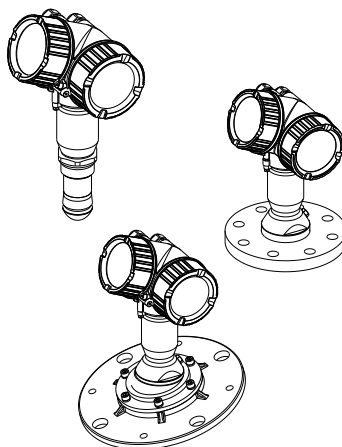


Brief Operating Instructions

Micropilot FMR67

HART

Free space radar

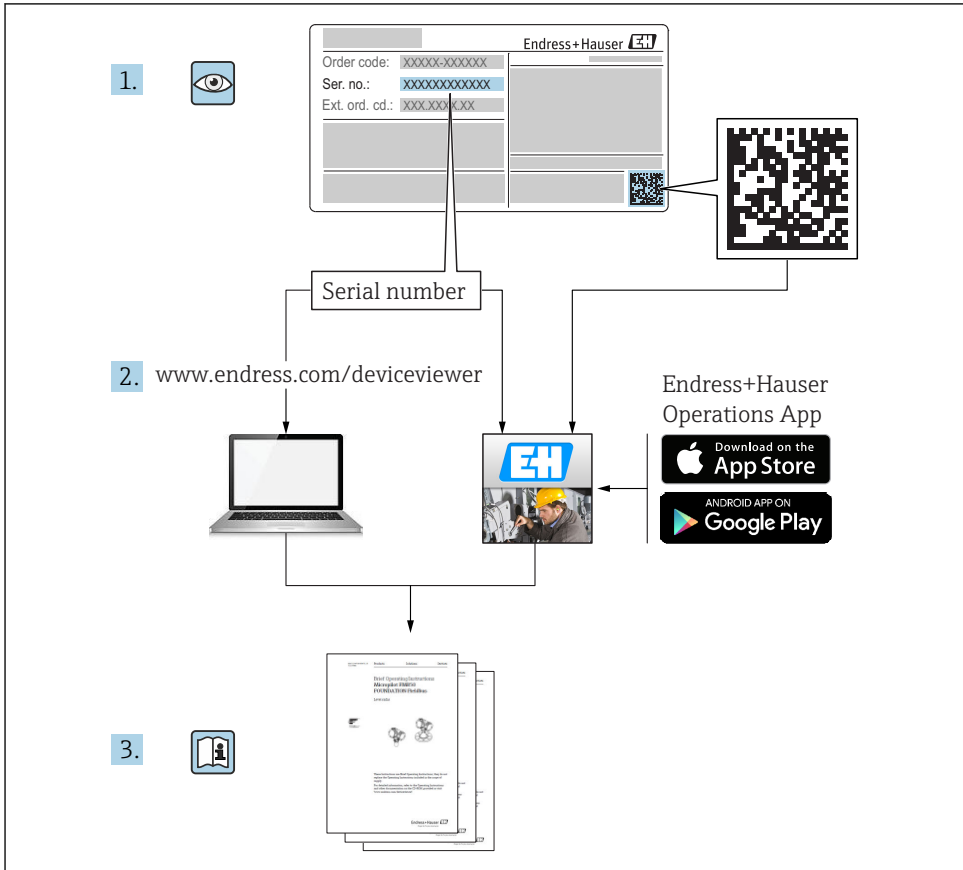


These Instructions are Brief Operating Instructions; they are not a substitute for the Operating Instructions pertaining to the device.

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*



A0023555

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1 Important document information

1.1 Symbols

1.1.1 Safety symbols

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

1.1.2 Electrical symbols

Symbol	Meaning	Symbol	Meaning
	Direct current		Alternating current
	Direct current and alternating current		Ground connection A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.

Symbol	Meaning
	Protective ground connection A terminal which must be connected to ground prior to establishing any other connections.
	Equipotential connection A connection that has to be connected to the plant grounding system: This may be a potential equalization line or a star grounding system depending on national or company codes of practice.

1.1.3 Tool symbols

 A0011219	 A0011220	 A0013442	 A0011221	 A0011222
Cross-head screwdriver	Flat blade screwdriver	Torx screwdriver	Allen key	Hexagon wrench

1.1.4 Symbols for certain types of information

Symbol	Meaning	Symbol	Meaning
	Permitted Procedures, processes or actions that are permitted.		Preferred Procedures, processes or actions that are preferred.
	Forbidden Procedures, processes or actions that are forbidden.		Tip Indicates additional information.
	Reference to documentation		Reference to page
	Reference to graphic	1 , 2 , 3 ...	Series of steps
	Result of a step		Visual inspection

1.1.5 Symbols in graphics

Symbol	Meaning
1, 2, 3 ...	Item numbers
1 , 2 , 3 ...	Series of steps
A, B, C, ...	Views
A-A, B-B, C-C, ...	Sections
	Hazardous area Indicates a hazardous area.
	Safe area (non-hazardous area) Indicates the non-hazardous area.

1.1.6 Symbols at the device

Symbol	Meaning
	Safety instructions Observe the safety instructions contained in the associated Operating Instructions.
	Temperature resistance of the connection cables Specifies the minimum value of the temperature resistance of the connection cables.

1.2 Terms and abbreviations

Term/abbreviation	Explanation
BA	Document type "Operating Instructions"
KA	Document type "Brief Operating Instructions"
TI	Document type "Technical Information"
SD	Document type "Special Documentation"
XA	Document type "Safety Instructions"
PN	Nominal pressure
MWP	Maximum Working Pressure The MWP can also be found on the nameplate.
ToF	Time of Flight
FieldCare	Scalable software tool for device configuration and integrated plant asset management solutions
DeviceCare	Universal configuration software for Endress+Hauser HART, PROFIBUS, FOUNDATION Fieldbus and Ethernet field devices
DTM	Device Type Manager
DD	Device Description for HART communication protocol
DC	Relative dielectric constant ϵ_r
Operating tool	The term "operating tool" is used in place of the following operating software: FieldCare / DeviceCare, for operation via HART communication and PC
BD	Blocking Distance; no signals are analyzed within the BD.

1.3 Registered trademarks

HART®

Registered trademark of the HART Communication Foundation, Austin, USA

KALREZ®, VITON®

Registered trademark of DuPont Performance Elastomers L.L.C., Wilmington, USA

TEFLON®

Registered trademark of E.I. DuPont de Nemours & Co., Wilmington, USA

2 Basic safety instructions

2.1 Requirements for the personnel

The personnel must fulfill the following requirements for its tasks:

- ▶ 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.

2.2 Designated 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. 80 GHz, a maximum radiated peak power of 6.3 mW and an average power output of 63 μ W, unrestricted use outside of closed, metallic vessels is also permitted (for example over heaps). Operation does not pose any danger whatsoever 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 for the following measurements only:

- ▶ Measured process variables: level, distance, signal strength
- ▶ Calculable process variables: volume or mass in any shape of vessel

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

- ▶ Use the measuring device only for media against which the process-wetted materials are adequately resistant.
- ▶ Observe the limit values in "Technical data".

Incorrect use

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

Verification for 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 may reach a temperature close to the medium temperature.

Danger of burns from contact with surfaces!

- ▶ For elevated fluid temperature, 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 in proper technical condition and fail-safe condition only.
- ▶ The operator is responsible for interference-free operation of the device.

Conversions to the device

Unauthorized modifications to the device are not permitted and can lead to unforeseeable dangers.

- ▶ If, despite this, modifications are required, consult with the manufacturer.

Repair

To ensure continued operational safety and reliability,

- ▶ Carry out repairs on the device only if they are expressly permitted.
- ▶ Observe federal/national regulations pertaining to repair of an electrical device.
- ▶ Use original spare parts and accessories from the manufacturer only.

Hazardous area

To eliminate a danger for persons or for the facility when the device is used in the hazardous area (e.g. explosion protection, pressure vessel safety):

- ▶ Based on the nameplate, check whether the ordered device is permitted for the intended use in the hazardous area.
- ▶ Observe the specifications in the separate supplementary documentation that is an integral part of these Instructions.

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 EC guidelines. These are listed in the corresponding EC Declaration of Conformity together with the standards applied.

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

2.5.2 EAC conformity

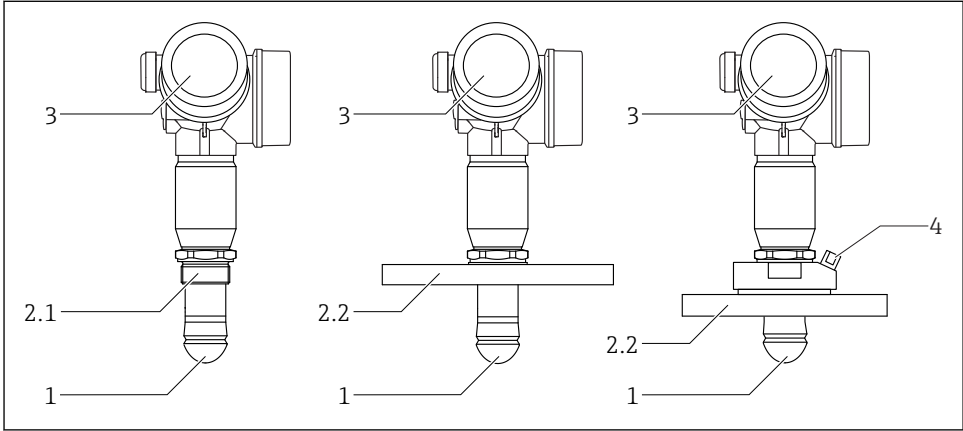
The measuring system meets the legal requirements of the applicable EAC guidelines. These are listed in the corresponding EAC Declaration of Conformity together with the standards applied.

