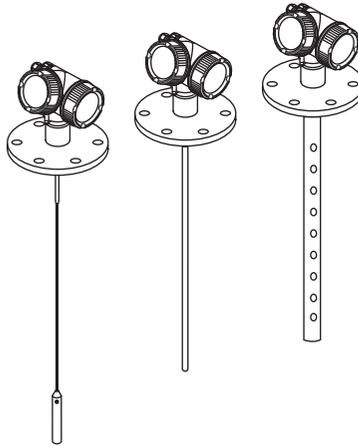


Brief Operating Instructions Levelflex FMP51, FMP52, FMP54 HART

Guided Level 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*

Description of the procedure (→ 📄 12)

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1 Important document information

1.1 Symbols

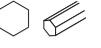
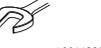
1.1.1 Safety symbols

Symbol	Meaning
 A0011189-EN	DANGER! This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.
 A0011190-EN	WARNING! This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.
 A0011191-EN	CAUTION! This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or medium injury.
 A0011192-EN	NOTICE! This symbol contains information on procedures and other facts which do not result in personal injury.

1.1.2 Electrical symbols

Symbol	Meaning
 A0011197	Direct current A terminal to which DC voltage is applied or through which direct current flows.
 A0011198	Alternating current A terminal to which alternating voltage is applied or through which alternating current flows.
 A0017381	Direct current and alternating current <ul style="list-style-type: none"> ▪ A terminal to which alternating voltage or DC voltage is applied. ▪ A terminal through which alternating current or direct current flows.
 A0011200	Ground connection A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.
 A0011199	Protective ground connection A terminal which must be connected to ground prior to establishing any other connections.
 A0011201	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
 A0011182	Allowed Indicates procedures, processes or actions that are allowed.
 A0011183	Preferred Indicates procedures, processes or actions that are preferred.
 A0011184	Forbidden Indicates procedures, processes or actions that are forbidden.
 A0011193	Tip Indicates additional information.
 A0011194	Reference to documentation Refers to the corresponding device documentation.
 A0011195	Reference to page Refers to the corresponding page number.
 A0011196	Reference to graphic Refers to the corresponding graphic number and page number.
	Series of steps
	Result of a sequence of actions

1.1.5 Symbols in graphics

Symbol	Meaning
1, 2, 3 ...	Item numbers
	Series of steps
A, B, C, ...	Views
A-A, B-B, C-C, ...	Sections

Symbol	Meaning
 <small>A0011187</small>	Hazardous area Indicates a hazardous area.
 <small>A0011188</small>	Safe area (non-hazardous area) Indicates a non-hazardous location.

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.

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 beginning work, the specialist staff must have read and understood the instructions in the Operating Instructions and supplementary documentation as well as in the certificates (depending on the application)
- ▶ Following instructions and basic conditions

2.2 Designated use

Application and measured materials

The measuring device described in these Operating Instructions is intended only for level and interface measurement of liquids. Depending on the version ordered the device can also measure potentially explosive, flammable, poisonous and oxidizing materials.

Observing the limit values specified in the "Technical data" and listed in the Operating Instructions and supplementary documentation, the measuring device may be used for the following measurements only:

- ▶ Measured process variable: Level and/or interface
- ▶ Calculated process variable: Volume oder mass in arbitrarily shaped vessels (calculated from the level by the linearization functionality)

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

- ▶ Use the measuring device only for measured materials 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 measured materials and cleaning agents, Endress+Hauser is glad to provide assistance in verifying the corrosion resistance of wetted materials, but does not accept any warranty or liability.

Residual risk

The electronics housing and its built-in components such as display module, main electronics module and I/O electronics module may heat to 80 °C (176 °F) during operation through heat transfer from the process as well as power dissipation within the electronics. During operation the sensor may assume a temperature near the temperature of the measured material.

Danger of burns due to heated surfaces!

- ▶ For high process temperatures: Install protection against contact in order 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.

With divisible probe rods, medium may penetrate into the joints between the individual parts of the rod. This medium may escape when loosening the joints. In the case of dangerous (e.g. aggressive or toxic) media this may cause injuries.

- ▶ When loosening the joints between the individual parts of the probe rod: Wear appropriate protective equipment according to the medium.

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

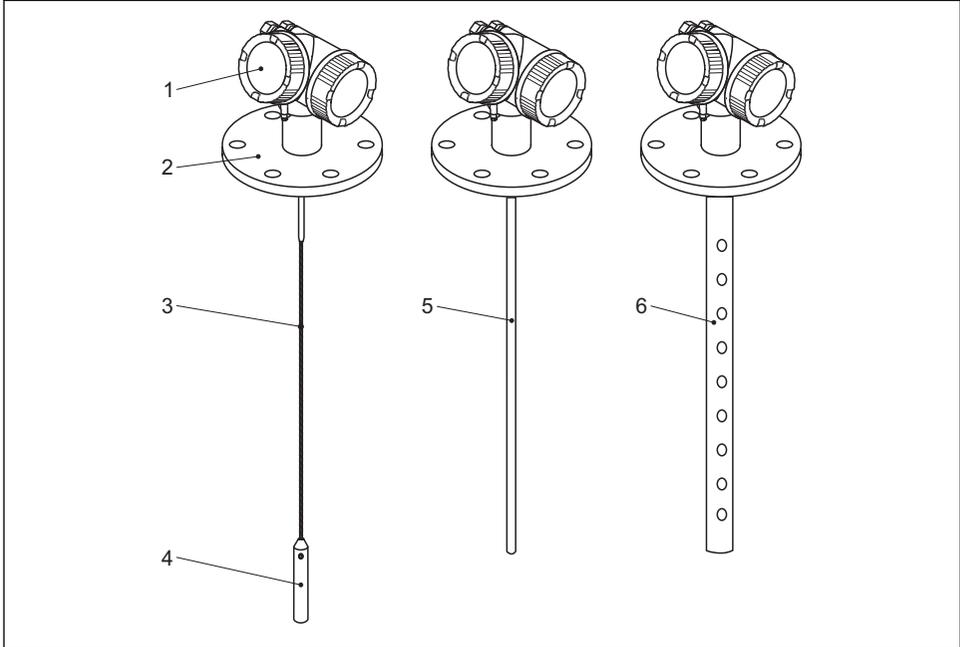
This measuring device is designed in accordance with good engineering practice to meet state-of-the-art safety requirements, has been tested, and left the factory in a condition in which they are safe to operate.

It meets general safety standards and legal requirements. It also complies with the EC directives listed in the device-specific EC Declaration of Conformity. Endress+Hauser confirms this by affixing the CE mark to the device.

3 Product description

3.1 Design

3.1.1 Levelflex FMP51/FMP52/FMP54/FMP55

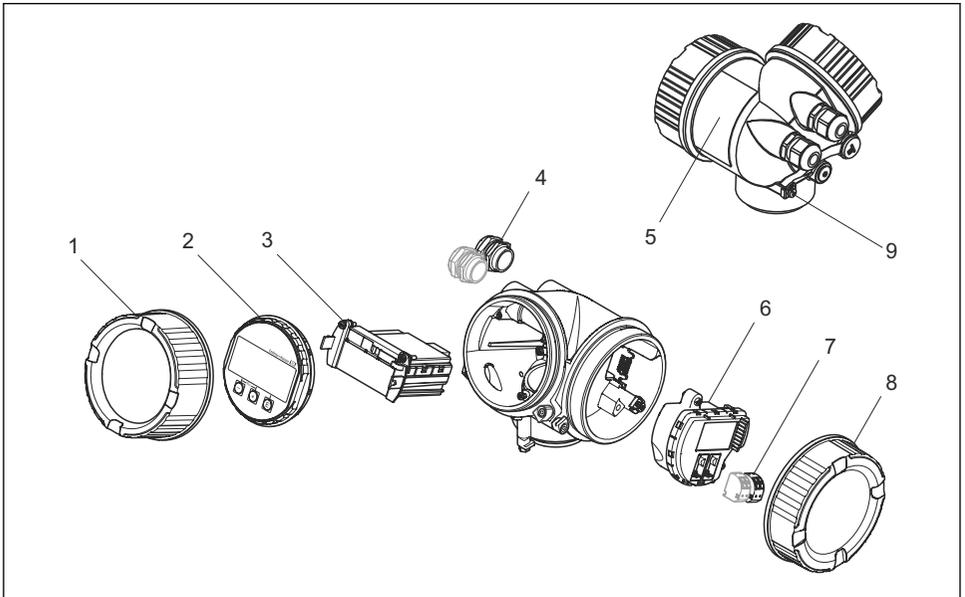


A0012399

1 Design of the Levelflex

- 1 Electronics housing
- 2 Process connection (here as an example: flange)
- 3 Rope probe
- 4 End-of-probe weight
- 5 Rod probe
- 6 Coax probe

3.1.2 Electronics housing



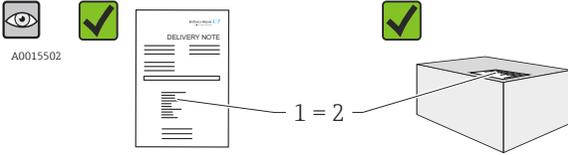
A0012422

2 Design of the electronics housing

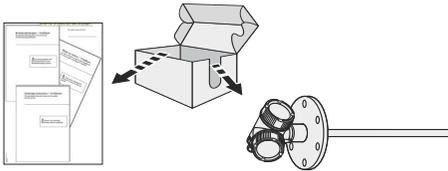
- 1 Electronics compartment cover
- 2 Display module
- 3 Main electronics module
- 4 Cable glands (1 or 2, depending on instrument version)
- 5 Nameplate
- 6 I/O electronics module
- 7 Terminals (pluggable spring terminals)
- 8 Connection compartment cover
- 9 Grounding terminal

4 Incoming acceptance and product identification

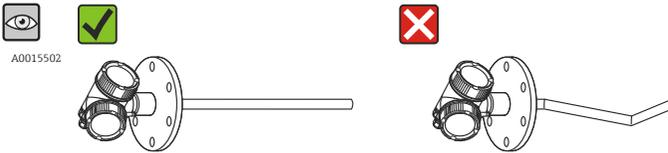
4.1 Incoming acceptance



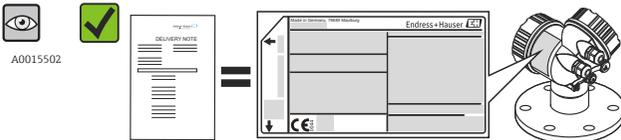
Is the order code on the delivery note (1) identical to the order code on the product sticker (2)?



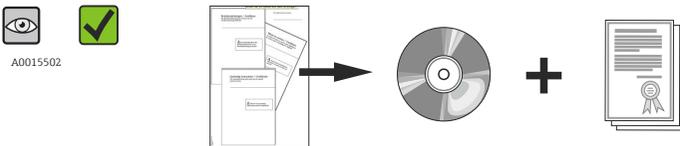
A0022486



Are the goods undamaged?



Do the nameplate data match the ordering information on the delivery note?



Is the DVD (operating tool) present?
If required (see nameplate):
Are the Safety Instructions (XA) present?

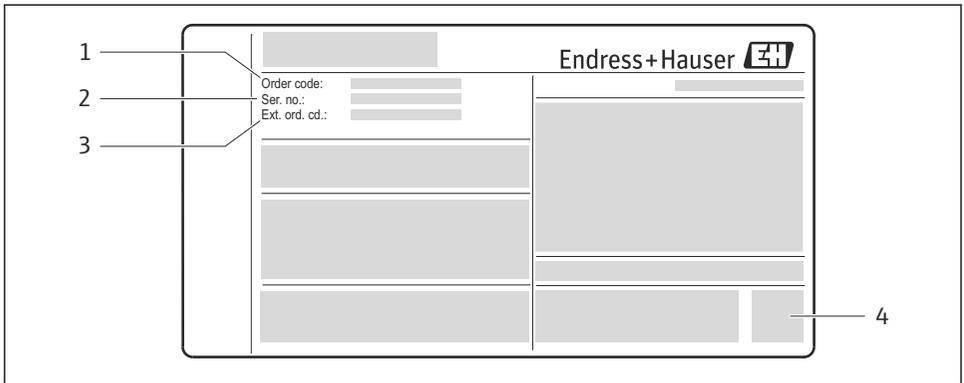
i If one of the conditions does not comply, contact your Endress+Hauser distributor.

4.2 Product identification

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

- Nameplate specifications
- Order code with breakdown of the device features on the delivery note
- Enter serial numbers from nameplates in *W@M Device Viewer* (www.endress.com/deviceviewer): All information about the measuring device is displayed.
- Enter the serial number from the nameplates 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 for 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 about interpreting the nameplate specifications, refer to the Operating Instructions for the device.

 Only 33 digits of the extended order code can be indicated on the nameplate. If the extended order code exceeds 33 digits, the rest will not be shown. However, the complete extended order code can be viewed in the operating menu of the device in the **Extended order code 1 to 3** parameter.

4.3 Device documentation

 All devices are supplied with Brief Operating Instructions. These Brief Operating Instructions 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*

The information required to retrieve the documentation can be found on the nameplate of the device.

 Technical documentation can also be downloaded from the Download Area of the Endress+Hauser web site: www.endress.com → Download. However this technical documentation applies to a particular instrument family and is not assigned to a specific device.

4.3.1 W@M Device Viewer

1. Launch the W@M Device Viewer: www.endress.com/deviceviewer
2. Enter the serial number (Ser. no.) of the device: see nameplate.
 - ↳ All the associated documentation is displayed.

4.3.2 Endress+Hauser Operations App

 The *Endress+Hauser Operations App* is available both for android smart phones (Google Play Store) and for iPhones and iPads (App Store).

