Operating Instructions
Levelflex FMP51
Modbus

Guided wave radar

Endress+Hauser [EH]

People for Process Automation
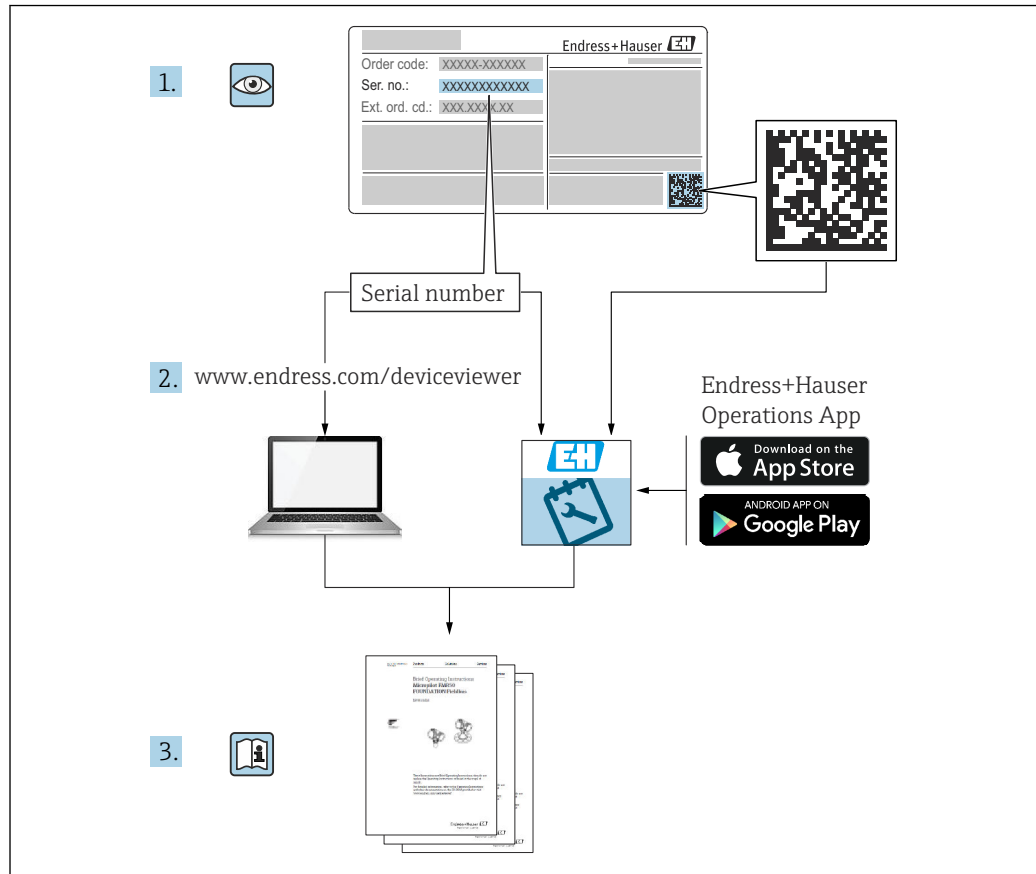
A0023555

Table of contents

1   Important document information

1.1   Document function

These Operating Instructions contain all the information required in the various life cycle phases of the device: from product identification, incoming acceptance and storage, to installation, connection, operation and commissioning, through to troubleshooting, maintenance and disposal.

1.2   Symbols

1.2.1   Safety symbols

⚠ DANGER

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

⚠ WARNING

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

⚠ CAUTION

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

NOTICE

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

1.2.2   Electrical symbols

∿

Alternating current

≂

Direct current and alternating current

⎓

Direct current

⏚

Ground connection

A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.

⏚ **Protective earth (PE)**

Ground terminals that must be connected to ground prior to establishing any other connections.

The ground terminals are located on the interior and exterior 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.

1.2.3   Tool symbols

✛ ✎

Phillips head screwdriver

❶ ✎
Flat-blade screwdriver

✪ ✎
Torx screwdriver

⬡ ✎
Allen key

☞
Open-ended wrench

1.2.4   Symbols for certain types of information and graphics

☑ **Permitted**
Procedures, processes or actions that are permitted

☑☑ **Preferred**
Procedures, processes or actions that are preferred

☒ **Forbidden**
Procedures, processes or actions that are forbidden

ℹ **Tip**
Indicates additional information

📖
Reference to documentation

🖼
Reference to graphic

▶
Notice or individual step to be observed
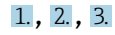
1. , **2.** , **3.**
Series of steps

↳
Result of a step

👁
Visual inspection

💻
Operation via operating tool

🔒
Write-protected parameter

1, 2, 3, ...
Item numbers

A, B, C, ...
Views

⚠ → 📖 **Safety instructions**
Observe the safety instructions contained in the associated Operating Instructions

🔌 **Temperature resistance of the connection cables**
Specifies the minimum value of the temperature resistance of the connection cables

1.3   Supplementary documentation

Document	Purpose and content of the document
Technical Information TI01454F (FMP51, Modbus)	**Planning aid for your device** The document contains all the technical data on the device and provides an overview of the accessories and other products that can be ordered for the device.
Brief Operating Instructions KA01421F (FMP51, Modbus)	**Guide that takes you quickly to the 1st measured value** The Brief Operating Instructions contain all the essential information from incoming acceptance to initial commissioning.
Description of Device Parameters GP01140F (FMP51, Modbus)	**Reference for your parameters** The document provides a detailed explanation of each individual parameter in the operating menu. The description is aimed at those who work with the device over the entire life cycle and perform specific configurations.

1.4 Terms and abbreviations

Term/abbreviation	Explanation
BA	Document type "Operating Instructions"
KA	Document type "Brief Operating Instructions"
TI	Document type "Technical Information"
SD	Document type "Special Documentation"
XA	Document type "Safety Instructions"
PN	Nominal pressure
MWP	Maximum Working Pressure The MWP can also be found on the nameplate.
ToF	Time of Flight
ε_r (DC value)	Relative dielectric constant
BD	Blocking Distance; no signals are analyzed within the BD.
PLC	Programmable Logic Controller
CDI	Common Data Interface

1.5   Registered trademarks

Modbus®
Registered trademark of SCHNEIDER AUTOMATION, INC.

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

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

TRI CLAMP®
Registered trademark of Alfa Laval Inc., Kenosha, USA

NORD-LOCK®
Registered trademark of Nord-Lock International AB

FISHER®
Registered trademark of Fisher Controls International LLC, Marshalltown, USA

MASONEILAN®
Registered trademark of Dresser, Inc., Addison, USA

2   Basic safety instructions

2.1   Requirements for the personnel

The personnel for installation, commissioning, diagnostics and maintenance must fulfill the following requirements:
▶ Trained, qualified specialists must have a relevant qualification for this specific function and task.
▶ Are authorized by the plant owner/operator.
▶ Are familiar with federal/national regulations.
▶ Before starting work, read and understand the instructions in the manual and supplementary documentation as well as the certificates (depending on the application).
▶ Follow instructions and comply with basic conditions.

The operating personnel must fulfill the following requirements:
▶ Are instructed and authorized according to the requirements of the task by the facility's owner-operator.
▶ Follow the instructions in this manual.

2.2   Intended use

Application and media
The measuring device described in this manual is intended only for the level and interface measurement of liquids. Depending on the version ordered, the measuring device can also measure potentially explosive, flammable, poisonous and oxidizing media.

Observing the limit values specified in the "Technical data" and the conditions listed in the manual and additional documentation, the measuring device may be used for the following measurements only:
▶ Measured process variables: level and/or interface height
▶ Calculable process variables: volume or mass in any shape of vessel (calculated from the level by the linearization functionality)

To ensure that the measuring device remains in proper condition for the operation time:
▶ Use the measuring device only for media to which the process-wetted materials have an adequate level of resistance.
▶ Observe the limit values in the "Technical data".

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

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 ℃ (176 ℉). 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 high medium temperatures, ensure protection against contact to prevent burns.

2.3   Workplace safety

When working on and with the device:
▶ Wear the required personal protective equipment according to federal/national regulations.

With separable probe rods, medium may penetrate the joints between the individual parts of the rod. This medium may escape when the joints are loosened. This can cause injuries in the case of dangerous (e.g., aggressive or toxic) media.

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

Modifications to the device

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

▶ If modifications are nevertheless 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 the repair of an electrical device.
▶ Use only original spare parts and accessories from the manufacturer.

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.

2.5 Product safety

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

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.

2.5.1 CE mark

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

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

2.5.2 EAC conformity

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

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

2.6   Safety Instructions (XA)

Depending on the approval, the following Safety Instructions (XA) are supplied with the device. They are an integral part of the Operating Instructions.

Ordering feature 010 (Approval)		Ordering feature 020 (Power Supply; Output)		Safety Instructions
Option	Meaning	Option	Meaning	
CC	CSA C/US XP Cl. I, Div. 1, Groups A-D	M	4-wire, Modbus RS485	XA01700F
C3	CSA C/US XP Cl. I, II, III, Div. 1, Groups A-G; Class I, AEx d [ia] IIC/ Ex d [ia] IIC; Class I, Div. 2, Groups A-D	M	4-wire, Modbus RS485	XA01700F

> For certified devices the relevant Safety Instructions (XA) are indicated on the nameplate.

2.6.1   Ex-marking in case of connected FHX50 remote display

If the device is prepared for the remote display FHX50 (product structure: feature 030: Display, Operation", option L or M), the Ex marking of some certificates changes according to the following table [1]:

Feature 010 ("Approval")	Feature 030 ("Display, Operation")	Ex-marking
BG	L, M or N	ATEX II 3G Ex nA [ia Ga] IIC T6 Gc
BH	L, M or N	ATEX II 3G Ex ic [ia Ga] IIC T6 Gc
B3	L, M or N	ATEX II 1/2G Ex d [ia] IIC T6 Ga/Gb, ATEX II 1/2D Ex ta [ia Db] IIIC Txx°C Da/Db
IG	L, M or N	IECEx Ex nA [ia Ga] IIC T6 Gc
IH	L, M or N	IECEx Ex ic [ia Ga] IIC T6 Gc
I3	L, M or N	IECEx Ex d [ia] IIC T6 Ga/Gb, IECEx Ex ta [ia Db] IIIC Txx°C Da/Db

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1)   The marking of certificates not mentioned in this table are not affected by the FHX50.

3   Product description

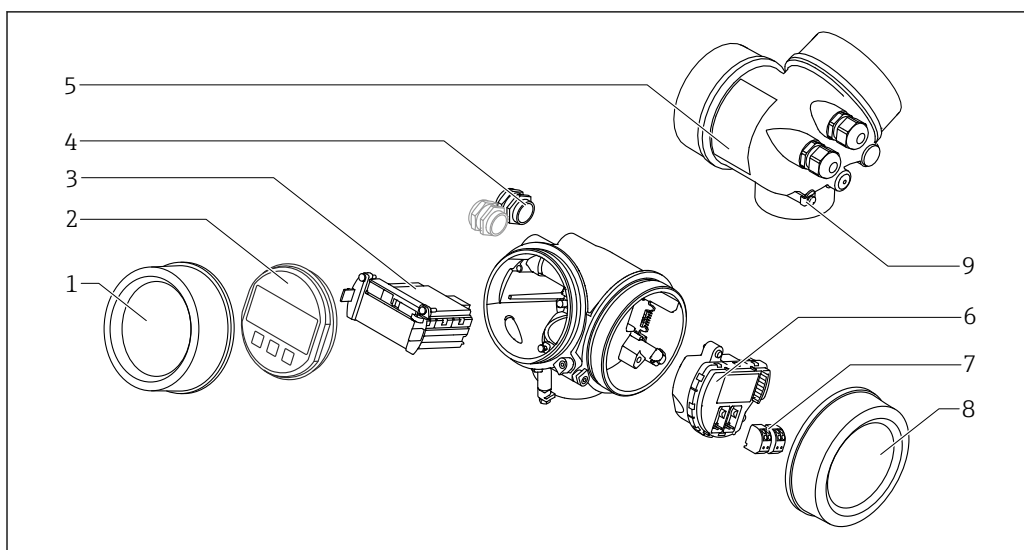## 3.1   Product design

3.1.1   Levelflex FMP51
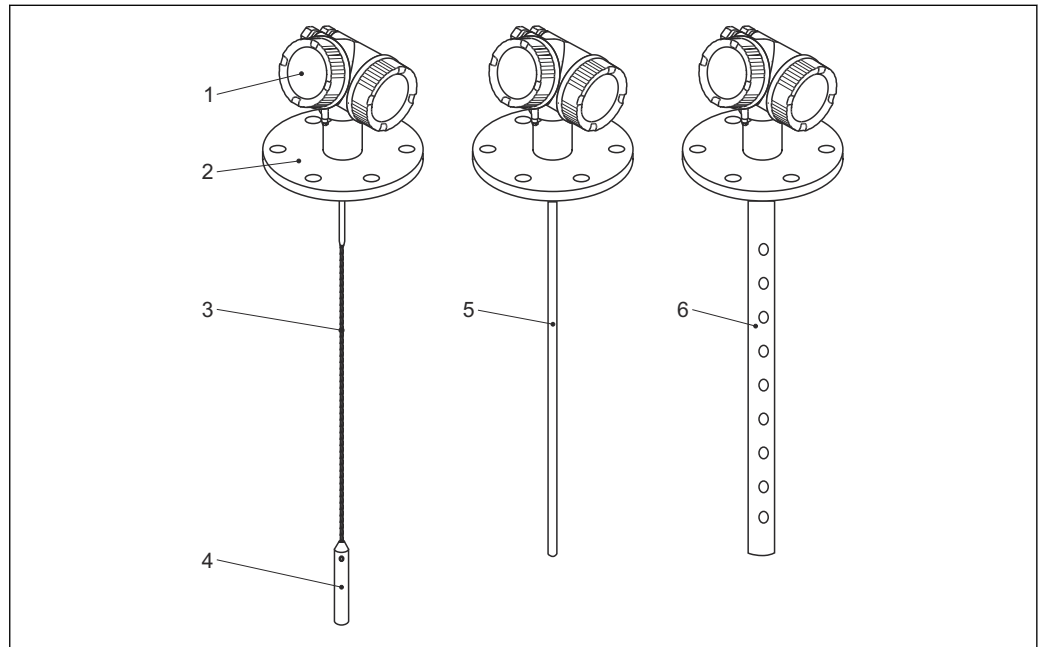
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🖼 *1   Design of the Levelflex*

1   Electronics housing
2   Process connection (here with flange as an example)
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   Ground terminal

4 Incoming acceptance and product identification

4.1 Incoming acceptance

Upon receipt of the goods check the following:
- Are the order codes on the delivery note and the product sticker identical?
- Are the goods undamaged?
- Do the nameplate data match the ordering information on the delivery note?
- If required (see nameplate): Are the Safety Instructions (XA) present?

If one of these conditions is not satisfied, contact your supplier.

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

4.2.1　Nameplate

▣ 3　*Nameplate of the Levelflex; Dimensions: mm (in)*

1　*Device name*
2　*Address of manufacturer*
3　*Order code*
4　*Serial number (Ser. no.)*
5　*Extended order code (Ext. ord. cd.)*
6　*Process pressure*
7　*Gas phase compensation: reference distance*
8　*Certificate symbol*
9　*Certificate and approval relevant data*
10　*Degree of protection: e.g. IP, NEMA*
11　*Document number of the Safety Instructions: e.g. XA, ZD, ZE*
12　*2-D matrix code (QR code)*
13　*Modification mark*
14　*Manufacturing date: year-month*
15　*Permitted temperature range for cable*
16　*Device revision (Dev.Rev.)*
17　*Additional information about the device version (certificates, approvals, communication): e.g. SIL, PROFIBUS*
18　*Firmware version (FW)*
19　*CE mark, C-Tick*
20　*DeviceID*
21　*Material in contact with process*
22　*Permitted ambient temperature (T_a)*
23　*Size of the thread of the cable glands*
24　*Length of probe*
25　*Signal outputs*
26　*Operating voltage*

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.

5 Storage, transport

5.1 Storage conditions

- Permitted storage temperature: −40 to +80 ℃ (−40 to +176 ℉)
- Use original packaging.

5.2 Transporting the product to the measuring point

⚠ WARNING

Housing or rod may become damaged or pull off.

Risk of injury!

▶ Transport the measuring device to the measuring point in its original packaging or by the process connection.

▶ Always secure lifting equipment (slings, eyes, etc.) at the process connection and never lift the device by the electronic housing or probe. 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 weighing more than 18 kg (39.6 lbs) (IEC 61010).
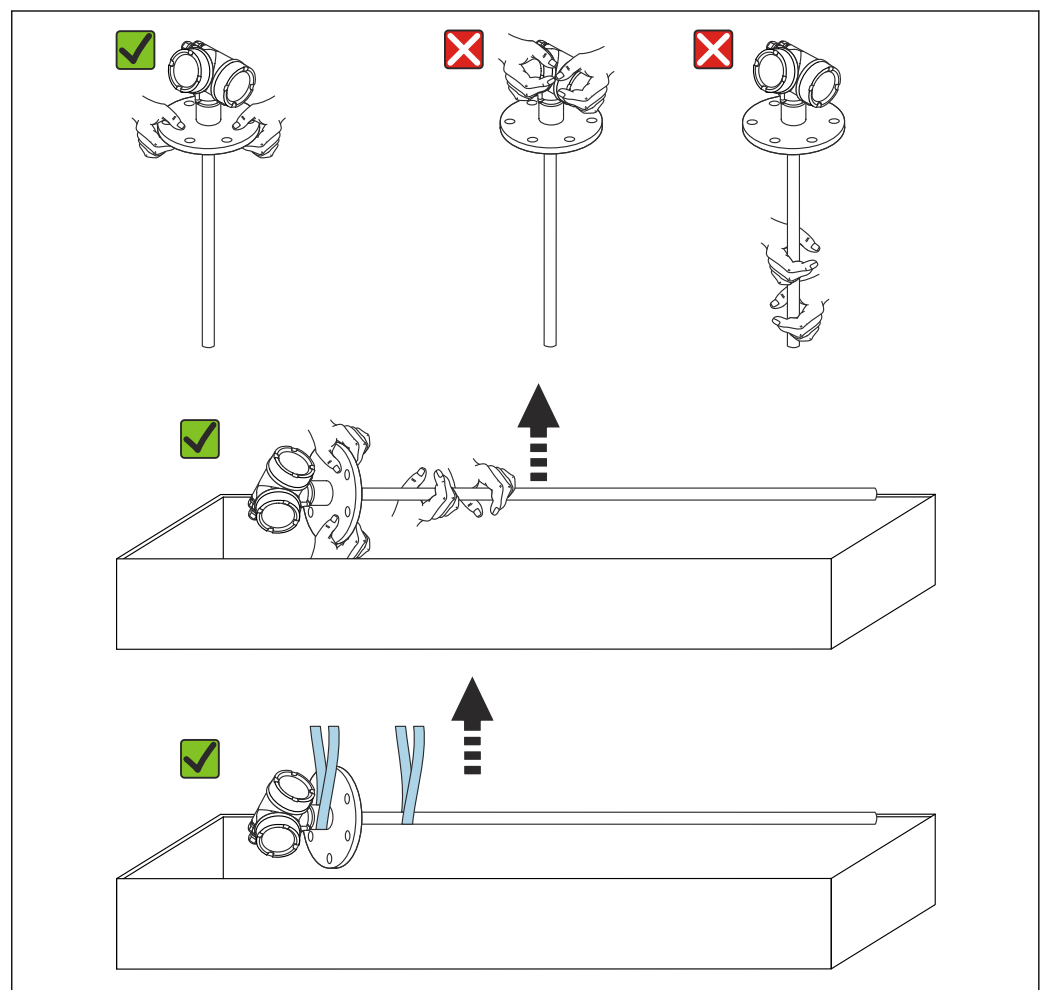
A0013920

6   Mounting

6.1   Mounting requirements

6.1.1   Suitable mounting position
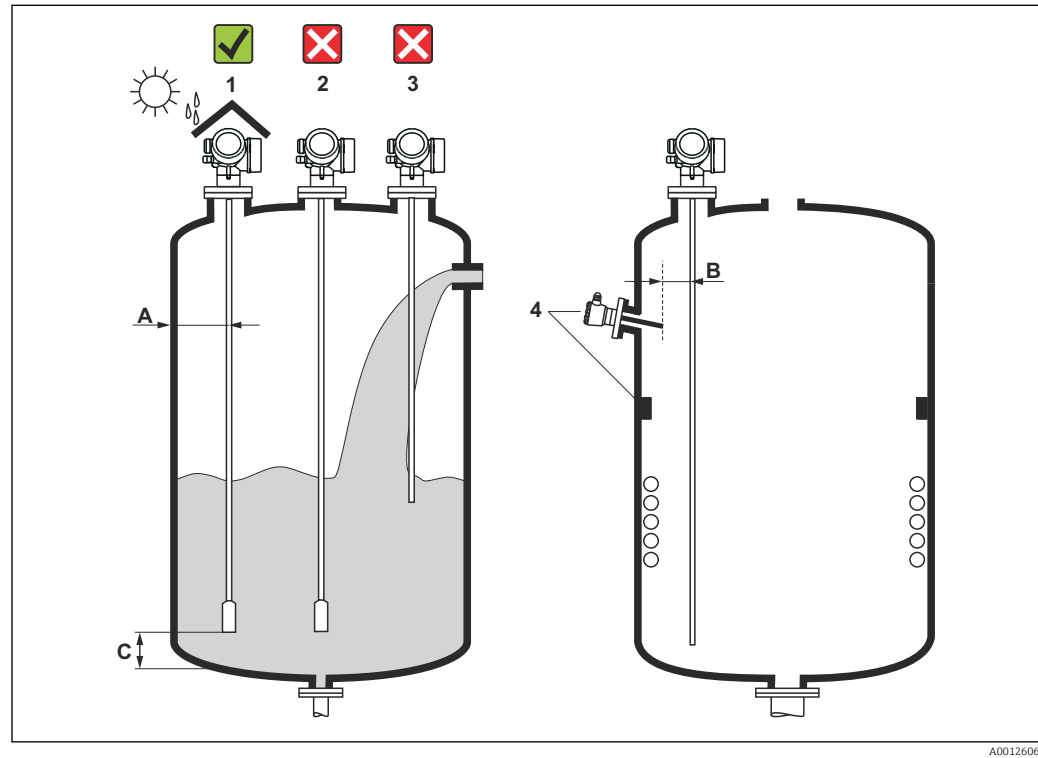
⊡ 4   *Installation conditions for Levelflex*

Spacing requirements when mounting

- Distance (A) between the vessel wall and rod and rope probes:
  - For smooth metallic walls: > 50 mm (2 in)
  - For plastic walls: > 300 mm (12 in) to metallic parts outside the vessel
  - For concrete walls: > 500 mm (20 in), otherwise the permitted measuring range may be reduced.
- Distance (B) between rod probes and internal fittings (3): > 300 mm (12 in)
- When using more than one Levelflex:
  Minimum distance between the sensor axes: 100 mm (3.94 in)
- Distance (C) from the end of the probe to the bottom of the vessel:
  - Rope probe: > 150 mm (6 in)
  - Rod probe: > 10 mm (0.4 in)
  - Coax probe: > 10 mm (0.4 in)

ℹ️ Coax probes can be mounted at any distance to the wall and internal fixtures.