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

3 Product description

3.1 Product design

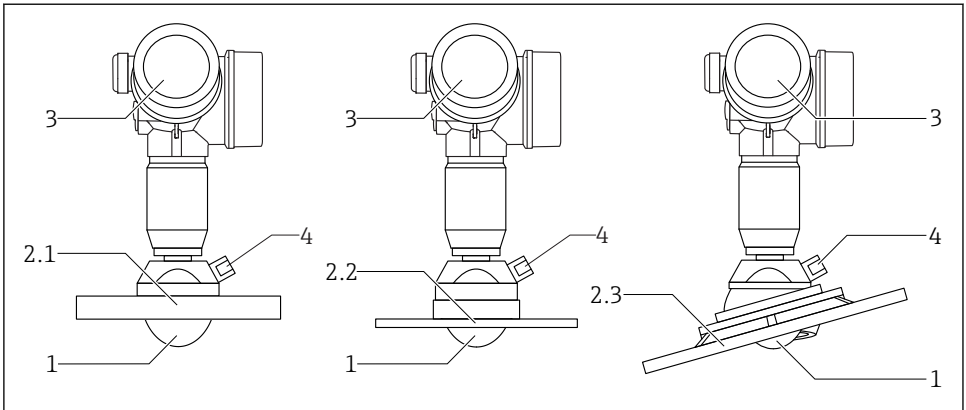
3.1.1 Micropilot FMR67



A0032714

1 Design of the Micropilot FMR67

- 1 Drip-off antenna PTFE
- 2.1 Process connection (Thread)
- 2.2 Process connection (Flange)
- 3 Electronics housing
- 4 Purge air connection



A0032782

2 Design of the Micropilot FMR67

- 1 PTFE antenna
- 2.1 Process connection (Flange)
- 2.2 Process connection (UNI-Flange)
- 2.3 Process connection (Flange with alignment device)
- 3 Electronics housing
- 4 Purge air connection

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?
- Do the nameplate data match the ordering information on the delivery note?
- Is the DVD with the operating tool present?

If required (see nameplate): Are the safety instructions (XA) present?



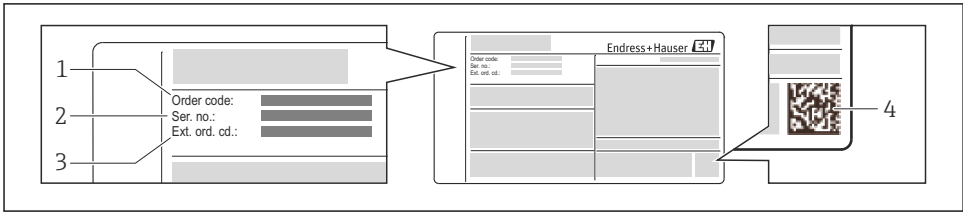
If one of these conditions does not apply, please contact your Endress+Hauser sales office.

4.2 Product identification

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

- Nameplate specifications
- Extended order code with breakdown of the device features on the delivery note
- Enter the serial number on the nameplate into *W@M Device Viewer* (www.endress.com/deviceviewer): all the information about the measuring device is displayed.
- Enter the serial number on the nameplate into the *Endress+Hauser Operations App* or scan the 2-D matrix code (QR code) on the nameplate with the *Endress+Hauser Operations App*: all the information about the measuring device is displayed.

4.2.1 Nameplate



A0021952

 3 Example of a nameplate

- 1 Order code
- 2 Serial number (ser. no.)
- 3 Extended order code (Ext. ord. cd.)
- 4 2-D matrix code (QR code)

 For detailed information on the breakdown of the specifications on the nameplate, see the Operating Instructions for the device .

 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 Storage, Transport

5.1 Storage conditions

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

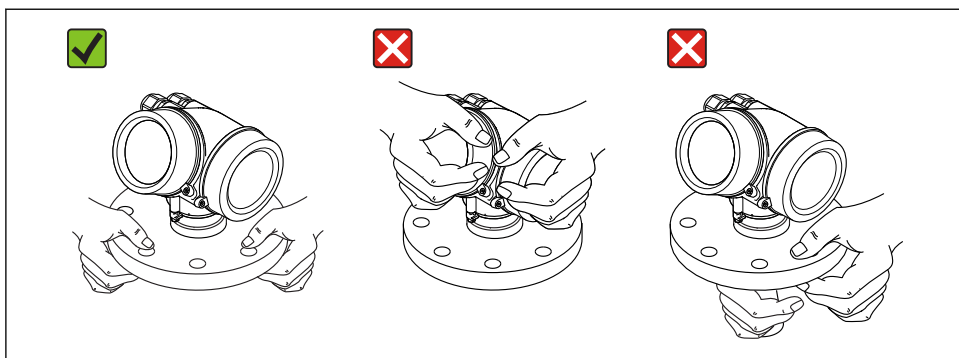
5.2 Transporting the product to the measuring point

NOTICE

Housing or sensor may become damaged or pull 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.) at the process connection and never lift the device by the electronic housing or sensor. 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).

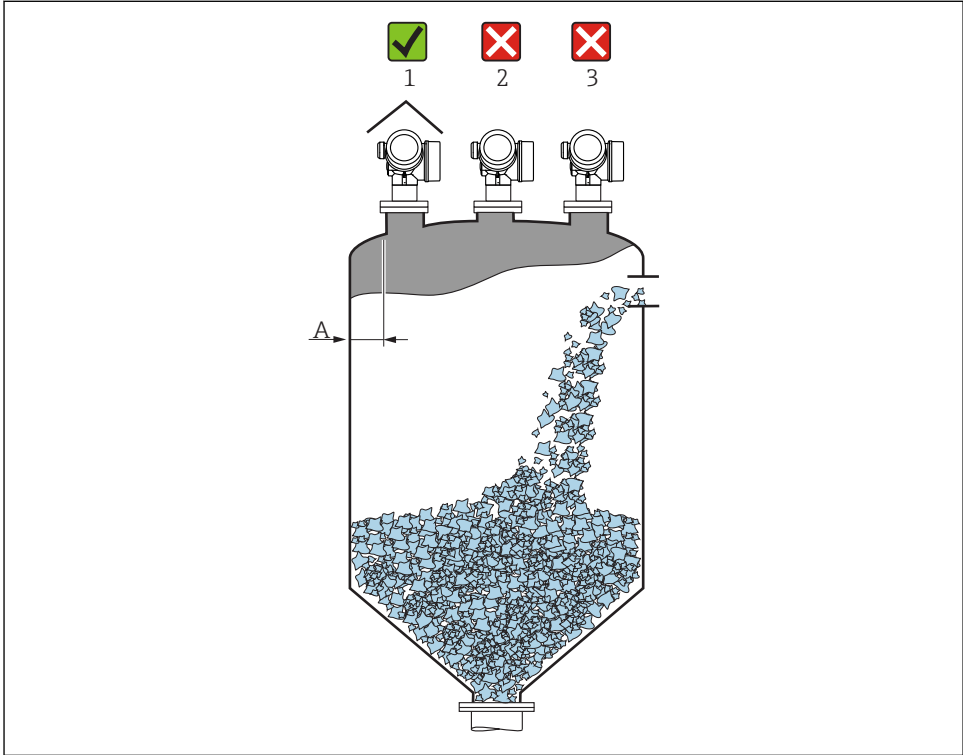


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6 Installation

6.1 Installation conditions

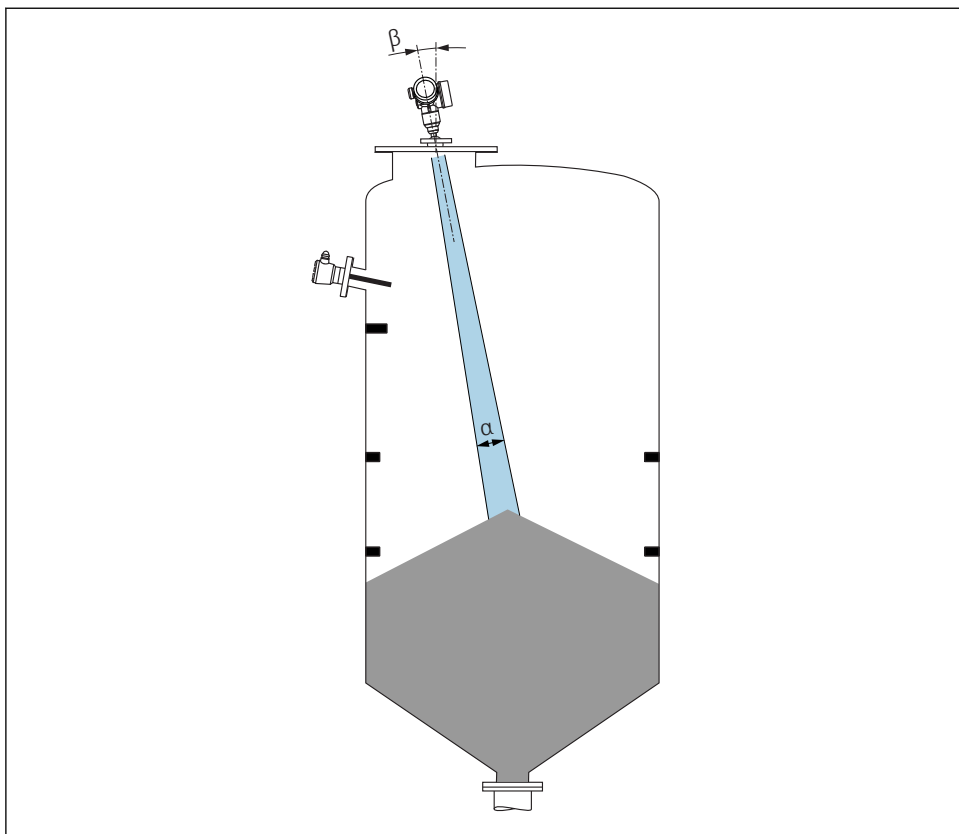
6.1.1 Mounting position



A0016883

- Recommended distance **A** wall - nozzle outer edge: $\sim 1/6$ of the container diameter. However, the device must not under any circumstances be mounted closer than 20 cm (7.87 in) to the container wall.
If the container wall is not smooth (corrugated iron, welding seams, joints, etc.) it is recommended to maintain the largest possible distance from the wall. Where necessary use an alignment unit to avoid interference reflections from the container wall. → 19
- Not in the center (2) as interference can cause signal loss.
- Not above the filling curtain (3).
- The use of a weather protection cover (1) is recommended to protect the transmitter from direct sunlight or rain.
- In applications with strong dust emissions, the integrated purge air connection can prevent the antenna from becoming clogged → 22.

