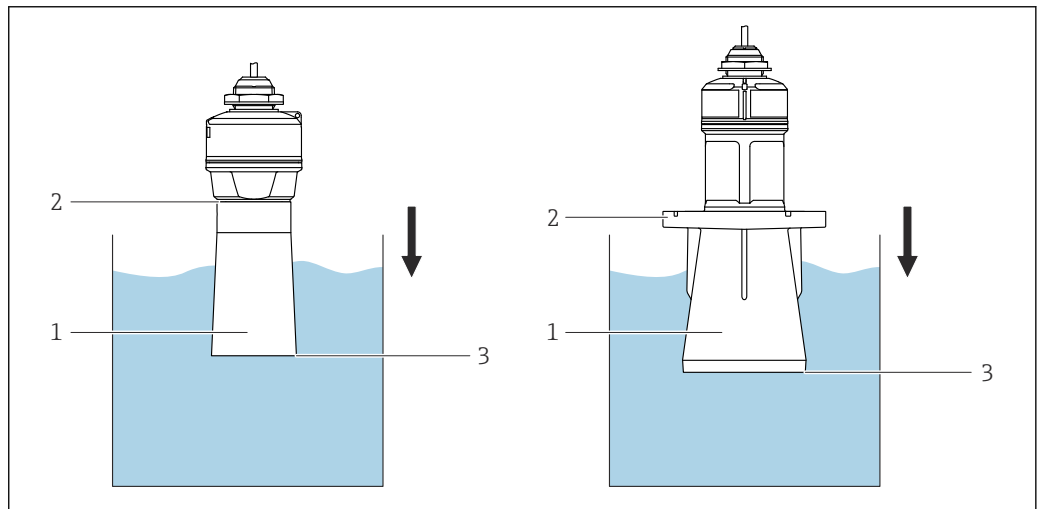
B Cable entry from above

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

Flooding protection tube

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

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



A0055202

 15 Function of flooding protection tube

1 Air pocket

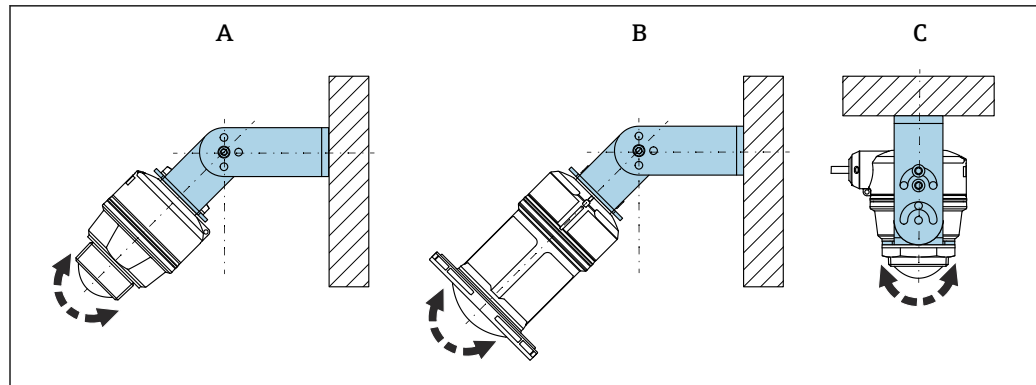
2 O-ring (EPDM) seal

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 case of flooding, the air cushion formed within the sleeve guarantees precise detection of the maximum fill level, located directly at the sleeve's end.

Installation with mounting bracket, adjustable

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



A0055113

16 Installation with mounting bracket, adjustable

- A Mounting bracket adjustable for 40 mm (1.5 in) antenna, wall mounting
 B Mounting bracket adjustable for 80 mm (3 in) antenna, wall mounting
 C Mounting bracket adjustable for 40 mm (1.5 in) antenna, ceiling mounting

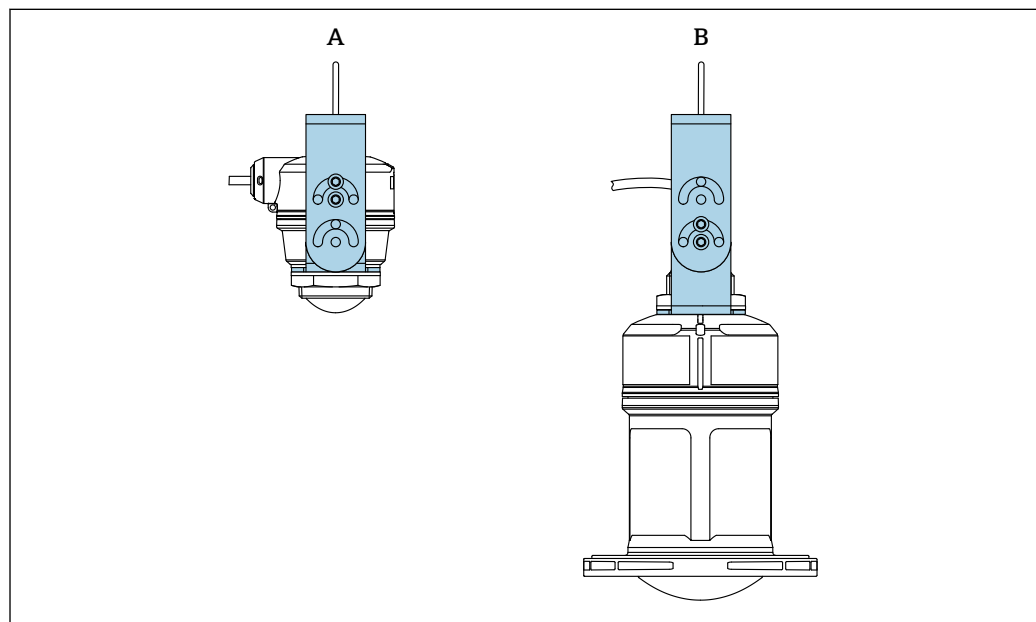
- Wall or ceiling mounting is possible
- Align the antenna vertically to the product surface using the mounting bracket

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



A0055397

17 Installation with rope mounting

- A Mounting bracket adjustable for 40 mm (1.5 in) antenna, rope mounting
 B Mounting bracket adjustable for 80 mm (3 in) antenna, rope mounting

Align the antenna perpendicular to the product surface.

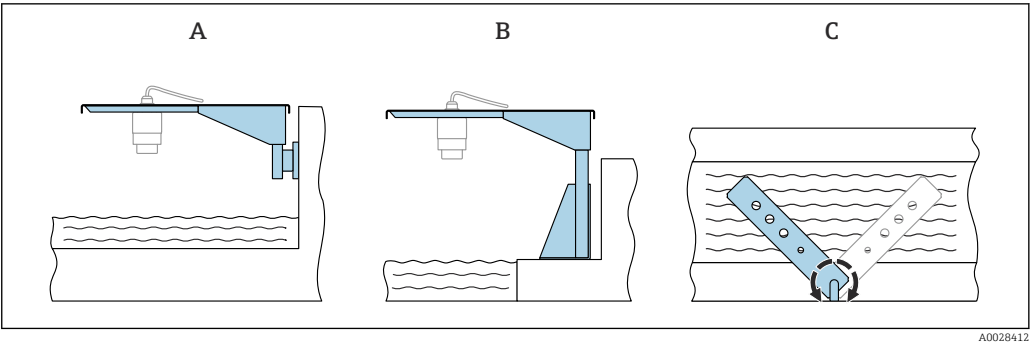


In the case of rope mounting, the cable must not be used to suspend the device.

Use separate rope.

Cantilever installation, with pivot

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



18 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)

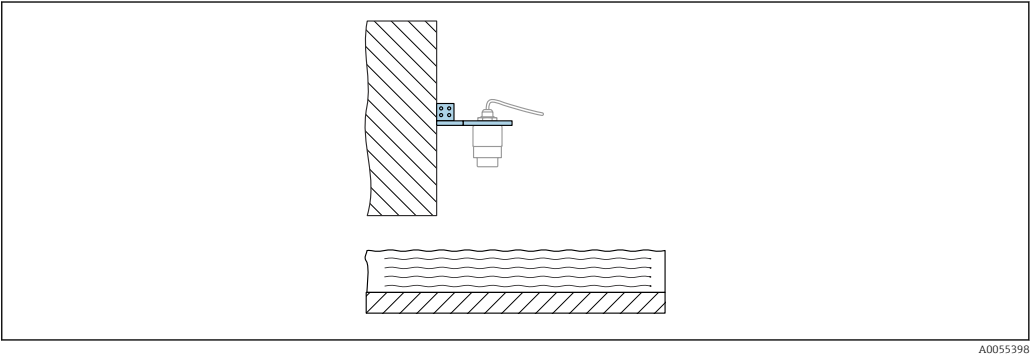
NOTICE

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.

Mounting with a pivotable mounting bracket

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



19 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.

Environment

Ambient temperature range	–40 to +80 °C (–40 to +176 °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.
Storage temperature	–40 to +80 °C (–40 to +176 °F)
Climate class	According to IEC 60068-2-38 test Z/AD (relative humidity 4 to 100 %).
Operating height	Up to 5 000 m (16 404 ft) above sea level

Degree of protection	Testing according to IEC 60529 and NEMA 250: ■ IP66, NEMA Type 4X ■ IP68, NEMA Type 6P (24 h at 1.83 m (6.00 ft) under water)
Vibration resistance	■ Stochastic noise (random sweep) as per 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
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).

Process

Process temperature, process pressure



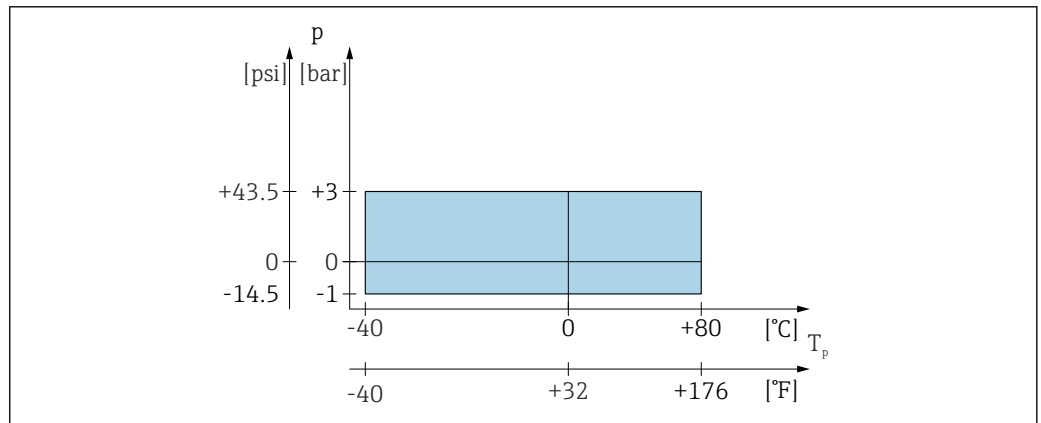
The maximum pressure for the device depends on the lowest-rated element with regard to pressure.

Components are: process connection, optional mounting parts, or accessories.

WARNING

Incorrect design or use of the device may cause injury due to bursting parts!

- ▶ 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. Observe the temperature dependency of the maximum working pressure. 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). Maximum working pressure 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.



A0056003

20 Permitted range for process temperature and process pressure

Process temperature range

-40 to +80 °C (-40 to +176 °F)

Process pressure range, 40 mm (1.5 in) antenna

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

Process pressure range, 80 mm (3 in) antenna with UNI slip-on flange 3", 4"

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

Process pressure range, 80 mm (3 in) antenna with UNI slip-on flange 6"

For unpressurized applications



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

Relative permittivity

For liquids

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

For bulk solids

$\epsilon_r \geq 1.6$

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



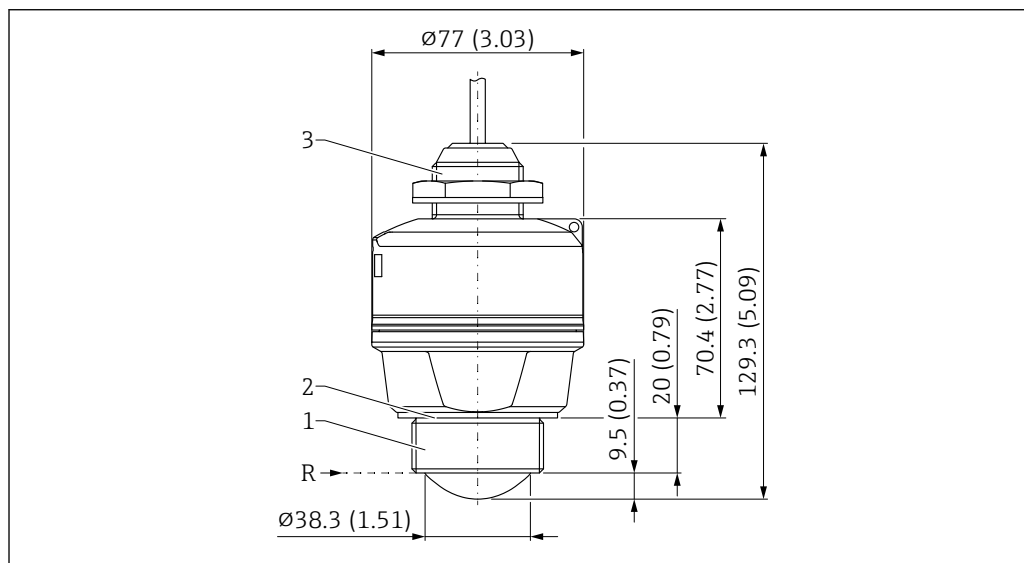
For the relative permittivity values (ϵ_r values) of many media commonly used in industry, please refer to:

