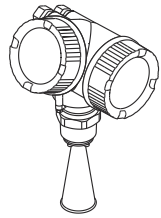
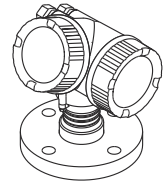
KA01125F/00/EN/03.22-00
71575725
2022-08-01

Brief Operating Instructions
Micropilot FMR51, FMR52 FOUNDATION Fieldbus

Free space radar



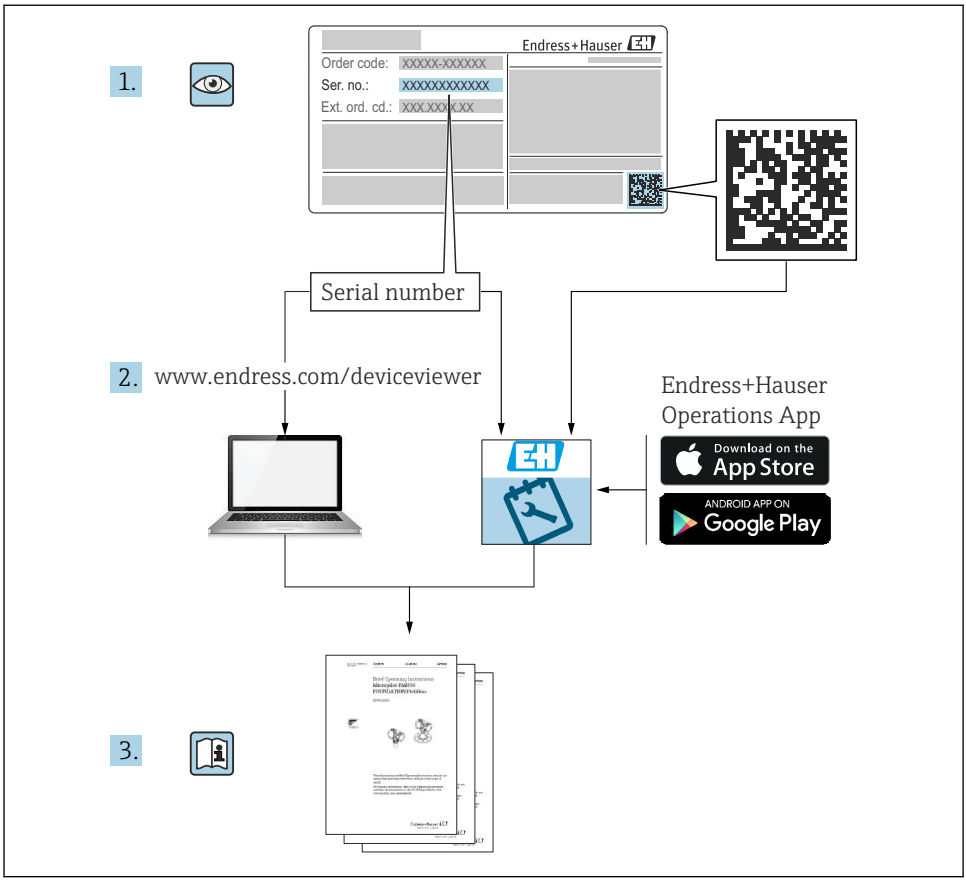


These Instructions are Brief Operating Instructions; they are not a substitute for the Operating Instructions pertaining to the device.

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 in liquids, pastes and sludges. Due to its operating frequency of approx. 26 GHz, a maximum radiated pulsed power of 5.7 mW and an average power output of 0.015 mW(for the version with advanced dynamics: maximum pulsed power: 23.3 mW; average power output: 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.

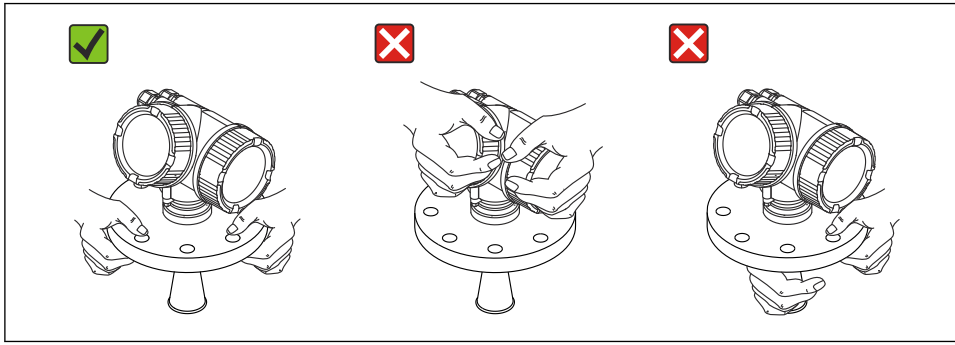
4.2.2 Transporting the product to the measuring point

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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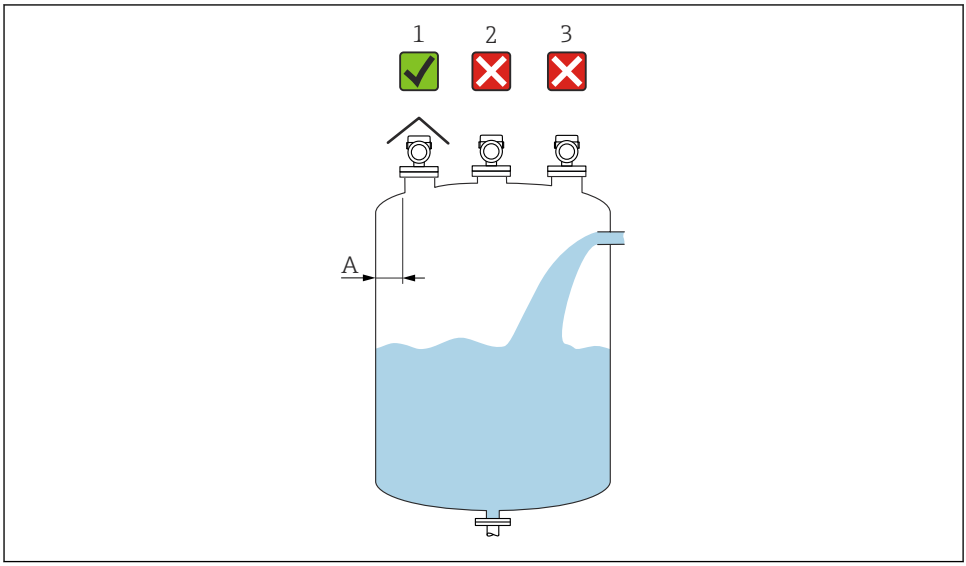
5 Mounting