Via the serial number:

1. Launch the *Endress+Hauser Operations App*.
2. Enter the serial number (Ser. no.) of the device: see nameplate.
 - ↳ All the associated documentation is displayed.

Via the 2-D matrix code (QR code):

1. Launch the *Endress+Hauser Operations App*.
2. Scan the 2-D matrix code (QR code) on the nameplate.
 - ↳ All the associated documentation is displayed.

5 Storage, Transport

5.1 Storage conditions

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

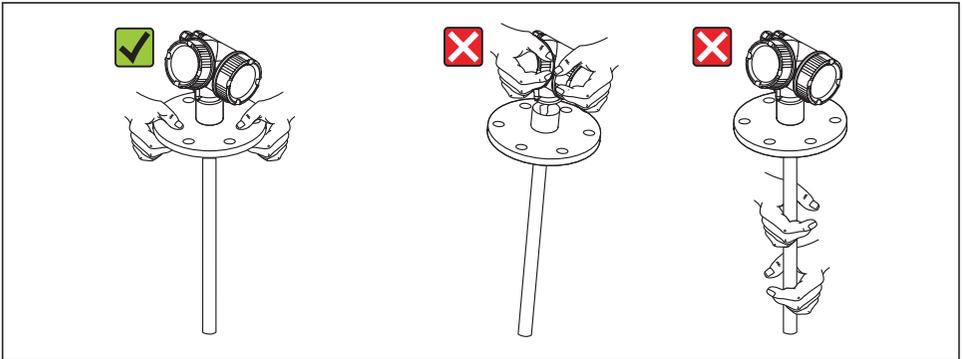
5.2 Transport product to the measuring point

⚠ WARNING

Housing or probe may be damaged or break away.

Risk of injury!

- ▶ Transport the measuring device to the measuring point in its original packaging or at the process connection.
- ▶ Do not fasten lifting devices (hoisting slings, lifting eyes etc.) at the housing or the probe but at the process connection. Take into account the mass center of the device in order to avoid unintended tilting.
- ▶ Comply with the safety instructions, transport conditions for devices over 18kg (39.6lbs).

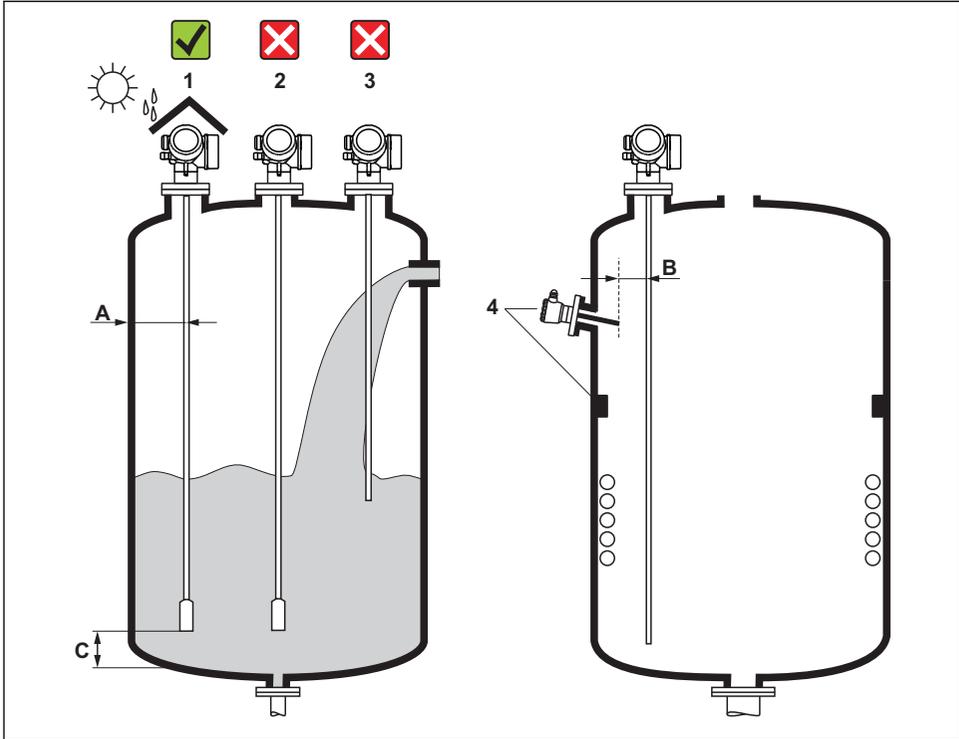


A0013920

6 Mounting

6.1 Mounting requirements

6.1.1 Suitable mounting position



A0012606

4 Mounting requirements for Levelflex

Mounting distances

- Distance (A) between wall and rod or rope probe:
 - for smooth metallic walls: > 50 mm (2")
 - for plastic walls: > 300 mm (12") mm to metallic parts outside the vessel
 - for concrete walls: > 500 mm (20") , otherwise the available measuring range may be reduced.
- Distance (B) between rod or rope probe and internal fittings in the vessel: > 300 mm (12")
- Distance (C) from end of probe to bottom of the vessel:
 - Rope probe: > 150 mm (6 in)
 - Rod probe: > 10 mm (0.4 in)
 - Coax probe: > 10 mm (0.4 in)



For coax probes the distance to the wall and to internal fittings is arbitrary.

Additional conditions

- When mounting in the open, a weather protection cover (1) may be installed to protect the device against extreme weather conditions.
- In metallic vessels: Preferably do not mount the probe in the center of the vessel (2), as this would lead to increased interference echoes.
If a central mounting position can not be avoided, it is crucial to perform an interference echo suppression(mapping) after the commissioning of the device.
- Do not mount the probe in the filling curtain (3).
- Avoid buckling the rope probe during installation or operation (e.g. through product movement against silo wall) by selecting a suitable mounting location.

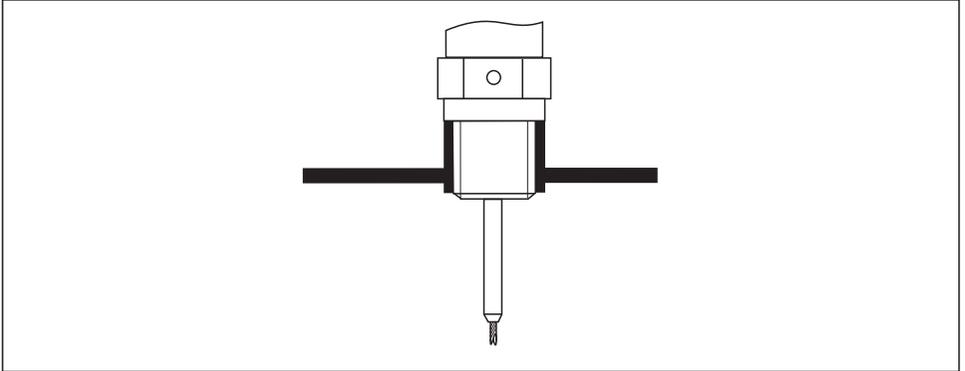
 With suspended rope probes (probe end not fixed at the bottom) the distance between the probe rope and internal fittings in the tank must not fall below 300 mm (12") during the entire process. A sporadic contact between the probe weight and the cone of the vessel, however, does not influence the measurement as long as the dielectric constant of the medium is at least $DC = 1.8$.

 When mounting the electronics housing into a recess (e.g. in a concrete ceiling), observe a minimum distance of 100 mm (4 inch) between the cover of the terminal compartment / electronics compartment and the wall. Otherwise the connection compartment / electronics compartment is not accessible after installation.

6.1.2 Notes on the process connection

Probes are mounted to the process connection with threaded connections or flanges. If during this installation there is the danger that the probe end moves so much that it touches the tank floor or cone at times, the probe must, if necessary, be shortened and fixed down (→  24).

Threaded connection



A0015121

 5 *Mounting with threaded connection; flush with the container ceiling*

Seal

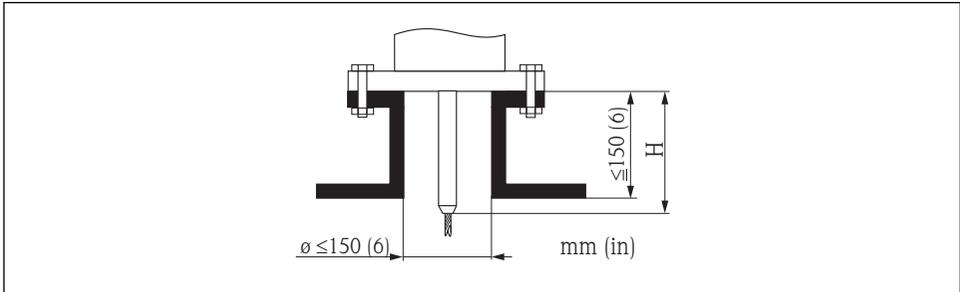
The thread as well as the type of seal comply to DIN 3852 Part 1, screwed plug form A.

They can be sealed with the following types of sealing rings:

- Thread G3/4": According to DIN 7603 with the dimensions 27 x 32 mm
- Thread G1-1/2": According to DIN 7603 with the dimensions 48 x 55 mm

Please use a sealing ring according to this standard in the form A, C or D and of a material that is resistant to the application.

Nozzle mounting



A0015122

- Permissible nozzle diameter: ≤ 150 mm (6 in).
For larger diameters the near range measuring capability may be reduced.
For nozzles $\geq \text{DN}300$: (\rightarrow 21).
- Permissible nozzle height ¹⁾: ≤ 150 mm (6 in).
For a larger height the near range measuring capability may be reduced.
Larger nozzle heights may be possible in special cases (see sections "Center rod for FMP51 and FMP52" and "Rod extension/centering HMP40 for FMP54").



With thermally insulated vessels the nozzle should also be insulated in order to prevent condensate formation.

1) Larger nozzle heights on request

Center rod for FMP51 and FMP52

For rope probes it may be necessary to use a version with center rod in order to prevent the probe rod from coming into contact with the nozzle wall. Probes with center rod are available for FMP51 and FMP52.

Probe	Max. nozzle height (= length of the center rod)	Option to be selected in feature 060 ("Probe")
FMP51	150 mm	LA
	6 inch	LB
	300 mm	MB
	12 inch	MD
FMP52	150 mm	OA
	6 inch	OC
	300 mm	OB
	12 inch	OD

Rod extension/centering HMP40 for FMP54

For FMP54 with rope probes the rod extension/centering HMP 40 is available as an accessory. It has to be used if otherwise the probe rope comes into contact with the lower edge of the nozzle.

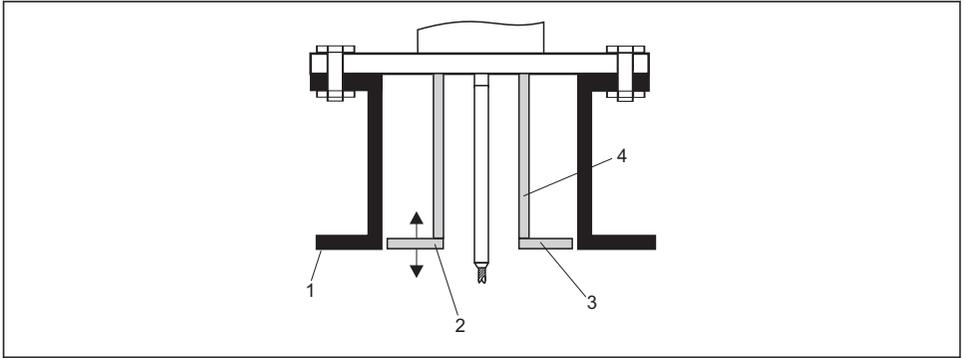


This accessory consists of the extension rod corresponding to the nozzle height, on which a centering disk is also mounted if the nozzles are narrow or when working in bulk solids. This component is delivered separately from the device. Please order the probe length correspondingly shorter.

Centering disks with small diameters (DN40 and DN50) may only be used if there is no significant build-up in the nozzle above the disk. The nozzle must not become clogged by the product.

Installation in nozzles $\geq DN300$

If installation in $\geq 300\text{mm}/12''$ nozzles is unavoidable, installation must be carried out in accordance with the following sketch.



A0014199

- 1 Lower edge of the nozzle
- 2 Approx. flush with the lower edge of the nozzle ($\pm 50\text{ mm}/2''$)
- 3 Plate
- 4 Pipe $\phi 150$ to 180 mm (6 to 7 inch)

Nozzle diameter	Plate diameter
300 mm (12")	280 mm (11")
$\geq 400\text{ mm}$ (16")	$\geq 350\text{ mm}$ (14")

6.1.3 Mounting cladded flanges



For cladded flanges of FMR52, observe the following:

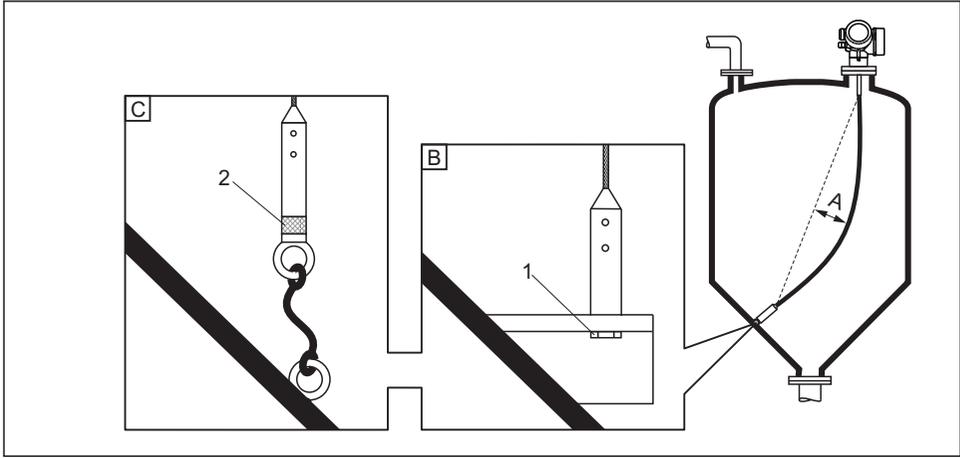
- Use flange screws according to the number of flange holes.
- Tighten the screws with the required torque (see table).
- Retighten the screws after 24 hours or after the first temperature cycle.
- Depending on process pressure and process temperature check and retighten the screws at regular intervals.