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

Mechanical construction

Dimensions

40 mm (1.5 in) antenna, cable entry from above



A0055109

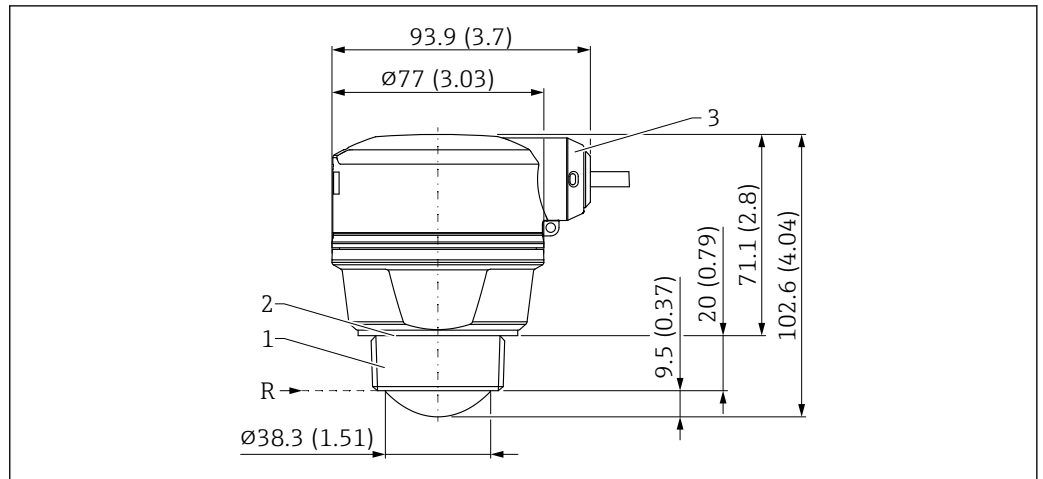
21 Dimensions; 40 mm (1.5 in) antenna with cable entry from above. Unit of measurement mm (in)

- R Reference point of the measurement
 1 Antenna end process connection, thread
 2 EPDM seal (G 1 1/2 thread)
 3 Cable entry from above process connection



The seal thickness is 2 mm (0.08 in).

40 mm (1.5 in) antenna, cable entry at the side



A0055112

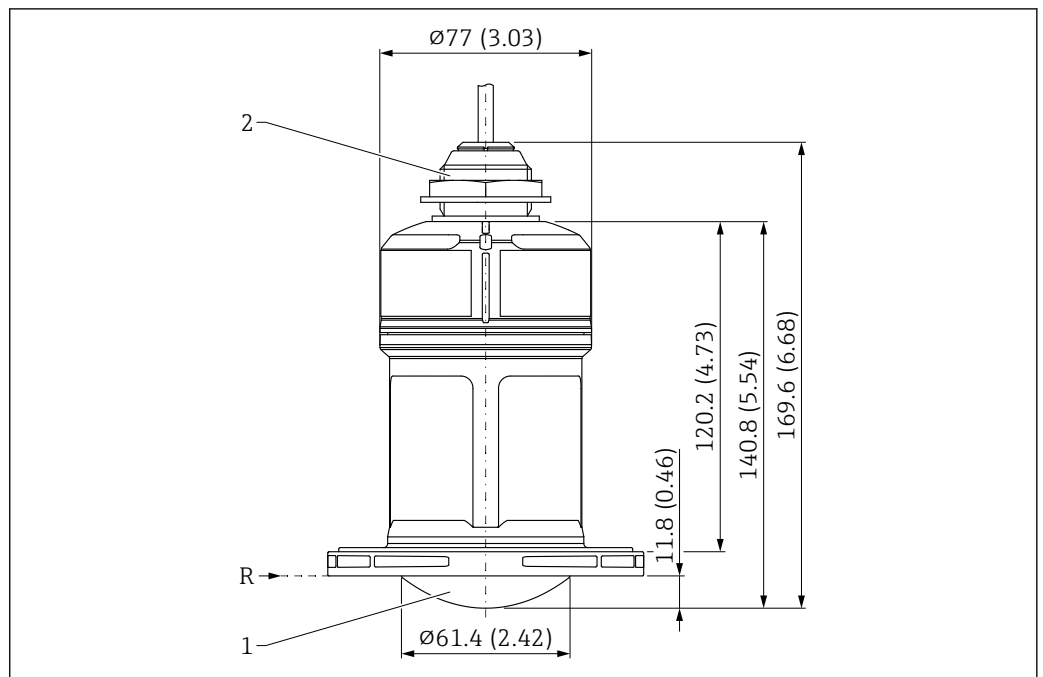
22 Dimensions; 40 mm (1.5 in) antenna with cable entry at the side. Unit of measurement mm (in)

- R Reference point of the measurement
 1 Antenna end process connection, thread
 2 EPDM seal (G 1 1/2 thread)
 3 Side cable entry



The seal thickness is 2 mm (0.08 in).

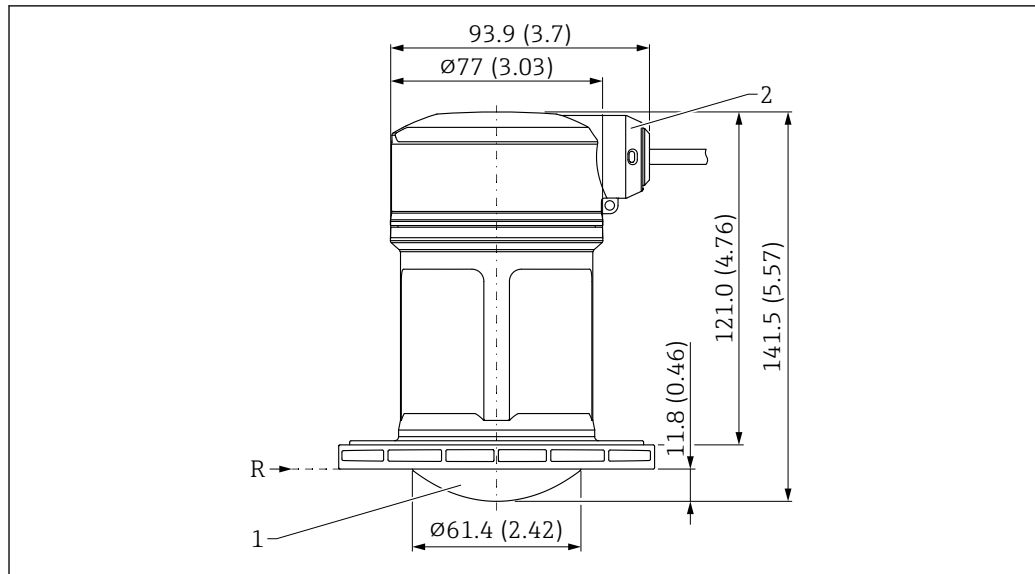
80 mm (3 in) antenna, cable entry from above



A0055111

23 Dimensions; 80 mm (3 in) antenna with cable entry from above. Unit of measurement mm (in)

- R Reference point of the measurement
 1 Antenna end process connection, without; prepared for UNI slip-on flange
 2 Cable entry from above process connection

80 mm (3 in) antenna, cable entry at the side

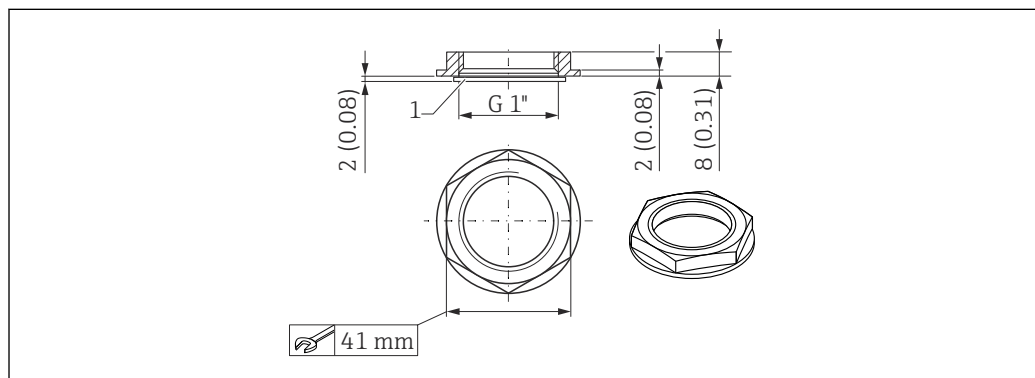
A0055110

24 Dimensions; 80 mm (3 in) antenna with cable entry at the side

R Reference point of the measurement

1 Antenna end process connection, without; prepared for UNI slip-on flange

2 Side cable entry

Counter nut, cable entry from above process connection

A0028419

25 Dimensions; counter nut, cable entry from above process connection. Unit of measurement mm (in)

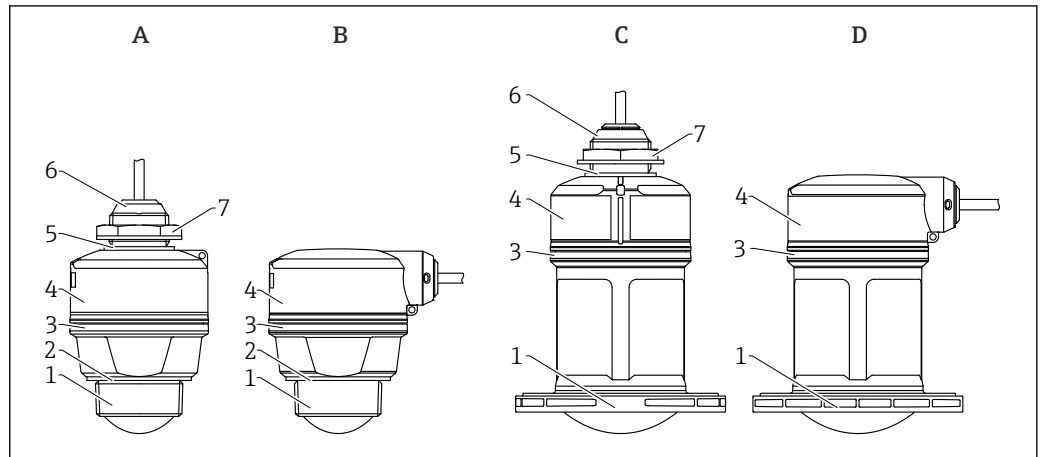
1 Seal

- The counter nut with seal (EPDM) is included in the scope of delivery
- Material: PA6.6

Weight**Weight (including 5 m (16 ft) cable)**

- Device with 40 mm (1.5 in) antenna: approx. 0.5 kg (1.1 lb)
- Device with 80 mm (3 in) antenna: approx. 0.7 kg (1.5 lb)

Materials



A0055121

26 Device design

- A 40 mm (1.5 in) antenna, cable entry from above
 B 40 mm (1.5 in) antenna, cable entry at the side
 C 80 mm (3 in) antenna, cable entry from above
 D 80 mm (3 in) antenna, cable entry at the side
 1 Antenna end process connection; PVDF
 2 EPDM seal (for G 1½" thread)
 3 PBT/PC design ring
 4 Sensor housing/Cable entry process connection; PBT/PC (for dust ignition-proof devices: PC)
 5 EPDM seal
 6 Cable entry; PBT/PC (for dust ignition-proof devices: PC)
 7 Counter nut; PA6.6

Connecting cable

Available cable length: 5 to 300 m (16 to 980 ft)

Material : PVC

For devices with marine approval: halogen-free cable (material: XLPE = connected polyethylene)

Operability

Operating concept

Operator-oriented menu structure for user-specific tasks

- Guidance
- Diagnostics
- Application
- System

Fast and safe commissioning

- Interactive wizard with graphical interface for guided commissioning in FieldCare/DeviceCare or SmartBlue app
- Menu guidance with brief descriptions of the individual parameter functions

Integrated data memory

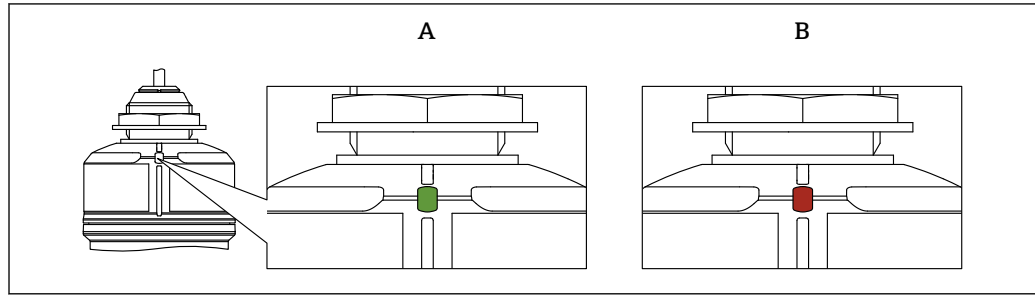
Up to 100 event messages recorded in the device

Efficient diagnostic behavior increases measurement reliability

- Remedial action is integrated in plain text
- Diverse simulation options

Bluetooth® wireless technology (optional)

- Quick and easy setup with the SmartBlue app or Field Xpert SMT70/SMT77
- No additional tools or adapters required
- Encrypted single point-to-point data transmission (tested by Fraunhofer Institute) and password-protected communication via Bluetooth® wireless technology
- The device can be retrofitted with Bluetooth® wireless technology

LED indicator

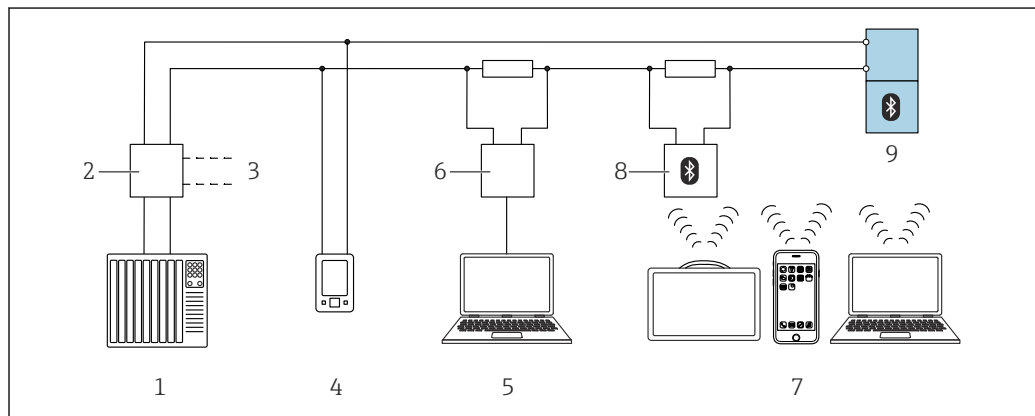
A0055146

27 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)

Remote operation**Via HART protocol or Bluetooth® wireless technology**

A0044334

28 Options for remote operation via HART protocol

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

Operation via Bluetooth® wireless technology (optional)**Prerequisite**

- Device with Bluetooth® wireless technology order option
- Smartphone or tablet with Endress+Hauser SmartBlue app or PC with DeviceCare from version 1.07.07 or Field Xpert 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.

