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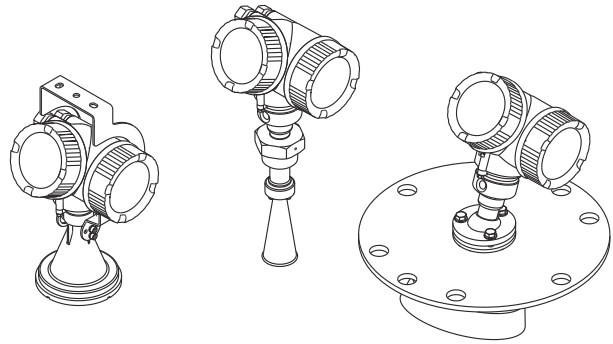
71575723
2022-08-01

Brief Operating Instructions **Micropilot FMR56, FMR57 HART**

Free space radar

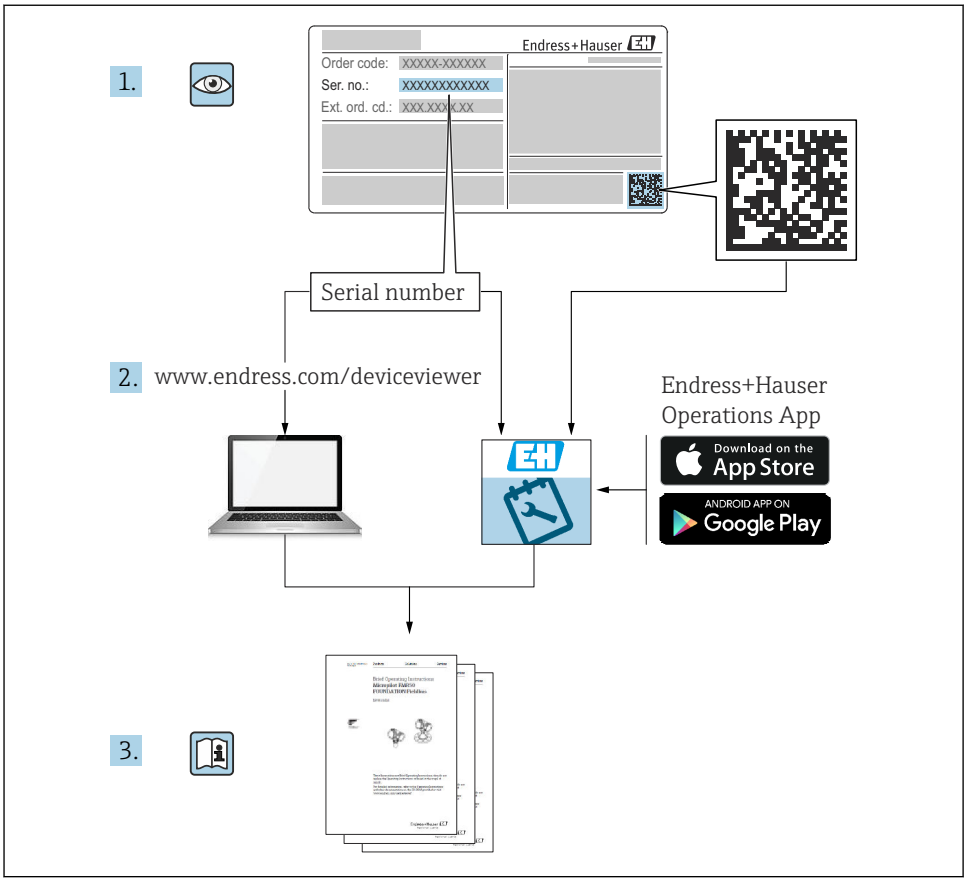


These Instructions are Brief Operating Instructions; they are not a substitute for the Operating Instructions pertaining to the device.

Detailed information about the device can be found in the Operating Instructions and the other documentation:
Available for all device versions via:
- Internet: www.endress.com/deviceviewer
- Smart phone/tablet: *Endress+Hauser Operations App*

Endress+Hauser
People for Process Automation

1 Associated documentation



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2 About this document

2.1 Symbols used

2.1.1 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.

2.1.2 Electrical symbols

⏚
Protective earth (PE)
Ground terminals that must be connected to ground prior to establishing any other connections.
The ground terminals are located on the inside and outside of the device.
- Interior ground terminal; protective earth is connected to the mains supply.
- Exterior ground terminal; device is connected to the plant grounding system.

2.1.3 Tool symbols

Tool symbols

Flat-blade screwdriver

Allen key

Open-ended wrench

2.1.4 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 documentation

Reference to graphic

▶
Notice or individual step to be observed

1., 2., 3.
Series of steps

↳
Result of a step


Visual inspection

1, 2, 3, ...
Item numbers

A, B, C, ...
Views

3 Basic safety instructions

3.1 Requirements for the personnel

Personnel must meet the following requirements to perform their tasks:
- Trained, qualified specialists must have a relevant qualification for this specific function and task.
- Personnel must be authorized by the plant owner/operator.
- They must be familiar with 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).
- They must follow instructions and comply with general policies.

3.2 Intended use

Application and media
The measuring device described in these Operating Instructions is intended for continuous, non-contact level measurement primarily in bulk solids. Because of its operating frequency of approx. 26 GHz, a maximum radiated pulsed power of 23.3 mW and an average power output of 0.076 mW, the device can also be used without restrictions outside closed metal vessels (for example, above basins, open channels or heaps). 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 device may be used only for the following measurements:
- Measured process variables: level, distance, signal strength
- Calculated process variables: volume or mass in vessels of any shape; flow rate through measuring weirs or channels (calculated based on the level using the linearization functionality)

To ensure that the measuring device remains in proper condition for the operation time:
- ▶ Use the measuring 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 using the device incorrectly or for purposes for which it was not intended.

Clarification in the case 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 contained therein (e.g. display module, main electronics module and I/O electronics module) may rise up to 80 °C (176 °F). When in operation, the sensor may 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.

3.3 Workplace safety

When working on and with the device:
- ▶ Wear the required personal protective equipment as per national regulations.

3.4 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 trouble-free operation of the device.

Hazardous area

To eliminate danger to persons or the facility when the device is used in the hazardous area (e.g. explosion protection):
- ▶ Check the nameplate to verify if the device ordered can be put to its intended use in the hazardous area.
- ▶ Observe the specifications in the separate supplementary documentation that is an integral part of these instructions.

3.5 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 the general safety standards and legal requirements.

NOTICE

Loss of degree of protection by opening of the device in humid environments

- If the device is opened in a humid environment, the degree of protection indicated on the nameplate is no longer valid. This may also impair the safe operation of the device.

3.5.1 CE mark

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

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

3.5.2 EAC conformity

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

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

4 Incoming acceptance and product identification

4.1 Incoming acceptance

Check the following during incoming acceptance:

- Are the order codes on the delivery note and the product sticker identical?
- Are the goods undamaged?
- Does the data on the nameplate match the order specifications on the delivery note?
- Is the DVD with the operating tool present?
  If required (see nameplate), have the Safety Instructions (XA) been provided?

If one of these conditions is not met, please contact your Endress+Hauser sales office.

4.2 Storage and transport

4.2.1 Storage conditions

- Permitted storage temperature: −40 to +80 °C (−40 to +176 °F)
- Use original packaging.

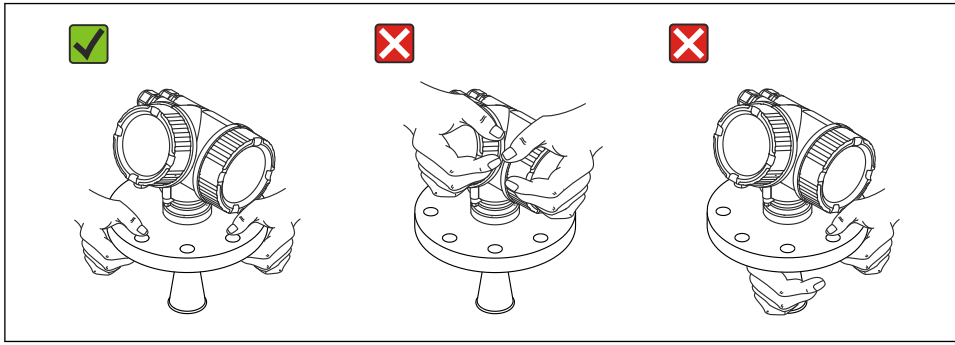
4.2.2 Transporting the product to the measuring point

NOTICE

Housing or antenna horn may become damaged or break off.

Risk of injury!

- Transport the measuring device to the measuring point in its original packaging or by the process connection.
- Always secure lifting equipment (slings, eyes, etc.) to the process connection and never to the electronic housing or antenna horn. Pay attention to the center of gravity of the device so that it does not tilt or slip unintentionally.
- Follow the safety instructions and transport conditions for devices over 18 kg (39.6 lbs), (IEC61010).



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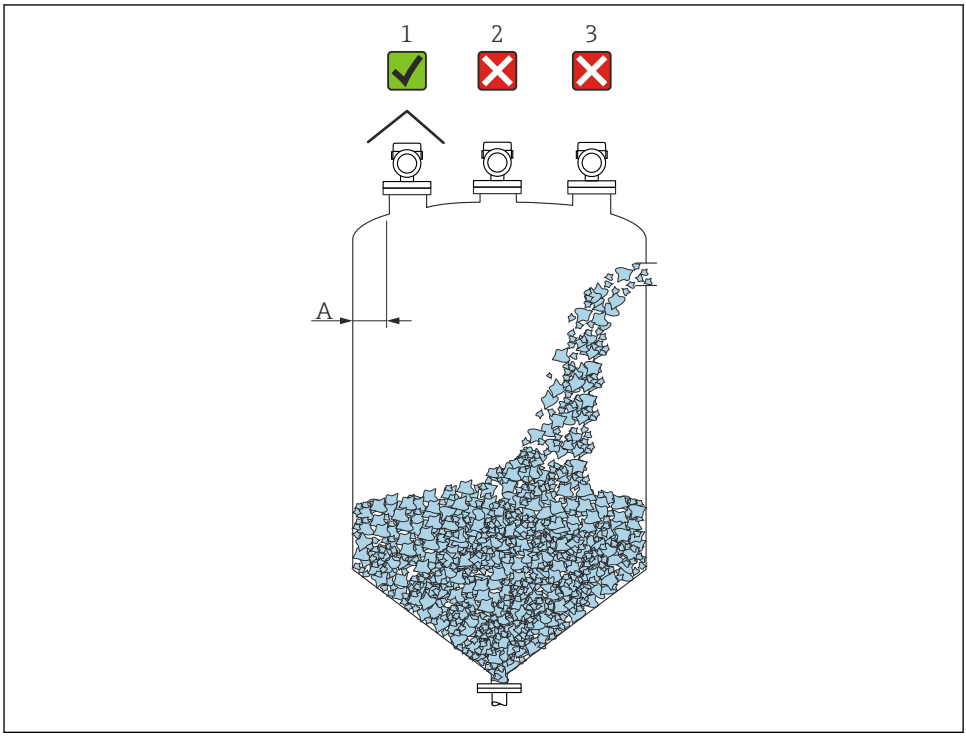
5 Mounting

5.1 Mounting location



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A Recommended distance from wall to nozzle outer edge ~ 1/6 of the vessel diameter. However, the device must not under any circumstances be mounted closer than 20 cm (7.87 in) to the vessel wall. If the vessel wall is not smooth (corrugated iron, welding seams, joints, etc.), it is advisable to maintain the greatest possible distance from the wall. Where necessary, use an alignment unit to avoid interference reflections from the vessel wall .

