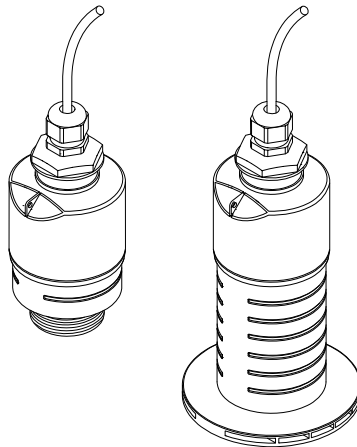


Brief Operating Instructions

Micropilot FMR20

Modbus RS485

Free space radar

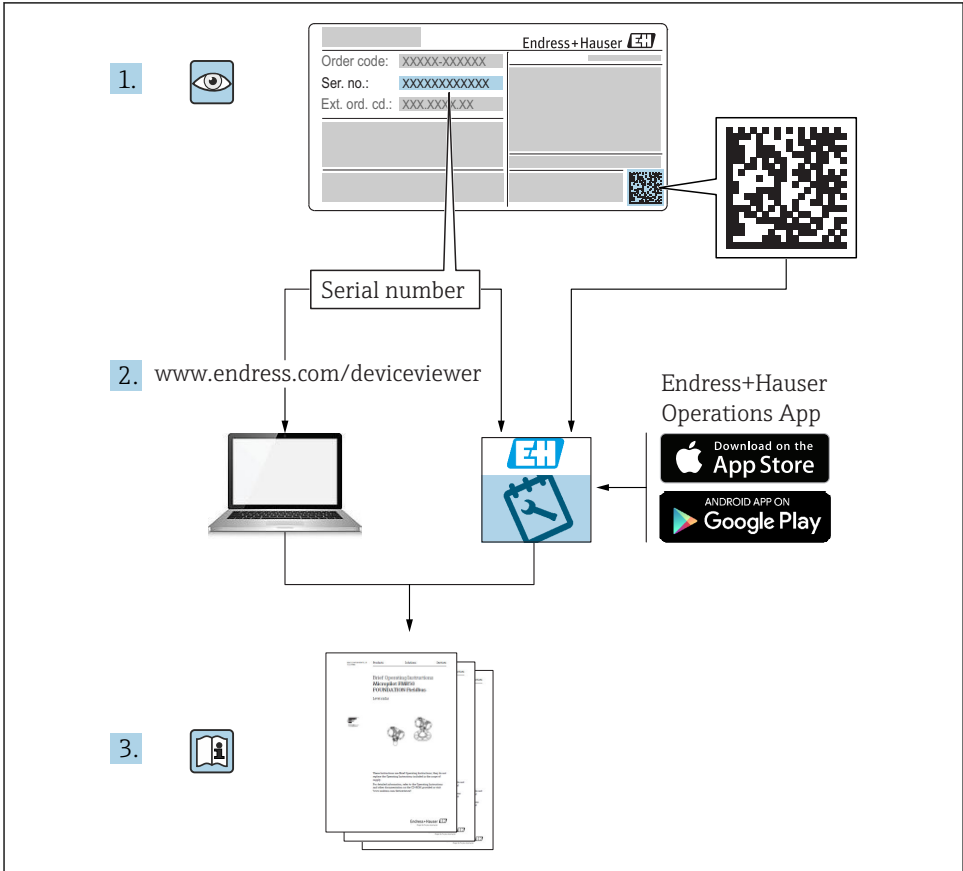


These Instructions are Brief Operating Instructions; they are not a substitute for the Operating Instructions pertaining to the device.

For detailed information, refer to the Operating Instructions and other documentation.

Available for all device versions via:

- Internet: www.endress.com/deviceviewer
- Smart phone/Tablet: Endress+Hauser Operations App



A0023555

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1 About this document

1.1 Symbols used

1.1.1 Safety symbols

DANGER

This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.

WARNING

This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.

CAUTION

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

NOTICE

This symbol contains information on procedures and other facts which do not result in personal injury.

1.1.2 Symbols for certain types of information and graphics

Permitted

Procedures, processes or actions that are permitted

Forbidden

Procedures, processes or actions that are forbidden

Tip

Indicates additional information



Reference to graphic



Notice or individual step to be observed

1, 2, 3

Series of steps



Result of a step

1, 2, 3, ...

Item numbers

A, B, C, ...

Views

1.2 Documentation

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



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

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

1.3 Supplementary documentation

BA01931F

Operating Instructions FMR20 Modbus

1.4 Registered trademarks

Modbus®

Registered trademark of SCHNEIDER AUTOMATION, INC.

Apple®

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

Android®

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

Bluetooth®

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

2 Basic safety instructions

2.1 Requirements for personnel

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

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

The operating personnel must fulfill the following requirements:

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

2.2 Designated use

Application and media

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

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

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

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

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

Incorrect use

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

Verification for borderline cases:

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

Residual risks

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

Danger of burns from contact with surfaces!

- ▶ In the event of elevated 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 according to federal/national regulations.

2.4 Operational safety

Risk of injury!

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

Hazardous area

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

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

2.5 Product safety

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

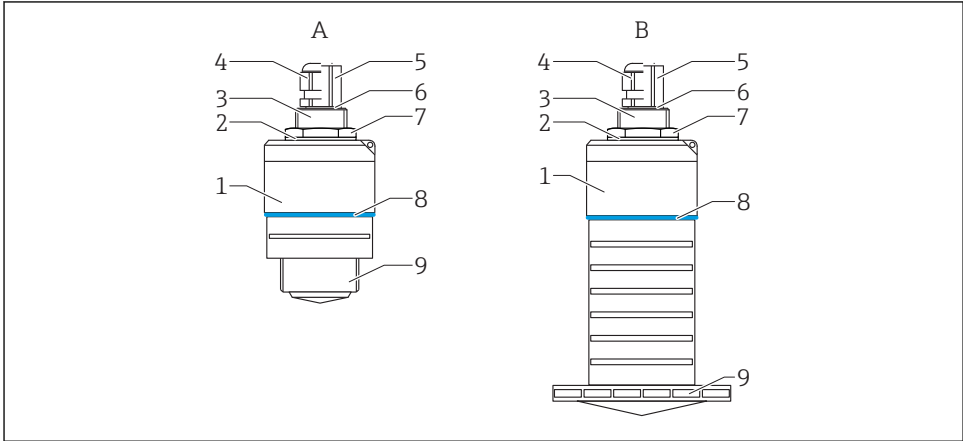
2.5.1 CE mark

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

Endress+Hauser confirms successful testing of the device by affixing to it the CE mark.