5.1 Mounting location



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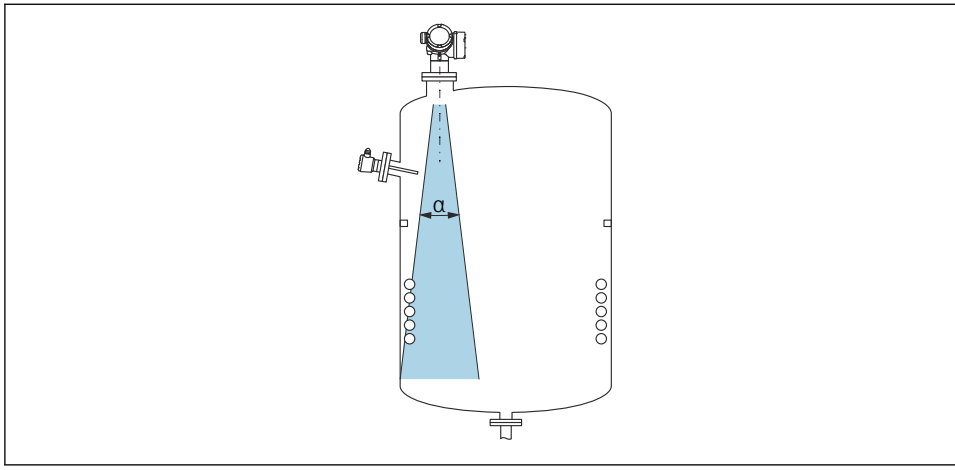
A Recommended distance from wall to nozzle outer edge ~ 1/6 of the vessel diameter. However, the device must not under any circumstances be mounted closer than 15 cm (5.91 in) to the tank wall.
1 Use of a weather protection cover; protection from direct sunlight or rain
2 Installation in the center, interference can cause signal loss
3 Do not install above the filling curtain

5.2 Orientation

5.3 Internal vessel fittings



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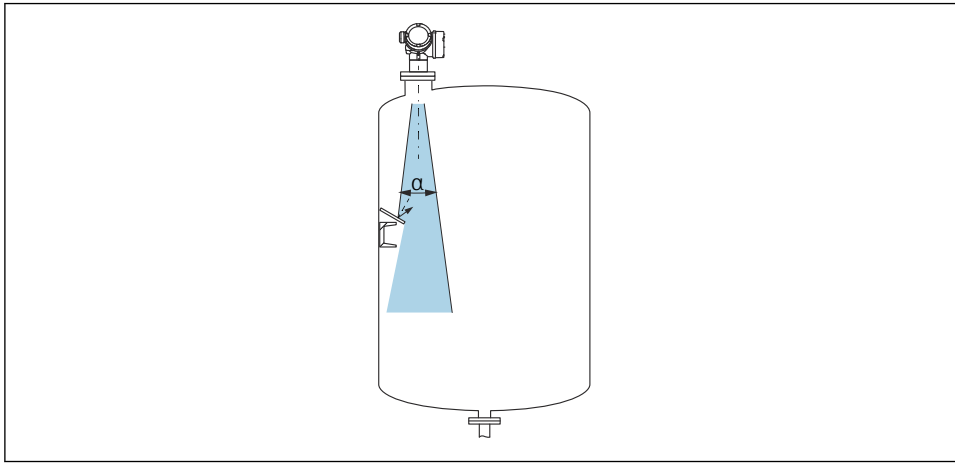
Avoid the location of internal fittings (limit switches, temperature sensors, struts, vacuum rings, heating coils, baffles etc.) inside the signal beam. Take into account the beam angle.

5.4 Avoiding interference echoes



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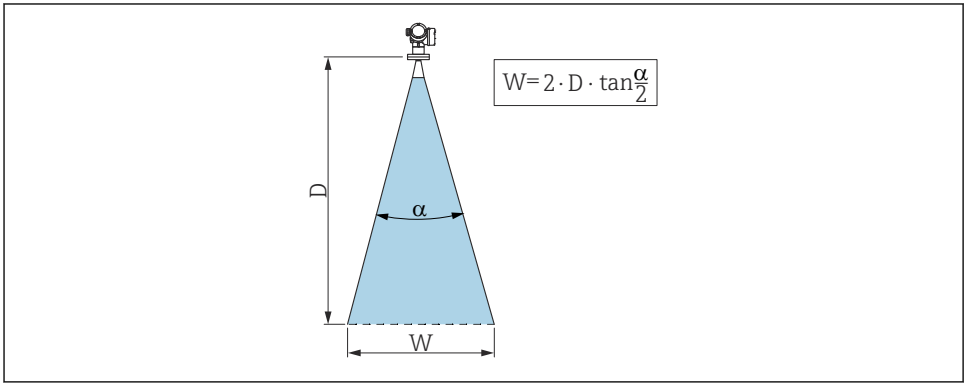
Metal orifice plates installed at an angle to scatter the radar signals help prevent interference echoes.

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 α, distance D and beam diameter W*

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

FMR51				
Antenna size	40 mm (1½ in)	50 mm (2 in)	80 mm (3 in)	100 mm (4 in)
Beam angle α	23°	18°	10°	8°
Distance (D)	**Beam diameter W**			
3 m (9.8 ft)	1.22 m (4 ft)	0.95 m (3.1 ft)	0.53 m (1.7 ft)	0.42 m (1.4 ft)
6 m (20 ft)	2.44 m (8 ft)	1.9 m (6.2 ft)	1.05 m (3.4 ft)	0.84 m (2.8 ft)
9 m (30 ft)	3.66 m (12 ft)	2.85 m (9.4 ft)	1.58 m (5.2 ft)	1.26 m (4.1 ft)
12 m (39 ft)	4.88 m (16 ft)	3.80 m (12 ft)	2.1 m (6.9 ft)	1.68 m (5.5 ft)
15 m (49 ft)	6.1 m (20 ft)	4.75 m (16 ft)	2.63 m (8.6 ft)	2.10 m (6.9 ft)
20 m (66 ft)	8.14 m (27 ft)	6.34 m (21 ft)	3.50 m (11 ft)	2.80 m (9.2 ft)
25 m (82 ft)	10.17 m (33 ft)	7.92 m (26 ft)	4.37 m (14 ft)	3.50 m (11 ft)
30 m (98 ft)	-	9.50 m (31 ft)	5.25 m (17 ft)	4.20 m (14 ft)
35 m (115 ft)	-	11.09 m (36 ft)	6.12 m (20 ft)	4.89 m (16 ft)
40 m (131 ft)	-	12.67 m (42 ft)	7.00 m (23 ft)	5.59 m (18 ft)
45 m (148 ft)	-	-	7.87 m (26 ft)	6.29 m (21 ft)
60 m (197 ft)	-	-	10.50 m (34 ft)	8.39 m (28 ft)
70 m (230 ft)	-	-	-	9.79 m (32 ft)