1 Use of a weather protection cover; protection from direct sunlight or rain

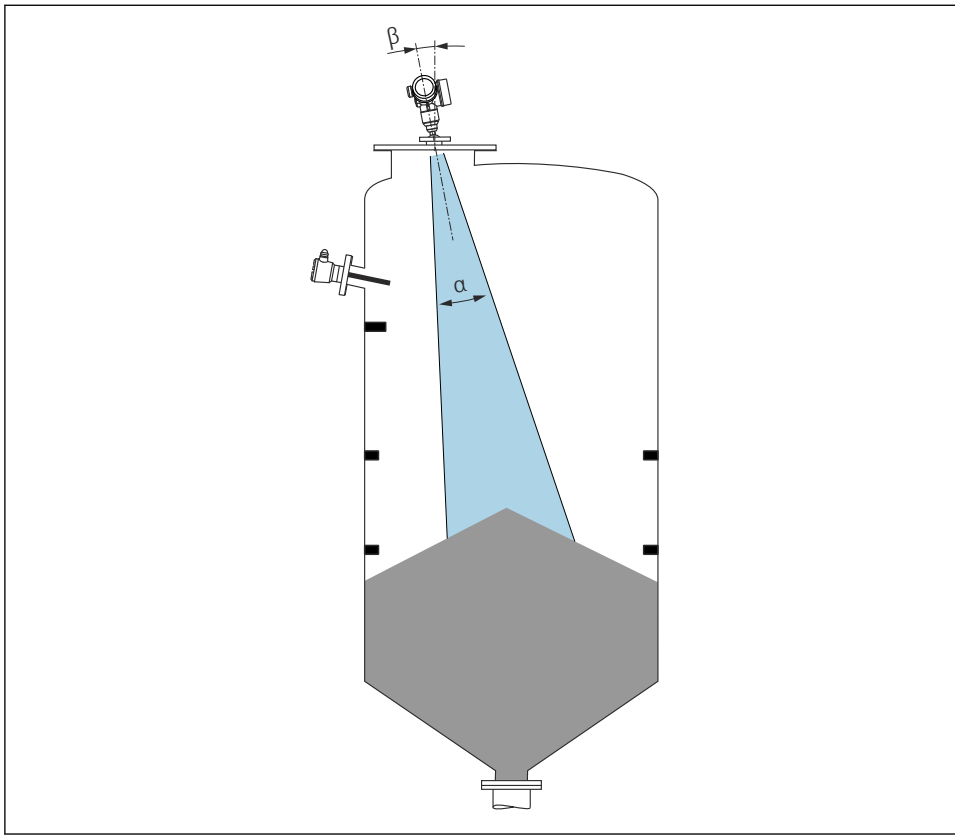
2 Installation in the center, interference can cause signal loss

3 Do not install above the filling curtain

In applications with strong dust emissions, the integrated purge air connection can prevent the antenna from becoming clogged.

5.2 Orientation

5.3 Internal vessel fittings



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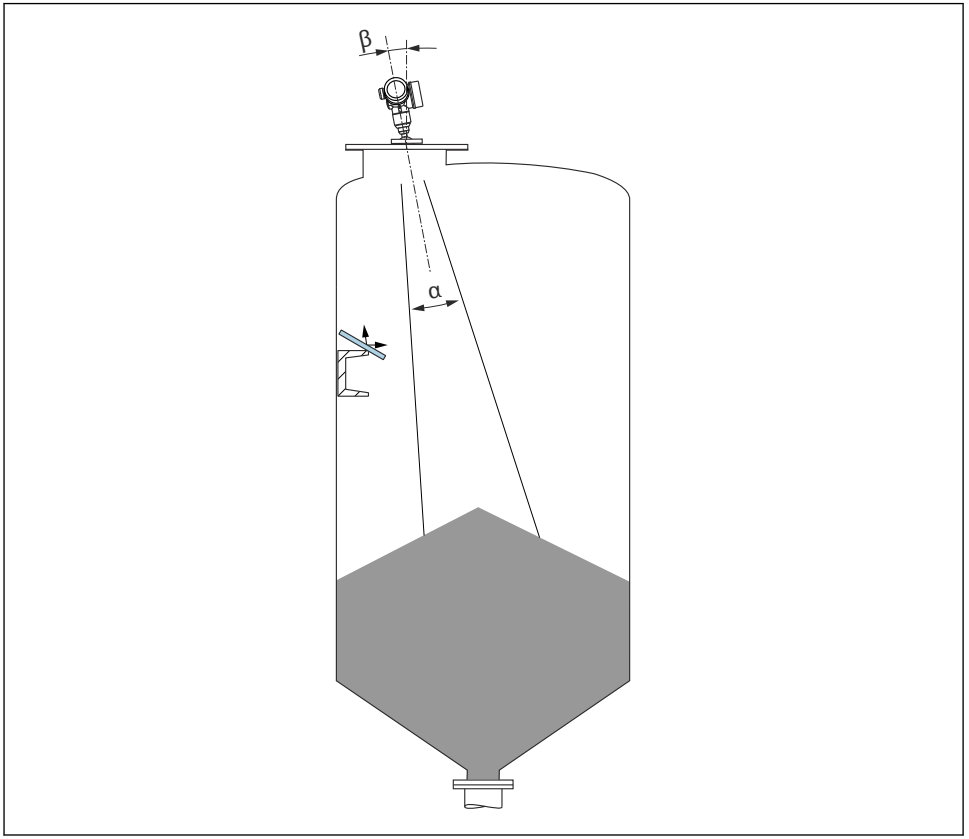
Avoid the location of internal fittings (limit switches, temperature sensors, struts etc.) inside the signal beam. Take into account the beam angle.

5.4 Avoiding interference echoes



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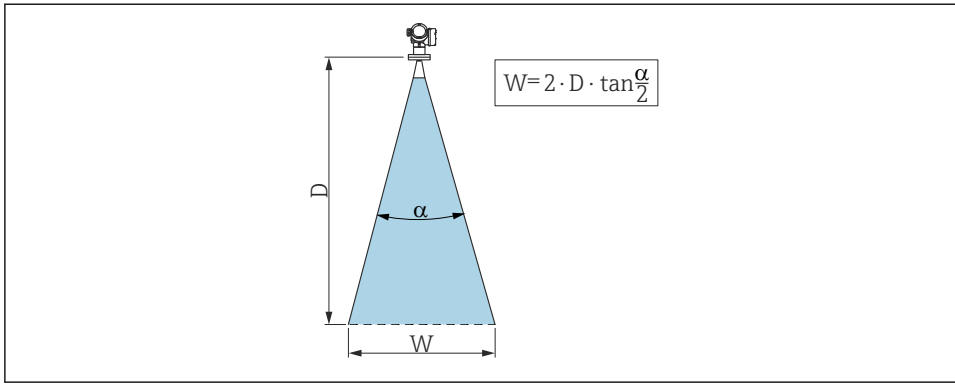
Metal orifice plates installed at an angle to scatter the radar signals help prevent interference echoes.

5.5 Beam angle

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.



1 Relationship between beam angle a, distance D and beam diameter W

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

FMR56		
Antenna size	80 mm (3 in)	100 mm (4 in)
Beam angle α	10°	8°
Distance (D)	**Beam diameter (W)**	
3 m (9.8 ft)	0.53 m (1.7 ft)	0.42 m (1.4 ft)
6 m (20 ft)	1.05 m (3.4 ft)	0.84 m (2.8 ft)
9 m (30 ft)	1.58 m (5.2 ft)	1.26 m (4.1 ft)
12 m (39 ft)	2.1 m (6.9 ft)	1.68 m (5.5 ft)
15 m (49 ft)	2.63 m (8.6 ft)	2.10 m (6.9 ft)
20 m (66 ft)	3.50 m (11 ft)	2.80 m (9.2 ft)
25 m (82 ft)	4.37 m (14 ft)	3.50 m (11 ft)
30 m (98 ft)	5.25 m (17 ft)	4.20 m (14 ft)

FMR57 - horn antenna		
Antenna size	80 mm (3 in)	100 mm (4 in)
Beam angle α	10°	8°
Distance (D)	**Beam diameter W**	
5 m (16 ft)	0.87 m (2.9 ft)	0.7 m (2.3 ft)
10 m (33 ft)	1.75 m (5.7 ft)	1.4 m (4.6 ft)
15 m (49 ft)	2.62 m (8.6 ft)	2.1 m (6.9 ft)
20 m (66 ft)	3.50 m (11 ft)	2.80 m (9.2 ft)
30 m (98 ft)	5.25 m (17 ft)	4.20 m (14 ft)
40 m (131 ft)	7.00 m (23 ft)	5.59 m (18 ft)
50 m (164 ft)	8.75 m (29 ft)	6.99 m (23 ft)

FMR57 - parabolic antenna		
Antenna size	200 mm (8 in)	250 mm (10 in)
Beam angle α	4°	3.5°
Distance (D)	**Beam diameter W**	
5 m (16 ft)	0.35 m (1.1 ft)	0.30 m (1 ft)
10 m (33 ft)	0.70 m (2.3 ft)	0.61 m (2 ft)
15 m (49 ft)	1.05 m (3.4 ft)	0.92 m (3 ft)
20 m (66 ft)	1.40 m (4.6 ft)	1.22 m (4 ft)
30 m (98 ft)	2.10 m (6.9 ft)	1.83 m (6 ft)
40 m (131 ft)	2.79 m (9.2 ft)	2.44 m (8 ft)
50 m (164 ft)	3.50 m (11 ft)	3.06 m (10 ft)
60 m (197 ft)	4.19 m (14 ft)	3.70 m (12 ft)
70 m (230 ft)	4.90 m (16 ft)	4.28 m (14 ft)

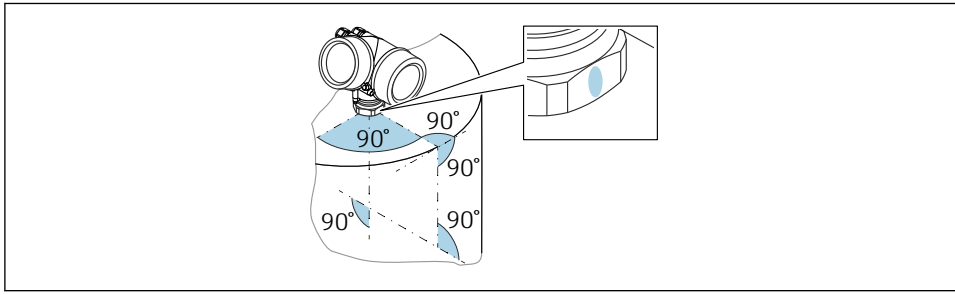
5.6 Free-space installation in vessel

5.6.1 Horn antenna with slip-on flange (FMR56)

Alignment

If using the Micropilot with a slip-on flange in explosion-hazardous areas, observe all the specifications in the relevant Safety Instructions (XA).