3 Product description

3.1 Product design



A0028416

1 Device design

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

4 Incoming acceptance and product identification

4.1 Goods acceptance

Check the following during goods acceptance:

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

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

4.2 Product identification

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

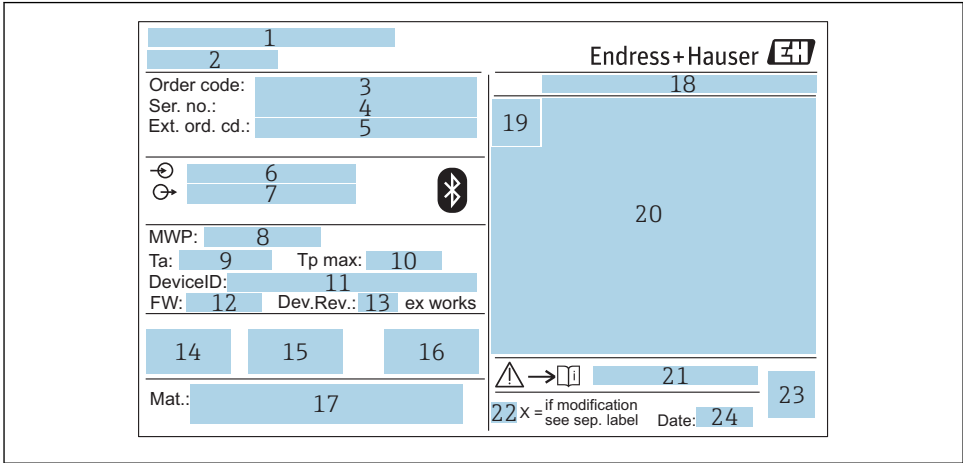
- Nameplate specifications
- Extended order code with breakdown of the device features on the delivery note
- ▶ Enter the serial number from the nameplates into *W@M Device Viewer* (www.endress.com/deviceviewer)
 - ↳ All the information about the measuring device and the scope of the associated Technical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

4.3 Manufacturer address

Endress+Hauser SE+Co. KG
Hauptstraße 1
79689 Maulburg, Germany

Address of the manufacturing plant: See nameplate.

4.4 Nameplate



A0029096

2 Nameplate of Micropilot

- 1 Manufacturer address
- 2 Device name
- 3 Order code
- 4 Serial number (ser. no.)
- 5 Extended order code (ext. ord. cd.)
- 6 Supply voltage
- 7 Signal outputs
- 8 Process pressure
- 9 Allowable ambient temperature (T_a)
- 10 Maximum process temperature
- 11 Device ID
- 12 Firmware version (FW)
- 13 Device revision (Dev.Rev.)
- 14 CE mark
- 15 Additional information about the device version (certificates, approvals)
- 16 C-tick
- 17 Materials in contact with process
- 18 Degree of protection: e.g. IP, NEMA
- 19 Certificate symbol
- 20 Certificate and approval relevant data
- 21 Document number of the Safety Instructions: e.g. XA, ZD, ZE

- 22 *Modification mark*
- 23 *2-D matrix code (QR code)*
- 24 *Manufacturing date: year-month*



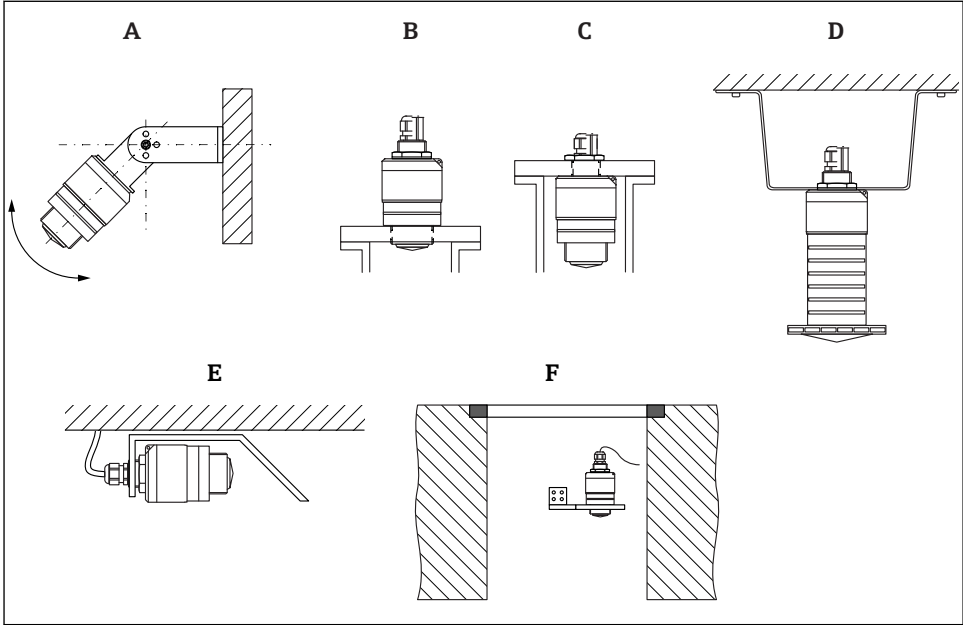
Up to 33 characters of the extended order code are indicated on the nameplate. If the extended order code contains additional characters, these cannot be displayed.

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

5 Installation

5.1 Installation conditions

5.1.1 Installation types



A0030605

3 Wall, ceiling or nozzle installation

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

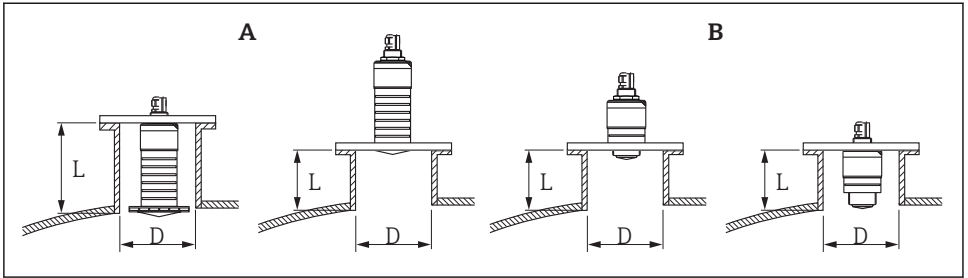


Caution!