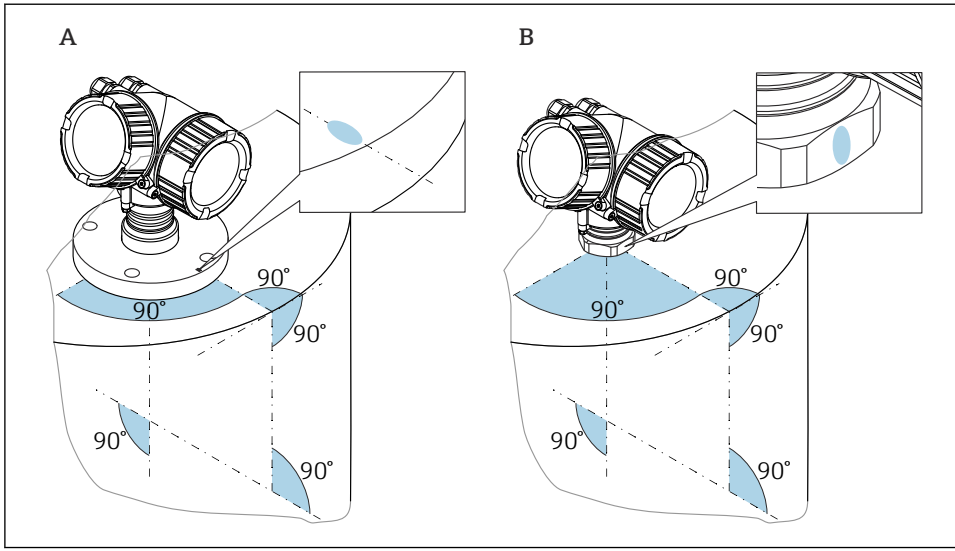
FMR52		
Antenna size	50 mm (2 in)	80 mm (3 in)
Beam angle α	18°	10°
Distance (D)	**Beam diameter W**	
3 m (9.8 ft)	0.95 m (3.1 ft)	0.53 m (1.7 ft)
6 m (20 ft)	1.9 m (6.2 ft)	1.05 m (3.4 ft)
9 m (30 ft)	2.85 m (9.4 ft)	1.58 m (5.2 ft)
12 m (39 ft)	3.80 m (12 ft)	2.1 m (6.9 ft)
15 m (49 ft)	4.75 m (16 ft)	2.63 m (8.6 ft)
20 m (66 ft)	6.34 m (21 ft)	3.50 m (11 ft)
25 m (82 ft)	7.92 m (26 ft)	4.37 m (14 ft)
30 m (98 ft)	9.50 m (31 ft)	5.25 m (17 ft)
35 m (115 ft)	11.09 m (36 ft)	6.12 m (20 ft)
40 m (131 ft)	12.67 m (42 ft)	7.00 m (23 ft)
45 m (148 ft)	-	7.87 m (26 ft)
60 m (197 ft)	-	10.50 m (34 ft)

5.6 Free-space installation in vessel

5.6.1 Horn antenna (FMR51)

Alignment

- Align the antenna perpendicular to the product surface.
  The maximum reach of the antenna can be reduced if it is not installed perpendicular to the product.
- A marking is provided on the flange (at a point between the flange holes), the threaded connection or the gland to aid the alignment. This marking must be aligned towards the tank wall as much as possible.



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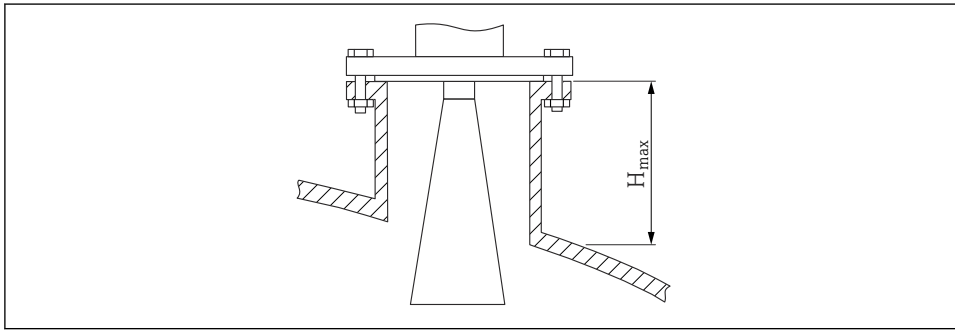
Depending on the device version the marking may be a circle or two parallel lines.

Information concerning nozzles

To ensure optimum measurement, the antenna should protrude from the nozzle. Depending on the antenna size, this is achieved by the following maximum nozzle heights:



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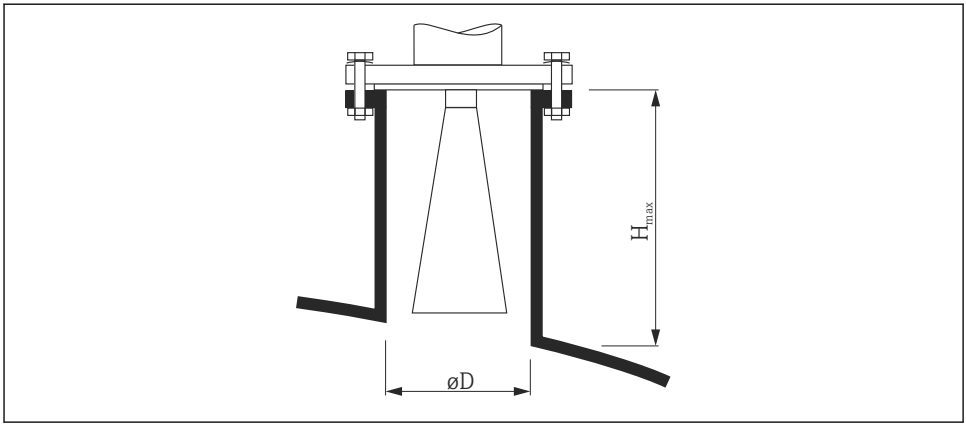
2 *Nozzle height for horn antenna (FMR51)*

Antenna	Maximum nozzle height H_{max}
Horn 40mm/1-1/2"	86 mm (3.39 in)
Horn 50mm/2"	115 mm (4.53 in)

Antenna	Maximum nozzle height H_{max}
Horn 80mm/3"	211 mm (8.31 in)
Horn 100mm/4"	282 mm (11.1 in)

Conditions for longer nozzles

If the medium has good reflective properties, higher nozzles are also possible. The maximum nozzle length H_{max} depends on the nozzle diameter D:



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Nozzle diameter D	Maximum nozzle height H_{max}	Recommended antenna
40 mm (1.5 in)	100 mm (3.9 in)	Horn 40mm/1-1/2"
50 mm (2 in)	150 mm (5.9 in)	Horn 50mm/2"
80 mm (3 in)	250 mm (9.8 in)	Horn 80mm/3"
100 mm (4 in)	500 mm (19.7 in)	Horn 100mm/4"
150 mm (6 in)	800 mm (31.5 in)	Horn 100mm/4"

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.

- For mounting in long nozzles, the device is available with an antenna extension of up to 1000 mm (39.4 in) (accessory). This allows the antenna to project out of the nozzle.
- The antenna extension may cause interference echoes in the near range. This means that the maximum measurable level may be reduced.

Information concerning threaded connections

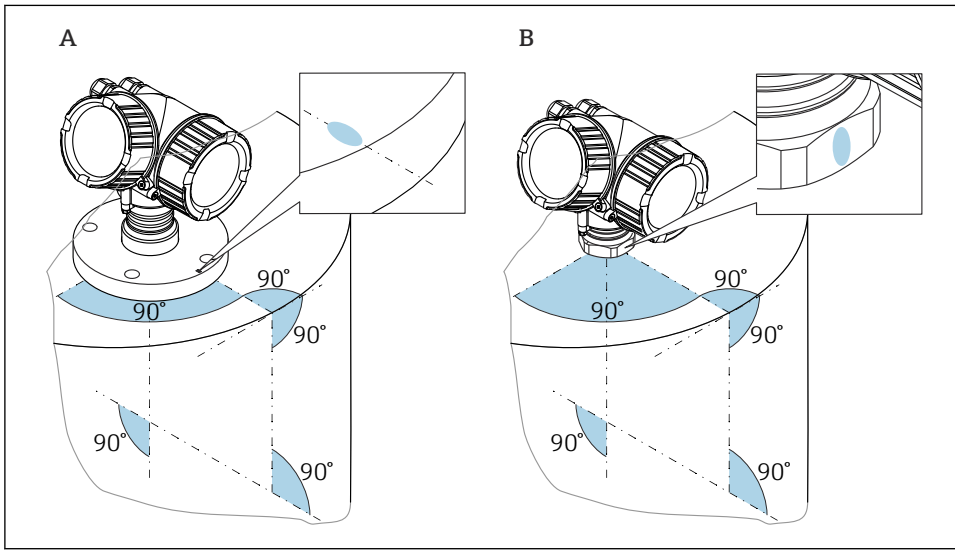
For devices with a threaded connection, it may be necessary - depending on the antenna size - to first disassemble the horn and then mount it again after screwing in the device.