- Align the antenna perpendicular to the product surface.
  Optionally, an adjustable flange seal (accessory) can be used for alignment
- A marking is provided on the gland to aid the alignment. This marking must be aligned towards the tank wall as much as possible.



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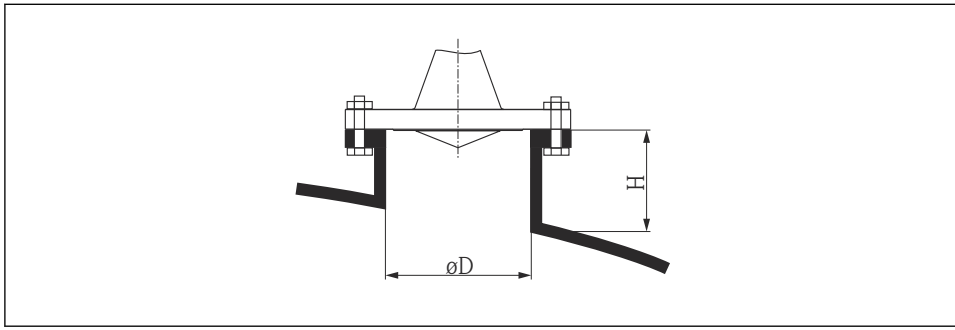
Depending on the device version the marking may be a circle or two parallel lines.

Information concerning nozzles



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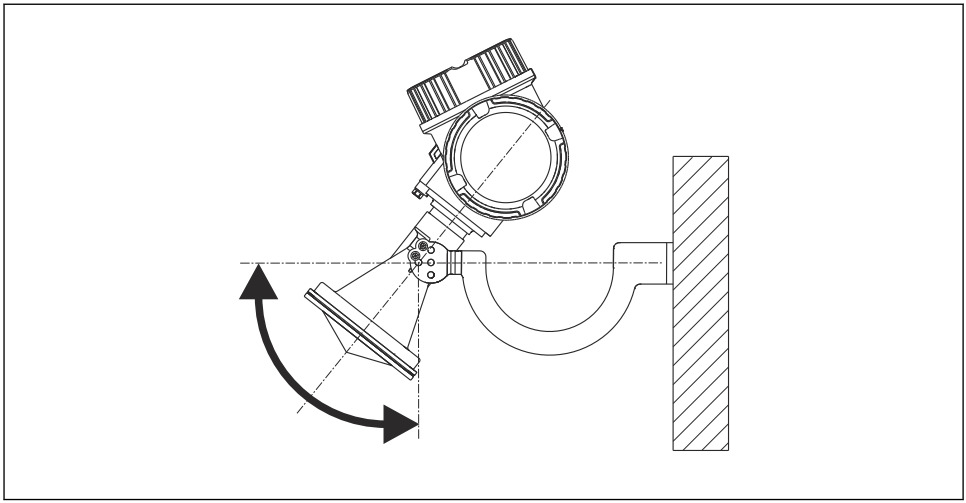
2 *Nozzle diameter and height for horn antennas with slip-on flange*

Ø*D*	**Maximum nozzle height** H_{max}
80 mm (3 in)	300 mm (11.8 in)
100 mm (4 in)	400 mm (15.8 in)
150 mm (6 in)	500 mm (19.7 in)

5.6.2 Horn antenna with mounting bracket (FMR56)



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3 Mounting the horn antenna with a mounting bracket

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.

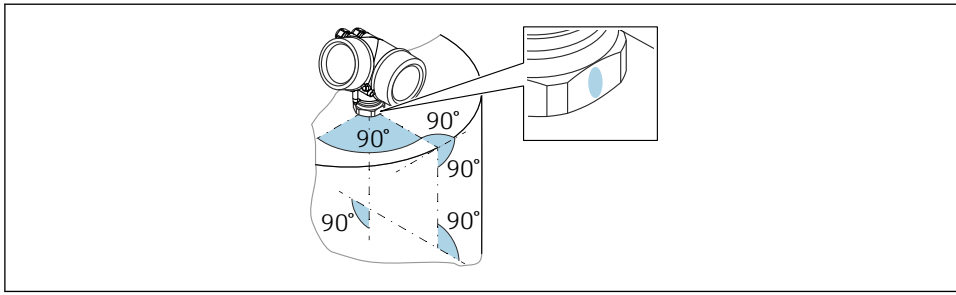
Risk of electrostatic charge.

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

5.6.3 Horn antenna (FMR57)

Alignment

- Ideally, the horn antenna should be installed vertically. To avoid interference reflections or for optimum alignment in the vessel, the Micropilot can be swiveled by 15° in all directions with the optional alignment device.
- A marking is provided on the gland to aid the alignment. This marking must be aligned towards the tank wall as much as possible.



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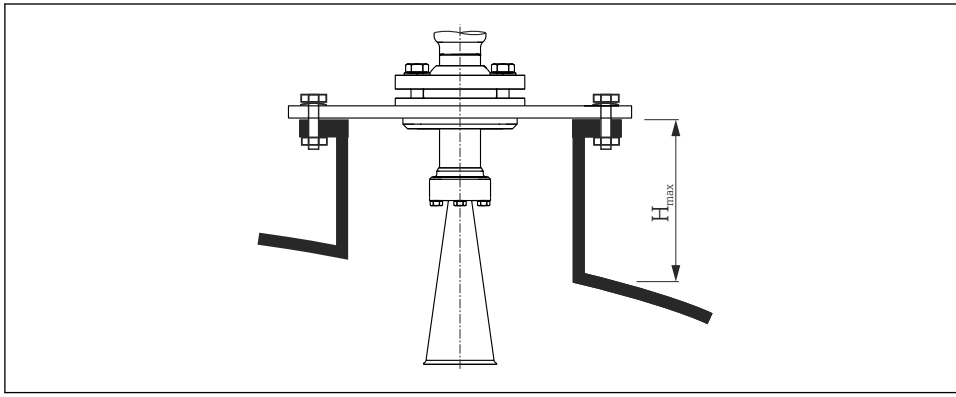
Depending on the device version the marking may be a circle or two parallel lines.

Information concerning nozzles

The horn antenna should project out of the nozzle. If this is not possible for mechanical reasons, larger nozzle heights can be accepted.



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4 *Nozzle height for horn antenna (FMR57)*

Antenna	Maximum nozzle height H_{max} (valid for antennas without an antenna extension)
Horn 80mm/3"	260 mm (10.2 in)
Horn 100mm/4"	480 mm (18.9 in)

Please contact the manufacturer's support service for applications with nozzles that are higher than indicated in the table.

Information concerning threaded connections

For devices with a threaded connection, it may be necessary - depending on the antenna size - to first disassemble the horn and then mount it again after screwing in the device.

- Tighten by the hexagonal nut only.
- Tool: open-ended wrench 60 mm
- Maximum permissible torque: 60 Nm (44 lbf ft)

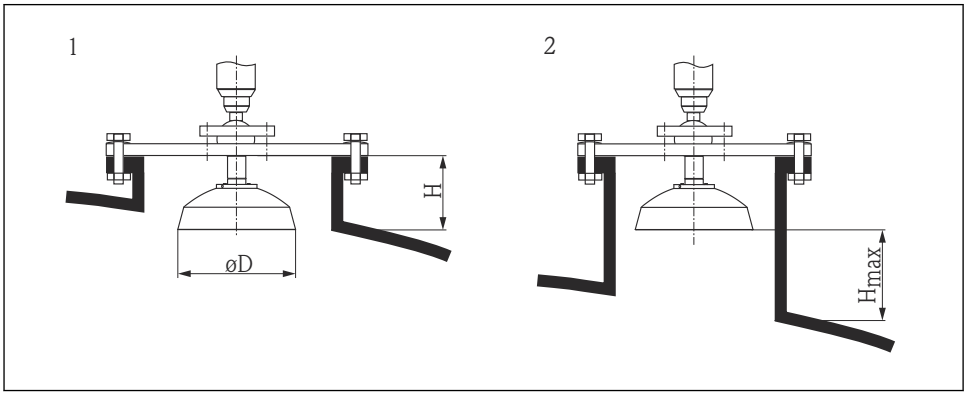
5.6.4 Parabolic antenna (FMR57)

Alignment

Ideally, the parabolic antenna should be installed vertically. To avoid interference reflections or for optimum alignment in the vessel, the Micropilot can be swiveled by 15 ° in all directions using the optional alignment unit.

Information concerning nozzles

- Case 1: Ideally, the parabolic antenna should project fully out of the nozzle (1). Particularly when using the alignment device, it is important to ensure that the parabolic reflector is projecting out of the nozzle/ceiling so as not to inhibit alignment.
- Case 2: For applications with higher nozzles, it may be necessary to install the parabolic antenna completely in the nozzle (2).
  The maximum height of the nozzle (H_{max}) to the surface of the parabolic antenna should not be greater than 500 mm (19.7 in). Interfering edges within the nozzle should be avoided.