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

5.1.2 Nozzle installation

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



A0028413

4 Nozzle installation

- A 80 mm (3 in) antenna
 B 40 mm (1.5 in) antenna

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

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

80 mm (3 in) antenna, installation inside nozzle

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

80 mm (3 in) antenna, installation outside nozzle

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

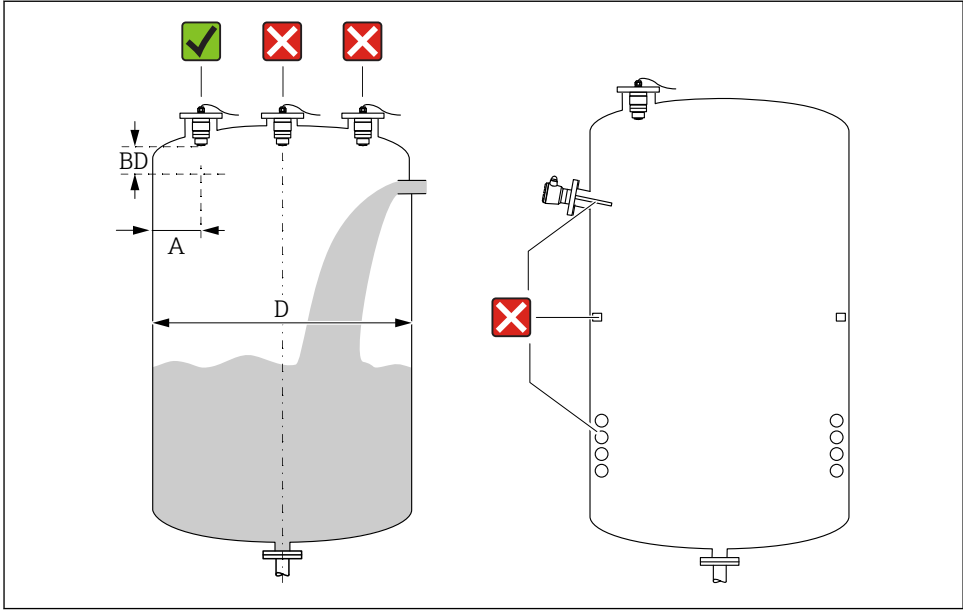
40 mm (1.5 in) antenna, installation outside nozzle

- D: min. 40 mm (1.5 in)
- L: max. $D \times 1.5$

40 mm (1.5 in) antenna, installation inside nozzle

- D: min. 80 mm (3 in)
- L: max. 140 mm (5.5 in) + $D \times 1.5$

5.1.3 Position for installation on a vessel



A0028410

5 Installation position on a vessel

- If possible install the sensor so that its lower edge projects into the vessel.
- Recommended distance **A** wall - nozzle outer edge: $\sim \frac{1}{6}$ of the vessel diameter **D**. Under no circumstances should the device be mounted closer than 15 cm (5.91 in) to the vessel wall.
- Do not install the sensor in the middle of the vessel.
- Avoid measurements through the filling curtain.
- Avoid equipment such as limit switches, temperature sensors, baffles, heating coils etc.
- No signals are evaluated within the Blocking distance (BD). It can therefore be used to suppress interference signals (e.g. the effects of condensate) in the vicinity of the antenna. An automatic Blocking distance of at least 0.1 m (0.33 ft) is configured as standard. However, this can be overwritten manually (0 m (0 ft) is also permitted).

Automatic calculation:

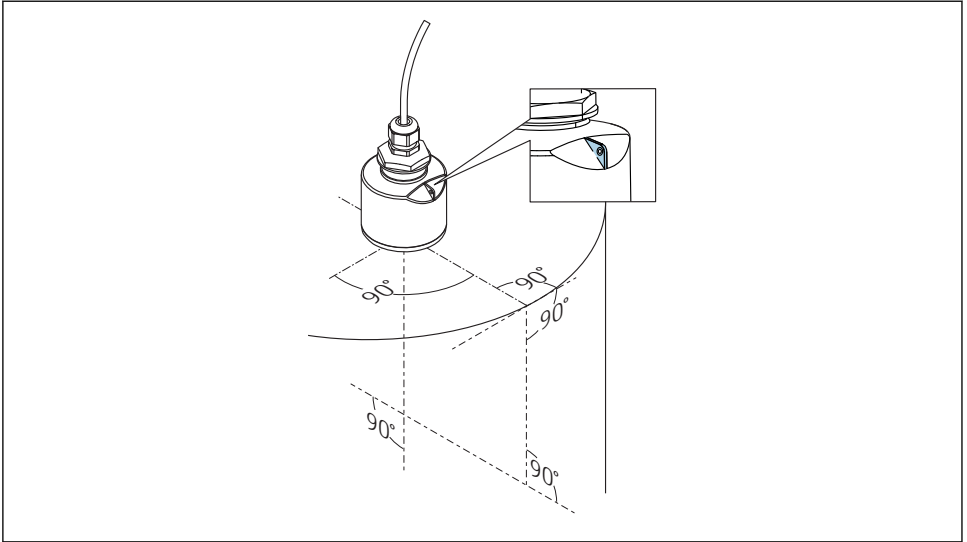
Blocking distance = Empty calibration - Full calibration - 0.2 m (0.656 ft).

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

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

5.1.4 Device alignment for installation on a vessel

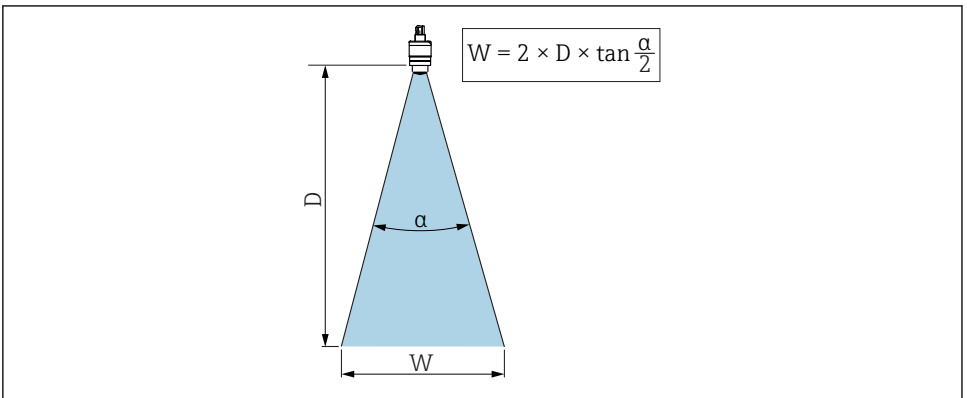
- Align the antenna vertically to the product surface.
- Align the eyelet with lug towards the vessel wall as well as possible.



A0028927

6 Device alignment for installation on a vessel

5.1.5 Beam angle



A0033201

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

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

Beam diameter W as a function of beam angle α and distance D .