Flange size	Number of screws	Recommended torque [Nm]	
		minimum	maximum
EN			
DN40/PN40	4	35	55
DN50/PN16	4	45	65
DN50/PN40	4	45	65
DN80/PN16	8	40	55
DN80/PN40	8	40	55
DN100/PN16	8	40	60
DN100/PN40	8	55	80
DN150/PN16	8	75	115
DN150/PN40	8	95	145
ASME			
1½"/150lbs	4	20	30
1½"/300lbs	4	30	40
2"/150lbs	4	40	55
2"/300lbs	8	20	30
3"/150lbs	4	65	95
3"/300lbs	8	40	55
4"/150lbs	8	45	70
4"/300lbs	8	55	80
6"/150lbs	8	85	125
6"/300lbs	12	60	90

Flange size	Number of screws	Recommended torque [Nm]	
		minimum	maximum
JIS			
10K 40A	4	30	45
10K 50A	4	40	60
10K 80A	8	25	35
10K 100A	8	35	55
10K 100A	8	75	115

6.1.4 Securing the probe

Securing rope probes



A0012609

A Sag of the rope: ≥ 1 cm per 1m of the probe length (0.12 inch per 1 ft of the probe length)

B Reliably grounded end of probe

C Reliably isolated end of probe

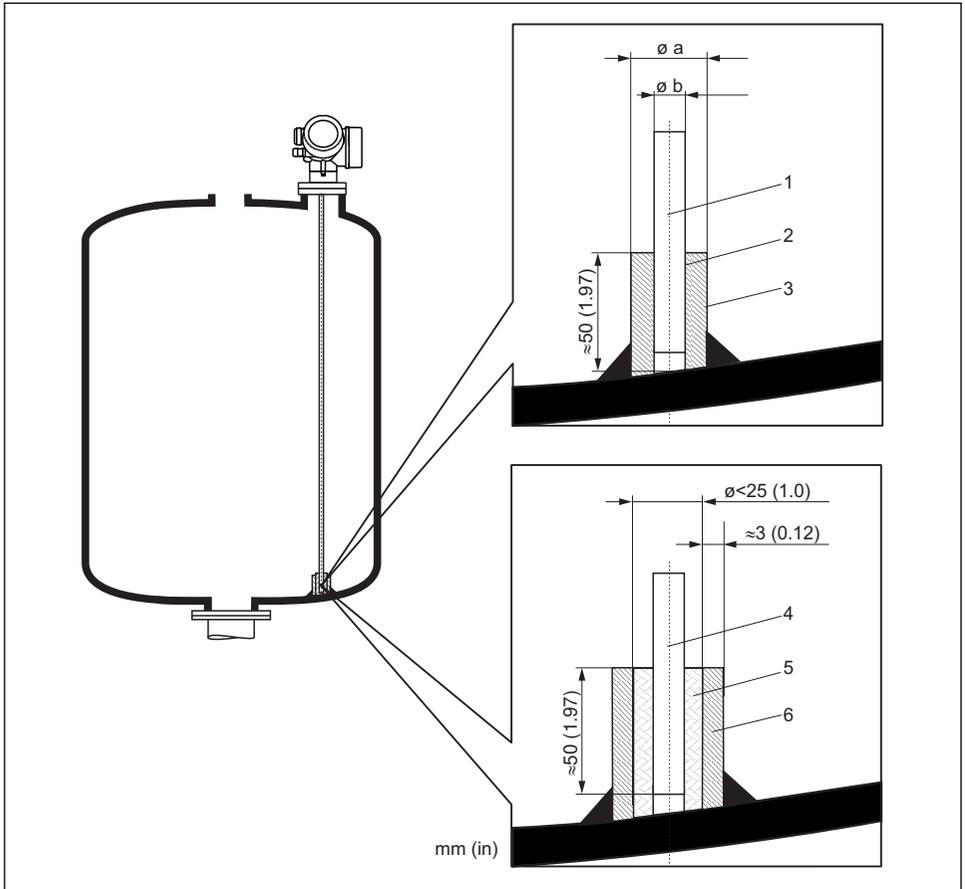
1: Mounting and contact with a bolt

2 Mounting kit isolated

- The end of the probe needs to be secured under the following conditions:
 - if otherwise the probe sporadically comes into contact with the wall of the vessel, the outlet cone, internal fittings or other parts of the installation.
- The end of probe can be secured at its internal thread
 - rope 4 mm (1/6"), 316: M 14
- The fixing must be either reliably grounded or reliably insulated. If it is not possible to mount the probe weight with a reliably insulated connection, it can be secured using an isolated eyelet, which is available as an accessory.
- In order to prevent an extremely high tensile load (e.g. due to thermal expansion) and the risk of rope crack, the rope has to be slack. Make the rope longer than the required measuring range such that there is a sag in the middle of the rope that is ≥ 1 cm/(1 m rope length) [0.12 inch/(1 ft rope length)].

Securing rod probes

- For Ex-approvals: For probe lengths ≥ 3 m (10 ft) a support is required.
- In general, rod probes must be supported if there is a horizontal flow (e.g. from an agitator) or in the case of strong vibrations.
- Rod probes may only be supported at the end of the probe.



A0012607

- 1 Probe rod, uncoated
- 2 Sleeve bored tight to ensure electrical contact between the rod and sleeve!
- 3 Short metal pipe, e.g. welded in place
- 4 Probe rod, coated
- 5 Plastic sleeve, e.g. PTFE, PEEK or PPS
- 6 Short metal pipe, e.g. welded in place

ϕ probe	ϕ a [mm (inch)]	ϕ b [mm (inch)]
8 mm (1/3")	< 14 (0.55)	8.5 (0.34)
12 mm (1/2")	< 20 (0.78)	12.5 (0.52)
16 mm (0.63in)	< 26 (1.02)	16.5 (0.65)

NOTICE

Poor grounding of the end of probe may cause measuring errors.

- ▶ Apply a narrow sleeve which has good electrical contact to the probe.

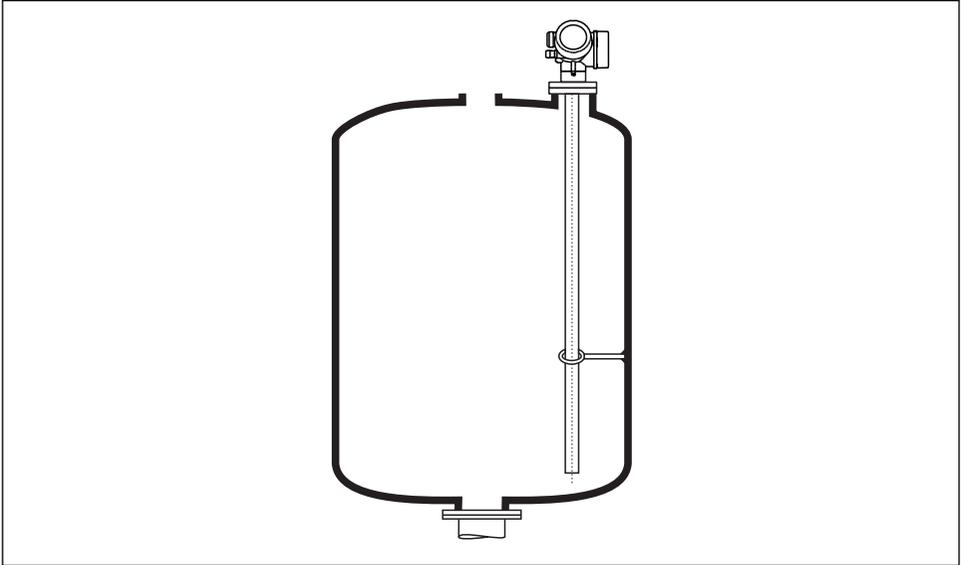
NOTICE

Welding may damage the main electronics module.

- ▶ Before welding: Ground the probe and dismount electronics.

Securing coax probes

For WHG-approvals: For probe lengths ≥ 3 m (10 ft) a support is required.

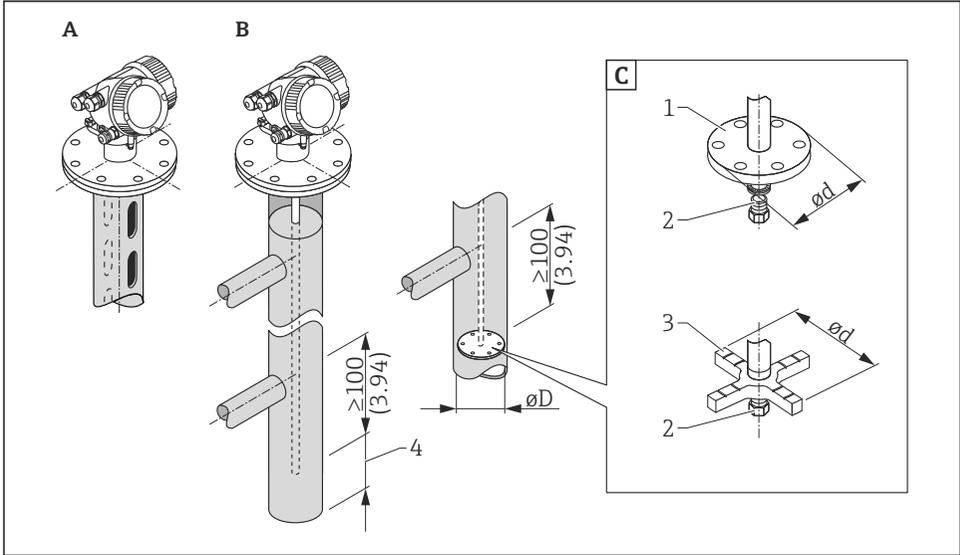


A0012608

Coax probes can be supported at any point of the outer tube.

6.1.5 Special mounting conditions

Bypasses and stilling wells



A0012615

- A Mounting in a stilling well
- B Mounting in a bypass
- C Center washer or centering star
- 1 Metallic center washer (316L) for level measurement
- 2 Fixing screw; torque: 25 Nm ± 5 Nm
- 3 Non-metallic centering star (PEEK, PFA) for interface measurement
- 4 Minimum distance between end of probe and lower edge of the bypass; see table below

Allocation of probe type and center washer or centering star to pipe diameter

Feature 610 - Accessory mounted					
Application	Option	Type of probe	Center washer Centering star		Pipe
			ø d [mm (in)]	Material	ø D [mm (in)]
Level measurement	OA	Rod probe	75 (2,95)	316L	DN80/3" to DN100/4"
	OB	Rod probe	45 (1,77)	316L	DN50/2" to DN65/2½"
	OC	Rope probe	75 (2,95)	316L	DN80/3" to DN100/4"

Feature 610 - Accessory mounted					
Application	Option	Type of probe	Center washer Centering star		Pipe
			φ d [mm (in)]	Material	φ D [mm (in)]
Interface measurement	OD	Rod probe	48...95 (1,89...3,74)	PEEK	≥ 50 mm (2")
	OE	Rod probe	37 (1,46)	PFA	≥ 40 mm (1.57")

Minimum distance between end of probe and lower edge of the bypass

Type of probe	Minimum distance
Rope	150 mm (6 in)
Rod	10 mm (0.4 in)
Coax	10 mm (0.4 in)

- Pipe diameter: > 40 mm (1.6") for rod probes
- Rod probe installation can take place up to a diameter size of 150 mm (6 in). In the event of larger diameters, a coax probe is recommended.
- Side disposals, holes or slits and welded joints that protrude up to approx. 5 mm (0.2") inwards do not influence the measurement.
- The pipe may not exhibit any steps in diameter.
- The probe must be 100 mm longer than the lower disposal.
- Within the measuring range, the probe must not get into contact with the pipe wall. If necessary, use a center washer or centering star (see feature 610 of the product structure).
- If the center washer or centering star is mounted at the end of the probe, it enables a reliable recognition of the end-of-probe signal (see feature 610 of the product structure).
Note: For interface measurements only use the nonmetallic centering star made of PEEK or PFA (feature 610, options OD or OE).
- Coax probes can always be applied if there is enough mounting space.

 For bypasses with condensate formation (water) and a medium with low dielectric constant (e.g. hydrocarbons):

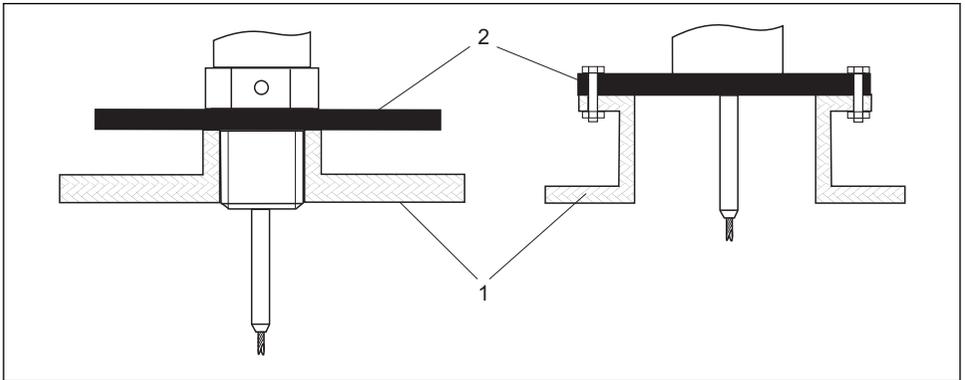
In the course of time the bypass is filled with condensate up to the lower disposal and for low levels the the level echo is superimposed by the condensate echo. Thus in this range the condensate level is measured instead of the correct level. Only higher levels are measured correctly. To prevent this, position the lower disposal 100 mm (4 in) below the lowest level to be measured and apply a metallic centering disk at the height of the lower edge of the lower disposal.