Supported operating tools

Smartphone or tablet with Endress+Hauser SmartBlue app, DeviceCare from version 1.07.07, FieldCare, AMS and PDM

Certificates and approvals

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

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

Other certificates and approvals for the product are available under <https://www.endress.com->Downloads>.

Radio standard EN 302729

The devices are approved for unrestricted use inside and outside closed containers in countries of the EU and the EFTA. As a prerequisite, the countries must have already implemented this standard.

The standard is already implemented in the following countries:

Belgium, Bulgaria, Germany, Denmark, Estonia, France, Greece, UK, Ireland, Iceland, Italy, Liechtenstein, Lithuania, Latvia, Malta, The Netherlands, Norway, Austria, Poland, Portugal, Romania, Sweden, Switzerland, Slovakia, Spain, Czech Republic and Cyprus.

Implementation is still underway in all of the countries not listed.

Please note the following for operation of the devices outside of closed vessels:

- Installation must be carried out by properly trained, expert staff
- The device antenna must be installed in a fixed location pointing vertically downwards
- The mounting site must be located at a distance of 4 km (2.49 mi) from the astronomy stations listed below or otherwise approval must be provided by the relevant authority. If a device is installed within a radius of 4 to 40 km (2.49 to 24.86 mi) around one of the listed stations, it must not be installed at a height of more than 15 m (49 ft) above the ground

Astronomy stations

Country	Name of the station	Latitude	Longitude
Germany	Effelsberg	50° 31' 32" North	06° 53' 00" East
Finland	Metsähovi	60° 13' 04" North	24° 23' 37" East
	Tuorla	60° 24' 56" North	24° 26' 31" East
France	Plateau de Bure	44° 38' 01" North	05° 54' 26" East
	Floirac	44° 50' 10" North	00° 31' 37" West
Great Britain	Cambridge	52° 09' 59" North	00° 02' 20" East
	Damhall	53° 09' 22" North	02° 32' 03" West
	Jodrell Bank	53° 14' 10" North	02° 18' 26" West
	Knockin	52° 47' 24" North	02° 59' 45" West
	Pickmere	53° 17' 18" North	02° 26' 38" West
Italy	Medicina	44° 31' 14" North	11° 38' 49" East
	Noto	36° 52' 34" North	14° 59' 21" East
	Sardinia	39° 29' 50" North	09° 14' 40" East
Poland	Fort Skala Krakow	50° 03' 18" North	19° 49' 36" East
Russia	Dmitrov	56° 26' 00" North	37° 27' 00" East
	Kalyazin	57° 13' 22" North	37° 54' 01" East
	Pushchino	54° 49' 00" North	37° 40' 00" East
	Zelenchukskaya	43° 49' 53" North	41° 35' 32" East
Sweden	Onsala	57° 23' 45" North	11° 55' 35" East
Switzerland	Bleien	47° 20' 26" North	08° 06' 44" East

Country	Name of the station	Latitude	Longitude
Spain	Yebes	40° 31' 27" North	03° 05' 22" West
	Robledo	40° 25' 38" North	04° 14' 57" West
Hungary	Penc	47° 47' 22" North	19° 16' 53" East

 As a general rule, the requirements outlined in EN 302729 must be observed.

FCC

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

[Any] changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

The devices are compliant with the FCC Code of Federal Regulations, CFR 47, Part 15, Sections 15.205, 15.207, 15.209.

To comply with FCC RF Exposure requirements for an uncontrolled environment, this device must be installed and operated to assure a minimum separation distance of at least 20 cm.

 In addition, the devices are compliant with Section 15.256. For these LPR (Level Probe Radar) applications the devices must be professionally installed in a downward operating position. In addition, the devices are not allowed to be mounted in a zone of 4 km (2.49 mi) around RAS stations and within a radius of 40 km (24.86 mi) around RAS stations the maximum operation height of devices is 15 m (49 ft) above ground.

Industry Canada

Canada CNR-Gen Section 8.4

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) This device may not interfere, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

[Any] changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

- The installation of the LPR/TLPR device shall be done by trained installers, in strict compliance with the manufacturer's instructions.
- The use of this device is on a "no-interference, no-protection" basis. That is, the user shall accept operations of high-powered radar in the same frequency band which may interfere with or damage this device. However, devices found to interfere with primary licensing operations will be required to be removed at the user's expense.
- To comply with ISED RF Exposure requirements for an uncontrolled environment, this device must be installed and operated to assure a minimum separation distance of at least 20 cm.
- The installer/user of this device shall ensure that it is at least 10 km from the Dominion Astrophysical Radio Observatory (DRAO) near Penticton, British Columbia. The coordinates of the DRAO are latitude 49°19'15" N and longitude 119°37'12" W. For devices not meeting this 10 km separation (e.g., those in the Okanagan Valley, British Columbia,) the installer/user must coordinate with, and obtain the written concurrence of, the Director of the DRAO before the equipment can be installed or operated. The Director of the DRAO may be contacted at 250-497-2300 (tel.) or 250-497-2355 (fax). (Alternatively, the Manager, Regulatory Standards Industry Canada, may be contacted.)

Pressure equipment with permitted pressure less than 200 bar, no pressure-bearing volume

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

If pressure equipment does not have a pressure-bearing housing, there is no pressure accessory present within the meaning of the Directive.

 Druckgeräterichtlinie DGRL (PED) 2014/68/EU, Artikel 2, Absatz 5

Ordering information

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

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



Product Configurator - the tool for individual product configuration

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

Tagging

Measuring point (TAG)

The device can be ordered with a tag name.

Location of tag name

In the additional specification, select:

- Stainless steel tag plate
- TAG provided by the customer
- IEC 61406 stainless steel TAG
- IEC 61406 stainless steel, stainless steel TAG
- IEC 61406 stainless steel TAG, plate provided

Definition of tag name

In the additional specification, specify:

Three lines of maximum 18 characters each

The specified tag name appears on the selected plate.

Visualization in SmartBlue app

The first 32 characters of the tag name

The tag name can always be changed specifically for the measuring point via Bluetooth® wireless technology.

Display in electronic nameplate (ENP)

The first 32 characters of the tag name



For details, refer to document SD03128P

Factory verification certificate

A factory verification certificate can be selected using the Product Configurator.

The verification points (three points) are defined at the following distances from the reference point:

- 2 m
- 4 m
- 6 m



Verification is performed under reference operating conditions.

Service

The following services, among others, can be selected using the Product Configurator.

- Cleaned of oil+grease (wetted)
- PWIS-free (paint-wetting impairment substances)
- Set medium
- Set damping
- Set max. alarm current
- Bluetooth® communication is disabled on delivery
- Customized empty/full calibration
- Product documentation on paper

A printed (hard copy) version of test reports, declarations and inspection certificates can optionally be ordered via the **Service**, Version, **Product documentation on paper** option. The required documents can be selected under the feature **Test, certificate, declaration** and are then included with the device on delivery.

Application packages

The application package can be ordered together with the device or can be activated subsequently with an activation code. Detailed information on the relevant order code is available from the website www.endress.com or from the Endress +Hauser Sales Center.

Heartbeat Technology

Heartbeat Technology offers diagnostic functionality by means of continuous self-monitoring as well as in-situ verification of devices in the application.

Heartbeat Diagnostics

Continuous self-monitoring of the device.

Diagnostic messages output to:

- An asset management system (e.g. FieldCare or DeviceCare)
- An automation system (e.g. PLC)

Heartbeat Verification

- Monitoring of the installed device without interrupting the process, including a verification report
- Clear measuring point assessment (pass/fail) with high total test coverage as part of the manufacturer's specification
- Can be used to document normative requirements
- Meets the requirements for metrological traceability in accordance with ISO 9001 (ISO 9001:2015 Section 7.1.5.2)

 The verification report can be generated via Bluetooth® and HART.

Detailed description

 See Special Documentation for SD Heartbeat Technology.

Accessories

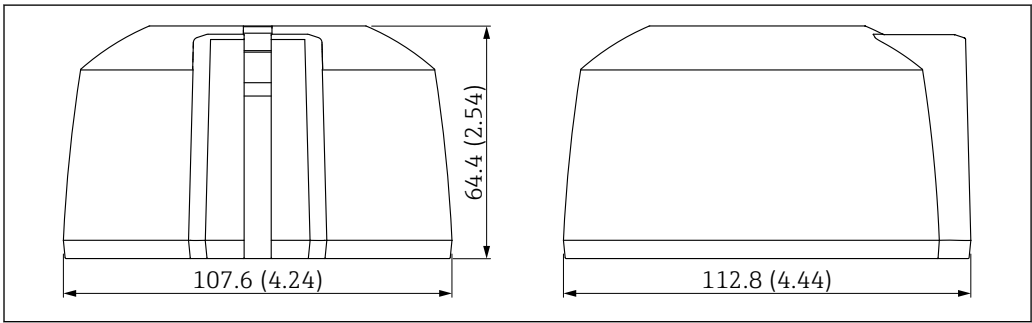
Accessories currently available for the product can be selected via the Product Configurator at www.endress.com:

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.

Weather protective cover for device with cable entry from above

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



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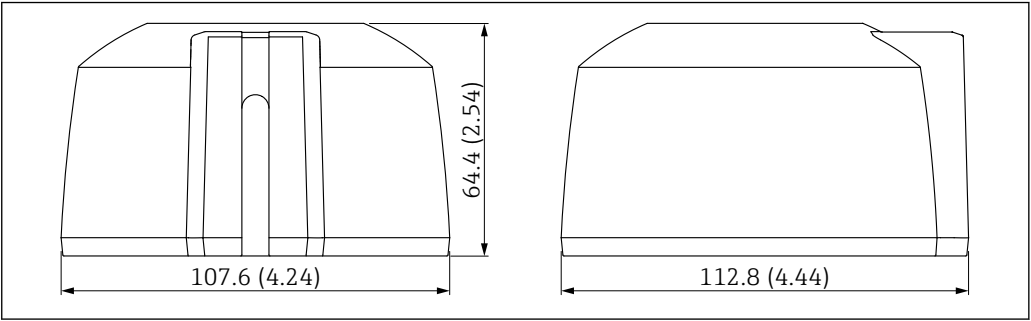
 29 Dimensions for protective cover G1/NPT1, cable entry from above. Unit of measurement mm (in)

Material
PBT/PC

Order code
71662413

Weather protective cover for device with cable entry at side

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

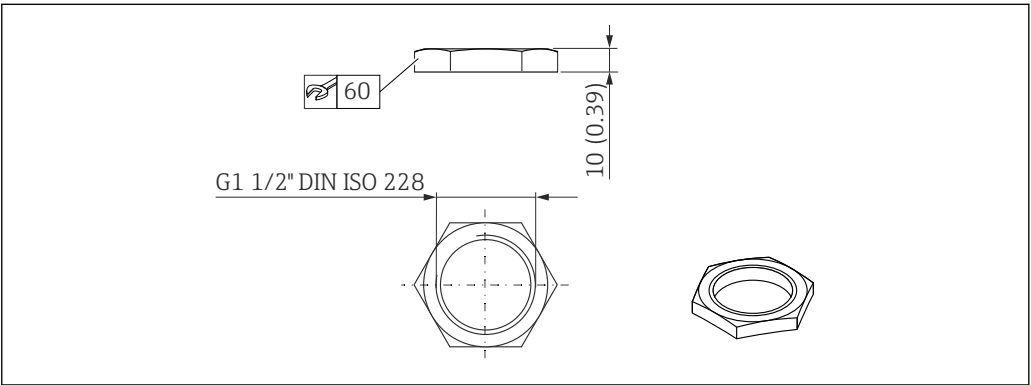


 30 Dimensions for protective cover with cable entry at the side. Unit of measurement mm (in)

Material
PBT/PC
Order code
71662414

Securing nut G 1½"