- Tighten by the hexagonal nut only.
- Tool: open-ended wrench 55 mm
- Maximum permissible torque: 60 Nm (44 lbf ft)

5.6.2 Horn antenna, flush mount (FMR52)

Alignment

- Align the antenna perpendicular to the product surface.
  The maximum reach of the antenna can be reduced if it is not installed perpendicular to the product.
- A marking is provided on the flange (at a point between the flange holes) or the gland to aid the alignment. This marking must be aligned towards the tank wall as much as possible.



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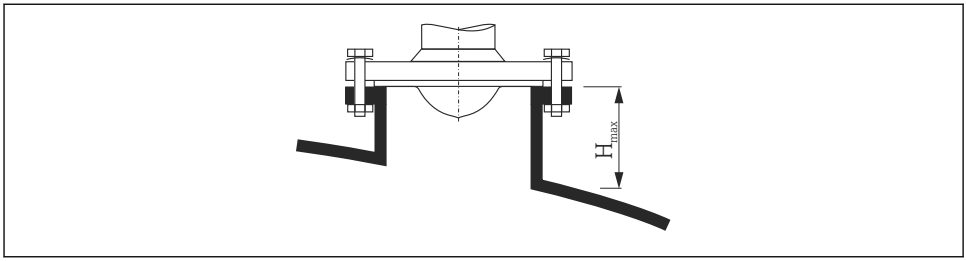
Depending on the device version the marking may be a circle or two parallel lines.

Information concerning nozzles



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3 Nozzle height for horn antenna, flush mount (FMR52)

Antenna	Maximum nozzle height H_{max}
Horn 50mm/2"	500 mm (19.7 in)
Horn 80mm/3"	500 mm (19.7 in)

- For flanges with PTFE cladding: Observe the instructions for mounting cladded flanges
- The PTFE flange cladding normally acts simultaneously as a seal between the nozzle and the device flange
- Please contact the manufacturer's support service for applications with nozzles that are higher than indicated in the table.

Mounting cladded flanges

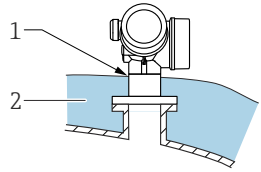
Note the following for cladded flanges:
- Use the same number of flange screws as the number of flange bores provided.
- Tighten the screws with the necessary torque (see Table).
- Retighten after 24 hours or after the first temperature cycle.
- Depending on the process pressure and temperature, check and retighten the screws, where necessary, at regular intervals.

The PTFE flange cladding normally acts simultaneously as a seal between the nozzle and the device flange.

Flange size	Number of screws	Tightening torque
EN		
DN50 PN10/16	4	45 to 65 Nm
DN50 PN25/40	4	45 to 65 Nm
DN80 PN10/16	8	40 to 55 Nm
DN80 PN25/40	8	40 to 55 Nm
DN100 PN10/16	8	40 to 60 Nm
DN100 PN25/40	8	55 to 80 Nm

Flange size	Number of screws	Tightening torque
DN150 PN10/16	8	75 to 115 Nm
ASME		
NPS 2" Cl.150	4	40 to 55 Nm
NPS 2" Cl.300	8	20 to 30 Nm
NPS 3" Cl.150	4	65 to 95 Nm
NPS 3" Cl.300	8	40 to 55 Nm
NPS 4" Cl.150	8	45 to 70 Nm
NPS 4" Cl.300	8	55 to 80 Nm
NPS 6" Cl.150	8	85 to 125 Nm
NPS 6" Cl.300	12	60 to 90 Nm
NPS 8" Cl.150	8	115 to 170 Nm
NPS 8" Cl.300	12	90 to 135 Nm
JIS		
10K 50A	4	40 to 60 Nm
10K 80A	8	25 to 35 Nm
10K 100A	8	35 to 55 Nm
10K 150A	8	75 to 115 Nm

5.7 Container with heat insulation



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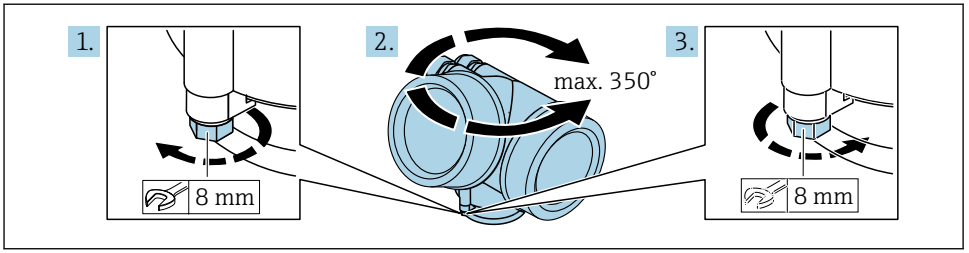
If process temperatures are high, the device should be included in the usual container insulation system (2) to prevent the electronics from heating as a result of thermal radiation or convection. The insulation should not be higher than the neck of the device (1).

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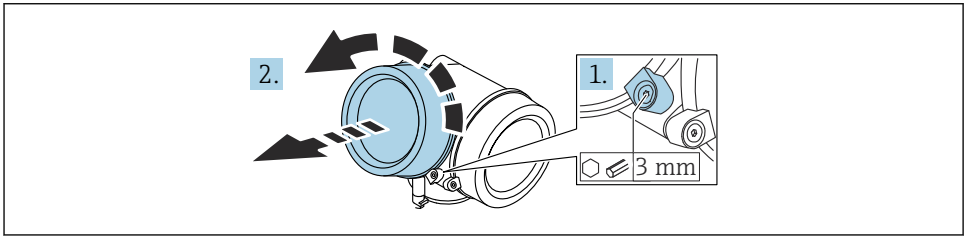
1. Unscrew the securing screw using an open-ended wrench.
2. Rotate the housing in the desired direction.
3. Tighten the securing screw (1.5 Nm for plastic housing; 2.5 Nm for aluminum or stainless steel housing).

5.9 Turning the display

5.9.1 Opening the cover



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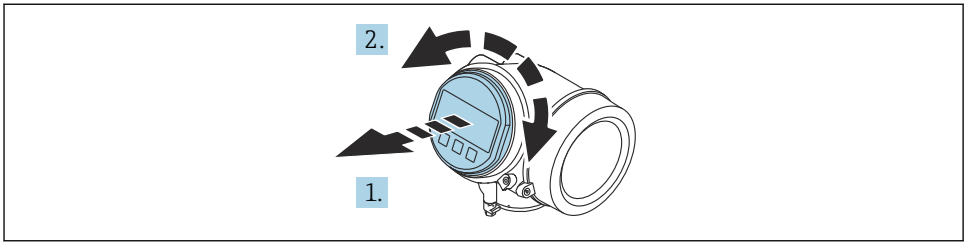
1. Loosen the screw of the securing clamp of the electronics compartment cover using an Allen key (3 mm) and turn the clamp 90 ° counterclockwise.
2. Unscrew the electronics compartment cover and check the cover seal; replace it if necessary.