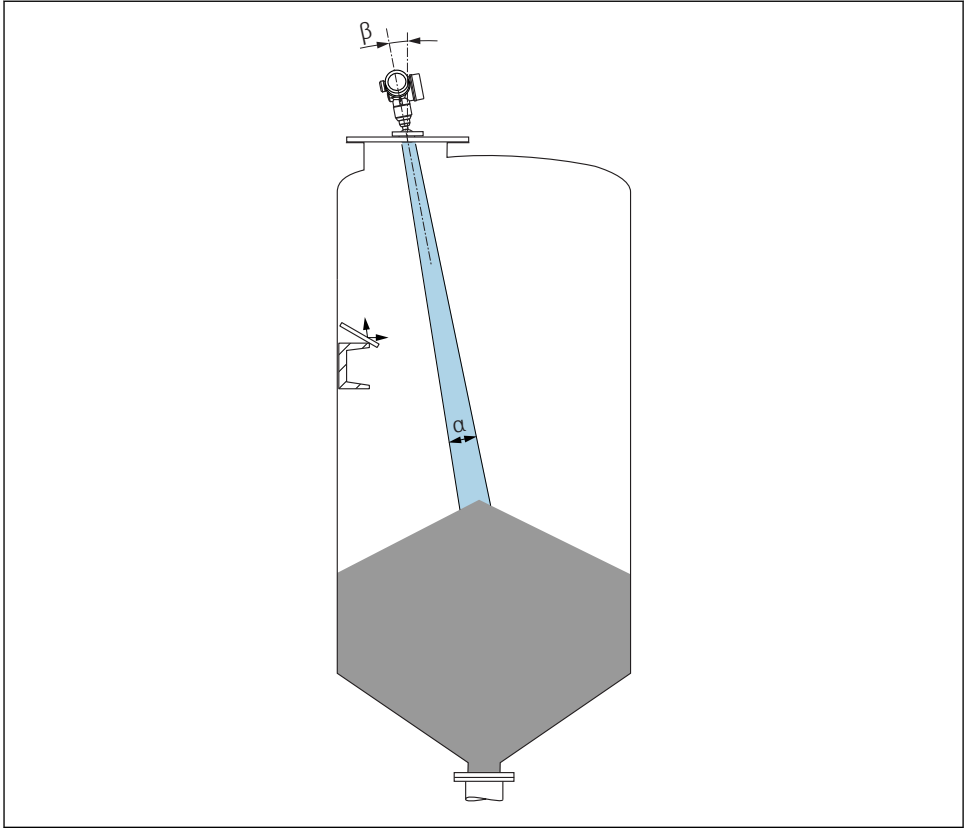
6.1.2 Internal container fittings



A0031814

Avoid the location of internal fittings (limit switches, temperature sensors, struts etc.) inside the signal beam. Pay attention to the beam angle →  17.

6.1.3 **Avoiding interference echoes**



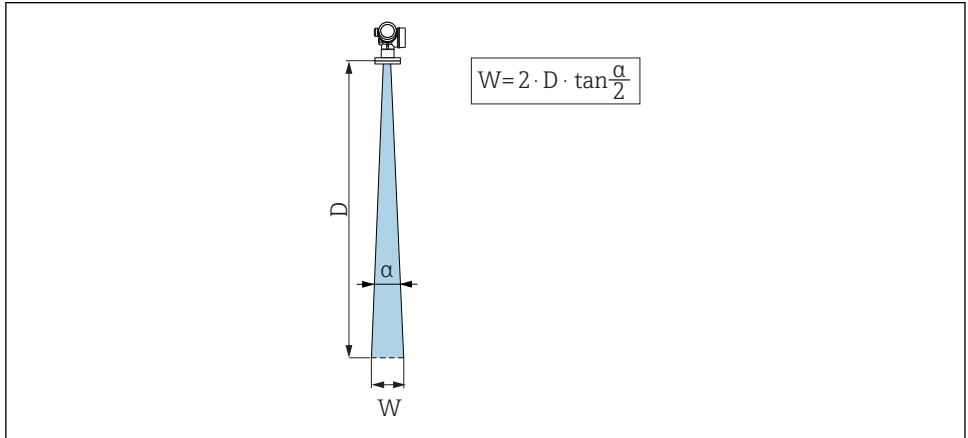
A0031817

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

6.1.4 Optimization options

- **Antenna size**
The larger the antenna the smaller the beam angle α , resulting in fewer interference echoes
→ 17.
- **Mapping**
Measurement can be optimized by electronically suppressing interference echoes.
- **Variable flange seal for FMR67**
Variable flange seals of sizes DN80 to DN150 (3" to 6") are available for the FMR67 with Drip-off antenna ¹⁾. They can be used to align the device to the product surface. Maximum angle of alignment: 8°.
How to order:
 - Order with the device ²⁾
 - Order as an accessory
- **Alignment unit for FMR67**
Flanges sized 4" / DN100 and higher are optionally available with an alignment unit ³⁾. They allow the sensor to be optimally aligned to suit conditions in the container in order to prevent interference reflections. The maximum angle is $\pm 15^\circ$.
The purpose of sensor alignment is primarily to:
 - Prevent interference reflections
 - Increase the maximum possible measuring range in conical outlets

6.1.5 Beam angle

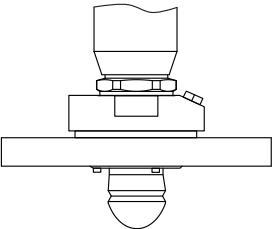
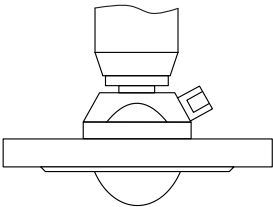


A0031824

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

1) Feature 070 in the product structure "Antenna", option GA
 2) Feature 100 in the product structure "Process connection", options PL, PM, PN, PO, PQ, PR
 3) see feature 100 in the product structure "Process connection".

The beam angle is defined as the angle α where 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.

FMR67		
		
Antenna ¹⁾	Drip-off, PTFE 50 mm / 2"	PTFE flush mount 80 mm / 3"
Beam angle α	6 °	5 °
Distance (D)	Beamwidth diameter W	
5 m (16 ft)	0.52 m (1.70 ft)	0.44 m (1.43 ft)
10 m (33 ft)	1.05 m (3.44 ft)	0.87 m (2.86 ft)
15 m (49 ft)	1.57 m (5.15 ft)	1.31 m (4.29 ft)
20 m (66 ft)	2.10 m (6.89 ft)	1.74 m (5.72 ft)
25 m (82 ft)	2.62 m (8.60 ft)	2.18 m (7.15 ft)
30 m (98 ft)	3.14 m (10.30 ft)	2.62 m (8.58 ft)
35 m (115 ft)	3.67 m (12.04 ft)	3.05 m (10.02 ft)
40 m (131 ft)	4.19 m (13.75 ft)	3.49 m (11.45 ft)
45 m (148 ft)	4.72 m (15.49 ft)	3.93 m (12.88 ft)
50 m (164 ft)	5.24 m (17.19 ft)	4.36 m (14.31 ft)
60 m (197 ft)	-	5.23 m (17.67 ft)
70 m (230 ft)	-	6.11 m (20.03 ft)
80 m (262 ft)	-	6.98 m (22.89 ft)
90 m (295 ft)	-	7.85 m (25.75 ft)
100 m (328 ft)	-	8.72 m (28.62 ft)
110 m (361 ft)	-	9.59 m (31.48 ft)
120 m (394 ft)	-	10.47 m (34.34 ft)
125 m (410 ft)	-	10.90 m (35.77 ft)

1) Feature 070 in the product structure

6.2 Installation: Drip-off antenna PTFE 50 mm / 2"

6.2.1 Aligning the antenna axis

Align the antenna vertically to the product surface.

Optionally, a variable flange seal (available as an accessory) can be used for alignment



Attention:

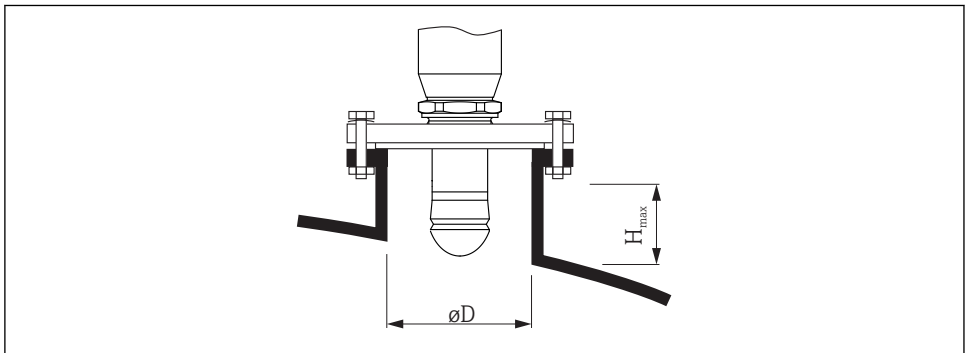
The maximum reach of the antenna can be reduced if it is not installed perpendicular to the product.

6.2.2 Radial alignment of the antenna

Radial alignment of the antenna is not necessary because the effect of polarization is negligible due to the narrow beam angle.

6.2.3 Information concerning nozzles

The maximum nozzle length H_{max} depends on the nozzle diameter D :



A0032209

Nozzle diameter D	Maximum nozzle height H_{max}
40 to 50 mm (1.5 to 2 in)	≤150 mm (6 in)
80 mm (3 in)	≤200 mm (8 in)
100 mm (4 in)	≤300 mm (12 in)
150 mm (6 in)	≤500 mm (20 in)



Note the following if the antenna does not project out of the nozzle:

- The end of the nozzle must be smooth and free from burrs. The edge of the nozzle should be rounded if possible.
- Mapping must be performed.
- Please contact Endress+Hauser for applications with nozzles that are higher than indicated in the table.