Additional conditions

- When mounting outdoors, a weather protection cover (1) can be used 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 cannot be avoided, it is essential to perform interference echo suppression (mapping) after commissioning the device.
- Do not mount the probe in the filling curtain (3).
- Avoid buckling the rope probe during installation or operation (e.g. as a result of product movement against silo wall) by selecting a suitable mounting location.

In the case of freely suspended rope probes (probe end not fixed at the bottom), the distance between the probe rope and internal fittings due to movement of the product must not fall below 300 mm (12 in). Occasional contact between the end-of-probe weight and the cone of the vessel, however, does not influence the measurement provided that the dielectric constant is at least DC = 1.8.

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

6.1.2 Mounting under confined conditions

Mounting with remote probe

The device version with a remote probe is suitable for applications with restricted mounting space. In this case, the electronics housing is mounted at a separate position from the probe.
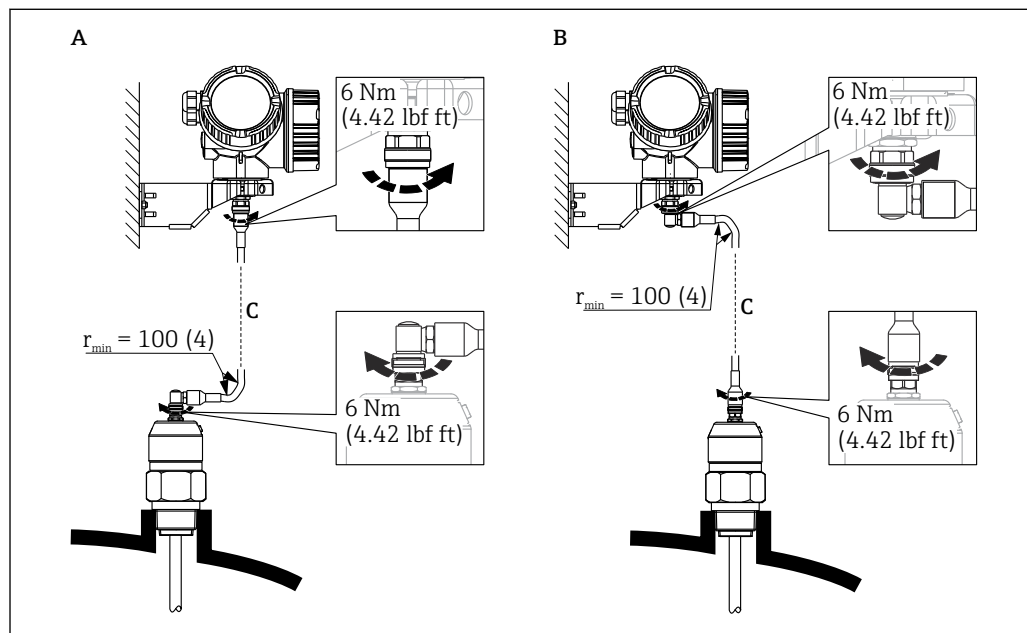
A0014794

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

- Product structure, feature 600 "Probe design":
  - Version MB "Sensor remote, 3m cable"
  - Version MC "Sensor remote, 6m cable"
  - Version MD "Sensor remote, 9m cable"
- The connecting cable is included in the delivery with these versions.
  Minimum bending radius: 100 mm (4 inch)
- The mounting bracket for the electronics housing is included in the delivery with these versions. Mounting options:
  - Wall mounting
  - Mounting on a post or pipe with a diameter of 42 to 60 mm (1-1/4 to 2 inch)
- The connection cable has one straight plug and one plug angled at 90°. Depending on the local conditions the angled plug can be connected at the probe or at the electronics housing.

ℹ️ The probe, electronics and connection cable are mutually compatible and bear a common serial number. Only components with the same serial number may be connected to one another.

Separable probes

A0021647
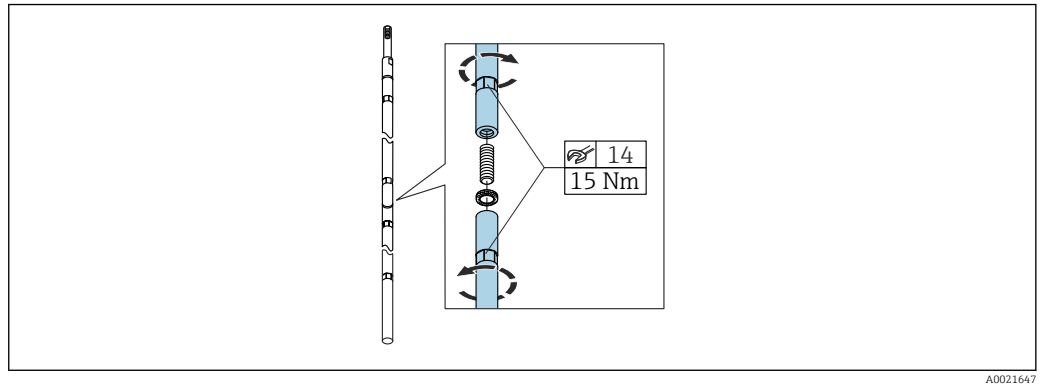
In confined mounting conditions (little distance to the ceiling), the use of separable rod probes is advisable (ϕ 16 mm).

- Max. probe length 10 m (394 in)
- Max. lateral loading capacity 30 Nm
- Probes can be separated several times, with the individual parts having the following lengths:
  - 500 mm (20 in)
  - 1000 mm (40 in)
- Tightening torque: 15 Nm

6.1.3   Notes on the mechanical load of the probe

Tensile loading capacity of rope probes

Sensor	Feature 060	Probe	Tensile loading capacity [kN]
FMP51	LA, LB MB, MD	Rope 4mm (1/6") 316	5

Lateral loading capacity of rod probes

Sensor	Feature 060	Probe	Lateral loading capacity (bending strength) [Nm]
FMP51	AA, AB	Rod 8mm (1/3") 316L	10
	AC, AD	Rod 12mm (1/2") 316L	30
	AL, AM	Rod 12mm (1/2") AlloyC	30
	BA, BB, BC, BD	Rod 16mm (0.63") 316L separable	30

Lateral load (bending moment) from flow conditions

The formula for calculating the bending moment M acting on the probe:

$M = c_w \cdot \rho/2 \cdot v^2 \cdot d \cdot L \cdot (L_N - 0.5 \cdot L)$

With:

c_w: coefficient of friction

ρ [kg/m^3]: density of medium

v [m/s]: flow velocity of the medium, perpendicular to the probe rod

d [m]: diameter of the probe rod

L [m]: level

L_N [m]: probe length

Sample calculation	
Coefficient of friction c_w	0.9 (assuming turbulent flow - high Reynolds number)
Density ρ [kg/m^3]	1000 (e.g. water)
Probe diameter d [m]	0.008
$L = L_N$	(unfavorable conditions)

A0014175

Bending torque [M] on rod probes, diameter 8mm (1/3")

A0014182-EN
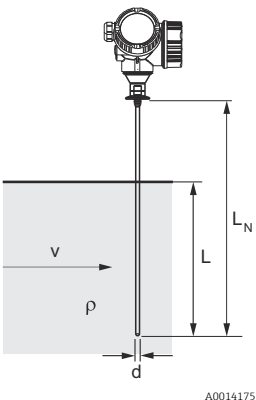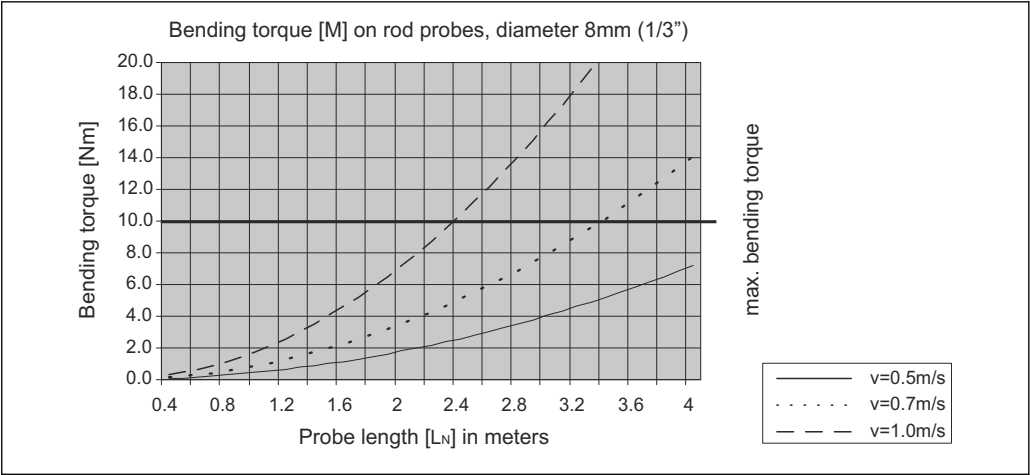
Lateral loading capacity of coax probes

Sensor	Feature 060	Process connection	Probe	Lateral loading capacity (bending strength) [Nm]
FMP51	UA, UB	G¾ or NPT¾ thread	Coax 316L, Ø 21.3 mm	60
		■ G1½ or NPT1½ thread ■ Flange	Coax 316L, Ø 42.4 mm	300
	UC, UD	Flange	Coax AlloyC, Ø 42.4 mm	300

6.1.4   Information concerning the process connection

Probes are mounted on 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 occasionally touches the vessel floor or cone, the probe may need to be shortened at the bottom end and secured (fixed down) → 🕮 28.

Threaded connection
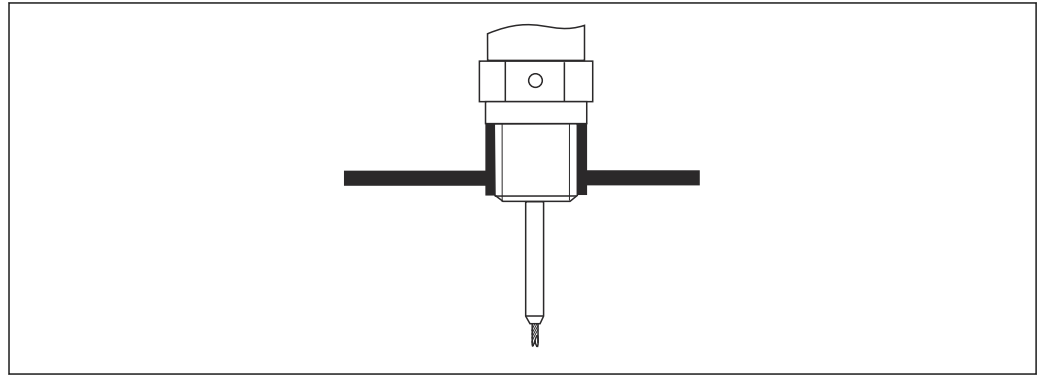
🖼 *5   Mounting with threaded connection; flush with the vessel ceiling*

Seal

The thread and the type of seal comply with DIN 3852 Part 1, screwed plug, form A.

The following types of sealing ring can be used:

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

Use a sealing ring according to this standard in form A, C or D and of a material that offers appropriate resistance for the application.

Nozzle installation
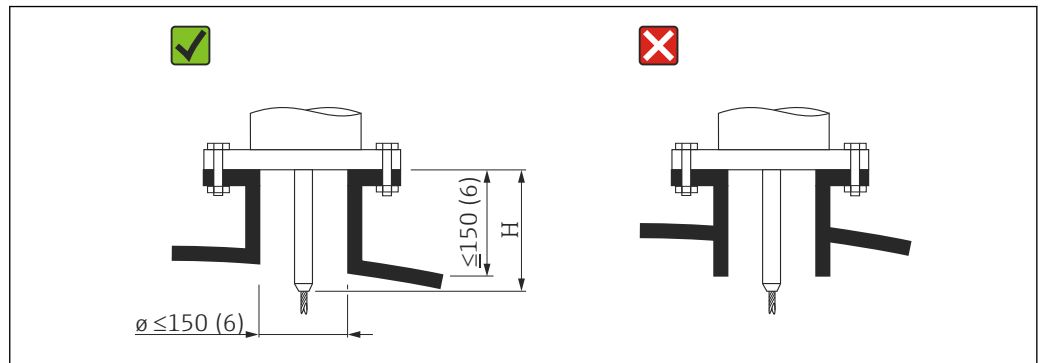
A0015122

H   Length of the centering rod or the rigid part of the rope probe

- Permissible nozzle diameter: ≤ 150 mm (6 in).
  For larger diameters, the near-range measuring capability may be reduced.
  For nozzles ≥ DN300: → 🔲 27.
- Permitted nozzle height [2]: ≤ 150 mm (6 in).
  For larger heights, the near-range measuring capability may be reduced.
  Larger nozzle heights may be possible in individual cases (see the "Centering rod" section).
- The end of the nozzle should be flush with the tank ceiling in order to avoid ringing effects.

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

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2)   Larger nozzle heights available on request

Centering rod

In the case of rope probes, it may be necessary to use a version with a centering rod so that the rope does not come in contact with the nozzle wall during the process.

Probe	Max. nozzle height (= length of centering rod)	Version of feature 060 ("probe")
FMP51	150 mm	LA
	6 inch	LB
	300 mm	MB
	12 inch	MD

Installation in nozzle ≥ DN300

If installation in nozzles ≥ 300 mm/12" is unavoidable, installation must be performed according to the following diagram in order to avoid interference signals in the near-range.

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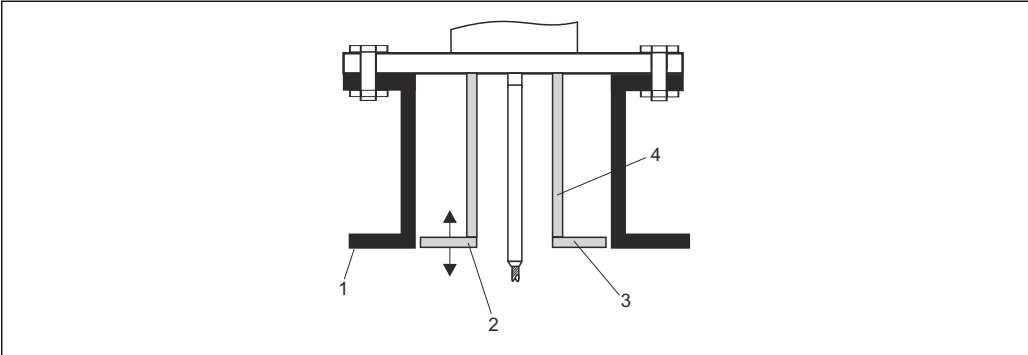
1   Lower edge of the nozzle
2   Approximately flush with the lower edge of the nozzle (± 50 mm)
3   Plate
4   Pipe Φ 150 to 180 mm

Nozzle diameter	Plate diameter
300 mm (12")	280 mm (11")
≥ 400 mm (16")	≥ 350 mm (14")

6.1.5   Securing the probe

Securing rope probes
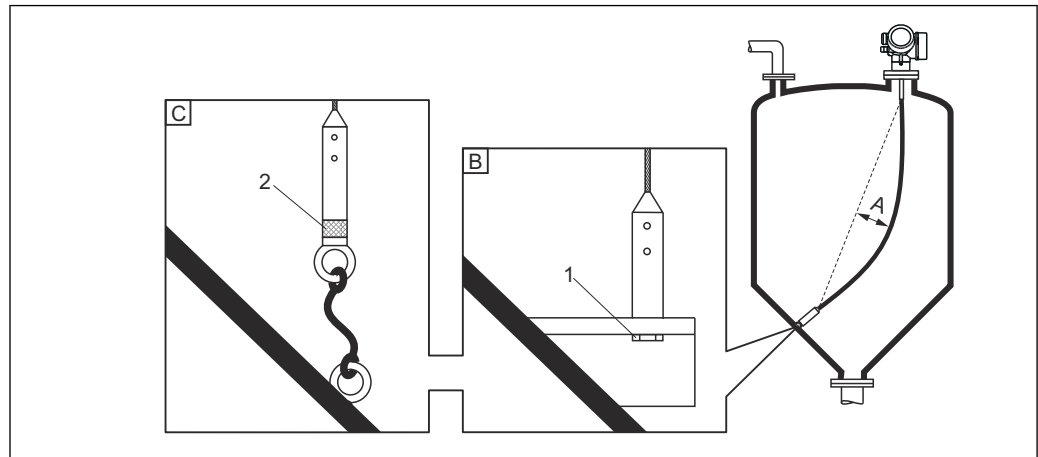
A0012609

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 ≥ 1cm/(1 m rope length) [0.12 inch/(1 ft rope length)].
  Tensile load limit of rope probes: (Verweisziel existiert nicht, aber @y.link.required='true')

Securing rod probes

- For WHG 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.
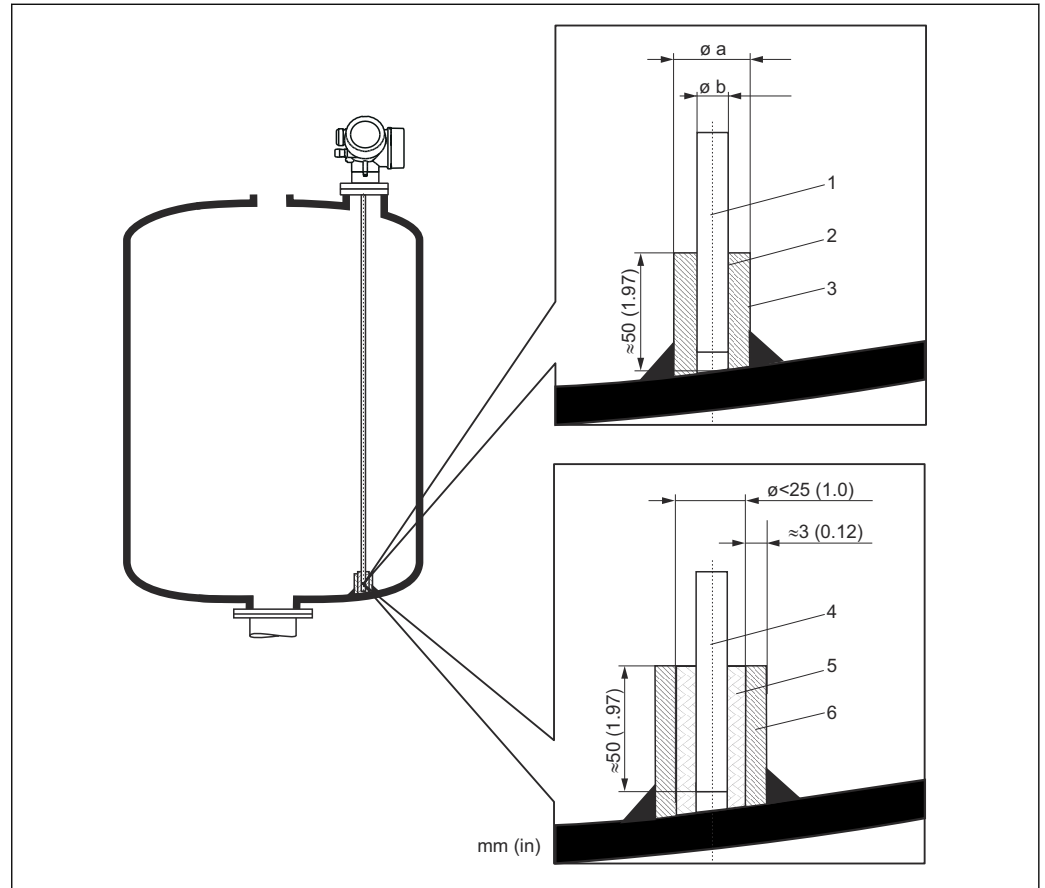
A0012607

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.
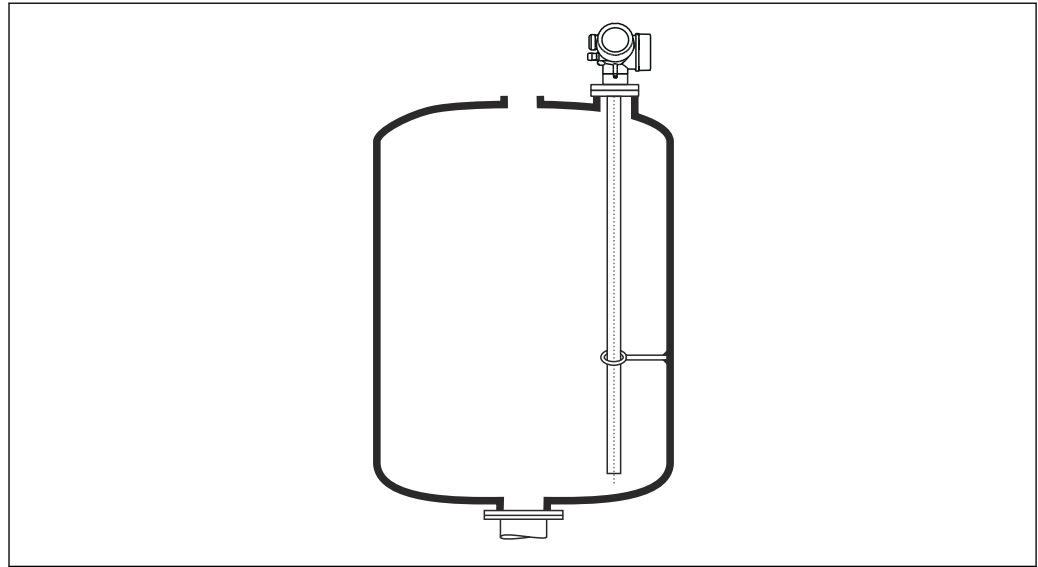
A0012608

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

6.1.6   Special installation situations

Bypasses and stilling wells

ℹ️ In bypass and stilling well applications it is recommended to use a centering disks or stars.