5.9.2 Turning the display module



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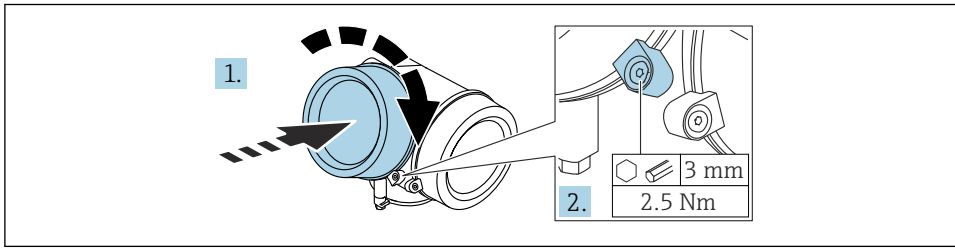
1. Pull out the display module with a gentle rotational movement.
2. Turn the display module to the desired position: Max. 8 × 45 ° in each direction.
3. Feed the coiled cable into the gap between the housing and main electronics module and plug the display module into the electronics compartment until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

5.9.3 Closing the cover of the electronics compartment



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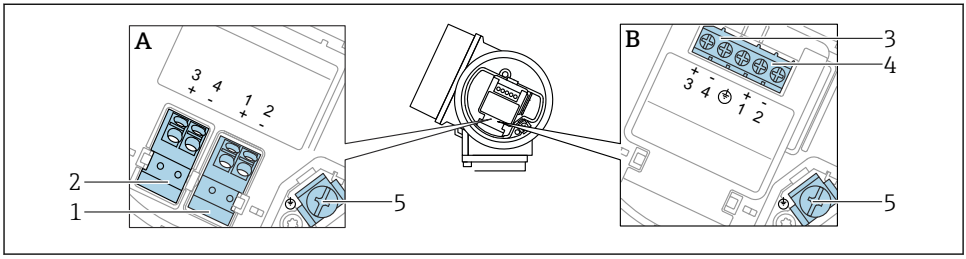
1. Screw down the cover of the electronics compartment.
2. Turn the securing clamp 90 ° in the clockwise direction and, using an Allen key (3 mm), tighten the screw of the securing clamp on the electronics compartment cover with 2.5 Nm.

6 Electrical connection

6.1 Connecting requirements

6.1.1 Terminal assignment

Terminal assignment PROFIBUS PA / FOUNDATION Fieldbus



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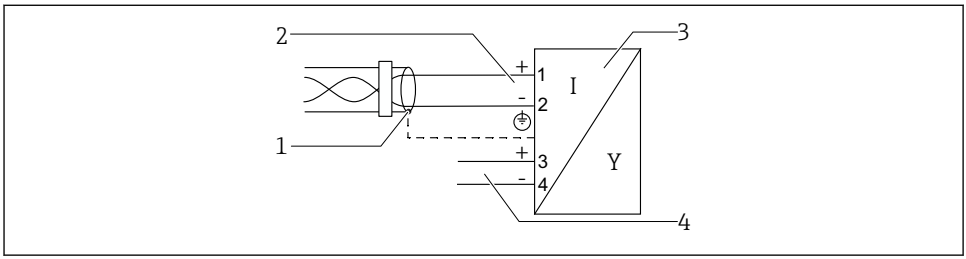
4 *Terminal assignment PROFIBUS PA / FOUNDATION Fieldbus*

A Without integrated overvoltage protection
B With integrated overvoltage protection
1 Connection, PROFIBUS PA / FOUNDATION Fieldbus: 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, PROFIBUS PA / FOUNDATION Fieldbus: terminals 1 and 2, with integrated overvoltage protection
5 Terminal for cable shield

Block diagram PROFIBUS PA / FOUNDATION Fieldbus



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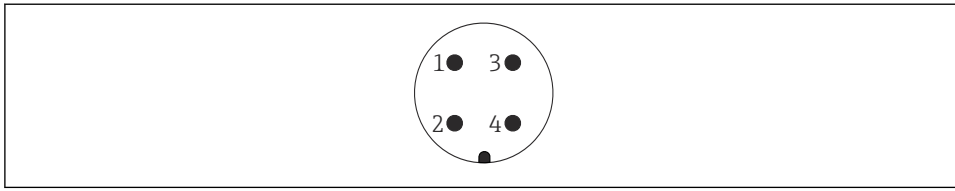
5 *Block diagram PROFIBUS PA / FOUNDATION Fieldbus*

1 Cable screen; observe cable specification
2 Connection PROFIBUS PA / FOUNDATION Fieldbus
3 Measuring device
4 Switch output (open collector)

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.



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6 Pin assignment of 7/8" plug

1 Signal -
2 Signal +
3 Not assigned
4 Shielding

6.1.3 Supply voltage

PROFIBUS PA, FOUNDATION Fieldbus

"Power supply; output" [1]	"Approval" [2]	Terminal voltage
E: 2-wire; FOUNDATION Fieldbus, switch output **G:** 2-wire; PROFIBUS PA, switch output	▪ Non-Ex ▪ Ex nA ▪ Ex nA(ia) ▪ Ex ic ▪ Ex ic(ia) ▪ Ex d(ia) / XP ▪ Ex ta / DIP ▪ CSA GP	9 to 32 V [3]
	▪ Ex ia / IS ▪ Ex ia + Ex d(ia) / IS + XP	9 to 30 V [3]

1) Feature 020 in the product structure
2) Feature 010 in the product structure
3) Input voltages up to 35 V do not damage the device.

Polarity-dependent	No
FISCO/FNICO compliant according to IEC 60079-27	Yes

6.2 Connecting the device

⚠ WARNING

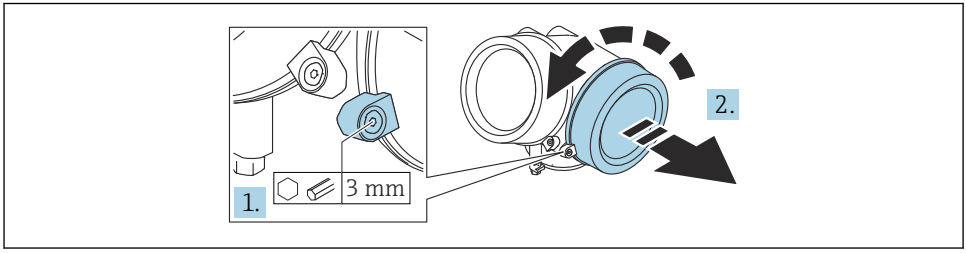
Explosion Hazard!