5 Nozzle mounting of Micropilot FMR57 with parabolic antenna

1 Antenna completely projects out of the nozzle
2 Antenna completely inside the nozzle

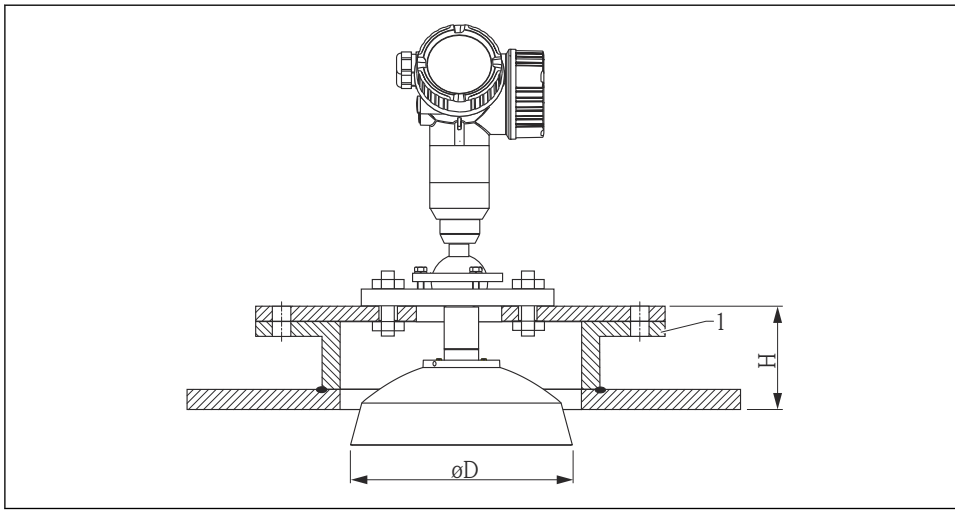
Antenna	Antenna diameter *D*	Nozzle height *H* for Case 1	Maximum nozzle height H_{max} for Case 2
Parabolic antenna 200mm/8"	173 mm (6.81 in)	< 50 mm (1.97 in)	500 mm (19.7 in)
Parabolic antenna 250mm/10"	236 mm (9.29 in)	< 50 mm (1.97 in)	500 mm (19.7 in)

Examples for installation with small flange

If the flange is smaller than the parabolic reflector, the device can be mounted in one of the following ways:

- Standard installation, the parabolic reflector must be dismantled in this case
- Installation with hinged flange

Standard installation



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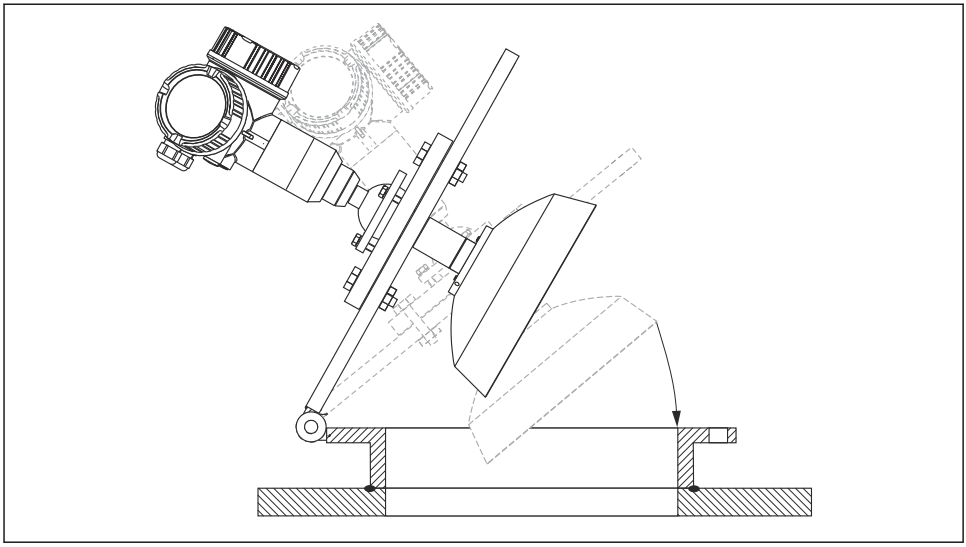
1 Nozzle

Antenna size	ØD	H (without antenna extension)
200 mm (8 in)	173 mm (6.81 in)	< 50 mm (1.96 in)
250 mm (10 in)	236 mm (9.29 in)	< 50 mm (1.96 in)

Installation with hinged flange

The length of the antenna must be taken into account in the case of hinged flanges.



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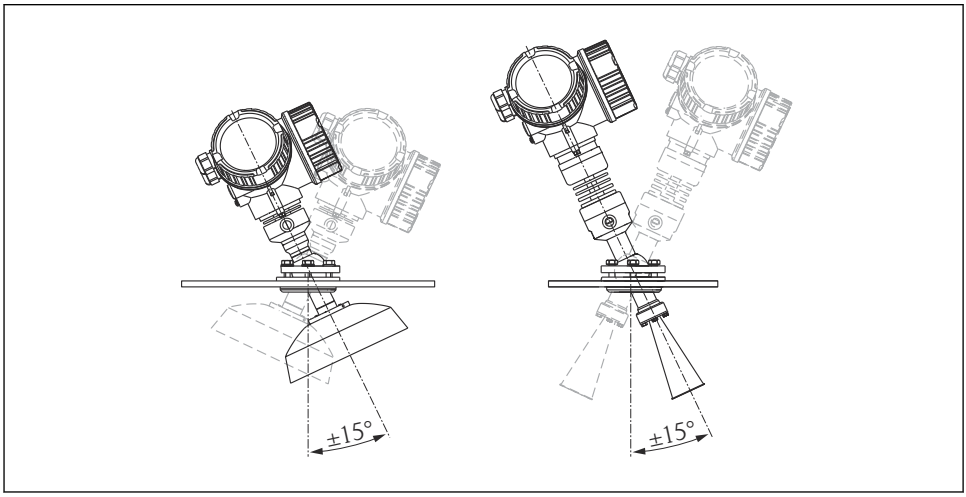
5.6.5 Alignment unit for FMR57

An angle of inclination of up to 15 ° in all directions can be set for the antenna axis using the alignment unit. The alignment unit is used to optimally align the radar beam with the bulk solid.



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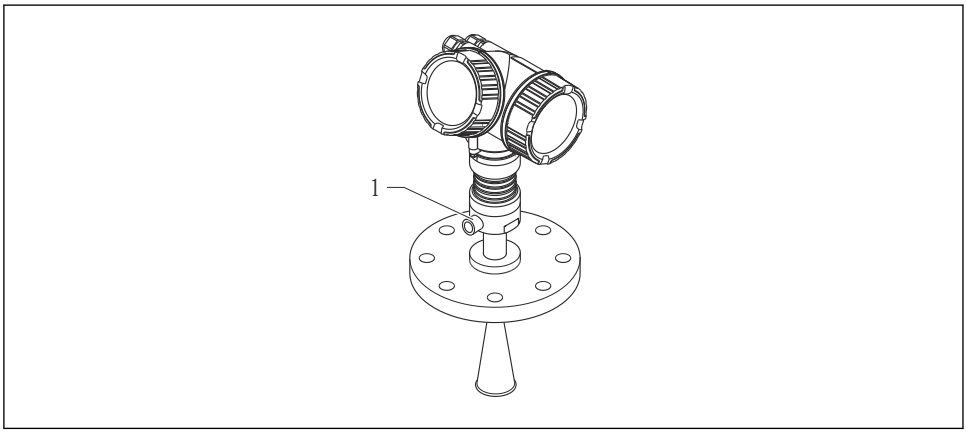
6 Micropilot FMR57 with alignment unit

Aligning the antenna axis

1. Release the screws
2. Align the antenna axis (up to max. ±15 ° possible in all directions)
3. Tighten the screws with 15 Nm (11 lbf ft)

5.6.6 Integrated purge air connection for FMR57

In applications with strong dust emissions, the integrated purge air connection can prevent the antenna from becoming clogged. Pulse operation is recommended.



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7 Micropilot FMR57 with purge air connection

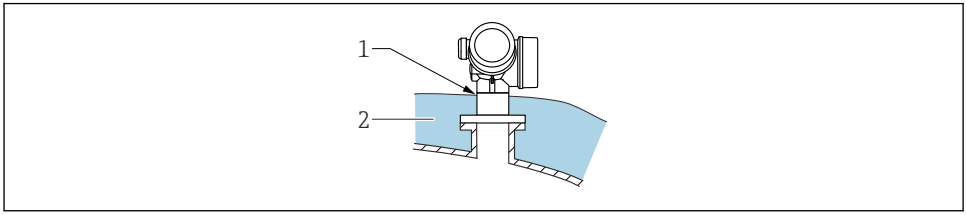
1 Purge air connection NPT¼ or G¼

Purge air pressure range

- **Pulse operation** :
  max. 6 bar (87 psi)
- **Continuous operation**:
  200 to 500 mbar (3 to 7.25 psi)

- Always use dry purge air
- In general, only purge to the extent necessary as excess purging can cause mechanical damage (abrasion)

5.7 Container with heat insulation



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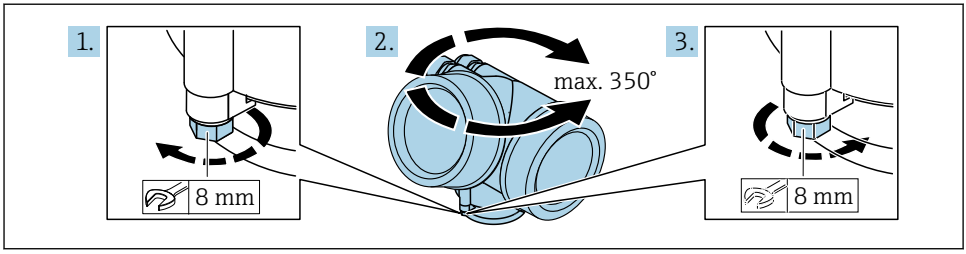
If process temperatures are high, the device should be included in the usual container insulation system (2) to prevent the electronics from heating as a result of thermal radiation or convection. The insulation should not be higher than the neck of the device (1).

5.8 Turning the transmitter housing

To provide easier access to the connection compartment or display module, the transmitter housing can be turned:



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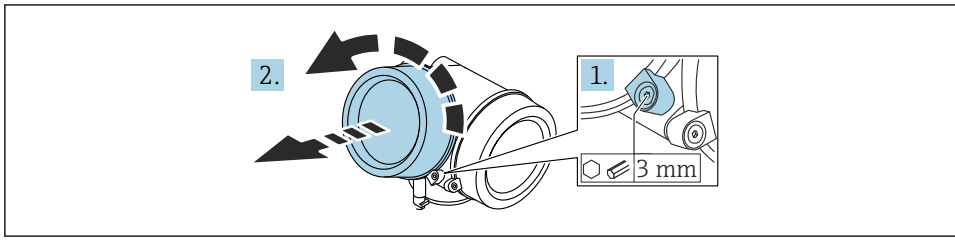
1. Unscrew the securing screw using an open-ended wrench.
2. Rotate the housing in the desired direction.
3. Tighten the securing screw (1.5 Nm for plastic housing; 2.5 Nm for aluminum or stainless steel housing).

5.9 Turning the display

5.9.1 Opening the cover



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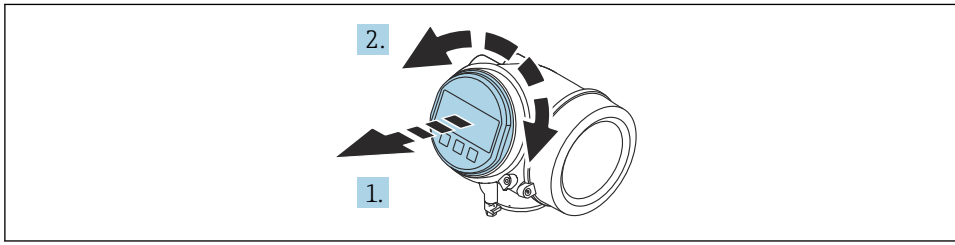
1. Loosen the screw of the securing clamp of the electronics compartment cover using an Allen key (3 mm) and turn the clamp 90 ° counterclockwise.
2. Unscrew the electronics compartment cover and check the cover seal; replace it if necessary.