A0012615
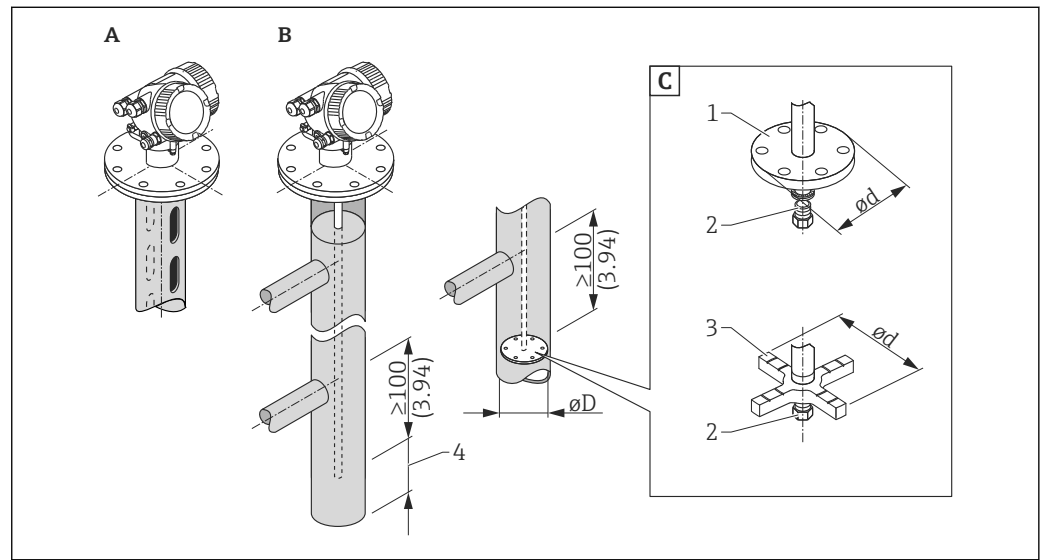
🖼 *6   Dimensions: mm (in)*

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**
			Φ d [mm (in)]	**Material**	**Φ D [mm (in)]**
Level measurement	0A	Rod probe	75 (2,95)	316L	DN80/3" to DN100/4"
	0B	Rod probe	45 (1,77)	316L	DN50/2" to DN65/2½"
	0C	Rope probe	75 (2,95)	316L	DN80/3" to DN100/4"
Level or interface measurement	0D	Rod probe	48...95 (1,89...3,74)	PEEK [1]	≥ 50 mm (2")
	0E	Rod probe	37 (1,46)	PFA [2]	≥ 40 mm (1.57")

1)   Operation temperature: −60 to +250 ℃ (−76 to 482 ℉)
2)   Operation temperature: −200 to +250 ℃ (−328 to +482 ℉)

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

Type of probe	Minimum distance
Rope	10 mm (0.4 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, secure the probe by retaining or tensioning. All rope probes are prepared for tensioning in containers (tensioning weight with anchor hole).
- If a metallic center washer 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.

ℹ️ 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.

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

Horizontal cylindrical and vertical tanks
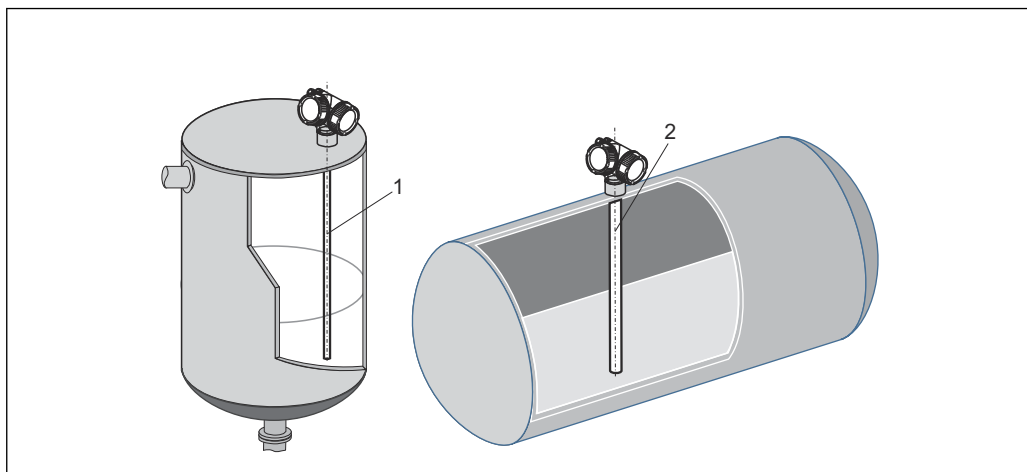
A0014141

• Any distance from wall provided occasional contact is avoided.
• When installing in tanks with many internal fittings or internal fittings situated close to the probe: use a coax prob (1), (2).

Underground tanks
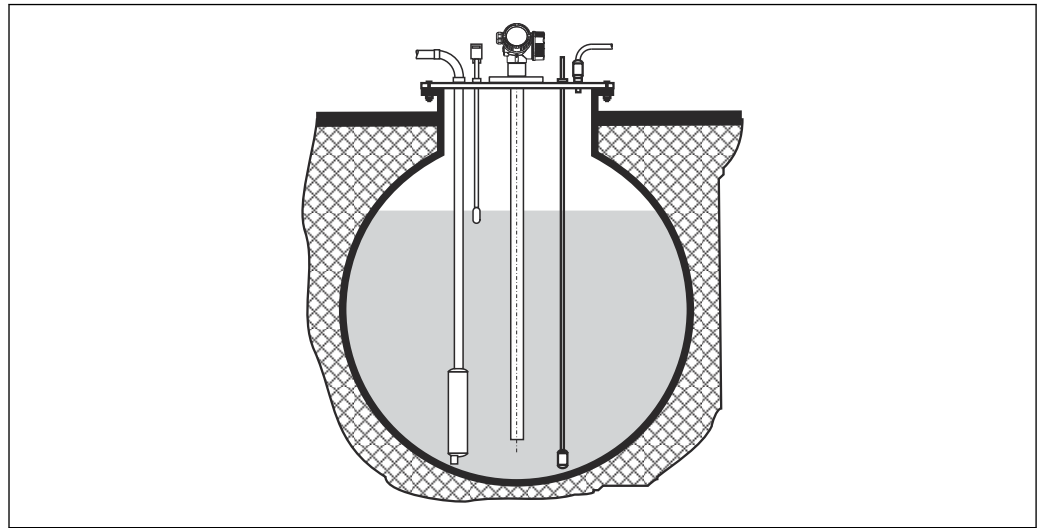
A0014142

In the case of nozzles with large diameters, use a coax probe to avoid reflections at the nozzle wall.

Mounting at an angle
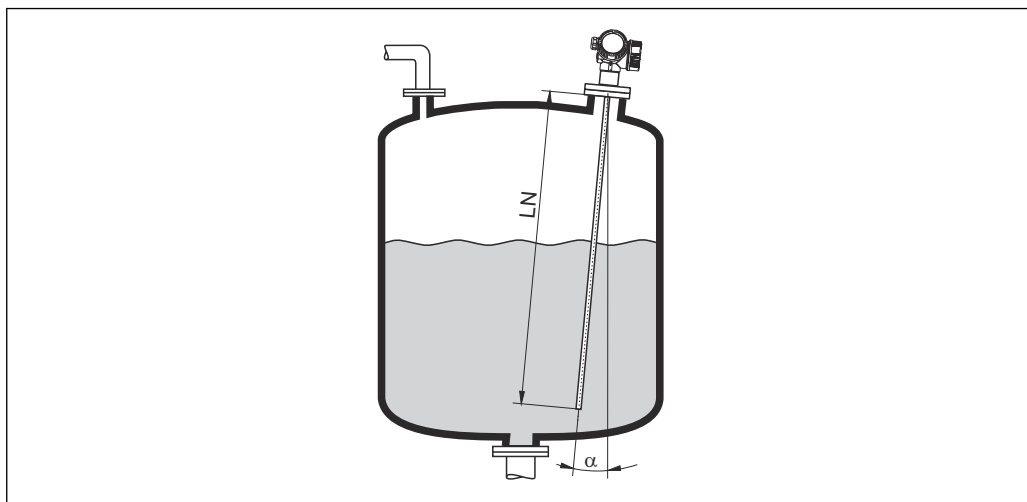
A0014145

- For mechanical reasons, the probe should be installed as vertically as possible.
- If the probe is installed at an angle, the length of the probe must be reduced depending on the angle of installation.
  - Up to LN = 1 m (3.3 ft): α = 30°
  - Up to LN = 2 m (6.6 ft): α = 10°
  - Up to LN = 4 m (13.1 ft): α = 5°

Non-metal vessels
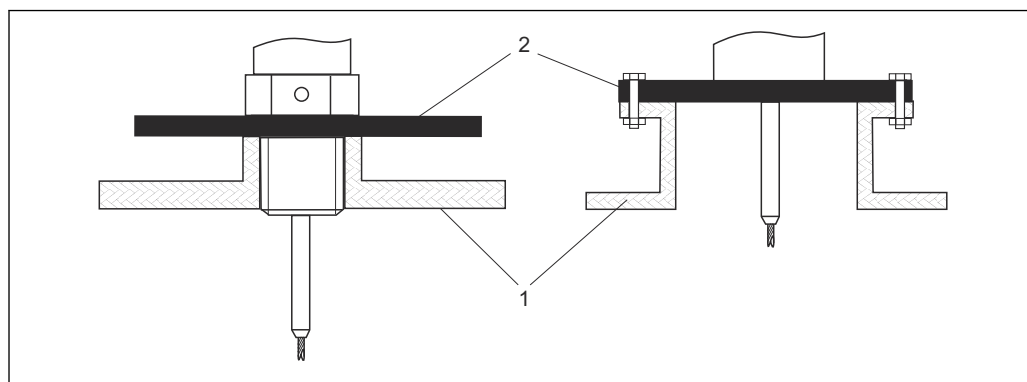
A0012527

1   Non-metal vessel
2   Metal sheet or metal flange

To ensure good measurement results when mounting on non-metal vessels
• Use a device with a metal flange (minimum size DN50/2").
• Alternatively, mount a metal plate with a diameter of at least 200 mm (8 in) at a right angle to the probe at the process connection.

    A metal surface is not required at the process connection in the case of coax probes.

Plastic and glass vessels: Mounting the probe on the outside wall

In the case of plastic and glass vessels, the probe can also be mounted on the outside wall under certain conditions.

A0014150
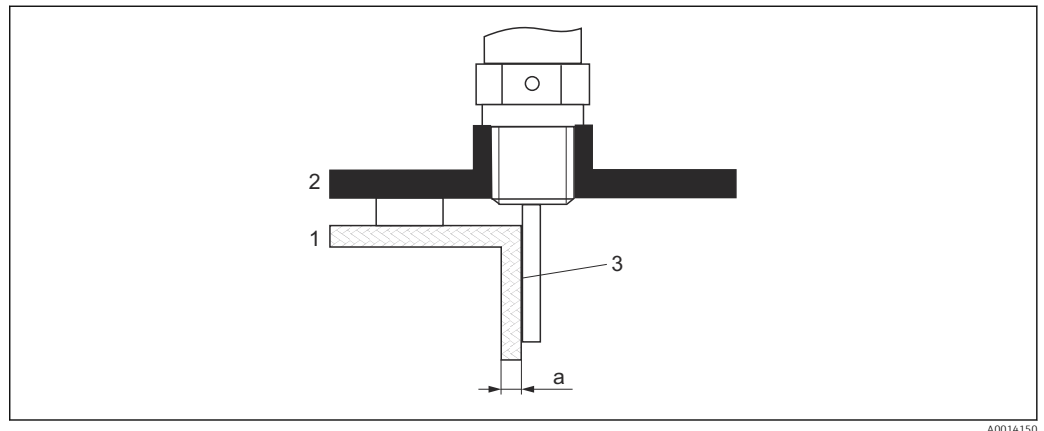
1   Plastic or glass vessel
2   Metal plate with screw-in sleeve
3   No space between vessel wall and probe!

Requirements
- Dielectric constant of the medium: DC > 7.
- Non-conductive vessel wall.
- Maximum wall thickness (a):
  - Plastic: < 15 mm (0.6 in)
  - Glass: < 10 mm (0.4 in)
- No metal reinforcements on the vessel.

Note the following when mounting the device:
- Mount the probe directly on the vessel wall without any space between the wall and probe.
- To prevent any influences on the measurement, mount a plastic half pipe with a minimum diameter of 200 mm (8 in) or a similar protective unit on the probe.
- If the vessel diameter is less than 300 mm (12 in):
  On the opposite side of the vessel, fit a grounding plate that is conductively connected to the process connection and covers around half of the vessel's circumference.
- If the vessel diameter is 300 mm (12 in) or higher:
  Mount a metal plate with a diameter of at least 200 mm (8 in) at a right angle to the probe at the process connection (see above).

Adjustment when mounting on the vessel exterior

When the probe is mounted on the outside of the vessel wall, the speed of propagation of the signal is reduced. There are two ways to compensate for this.

Compensation via gas phase compensation factor

The effect of the dielectric wall is comparable to the effect of a dielectric gas phase and can therefore be corrected in the same way. The correction factor is calculated as the quotient of the actual probe length LN and the probe length measured when the vessel is empty.

The device determines the position of the probe end echo in the differential curve. Therefore, the value of the measured probe length depends on the mapping curve. In order to obtain a more accurate value, it is advisable to determine the measured probe length manually using the envelope curve display in FieldCare.

Step	Parameter	Action
1	Expert → Sensor → Gas phase compensation → GPC mode	Select the **Const. GPC factor** option.
2	Expert → Sensor → Gas phase compensation → Const. GPC factor	Quotient: Enter "(actual probe length)/(measured probe length)".

Compensation via the calibration parameters

If it is necessary to actually compensate for a gas phase, the gas phase compensation function is not available for the correction of external mounting. In this case, the calibration parameters (**Empty calibration** and **Full calibration**) must be adjusted. In addition, a value that is greater than the actual probe length must be entered in the **Present probe length** parameter. In all three cases, the correction factor is the quotient of the probe length measured when the vessel is empty and the actual probe LN.

The device searches for the probe end echo in the differential curve. Therefore, the value of the measured probe length depends on the mapping curve. In order to obtain a more accurate value, it is advisable to determine the measured probe length manually using the envelope curve display in FieldCare.

Step	Parameter	Action
1	Setup → Empty calibration	Increase the parameter value by the factor "(measured probe length)/(actual probe length)".
2	Setup → Full calibration	Increase the parameter value by the factor "(measured probe length)/(actual probe length)".
3	Setup → Advanced setup → Probe settings → Probe length correction → Confirm probe length	Select the **Manual input** option.
4	Setup → Advanced setup → Probe settings → Probe length correction → Present probe length	Enter the measured probe length.

Vessel with thermal insulation

ℹ️ If process temperatures are high, the device must be included in normal vessel insulation (1) in order to prevent the electronics heating up as a result of thermal radiation or convection. The insulation may not go beyond the points labeled "MAX" in the drawings.
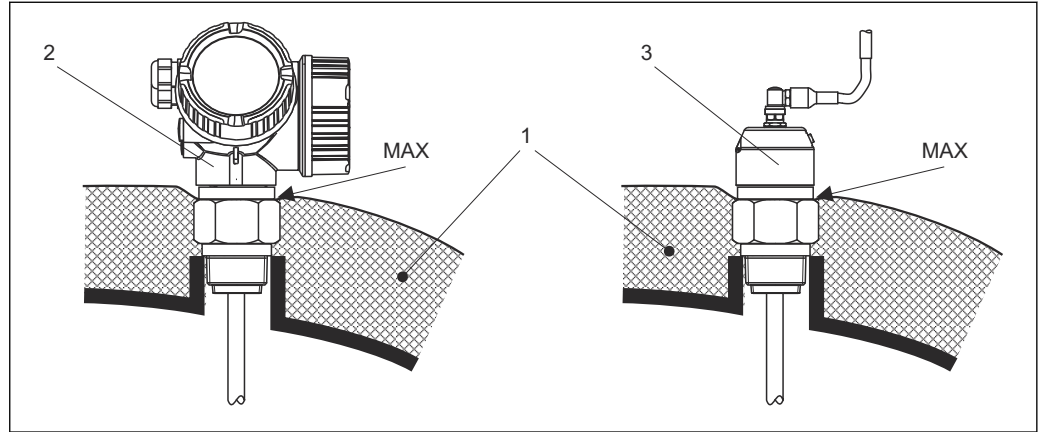
🔲 *7   Process connection with thread - FMP51*

1   Vessel insulation
2   Compact device
3   Sensor remote (feature 600)
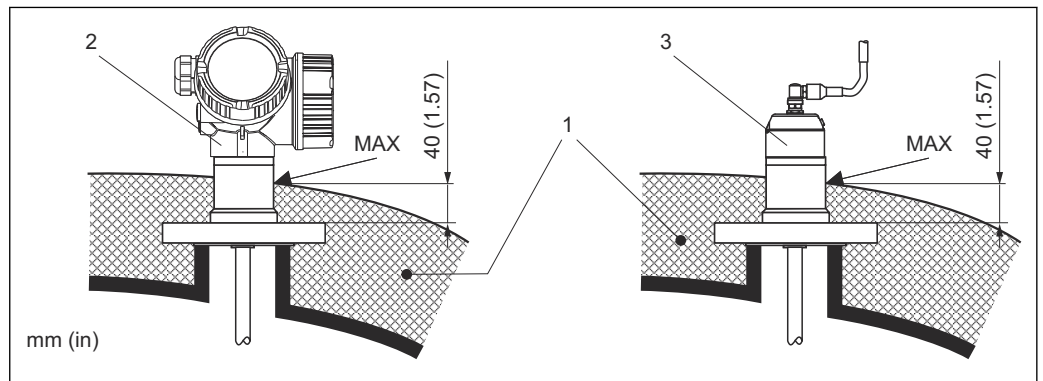
🔲 *8   Process connection with flange - FMP51*

1   Vessel insulation
2   Compact device
3   Sensor remote (feature 600)

6.2   Mounting the measuring device

6.2.1   Required mounting tool

- For threaded connection 3/4": open-ended wrench 36 mm
- For threaded connection 1-1/2": open-ended wrench 55 mm
- To shorten rod or coax probes: use a saw
- To shorten rope probes:
  - Allen screw AF3 (for 4-mm ropes) or AF4 (for 6-mm ropes)
  - Saw or bolt cutters
- For flanges and other process connections: use an appropriate mounting tool
- To turn the housing: use an open-ended wrench 8 mm

6.2.2   Shortening the probe

Shortening rod probes

Rod probes must be shortened if the distance to the vessel floor or outlet cone is less than 10 mm (0.4 in). To shorten, saw off the bottom end of the rod probe.

ℹ️   It is **not** possible to shorten FMP52 rod probes due to their coating.