40 mm (1.5 in) antenna, α 30°

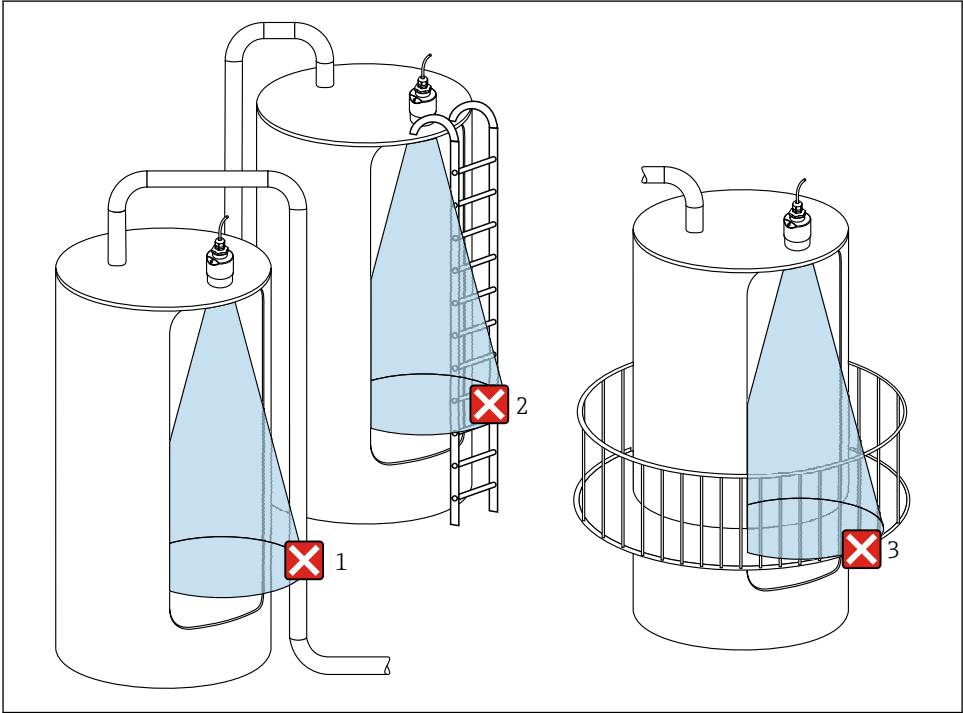
$$W = D \times 0.54$$

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

$$W = D \times 0.21$$

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

$$W = D \times 0.21$$

5.1.6 Measurement in plastic vessels

A0029540

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

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

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

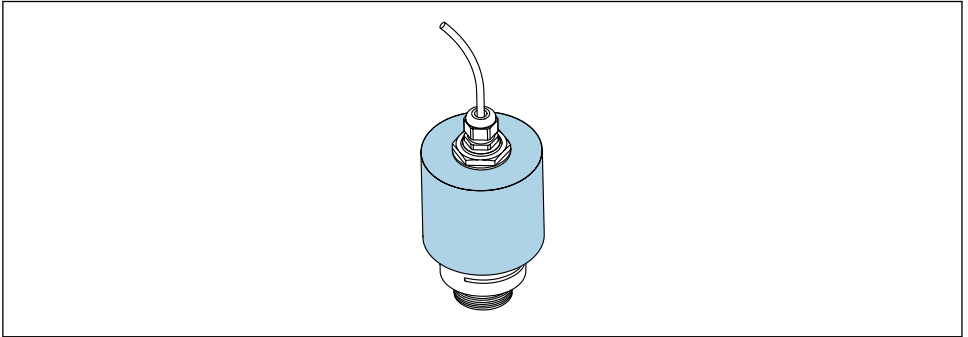
Please ensure there are no interfering installations made of a conductive material in the signal beam (see the beam angle section for information on calculating the beamwidth diameter).

Please contact the manufacturer for further information.


5.1.7 Protective hood

For outdoor use, a protective hood is recommended.

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



A0031277

 9 Protective hood, e.g. with 40 mm (1.5") antenna



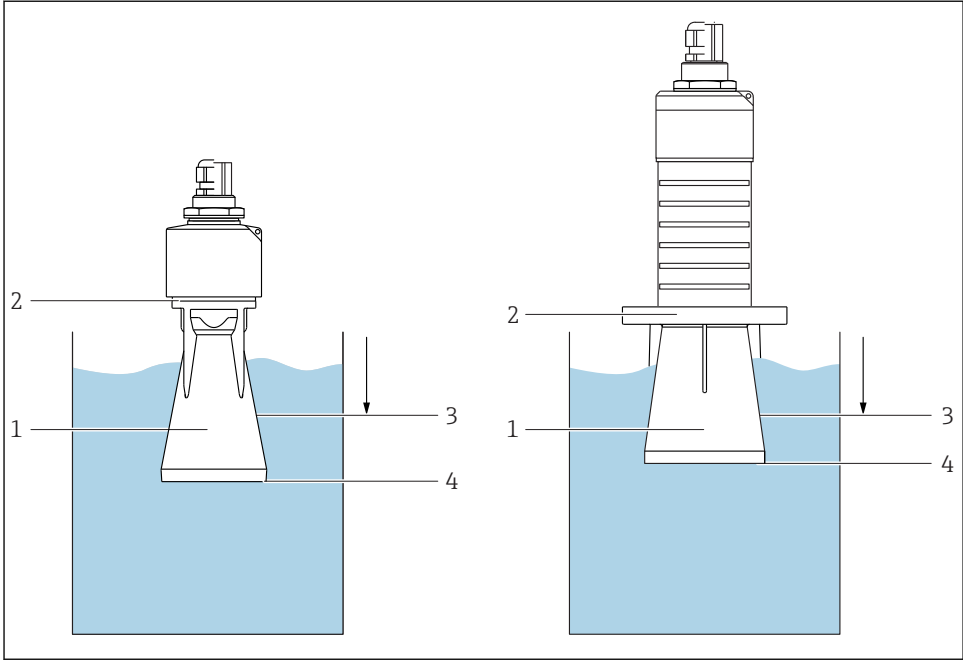
The sensor is not completely covered by the protective hood.

5.1.8 Using the flooding protection tube

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

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

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



A0031093

10 Function of flooding protection tube

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

The tube is screwed directly onto the sensor and seals off the system by means of an O-ring making it air-tight. In the event of flooding, the air pocket that formed in the tube ensures the measurement of the maximum level at the end of the tube. Due to the fact that the Blocking distance is inside the tube, multiple echoes are not analyzed.

Configuration parameters for flooding protection tube

Configuring the blocking distance when using the flooding protection tube

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

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

1. Navigate to: Setup → Confirm distance
 - ↳ Compare the distance displayed with the actual value in order to start the recording of an interference echo map.

2. Navigate to: Setup → Mapping end point

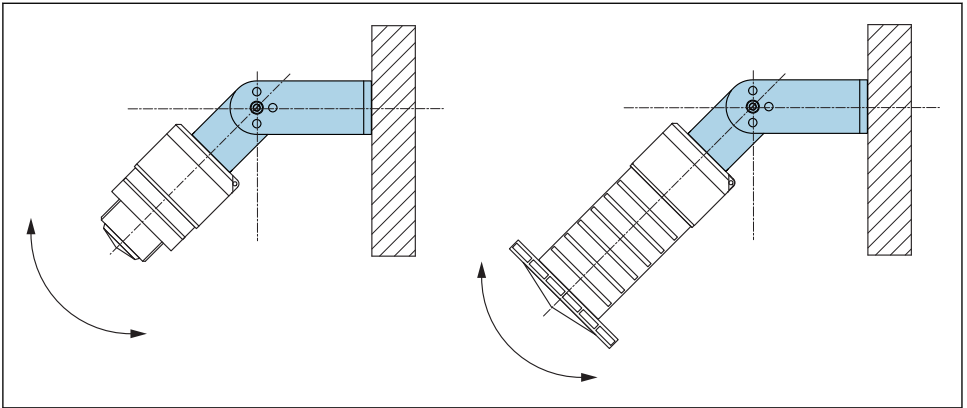
- ↳ This parameter determines the distance up to which the new mapping is to be recorded.