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

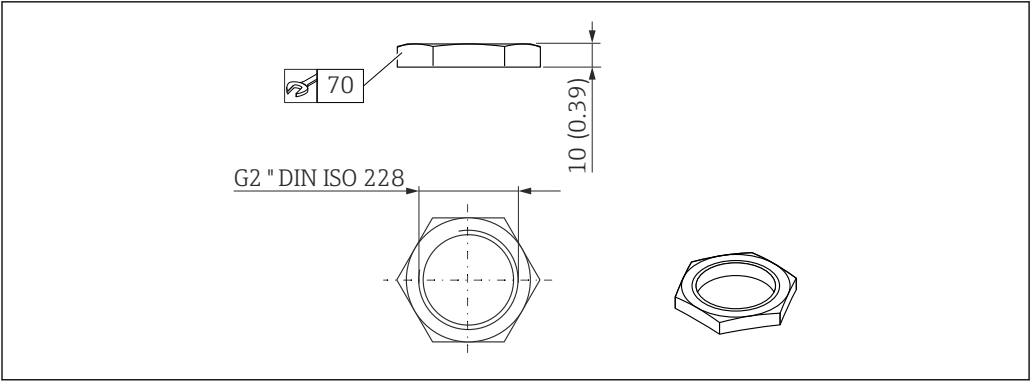


 31 Dimensions of securing nut. Unit of measurement mm (in)

Material
PC
Order code
52014146

Securing nut G 2"

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



A0029101

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

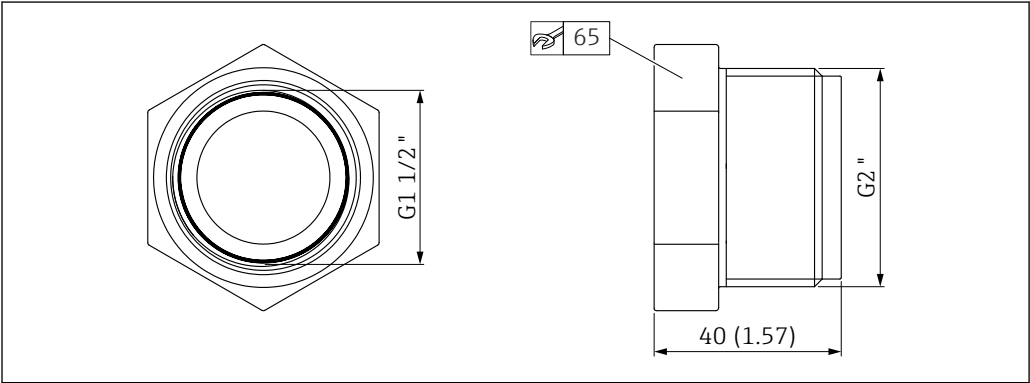
Material
PC

Order code
52000598

Uni adapter G 1½" > G 2"



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



A0055848

33 Dimensions of Uni adapter

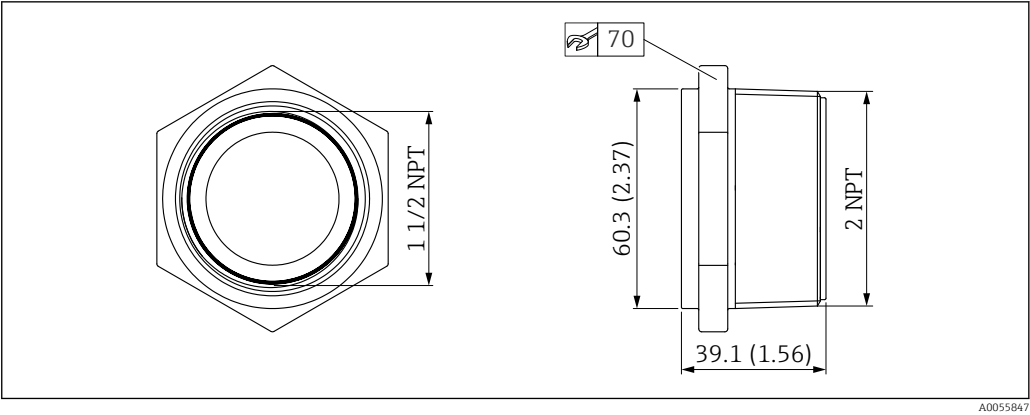
Material
PVC

Order code
71662415

Uni adapter MNPT 1½" > MNPT 2"



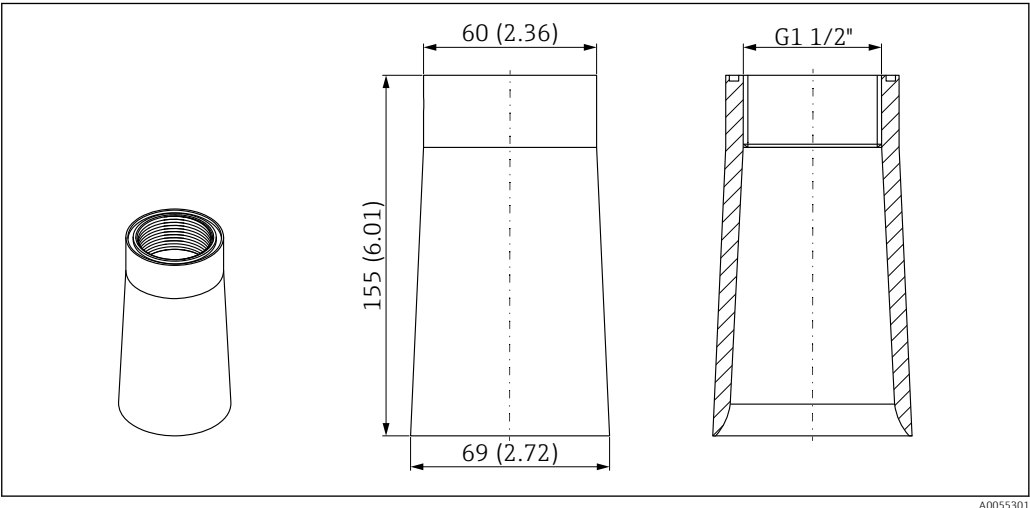
Temperature range -40 to 65 °C (-40 to 150 °F)



34 Dimensions of Uni adapter

Material
PP
Order code
71668921

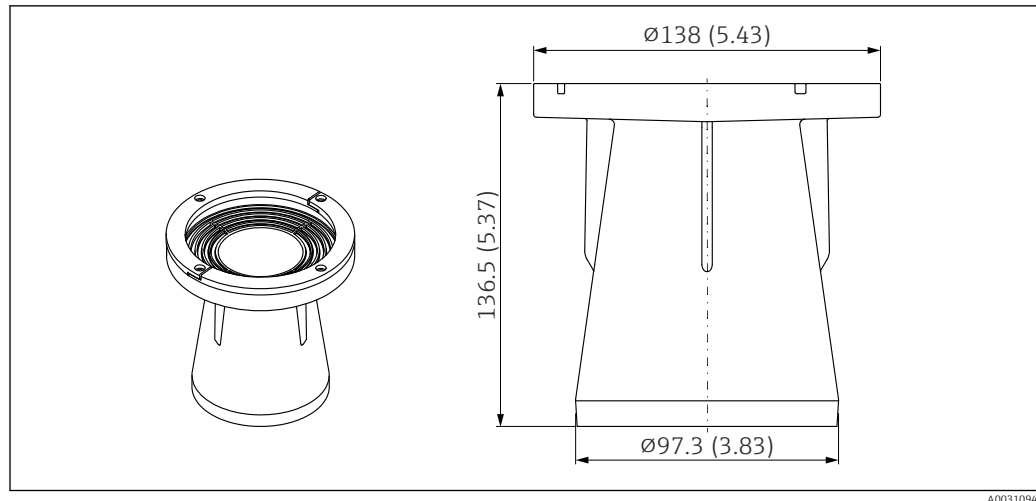
Flooding protection tube 40 mm (1.5 in) Suitable for use with devices with a 40 mm (1.5 in) antenna and G 1 1/2" antenna end thread process connection



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

Material
PP
Order code
71091216

Flooding protection tube 80 mm (3 in) Suitable for use with devices with a 80 mm (3 in) antenna and antenna end process connection, "without, prepared for UNI slip-on flange > Accessories".



A0031094

36 Flooding protection tube dimensions 80 mm (3 in). Unit of measurement mm (in)

Material

PBT/PC

Order code

71662270

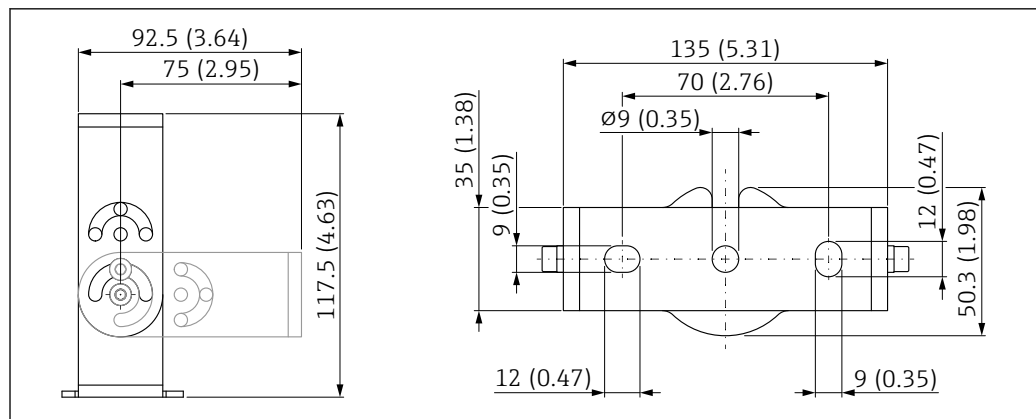
Mounting bracket, adjustable, wall/rope/ ceiling, 75 mm

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"

Cable entry process connection G 1"/NPT 1"



A0055384

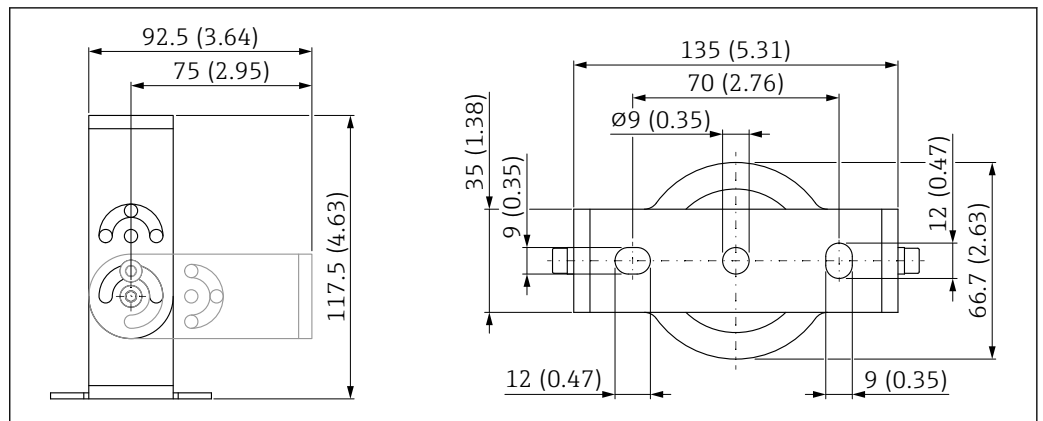
37 Dimensions of mounting bracket. Unit of measurement mm (in)

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

Antenna end process connection G 1½"/NPT 1½"

A0055372

38 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")

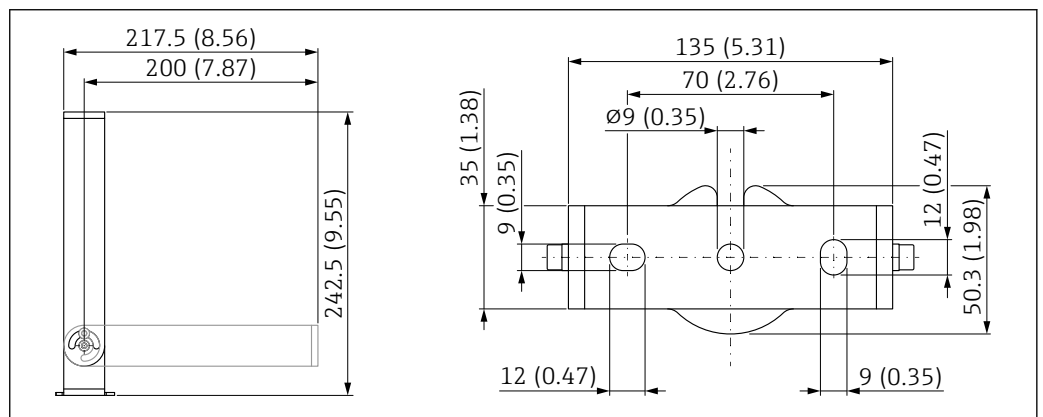
71662419

**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"

Cable entry process connection G 1"/NPT 1"