- ▶ 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



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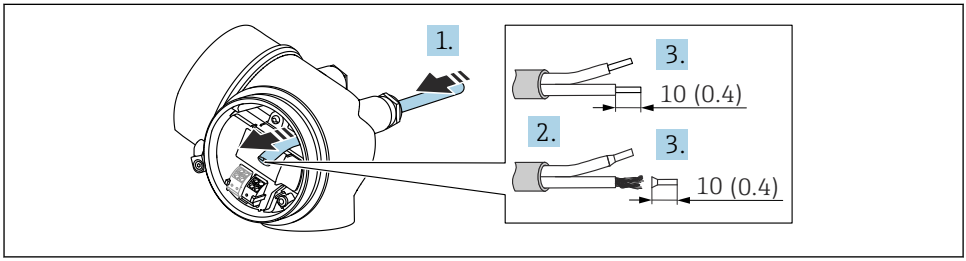
1. Loosen the screw of the securing clamp of the connection compartment cover using an Allen key (3 mm) and turn the clamp 90 ° counterclockwise.
2. Unscrew the connection compartment cover and check the cover seal; replace it if necessary.

6.2.2 Connecting



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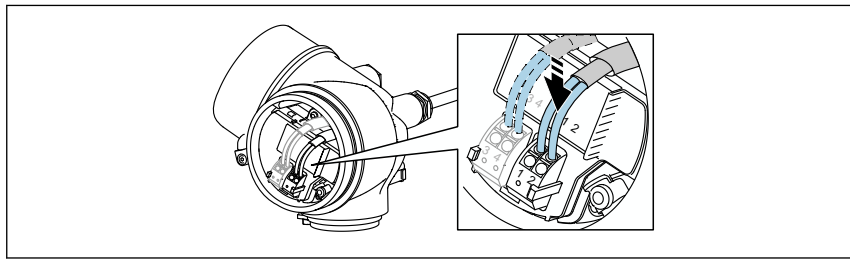
7 *Engineering unit: mm (in)*

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.



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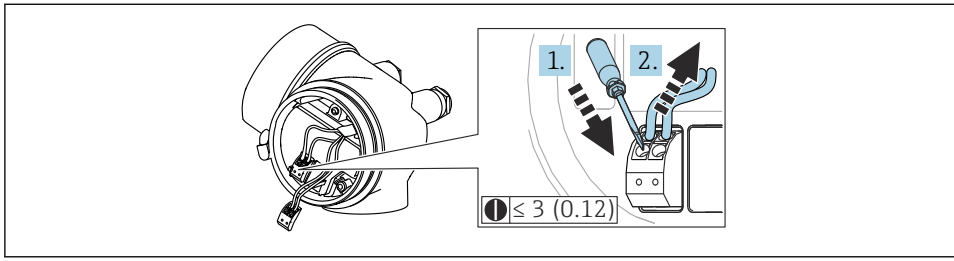
6. If using shielded cables: Connect the cable shield to the ground terminal.

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.



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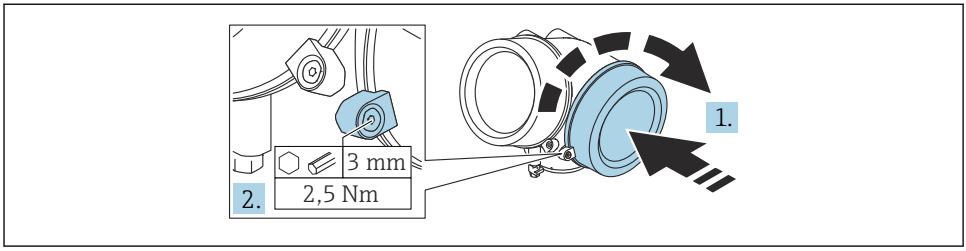
8 Engineering unit: mm (in)

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



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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 Integration into a FOUNDATION Fieldbus network

7.1 Device description file (DD)

You require the following to configure a device and integrate it into an FF network:
- An FF configuration program
- The Cff file (Common File Format: *.cff)
- The device description (DD) is in one of the following formats:
  - Device description format 4 : *sym, *ffo
  - Device description format 5 : *sy5, *ff5

Data for device-specific DD

Manufacturer ID	0x452B48
Device type	0x1028
Device revision	0x01
DD Revision	Information and files available at: ▪ www.endress.com ▪ www.fieldcommgroup.org
CFF Revision	

7.2 Integration into the FF network

- For more in-depth information on integrating the device into the FF system, see the description for the configuration software used.
- When integrating the field devices into the FF system, make sure you are using the right files. You can read out the required version by means of the Device Revision/ DEV_REV and DD Revision/DD_REV parameters in the Resource Block.

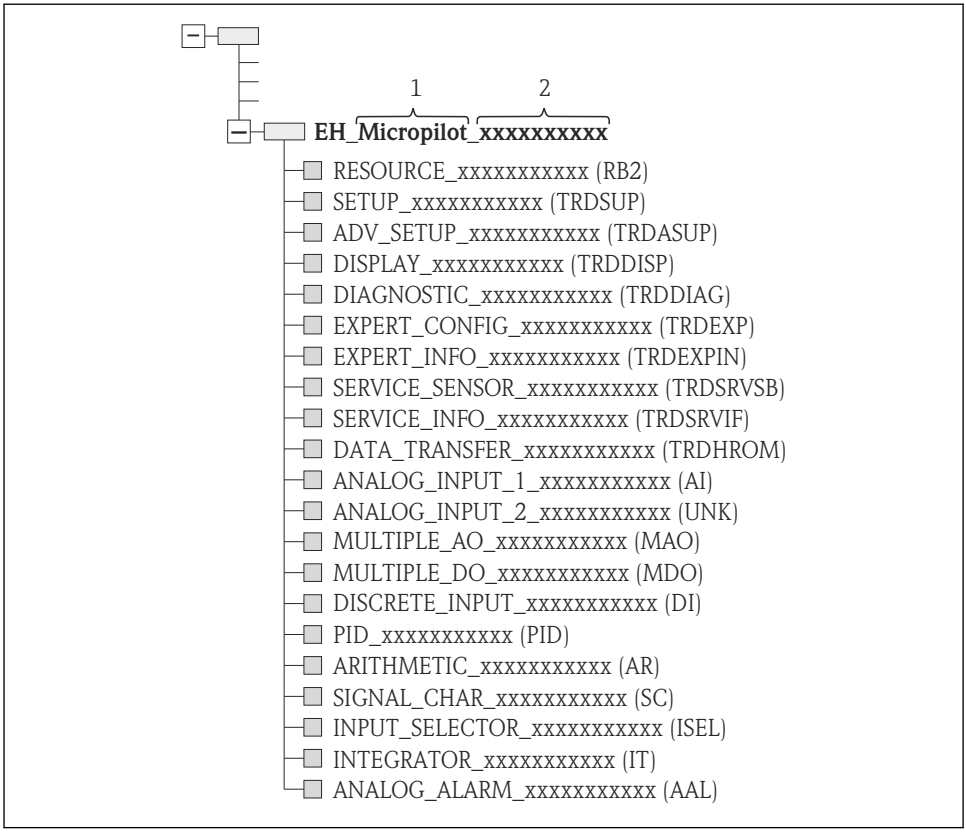
The device is integrated into the FF network as follows:

1. Start the FF configuration program.
2. Download the Cff and device description files (*.ffo, *.sym (for format 4) *ff5, *sy5 (for format 5) to the system.
3. Configure the interface.
4. Configure the device for the measuring task and for the FF system.