Shortening rope probes

Rope probes must be shortened if the distance to the vessel floor or outlet cone is less than 150 mm (6 in).
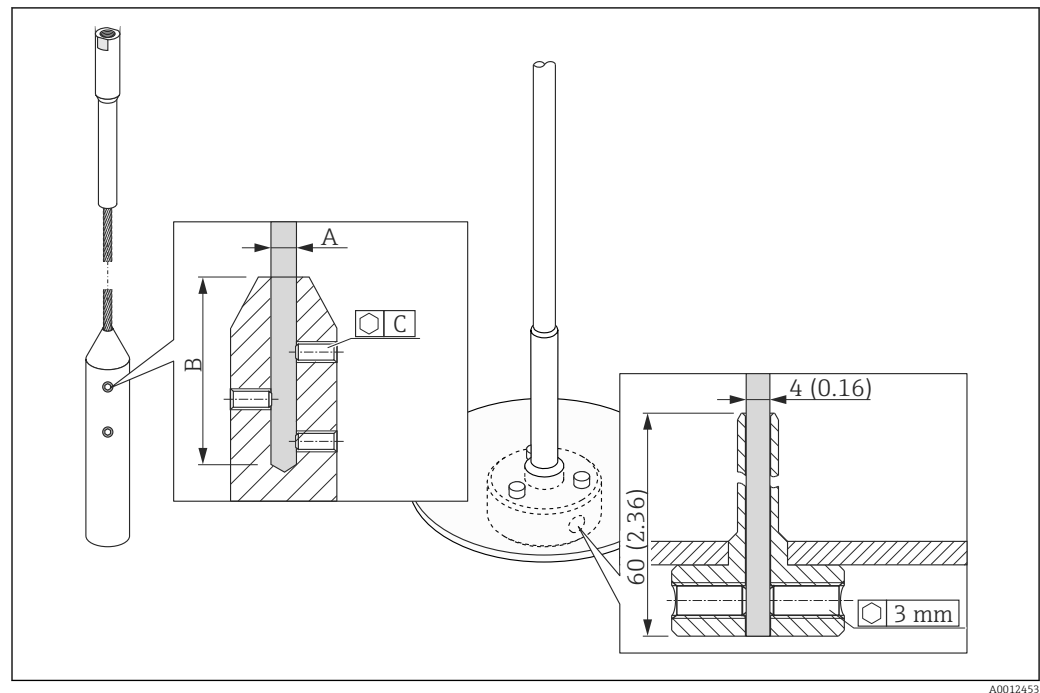
Rope material	A	B	C	Torque of setscrews
316	4 mm (0.16 in)	40 mm (1.6 in)	3 mm	5 Nm (3.69 lbf ft)

1. Using the Allen key, loosen the setscrews on the rope weight or on the fastener for the centering disk. Note: The setscrews have a clamping coating in order to prevent them from becoming loose accidentally. A higher torque is therefore required to loosen the screws.

2. Remove the released rope from the weight or from the sleeve.

3. Measure off the new rope length.

4. At the point to be shortened, wrap adhesive tape around the rope to prevent it from fraying.

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 setscrews back into place. Due to the clamping coating of the setscrews, it is not necessary to apply a locking compound.

Shortening coax probes

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

Coax probes can be shortened by a maximum of 80 mm (3.2 in) from below. They have centering devices on the inside to secure the rod centrally in the pipe. A raised edge holds the centering devices in place on the rod. It is possible to shorten the probe up to approx. 10 mm (0.4 in) below the centering device.

To shorten, saw off the bottom end of the coax probe.

Entering the new probe length

After shortening the probe:

1. Switch to the **Probe settings** submenu and perform a probe length correction.

2.

A0014241
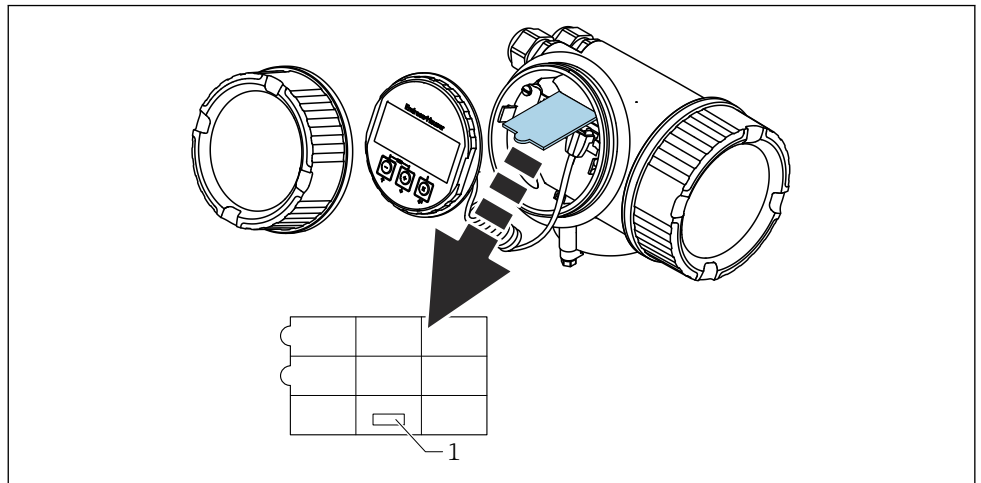
1   Field for the new probe length

For documentation purposes, enter the new probe length into the quick reference guide which can be found in the electronics housing behind the display module.

6.2.3 Mounting the device

Mounting devices with a threaded connection
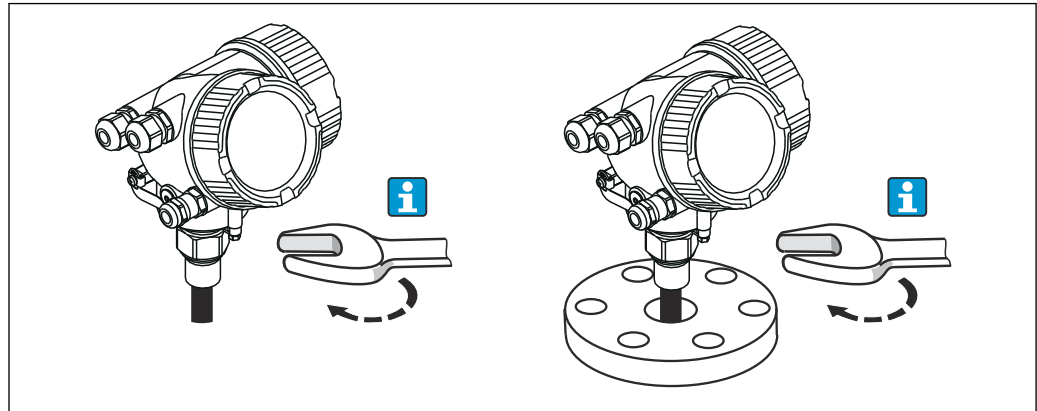
A0012528

Screw the device with the threaded connection into a sleeve or flange and then secure it to the process vessel via the sleeve/flange.

- When screwing into place, turn by the hex bolt only:
  - Thread 3/4": open-ended wrench 36 mm
  - Thread 1-1/2": open-ended wrench 55 mm
- Maximum permissible tightening torque:
  - Thread 3/4": 45 Nm
  - Thread 1-1/2": 450 Nm
- Recommended torque if using the enclosed aramid fiber seal and 40 bar process pressure:
  - Thread 3/4": 25 Nm
  - Thread 1-1/2": 140 Nm
- When installing in metal vessels, ensure there is good metal contact between the process connection and the vessel.

Mounting devices with a flange

If a seal is used to mount the device, use uncoated metal screws to ensure good electrical contact between the process flange and the probe flange.

Mounting rope probes

NOTICE

Electrostatic discharge can damage the electronics.

▶ Ground the housing before lowering the rope probe into the vessel.
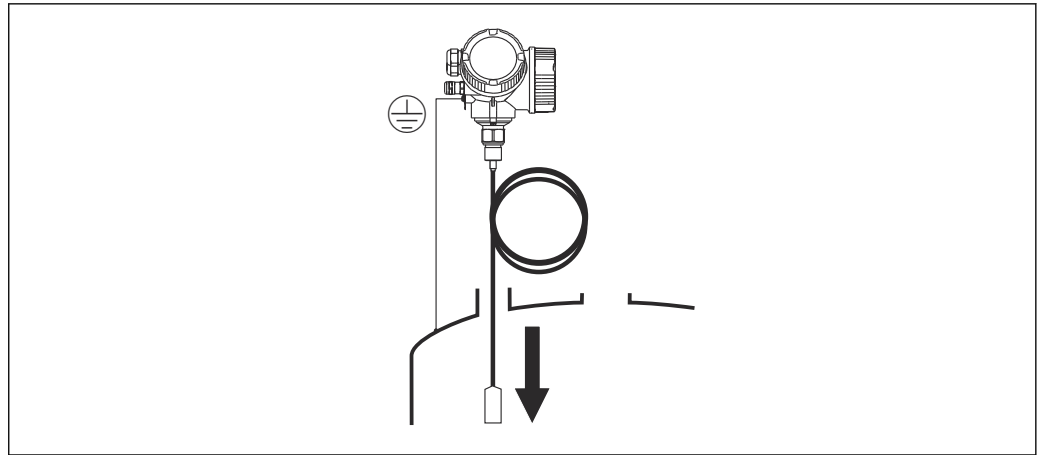
A0012852

Pay attention to the following when introducing the rope probe into the vessel:

• Uncoil the rope slowly and lower it carefully into the vessel.
• Make sure the rope does not bend or buckle.
• Avoid uncontrolled swinging of the weight, as this could damage internal fittings in the vessel.

6.2.4   Mounting the "Sensor, remote" version

This section only applies for devices with the version "Probe design" = "Sensor, remote" (feature 600, version MB/MC/MD).

The following is included in the delivery with the version "Probe design" = "Remote":

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

⚠ CAUTION

Mechanical stress can damage the plugs of the connection cable or cause them to become loose.
▶ Mount the probe and the electronics housing securely before connecting the connecting cable.
▶ Lay the connecting cable in such a way that it is not exposed to mechanical stress. Minimum bending radius: 100 mm (4").
▶ When connecting the cable, connect the straight plug before you connect the angled plug. Torque for the thread adapter nut of both plugs: 6 Nm.

The probe, electronics and connection cable are mutually compatible and bear a common serial number. Only components with the same serial number may be connected to one another.

In the event of strong vibrations, a locking compound, e.g. Loctite 243, can also be used on the plug-in connectors.

Mounting the electronics housing
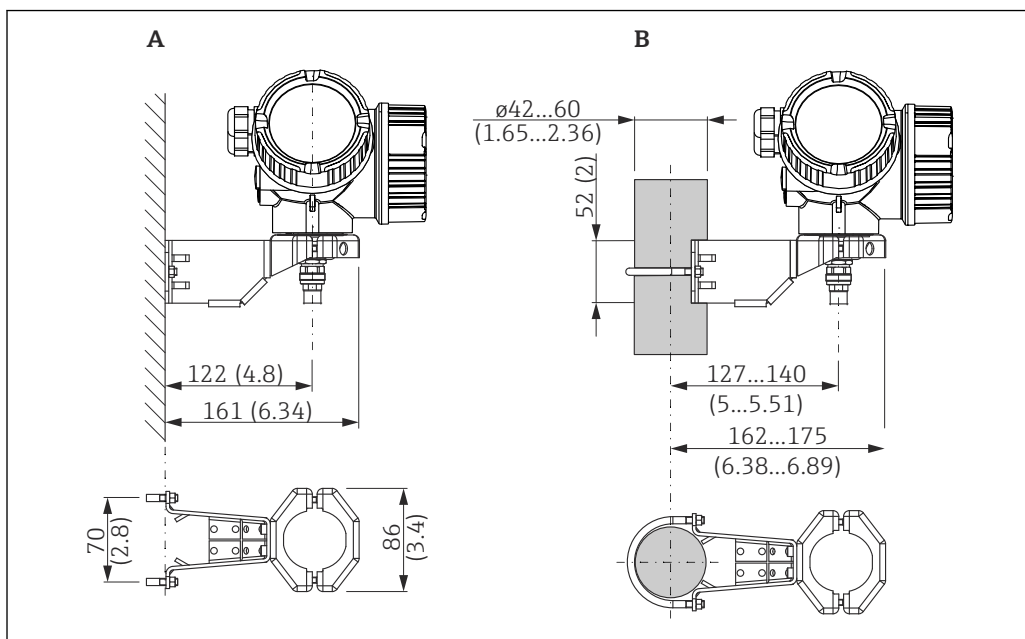
🖾 9 *Mounting the electronics housing with the mounting bracket; engineering unit: mm (in)*

A   Wall mounting
B   Post mounting

Connecting the connecting cable

Required tools:
Open-ended wrench AF18
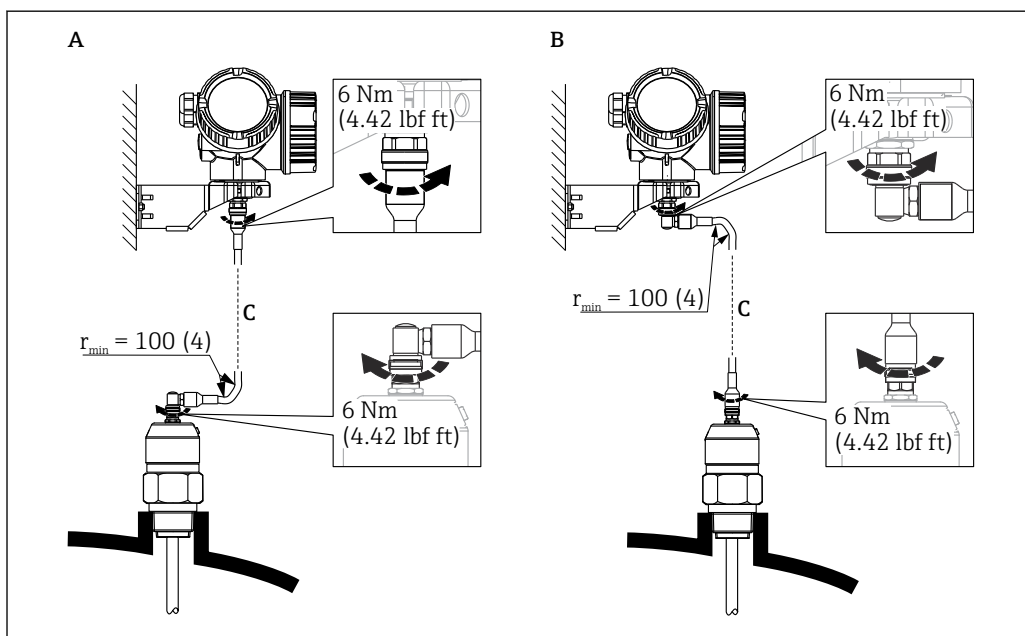
🖾 10 *Connecting the connecting cable. The cable can be connected in the following ways:*

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:
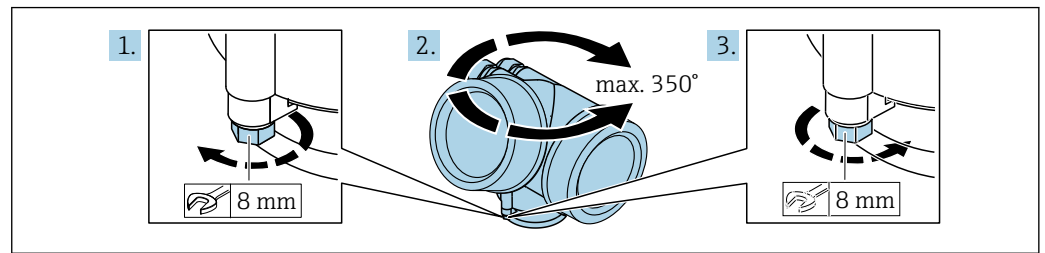
1. Unscrew the securing screw using an open-ended wrench.

2. Rotate the housing in the desired direction.

3. Tighten the securing screw (1.5 Nm for plastic housing; 2.5 Nm for aluminum or stainless steel housing).

6.2.6   Turning the display

Opening the cover
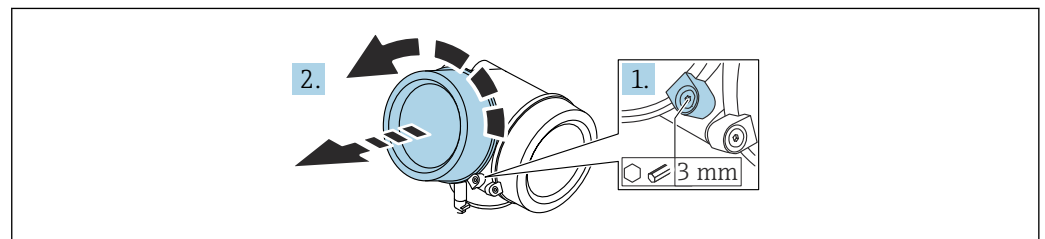
1. Loosen the screw of the securing clamp of the electronics compartment cover using an Allen key (3 mm) and turn the clamp 90 ˚ counterclockwise.

2. Unscrew the electronics compartment cover and check the cover seal; replace it if necessary.

Turning the display module
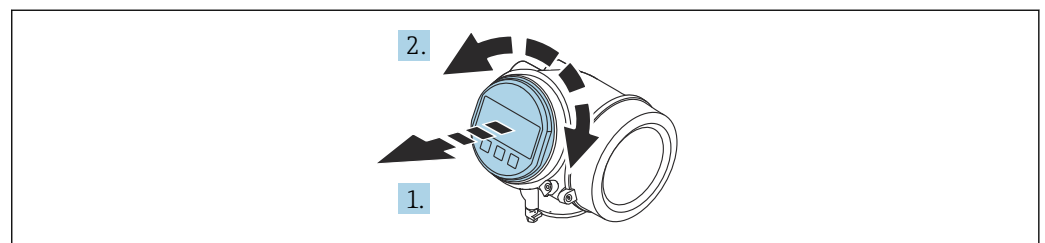
1. Pull out the display module with a gentle rotational movement.

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.

Closing the cover of the electronics compartment

A0021451
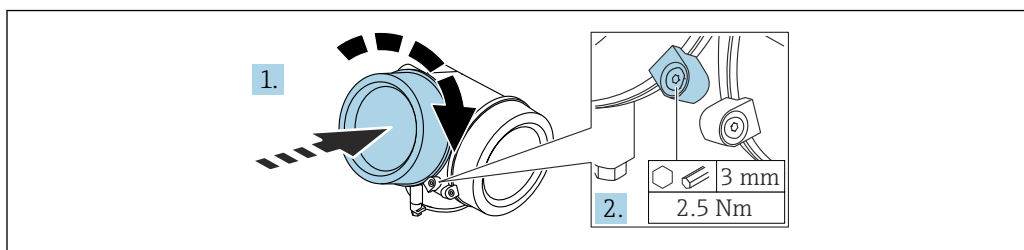
1. Screw down the cover of the electronics compartment.

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.

6.3   Post-mounting check

❍	Is the device undamaged (visual inspection)?
❍	Does the device meet the measuring point specifications? For example: • Process temperature • Process pressure • Ambient temperature • Measuring range
❍	Are the measuring point identification and labeling correct (visual inspection)?
❍	Is the device adequately protected from precipitation and direct sunlight?
❍	Are the securing screw and securing clamp tightened securely?

7   Electrical connection

7.1   Connecting requirements

7.1.1   Terminal assignment

Modbus

Connection to a Modbus master

A0035159
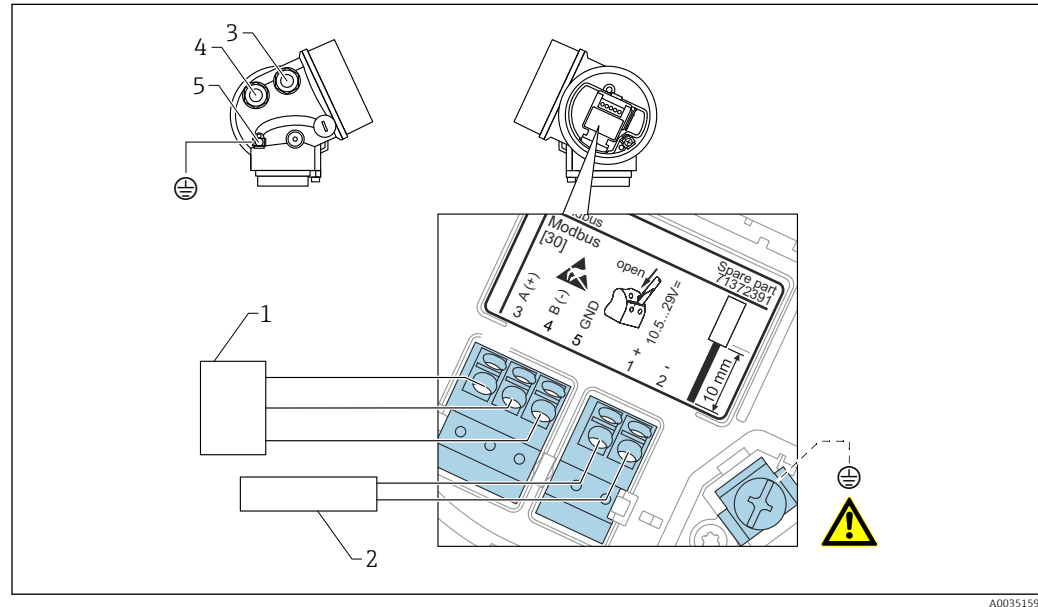
1   Modbus master
2   Supply voltage
3   Cable entry for the Modbus connection
4   Cable entry for the supply voltage
5   Connection for protective ground

Connection to FieldCare/DeviceCare via RS485

For configuration via FieldCare or DeviceCare, it is advisable to disconnect the device from the bus and to connect it to the computer via a USB-to-RS485 interface.