5.9.2 Turning the display module



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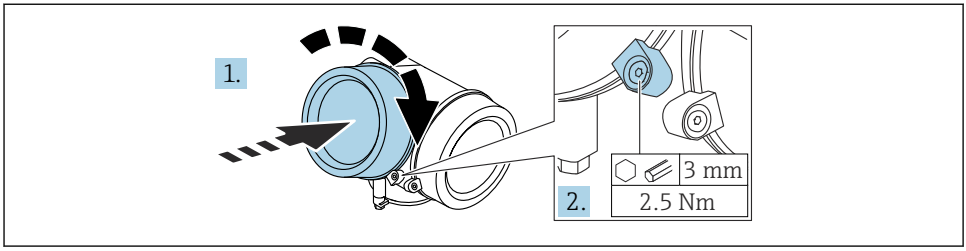
1. Pull out the display module with a gentle rotational movement.
2. Turn the display module to the desired position: Max. 8 × 45 ° in each direction.
3. Feed the coiled cable into the gap between the housing and main electronics module and plug the display module into the electronics compartment until it engages.

5.9.3 Closing the cover of the electronics compartment



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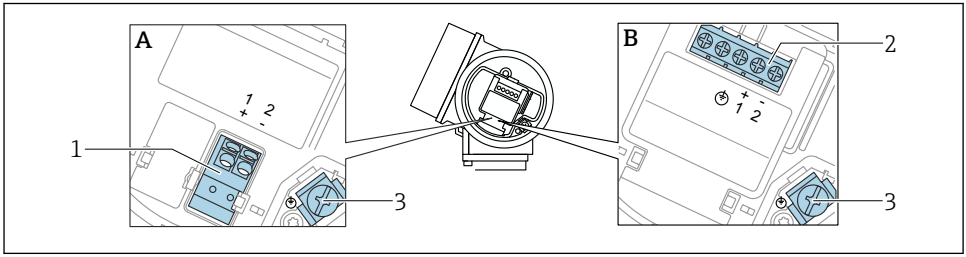
1. Screw down the cover of the electronics compartment.
2. Turn the securing clamp 90 ° in the clockwise direction and, using an Allen key (3 mm), tighten the screw of the securing clamp on the electronics compartment cover with 2.5 Nm.

6 Electrical connection

6.1 Connecting requirements

6.1.1 Terminal assignment

Terminal assignment, 2-wire: 4 to 20 mA HART



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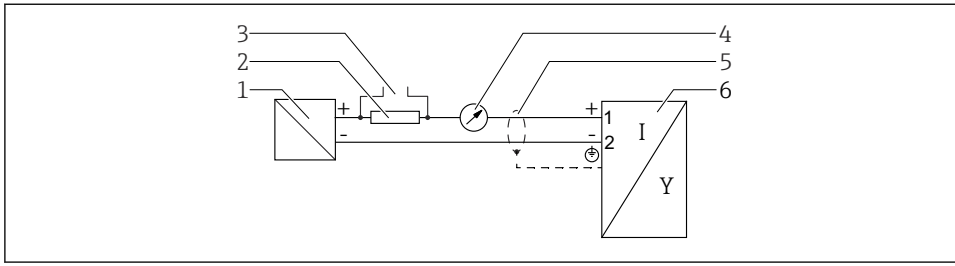
8 Terminal assignment, 2-wire: 4 to 20 mA HART

A Without integrated overvoltage protection
B With integrated overvoltage protection
1 Connection 4 to 20 mA, HART passive: terminals 1 and 2, without integrated overvoltage protection
2 Connection 4 to 20 mA, HART passive: terminals 1 and 2, with integrated overvoltage protection
3 Terminal for cable shield

Block diagram, 2-wire: 4 to 20 mA HART

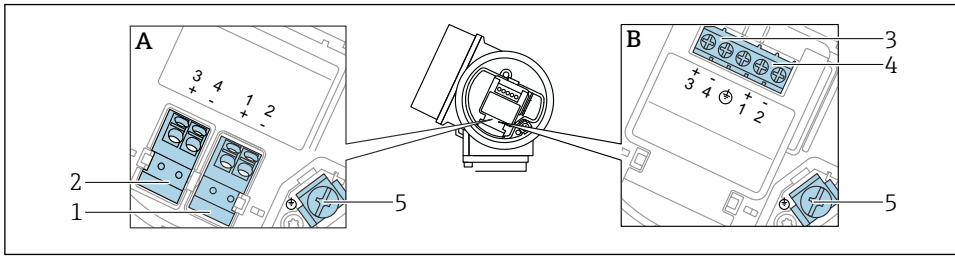


A0036499

9 Block diagram, 2-wire: 4 to 20 mA HART

1 *Active barrier for power supply (e.g. RN221N); observe terminal voltage*
2 *Resistor for HART communication (≥ 250 Ω); observe maximum load*
3 *Connection for Commubox FXA195 or FieldXpert SFX350/SFX370 (via VIATOR Bluetooth modem)*
4 *Analog display unit; observe maximum load*
5 *Cable screen; observe cable specification*
6 *Measuring device*

Terminal assignment, 2-wire: 4 to 20 mA HART, switch output

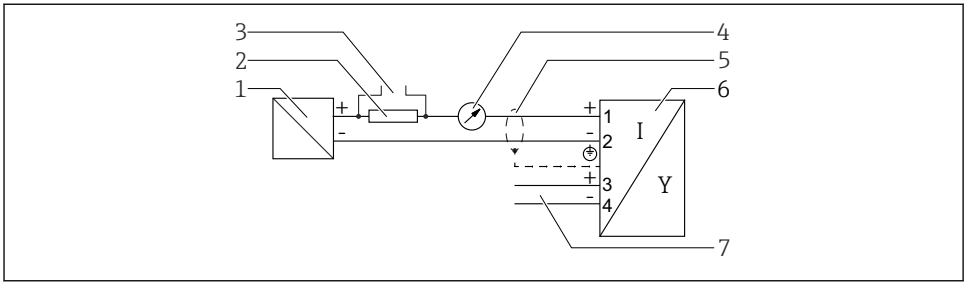


A0036500

10 Terminal assignment, 2-wire: 4 to 20 mA HART, switch output

A *Without integrated overvoltage protection*
B *With integrated overvoltage protection*
1 *Connection 4 to 20 mA, HART passive: terminals 1 and 2, without integrated overvoltage protection*
2 *Connection, switch output (open collector): terminals 3 and 4, without integrated overvoltage protection*
3 *Connection, switch output (open collector): terminals 3 and 4, with integrated overvoltage protection*
4 *Connection 4 to 20 mA, HART passive: terminals 1 and 2, with integrated overvoltage protection*
5 *Terminal for cable shield*

Block diagram, 2-wire: 4 to 20 mA HART, switch output

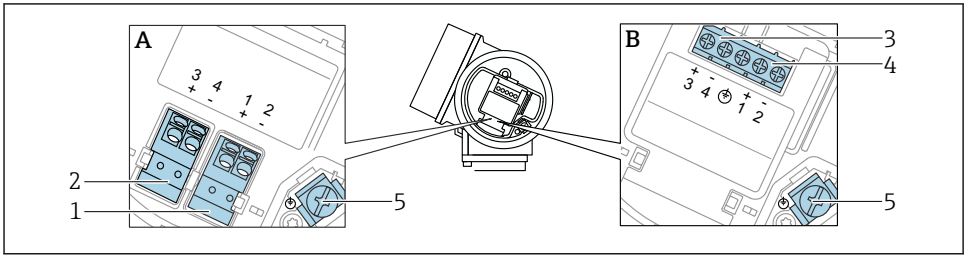


A0036501

11 *Block diagram, 2-wire: 4 to 20 mA HART, switch output*

1 *Active barrier for power supply (e.g. RN221N); observe terminal voltage*
2 *Resistor for HART communication (≥ 250 Ω); observe maximum load*
3 *Connection for Commubox FXA195 or FieldXpert SFX350/SFX370 (via VIATOR Bluetooth modem)*
4 *Analog display unit; observe maximum load*
5 *Cable screen; observe cable specification*
6 *Measuring device*
7 *Switch output (open collector)*

Terminal assignment, 2-wire: 4 to 20 mA HART, 4 to 20 mA

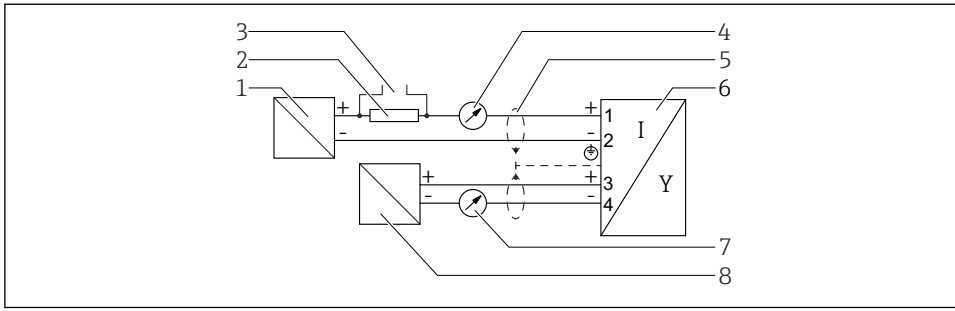


A0036500

12 *Terminal assignment, 2-wire: 4 to 20 mA HART, 4 to 20 mA*

A *Without integrated overvoltage protection*
B *With integrated overvoltage protection*
1 *Connection current output 1, 4 to 20 mA HART passive: terminals 1 and 2, without integrated overvoltage protection*
2 *Connection current output 2, 4 to 20 mA: terminals 3 and 4, without integrated overvoltage protection*
3 *Connection current output 2, 4 to 20 mA: terminals 3 and 4, with integrated overvoltage protection*
4 *Connection current output 1, 4 to 20 mA HART passive: terminals 1 and 2, with integrated overvoltage protection*
5 *Terminal for cable shield*

Block diagram, 2-wire: 4 to 20 mAHART, 4 to 20 mA

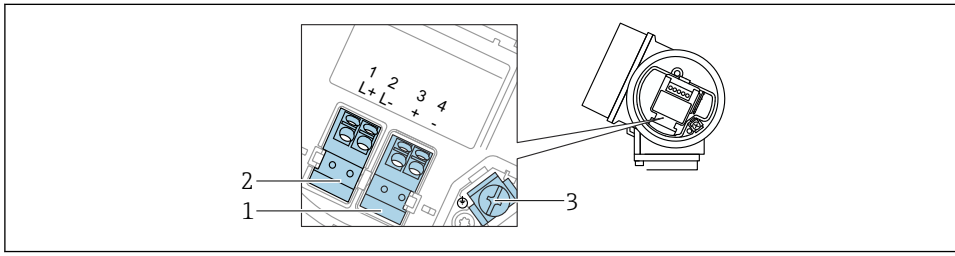


A0036502

13 Block diagram, 2-wire: 4 to 20 mAHART, 4 to 20 mA

1 Active barrier for power supply (e.g. RN221N), current output 1; observe terminal voltage
2 Resistor for HART communication (≥ 250 Ω); observe maximum load
3 Connection for Commubox FXA195 or FieldXpert SFX350/SFX370 (via VIATOR Bluetooth modem)
4 Analog display unit; observe maximum load
5 Cable screen; observe cable specification
6 Measuring device
7 Analog display unit; observe maximum load
8 Active barrier for power supply (e.g. RN221N), current output 2; observe terminal voltage