A0055385

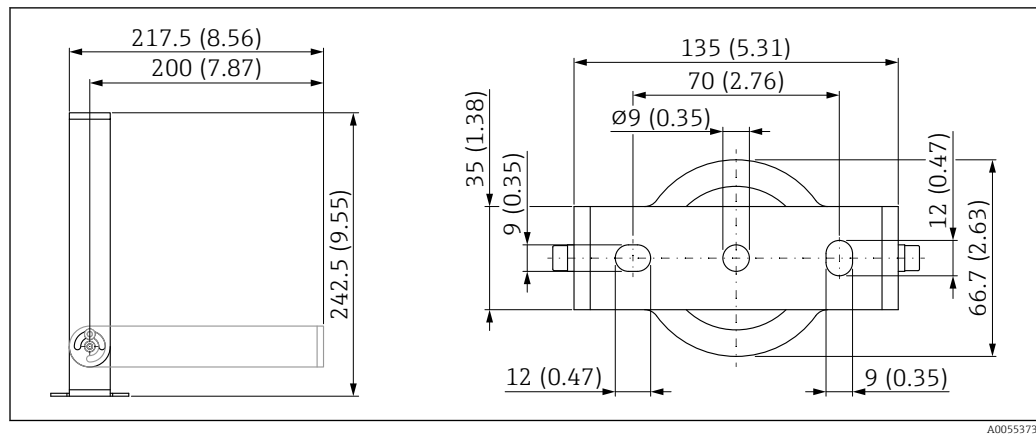
39 Dimensions of mounting bracket. Unit of measurement mm (in)

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

Antenna end process connection G 1½"/NPT 1½"

A0055373

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

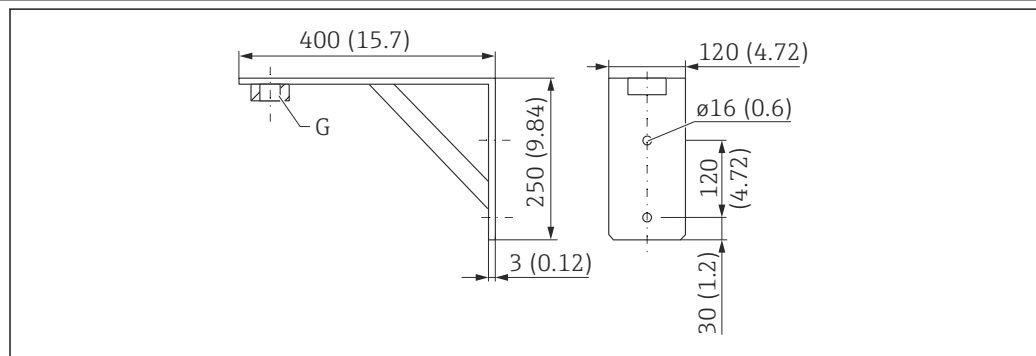
Consists of:

- 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

Angle bracket for wall mounting



A0019346

41 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"

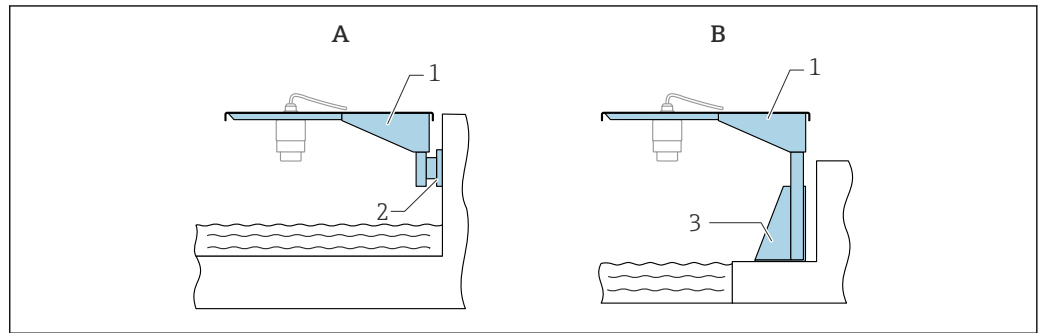
Order number for G 2" process connection

71452325

Also suitable for MNPT 2"

Cantilever with pivot

Installation type sensor cable entry process connection

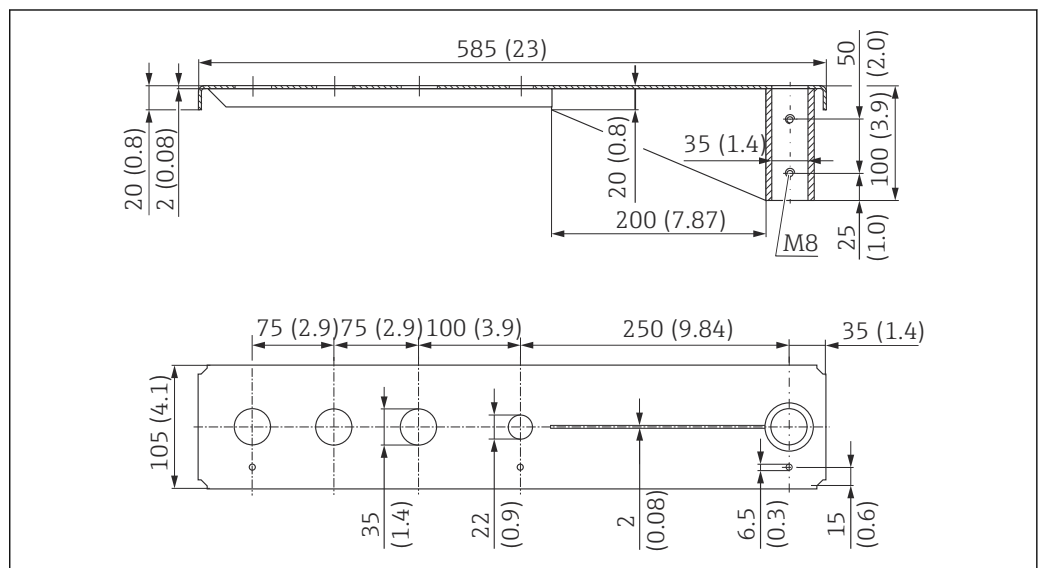


A0028885

42 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

43 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

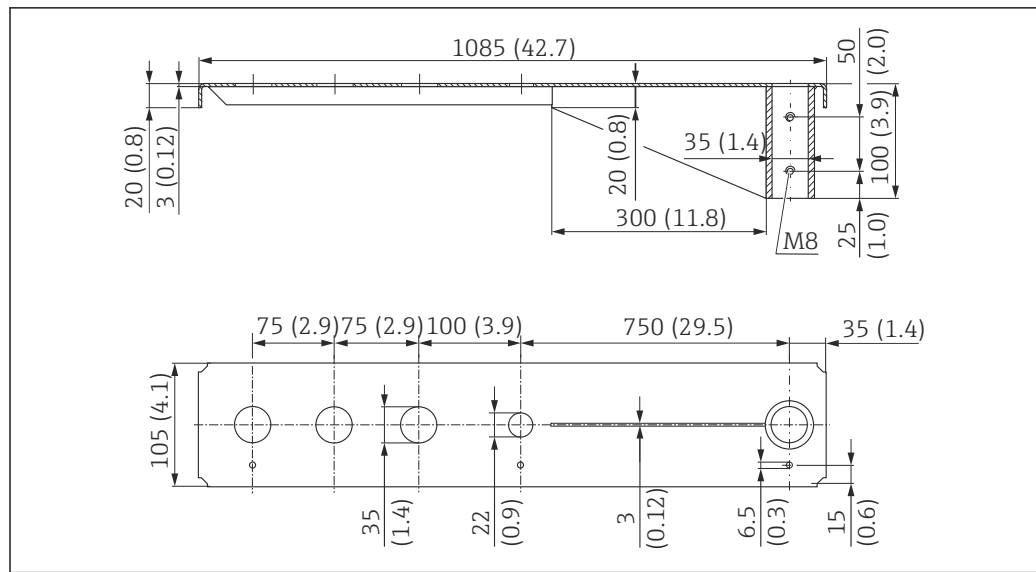
316L (1.4404)

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



44 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

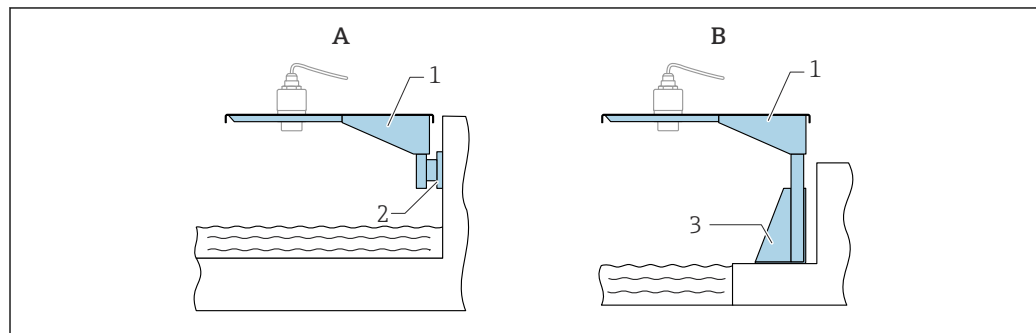
316L (1.4404)

Order number

71452316

- i** 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

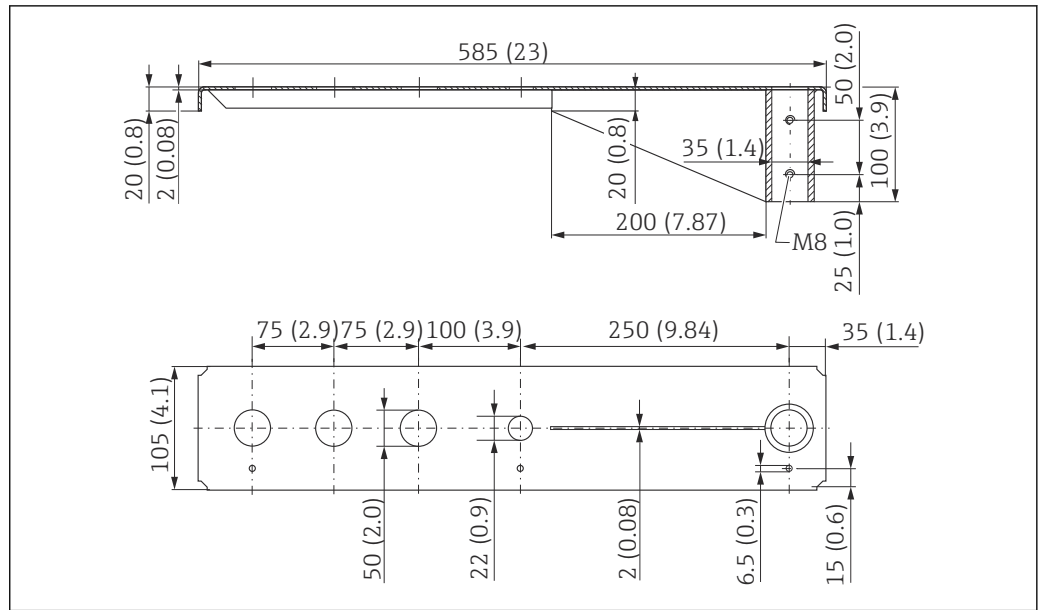
Installation type sensor antenna end process connection



45 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"



46 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

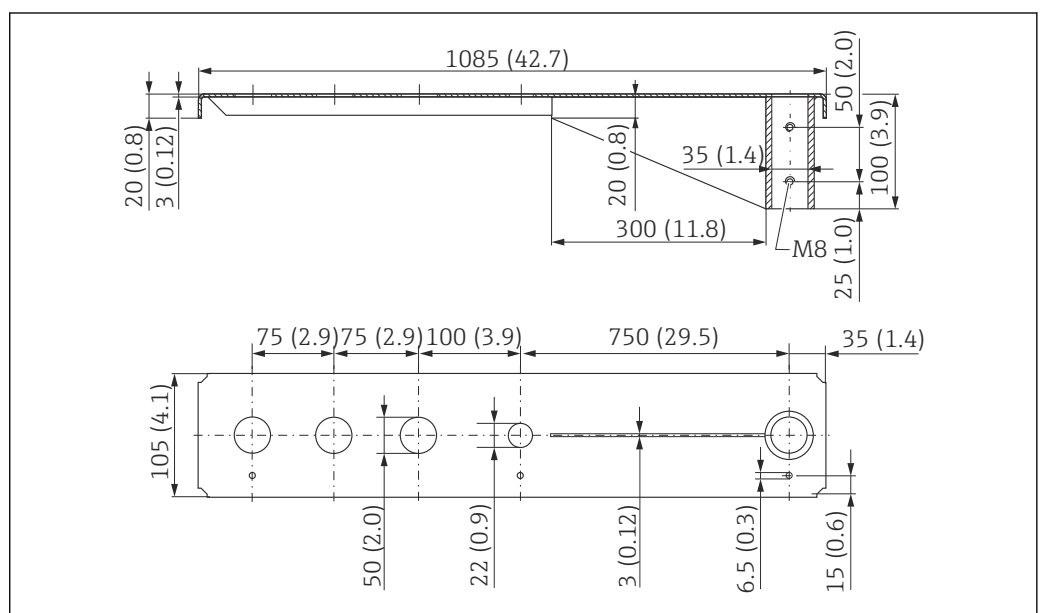
316L (1.4404)

Order code

71452318

- 50 mm (2.0 in) openings for all G 1½" or MNPT 1½" antenna end thread process connections
- 22 mm (0.87 in) opening can be used for an additional sensor
- Retaining screws are included in delivery

1 000 mm cantilever with pivot, sensor antenna end process connection G 1½"