6.2.4 Information concerning threaded connections

- When screwing in, turn by the hex bolt only.
- Tool: open-ended wrench 55 mm
- Maximum permissible torque: 50 Nm (36 lbf ft)

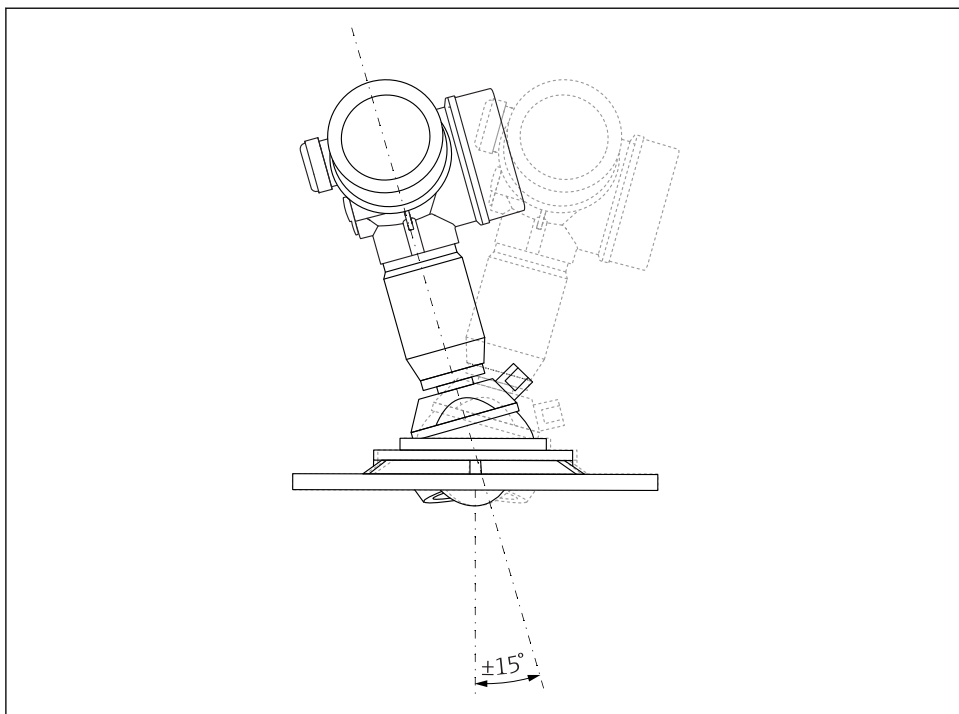
6.3 Installation: flush mount antenna

6.3.1 Aligning the antenna axis

UNI flanges with an integrated alignment unit are available for FMR67 devices with a flush mount antenna. 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 to the bulk solid.

Process connection with alignment unit ¹⁾	UNI flange	Material	Pressure rating	Suitable for
XCA	UNI 4" / DN100 / 100A	Aluminum	max. 14.5lbs / PN1 / 1K	■ 4" 150lbs ■ DN100 PN16 ■ 10K 100A
XDA	UNI 6" / DN150 / 150A	Aluminum	max. 14.5lbs / PN1 / 1K	■ 6" 150lbs ■ DN150 PN16 ■ 10K 150A
XEA	UNI 8" / DN200 / 200A	Aluminum	max. 14.5lbs / PN1 / 1K	■ 8" 150lbs ■ DN200 PN16 ■ 10K 200A
XFA	UNI 10" / DN250 / 250A	Aluminum	max. 14.5lbs / PN1 / 1K	■ 10" 150lbs ■ DN250 PN16 ■ 10K 250A

1) Feature 100 in the product structure



A0032097

5 Micropilot FMR67 with alignment unit

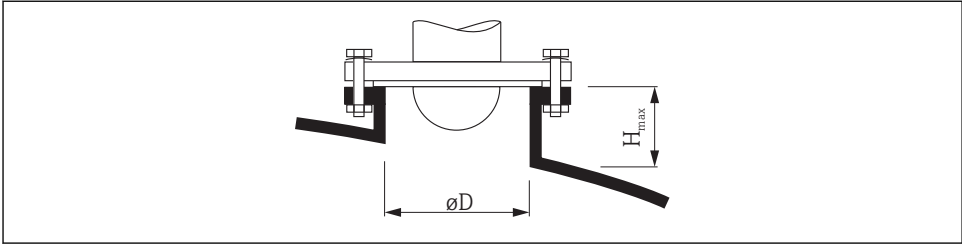
Aligning the antenna axis

1. Release the screws
2. Align the antenna axis (up to max. $\pm 15^\circ$ possible in all directions)
3. Tighten the screws with 10 Nm (7.4 lbf ft)

6.3.2 Radial alignment of the antenna

Radial alignment of the antenna is not necessary because the effect of polarization is negligible due to the narrow beam angle.

6.3.3 Information concerning nozzles



A0032206

Nozzle diameter D	Maximum nozzle height H_{max}
40 to 50 mm (1.5 to 2 in)	≤ 150 mm (6 in)
80 mm (3 in)	≤ 200 mm (8 in)
100 mm (4 in)	≤ 300 mm (12 in)
150 mm (6 in)	≤ 500 mm (20 in)

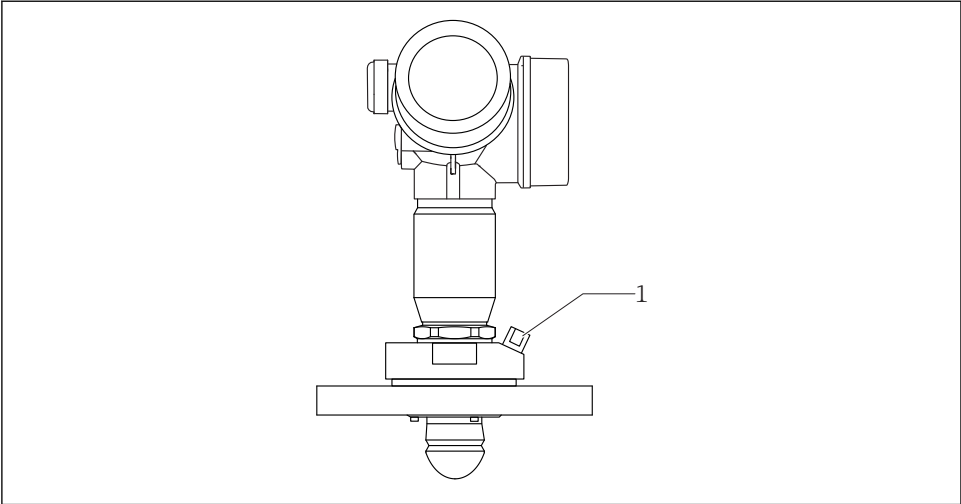
-  Note the following if the antenna does not project out of the nozzle:
- The end of the nozzle must be smooth and free from burrs. The edge of the nozzle should be rounded if possible.
 - Mapping must be performed.
 - Please contact Endress+Hauser for applications with nozzles that are higher than indicated in the table.

6.4 Purge air connection for FMR67

6.4.1 Purge air adapter for Drip-off antennas

Purge air connection ¹⁾	Meaning
A	without
3	Purge air adapter G 1/4"
4	Purge air adapter NPT 1/4"

1) Feature 110 in the product structure



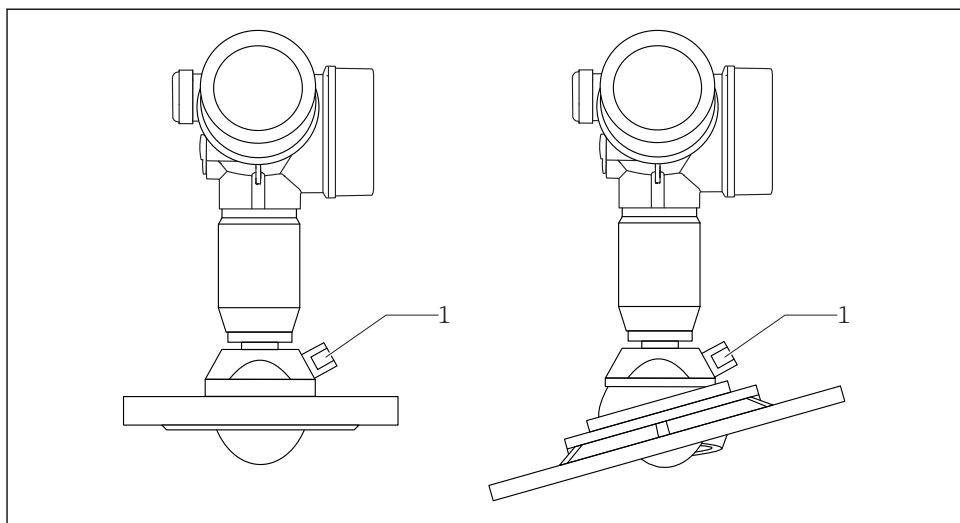
A0032098

1 *Purge air connection NPT 1/4" or G 1/4"*

6.4.2 **Integrated purge air connection for flush-mounted antennas**

Purge air connection ¹⁾	Meaning
1	Purge air connection G 1/4"
2	Purge air connection NPT 1/4"

1) Feature 110 in the product structure



A0032099

1 Purge air connection NPT 1/4" or G 1/4"

6.4.3 Use

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

Purge air pressure range

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

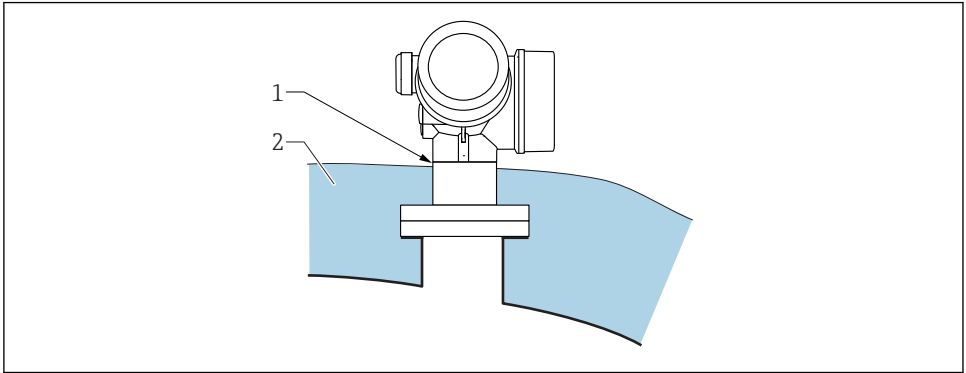


Always use dry purge air.



In general, purging should only be performed to the extent necessary as excess purging can cause mechanical damage (abrasion).

6.5 Container with heat insulation

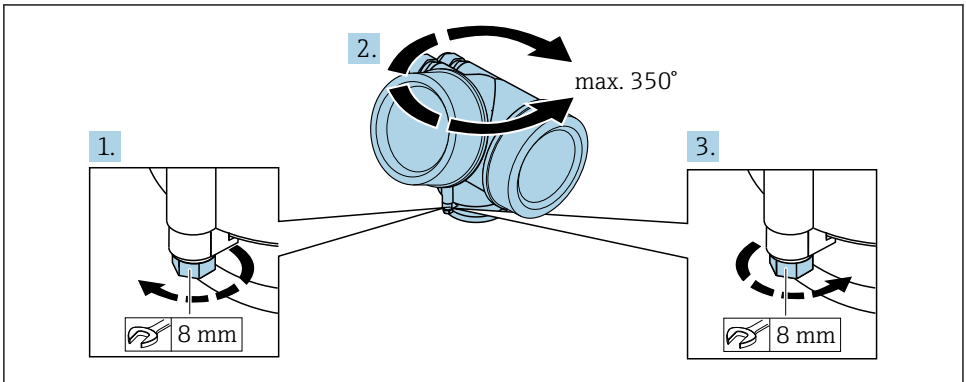


A0032207

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).