Terminal assignment, 4-wire: 4 to 20 mA HART (10.4 to 48 V_{DC})

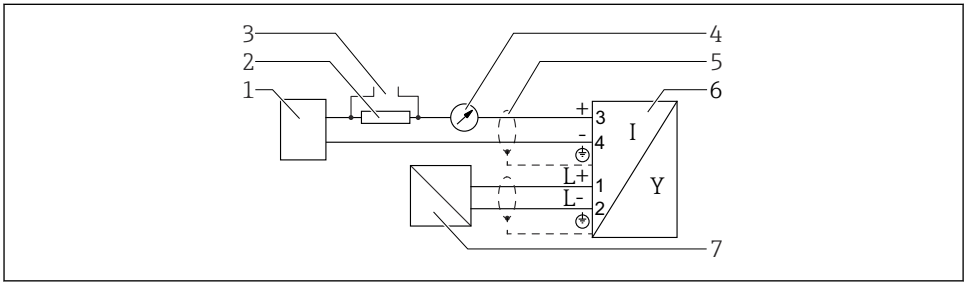


A0036516

14 Terminal assignment, 4-wire: 4 to 20 mA HART (10.4 to 48 V_{DC})

1 Connection 4 to 20 mA HART (active): terminals 3 and 4
2 Connection, supply voltage: terminals 1 and 2
3 Terminal for cable shield

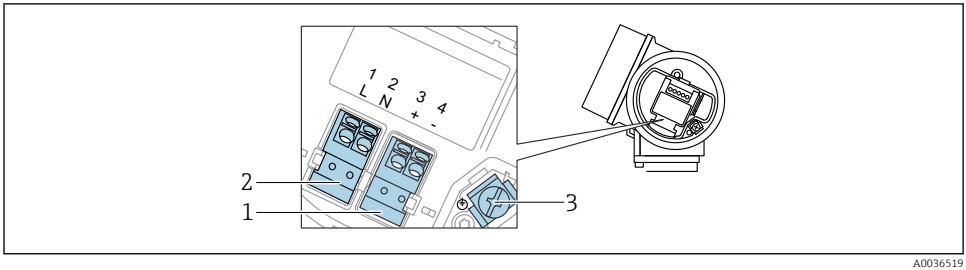
Block diagram, 4-wire: 4 to 20 mA HART (10.4 to 48 V_{DC})



15 Block diagram, 4-wire: 4 to 20 mA HART (10.4 to 48 V_{DC})

1 *Evaluation unit, e.g. PLC*
2 *Resistor for HART communication (≥ 250 Ω); observe maximum load*
3 *Connection for Commubox FXA195 or FieldXpert SFX350/SFX370 (via VIATOR Bluetooth modem)*
4 *Analog display unit; observe maximum load*
5 *Cable screen; observe cable specification*
6 *Measuring device*
7 *Supply voltage; observe terminal voltage, observe cable specification*

Terminal assignment, 4-wire: 4 to 20 mA HART (90 to 253 V_{AC})



16 Terminal assignment, 4-wire: 4 to 20 mAHART (90 to 253 V_{AC})

1 *Connection 4 to 20 mA HART (active): terminals 3 and 4*
2 *Connection, supply voltage: terminals 1 and 2*
3 *Terminal for cable shield*

⚠ CAUTION

To ensure electrical safety:

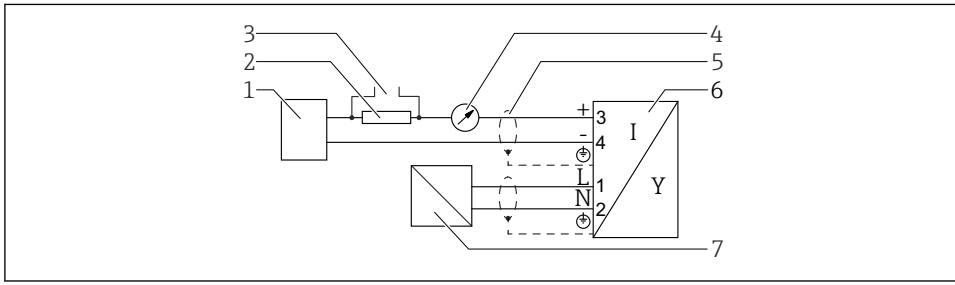
- ▶ Do not disconnect the protective ground connection.
- ▶ Disconnect the device from the supply voltage before disconnecting the protective ground.

Connect protective ground to the inner ground terminal (3) before connecting the supply voltage. If necessary, connect the potential matching line to the outer ground terminal.

In order to ensure electromagnetic compatibility (EMC): do **not** ground the device exclusively via the protective ground conductor of the supply cable. Instead, the functional grounding must also be connected to the process connection (flange or threaded connection) or to the external ground terminal.

An easily accessible power switch must be installed in the proximity of the device. The power switch must be marked as a disconnector for the device (IEC/EN61010).

Block diagram, 4-wire: 4 to 20 mA HART (90 to 253 V_{AC})

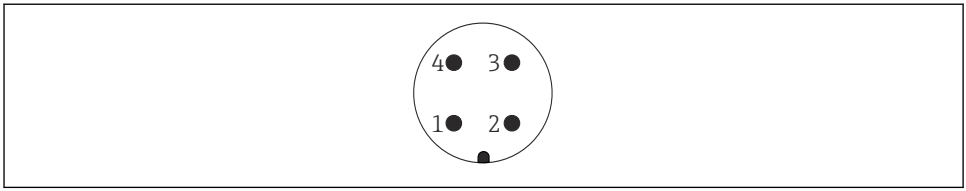


17 *Block diagram, 4-wire: 4 to 20 mA HART (90 to 253 V_{AC})*

1 *Evaluation unit, e.g. PLC*
2 *Resistor for HART communication (≥ 250 Ω); observe maximum load*
3 *Connection for Commubox FXA195 or FieldXpert SFX350/SFX370 (via VIATOR Bluetooth modem)*
4 *Analog display unit; observe maximum load*
5 *Cable screen; observe cable specification*
6 *Measuring device*
7 *Supply voltage; observe terminal voltage, observe cable specification*

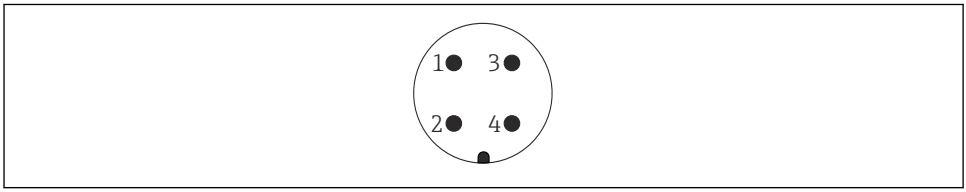
6.1.2 Device plug

In the case of the device versions with a plug, the housing does not need to be opened to connect the signal cable.



18 Pin assignment of M12 plug

1 Signal +
2 Not assigned
3 Signal -
4 Ground

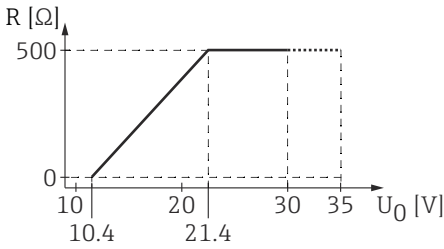


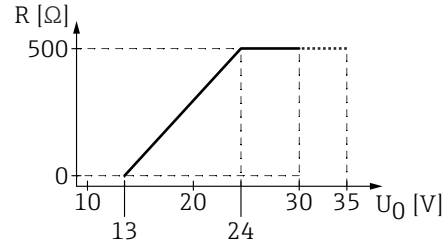
19 Pin assignment of 7/8" plug

1 Signal -
2 Signal +
3 Not assigned
4 Shielding

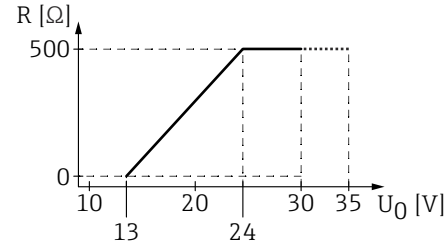
6.1.3 Supply voltage

2-wire, 4-20mA HART, passive

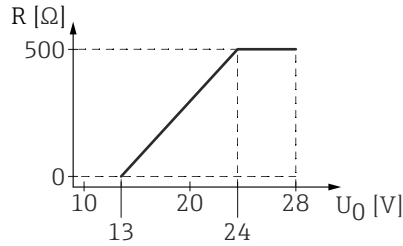
"Power supply, output" [1]	"Approval" [2]	Terminal voltage U at device	Maximum load R, depending on the supply voltage U_0 of the power supply unit
A: 2-wire; 4-20mA HART	▪ Non-Ex ▪ Ex nA ▪ Ex ic ▪ CSA GP	10.4 to 35 V [3] [4] [5]	
	Ex ia / IS	10.4 to 30 V [3] [4] [5]	

"Power supply, output" [1]	"Approval" [2]	Terminal voltage U at device	Maximum load R, depending on the supply voltage U_0 of the power supply unit
	▪ Ex d(ia) / XP ▪ Ex ic(ia) ▪ Ex nA(ia) ▪ Ex ta / DIP	13 to 35 V [5) 6)]	
	Ex ia + Ex d(ia) / IS + XP	13 to 30 V [5) 6)]	

1) Feature 020 in the product structure
2) Feature 010 in the product structure
3) At ambient temperatures $T_a \leq$ -20 °C, a terminal voltage ≥ U 15 V is required to start the device with the minimum error current (3.6 mA). The start-up current can be configured. If the device is operated with a fixed current of I ≥ 5.5 mA (HART Multidrop mode), a voltage U ≥ 10.4 V is sufficient in the entire ambient temperature range.
4) In the current simulation mode, a voltage U ≥ 12.5 V is required.
5) When using the Bluetooth module, the minimum supply voltage increases by 3 V.
6) At ambient temperatures $T_a \leq$ -20 °C, a terminal voltage ≥ U 16 V is required to start the device with the minimum error current (3.6 mA).

"Power supply, output" [1]	"Approval" [2]	Terminal voltage U at device	Maximum load R, depending on the supply voltage U_0 of the power supply unit
B: 2-wire; 4-20 mA HART, switch output	▪ Non-Ex ▪ Ex nA ▪ Ex nA(ia) ▪ Ex ic ▪ Ex ic(ia) ▪ Ex d(ia) / XP ▪ Ex ta / DIP ▪ CSA GP	13 to 35 V [3) 4)]	
	▪ Ex ia / IS ▪ Ex ia + Ex d(ia) / IS + XP	13 to 30 V [3) 4)]	

1) Feature 020 in the product structure
2) Feature 010 in the product structure
3) At ambient temperatures $T_a \leq$ -30 °C, a terminal voltage ≥ U 16 V is required to start the device with the minimum error current (3.6 mA).
4) When using the Bluetooth module, this minimum supply voltage increases by 3 V.