 47 Dimensions of 1 000 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

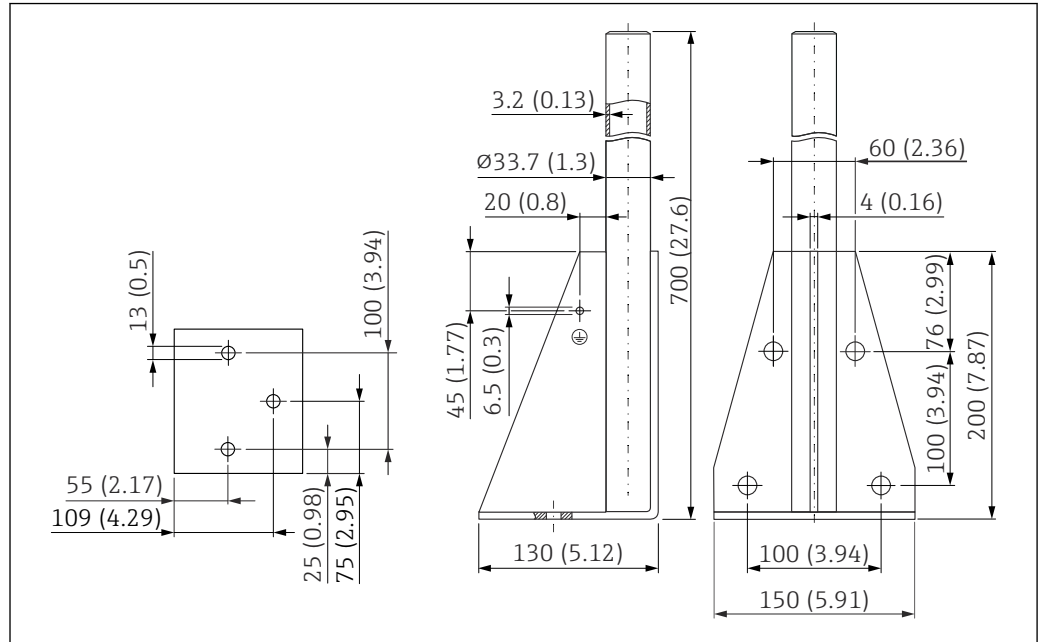
316L (1.4404)

Order code

71452319



- 50 mm (2.0 in) openings for all G 1½" or MNPT 1½" antenna end thread process connections
- 22 mm (0.87 in) opening can be used for an additional sensor
- Retaining screws are included in delivery

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

A0037799

48 Dimensions. Unit of measurement mm (in)

Weight:

4.2 kg (9.26 lb)

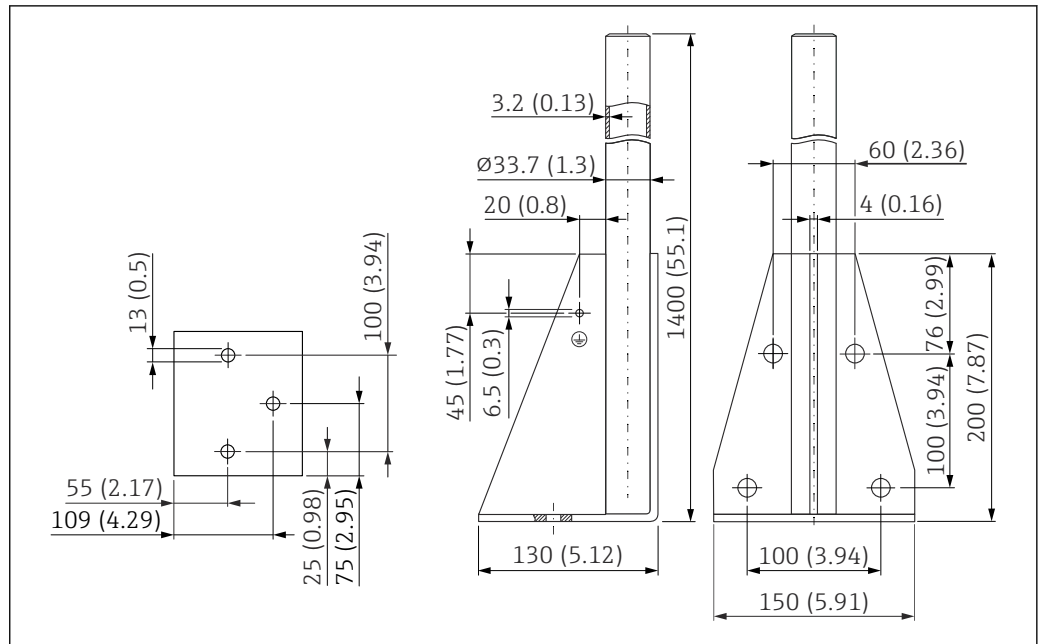
Material

316L (1.4404)

Order code

71452327

Mounting stand, 1 400 mm (55.1 in) for cantilever with pivot



49 Dimensions. Unit of measurement mm (in)

Weight:

6 kg (13.23 lb)

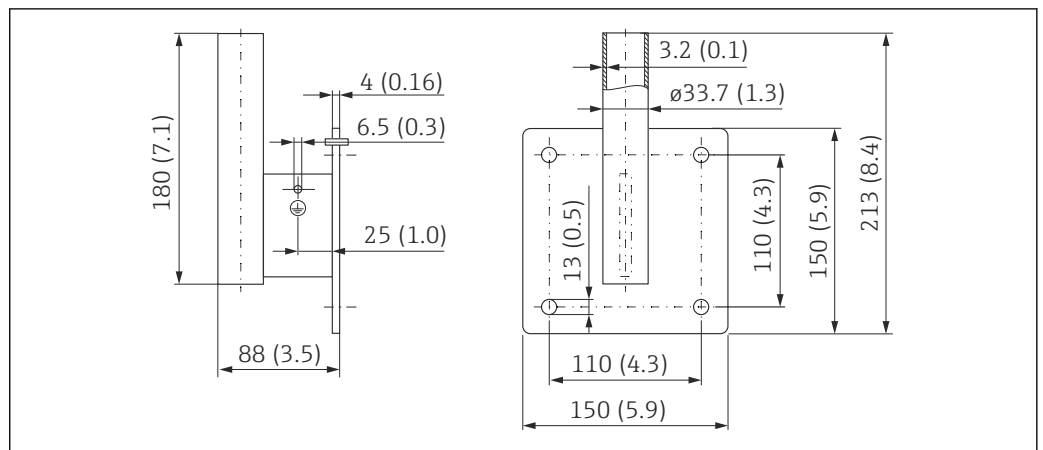
Material

316L (1.4404)

Order code

71452326

Wall bracket for cantilever with pivot



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

Weight

1.2 kg (2.65 lb)

Material

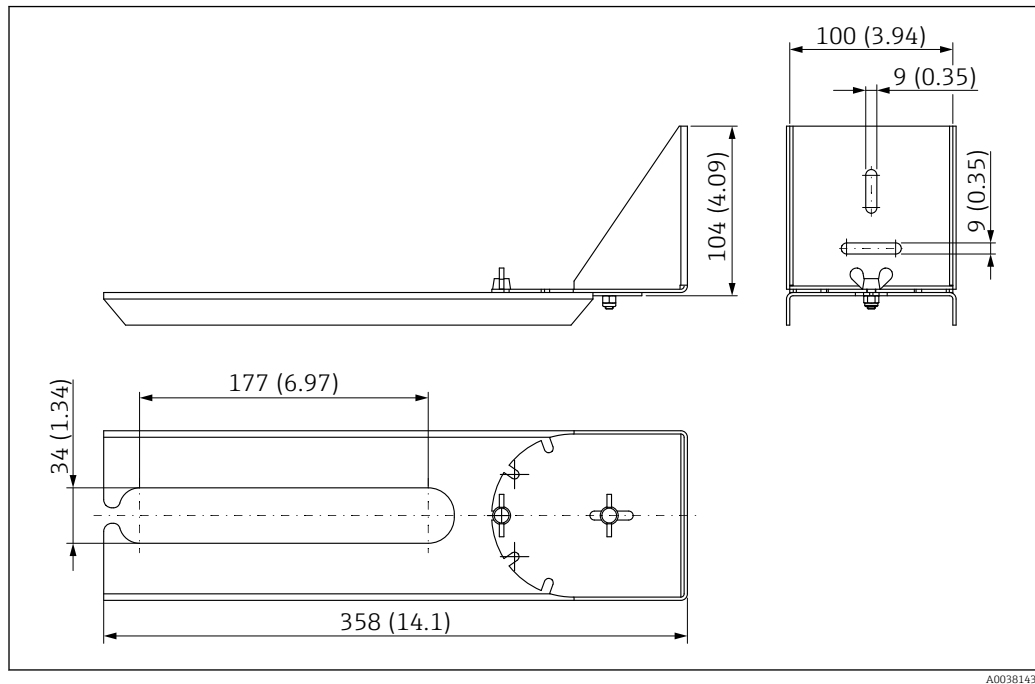
316L (1.4404)

Order number

71452323

Pivotable mounting bracket

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



51 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

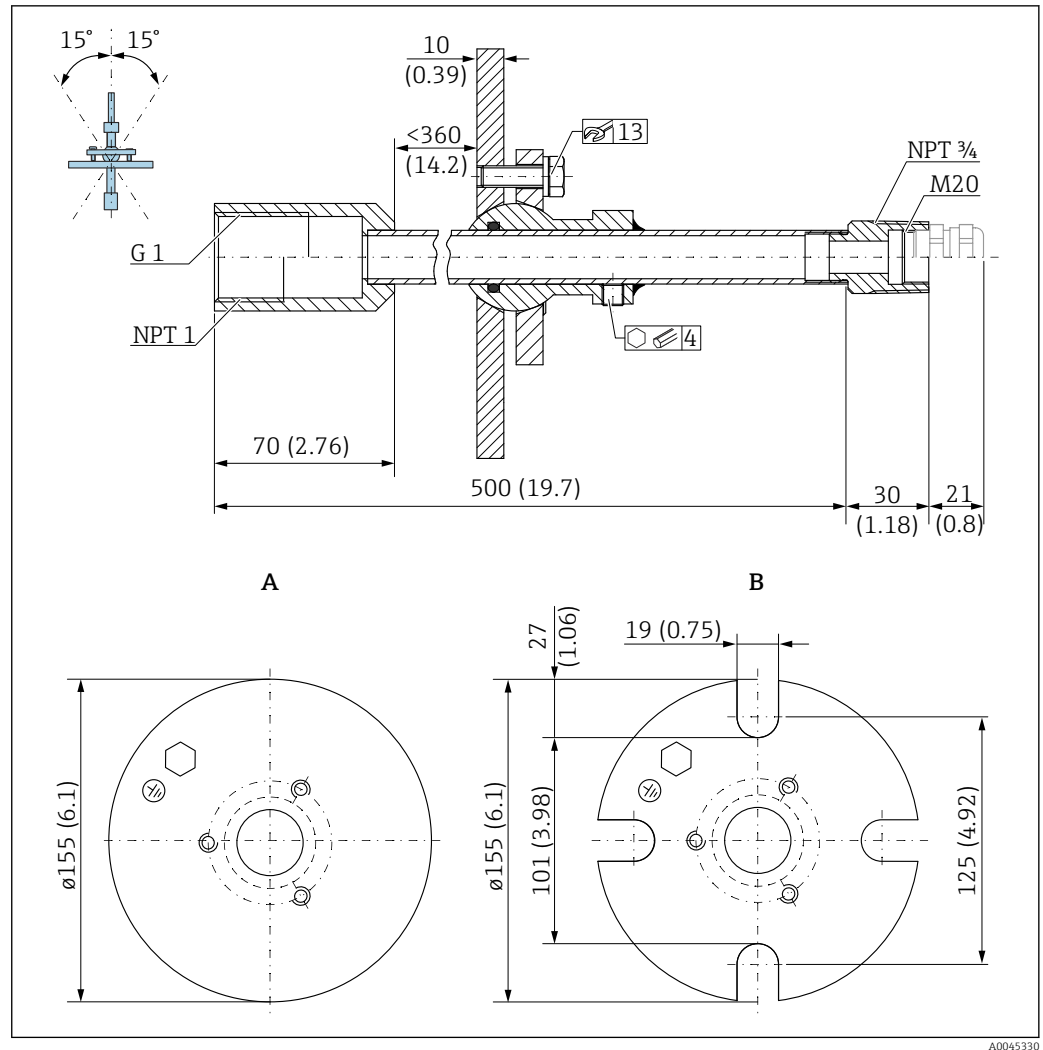
316L (1.4404)