A0035158

1   Computer with FieldCare/DeviceCare
2   USB-RS485 interface
3   Supply voltage
4   Cable entry for RS485
5   Cable entry for the supply voltage
6   Connection for protective ground
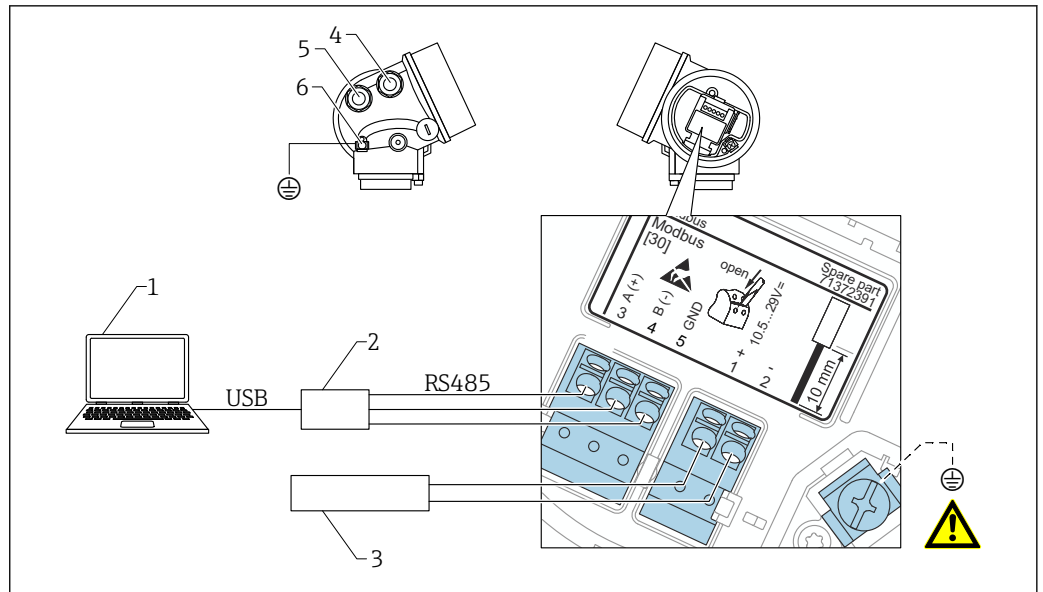
Connection to DeviceCare/FieldCare via service interface

A0032466

1   Service interface (CDI) of the measuring device (= Endress+Hauser Common Data Interface)
2   Commubox FXA291
3   Computer with DeviceCare/FieldCare operating tool
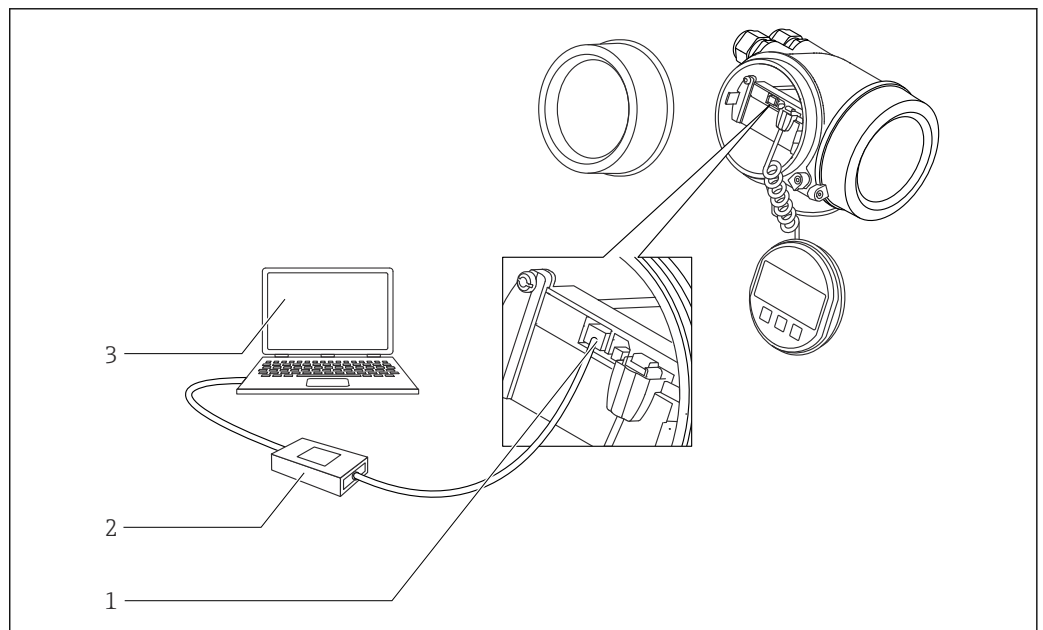
7.1.2   Cable specification

- Power line: Standard device cable
- Modbus connection : A shielded cable is recommended. Observe grounding concept of the plant.

7.1.3   Power supply

Supply voltage	10.5 to 29 V_{DC}
Ripple	1 V_{SS} (< 100 Hz); 10 mV_{SS} (> 100 Hz)

7.1.4   Overvoltage protection

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

External overvoltage protection module

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

7.1.5   Output signal

Physical interface	RS485 in accordance with EIA/TIA-485 standard
Terminating resistor	Not integrated

7.1.6   Protocol-specific data

Protocol	• Modbus RTU • Level Master
Response times	• Direct data access: typically 25 to 50 ms • Auto-scan buffer (data range): typically 3 to 5 ms
Device type	Slave
Slave address range	1 to 63
Function codes	• 03: Read holding register • 04: Read input register
Baud rate	Automatic baud rate detection
Parity	Automatic parity detection
Data transmission mode	RTU

7.2   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.
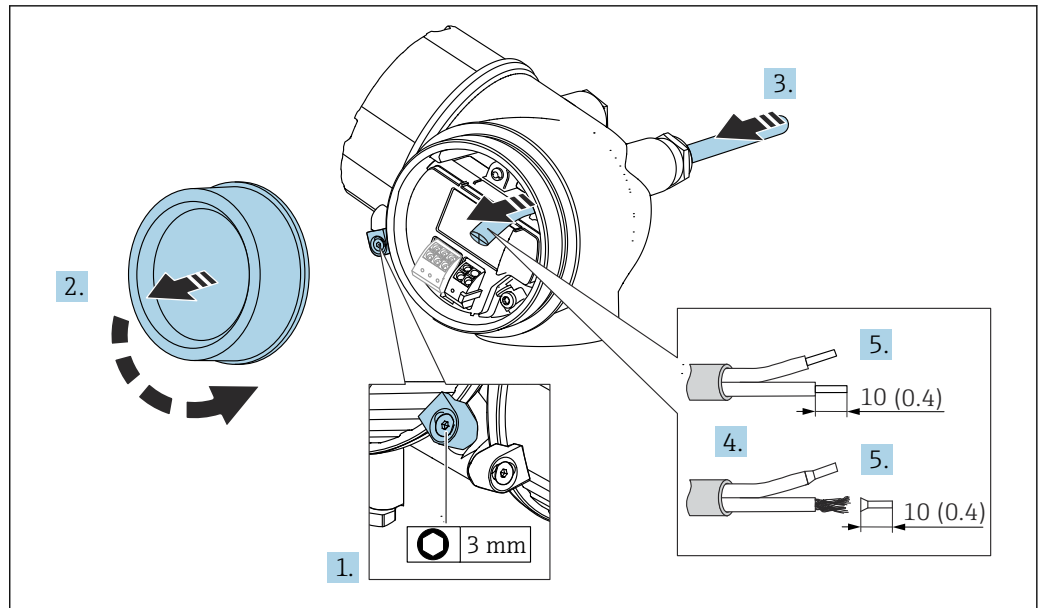
⊠ *11   Engineering unit: mm (in)*

1. Loosen the screw of the securing clamp on the connection compartment cover and turn the securing clamp 90° counterclockwise.

2. Unscrew the connection compartment cover.

3. Push the cable through the cable entry. To ensure tight sealing, do not remove the sealing ring from the cable entry.

4. Remove the cable sheath.

5. Strip the cable ends 10 mm (0.4 in). In the case of stranded cables, also fit ferrules.

6. Firmly tighten the cable glands.

7.
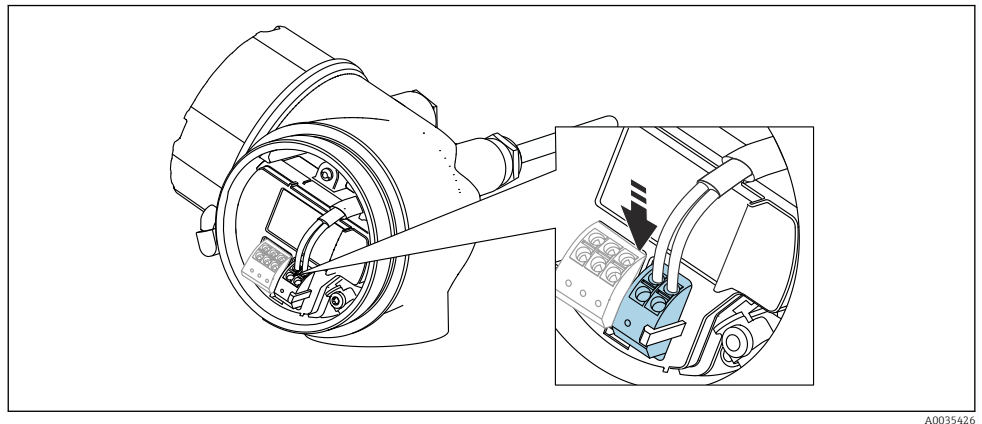
Connect the cable according to the terminal assignment → ⊟ 48.

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

9. Fit the cover of the connection compartment back on.

10. If present, turn the cover lock so that it is located over the edge of the cover and then tighten.

7.2.1   Plug-in spring-force terminals

The electrical connection of device versions without an integrated overvoltage protection is established at 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.
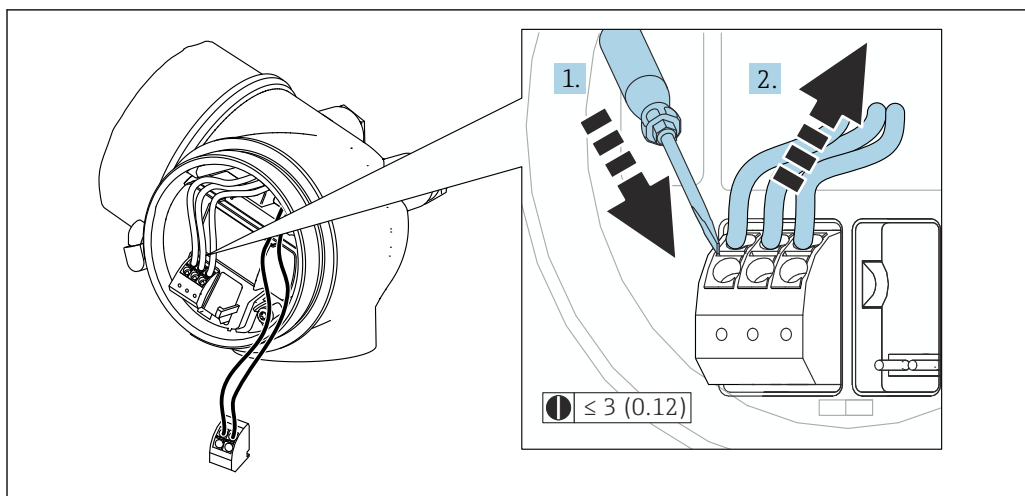
⊡ *12 Engineering unit: mm (in)*

To remove cables from the terminal:

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.
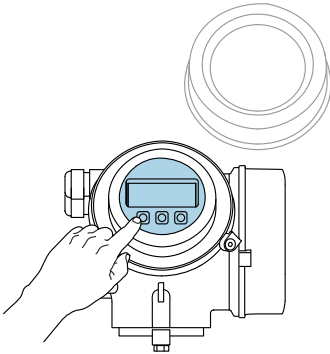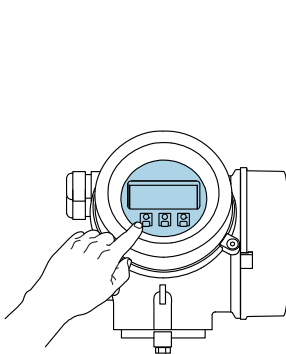
7.3   Post-connection check

❑	Is the device or cable undamaged (visual check)?
❑	Do the cables comply with the requirements ?
❑	Do the cables have adequate strain relief?
❑	Are all cable glands installed, securely tightened and leak-tight?
❑	Does the supply voltage match the specifications on the nameplate?
❑	Is the terminal assignment correct → 🕮 48?
❑	If required: Has protective ground connection been established ?
❑	If supply voltage is present, is the device ready for operation and do values appear on the display module?
❑	Are all housing covers installed and securely tightened?
❑	Is the securing clamp tightened correctly?

8 Operation options

8.1 Overview

8.1.1 Local operation

Operation with	*Pushbuttons*	*Touch Control*
Order code for "Display; Operation"	Option **C** "SD02"	Option **E** "SD03"
Display elements	4-line display	4-line display white background lighting; switches to red in event of device error
	Format for displaying measured variables and status variables can be individually configured	
	Permitted ambient temperature for the display: −20 to +70 ℃ (−4 to +158 ℉) The readability of the display may be impaired at temperatures outside the temperature range.	
Operating elements	local operation with 3 push buttons (⊞, ⊟, �E)	external operation via touch control; 3 optical keys: ⊞, ⊟, E
	Operating elements also accessible in various hazardous areas	
Additional functionality	Data backup function The device configuration can be saved in the display module.	
	Data comparison function The device configuration saved in the display module can be compared to the current device configuration.	
	Data transfer function The transmitter configuration can be transmitted to another device using the display module.	

8.1.2   Operation with remote display and operating module FHX50
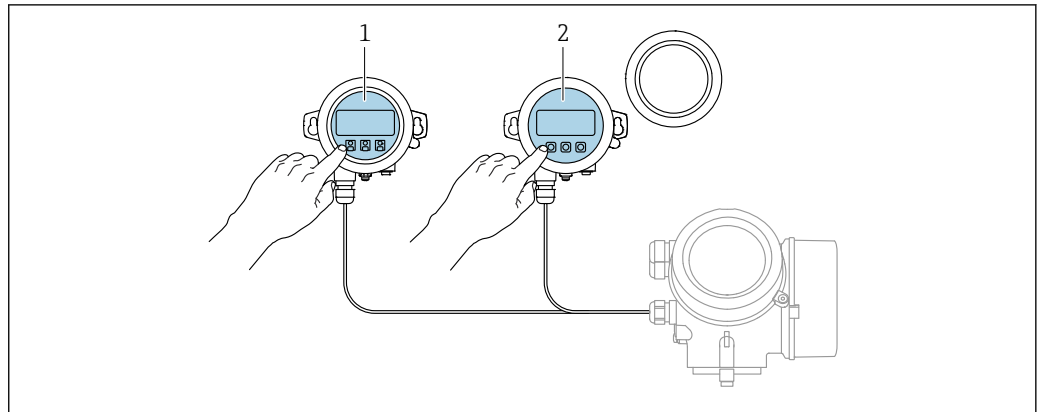
🖼 13   FHX50 operating options

1   Display and operating module SD03, optical keys; can be operated through the glass of the cover
2   Display and operating module SD02, push buttons; cover must be removed

8.1.3   Remote operation

Via service interface (CDI)
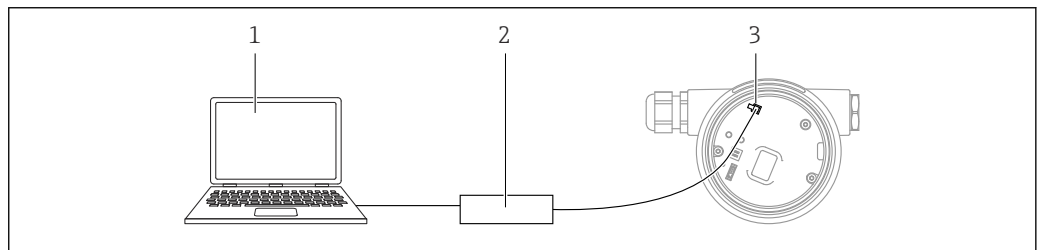
1   Computer with FieldCare/DeviceCare operating tool
2   Commubox FXA291
3   Service interface (CDI) of the measuring device (= Endress+Hauser Common Data Interface)

8.2   Structure and function of the operating menu

8.2.1   Structure of the operating menu

Menu	Submenu / parameter	Meaning
	Language [1]	Defines the operating language of the local display
Commissioning [2]		Launches the interactive wizard for guided commissioning. Additional settings generally do not need to be made in the other menus when the wizard is finished.
Setup	Parameter 1 ... Parameter N	Once values have been set for these parameters, the measurement should generally be completely configured.
	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	**Diagnostic list**	Contains up to 5 currently active error messages.
	Event logbook [3]	Contains the last 20 messages (which are no longer active).
	Device information	Contains information for identifying the device.
	Measured values	Contains all current measured values.
	Data logging	Contains the history of the individual measuring values.
	Simulation	Is used to simulate measured values or output values.
	Device check	Contains all parameters needed to check the measurement capability of the device.
	Heartbeat [4]	Contains all the wizards for the **Heartbeat Verification** and **Heartbeat Monitoring** application packages.
Expert [5] Contains all the parameters of the device (including those that are already contained in one of the other menus). This menu is organized according to the function blocks of the device. The parameters of the Expert menu are described in: GP01140F (Modbus)	**System**	Contains all higher-level device parameters that do not pertain either to the measurement or to measured value communication.
	Sensor	Contains all the parameters to configure the measurement.
	Output	Contains all the parameters to configure the switch output (PFS)

Menu	Submenu / parameter	Meaning
	Communication	Contains all the parameters to configure the digital communication interface (HART, PROFIBUS PA, FOUNDATION Fieldbus or Modbus).
	Diagnostics	Contains all the parameters to detect and analyze operational errors.

1) If you are operating via operating tools (e.g. FieldCare), the "Language" parameter is located under "Setup → Advanced setup → Display"
2) Only if operating via an FDT/DTM system
3) Only available if operating via the local display
4) Only available if operating via DeviceCare or FieldCare
5) When you call up the "Expert" menu, you are always asked for an access code. If a customer-specific access code has not been defined, "0000" must be entered.

8.2.2   User roles and related access authorization

The two user roles **Operator** and **Maintenance** have different write access to the parameters if a device-specific access code has been defined. This protects the device configuration via the local display from unauthorized access → 🖹 59.

Access authorization to parameters

User role	Read access		Write access	
	Without access code (from the factory)	With access code	Without access code (from the factory)	With access code
Operator	✔	✔	✔	--
Maintenance	✔	✔	✔	✔

If an incorrect access code is entered, the user obtains the access rights of the **Operator** role.

ℹ️ The user role with which the user is currently logged on is indicated by the **Access status display** parameter (if operating via the local display) or **Access status tooling** parameter (if operating via the operating tool).

8.2.3   Write protection via access code

Using the device-specific access code, the parameters for the measuring device configuration are write-protected and their values can no longer be changed via local operation.

Defining the access code via the local display

1. Navigate to: Setup → Advanced setup → Administration → Define access code → Define access code

2. Define a max. 4-digit numeric code as an access code.

3. Repeat the numeric code in the **Confirm access code** parameter to confirm it.
   ↳ The ⊠-symbol appears in front of all write-protected parameters.

Defining the access code via the operating tool (e.g. FieldCare)

1. Navigate to: Setup → Advanced setup → Administration → Define access code

2. Define a max. 4-digit numeric code as an access code.
   ↳ Write protection is active.

Parameters that can always be changed

The write protection does not include certain parameters that do not affect the measurement. Despite the defined access code, these parameters can always be modified even if the other parameters are locked.

The device automatically locks the write-protected parameters again if a key is not pressed for 10 minutes in the navigation and editing view. If the user goes from the navigation and editing mode back to the measured value display mode, the device automatically locks the write-protected parameters after 60 s.

> - If write access is activated via an access code, it can be only be deactivated again via this access code → 🖺 60.
> - In the "Description of Device Parameters" documents, each write-protected parameter is identified with the ⊠-symbol.

8.2.4   Disabling write protection via access code

If the ⌧ symbol appears in front of a parameter on the local display, the parameter is write-protected by a device-specific access code and its value cannot currently be changed via the local display → 🗎 59.

The locking of the write access via local operation can be disabled by entering the device-specific access code.

1. After you press 🗉, the input prompt for the access code appears.

2. Enter the access code.
    ↳ The ⌧-symbol in front of the parameters disappears; all previously write-protected parameters are now re-enabled.

8.2.5   Deactivation of the write protection via access code

Via local display

1. Navigate to: Setup → Advanced setup → Administration → Define access code → Define access code

2. Enter **0000**.

3. Repeat **0000** in the **Confirm access code** parameter to confirm.
    ↳ The write protection is deactivated. Parameters can be changed without entering an access code.

Via an operating tool (e.g. FieldCare)

1. Navigate to: Setup → Advanced setup → Administration → Define access code

2. Enter **0000**.
    ↳ The write protection is deactivated. Parameters can be changed without entering an access code.

8.2.6   Write protection via write protection switch

Unlike parameter write protection via a user-specific access code, this allows the user to lock write access to the entire operating menu - apart from the **"Contrast display" parameter**.