6.6 Turning the transmitter housing

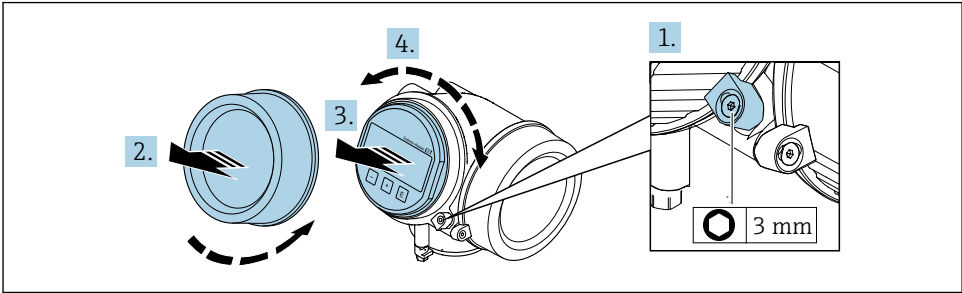
To provide easier access to the connection compartment or display module, the transmitter housing can be turned:



A0032242

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).

6.7 Turning the display module



A0032238

1. If present: Loosen the screw of the securing clamp of the electronics compartment cover using an Allen screw and turn the clamp 90° counterclockwise.
2. Unscrew cover of the electronics compartment from the transmitter housing.
3. Pull out the display module with a gentle rotational movement.
4. Rotate the display module to the desired position: max. 8 × 45° in each direction.
5. 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.
6. Screw the electronics compartment cover back onto the transmitter housing.
7. Tighten the securing clamp with an Allen screw (torque: 2.5 Nm).

6.8 Post-installation check

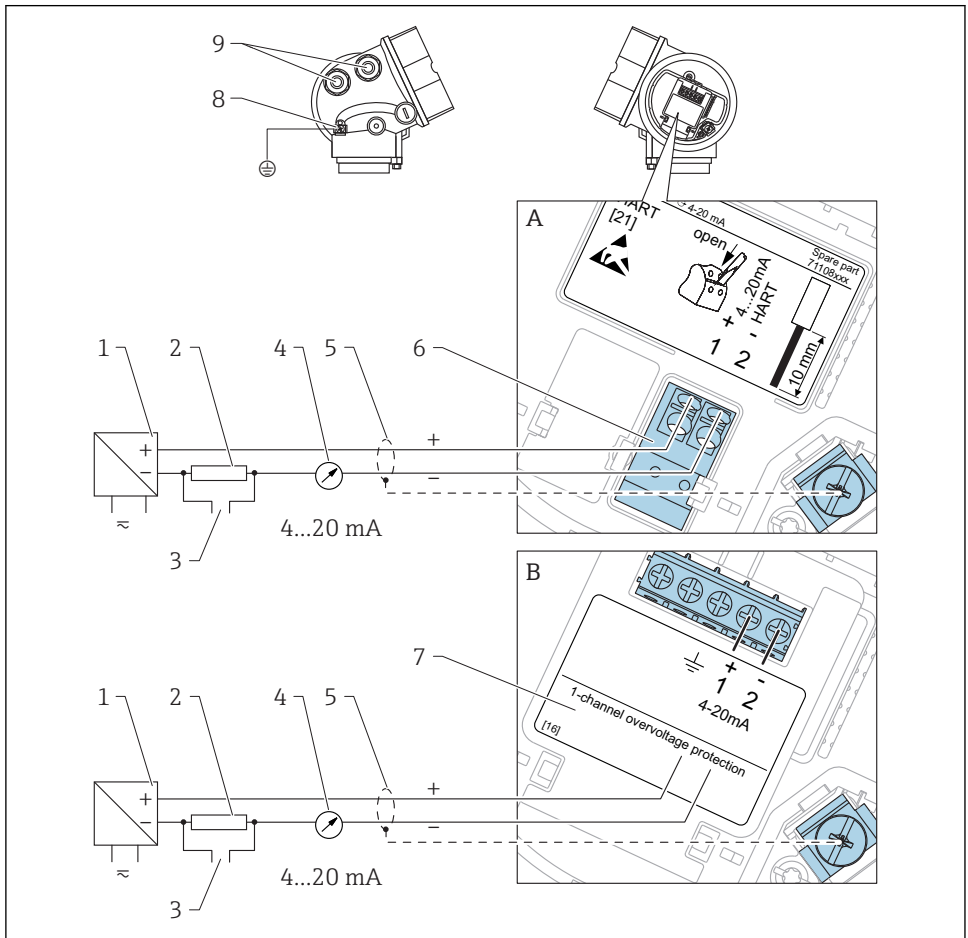
☐	Is the device undamaged (visual inspection)?
☐	Does the device conform to the measuring point specifications? For example: ■ Process temperature ■ Process pressure (refer to the chapter on "Material load curves" of the "Technical Information" document) ■ Ambient temperature range ■ Measuring range
☐	Are the measuring point identification and labeling correct (visual inspection)?
☐	Is the device adequately protected from precipitation and direct sunlight?
☐	Are the securing screw and securing clamp tightened securely?

7 Electrical connection

7.1 Connection conditions

7.1.1 Terminal assignment

2-wire: 4-20mA HART



A0011294

6 Terminal assignment 2-wire; 4-20mA HART

A Without integrated overvoltage protection

B With integrated overvoltage protection

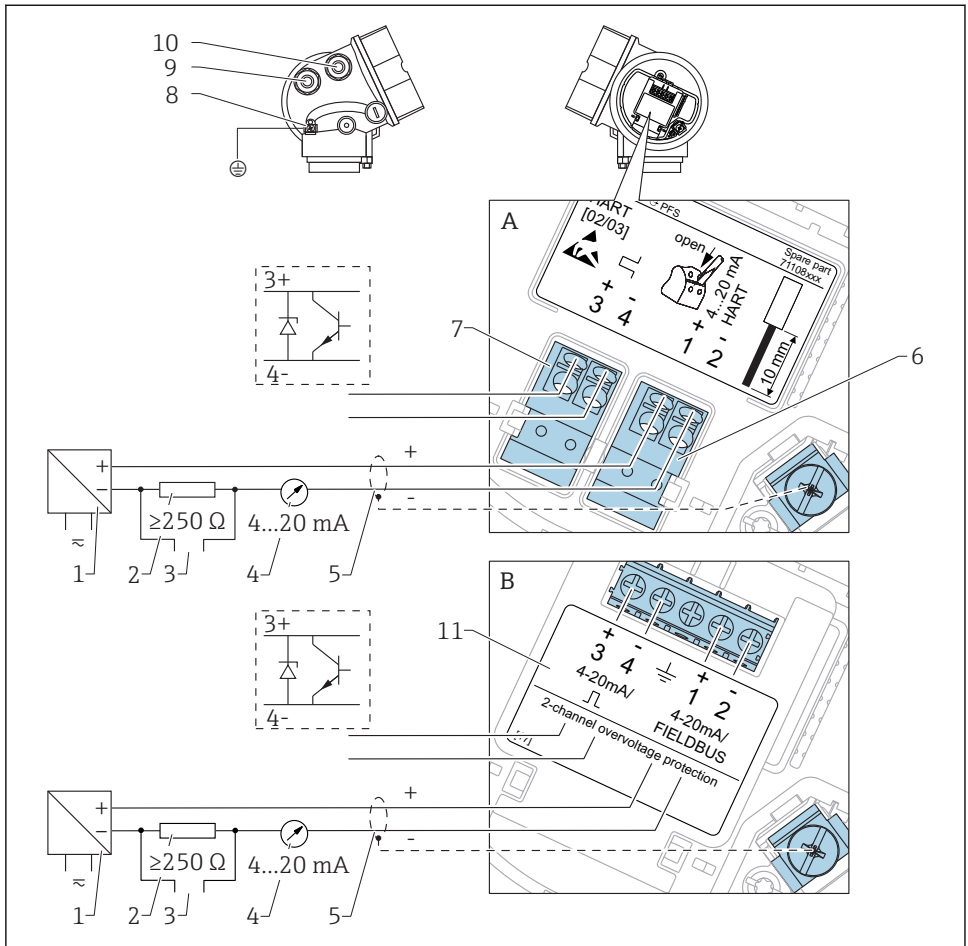
1 Active barrier with power supply (e.g. RN221N): Observe terminal voltage

2 HART communication resistor ($\geq 250 \Omega$): Observe maximum load

3 Connection for Commubox FXA195 or FieldXpert SFX350/SFX370 (via VIATOR Bluetooth modem)

-
- 4 *Analog display device: Observe maximum load*
 - 5 *Cable screen; observe cable specification*
 - 6 *4-20mA HART (passive): Terminals 1 and 2*
 - 7 *Overvoltage protection module*
 - 8 *Terminal for potential equalization line*
 - 9 *Cable entry*