3. Navigate to: Setup → Present mapping

- ↳ Displays the distance up to which a mapping has already been recorded.

5.1.9 Installation with mounting bracket, adjustable

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



A0030606

11 Installation with mounting bracket, adjustable

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

NOTICE

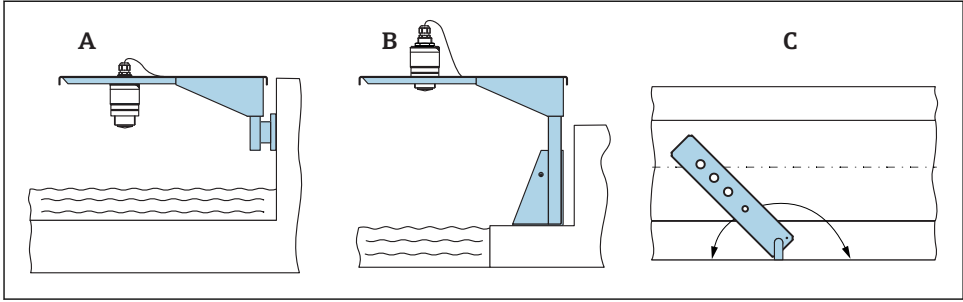
There is no conductive connection between the mounting bracket and transmitter housing.

Electrostatic charging possible.

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

5.1.10 Cantilever installation, with pivot

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



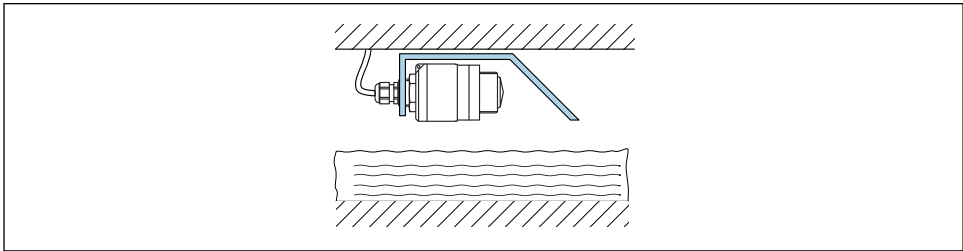
A0028412

12 Cantilever installation, with pivot

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

5.1.11 Installation of horizontal mounting bracket for sewer shafts

The horizontal mounting bracket for sewer shafts is available as an accessory.

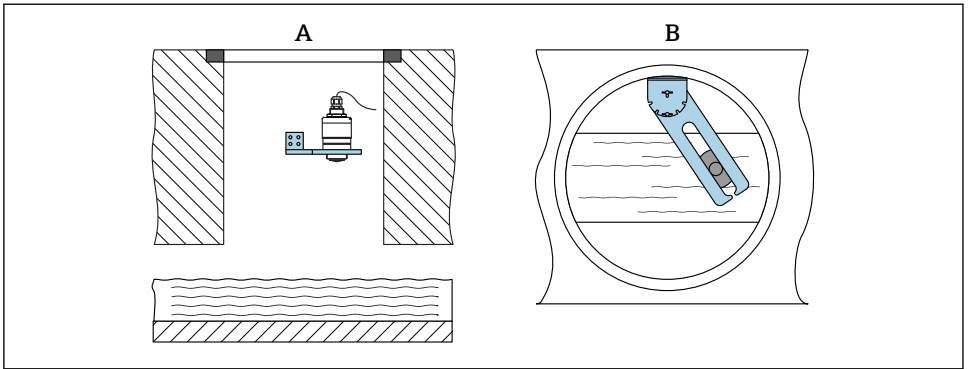


A0037747

13 Installation of horizontal mounting bracket for sewer shafts

5.1.12 Mounting in a shaft

The pivoted mounting bracket is available as an accessory.



A0037748

14 *Mounting in a shaft, pivotable and adjustable*

A *Arm with wall bracket*

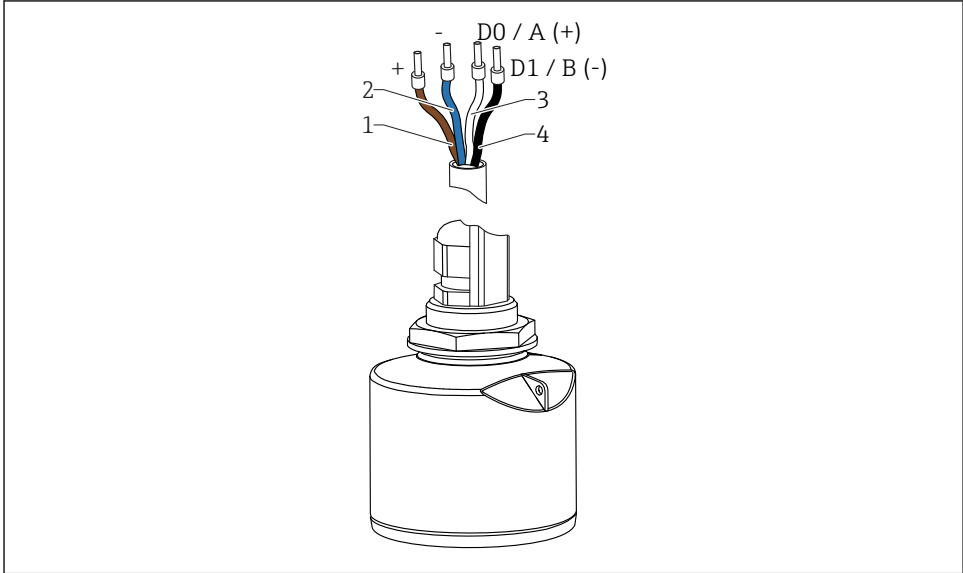
B *Pivotable and adjustable arm (e.g. to align the device with the center of a channel)*

5.2 Post-installation check

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

6 Electrical connection

6.1 Cable assignment



A0037750

15 FMR20 cable assignment, Modbus

- 1 Plus, brown wire
- 2 Minus, blue wire
- 3 Modbus DO/A (+), white wire
- 4 Modbus DI/B (-), black wire

6.2 Supply voltage

5 to 30 V_{DC}

An external power supply is necessary.

Battery operation

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

Potential equalization

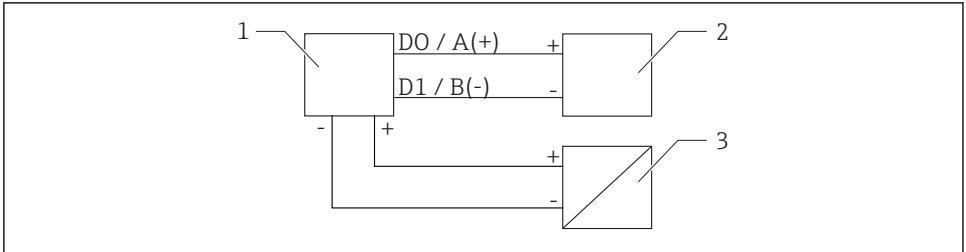
No special measures for potential equalization are required.