"Power supply, output" [1]	"Approval" [2]	Terminal voltage U at device	Maximum load R, depending on the supply voltage U_0 of the power supply unit
C: 2-wire; 4-20mA HART, 4-20mA	all	13 to 28 V [3] [4]	

1) Feature 020 in the product structure
2) Feature 010 in the product structure
3) At ambient temperatures $T_a \leq$ -30 °C, a terminal voltage ≥ U 16 V is required to start the device with the minimum error current (3.6 mA).
4) When using the Bluetooth module, this minimum supply voltage increases by 3 V.

Integrated polarity reversal protection	Yes
Permitted residual ripple with f = 0 to 100 Hz	U_{SS} < 1 V
Permitted residual ripple with f = 100 to 10000 Hz	U_{SS} < 10 mV

4-wire, 4-20mA HART, active

"Power supply; output" [1]	Terminal voltage U	Maximum load R_{max}
K: 4-wire 90-253VAC; 4-20mA HART	90 to 253 V_{AC} (50 to 60 Hz), overvoltage category II	500 Ω
L: 4-wire 10.4-48VDC; 4-20mA HART	10.4 to 48 V_{DC}	

1) Feature 020 in the product structure

6.2 Connecting the device

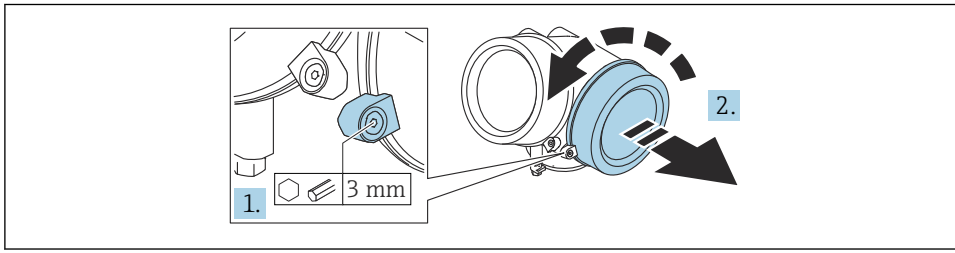
⚠ WARNING

Explosion Hazard!

- ▶ Observe applicable national standards.
- ▶ Comply with the specifications in the Safety Instructions (XA).
- ▶ Use specified cable glands only.
- ▶ Check to ensure that the power supply matches the information on the nameplate.
- ▶ Switch off the power supply before connecting the device.
- ▶ Connect the potential matching line to the outer ground terminal before applying the power supply.

Required tools/accessories:
- For devices with a cover lock: Allen key AF3
- Wire stripper
- When using stranded cables: One ferrule for every wire to be connected.

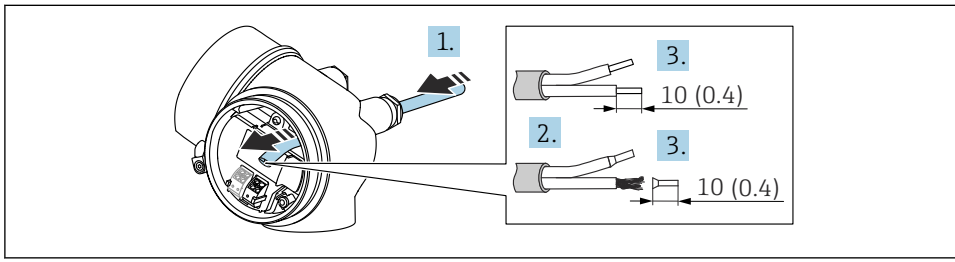
6.2.1 Opening cover



A0021490

1. Loosen the screw of the securing clamp of the connection compartment cover using an Allen key (3 mm) and turn the clamp 90 ° counterclockwise.
2. Unscrew the connection compartment cover and check the cover seal; replace it if necessary.

6.2.2 Connecting

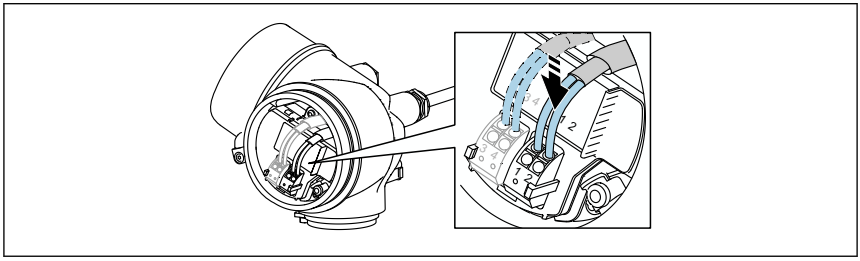


A0036418

20 Engineering unit: mm (in)

1. Push the cable through the cable entry . To ensure tight sealing, do not remove the sealing ring from the cable entry.
2. Remove the cable sheath.
3. Strip the cable ends 10 mm (0.4 in). In the case of stranded cables, also fit ferrules.
4. Firmly tighten the cable glands.

5. Connect the cable according to the terminal assignment.

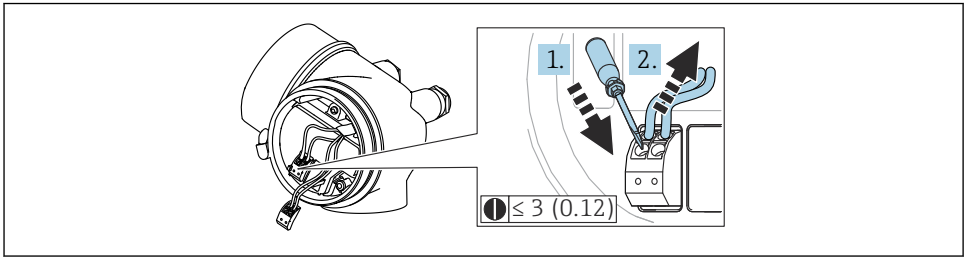


A0034682

6. If using shielded cables: Connect the cable shield to the ground terminal.

6.2.3 Plug-in spring-force terminals

The electrical connection of device versions without an integrated overvoltage protection is via plug-in spring-force terminals. Rigid conductors or flexible conductors with ferrules can be inserted directly into the terminal without using the lever, and create a contact automatically.



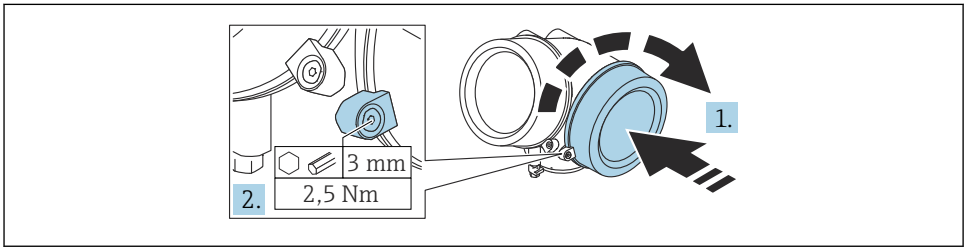
A0013661

21 Engineering unit: mm (in)

To remove the cable from the terminal again:

1. Using a flat-blade screwdriver ≤ 3 mm, press down on the slot between the two terminal holes
2. Simultaneously pull the cable end out of the terminal.

6.2.4 Closing the cover of the connection compartment



A0021491

1. Screw down the cover of the connection compartment.
2. Turn the securing clamp 90 ° in the clockwise direction and, using an Allen key (3 mm), tighten the screw of the securing clamp on the connection compartment cover with 2.5 Nm.

7 Operation options

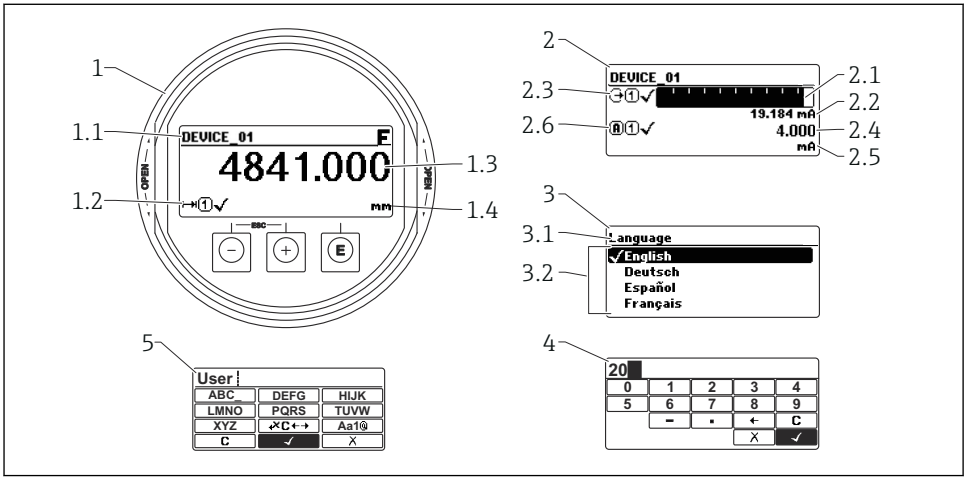
The device can be operated as follows:
- Operation via operating menu (display)
- DeviceCare / FieldCare, see Operating Instructions
- SmartBlue (app), Bluetooth (optional), see Operating Instructions

22 *Download link*

8 Commissioning

8.1 Structure and function of the operating menu

8.1.1 Display



A0012635

23 Display format on the display and operating module

1 Measured value display (1 value max. size)
1.1 Header containing tag and error symbol (if an error is active)
1.2 Measured value symbols
1.3 Measured value
1.4 Unit
2 Measured value display (bar graph + 1 value)
2.1 Bar graph for measured value 1
2.2 Measured value 1 (including unit)
2.3 Measured value symbols for measured value 1
2.4 Measured value 2
2.5 Unit for measured value 2
2.6 Measured value symbols for measured value 2
3 Visualization of a parameter (here: parameter with picklist)
3.1 Header containing parameter name and error symbol (if an error is active)
3.2 Picklist; ☑ marks the current parameter value.
4 Input matrix for numbers
5 Input matrix for alphanumeric and special characters

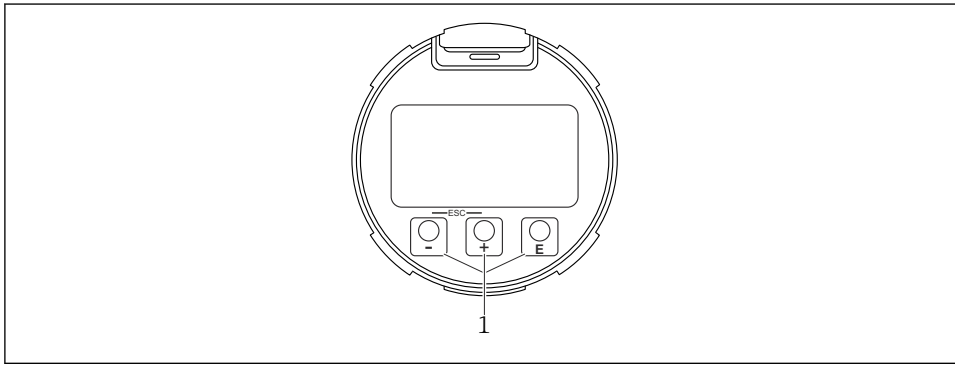
8.1.2 Operating elements

Functions

- Display of measured values and fault and notice messages
- Background lighting, which switches from green to red in the event of an error
- The device display can be removed for easier operation

The device displays are available with the additional option of Bluetooth® wireless technology.