2-wire: 4-20mA HART, switch output

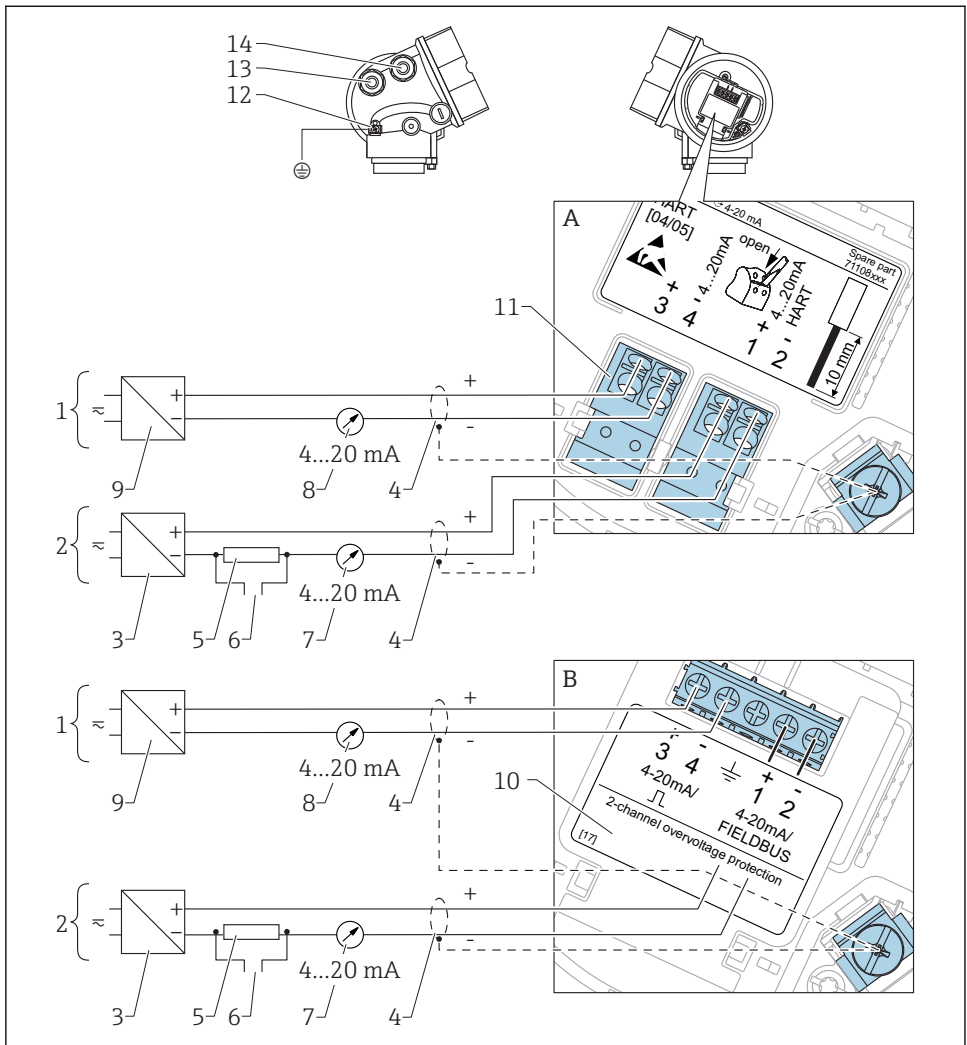


A0013759

7 Terminal assignment 2-wire; 4-20mA HART, switch output

- A Without integrated overvoltage protection
- B With integrated overvoltage protection
- 1 Active barrier with power supply (e.g. RN221N): Observe terminal voltage
- 2 HART communication resistor ($\geq 250 \Omega$): Observe maximum load
- 3 Connection for Commubox FXA195 or FieldXpert SFX350/SFX370 (via VIATOR Bluetooth modem)
- 4 Analog display device: Observe maximum load
- 5 Cable screen; observe cable specification
- 6 4-20mA HART (passive): Terminals 1 and 2
- 7 Switch output (open collector): Terminals 3 and 4
- 8 Terminal for potential equalization line

- 9 *Cable entry for 4-20mA HART line*
- 10 *Cable entry for switch output line*
- 11 *Overvoltage protection module*

2-wire: 4-20mA HART, 4-20mA

A0013923

8 Terminal assignment 2-wire, 4-20 mA HART, 4...20mA

A Without integrated overvoltage protection

B With integrated overvoltage protection

1 Connection current output 2

2 Connection current output 1

3 Supply voltage for current output 1 (e.g. RN221N); Observe terminal voltage

4 Cable screen; observe cable specification

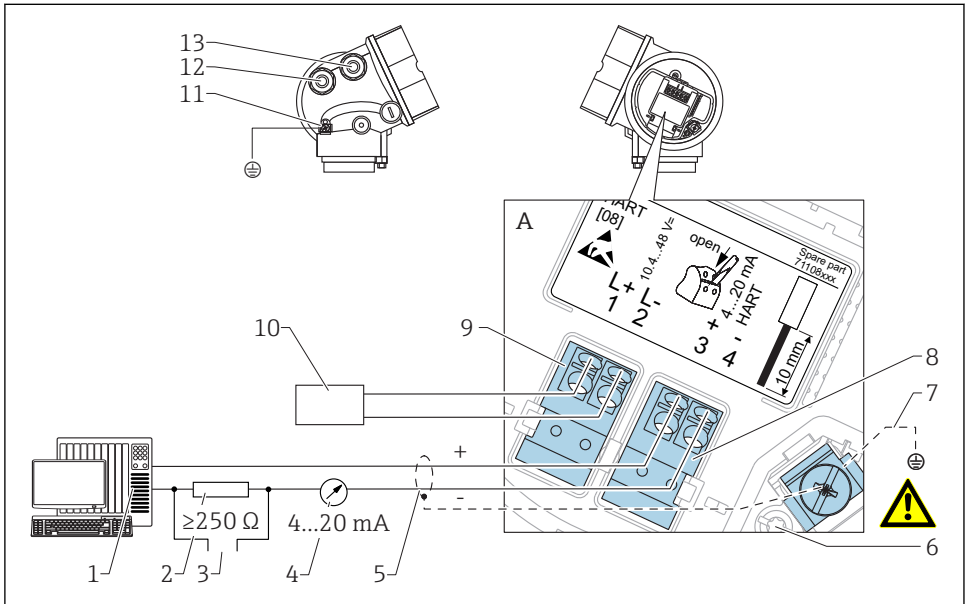
5 HART communication resistor ($\geq 250 \Omega$); Observe maximum load

6 Connection for Commubox FXA195 or FieldXpert SFX350/SFX370 (via VIATOR Bluetooth modem)

- 7 *Analog display device ; observe maximum load*
- 8 *Analog display device ; observe maximum load*
- 9 *Supply voltage for current output 2 (e.g. RN221N); Obeserve terminal voltage*
- 10 *Overvoltage protection module*
- 11 *Current output 2: Terminals 3 and 4*
- 12 *Terminal for the potential equalization line*
- 13 *Cable entry for current output 1*
- 14 *Cable entry for current output 2*



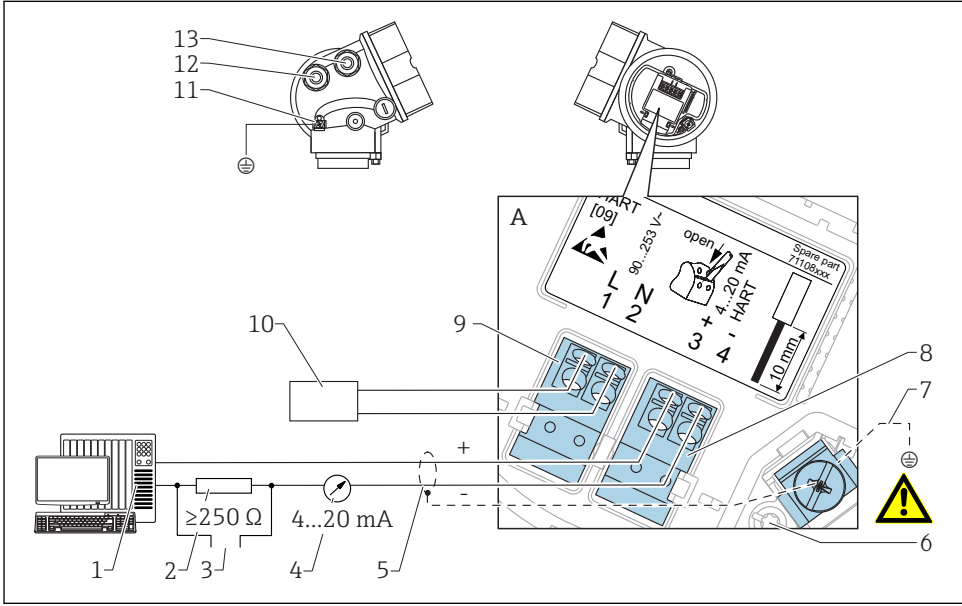
This version is also suited for single-channel operation. In this case, current output 1 (terminals 1 and 2) must be used.

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

A0011340

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

- 1 Evaluation unit, e.g. PLC
- 2 HART communication resistor ($\geq 250 \Omega$): Observe maximum load
- 3 Connection for Commubox FXA195 or FieldXpert SFX350/SFX370 (via VIATOR Bluetooth modem)
- 4 Analog display device: Observe maximum load
- 5 Signal cable including screening (if required), observe cable specification
- 6 Protective connection; do not disconnect!
- 7 Protective earth, observe cable specification
- 8 4...20mA HART (active): Terminals 3 and 4
- 9 Supply voltage: Terminals 1 and 2
- 10 Supply voltage: Observe terminal voltage, observe cable specification
- 11 Terminal for potential equalization
- 12 Cable entry for signal line
- 13 Cable entry for power supply

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

A0018965

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

- 1 Evaluation unit, e.g. PLC
- 2 HART communication resistor ($\geq 250 \Omega$): Observe maximum load
- 3 Connection for Commubox FXA195 or FieldXpert SFX350/SFX370 (via VIATOR Bluetooth modem)
- 4 Analog display device: Observe maximum load
- 5 Signal cable including screening (if required), observe cable specification
- 6 Protective connection; do not disconnect!
- 7 Protective earth, observe cable specification
- 8 4...20mA HART (active): Terminals 3 and 4
- 9 Supply voltage: Terminals 1 and 2
- 10 Supply voltage: Observe terminal voltage, observe cable specification
- 11 Terminal for potential equalization
- 12 Cable entry for signal line
- 13 Cable entry for power supply

⚠ CAUTION**To ensure electrical safety:**

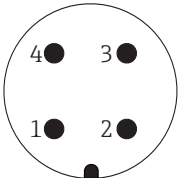
- ▶ Do not disconnect the protective connection (6).
- ▶ Disconnect the supply voltage before disconnecting the protective earth (7).

- i** Connect protective earth to the internal ground terminal (7) before connecting the supply voltage. If necessary, connect the potential matching line to the external ground terminal (11).
- i** In order to ensure electromagnetic compatibility (EMC): Do not only ground the device via the protective earth 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.
- i** An easily accessible power switch must be installed in the proximity of the device. The power switch must be marked as a disconnecter for the device (IEC/EN61010).

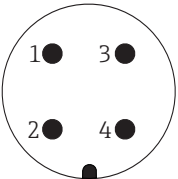
7.1.2 Device plug connectors

 For the versions with fieldbus plug connector (M12 or 7/8"), the signal line can be connected without opening the housing.