 With heat insulated tanks the bypass should also be insulated in order to prevent condensate formation.

 For rope probes with a length exceeding 2 m (6.7 ft) an additional weight or a spring should be mounted in addition to the center a washer (option OC) in order to tighten the rope. The mass of the center wahser is 155 g (5.5 oz).

 For information on bypass solutions from Endress+Hauser please contact your Endress +Hauser sales representative.

Non-metallic vessels



A0012527

- 1 *Non-metallic vessel*
- 2 *Metal sheet or metal flange*

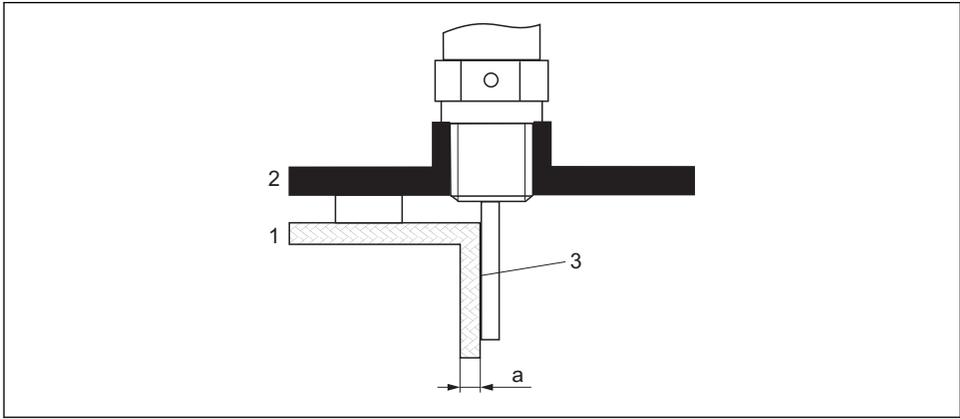
To measure, Levelflex with a rod probe needs a metallic surface at the process connection. Therefore:

- Select an instrument version with metal flange (minimum size DN50/2").
- Or: mount a metal sheet with a diameter of at least 200 mm (8") to the probe at the process connection. Its orientation must be perpendicular to the probe.



No additional measures are required for coax probes.

Plastic or glass tanks: Mounting the probe externally at the wall



A0014150

- 1 Plastic or glass tank
- 2 Metall sheet with threaded sleeve
- 3 No free space between tank wall and probe!

Requirements

- The dielectric constant of the medium must be at least $DC > 7$.
- The tank wall must be non-conductive.
- Maximum wall thickness (a):
 - Plastic: $< 15 \text{ mm (0.6")}$
 - Glass: $< 10 \text{ mm (0.4")}$
- There may be no metallic reinforcements fixed to the tank.

Mounting conditions:

- The probe must be mounted directly to the tank wall (no open space)
- A plastic half pipe with a diameter of approx. 200 mm (8"), or some other protective unit, must be affixed externally to the probe to prevent any influences on the measurement.
- If the tank diameter is less than 300 mm (12"):
 - A metallic grounding sheet must be installed at the opposite side of the tank. The sheet must be conductively connected to the process connection and cover about the half of the vessel's circumference.
- If the tank diameter exceeds 300 mm (12"):
 - A metal sheet with a diameter of at least 200 mm (8") must be mounted to the probe at the process connection. Its orientation must be perpendicular to the probe (see above).

Calibration for external probe mounting

If the probe is mounted externally at the wall of the tank, the speed of signal propagation will be reduced. There are two possibilities to compensate for this effect.

Compensation with the gas phase compensation factor

The effect of the dielectric wall can be compared to the effect of a dielectric gas phase. Thus it can be compensated for in the same manner. The compensation factor is given by the quotient of the actual probe length LN and the probe length measured when the tank is empty.



The device looks for the end of probe signal in the subtracted curve. Thus, the value of the measured probe length depends on the mapping. In order to obtain an exact value, it is advisable to determine the probe length manually using the envelope curve display in FieldCare.

Step	Parameter	Action
1	Expert → Sensor → Gas phase comp. → GPC mode	Select the Const. GPC factor option.
2	Expert → Sensor → Gas phase comp. → Const.GPC factor	Enter quotient: "(Actual probe length)/(Measured probe length)".

Compensation via the calibration parameters

If an actual gas phase has to be compensated for, the gas phase compensation functionality is no longer available for a correction of the external mounting. In this case the calibration parameters (**Empty calibration** and **Full calibration**) must be adjusted and a value longer than the actual probe length has to be entered into the **Present probe length** parameter. The correction factor for these three parameters is given by the quotient of the probe length measured when the tank is empty and the actual probe length LN.



The device looks for the end of probe signal in the subtracted curve. Thus, the value of the measured probe length depends on the mapping. In order to obtain an exact value, it is advisable to determine the probe length manually using the envelope curve display in FieldCare.

Step	Parameter	Action
1	Setup → Empty calibr.	Increase parameter value by "(Measured probe length)/(Actual probe length)".
2	Setup → Full calibr.	Increase parameter value by "(Measured probe length)/(Actual probe length)".
3	Setup → Advanced setup → Probe settings → Prob.length corr → Confirm length	Select the Manual input option.
4	Setup → Advanced setup → Probe settings → Prob.length corr → Pres. length	Enter measured probe length.

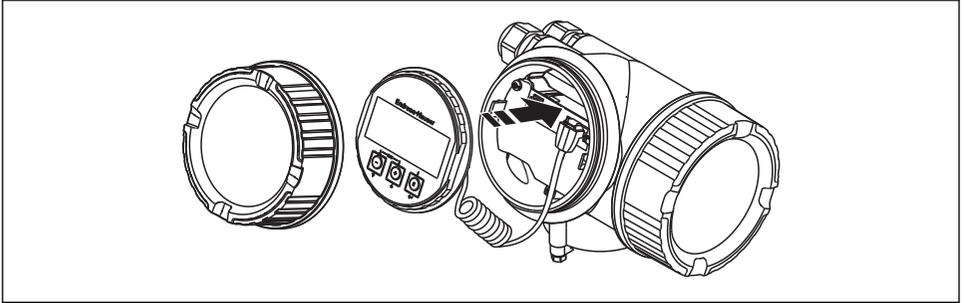
6.2 Mounting the device

6.2.1 Required mounting tools

- For mounting thread 3/4": Hexagonal wrench 36 mm
- For mounting thread 1-1/2": Hexagonal wrench 55 mm
- To shorten rod or coax probes: Saw
- To shorten rope probes:
 - Allen key AF 3 mm (for 4mm ropes) or AF 4 mm (for 6 mm ropes)
 - Saw or bolt cutter
- For flanges and other process connections: appropriate mounting tools
- To turn the housing: Hexagonal wrench 8 mm

6.2.2 Shortening the probe

i When shortening the probe: Enter the new length of probe into the Quick Setup which can be found in the electronics housing behind the display module.



A0014241

Shortening rod probes

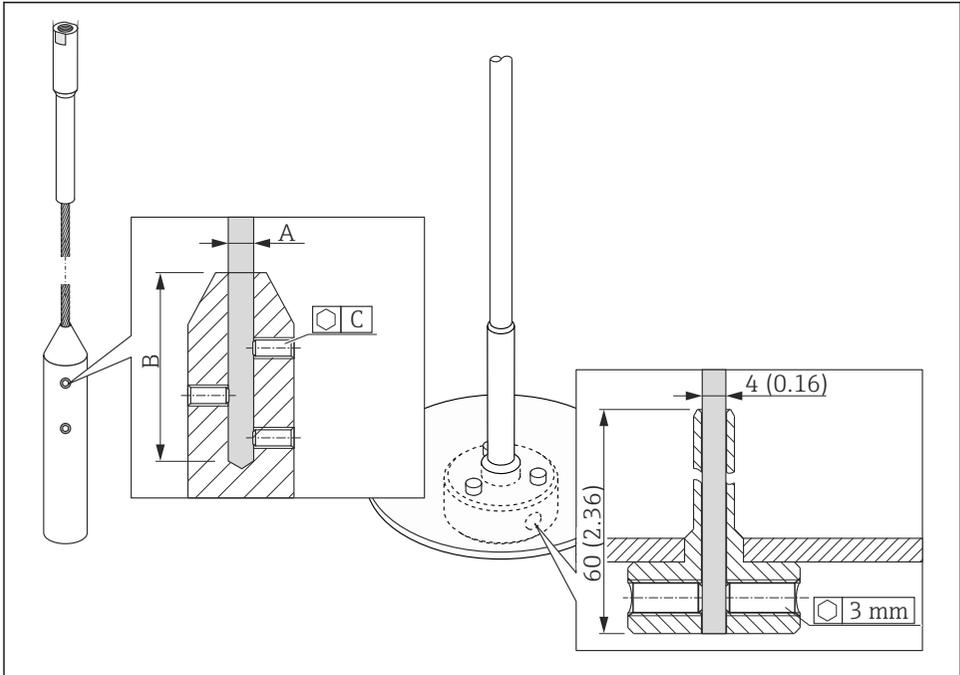
Rod probes must be shortened if the distance to the container floor or outlet cone is less than 10 mm (0.4 in). The rods of a rod probe are shortened by sawing at the bottom end.

i Rod probes of FMP52 can **not** be shortened as they are coated.

Shortening rope probes

Rope probes must be shortened if the distance to the container floor or outlet cone is less than 150 mm (6 in).

i Rope probes of FMP52 can **not** be shortened as they are coated.



A0012453

Rope material	A	B	C	Torque for set screws
316	4 mm (0.16 in)	40 mm (1.6 in)	3 mm	5 Nm (3.69 lbf ft)

1. Using an Allen key, loosen the set screws at the end-of-probe weight or the clamping sleeve of the centering disk. Note: The set screws have got a clamping coating in order to prevent accidental loosening. Thus an increased torque might be necessary to loosen them.
2. Remove released rope from the weight or sleeve.
3. Measure off new rope length.
4. Wrap adhesive tape around the rope at the point to be shortened to prevent it from fanning out.
5. Saw off the rope at a right angle or cut it off with a bolt cutter.

6. Insert the rope completely into the weight or sleeve.
7. Screw the set screws into place. Due to the clamping coating of the setscrews application of a screw locking fluid is not necessary.

Shortening coax probes

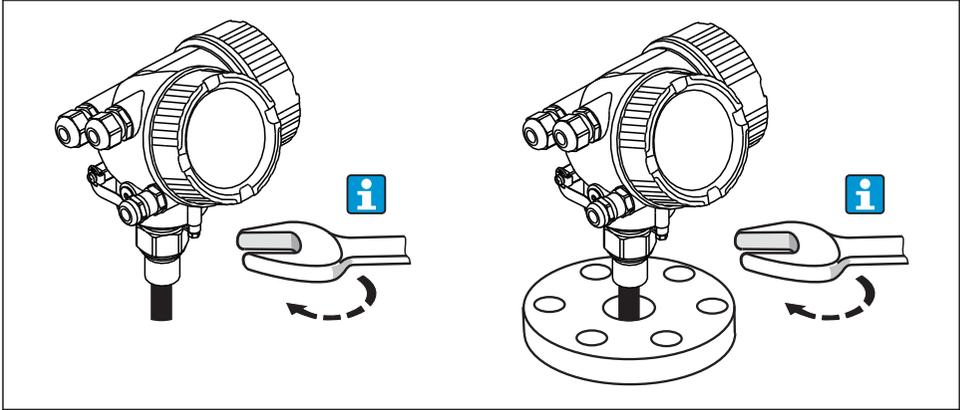
Coax probes must be shortened if the distance to the container floor or outlet cone is less than 10 mm (0.4 in).

-  Coax probes can be shortened max. 80 mm (3.2 in) from the end. They have centering units inside, which fix the rod centrally in the pipe. The centerings are held with borders on the rod. Shortening is possible up to approx. 10 mm (0.4 in) below the centering unit.

The coax probe is shortened by sawing the pipe at the bottom end.

6.2.3 Mounting the device

Mounting devices with thread



A0012528

Devices with mounting thread are screwed into a welding boss or a flange and are usually also secured with these.

- i** ■ Tighten with the hexagonal nut only:
 - Thread 3/4": Hexagonal wrench 36 mm
 - Thread 1-1/2": Hexagonal wrench 55 mm
- Maximum permissible torque:
 - Thread 3/4": 45 Nm
 - Thread 1-1/2": 450 Nm
- Recommended torque when using the supplied aramid fibre seal and a process pressure of 40 bar (580 psi):
 - Thread 3/4": 25 Nm
 - Thread 1-1/2": 140 Nm
- When installing in metal containers, take care to ensure good metallic contact between the process connection and container.