7.3 Device identification and addressing

FOUNDATION Fieldbus identifies the device using its identification code (device ID) and automatically assigns it a suitable field address. The identity code cannot be changed. The device appears in the network display once you have started the FF configuration program and integrated the device into the network. The blocks available are displayed under the device name.

If the device description has not yet been loaded, the blocks report "Unknown" or "(UNK)".



9 Typical display in a configuration program after the connection has been established

1 Device name
2 Serial number

7.4 Block model

7.4.1 Blocks in the device software

The device has the following blocks:
- Resource block (device block)
- Transducer blocks
  - Setup transducer block (TRDSUP)
  - Advanced setup transducer block (TRDASUP)
  - Display transducer block (TRDDISP)
  - Diagnostic transducer block (TRDDIAG)
  - Advanced diagnostic transducer block (TRDADVDIAG)
  - Expert configuration transducer block (TRDEXP)
  - Expert information transducer block (TRDEXPIN)
  - Service sensor transducer block (TRDSRVSB)
  - Service information transducer block (TRDSRVIF)
  - Data transfer transducer block (TRDHROM)
- Function blocks
  - 2 AI blocks (AI)
  - 1 discrete input block (DI)
  - 1 multiple analog output block (MAO)
  - 1 multiple discrete output block (MDO)
  - 1 PID block (PID)
  - 1 arithmetic block (AR)
  - 1 signal characterizer block (SC)
  - 1 input selector block (ISEL)
  - 1 integrator block (IT)
  - 1 analog alarm block (AAL)

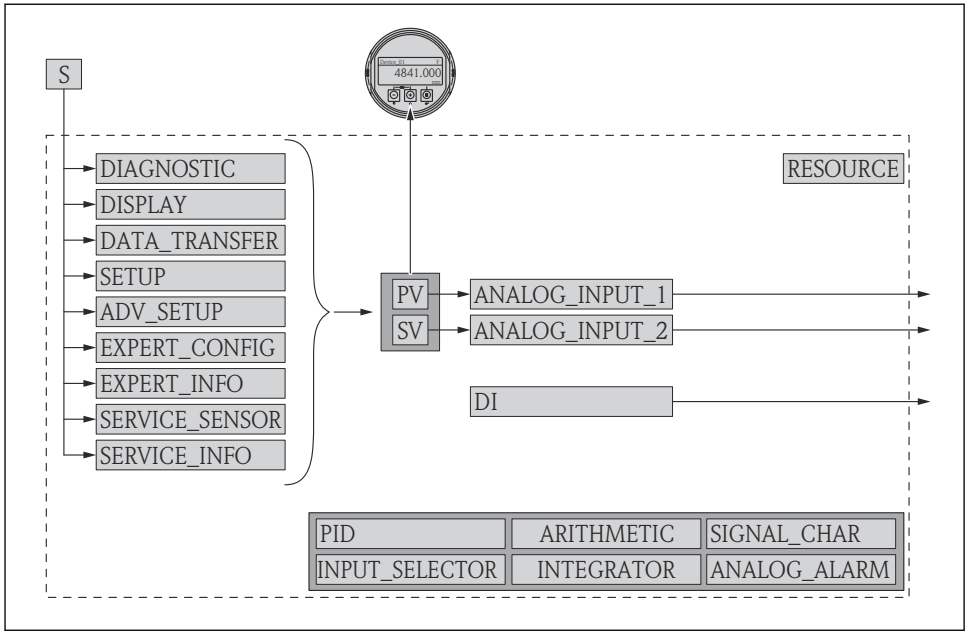
In addition to the pre-instantiated blocks already mentioned, the following blocks can also be instantiated:
- 3 AI blocks (AI)
- 2 Discrete Input Blocks (DI)
- 1 PID block (PID)
- 1 arithmetic block (AR)
- 1 signal characterizer block (SC)
- 1 input selector block (ISEL)
- 1 integrator block (IT)
- 1 analog alarm block (AAL)

Up to 20 blocks can be instantiated in the device altogether, including the blocks already instantiated. For instantiating blocks, see the appropriate Operating Instructions of the configuration program used.

Endress+Hauser Guideline BA00062S.

The guideline provides an overview of the standard function blocks that are described in FOUNDATION Fieldbus Specifications FF 890 - 894. It is designed as an aid when using these blocks that are implemented in the Endress+Hauser field devices.

7.4.2 Block configuration when device is delivered



10 Block configuration when device is delivered

S Sensor
PV Primary value: level linearized
SV Secondary value: distance

7.5 Assignment of measured values (CHANNEL) in the AI block

The input value of an analog input block is determined via the **"Channel" parameter**.

Channel	Measured value
0	Uninitialized
211	Terminal voltage
773	Analog output adv. diagnostics
774	Analog output adv. diagnostics
32786	Absolute echo amplitude
32856	Distance
32885	Electronic temperature

Channel	Measured value
32949	Level linearized
33044	Relative echo amplitude

7.6 Methods

The FOUNDATION Fieldbus Specification allows for the use of methods to simplify device operation. A method is a sequence of interactive steps to be carried out in the specified order so as to configure certain device functions.

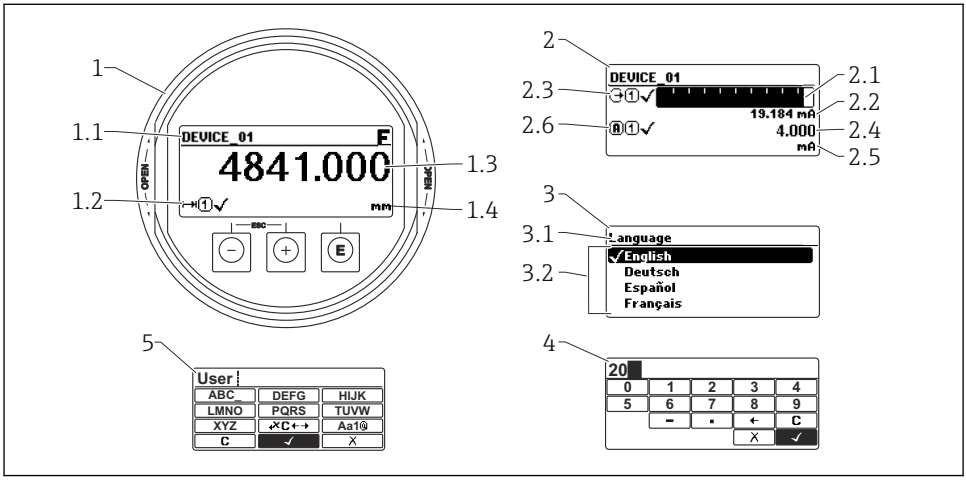
The following methods are available for the devices:

- **Restart**
  This method is located in the resource block and is used to configure the **Reset device** parameter. This resets the device parameters to a specific state.
- **ENP Restart**
  This method is located in the resource block and allows the parameters of the electronic nameplate (**E**lectronic **N**ame **P**late) to be changed.
- **Setup**
  This method is located in the SETUP transducer block and is used for basic configuration of the measurement parameters (measurement units, tank or vessel type, medium, empty and full calibration).
- **Linearization**
  This method is located in the ADV_SETUP transducer block and allows the linearization table to be managed for the purpose of converting the level measured into a volume, a mass or a flow rate.
- **Self Check**
  This method is located in the EXPERT_CONFIG transducer block and is used to perform a device self-test.