Pin assignment of the M12 plug connector

 A0011175	Pin	Meaning
	1	Signal +
	2	not connected
	3	Signal -
	4	Ground

Pin assignment of the 7/8" plug connector

 A0011176	Pin	Meaning
	1	Signal -
	2	Signal +
	3	Not connected
	4	Screen

7.1.3 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-hazardous - Ex nA - Ex ic - CSA GP	14 to 35 V	Graph showing Maximum load R [Ω] vs supply voltage U₀ [V]. The curve starts at 14 V, rises linearly to 500 Ω at 25 V, and remains constant at 500 Ω up to 35 V.
	Ex ia / IS	14 to 30 V	
	- Ex d(ia) / XP - Ex ic(ia) - Ex nA(ia) - Ex ta / DIP	14 to 35 V ³⁾	
	Ex ia + Ex d(ia) / IS + XP	14 to 30 V	

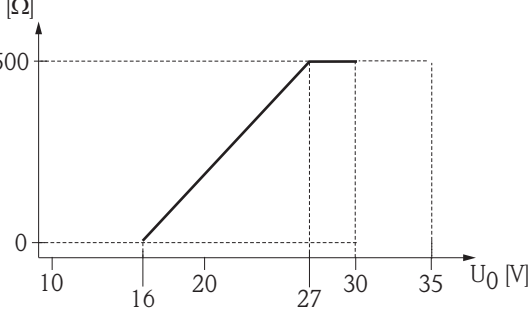
A0031745

- 1) Feature 020 in the product structure
- 2) Feature 010 in the product structure
- 3) At ambient temperatures $T_a \leq -20^\circ\text{C}$, a terminal voltage $U \geq 16\text{ V}$ is required to start the device with the min. 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-hazardous - Ex nA - Ex nA(ia) - Ex ic - Ex ic(ia) - Ex d(ia) / XP - Ex ta / DIP - CSA GP	16 to 35 V	Graph showing Maximum load R [Ω] vs supply voltage U₀ [V]. The curve starts at 16 V, rises linearly to 500 Ω at 27 V, and remains constant at 500 Ω up to 35 V.
	- Ex ia / IS - Ex ia + Ex d(ia) / IS + XP	16 to 30 V	

A0031746

- 1) Feature 020 in the product structure
- 2) Feature 010 in the product structure

"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	16 to 30 V	

1) Feature 020 in the product structure

2) Feature 010 in the product structure

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

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

7.1.4 Overvoltage protection

If the measuring device is used for level measurement in flammable liquids which requires the use of overvoltage protection according to DIN EN 60079-14, standard for test procedures 60060-1 (10 kA, pulse 8/20 μ s), overvoltage protection has to be ensured by an integrated or external overvoltage protection module.

Integrated overvoltage protection

An integrated overvoltage protection module is available for 2-wire HART as well as PROFIBUS PA and FOUNDATION Fieldbus devices.

Product structure: Feature 610 "Accessory mounted", option NA "Overvoltage protection".

Technical data	
Resistance per channel	$2 \times 0.5 \Omega$ max.
Threshold DC voltage	400 to 700 V
Threshold impulse voltage	< 800 V
Capacitance at 1 MHz	< 1.5 pF
Nominal arrest impulse voltage (8/20 μ s)	10 kA

External overvoltage protection

HAW562 or HAW569 from Endress+Hauser are suited as external overvoltage protection.



For detailed information please refer to the following documents:

- HAW562: TI01012K
- HAW569: TI01013K

7.1.5 Connecting the measuring device



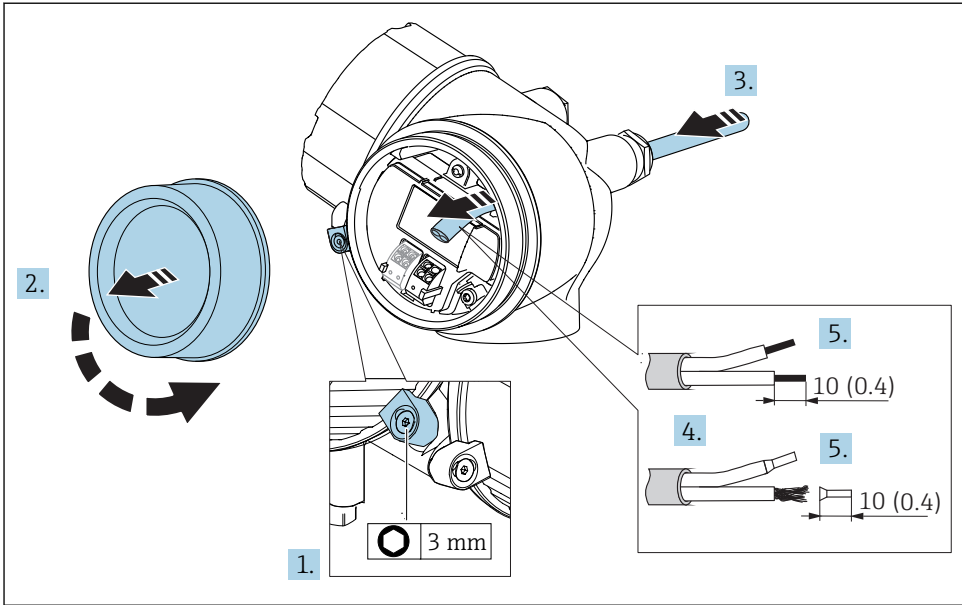
WARNING

Risk of explosion!

- ▶ 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.

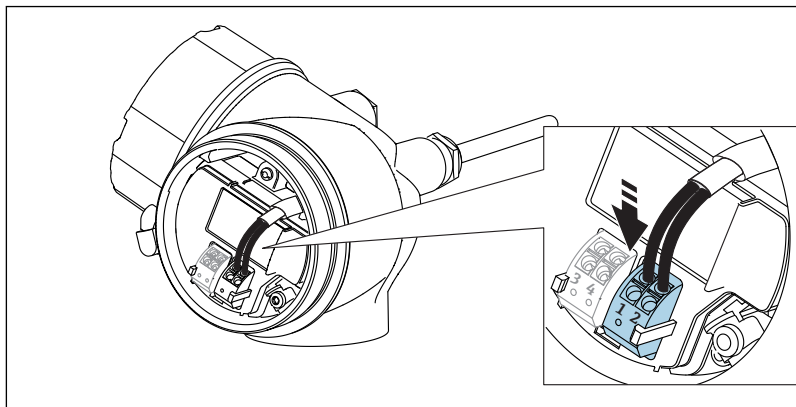


A0012619

11 Dimensions: mm (in)

1. Loosen the screw of the securing clamp on the connection compartment cover and turn the securing clamp 90° counterclockwise.
2. Unscrew the connection compartment cover.
3. Push the cable through the cable entry . To ensure tight sealing, do not remove the sealing ring from the cable entry.
4. Remove the cable sheath.
5. Strip the cable ends over a length of 10 mm (0.4 in). In the case of stranded cables, also fit ferrules.
6. Firmly tighten the cable glands.

7.



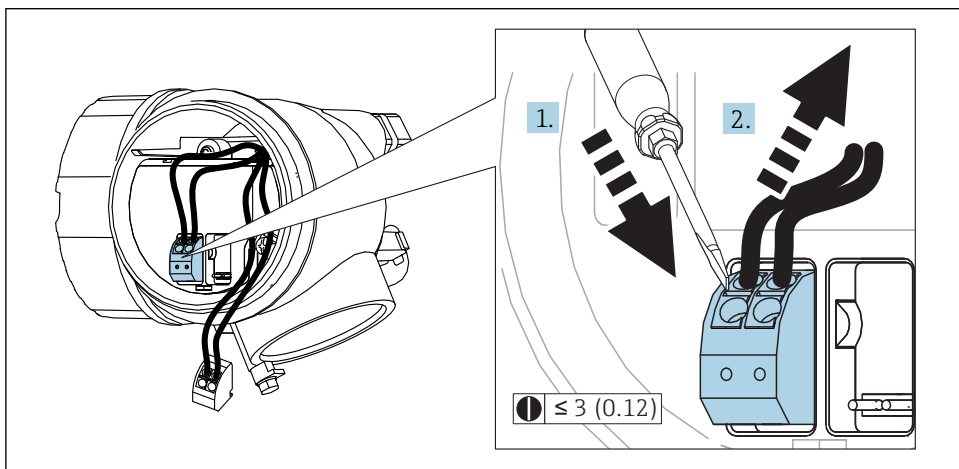
A0032468

Connect the cable in accordance with the terminal assignment → 27.

8. If using shielded cables: Connect the cable shield to the ground terminal.
9. Fit the cover of the connection compartment back on.
10. If present, turn the cover lock so that it is located over the edge of the cover and then tighten.

Plug-in spring-force terminals

In the case of devices without integrated overvoltage protection, electrical connection 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

12 Dimensions: mm (in)

To remove cables from the terminal:

- 1. Using a flat-blade screwdriver $\leq 3\text{ mm}$, press down on the slot between the two terminal holes
- 2. while simultaneously pulling the cable end out of the terminal.

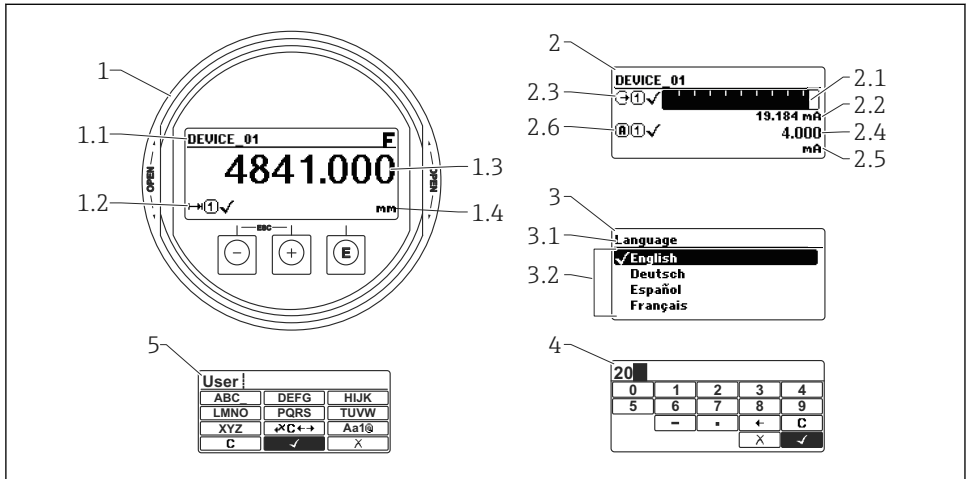
7.1.6 Post-connection check

☐	Is the device or cable undamaged (visual check)?
☐	Do the cables comply with the requirements ?
☐	Do the cables have adequate strain relief?
☐	Are all cable glands installed, securely tightened and leak-tight?
☐	Does the supply voltage match the specifications on the nameplate?
☐	Is the terminal assignment correct →  27?
☐	If required: Has protective ground connection been established ?
☐	If supply voltage is present, is the device ready for operation and do values appear on the display module?
☐	Are all housing covers installed and securely tightened?
☐	Is the securing clamp tightened correctly?