Flange mounting

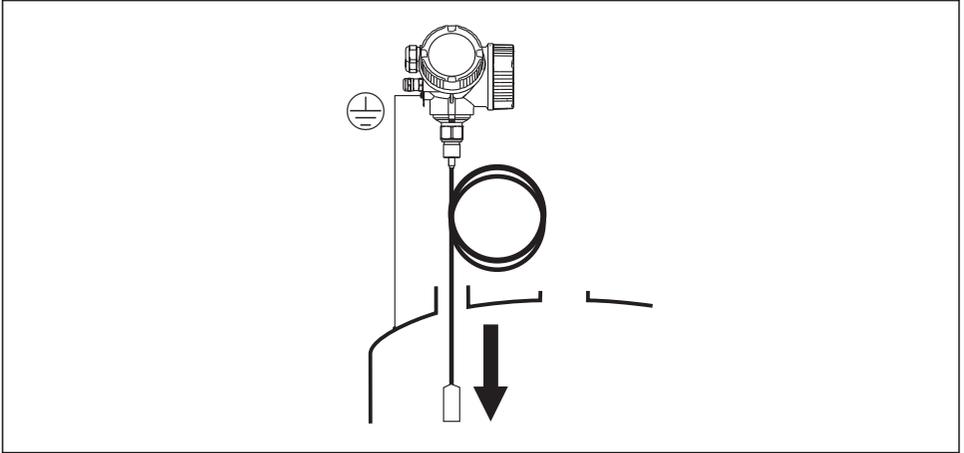
If a seal is used, be sure to use unpainted metal bolts to ensure good electrical contact between probe flange and process flange.

Mounting rope probes

NOTICE

Electrostatic discharges may damage the electronics.

- ▶ Earth the housing before lowering the rope into the vessel.



A0012852

When lowering the rope probe into the vessel, observe the following:

- Uncoil rope and lower it slowly and carefully into the vessel.
- Do not kink the rope.
- Avoid any backlash, since this might damage the probe or the vessel fittings.

6.2.4 Mounting the "Sensor remote" version

 This section is only valid for devices of the version "Probe Design" = "Sensor remote" (feature 600, option MB/MC/MD).

For the version "Probe design" = "Sensor remote" the following is supplied:

- The probe with the process connection
- The electronics housing
- The mounting bracket for wall or pipe mounting of the electronics housing
- The connection cable (length as ordered). The cable has got one straight and one angled plug (90°). Depending on the local conditions the angled plug can be connected at the probe or at the electronics housing.

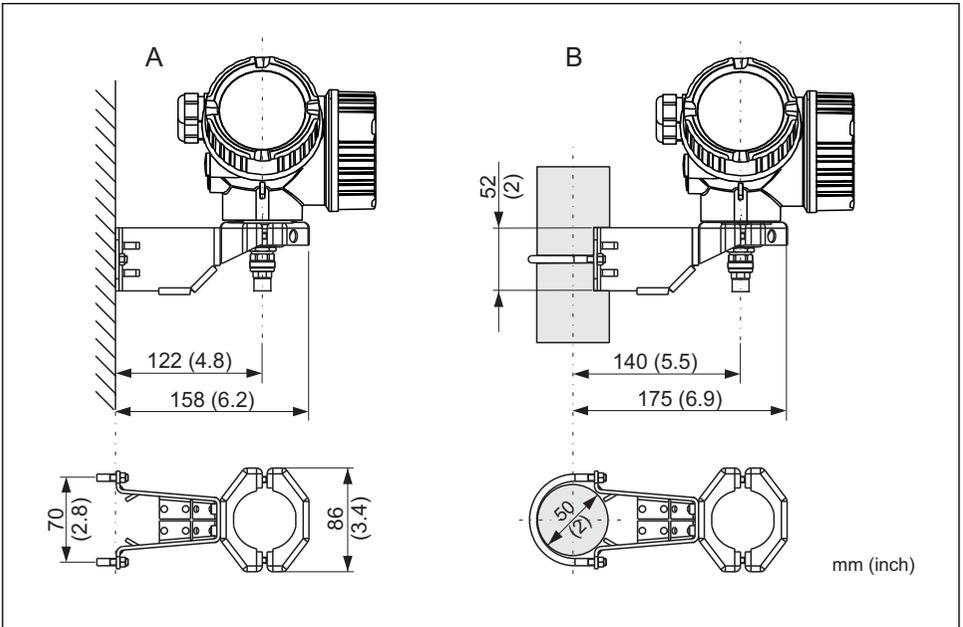
CAUTION

The plugs of the connection cable may be damaged by mechanical stress.

- ▶ Mount the probe and the electronics housing tightly before connecting the cable.
- ▶ Lay the cable such that it is not exposed to mechanical stress. Minimum bending radius: 100 mm (4").
- ▶ When connecting the cable: Connect the straight plug before the angled one. Torque for both coupling nuts: 6 Nm.

 If the measuring point is exposed to strong vibrations, an additional locking compound (e.g. Loctite 243) can be applied at the plug connectors.

Mounting the electronics housing



A0014793

6 Mounting the electronics housing using the mounting bracket

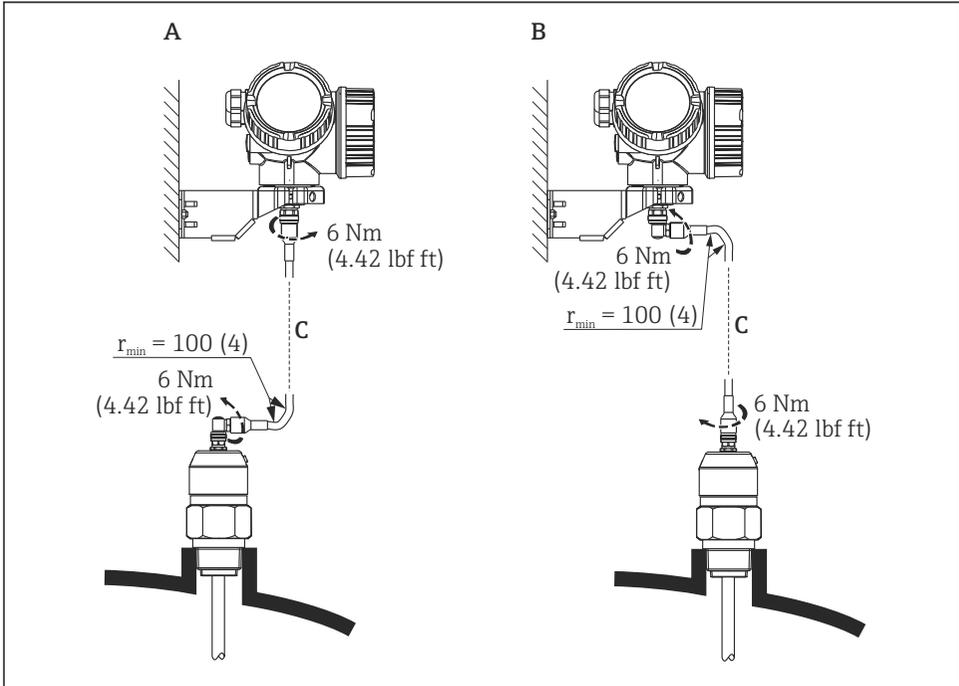
A Wall mounting

B Pipe mounting

Connecting the cable

Required tools:

Open-end wrench 18AF



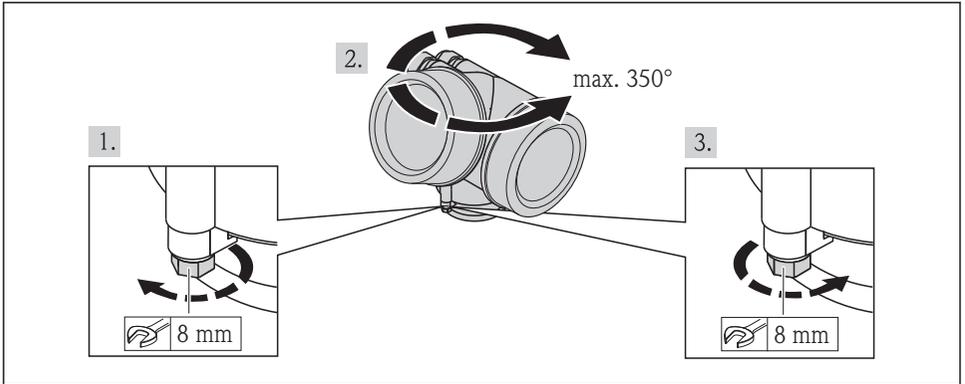
A0014794

7 Connecting the cable. There are the following possibilities:

- A Angled plug at the probe
- B Angled plug at the electronics housing
- C Length of the remote cable as ordered

6.2.5 Turning the transmitter housing

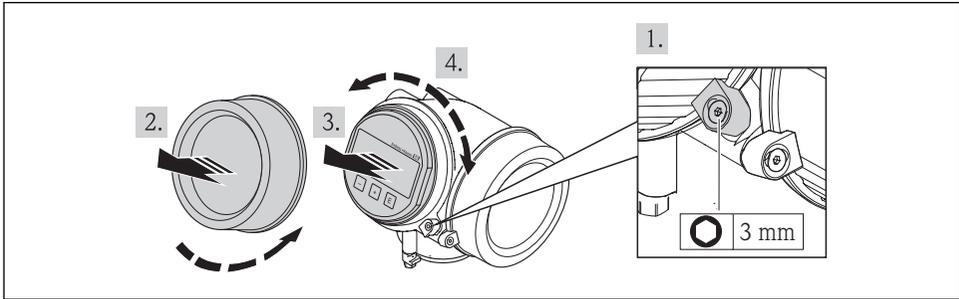
To provide easier access to the connection compartment or display module, the transmitter housing can be turned:



A0013713

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 plastics housing; 2,5 Nm for aluminium or stainless steel housing).

6.2.6 Turning the display module



A0013905

1. If present: Loosen the screw of the securing clamp of the electronics compartment cover using an Allen key 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 rotation movement.
4. Rotate the display module into the desired position: Max. $8 \times 45^\circ$ in each direction.
5. Feed the spiral 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 cover of the electronics compartment firmly back onto the transmitter housing.
7. Tighten the securing clamp again using the Allen key (Torque: 2.5 Nm).

6.3 Post-installation check

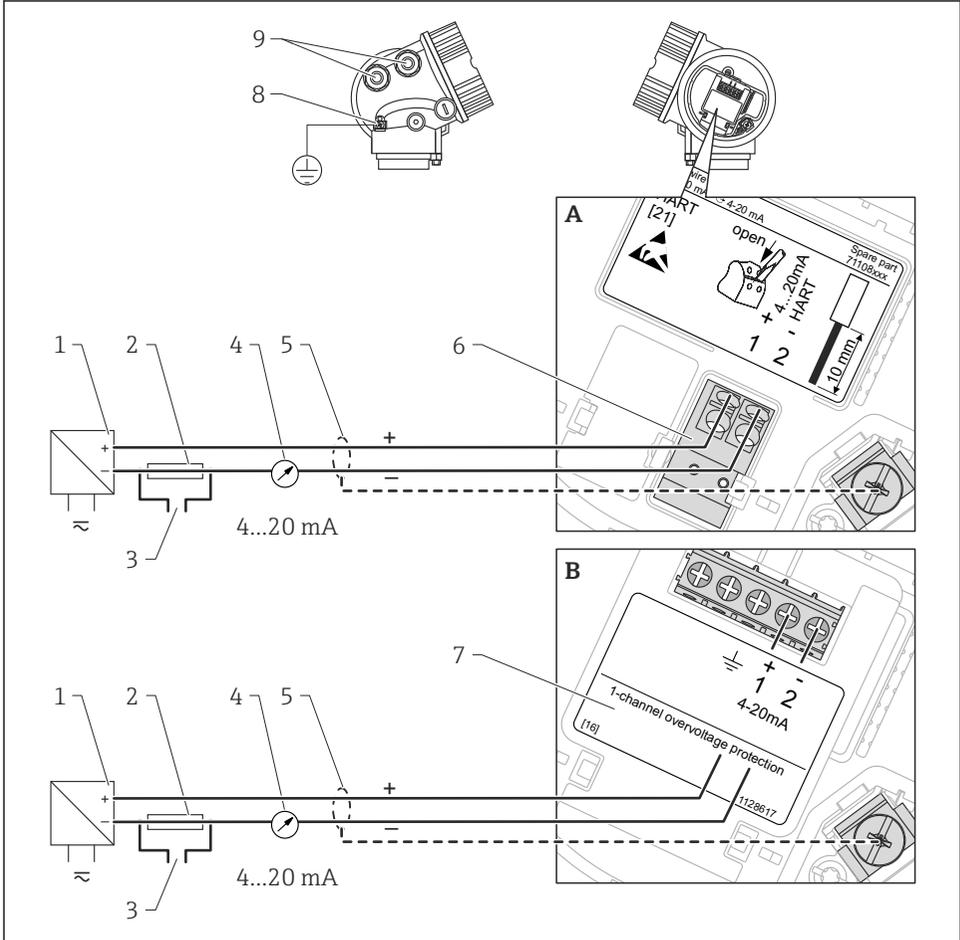
<input type="radio"/>	Is the device undamaged (visual inspection)?
<input type="radio"/>	<p>Does the device conform to the measuring point specifications?</p> <p>For example:</p> <ul style="list-style-type: none"> ▪ Process temperature ▪ Process pressure (refer to the chapter on "Material load curves" of the "Technical Information" document) ▪ Ambient temperature range ▪ Measuring range
<input type="radio"/>	Are the measuring point identification and labeling correct (visual inspection)?
<input type="radio"/>	Is the device adequately protected from precipitation and direct sunlight?
<input type="radio"/>	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