8 Commissioning

8.1 Structure and function of the operating menu

8.1.1 Display



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11 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

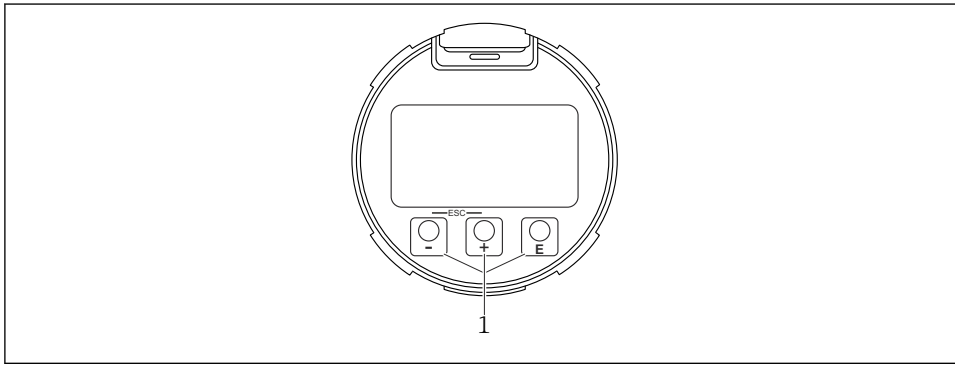
8.1.2 Operating elements

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.



12 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

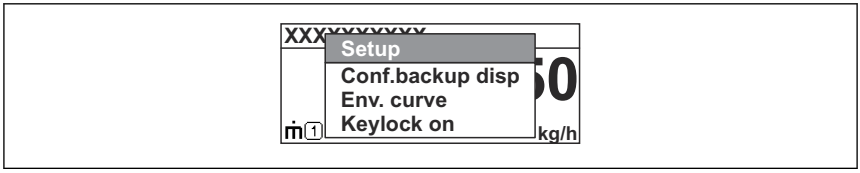
Using the context menu, the user can call up the following menus quickly and directly from the operational display:

- 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.



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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	BA01121F - Operating Instructions, FMR51/FMR52, FOUNDATION Fieldbus
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.	GP01017F - Description of device parameters, FMR5x, FOUNDATION Fieldbus

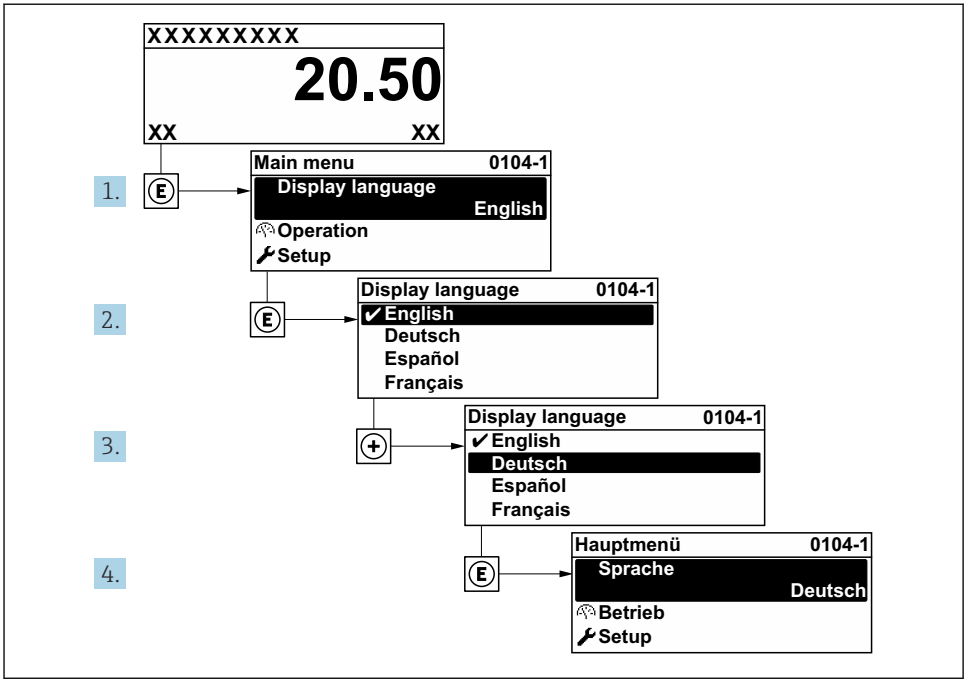
8.4 Disabling write protection

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

BA01121F - Operating Instructions, FMR51/FMR52, FOUNDATION Fieldbus

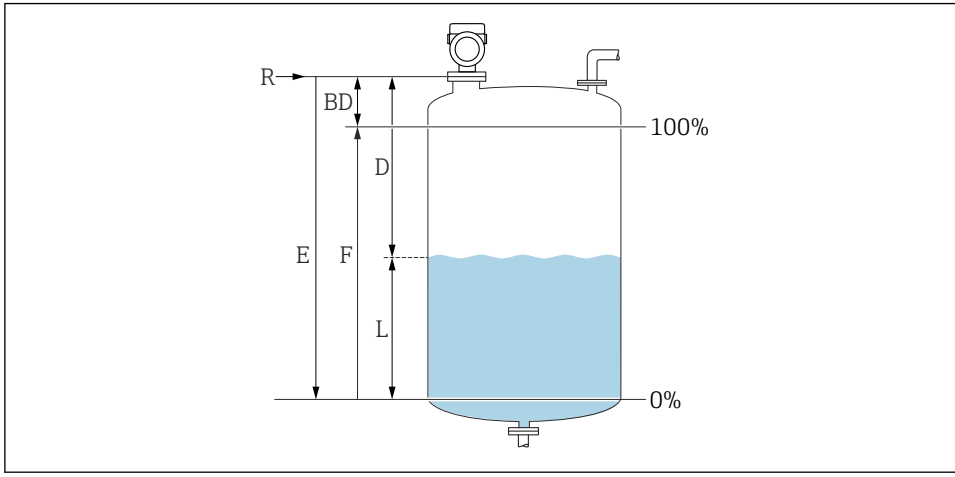
8.5 Setting the operating language

Factory setting: English or ordered local language



13 *Taking the example of the local display*

8.6 Configuring level measurement



14 *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 → Medium group
   ↳ Specify media group ("aqueous": DK>4 or "other": DK>1.9)
5. 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.

6. Setup → Full calibration
   ↳ Distance between minimum level (0%) and maximum level (100%).
7. Setup → Level
   ↳ Currently measured level
8. Setup → Distance
   ↳ Distance between lower edge of flange or thread and medium surface.
9. Setup → Signal quality
   ↳ Displays the signal quality of the analyzed level echo.
10. Setup → Mapping → Confirm distance
    ↳ Compare the distance displayed with the actual value to start recording an interference echo map.
11. Setup → Advanced setup → Level → Level unit
    ↳ Select the level unit: %, m, mm, ft, in (factory setting: %)

The reaction time of the device is preconfigured via the **Tank type** parameter. Advanced configuration is possible in the **Advanced setup** submenu.

8.7 User-specific applications

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

BA01121F - Operating Instructions, FMR51/FMR52, FOUNDATION Fieldbus

Also, for the **Expert** submenu:

GP01017F - Description of device parameters, FMR5x, FOUNDATION Fieldbus

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