Order code

71429910

FAU40 alignment unit

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



52 Dimensions. Unit of measurement mm (in)

A Welding flange

B UNI flange

Material

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

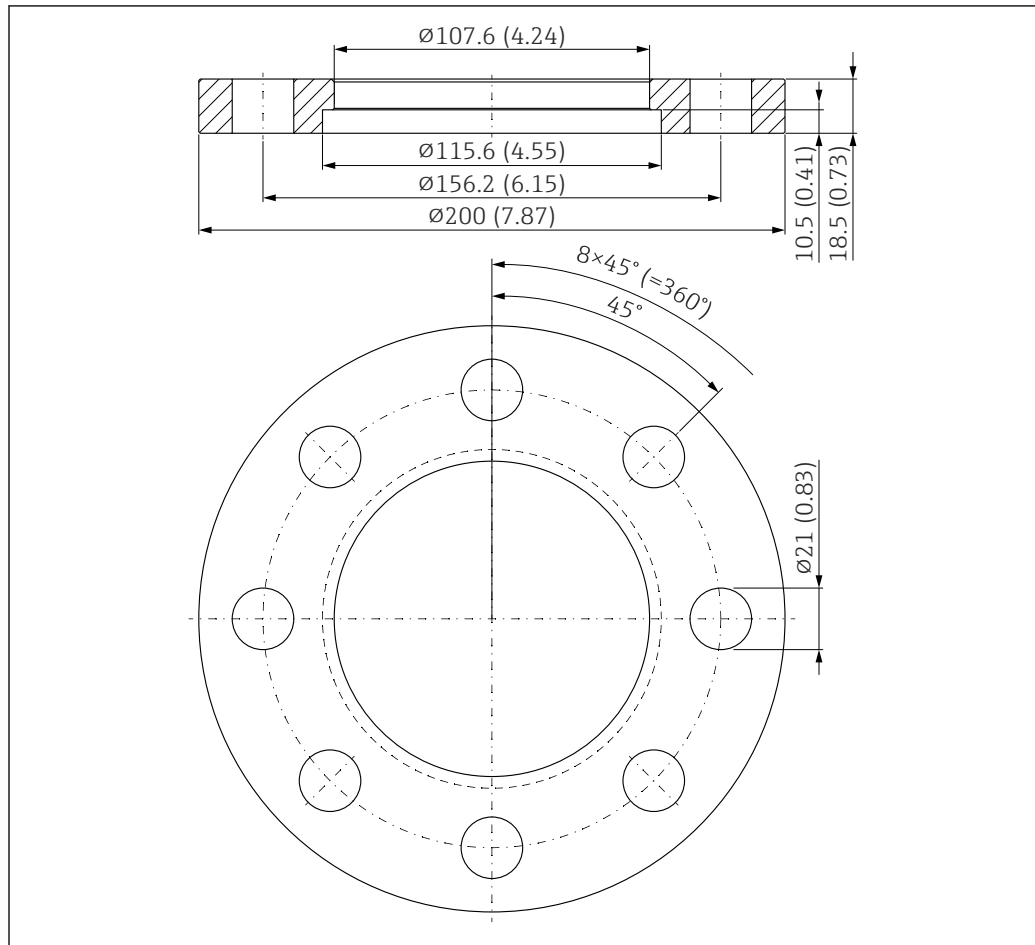
Order number

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

**UNI slip-on flange 3"/
DN80/80, PP**



A0055501

53 Dimensions of UNI slip-on flange 3"/DN80/80. Unit of measurement mm (in)

A Sensor connection in accordance with the product structure "Antenna end process connection; without; prepared for UNI slip-on flange > Accessories"

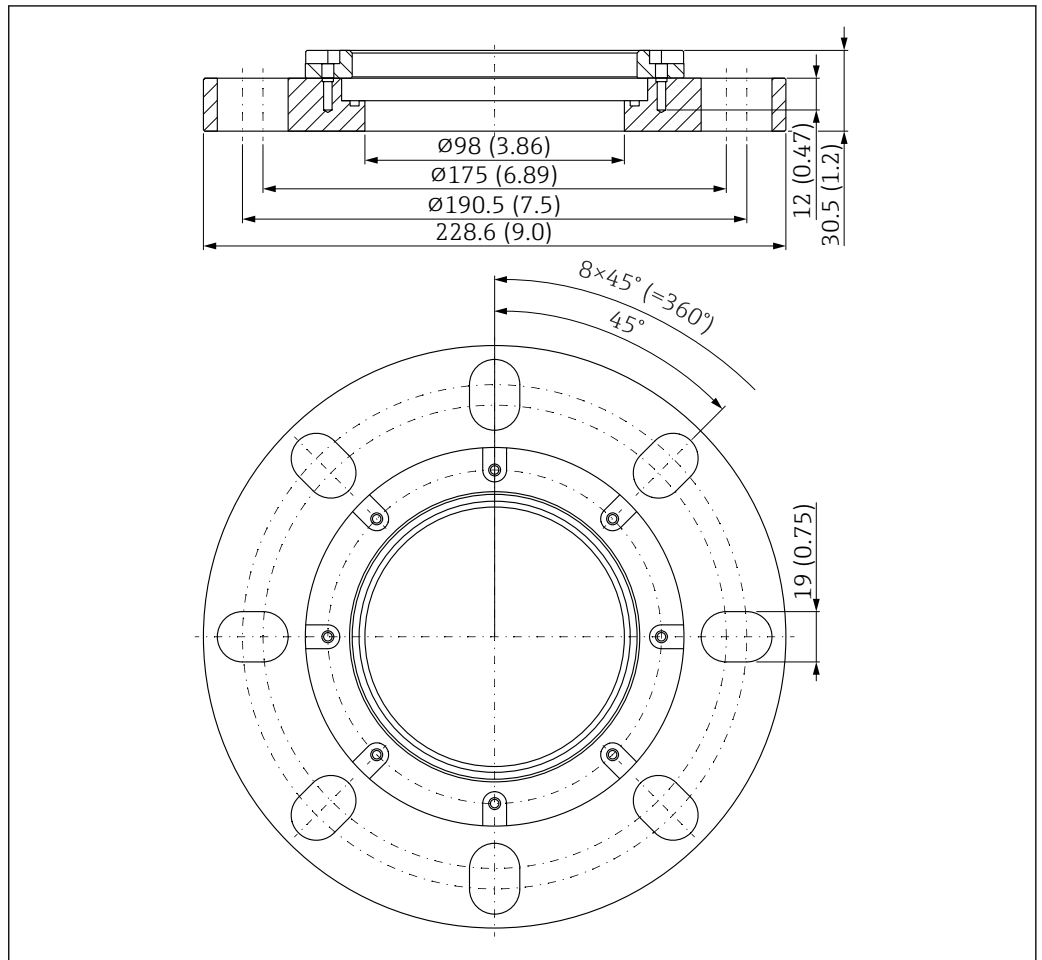
Material

PP

Order code

71162777

**UNI slip-on flange 4"/
DN100/100, PP**



54 Dimensions of UNI slip-on flange 4"/DN100/100. Unit of measurement mm (in)

A Sensor connection in accordance with the product structure "Antenna end process connection; without; prepared for UNI slip-on flange > Accessories"

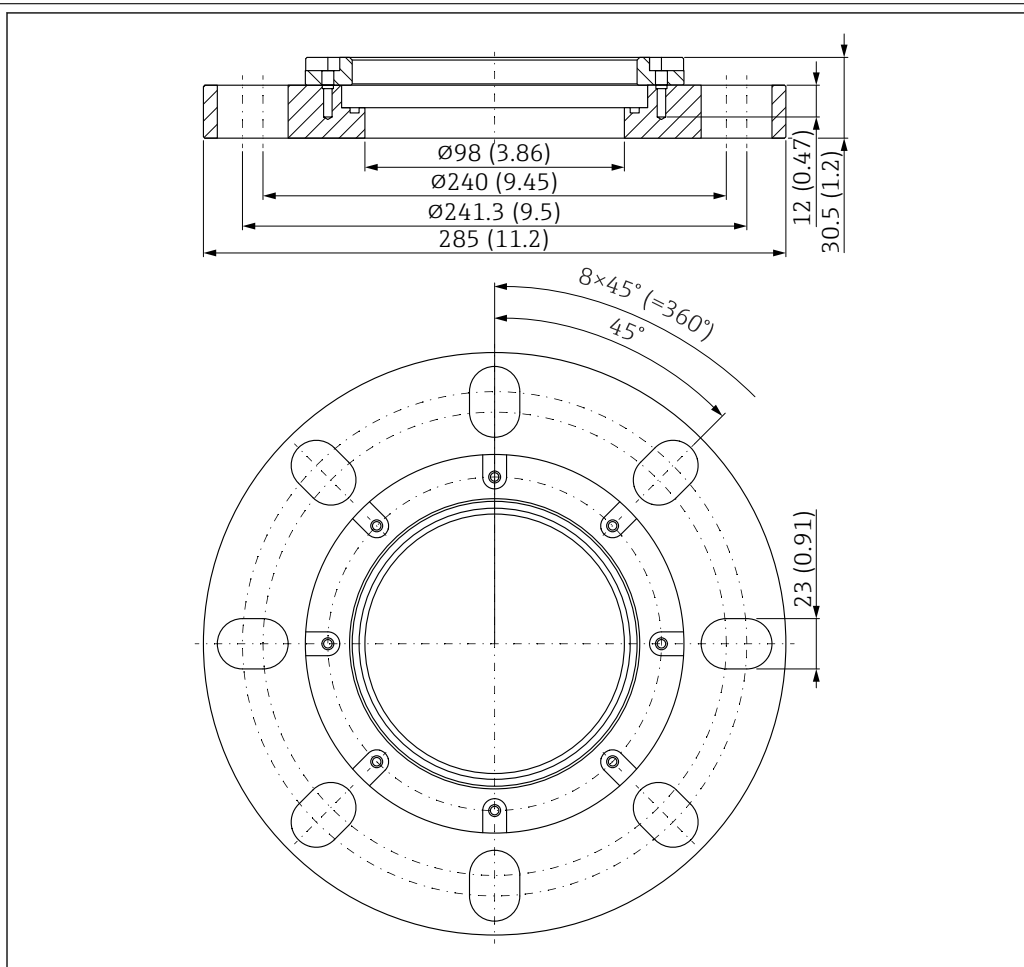
Material

PP

Order code

71162778

**UNI slip-on flange 6"/
DN150/150, PP**



55 Dimensions of UNI slip-on flange 6"/DN150/150. Unit of measurement mm (in)

A Sensor connection in accordance with the product structure "Antenna end process connection; without; prepared for UNI slip-on flange > Accessories"

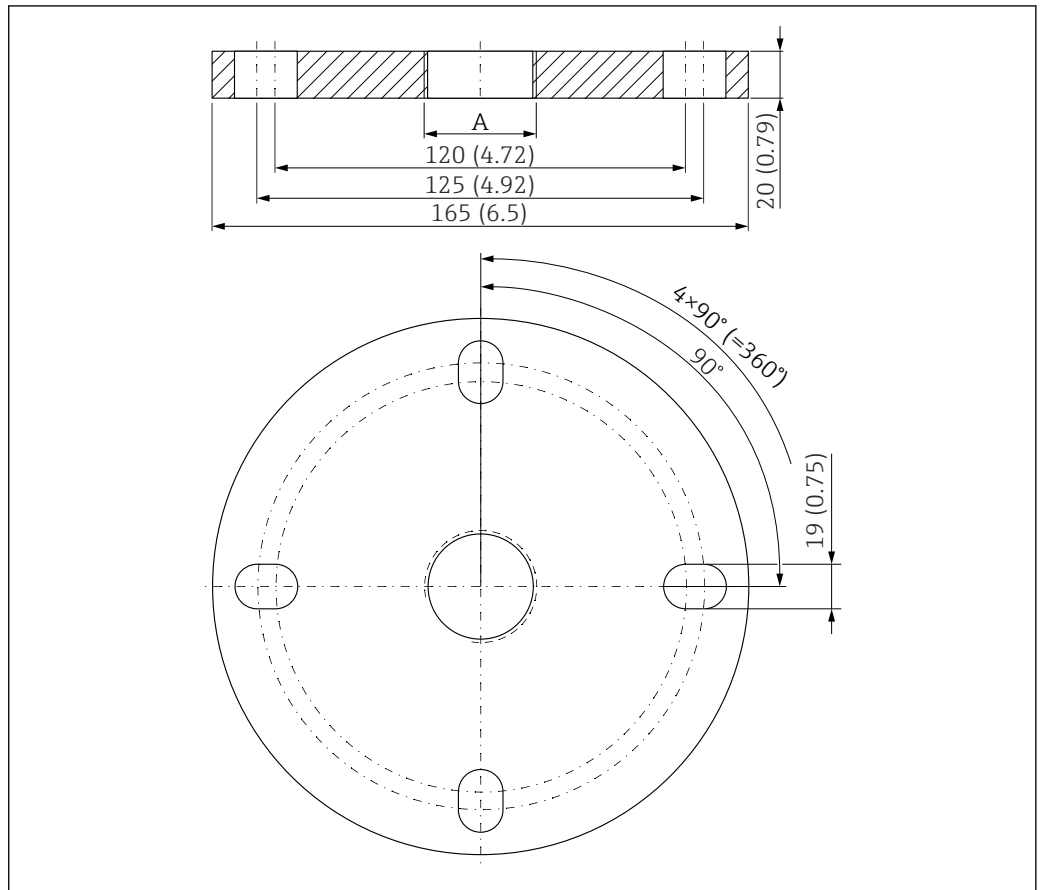
Material

PP

Order code

71162780

UNI flange 2"/DN50/50, PP



A0037946

56 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"