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

A Without integrated overvoltage protection

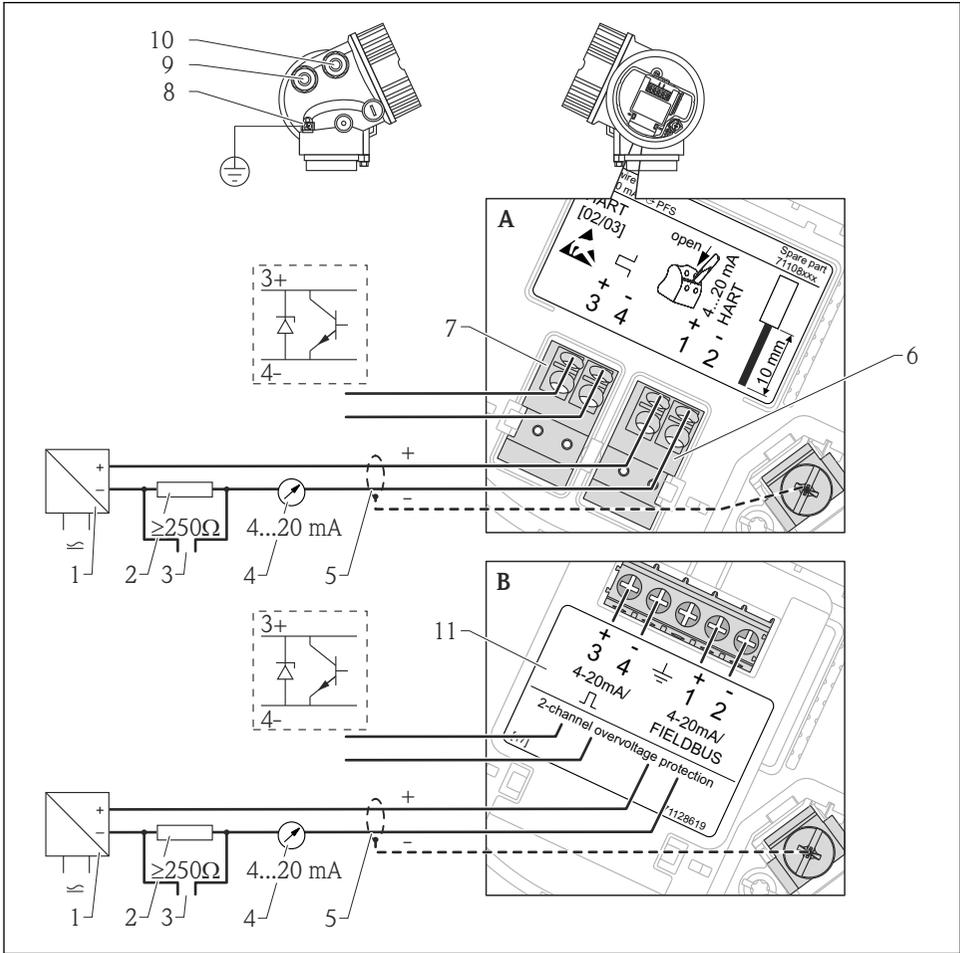
B With integrated overvoltage protection

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



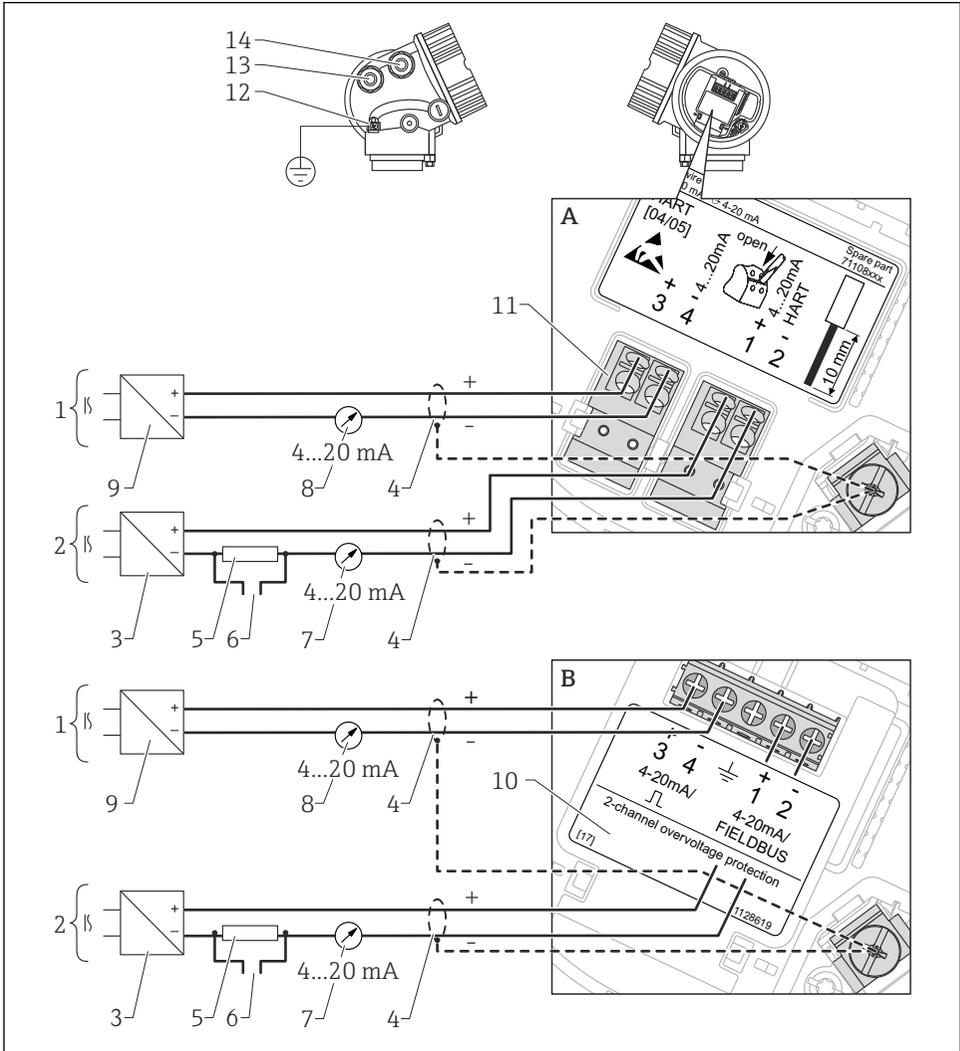
A0013759

9 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

10 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. RN22 1N); Observe terminal voltage

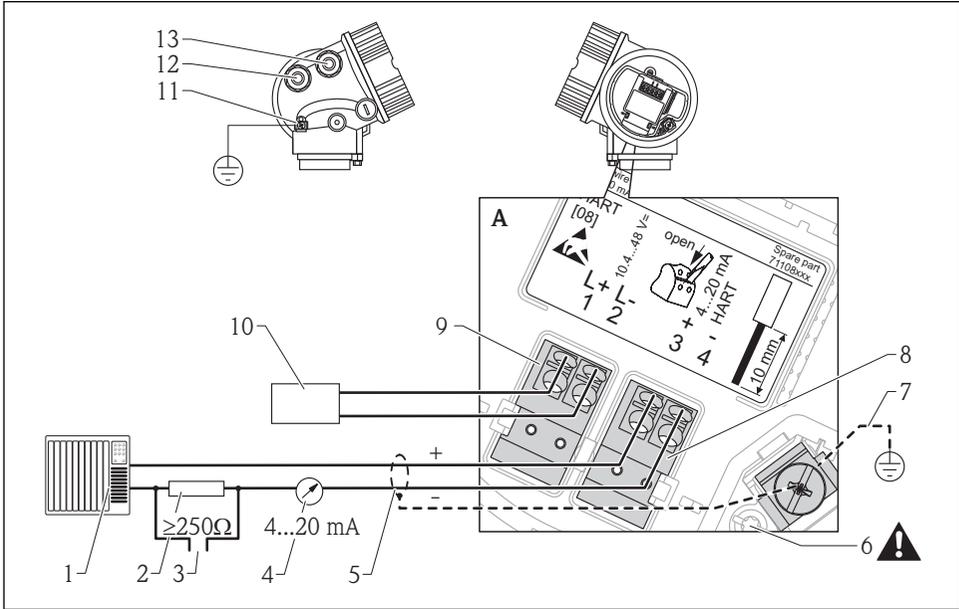
4 Cable screen; observe cable specification

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); Obesrve 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

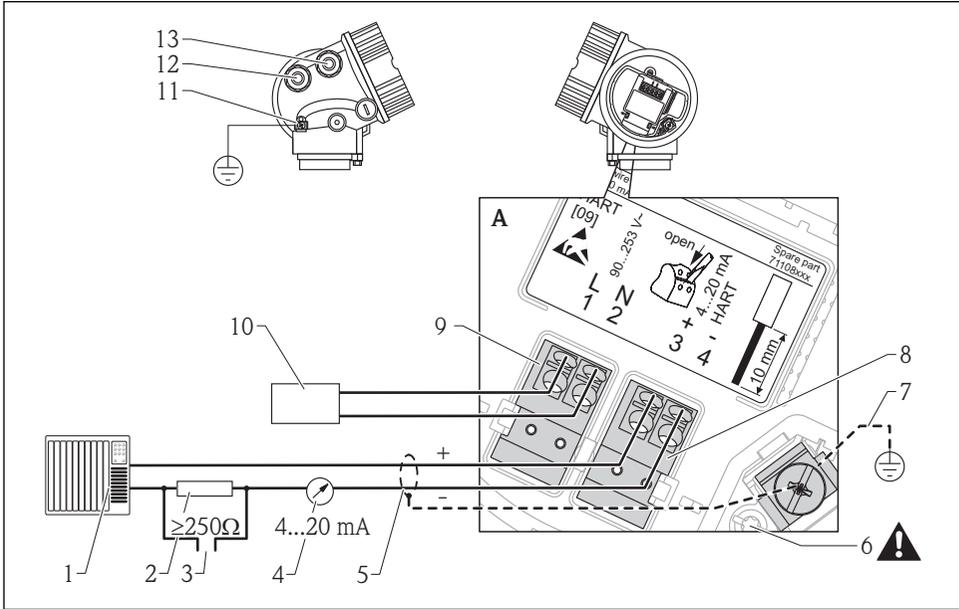
11 Terminal assignment 4-wire; 4-20mA HART (10.4 to 48 VDC)

- 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).

-  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).
-  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.
-  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).

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

A0018965

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

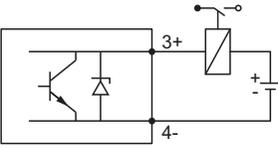
- 1 Evaluation unit, e.g. PLC
- 2 HART communication resistor ($\geq 250 \Omega$): Observe maximum load
- 3 Connection for Commubox FXA195 or FieldXpert SFX350/SFX370 (via VIATOR Bluetooth modem)
- 4 Analog display device: Observe maximum load
- 5 Signal cable including screening (if required), observe 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).

-  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).
-  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.
-  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).

Connection examples for the switch output

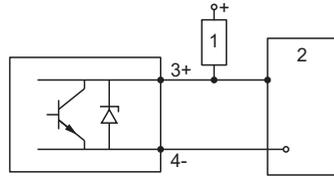


13 Connection of a relay

Suitable relays (examples):

- Solid-state relay: Phoenix Contact OV-24DC/480AC/5 with mounting rail connector UMK-1 OM-R/AMS
- Electromechanical relay: Phoenix Contact PLC-RSC-12DC/21

A0015909



14 Connection of a digital input

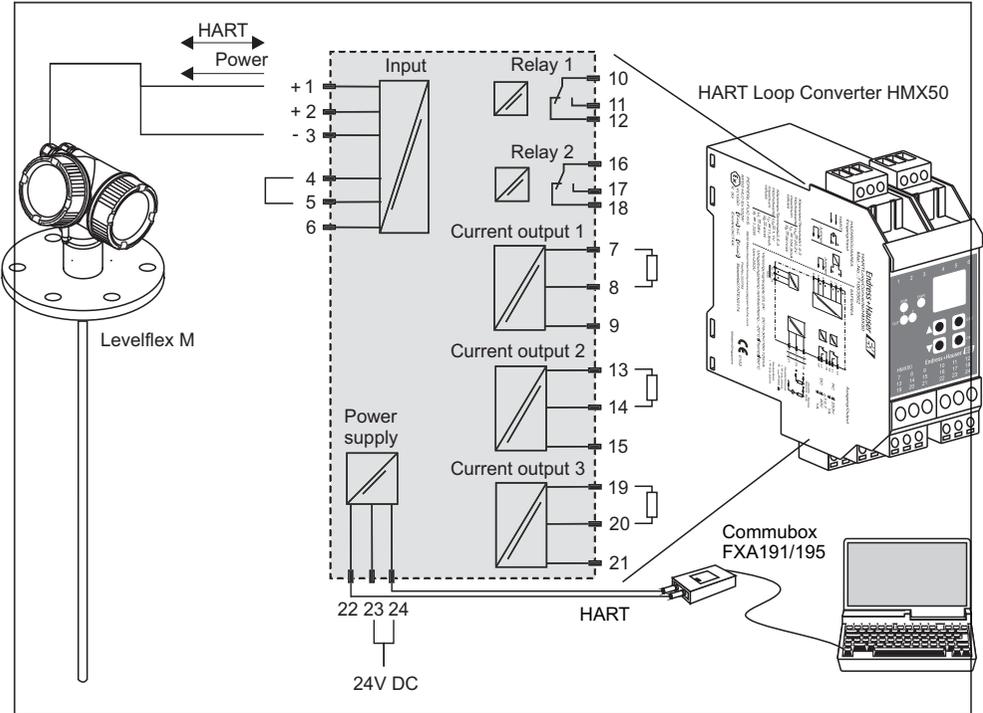
- 1 Pull-up resistor
- 2 Digital input

A0015910

i For optimum interference immunity we recommend to connect an external resistor (internal resistance of the relay or Pull-up resistor) of $< 1\,000\ \Omega$.

HART loop converter HMX50

The dynamic variables of the HART protocol can be converted into individual 4 to 20 mA sections using the HART loop converter HMX50. The variables are assigned to the current output and the measuring ranges of the individual parameters are defined in the HMX50.



A0011356-EN

15 Connection diagram for HART loop converter HMX50 (example: passive 2-wire device and current outputs connected as power source)

The HART loop converter HMX50 can be acquired using the order number 71063562.