The parameter values are now read only and cannot be edited any more (exception **"Contrast display" parameter**):
• Via local display
• Via MODBUS RS485 protocol

1. Loosen the securing clamp.

2. Unscrew the electronics compartment cover.

3. Pull out the display module with a gentle rotational movement. To make it easier to access the write protection switch, attach the display module to the edge of the electronics compartment.
    ↳ Display module is attached to the edge of the electronics compartment.
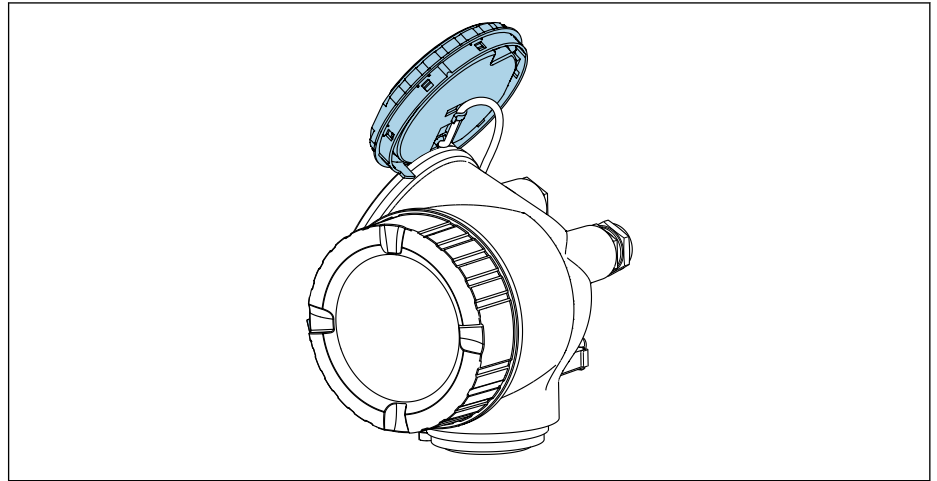
A0032236

4. Setting the write protection switch (WP) on the main electronics module to the **ON** position enables hardware write protection. Setting the write protection switch (WP) on the main electronics module to the **OFF** position (factory setting) disables hardware write protection.
    ↳ If the hardware write protection is enabled: The **Hardware locked** option is displayed in the **Locking status** parameter. In addition, on the local display the ⊠ symbol appears in front of the parameters in the header of the operational display and in the navigation view.
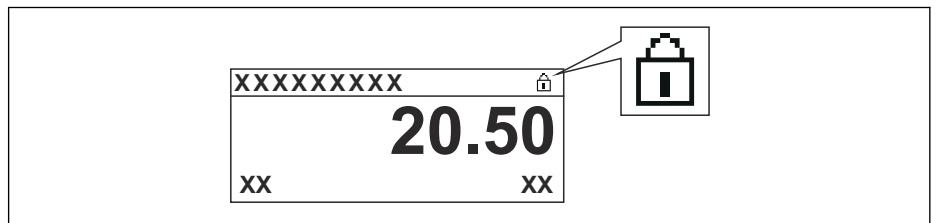
A0015870

    If hardware write protection is disabled: No option is displayed in the **Locking status** parameter. On the local display, the ⊠ symbol disappears from in front of the parameters in the header of the operational display and in the navigation view.

5. Feed the cable into the gap between the housing and main electronics module and plug the display module into the electronics compartment in the desired direction until it engages.

6. Reverse the removal procedure to reassemble the transmitter.

8.2.7 Enabling and disabling the keypad lock

Access to the entire operating menu via local operation can be locked via the keypad lock. When access is locked, it is no longer possible to navigate through the operating menu or change the values of individual parameters. Users can only read the measured values on the operational display.

The keypad lock is switched on and off via a context menu.

Switching on the keypad lock

ℹ️ SD03 display module only
The keypad lock is switched on automatically:
- If the device has not been operated via the display for > 1 minute.
- Each time the device is restarted.

Switching on the keypad lock manually

1. The device is in the measured value display.
   Press Ⓔ for at least 2 seconds.
   ↳ A context menu appears.

2. In the context menu select the **Keylock on** option.
   ↳ The keypad lock is switched on.

ℹ️ If the user attempts to access the operating menu while the keypad lock is active, the message **Keylock on** appears.

Switching off the keypad lock

1. The keypad lock is switched on.
   Press Ⓔ for at least 2 seconds.
   ↳ A context menu appears.

2. In the context menu select the **Keylock off** option.
   ↳ The keypad lock is switched off.

8.3   Display and operating module

8.3.1   Display
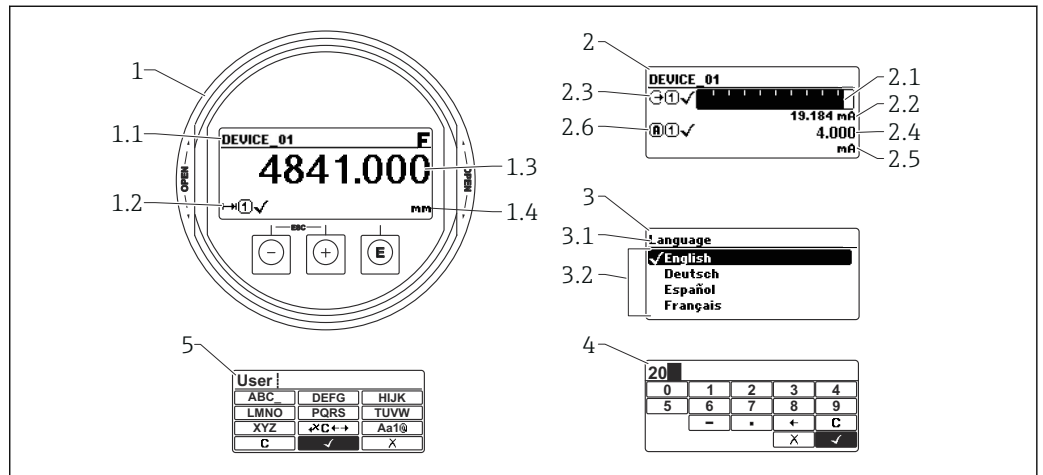
A0012635

🖾 *14   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   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   Parameter display (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

Display symbols for the submenus

Symbol	Meaning
A0018367	**Display/operat.** Is displayed: • In the main menu next to the "Display/operat." selection • In the header on the left in the "Display/operat." menu
A0018364	**Setup** Is displayed: • In the main menu next to the "Setup" selection • In the header on the left in the "Setup" menu
A0018365	**Expert** Is displayed: • In the main menu next to the "Expert" selection • In the header on the left in the "Expert" menu
A0018366	**Diagnostics** Is displayed: • In the main menu next to the "Diagnostics" selection • In the header on the left in the "Diagnostics" menu

Status signals

Symbol	Meaning
F A0032902	**"Failure"** A device error has occurred. The measured value is no longer valid.
C A0032903	**"Function check"** The device is in the service mode (e.g. during a simulation).
S A0032904	**"Out of specification"** The device is operated: • Outside of its technical specifications (e.g. during startup or a cleaning) • Outside of the configuration performed by the user (e.g. level outside the configured range)
M A0032905	**"Maintenance required"** Maintenance is required. The measured value is still valid.

Display symbols for locking status

Symbol	Meaning
A0013148	**Read-only parameter** The parameter shown is only for display purposes and cannot be edited.
A0013150	**Device locked** • In front of a parameter name: The device is locked via software and/or hardware. • In the header of the measured value screen: The device is locked via hardware.

Measured value symbols

Symbol	Meaning
Measured values	
Level	Level
Distance	Distance
Current output	Current output
Measured current	Measured current
Terminal voltage	Terminal voltage
Electronics or sensor temperature	Electronics or sensor temperature
Measuring channels	
Measuring channel 1	Measuring channel 1
Measuring channel 2	Measuring channel 2
Status of the measured value	
"Alarm" status	**"Alarm" status** The measurement is interrupted. The output assumes the defined alarm condition. A diagnostic message is generated.
"Warning" status	**"Warning" status** The device continues to measure. A diagnostic message is generated.

8.3.2   Operating elements

Key	Meaning
⊟ A0018330	**Minus key** *In a menu, submenu* Moves the selection bar upwards in a picklist. *In the text and numeric editor* In the input mask, moves the selection bar to the left (backwards).
⊞ A0018329	**Plus key** *In a menu, submenu* Moves the selection bar downwards in a picklist. *In the text and numeric editor* In the input mask, moves the selection bar to the right (forwards).

Ⓔ
 A0018328
	Enter key
	
	 For measured value display
	 • Pressing the key briefly opens the operating menu.
	 • Pressing the key for 2 s opens the context menu.
	
	 In a 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 the text and numeric editor
	 • Pressing the key briefly:
	   • Opens the selected group.
	   • Carries out the selected action.
	 • Pressing the key for 2 s confirms the edited parameter value.

⊟ + ⊞
 A0032909
	Escape key combination (press keys simultaneously)
	
	 In a 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 the text and numeric editor
	 Closes the text or numeric editor without applying changes.

⊟ + Ⓔ A0032910	**Minus/Enter key combination (press and hold down the keys simultaneously)** Reduces the contrast (brighter setting).
⊞ + Ⓔ A0032911	**Plus/Enter key combination (press and hold down the keys simultaneously)** Increases the contrast (darker setting).

8.3.3   Entering numbers and text

Numeric editor	Text editor

1   Editing view
2   Display area of the entered values
3   Input mask
4   Operating elements

Input mask

The following input and operating symbols are available in the input mask of the numeric and text editor:

Numeric editor

Symbol	Meaning
0 ... **9**	Selection of numbers from 0 to 9.
.	Inserts decimal separator at the cursor position.
−	Inserts minus sign at the cursor position.
✓	Confirms selection.
←	Moves the input position one position to the left.
✗	Exits the input without applying the changes.
C	Clears all entered characters.

Text editor

Symbol	Meaning
ABC_ ... **XYZ**	Selection of letters from A to Z

Aa1⌀ A0013981	Toggle • Between upper-case and lower-case letters • For entering numbers • For entering special characters
✓ A0013985	Confirms selection.
✗C←→ A0013987	Switches to the selection of the correction tools.
✗ A0013986	Exits the input without applying the changes.
C A0014040	Clears all entered characters.

Text correction under ✗C←→

Symbol	Meaning
C A0032907	Clears all entered characters.
→ A0018324	Moves the input position one position to the right.
← A0018326	Moves the input position one position to the left.
✗ A0032906	Deletes one character immediately to the left of the input position.

8.3.4   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.

<small>A0037872</small>
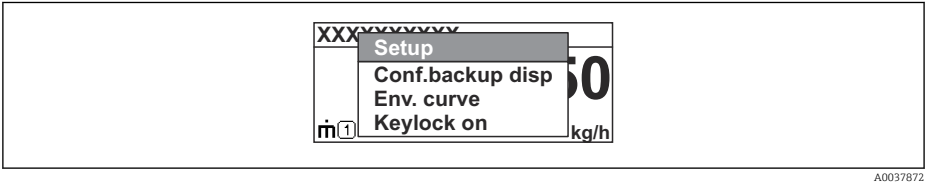
2. Press ☐ + ☐ simultaneously.
   ↳ The context menu is closed and the operational display appears.

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.

8.3.5 Envelope curve display on the display and operating module

In order to assess the measuring signal, the envelope curve and - if a mapping has been recorded - the mapping curve can be shown on the display and operating module:
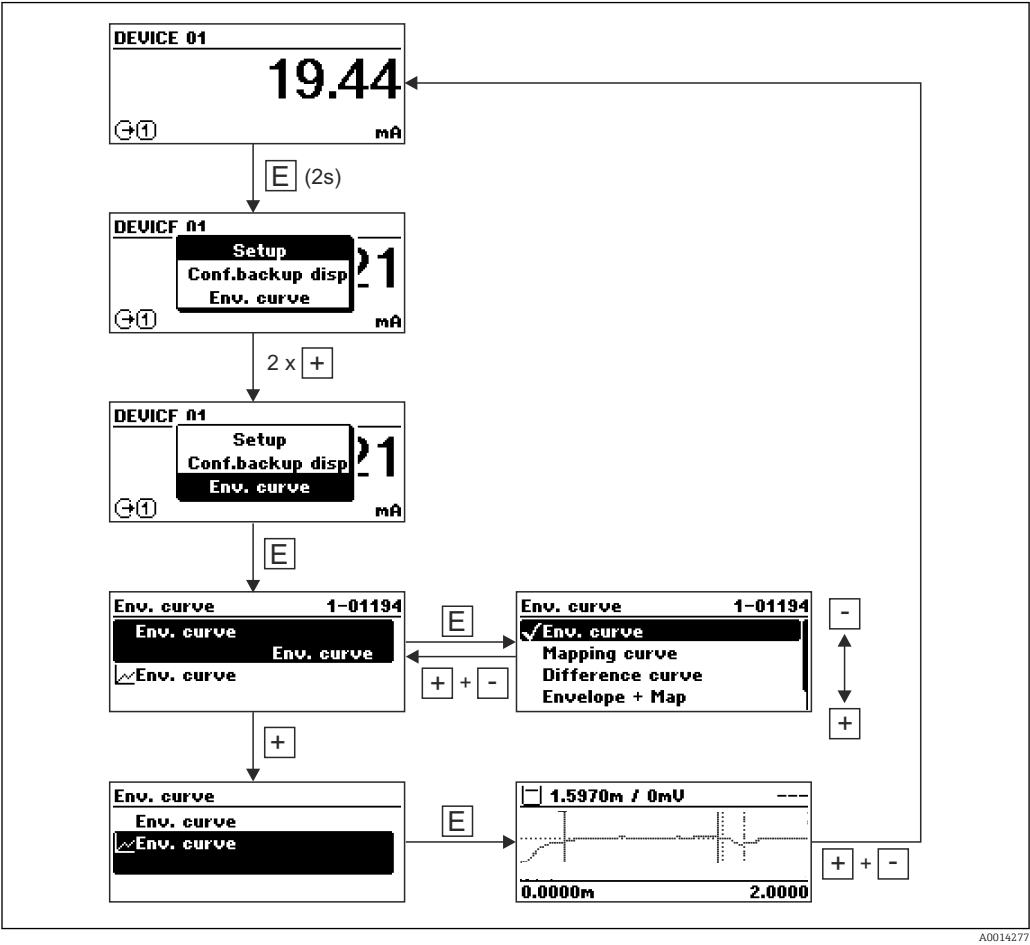
A0014277

9   Commissioning using the Commissioning Wizard

A Wizard is provided in FieldCare and DeviceCare [3] that guides the user through the initial commissioning process.

Configure Modbus communication → 🗎 79

1. Connect the device with FieldCare or DeviceCare → 🗎 55.

2. Open the device in FieldCare or DeviceCare.
    ↳ The dashboard (homepage) of the device is displayed:
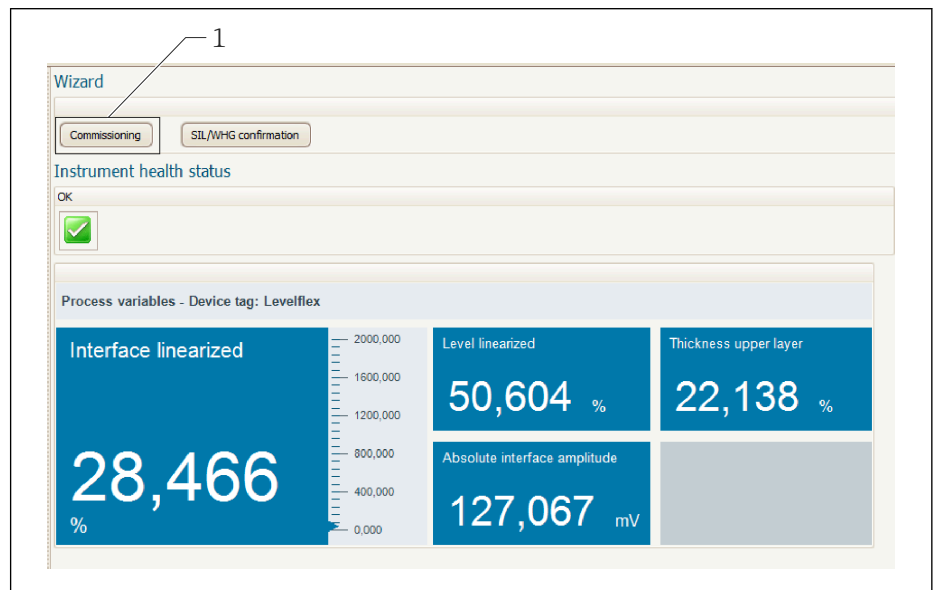
1   "Commissioning" button calls up the wizard

3. Click "Commissioning" to launch the Wizard.

4. Enter the appropriate value in each parameter or select the appropriate option. These values are written directly to the device.

5. Click "Next" to go to the next page.

6. Once all the pages have been completed, click "Finish" to close the Wizard.

If you cancel the Wizard before all the necessary parameters have been entered, the device may be in an undefined state. In such situations, it is advisable to reset the device to the factory default settings.

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[3]   DeviceCare is available for download at www.software-products.endress.com. To download the software, it is necessary to register in the Endress +Hauser software portal.

10 Commissioning via operating menu

10.1 Function check

Before commissioning your measuring point, ensure that the post-mounting and post-connection checks have been performed:

- Checklist for "Post-mounting check" → 🖺 47
- Checklist for "Post-connection check" → 🖺 53

10.2 Setting the operating language

Factory setting: English or ordered local language
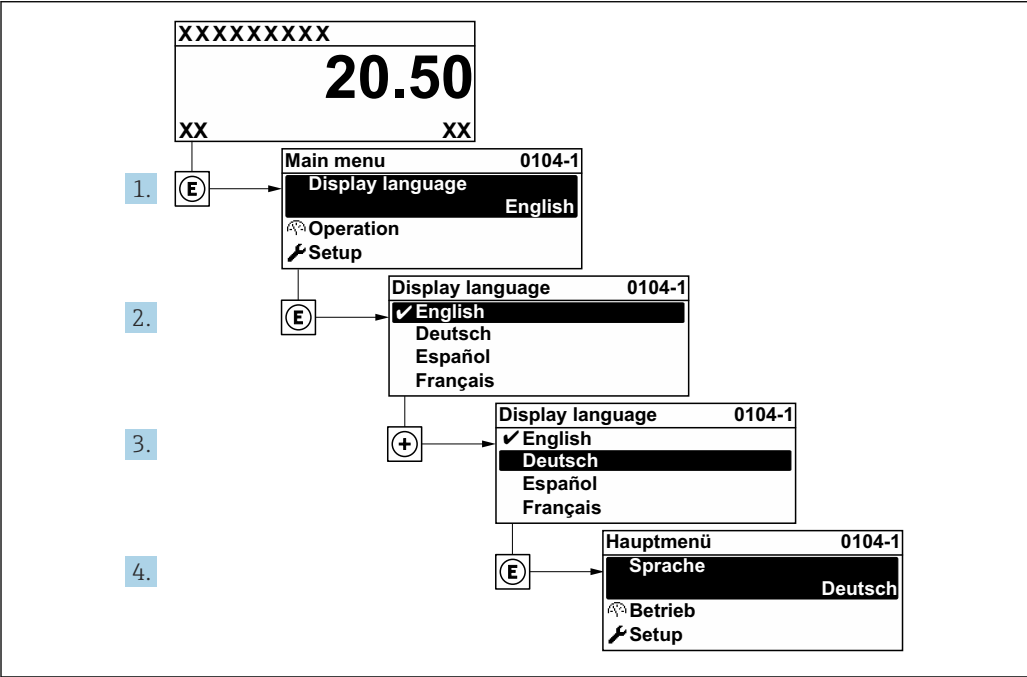
🖾 *15   Taking the example of the local display*

10.3   Configuring level measurement
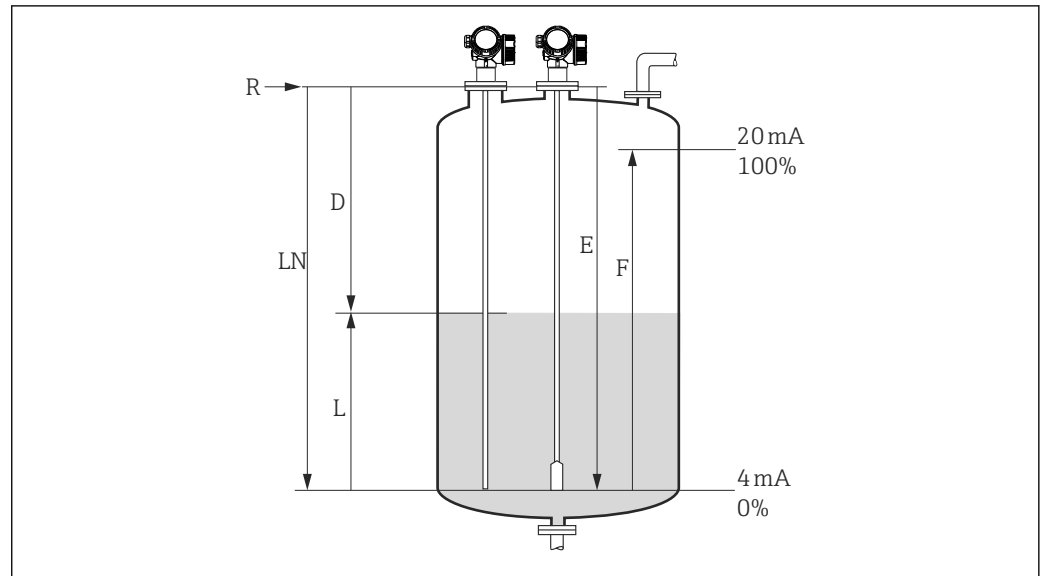
🖼 16   *Configuration parameters for level measurement in liquids*

LN   Probe length
R   Reference point of measurement
D   Distance
L   Level
E   Empty calibration (= zero point)
F   Full calibration (= span)

ℹ️   If the DC value is less than 7 in the case of rope probes, measurement in the area of the tensioning weight is not possible. In such cases, the empty calibration *E* should not exceed *LN* - 250 mm (*LN* - 10 in).