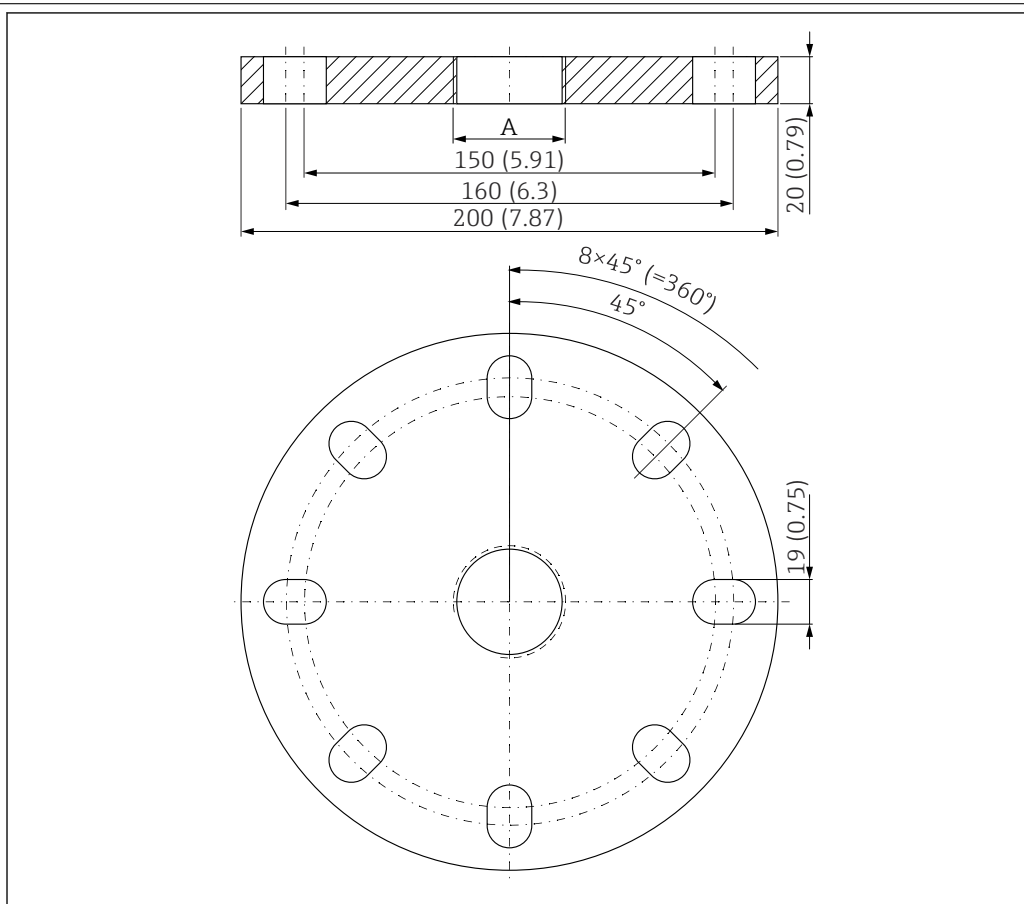
Material

PP

Order code

FAX50-####

UNI flange 3"/DN80/80, PP



A0037947

57 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"

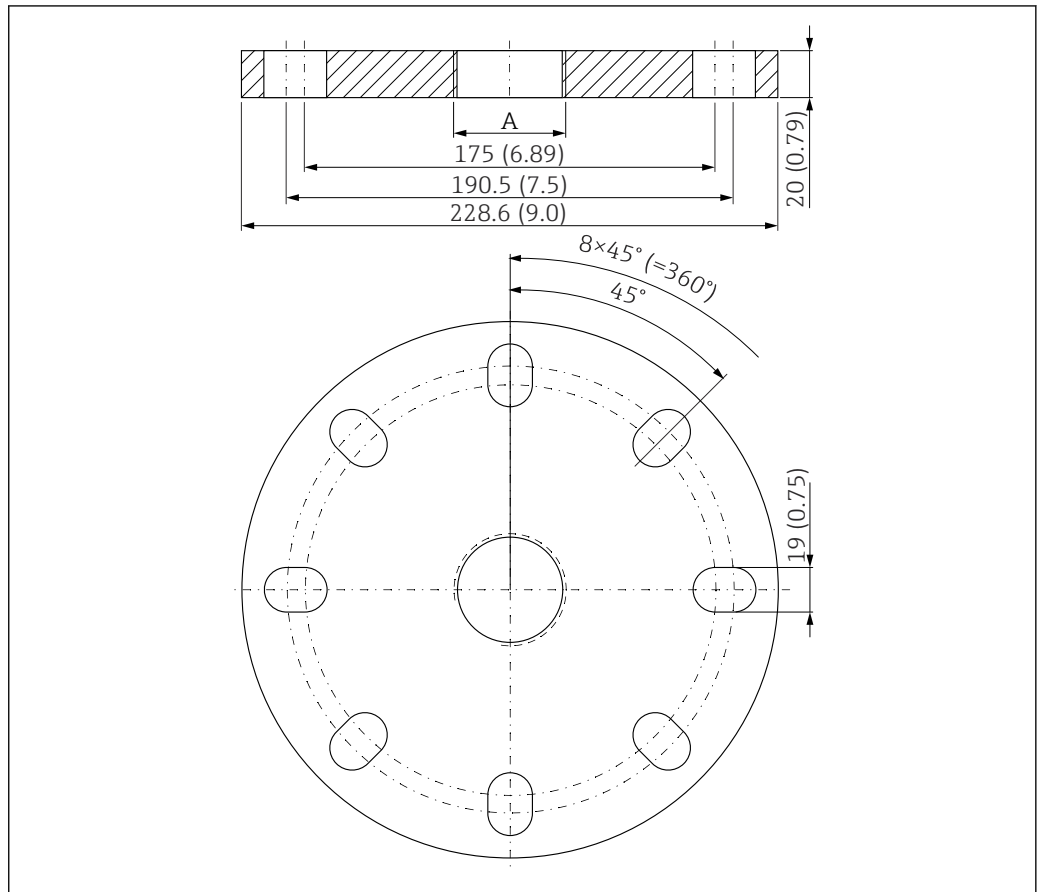
Material

PP

Order code

FAX50-####

**UNI flange 4"/DN100/100,
PP**



58 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

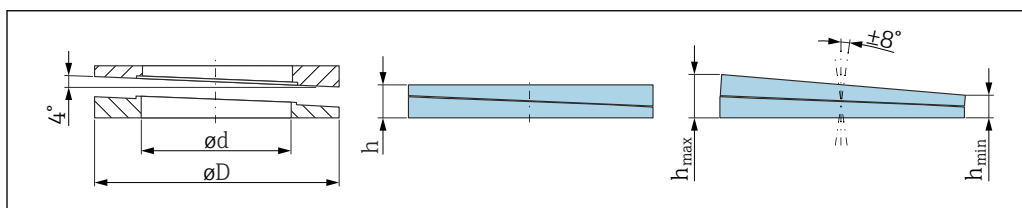
PP

Order code

FAX50-####

Adjustable flange seal

The adjustable flange seal is used to align the sensor.

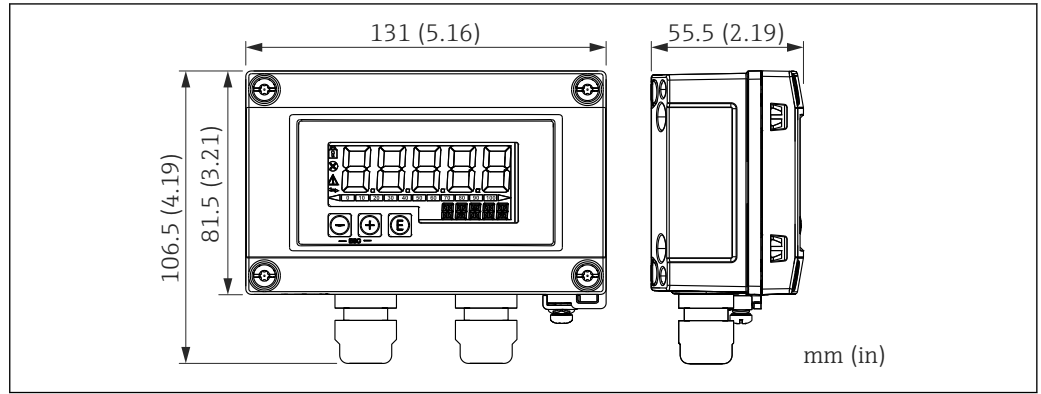


A0045324

59 Dimensions

Technical data: version DN/JIS			
Order code	71074263	71074264	71074265
Compatible with	DN80 PN10/40	DN100 PN10/16	- DN150 PN10/16 - JIS 10K 150A
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 _{min}	14 mm (0.55 in)	14 mm (0.55 in)	14 mm (0.55 in)
h _{max}	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	- ASME 3" 150 lbs - JIS 80A 10K	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 _{min}	14 mm (0.55 in)	14 mm (0.55 in)	14 mm (0.55 in)
h _{max}	30 mm (1.18 in)	33 mm (1.3 in)	39 mm (1.45 in)

RIA15 in the field housing



A0017722

60 Dimensions of RIA15 in the field housing. Unit of measurement mm (in)

i Older device versions before February 2025 can only be connected via the 4 to 20 mA current output.

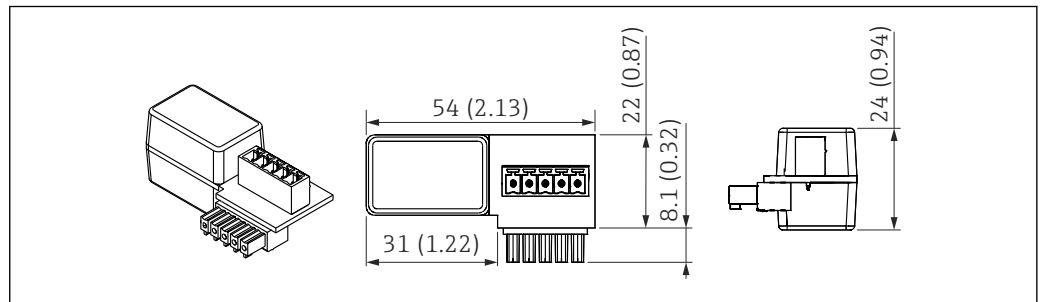
i The remote display RIA15 can be ordered with or without operation via the product structure "Accessory enclosed".

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

Other housing versions are available via the RIA15 product structure.

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

HART communication resistor

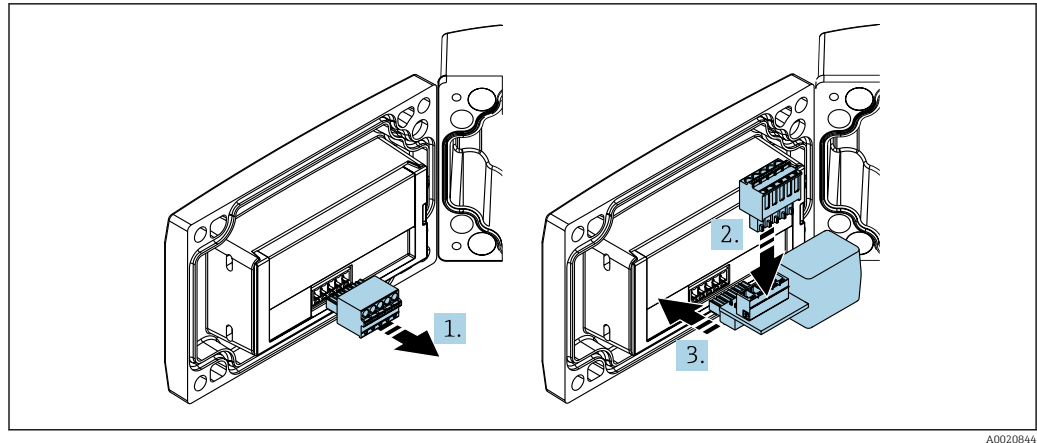


A0020858

61 Dimensions of HART communication resistor. Unit of measurement mm (in)

The HART communication resistor is required for operation of the RIA15 and is supplied with "remote display RIA15, with operation via HART" when ordering.

i Document Technical Information TI01043K and Operating Instructions BA01170K



A0020844

i In order to operate the RIA15, the HART communication resistor must be integrated.

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

DeviceCare SFE100

Configuration tool for IO-Link, HART, PROFIBUS and FOUNDATION Fieldbus devices. DeviceCare is available for download free of charge at www.software-products.endress.com. You need to register in the Endress+Hauser software portal to download the application.

 Technical Information TI01134S

FieldCare SFE500

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

 Technical Information TI00028S

Device Viewer

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

Commubox FXA195 HART

For intrinsically safe HART communication with FieldCare via the USB interface

 Technical Information TI00404F

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

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

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

Field Xpert SMT77

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

 For details, see "Technical Information" TI01418S

SmartBlue app	Mobile app for easy configuration of devices on site via Bluetooth® wireless technology.
RMA42	Digital process transmitter for monitoring and displaying analog measured values  For details, see Technical Information TI00150R and Operating Instructions BA00287R

Documentation



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

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

Standard documentation	Document type: Operating Instructions (BA) Installation and initial commissioning – contains all the functions in the operating menu that are needed for a routine measuring task. Functions beyond this scope are not included. Document type: Description of Device Parameters (GP) The document is part of the Operating Instructions and serves as a reference for parameters, providing a detailed explanation of each individual parameter of the operating menu. Document type: Brief Operating Instructions (KA) Quick guide to the first measured value – includes all essential information from incoming acceptance to electrical connection. Document type: Safety Instructions, certificates Depending on the approval, safety instructions are supplied with the device, e.g. XA. This documentation is an integral part of the Operating Instructions. Information on the Safety Instructions (XA) that are relevant for the device is provided on the nameplate.
Supplementary device-dependent documentation	Additional documents are supplied depending on the device version ordered: Always comply strictly with the instructions in the supplementary documentation. The supplementary documentation is an integral part of the device documentation.

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