Additional documentation: TI00429F and BA00371F.

7.1.2 Cable specification

For ambient temperature $T_U \geq 60^\circ\text{C}$ (140°F): use cable for temperature $T_U + 20\text{ K}$.

HART

- A normal device cable suffices if only the analog signal is used.
- A shielded cable is recommended if using the HART protocol. Observe grounding concept of the plant.
- For 4-wire devices: Standard device cable is sufficient for the power line.

7.1.3 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

<p style="text-align: right; font-size: small;">A0011175</p>	Pin	Meaning
	1	Signal +
	2	not connected
	3	Signal -
	4	Ground

Pin assignment of the 7/8" plug connector

<p style="text-align: right; font-size: small;">A0011176</p>	Pin	Meaning
	1	Signal -
	2	Signal +
	3	Not connected
	4	Screen

7.1.4 Power supply

2-wire, 4-20mA HART, passive

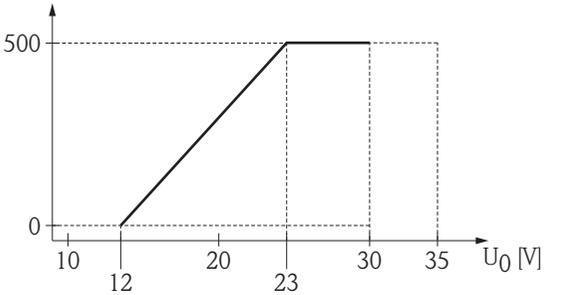
"Power Supply, Output" ¹⁾	"Approval" ²⁾	Terminal voltage U at the device	Maximum load R, depending on the supply voltage U_0 at the supply unit
A: 2-wire; 4-20mA HART	<ul style="list-style-type: none"> ▪ Non-Ex ▪ Ex nA ▪ CSA GP 	11.5 to 35 V ³⁾	<p style="text-align: right;">A0014076</p>
	Ex ic	11.5 to 32 V ³⁾	
	Ex ia / IS	11.5 to 30 V ³⁾	
	<ul style="list-style-type: none"> ▪ Ex d / XP ▪ Ex ic(ia) ▪ Ex tD / DIP 	13.5 to 30 V ⁴⁾	<p style="text-align: right;">A0014077</p>

1) Feature 020 of the product structure

2) Feature 010 of the product structure

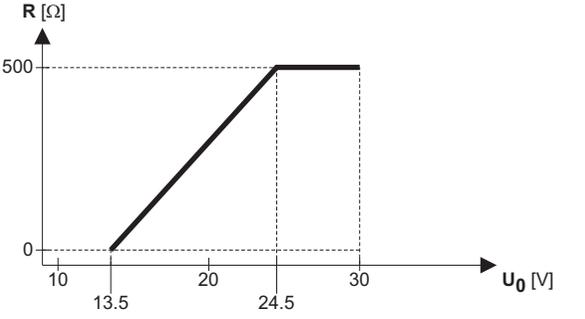
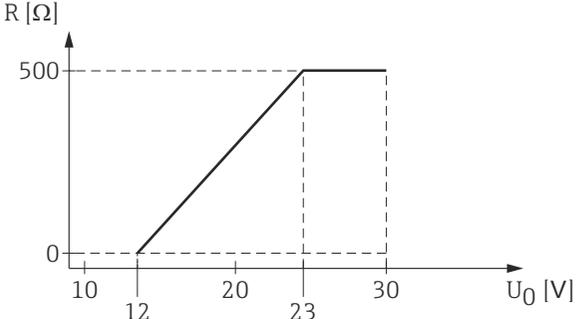
3) For ambient temperatures $T_a \leq -30^\circ\text{C}$ (-22°F) a minimum voltage of 14 V is required for the startup of the device at the MIN error current (3,6 mA). The startup current can be parametrized. If the device is operated with a fixed current $I \geq 4,5$ mA (HART multidrop mode), a voltage of $U \geq 11,5$ V is sufficient throughout the entire range of ambient temperatures.

4) For ambient temperatures $T_a \leq -20^\circ\text{C}$ (-4°F) a minimum voltage of 16 V is required for the startup of the device at the MIN error current (3.6 mA).

"Power Supply, Output" ¹⁾	"Approval" ²⁾	Terminal voltage U at the device	Maximum load R, depending on the supply voltage U ₀ at the supply unit
B: 2-wire; 4-20 mA HART, switch output	<ul style="list-style-type: none"> ▪ Non-Ex ▪ Ex nA ▪ Ex nA(ia) ▪ Ex ic ▪ Ex ic(ia) ▪ Ex d(ia) / XP ▪ Ex ta / DIP ▪ CSA GP 	12 to 35 V ³⁾	 <p>The graph plots Maximum load R [Ω] on the y-axis (0 to 500) against supply voltage U₀ [V] on the x-axis (10 to 35). The load is 0 Ω for U₀ < 12 V. It increases linearly from 0 Ω at 12 V to 500 Ω at 23 V. From 23 V to 35 V, the load remains constant at 500 Ω. Dashed lines indicate the coordinates of the key points: (12, 0), (23, 500), (30, 500), and (35, 500).</p>
	<ul style="list-style-type: none"> ▪ Ex ia / IS ▪ Ex ia + Ex d(ia) / IS + XP 	12 to 30 V ³⁾	

A0019136

- 1) Feature 020 of the product structure
- 2) Feature 010 of the product structure
- 3) For ambient temperatures T_a ≤ -30 °C (-22 °F) a minimum voltage of 14 V is required for the startup of the device at the MIN error current (3.6 mA).

"Power Supply, Output" 1)	"Approval" 2)	Terminal voltage U at the device	Maximum load R, depending on the supply voltage U ₀ at the supply unit
C: 2-wire; 4-20mA HART, 4-20mA	alle	Channel 1: 13.5 to 30 V ³⁾	 <p style="text-align: right; font-size: small;">A0014077</p>
		Channel 2: 12 to 30 V	 <p style="text-align: right; font-size: small;">A0022583</p>

- 1) Feature 020 of the product structure
- 2) Feature 010 of the product structure
- 3) For ambient temperatures $T_a \leq -30^\circ\text{C}$ (-22°F) a minimum voltage of 16 V is required for the startup of the device at the MIN error current (3.6 mA).

Polarity reversal protection	Yes
Admissible residual ripple at f = 0 to 100 Hz	$U_{SS} < 1\text{ V}$
Admissible residual ripple at f = 100 to 10000 Hz	$U_{SS} < 10\text{ mV}$

4-wire, 4-20mA HART, active

"Power supply; Output" ¹⁾	Terminal voltage	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 of the product structure

7.1.5 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 * 0.5 Ω 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

7.2 Connecting the device

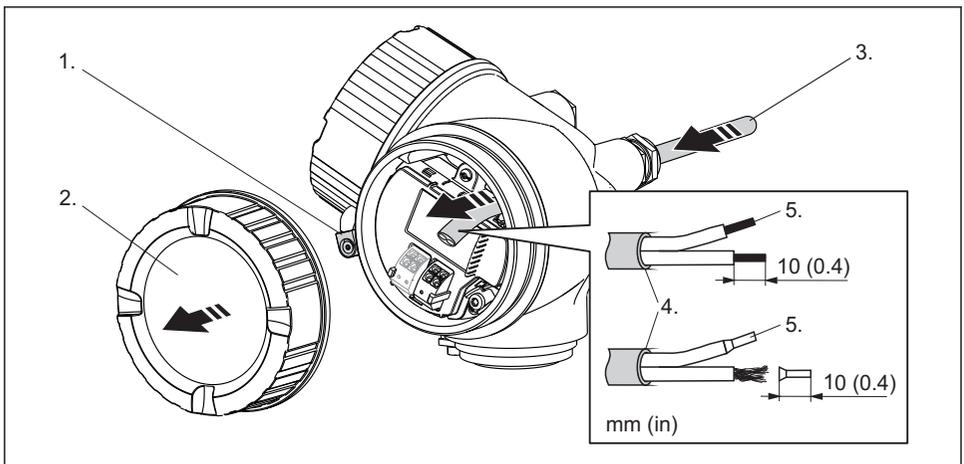
⚠ WARNING

Explosion hazard!

- ▶ Comply with the relevant national standards.
- ▶ Observe the specifications in the Safety Instructions (XA).
- ▶ Only use the specified cable glands.
- ▶ Check whether the supply voltage matches the specifications on the nameplate.
- ▶ Before connecting the device: Switch the supply voltage off.
- ▶ Before switching on the supply voltage: Connect the potential bonding line to the exterior ground terminal.

Required tools and accessories:

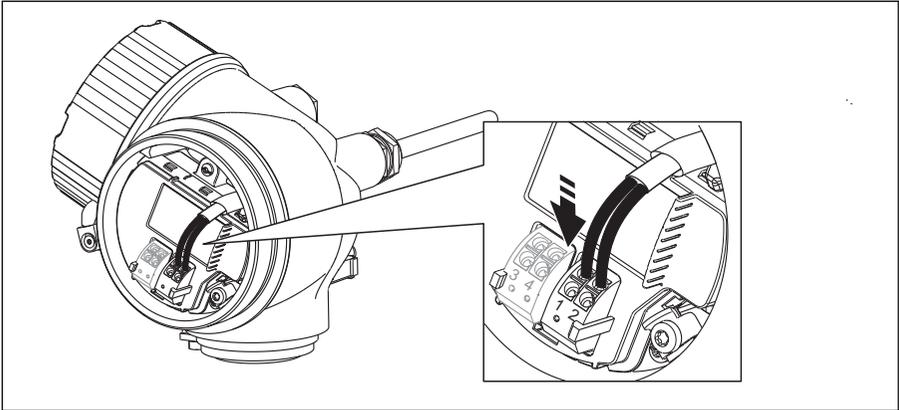
- For instruments with safety pin for the lid: AF 3 Allen key
- Wire stripping pliers
- When using stranded wires: Wire end sleeves.



A0012619

1. Loosen the screw of the securing clamp of the connection compartment cover and turn the 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. Strip the cable.
5. Strip the cable ends 10 mm (0.4 in). For stranded cables, also attach wire end ferrules.
6. Firmly tighten the cable glands.

7.



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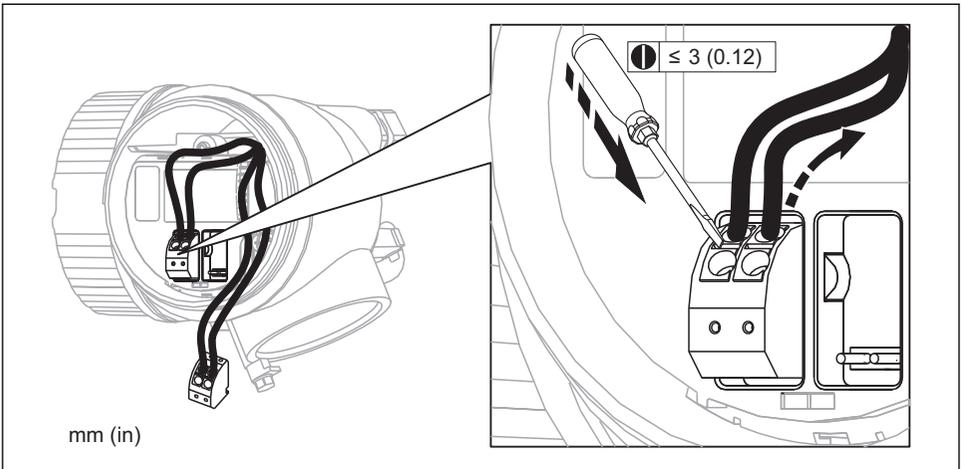
Connect the cable in accordance with the terminal assignment (→  46).

8. When using screened cable: Connect the cable screen to the ground terminal.
9. Screw the cover onto the connection compartment.
10. For instruments with safety pin for the lid: Adjust the safety pin so that its edge is over the edge of the display lid. Tighten the safety pin.

7.2.1 Pluggable spring-force terminals

Instruments without integrated overvoltage protection have pluggable spring-force terminals. Rigid conductors or flexible conductors with cable sleeve can directly be inserted and are contacted automatically.

To remove cables from the terminal: Press on the groove between the terminals using a flat-tip screwdriver ≤ 3 mm (0.12 inch) while pulling the cables out of the terminals.



A0013661

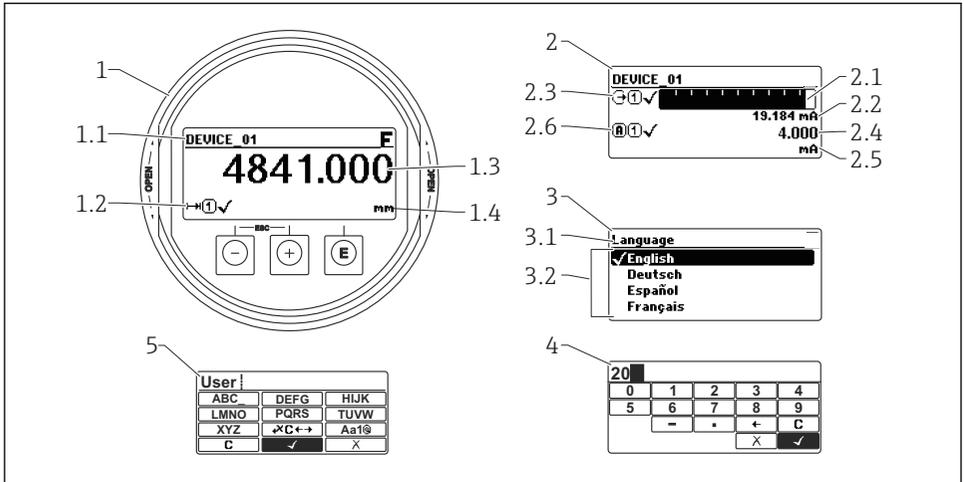
7.3 Post-connection check

<input type="radio"/>	Are cables or the device undamaged (visual inspection)?
<input type="radio"/>	Do the cables comply with the requirements?
<input type="radio"/>	Do the cables have adequate strain relief?
<input type="radio"/>	Are all cable glands installed, firmly tightened and correctly sealed?
<input type="radio"/>	Does the supply voltage match the specifications on the transmitter nameplate?
<input type="radio"/>	Is the terminal assignment correct (→ 46)?
<input type="radio"/>	If required: Is the protective earth connected correctly (→ 46)?
<input type="radio"/>	If supply voltage is present: Is the device ready for operation and do values appear on the display module?
<input type="radio"/>	Are all housing covers installed and firmly tightened?
<input type="radio"/>	Is the securing clamp tightened correctly?