8 Commissioning (via operating menu)

8.1 Display and operating module

8.1.1 Display appearance



A0012635

 13 Appearance of the display and operation module for on-site operation

- 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 (1 bargraph + 1 value)
 - 2.1 Bargraph 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 Representation of a parameter (here: a parameter with selection list)
 - 3.1 Header containing parameter name and error symbol (if an error is active)
 - 3.2 Selection list; ☒ marks the current parameter value.
- 4 Input matrix for numbers
- 5 Input matrix for alphanumeric and special characters

8.1.2 Operating elements

Key	Meaning
 A0018330	Minus key <i>For menu, submenu</i> Moves the selection bar upwards in a picklist. <i>For text and numeric editor</i> In the input mask, moves the selection bar to the left (backwards).
 A0018329	Plus key <i>For menu, submenu</i> Moves the selection bar downwards in a picklist. <i>For text and numeric editor</i> In the input mask, moves the selection bar to the right (forwards).
 A0018328	Enter key <i>For measured value display</i> - Pressing the key briefly opens the operating menu. - Pressing the key for 2 s opens the context menu. <i>For menu, submenu</i> - Pressing the key briefly Opens the selected menu, submenu or parameter. - Pressing the key for 2 s for parameter: If present, opens the help text for the function of the parameter. <i>For text and numeric editor</i> - Pressing the key briefly - Opens the selected group. - Carries out the selected action. - Pressing the key for 2 s confirms the edited parameter value.
 A0032909	Escape key combination (press keys simultaneously) <i>For menu, submenu</i> - 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"). <i>For text and numeric editor</i> Closes the text or numeric editor without applying changes.
 A0032910	Minus/Enter key combination (press and hold down the keys simultaneously) Reduces the contrast (brighter setting).
 A0032911	Plus/Enter key combination (press and hold down the keys simultaneously) Increases the contrast (darker setting).
 A0032912	Minus/Plus/Enter key combination (press and hold down the keys simultaneously) <i>For measured value display</i> Enables or disables the keypad lock.

8.1.3 Opening the context menu

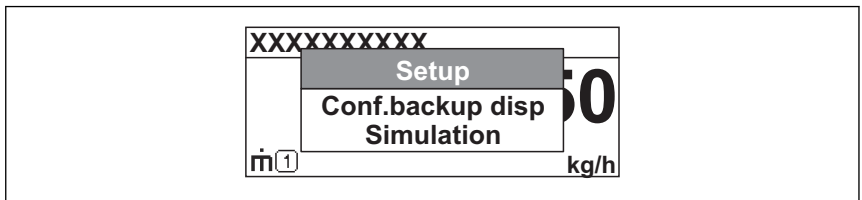
Using the context menu, the user can call up the following menus quickly and directly from the operational display:

- Setup
- Conf. backup disp.
- Simulation

Calling up and closing the context menu

The user is in the operational display.

1. Press $\boxed{\text{F}}$ for 2 s.
 - The context menu opens.



A0014003-EN

2. Press $\boxed{\text{F}}$ + $\boxed{\text{F}}$ 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 $\boxed{\text{F}}$ to navigate to the desired menu.
3. Press $\boxed{\text{F}}$ to confirm the selection.
 - The selected menu opens.

8.2 Operating menu

Parameter/Submenu	Meaning	Description
Language Setup → Advanced setup → Display → Language	Defines the operating language of the on-site display.	BA01620F (FMR67, HART)
Setup	When appropriate values have been assigned to all setup parameters, the measured value should be completely configured in a standard application.	
Present mapping Setup → Mapping → Present mapping	Interference echo suppression	
Advanced setup Setup → Advanced setup	Contains further submenus and parameters: ▪ to adapt the device to special measuring conditions. ▪ to process the measured value (scaling, linearization). ▪ to configure the signal output.	
Diagnostics	Contains the most important parameters needed to detect and analyze operational errors.	GP01101F (FMR6x, HART)
Expert ¹⁾	Contains all parameters of the device (including those which are already contained in one of the above submenus). This menu is organized according to the function blocks of the device.	

- 1) By entering the "Expert" menu, an access code is always requested. If a customer specific access code has not been defined, "0000" has to be entered.

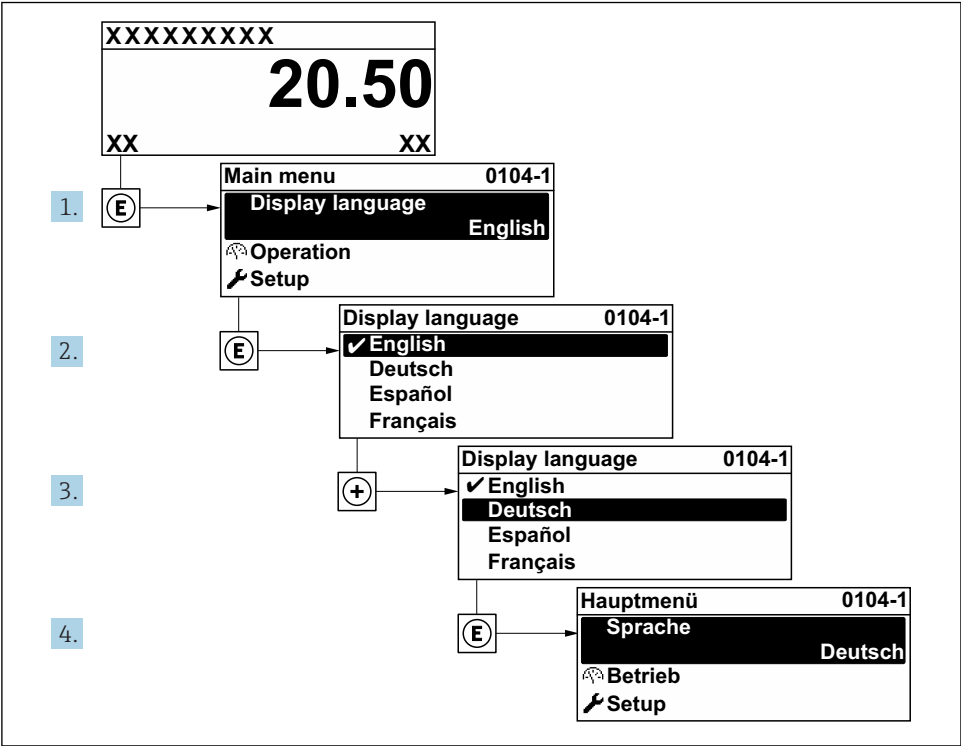
8.3 Unlock the device

If the device has been locked, it must be be unlocked before the measurement can be configured.

 For details refer to the Operating Instructions of the device:
BA01620F (FMR67, HART)

8.4 Setting the operating language

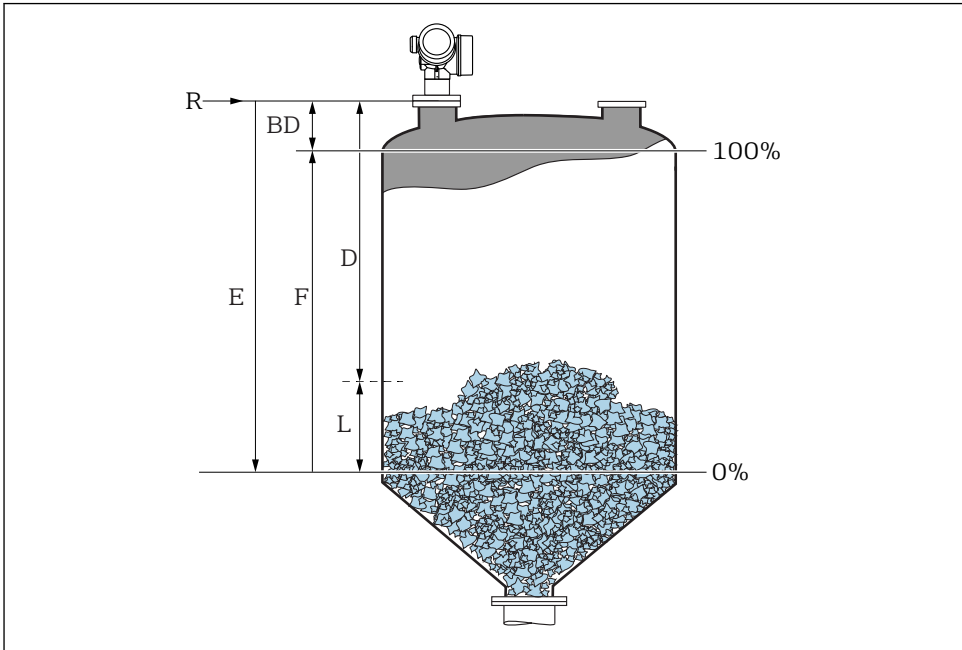
Factory setting: English or ordered local language



A0029420

 14 Using the example of the local display

8.5 Configuration of a level measurement



A0016934

1. Setup → Device tag
↳ Enter device tag.
2. Setup → Distance unit
↳ Select distance unit.
3. Setup → Bin type
↳ Select bin type.
4. Setup → Max. filling speed solid
↳ Enter maximum expected filling speed.
5. Setup → Max. draining speed solid
↳ Enter maximum expected draining speed.
6. Setup → Empty calibration
↳ Enter empty distance E (Distance from reference point R to the 0% level)
7. If the measuring range covers only an upper part of the tank or silo ($E << \text{tank/silo height}$), it is mandatory to enter the actual tank or silo height into the parameter. If there is an outlet cone, the tank or silo height should not be adjusted as usually E is not $<< \text{tank/silo height}$ in these applications.
Setup → Advanced setup → Level → Tank/silo height

8. Setup → Full calibration
 - ↳ Enter full distance F (Distance from the 0% to the 100% level).
9. Setup → Level
 - ↳ Indicates the measured level L.
10. Setup → Distance
 - ↳ Indicates the measured distance from the reference point R to the level L.
11. Setup → Signal quality
 - ↳ Indicates the quality of the evaluated level echo.
12. Setup → Mapping → Confirm distance
 - ↳ Compare distance indicated on the display to real distance in order to start the recording of an interference echo map.
13. Setup → Advanced setup → Level → Level unit
 - ↳ Select level unit: %, m, mm, ft, in (Factory setting: %)



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

8.6 User-specific applications



For details of setting the parameters of user-specific applications, see separate documentation:

BA01620F (FMR67, HART)



For the **Expert** menu see:

GP01101F (Description of Device Parameters, FMR6x, HART)



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