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

6.3 Connecting the device

6.3.1 Block circuit diagram for Modbus RS485 connection

The RS485 connection meets the requirements of the RS485-IS specification for use in hazardous environments.

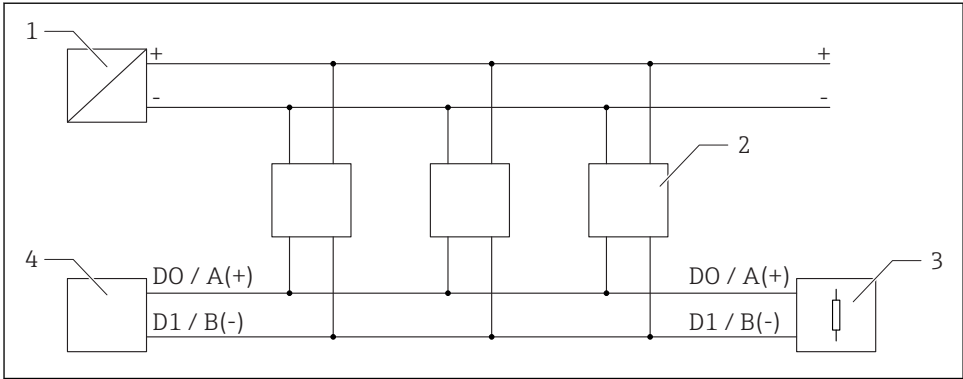


A0037751

16 Block circuit diagram for Modbus RS485 connection

- 1 Device with Modbus communication
- 2 Modbus master/RTU
- 3 Power supply

Up to 32 users can be connected on the RS485 bus.



A0038149

17 Block circuit diagram for Modbus RS485 connection, multiple users

- 1 Power supply
- 2 Device with Modbus communication
- 3 Bus termination
- 4 Modbus master/RTU

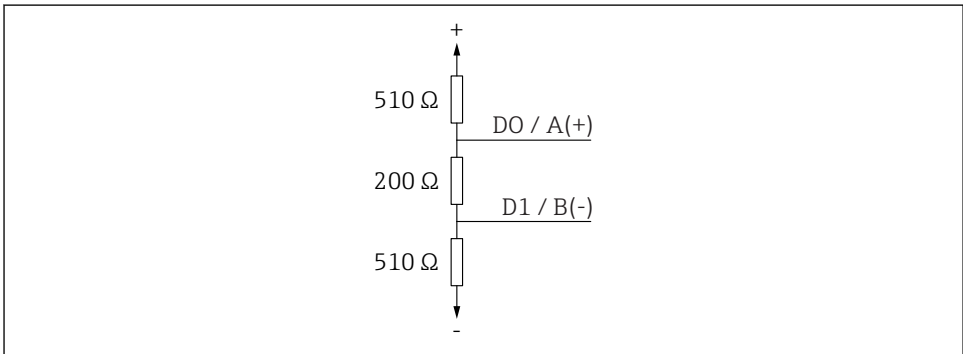
i The bus cable should be a type-A fieldbus cable with a maximum length of 1 200 m (3 937 ft).

If the device is installed in a hazardous environment, the cable length may not exceed 1 000 m (3 281 ft).

A terminating resistor must be connected at both ends of the RS485 bus.

6.3.2 Modbus RS485 bus terminating resistor

The bus terminating resistor should be installed as per the RS485-IS specification.



A0038150

18 Representation of the bus terminating resistor as per the RS485-IS specification

6.4 Post-connection check

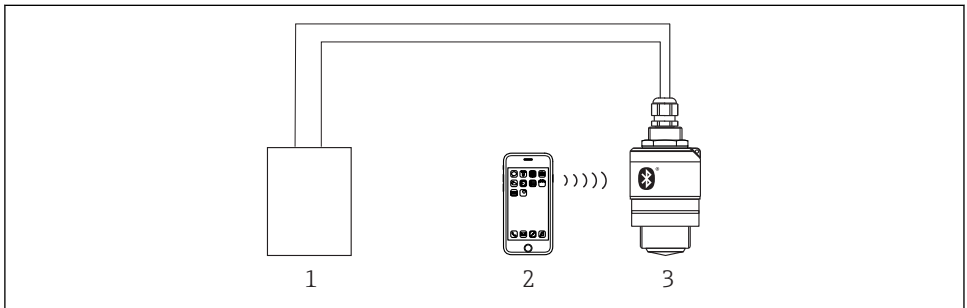
- Is the device or cable undamaged (visual inspection)?
- Do the mounted cables have adequate strain relief?
- Are the cable glands mounted and firmly tightened?
- Does the supply voltage match the specifications on the nameplate?
- No reverse polarity, is terminal assignment correct?

7 Operability


7.1 Operating concept

- Modbus
- SmartBlue (app) via *Bluetooth*[®] wireless technology
- Menu guidance with brief explanations of the individual parameter functions in the operating tool

7.2 Operation via *Bluetooth*[®] wireless technology

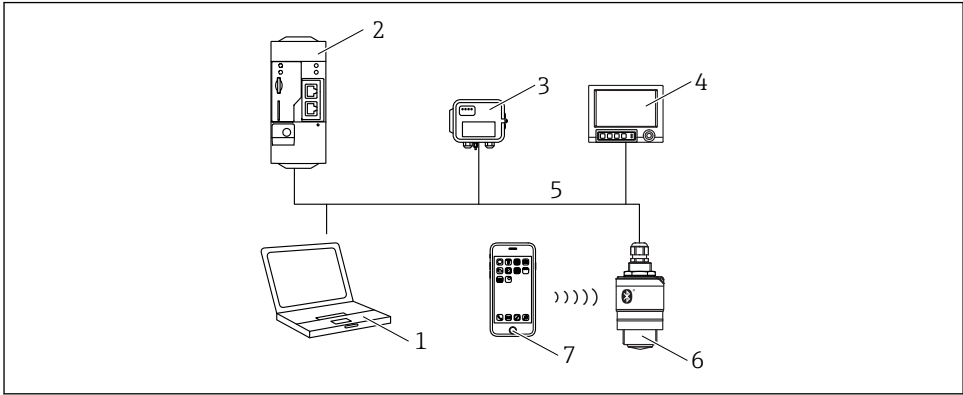


A0028895

 19 Possibilities for remote operation via *Bluetooth*[®] wireless technology

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

7.3 Remote operation via Modbus protocol



A0037752

20 Options for remote operation via Modbus protocol

- 1 Computer with Modbus operating tool (client application, terminal application, etc.)
- 2 Remote Transmit Unit (RTU) with Modbus (e.g. Fieldgate FXA42)
- 3 Connect Sensor FXA30B
- 4 Memograph M RSG45
- 5 Modbus RS485
- 6 Transmitter with Modbus and Bluetooth® wireless technology
- 7 Smartphone / tablet with SmartBlue (app)

8 System integration via Modbus protocol

8.1 Modbus RS485 information

8.1.1 Modbus settings

The following settings can be customized via Bluetooth and Modbus.