8 Commissioning (via operating menu)

8.1 Display and operating module

8.1.1 Display appearance



A0012635

16 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
 A0013969	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).
 A0013970	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).
 A0013952	Enter key <i>For measured value display</i> <ul style="list-style-type: none"> ▪ Pressing the key briefly opens the operating menu. ▪ Pressing the key for 2 s opens the context menu. <i>For menu, submenu</i> <ul style="list-style-type: none"> ▪ 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> <ul style="list-style-type: none"> ▪ Pressing the key briefly <ul style="list-style-type: none"> - Opens the selected group. - Carries out the selected action. ▪ Pressing the key for 2 s confirms the edited parameter value.
 A0013971	Escape key combination (press keys simultaneously) <i>For menu, submenu</i> <ul style="list-style-type: none"> ▪ Pressing the key briefly <ul style="list-style-type: none"> - 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.
 A0013953	Minus/Enter key combination (press and hold down the keys simultaneously) Reduces the contrast (brighter setting).
 A0013954	Plus/Enter key combination (press and hold down the keys simultaneously) Increases the contrast (darker setting).
 A0013955	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

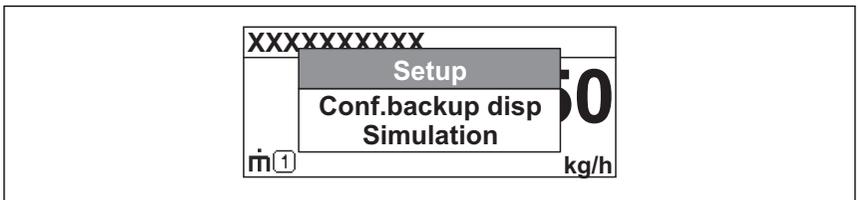
Using the context menu, the user can call up the following menus quickly and directly from the operational display:

- Setup
- Conf. backup disp.
- Simulation

Calling up and closing the context menu

The user is in the operational display.

1. Press \square for 2 s.
 - ↳ The context menu opens.



A0014003-EN

2. Press \square + \oplus 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 \oplus to navigate to the desired menu.
3. Press \square to confirm the selection.
 - ↳ The selected menu opens.

8.2 Operating menu

Parameter/Submenu	Meaning	Description
Language ¹⁾	Defines the operating language of the on-site display.	BA01001F (Operating Instructions FMP51/ FMP52/FMP54, HART)
Setup	When appropriate values have been assigned to all setup parameters, the measured should be completely configured in a standard application.	
Setup→Mapping	Interference echo suppression	
Setup→Advanced setup	Contains further submenus and parameters: <ul style="list-style-type: none"> ▪ 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.	GP0100F/00/DE (Description of Device Parameters FMP5x, HART)
Expert ²⁾	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) In case of operation via operating tools (e.g. FieldCare), the "Language" parameter is located at "Setup→Advanced setup→Display"
- 2) On 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

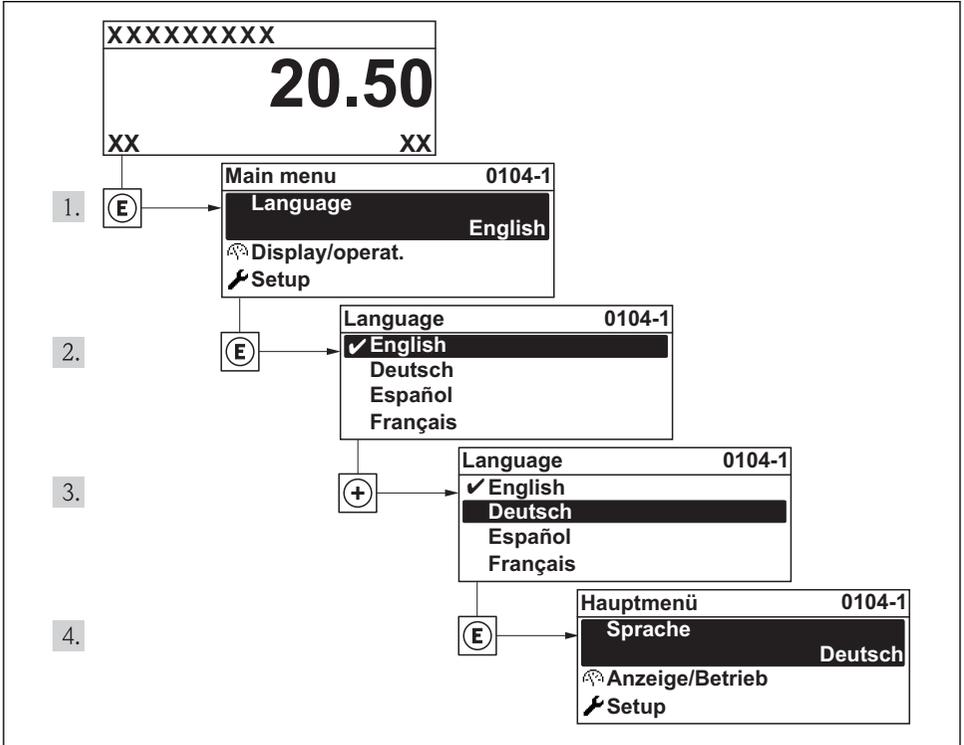
If the device has been locked, it must be unlocked before the measurement can be configured.



For details refer to the Operating Instructions of the device:
BA01001F (FMP51/FMP52/FMP54, HART)

8.4 Setting the operating language

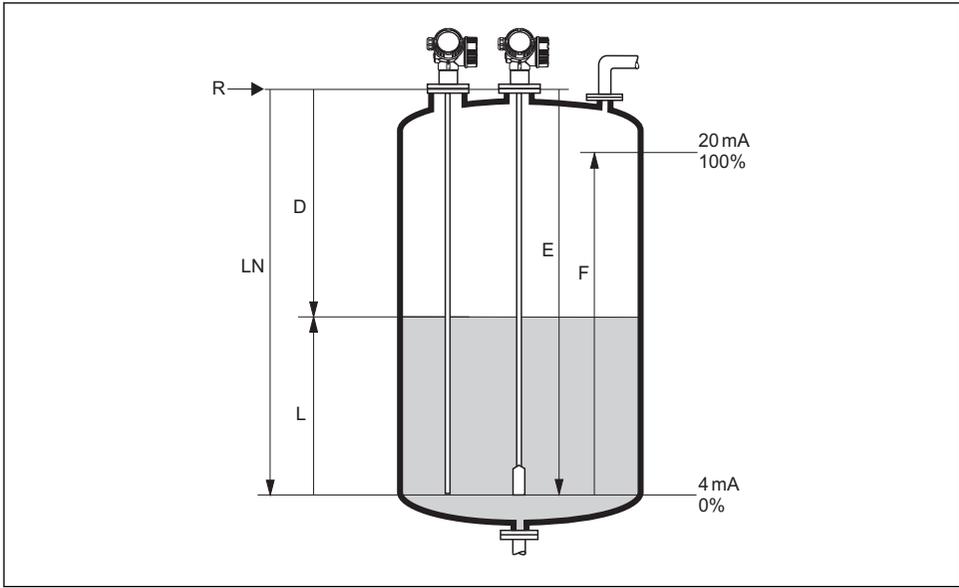
Factory setting: English or ordered local language



A0013996

17 Taking the example of the local display

8.5 Configuration of a level measurement



A0011360

18 Configuration parameters for level measurements in liquids

LN = Length of probe

D = Distance

L = Level

R = Reference point of the measurement

E = Empty calibration (= Zero point)

F = Full calibration (= span)

1. Setup → Device tag

↳ Enter tag for measuring point.

2. Setup → Distance unit

↳ Select distance unit.

3. Setup → Operating mode²⁾

↳ Select **Level** option.

4. Setup → Tank type

↳ Select tank type.

5. Setup → Tube diameter (only if "Tank type" = "Bypass / pipe")

↳ Enter the diameter of the bypass or stilling well.

6. Setup → Medium group

2) only visible for devices with "interface measurement" application package

↳ Select medium group (**Others** or **Water based (DC >= 4)**)

7. Setup → Empty calibration

↳ Enter the distance E between the reference point R and the minimum level (0%).

8. Setup → Full calibration

↳ Enter distance F between the minimum (0%) and maximum (100%) level.

9. Setup → Level

↳ Displays the measured level L.

10. Setup → Distance

↳ Displays the distance D between the reference point R and the level L.

11. Setup → Signal quality

↳ Displays the signal quality of the level echo.

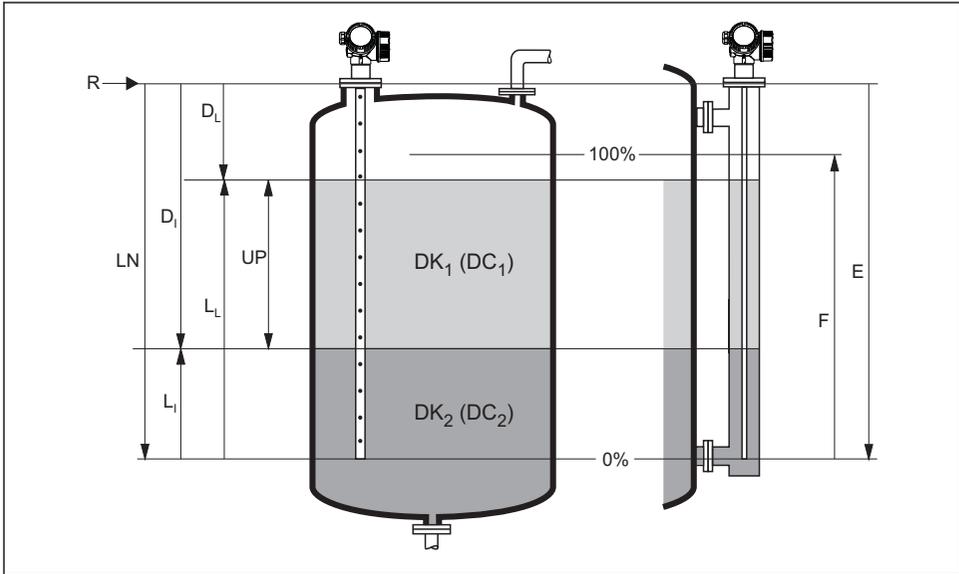
12. Setup → Mapping → Confirm distance

↳ Compare the displayed distance to the real distance in order to start the recording of the mapping curve³⁾.

3) For FMP54 with gas phase compensation (product structure: feature 540 "Application Package", option EF or EG) a map must NOT be recorded.

8.6 Configuration of an interface measurement

i Only devices with the respective software option can be used for interface measurements. This option is selected in the product structure: Feature 540 "Application package", option EB "Interface measurement".



A0011177

19 Configuration parameters for interface measurements

R = Reference point of the measurement

E = Empty calibration (= zero point)

F = Full calibration (= span)

LN = Length of probe

UP = Measured thickness upper layer

D_1 = Interface distance (Distance from reference point to lower medium)

L_1 = Interface

D_L = Distance

L_L = Level

1. **Setup** → **Device tag**
↳ Enter tag for measuring point.
2. **Setup** → **Distance unit**
↳ Select distance unit.
3. **Setup** → **Operating mode**⁴⁾
↳ Select the **Interface** option.
4. **Setup** → **Tank type**

⁴⁾ only visible for devices with "interface measurement" application package

- ↳ Select tank type.
- 5. **Setup → Tube diameter** (only if "Tank type" = "Bypass / pipe")
 - ↳ Enter the diameter of the bypass or stilling well.
- 6. **Setup → Tank level**
 - ↳ Select tank level (**Partially filled** oder **Fully flooded**)
- 7. **Setup → Distance to upper connection**
 - ↳ In bypasses: Enter distance from reference point R to lower edge of the upper connection; otherwise: Keep the factory setting
- 8. **Setup → DC value**
 - ↳ Enter dielectric constant of the upper medium.
- 9. **Setup → Empty calibration**
 - ↳ Enter the distance E between the reference point R and the minimum level (0%).
- 10. **Setup → Full calibration**
 - ↳ Enter distance F between the minimum (0%) and maximum (100%) level.
- 11. **Setup → Level**
 - ↳ Displays the measured level L_L .
- 12. **Setup → Interface**
 - ↳ Displays the interface height L_I .
- 13. **Setup → Distance**
 - ↳ Displays the distance D_L between the reference point R and the level L_L .
- 14. **Setup → Interface distance**
 - ↳ Displays the distance D_I between the reference point R and the interface L_I .
- 15. **Setup → Signal quality**
 - ↳ Displays the signal quality of the level echo.
- 16. **Setup → Mapping → Confirm distance**
 - ↳ Compare the displayed distance to the real distance in order to start the recording of the mapping curve.

8.7 User-specific applications

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

BA01001F/00/DE (Operating Instructions FMP51/FMP52/FMP54, HART)

 For the **Expert** submenu refer to:

GP01000F/00/DE (Description of Device Parameters FMP5x, HART)



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