1.   Setup → Device tag
      ↳ Enter device tag.

2.   For devices in the "Interface measurement" application package:
      Navigate to: Setup → Operating mode
      ↳ Select the **Level** option.

3.   Navigate to: Setup → Distance unit
      ↳ Select the length unit.

4.   Navigate to: Setup → Tank type
      ↳ Select tank type.

5.   For **Tank type** parameter = Bypass / pipe:
      Navigate to: Setup → Tube diameter
      ↳ Specify the diameter of the bypass or stilling well.

6.   Navigate to: Setup → Medium group
      ↳ Specify the medium group: (**Water based (DC >= 4)** or **Others**)

7.   Navigate to: Setup → Empty calibration
      ↳ Specify the empty distance E (distance from the reference point R to the 0% mark).

8.   Navigate to: Setup → Full calibration
      ↳ Specify the full distance F (distance from the 0% mark to the 100% mark).

9.   Navigate to: Setup → Level
      ↳ Displays the measured level L.

10. Navigate to: Setup → Distance
   ↳ Displays the distance D between the reference point R and the level L.

11. Navigate to: Setup → Signal quality
   ↳ Displays the signal quality of the analyzed level echo.

12. Operation via local display:
    Navigate to: Setup → Mapping → Confirm distance
   ↳ Compare the distance displayed with the actual value in order to start recording an interference echo map if necessary [4].

13. Operation via operating tool:
    Navigate to: Setup → Confirm distance
   ↳ Compare the distance displayed with the actual value to start recording an interference echo map (where applicable) [4].

---

4)   For FMP54 with gas phase compensation (product structure: feature 540 "Application Package", option "EF" or "EG"), an interference echo map
      may not be recorded

10.4   Configuring interface measurement

An interface measurement is only possible if the device has the corresponding software option. In the product structure: feature 540 "Application Package", option EB "Interface measurement".
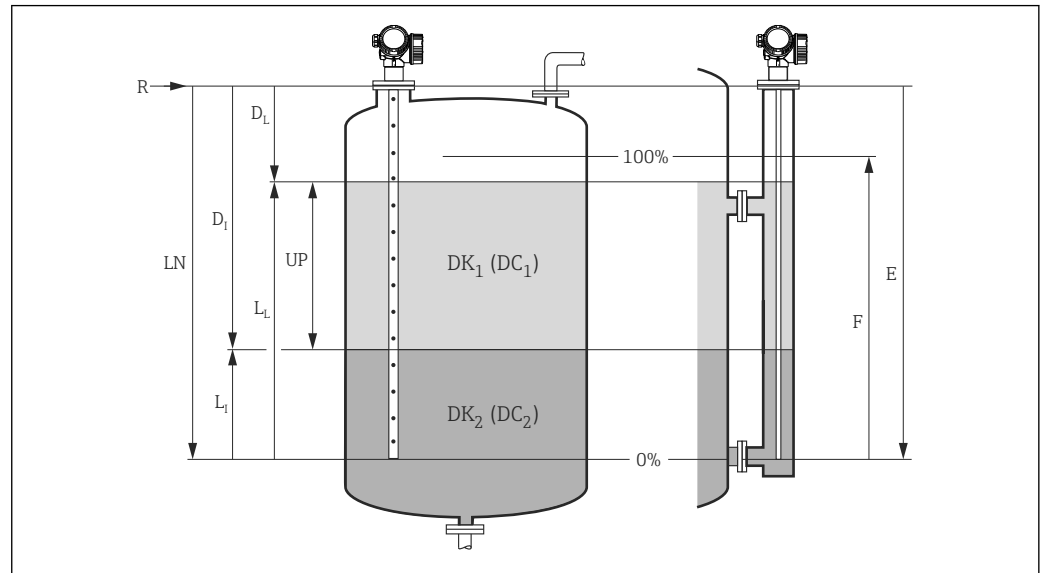
🖾 *17   Configuration parameters for interface measurement*

LN   Probe length
R   Reference point of measurement
DI   Interface distance (distance from flange to lower medium)
LI   Interface
DL   Distance
LL   Level
UP   Thickness upper layer
E   Empty calibration (= zero point)
F   Full calibration (= span)

1. Navigate to: Setup → Device tag
    ↳ Enter device tag.

2. Navigate to: Setup → Operating mode
    ↳ Select the **Interface** option.

3. Navigate to: Setup → Distance unit
    ↳ Select the length unit.

4. Navigate to: Setup → Tank type
    ↳ Select tank type.

5. For **Tank type** parameter = Bypass / pipe:
    Navigate to: Setup → Tube diameter
    ↳ Specify the diameter of the bypass or stilling well.

6. Navigate to: Setup → Tank level
    ↳ Specify the filling level (**Fully flooded** or **Partially filled**)

7. Navigate to: Setup → Distance to upper connection
    ↳ In bypasses: Specify the distance from the reference point R to the lower edge of the upper outflow. In all other cases, retain the factory setting.

8. Navigate to: Setup → DC value
    ↳ Specify the relative dielectric constant (ε_r) of the upper medium.

9. Navigate to: Setup → Empty calibration
   ↳ Specify the empty distance E (distance from the reference point R to the 0% mark).

10. Navigate to: Setup → Full calibration
    ↳ Specify the full distance F (distance from the 0% mark to the 100% mark).

11. Navigate to: Setup → Level
    ↳ Displays the measured level L_L.

12. Navigate to: Setup → Interface
    ↳ Displays the interface height L_I.

13. Navigate to: Setup → Distance
    ↳ Displays the distance D_L between the reference point R and the level L_L.

14. Navigate to: Setup → Interface distance
    ↳ Displays the distance D_I between the reference point R and the interface L_I.

15. Navigate to: Setup → Signal quality
    ↳ Displays the signal quality of the analyzed level echo.

16. Operation via local display:
    Navigate to: Setup → Mapping → Confirm distance
    ↳ Compare the distance displayed with the actual value in order to start recording an interference echo map if necessary [5].

17. Via an operating tool (e.g. FieldCare):
    Navigate to: Setup → Confirm distance
    ↳ Compare the distance displayed with the actual value to start recording an interference echo map (where applicable) [5].

---

5) For FMP54 with gas phase compensation (product structure: feature 540 "Application Package", option "EF" or "EG"), an interference echo map may not be recorded

10.5   Recording the reference envelope curve

After the measurement has been configured, it is recommended to record the current envelope curve as a reference envelope curve. This can then be used later for diagnostic purposes. The **Save reference curve** parameter is used to record the envelope curve.

Path in the menu

Expert → Diagnostics → Envelope diagnostics → Save reference curve

Meaning of the options
- No
  No action
- Yes
  The current envelope curve is saved as a reference curve.

The reference envelope curve can only be displayed in the envelope curve diagram of FieldCare after it has been loaded from the device into FieldCare. The "Load Reference Curve" function in FieldCare is used for this.
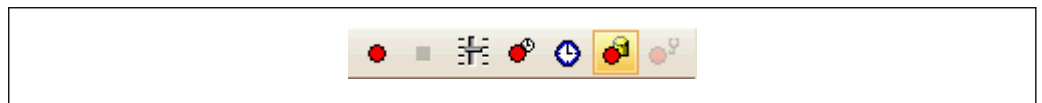
 *18   "Load Reference Curve" function

10.6 Configuring the local display

10.6.1 Factory setting of local display for level measurements

Parameter	Factory setting for devices with 1 current output	Factory setting for devices with 2 current outputs
Format display	1 value, max. size	1 value, max. size
Value 1 display	Level linearized	Level linearized
Value 2 display	Distance	Distance
Value 3 display	Current output 1	Current output 1
Value 4 display	None	Current output 2

10.6.2 Factory setting of local display for interface measurements

Parameter	Factory setting for devices with 1 current output	Factory setting for devices with 2 current outputs
Format display	1 value, max. size	1 value, max. size
Value 1 display	Interface linearized	Interface linearized
Value 2 display	Level linearized	Level linearized
Value 3 display	Thickness upper layer	Current output 1
Value 4 display	Current output 1	Current output 2

10.6.3 Adjusting the local display

The local display can be adjusted in the following submenu:
Setup → Advanced setup → Display

10.7   Configuring Modbus communication

10.7.1   Bus parameters

Bus parameter	Setting
Baud rate	Detected automatically; no setting required.
Parity	Detected automatically; no setting required.
Modbus address of the device	To be configured using the HART address parameter: Expert → Communication → Configuration → HART address Value range: 1 to 63

10.7.2   Device parameters

The following parameters are fixed. Any change by the user is reversed immediately by the device.
- **Current span** = **Fixed current**
- **Fixed current** = **10 mA**

10.7.3   Process parameters

Process parameters that should be transmitted via the bus must be assigned one of the following HART variables:

Expert → Communication → Output
- **Assign PV**
- **Assign SV**
- **Assign TV**
- **Assign QV**

These HART variables can be accessed via certain Modbus registers: → 🕮 199.

10.8   Configuration management

After commissioning, it is possible to save the current device configuration, copy it to another measuring point or restore the previous device configuration. You can do so using the **Configuration management** parameter and the options available.

Path in the menu
Setup → Advanced setup → Configuration backup display → Configuration management

Meaning of the options
- **Cancel**

  No action is executed and the user exits the parameter.
- **Execute backup**

  A backup copy of the current device configuration is saved from the HistoROM (integrated in the device) to the display module of the device.
- **Restore**

  The last backup copy of the device configuration is copied from the display module to the HistoROM of the device.
- **Duplicate**

  The transmitter configuration of the device is duplicated to another device using the display module. The following parameters, which characterize the individual measuring point are **not** transferred:
  - HART date code
  - HART short tag
  - HART message
  - HART descriptor
  - HART address
  - Device tag
  - Medium type
- **Compare**

  The device configuration saved in the display module is compared to the current device configuration of the HistoROM. The result of the comparison is displayed in the **Comparison result** parameter.
- **Clear backup data**

  The backup copy of the device configuration is deleted from the display module of the device.

  While this action is in progress, the configuration cannot be edited via the local display and a message on the processing status appears on the display.

  If an existing backup copy is restored on a device other than the original device using the **Restore** option, in some cases individual device functions may not be available. In some cases it is also not possible to restore the original state by resetting to the "as-delivered" state → 🖺 178.

  The **Duplicate** option should always be used to copy the configuration to another device.

10.9   Protecting settings from unauthorized access

The settings can be protected from unauthorized access in two ways:

- Locking via parameter (software locking) → 🖷 59
- Locking via write protection switch (hardware locking) → 🖷 60

11 Diagnostics and troubleshooting

11.1 General troubleshooting

11.1.1 General errors

Error	Possible cause	Solution
Device does not respond.	Supply voltage not connected.	Connect the correct voltage.
	The cables do not contact the terminals properly.	Ensure electrical contact between the cable and the terminal.
Values on the display invisible	Contrast setting is too weak or too strong.	- Increase contrast by pressing ⊞ and Ⓔ simultaneously. - Decrease contrast by pressing ⊟ and Ⓔ simultaneously.
	The plug of the display cable is not connected correctly.	Connect the plug correctly.
	Display is defective.	Replace display.
"Communication error" is indicated on the display when starting the device or connecting the display.	Electromagnetic interference	Check grounding of the device.
	Broken display cable or display plug.	Replace display.
Duplication of parameters via display from one device to another not working. Only the "Save" and "Cancel" options are available.	Display with backup is not properly detected if a data backup was not carried out on the new device previously.	Connect display (with backup) and restart device.
CDI communication does not work.	Wrong setting of the COM port on the computer.	Check the setting of the COM port on the computer and change it if necessary.
Device measures incorrectly.	Parameter configuration error	Check and correct the parameter configuration.

11.1.2 Parametrization errors

Parametrization errors for level measurements

Error	Possible cause	Remedial action
Measured value incorrect	If measured distance (Setup → Distance) matches the real distance: Calibration error	• Check the **Empty calibration** parameter (→ 🖹 121) and correct if necessary. • Check the **Full calibration** parameter (→ 🖹 122) and correct if necessary. • Check the linearization and correct if necessary (**Linearization** submenu (→ 🖹 147)).
	If measured distance (Setup → Distance) does not match the real distance: An interference echo is present.	Carry out mapping (**Confirm distance** parameter (→ 🖹 129)).
No change of measured value on filling/emptying	An interference echo is present.	Carry out mapping (**Confirm distance** parameter (→ 🖹 129)).
	Buildup at the probe.	Clean the probe.
	Error in the echo tracking.	Deactivate echo tracking (Expert → Sensor → Echo tracking → Evaluation mode = **History off**).
Echo lost diagnostic message appears after the supply voltage is switched on.	Echo threshold too high.	Check the **Medium group** parameter (→ 🖹 121). If necessary, select a more detailed setting with the **Medium property** parameter (→ 🖹 135).
	Level echo suppressed.	Delete the map and record it again if necessary (**Record map** parameter (→ 🖹 131)).
Device displays a level when the tank is empty.	Incorrect probe length	Perform probe length correction (**Confirm probe length** parameter (→ 🖹 161)).
	Interference echo	Carry out mapping over the entire probe length when the tank is empty (**Confirm distance** parameter (→ 🖹 129)).
Wrong slope of the level over the entire measuring range	Wrong tank type selected.	Select the correct **Tank type** parameter (→ 🖹 120).

Parametrization errors for interface measurements

Error	Possible cause	Remedial action
With the setting **Tank level = Fully flooded**, the interface level displayed jumps to higher values when the tank is emptied.	The total level is detected outside the upper blocking distance.	Increase the blocking distance (**Blocking distance** parameter (→ 🖹 138)).
		Set **Tank level** parameter (→ 🖹 126) = **Partially filled**.
With the setting **Tank level = Partially filled**, the total level displayed jumps to lower values when the tank is filled.	The total level goes to the upper blocking distance.	Reduce the blocking distance (**Blocking distance** parameter (→ 🖹 138)).
Incorrect slope of the interface measured value	The dielectric constant (DC value) of the upper medium is incorrectly set.	Enter the correct dielectric constant (DC value) of the upper medium (**DC value** parameter (→ 🖹 127)).
The measured value for the interface and the total level are identical.	The echo threshold for the total level is too high due to an incorrect dielectric constant.	Enter the correct dielectric constant (DC value) of the upper medium (**DC value** parameter (→ 🖹 127)).

Error	Possible cause	Remedial action
The total level jumps to the interface level in the case of thin interfaces.	The thickness of the upper medium is lower than 60 mm.	Measurement of the interface is only possible for interface heights greater than 60 mm.
Interface measured value jumps.	Emulsion layer present.	Emulsion layers impair the measurement. Contact Endress+Hauser.

11.2   Diagnostic information on local display

11.2.1   Diagnostic message

Faults detected by the self-monitoring system of the measuring device are displayed as a diagnostic message in alternation with the measured value display.

Measured value display in alarm condition	Diagnostic message

1   Status signal
2   Status symbol (symbol for event level)
3   Status symbol with diagnostic event
4   Event text
5   Operating elements

Status signals

F A0032902	**"Failure (F)" option** A device error has occurred. The measured value is no longer valid.
C A0032903	**"Function check (C)" option** The device is in the service mode (e.g. during a simulation).
S A0032904	**"Out of specification (S)" option** The device is operated: • Outside of its technical specifications (e.g. during startup or a cleaning) • Outside of the configuration performed by the user (e.g. level outside the configured range)
M A0032905	**"Maintenance required (M)" option** Maintenance is required. The measured value is still valid.

Status symbol (symbol for event level)

⊗	**"Alarm" status** The measurement is interrupted. The signal outputs adopt the defined alarm condition. A diagnostic message is generated.
⚠	**"Warning" status** The device continues to measure. A diagnostic message is generated.

Diagnostic event and event text

The fault can be identified by means of the diagnostic event. The event text helps you by providing information about the fault. In addition, the associated status symbol is displayed in front of the diagnostic event.

	Diagnostic event		
Status symbol	Status signal	Event number	Event text
	↓	↓	↓
Example ⚠	**S** A0032904	441	**Curr.output 1**
		3-digit number	
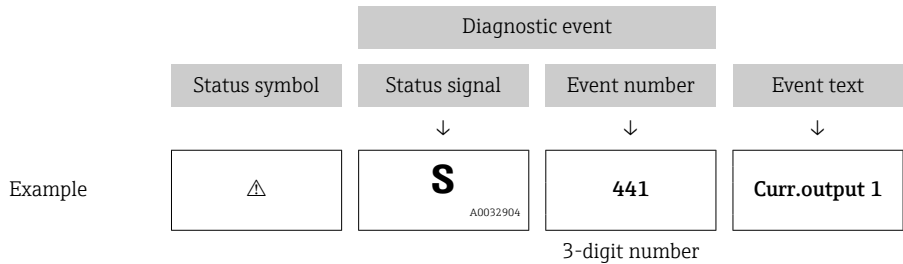
If two or more diagnostic events occur simultaneously, only the diagnostic message with the highest priority is shown. Additional queued diagnostic messages can be shown in the **Diagnostic list** submenu.

ℹ Past diagnostic messages that are no longer pending are shown as follows:
- On the local display:
  In the **Event logbook** submenu
- In FieldCare:
  Via the "Event List /HistoROM" function.

Operating elements

Operating functions in menu, submenu	
⊞	**Plus key** Opens the message about the remedial measures.
Ⓔ	**Enter key** Opens the operating menu.

11.2.2 Calling up remedial measures

A0029431-EN
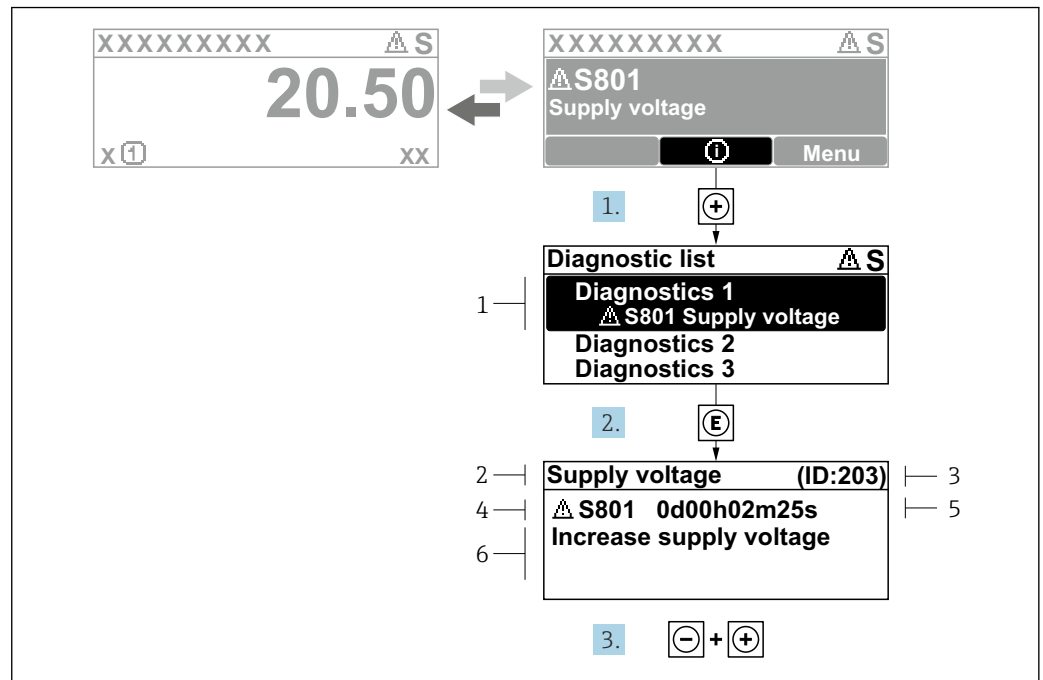
🖼 *19   Message for remedial measures*

1   Diagnostic information
2   Short text
3   Service ID
4   Diagnostic behavior with diagnostic code
5   Operation time when error occurred
6   Remedial measures

The user is in the diagnostic message.

1. Press ⊞ (ⓘ symbol).
    ↳ The **Diagnostic list** submenu opens.

2. Select the desired diagnostic event with ⊞ or ⊟ and press ⌷ .
    ↳ The message for the remedial measures for the selected diagnostic event opens.

3. Press ⊟ + ⊞ simultaneously.
    ↳ The message about the remedial measures closes.

The user is in the **Diagnostics** menu at an entry for a diagnostics event, e.g. in the
Diagnostic list or in **Previous diagnostics**.

1. Press ⌷.
    ↳ The message for the remedial measures for the selected diagnostic event opens.

2. Press ⊟ + ⊞ simultaneously.
    ↳ The message about the remedial measures closes.

11.3   Diagnostic event in the operating tool

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

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

A: Via the operating menu

1. Navigate to the **Diagnostics** menu.
    ↳   In the **Actual diagnostics** parameter, the diagnostic event is shown with event text.