Setting	Options	Default
Data bits	7,8	8
Parity	Even, odd, none	Even
Stop bits	1,2	1
Baud rate	1200, 2400, 4800, 9600, 19200	9600
Protocol	RTU, ASCII	RTU
Addressing	1 to 200	200
Minimum polling interval	500 ms	

8.1.2 Modbus function codes

Function code	Action	Register type	Command type
03 (0x03)	Single / multiple read	Holding Register	Standard
06 (0x06)	Single write	Holding Register	Standard
16 (0x10)	Multiple write	Holding Register	Standard

8.1.3 Modbus exceptions

Exception	Number	Description
MB_EX_ILLEGAL_FUNCTION	01 (0x01)	Function code is not supported
MB_EX_ILLEGAL_DATA_ADDRESS	02 (0x02)	Register address is not available
MB_EX_ILLEGAL_DATA_VALUE	03 (0x03)	Data value is not permitted (e.g. writing of a float32 to a char8 register). Also valid for writing to read-only registers.

8.1.4 Modbus special data types

Data type	Registers per parameter	Description			
float32 (IEEE754)	2	As a float32 consists of four bytes, a parameter with float32 as the data type must be divided into two 16-bit words that are transmitted via Modbus. To read a float32-type parameter, two consecutive Modbus registers therefore must be read.			
		Modbus register [n]	Modbus register [n+1]		
		Byte A	Byte B	Byte C	Byte D
		float32 value			
uint32 / int32	2	The same conditions that apply for float32 data types also apply for uint32 / int32 data types.			
		Modbus register [n]	Modbus register [n+1]		
		Byte A	Byte B	Byte C	Byte D
		uint32 / Int32 value			
string (char8 array)	0,5	As a single character of a character string only needs one byte, two characters are always packed into a Modbus register. Furthermore, the length of a parameter with string as the data type is limited to 60 characters.			
		Modbus register [n]	Modbus register [n+1]		
		char8 [n]	char8 [n+1]	char8 [n+2]	char8 [n+3]

8.2 Measured variables via Modbus protocol

The 8 most important process parameters are mapped as burst parameters to the first addresses in the Modbus address range. This means that these parameters can be read out in one measurement transmission. All parameters are available in the Float32 format.



The register address must be incremented by one (register address +1) when using the Memograph M RSG45 or Fieldgate FXA30b Modbus master. This can also apply for other masters.

Modbus address	Parameter name	Description	SI unit
5000	MODB_PV_VALUE	Level linearized (PV)	Depends on the type of linearization
5002	MODB_SV_VALUE	Distance (SV)	m
5004	MODB_TV_VALUE	Relative echo amplitude (TV)	dB
5006	MODB_QV_VALUE	Temperature (QV)	°C
5008	MODB_SIGNALQUALITY	Signal quality	-
5010	MODB_ACTUALDIAGNOSTICS	Current diagnostics number	-
5012	MODB_LOCATION_LONGITUDE	Longitude coordinate	°
5014	MODB_LOCATION_LATITUDE	Latitude coordinate	°

9 Commissioning and operation

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

9.1 Commissioning via SmartBlue (App)

9.1.1 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).

9.1.2 SmartBlue system requirements

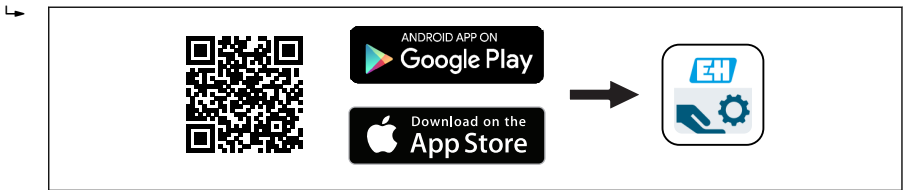
SmartBlue system requirements

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

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

9.1.3 SmartBlue App

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



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21 Download link

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



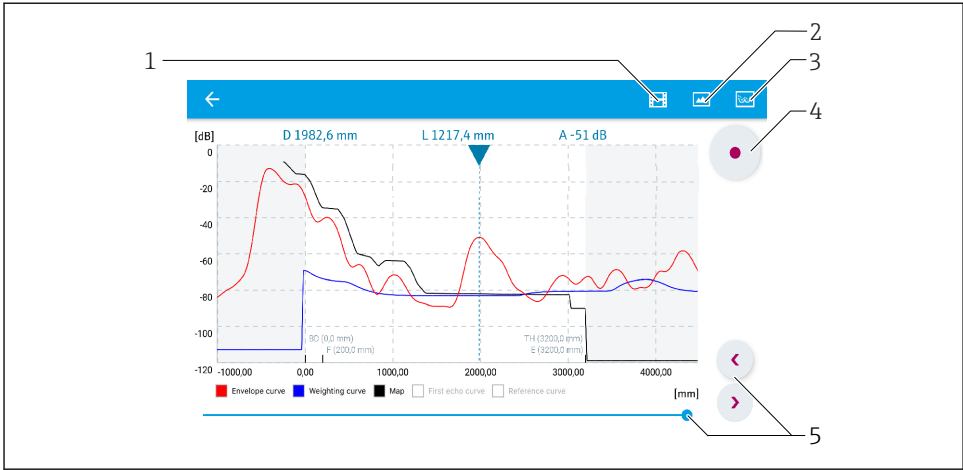
After logging in for the first time, change the password!

9.1.4 Envelope curve display in SmartBlue

Envelope curves can be displayed and recorded in SmartBlue.

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

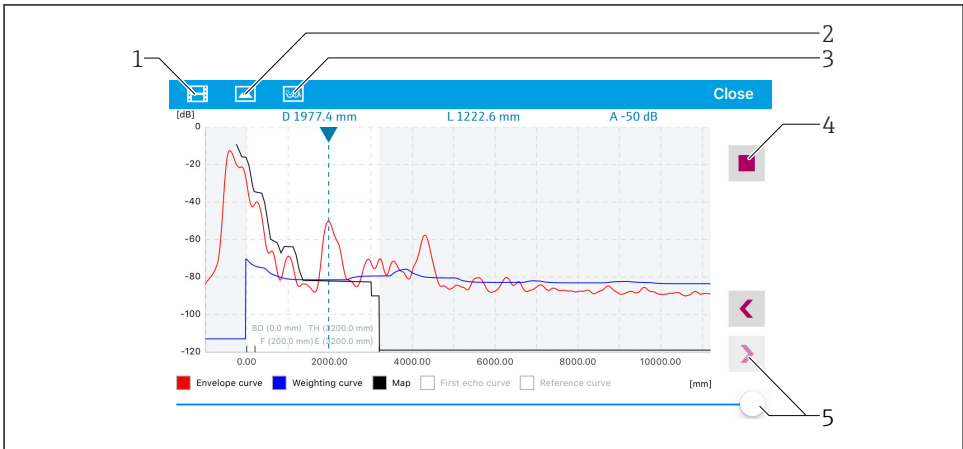
- D = Distance
- L = Level
- A = Absolute amplitude
- With screenshots, the displayed section (zoom function) is saved
- With video sequences, the whole area without zoom function is saved all the time