Backlighting is switched on or off depending on the supply voltage and the current consumption.



24 Display module

1 Operating keys

Key assignment

- Key ⊞
  - Navigate down in the picklist
  - Edit the numerical values or characters within a function
- Key ⊟
  - Navigate up in the picklist
  - Edit the numerical values or characters within a function
- Key Ⓔ
  - *In the measured value display:* Pressing the key briefly opens the operating menu.
  - Pressing the key for 2 s opens the context menu.
  - *In the menu, submenu:* Pressing the key briefly:
  - Opens the selected menu, submenu or parameter.
  - Pressing the key for 2 s in a parameter:
  - If present, opens the help text for the function of the parameter.
  - *In a text and numeric editor:* Pressing the key briefly:
  - Opens the selected group.
  - Carries out the selected action.
  - Carries out the selected action.

- ⊞ key and ⊟ key (ESC function - press keys simultaneously)
  - *In the menu, submenu:* Pressing the key briefly:
  - Exits the current menu level and takes you to the next higher level.
  - If help text is open, closes the help text of the parameter.
  - Pressing the key for 2 s returns you to the measured value display ("home position").
  - *In a text and numeric editor:* Closes the text or numeric editor without applying changes.
- ⊟ key and Ⓔ key (press keys simultaneously)
  Reduces the contrast (brighter setting).
- ⊞ key and Ⓔ key (press and hold keys simultaneously)
  Increases the contrast (darker setting).

8.2 Opening the context menu

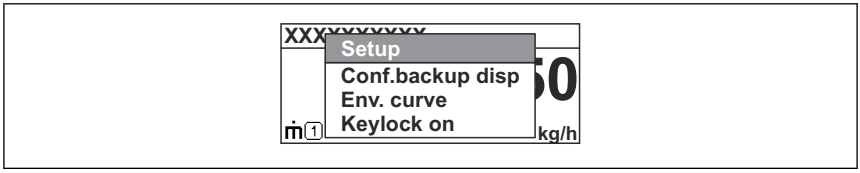
Using the context menu, the user can call up the following menus quickly and directly from the operational display:

- Setup
- Conf. backup disp.
- Envelope curve
- Keylock on

Calling up and closing the context menu

The user is in the operational display.

1. Press Ⓔ for 2 s.
   ↳ The context menu opens.



A0037872

2. Press ⊟ + ⊞ simultaneously.
   ↳ The context menu is closed and the operational display appears.

Calling up the menu via the context menu

1. Open the context menu.
2. Press ⊞ to navigate to the desired menu.
3. Press Ⓔ to confirm the selection.
   ↳ The selected menu opens.

8.3 Operating menu

Parameter/submenu	Meaning	Description
Language Setup → Advanced setup → Display → LanguageExpert → System → Display → Language	Defines the operating language of the local display	BA01048F - Operating Instructions, FMR56/ FMR57, HART
Setup	Once values have been set for the setup parameters, the measurement should generally be completely configured.	
Setup→Mapping	Mapping of interference echoes	
Setup→Advanced setup	Contains additional submenus and parameters ▪ For more customized configuration of the measurement (adaptation to special measuring conditions) ▪ For converting the measured value (scaling, linearization). ▪ For scaling the output signal.	
Diagnostics	Contains the most important parameters for diagnosing the condition of the device	
Expert menu n the **Enter access code** parameter enter **0000** if no customer-specific access code has been defined.	Contains all parameters of the device (including those that are already in one of the other menus). This menu is organized according to the function blocks of the device.	GP01014F - Description of device parameters, FMR5x, HART

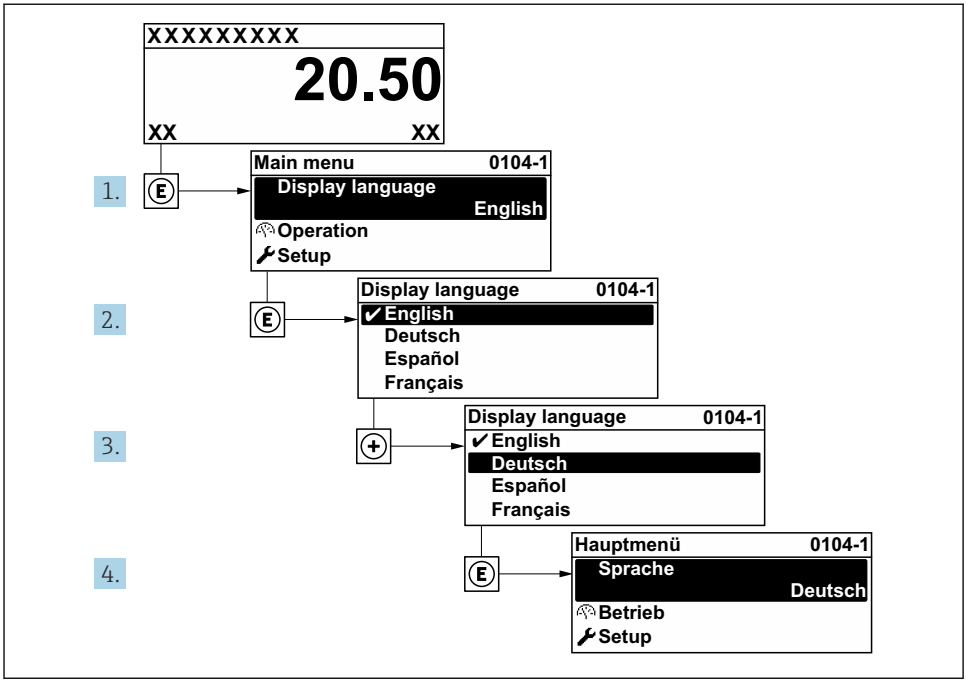
8.4 Disabling write protection

If the device is write-protected, it must first be unlocked, see Operating Instructions.

BA01048F - Operating Instructions, FMR56/FMR57, HART

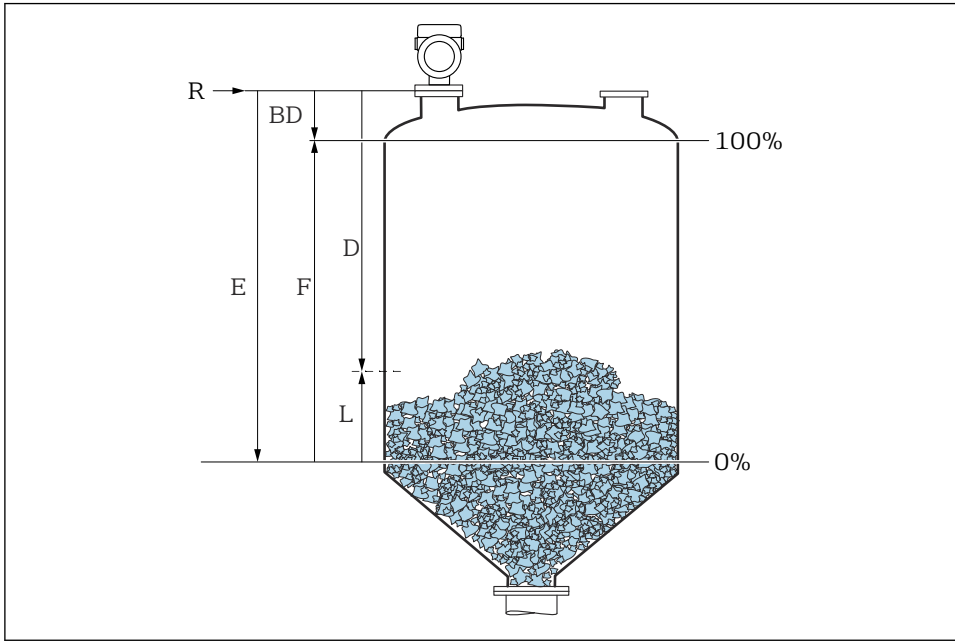
8.5 Setting the operating language

Factory setting: English or ordered local language



25 *Taking the example of the local display*

8.6 Configuring level measurement



26 *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)*

1. Setup → Device tag
   ↳ Enter a unique name for the measuring point to identify the device quickly within the plant.
2. Setup → Distance unit
   ↳ Used for the basic calibration (Empty / Full).
3. Setup → Bin type
   ↳ Optimizes the signal filters for the respective bin type. Note: 'Workbench test' deactivates all filters. This option should exclusively be used for tests.

4. Setup → Max. filling speed solid
   ↳ By selecting the maximum expected filling and draining speed the signal evaluation is automatically optimized for the process. Note: The filling and draining speeds can be set separately as the filling and draining procedures may be different. Note: With the 'No filter / test' option all signal evaluation filters are deactivated. This option should exclusively be used for tests.
5. Setup → Max. draining speed solid
   ↳ By selecting the maximum expected filling and draining speed the signal evaluation is automatically optimized for the process. Note: The filling and draining speeds can be set separately as the filling and draining procedures may be different. Note: With the 'No filter / test' option all signal evaluation filters are deactivated. This option should exclusively be used for tests.
6. Setup → Empty calibration
   ↳ Specify empty distance E (distance from reference point R to 0% mark).Setup → Advanced setup → Level → Tank/silo heightIf the parametrized measuring range (Empty calibration) differs significantly from the tank or silo height, it is recommended to enter the tank or silo height in this parameter. Example: Continuous level monitoring in the upper third of a tank or silo. Note: For tanks with conical outlet, this parameter should not be changed as in this type of applications 'Empty calibration' is usually not << the tank or silo height.
7. Setup → Full calibration
   ↳ Distance between minimum level (0%) and maximum level (100%).
8. Setup → Level
   ↳ Currently measured level
9. Setup → Distance
   ↳ Distance between lower edge of flange or thread and medium surface.
10. Setup → Signal quality
    ↳ Displays the signal quality of the analyzed level echo.
11. Setup → Mapping → Confirm distance
    ↳ Compare the distance displayed with the actual value to start recording an interference echo map.
12. Setup → Advanced setup → Level → Level unit
    ↳ Select the level unit: %, m, mm, ft, in (factory setting: %)

It is strongly recommended to adjust the maximum filling and draining speed to the actual process.

8.7 User-specific applications

To configure the parameters for user-specific applications, see:

BA01048F - Operating Instructions, FMR56/FMR57, HART

Also, for the **Expert** submenu:

GP01014F - Description of device parameters, FMR5x, HART

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