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22 Envelope curve display (sample) in SmartBlue for Android

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

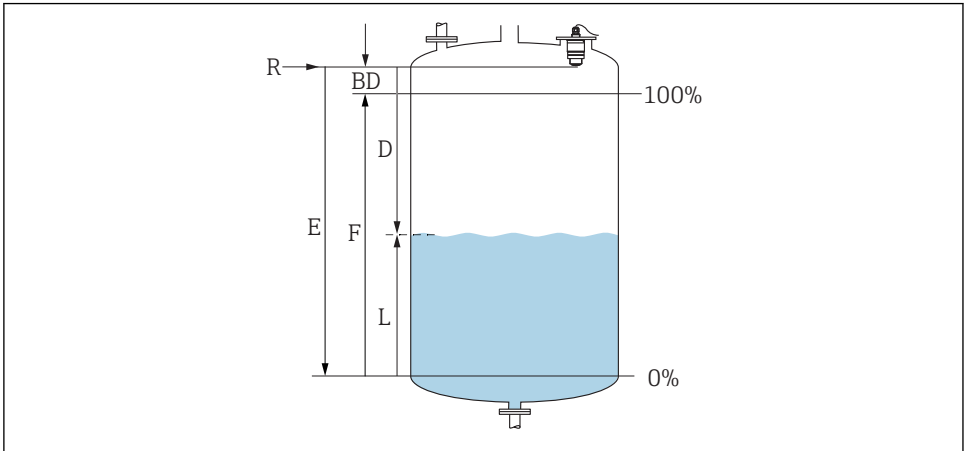


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23 Envelope curve display (sample) in SmartBlue for iOS

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

9.2 Configuring level measurement via operating software



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24 Configuration parameters for level measurement in liquids

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

9.2.1 Via SmartBlue

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

7. Navigate to: Setup → Present mapping
 - ↳ Displays the distance up to which a mapping has already been recorded
8. Setup → Confirm distance
9. Navigate to: Setup → Level
 - ↳ Shows the level L measured
10. Navigate to: Setup → Signal quality
 - ↳ Displays the signal quality of the analyzed level echo

9.2.2 Via Modbus

1. Navigate to: Modbus Register 5262 (float32) (LE_EMPTY)
 - ↳ Write empty distance E
2. Navigate to: Modbus Register 5264 (float32) (LE_FULL)
 - ↳ Write full distance F (span: max. level - min. level)
3. Navigate to: Modbus Register 5105 (float32) (LCRS_DISTANCE_VALUE)
 - ↳ Shows the distance D that is currently measured from the reference point (lower edge of flange / last sensor thread) to the level
4. If distance is o.k.:

Navigate to: Distance ok → Modbus Register 5266 (uint16) (LCRS_DISTANCESELECTIONCONTROL)

 - ↳ Write distance ok (value: 32859)
 - ↳ MAP is recorded
5. If distance is not o.k.:

Navigate to: Distance ok → Modbus Register 5266 (uint16) (LCRS_DISTANCESELECTIONCONTROL)

 - ↳ Start manual recording of MAP (value: 179)
6. Navigate to: Modbus Register 5267 (float32) (LCRS_MAPPING_ENDPOINTCTRL)
 - ↳ Write real distance - 0.1m
 - ↳ MAP is recorded up to this distance
7. End mapping → Modbus Register 5266 (uint16) (LCRS_DISTANCESELECTIONCONTROL)
 - ↳ Write end mapping (value: 32862)
8. Or: do nothing
 - ↳ No mapping recorded -> factory settings are used.

9.3 Flow measurement configuration

The procedure for configuring flow measurement is described in the Operating Instructions pertaining to the device.

9.4 Measuring mode

The following measuring modes are possible:

- The continuous mode (standard mode)
The device measures continuously once per second.
- The single-shot mode
The device only performs one measurement and afterwards goes to a mode with reduced power consumption. This can reduce the power consumption of the device.

The measuring mode can be configured as follows:

- Via Modbus
Modbus Register 5426 (uint16) (MODB_RUNMODE) → write 3494 (single-shot mode) or 1380 (continuous mode)
- Via app
Navigate to: Setup → Communication → Advanced setup → Measurement mode

A measurement can be triggered by the following criteria in the single-shot mode:

- Start-up
When the device is started, a measurement is taken in the single-shot mode
- By writing the value 32965 to the Modbus Register 5427 (uint16) (MODB_MEASUREMENT_TRIGGER)

10 Diagnostics and troubleshooting

10.1 General errors

Error	Possible cause	Remedy
Device does not respond	Supply voltage does not match the specification on the nameplate	Apply correct voltage
	The polarity of the supply voltage is wrong	Correct the polarity
	The cables do not contact the terminals properly	Ensure electrical contact between the cable and the terminal
Modbus communication not working	Modbus signals connected incorrectly	Connect the Modbus signals correctly
	Access code is activated	Enter access code
Device measures incorrectly	Configuration error	<ul style="list-style-type: none"> ■ Check and correct the parameter configuration ■ Carry out mapping

Error	Possible cause	Remedy
Display values not plausible (linearization)	SmartBlue and Modbus active simultaneously	Log off Modbus and disconnect or Log off SmartBlue and disconnect (connection via SmartBlue has priority)
Linearized output value not plausible	Linearization error	Check the linearization table Check the vessel selection in the linearization module

10.2 Error - SmartBlue operation

Error	Possible cause	Remedy
Device is not visible in the live list	No Bluetooth connection	Enable Bluetooth function on smartphone or tablet
		Bluetooth function of sensor disabled, perform recovery sequence
Device is not visible in the live list	The device is already connected with another smartphone/tablet	Only one point-to-point connection is established between a sensor and a smartphone or tablet
Device is visible in the live list but cannot be accessed via SmartBlue	Android end device	Is the location function permitted for the app, was it approved the first time?
		GPS or positioning function must be activated for certain Android versions in conjunction with Bluetooth
		Activate GPS - close the app fully and restart - enable the positioning function for the app
Device is visible in the live list but cannot be accessed via SmartBlue	Apple end device	Log in as standard Enter user name "admin" Enter initial password (device serial number) paying attention to lower/upper case
Login via SmartBlue not possible	Device is being put into operation for the first time	Enter initial password (device serial number) and change. Pay attention to lower/upper case when entering the serial number.
Device cannot be operated via SmartBlue	Incorrect password entered	Enter correct password
Device cannot be operated via SmartBlue	Password forgotten	Contact the manufacturer's Service Department
Device cannot be operated via SmartBlue	The sensor temperature is too high	If the ambient temperature results in an elevated sensor temperature of >60 °C (140 °F), Bluetooth communication may be disabled. Shield the device, isolate it and cool it down if necessary.

10.3 Diagnostic event in the operating tool

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

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

Calling up remedial measures

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



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