2. On the right in the display range, hover the cursor over the **Actual diagnostics** parameter.
    ↳
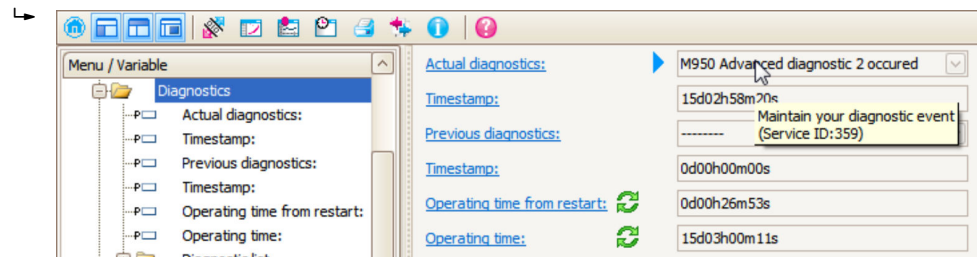
A tool tip with remedial measures for the diagnostic event appears.

B: Via the "Create documentation" function

1.
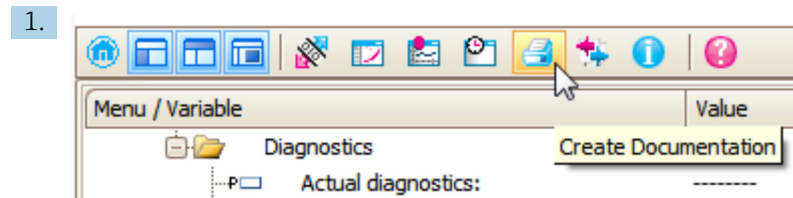
Select the "Create documentation" function.

2.
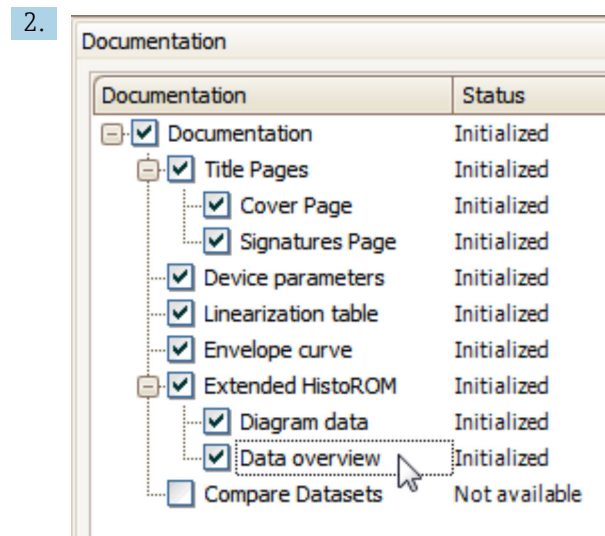
Make sure "Data overview" is marked.

3. Click "Save as ..." and save a PDF of the protocol.
    ↳ The protocol contains the diagnostic messages and remedy information.

C: Via the "Eventlist / Extended HistoROM" function

1.
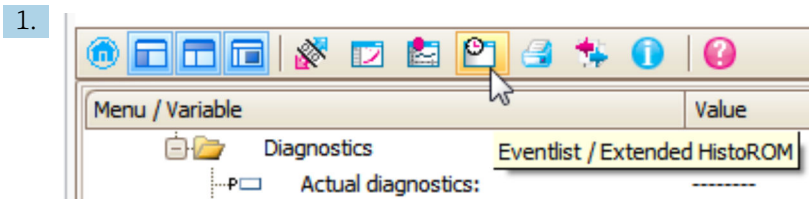
Select the "Eventlist / Extended HistoROM" function.

2.

Select the "Load Eventlist" function.
    ↳ The list of events, including remedy information, is shown in the "Data overview" window.

11.4 Diagnostic list

In the **Diagnostic list** submenu submenu, up to 5 currently pending diagnostic messages can be displayed. If more than 5 messages are pending, the messages with the highest priority are shown on the display.

Navigation path
Diagnostics → Diagnostic list

Calling up and closing the remedial measures

1. Press E.
    ↳ The message for the remedial measures for the selected diagnostic event opens.

2. Press ⊟ + ⊞ simultaneously.
    ↳ The message about the remedial measures closes.

11.5 Event logbook

11.5.1 Event history

A chronological overview of the event messages that have occurred is provided in the **Event list** submenu [6].

Navigation path
Diagnostics → Event logbook → Event list

A maximum of 100 event messages can be displayed in chronological order.

Die Ereignishistorie umfasst Einträge zu:
- Diagnostic events
- Information events

---

[6] This submenu is only available for operation via local display. In the case of operation via FieldCare, the event list can be displayed with the "Event List / HistoROM" functionality of FieldCare.

In addition to the operation time of its occurrence, each event is also assigned a symbol that indicates whether the event has occurred or is ended:
- Diagnostic event
  - ⊕: Event has occurred
  - ⊖: Event has ended
- Information event
  ⊕: Event has occurred

Calling up and closing the remedial measures

1. Press Ⓔ
   ↳ The message for the remedial measures for the selected diagnostic event opens.

2. Press ⊟ + ⊞ simultaneously.
   ↳ The message about the remedial measures closes.

11.5.2   Filtering the event logbook

Using the **Filter options** parameter, you can define which category of event messages is displayed in the **Event list** submenu.

Navigation path
Diagnostics → Event logbook → Filter options

Filter categories
- All
- Failure (F)
- Function check (C)
- Out of specification (S)
- Maintenance required (M)
- Information

11.5.3   Overview of information events

Info number	Info name
I1000	--------(Device ok)
I1089	Power on
I1090	Configuration reset
I1091	Configuration changed
I1092	Embedded HistoROM deleted
I1110	Write protection switch changed
I1137	Electronic changed
I1151	History reset
I1154	Reset terminal voltage min/max
I1155	Reset electronic temperature
I1156	Memory error trend
I1157	Memory error event list
I1184	Display connected
I1185	Display backup done
I1186	Restore via display done
I1187	Settings downloaded with display
I1188	Display data cleared

Info number	Info name
I1189	Backup compared
I1256	Display: access status changed
I1264	Safety sequence aborted
I1335	Firmware changed
I1397	Fieldbus: access status changed
I1398	CDI: access status changed
I1512	Download started
I1513	Download finished
I1514	Upload started
I1515	Upload finished
I1554	Safety sequence started
I1555	Safety sequence confirmed
I1556	Safety mode off

11.6   Firmware history

Date	Firmware version	Modifications	Documentation (FMP51, Modbus)		
			Operating Instructions	Description of Device Parameters	Technical Information
04.2016 [1]	01.03.zz	• Update to HART 7 • All 17 languages are available in the device • Improvements and bugfixes • Available with Modbus interface	BA01957F/00/EN/01.19	GP01140F/00/EN/01.19	TI01454F/00/EN/01.19

1)   Earlier software versions not available with Modbus interface

The firmware version can explicitly be ordered via the product structure. In this way it is possible to ensure compatibility of the firmware version with an existing or planned system integration.

12   Maintenance

The measuring device requires no special maintenance.

12.1   Exterior cleaning

When exterior-cleaning the device, always use cleaning agents that do not attack the surface of the hosuing and the seals.

13   Repair

13.1   General information

13.1.1   Repair concept

Under the Endress+Hauser repair concept, devices have a modular design and repairs can be carried out by Endress+Hauser Service or by properly trained customers.

Spare parts are grouped into logical kits with the associated replacement instructions.

For more information on service and spare parts, please contact Endress+Hauser Service.

13.1.2   Repair of Ex-certified devices

When repairing Ex-certified devices, please also note the following:

- Only specialist personnel or Endress+Hauser-Service can carry out repairs to Ex certified devices.
- Relevant standards and national regulations as well as safety instructions (XA) and certificates must be observed.
- Only original Endress+Hauser spare parts may be used.
- When ordering spare parts, please check the device designation on the nameplate. Parts may only be replaced by identical parts.
- Carry out repairs according to the instructions. Following a repair, the individual testing specified for the device must be performed.
- A certified device may be converted to another certified device version by Endress +Hauser Service only.
- All repairs and modifications must be documented.

13.1.3   Replacing electronics modules

When electronics modules have been replaced the device does not need to be recalibrated as the parameters are saved in the HistoROM inside the housing. It may be necessary when replacing the main electronics to record a new interference echo suppression.

13.1.4   Replacing a device

Once a complete device has been replaced, the parameters can be transferred back into the device using one of the following methods:

- Using the display module
  Prerequisite: The configuration of the old device was saved previously in the display module → 🖺 175.
- Via FieldCare
  Prerequisite: The configuration of the old device was saved previously to the computer using FieldCare.

You can continue measuring without performing a new calibration. Only interference echo suppression may need to be carried out once again.

13.2   Spare parts

- Some replaceable measuring device components are identified by means of a spare part nameplate. This contains information about the spare part.
- In the connection compartment cover of the device there is a spare part nameplate which contains the following information:
  - A list of the most important spare parts for the measuring device, including their ordering information.
  - The URL to the *W@M Device Viewer* (www.endress.com/deviceviewer):
    All the spare parts for the measuring device, along with the order code, are listed here and can be ordered. If available, users can also download the associated Installation Instructions.
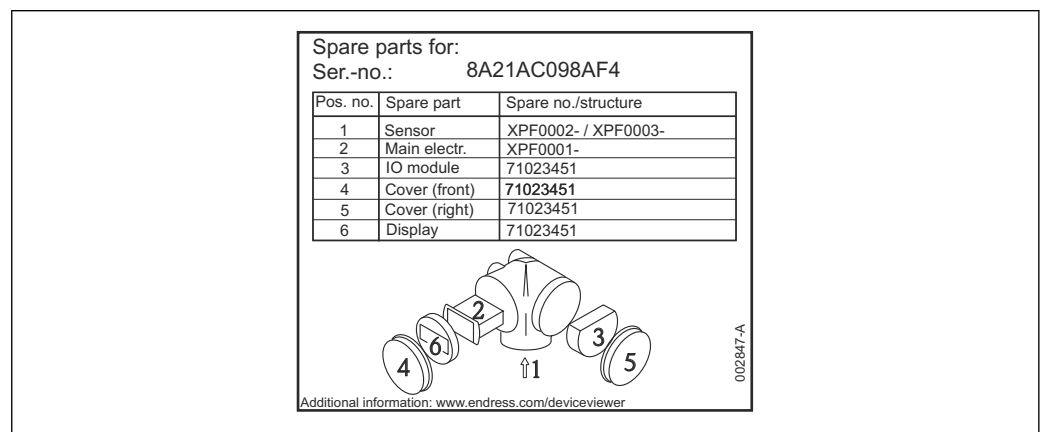
🖼 20   Example for spare part nameplate in the connection compartment cover

Measuring device serial number:
- Located on the device and spare part nameplate.
- Can be read out via the "Serial number" parameter in the "Device information" submenu.

13.3   Return

The requirements for safe device return can vary depending on the device type and national legislation.

1. Refer to the web page for information:
   http://www.endress.com/support/return-material
   ↳ Select the region.

2. Return the device if repairs or a factory calibration are required, or if the wrong device was ordered or delivered.

13.4   Disposal

Observe the following notes during disposal:
- Observe valid federal/national regulations.
- Ensure proper separation and reuse of the device components.

14   Accessories

14.1   Device-specific accessories

14.1.1   Weather protection cover

The weather protection cover can be ordered together with the device via the "Accessory enclosed" product structure.
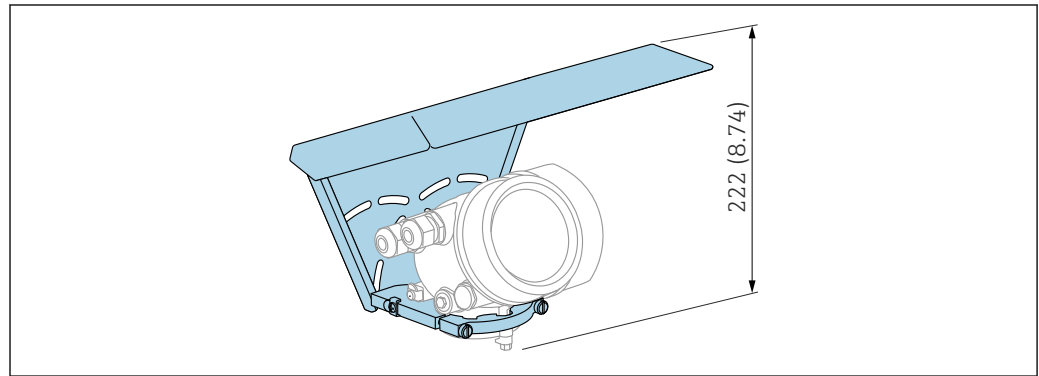
🖼 21   Height. Unit of measurement mm (in)
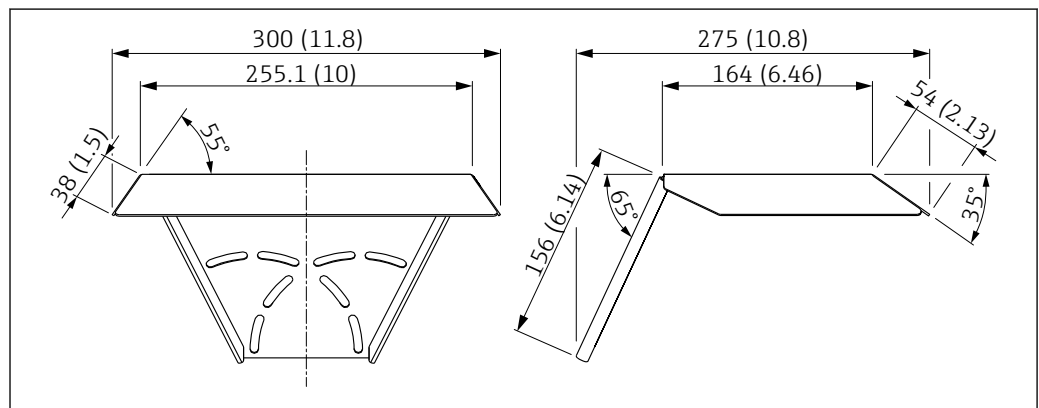
🖼 22   Dimensions. Unit of measurement mm (in)

Material
316L
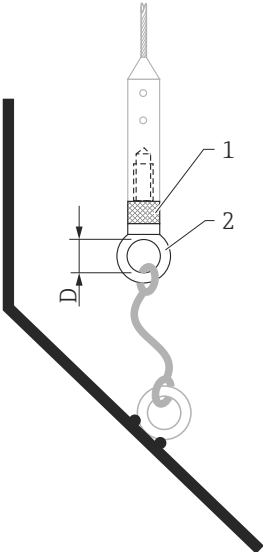
Order number for accessories:
71162242
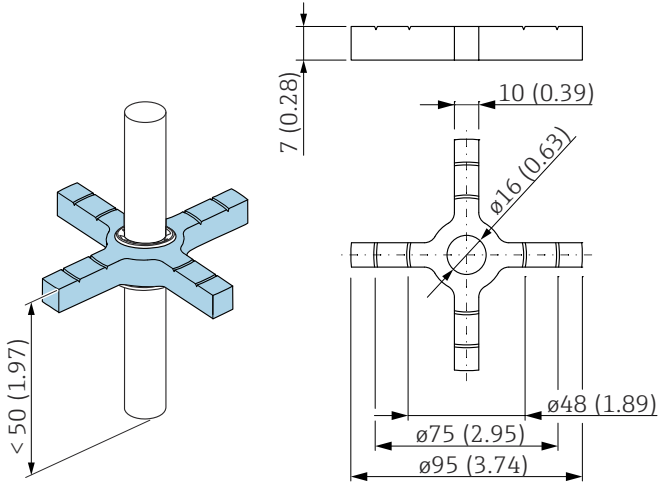
14.1.2   Mounting bracket for electronics housing

Accessories	Description
Mounting bracket for electronics housing	**A** **B** ø42...60 (1.65...2.36) 52 (2) 122 (4.8) 161 (6.34) 127...140 (5...5.51) 162...175 (6.38...6.89) 70 (2.8) 86 (3.4) A0014793 🖾 *23 Mounting bracket for electronics housing; engineering unit: mm (in)* *A Wall mounting* *B Post mounting* ℹ With "remote sensor" device versions (see feature 060 in the product structure), the mounting bracket is included in the scope of delivery. However, it can also be ordered separately as an accessory (order number: 71102216).

14.1.3 Mounting kit, insulated

Accessories	Description
Mounting kit, insulated suitable for FMP51	 A0013586 *⊡ 24 Scope of delivery of mounting kit:* *1 Insulation sleeve* *2 Ring bolt* To secure rope probes so that they are reliably insulated. Maximum process temperature: 150 °C (300 °F) For rope probes 4 mm ($\frac{1}{6}$ in) or 6 mm (1/4 in) with PA>steel : • Diameter D = 20 mm (0.8 in) • Order number: 52014249 For rope probes 6 mm ($\frac{1}{4}$ in) or 8 mm (1/3 in) with PA>steel: • Diameter D = 25 mm (1 in) • Order number: 52014250 Due to the risk of electrostatic charge, the insulation sleeve is not suitable for use in hazardous areas! In this case, the probe must be secured so that it is reliably grounded. The mounting kit can also be ordered directly with the device (Levelflex product structure, feature 620 "Accessory enclosed", version PG "mounting kit, insulated, rope").
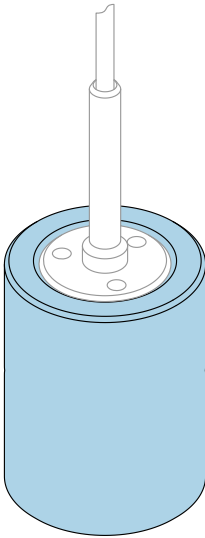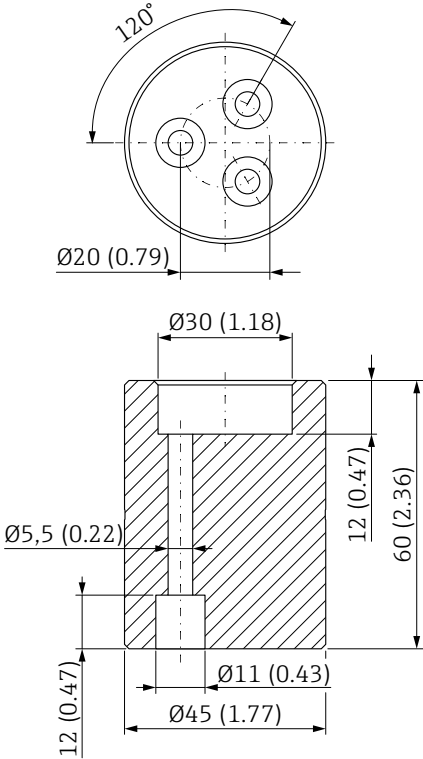
14.1.4 Centering star
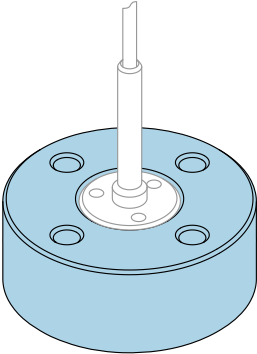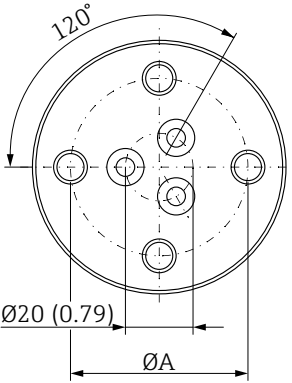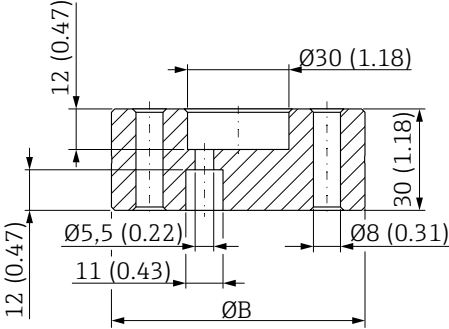
Accessories	Description
Centering star PEEK ∅ 48-95 mm suitable for FMP51	 A0014576 The centering star is suitable for probes with a rod diameter of 16 mm (0.6 in) and can be used in pipes from DN50 to DN100. The markings make it easer to cut to size, ensuring that the centering star can be adjusted to the pipe diameter. See also Operating Instructions SD02316F. • Material of centering star: PEEK • Material of retaining rings: PH15-7Mo (UNS S15700) • Permitted process temperature range: −60 to +250 ℃ (−76 to +482 ℉) • Order number: 71069064 ℹ️ If the centering star is used in a bypass, it must be positioned below the lower bypass outlet. This must be taken into account when choosing the probe length. In general, the centering star should not be mounted more than 50 mm (1.97") above the probe tip. It is advised not to use the PEEK centering star in the measuring range of the rod probe. ℹ️ The PEEK centering star can also be ordered directly with the device (Levelflex product structure, feature 610 "Accessory mounted", option OD). In this case, it is not secured to the rod using the retaining rings, but instead is secured using a hexagonal-headed bolt (A4-70) and a Nord Lock washer (1.4547) at the tip of the probe rod.

Accessories	Description

Centering star PFA
• ϕ 16.4 mm (0.65 in)
• ϕ 37 mm (1.46 in)
 	
suitable for
 	
FMP51
	
	A For probe 8 mm (0.3 in)
	B For probes 12 mm (0.47 in) and 16 mm (0.63 in)
	
	The centering star is suitable for probes with a rod diameter of 8 mm (0.3 in), 12 mm (0.47 in) and 16 mm (0.63 in) (including coated rod probes) and can be used in pipes from DN40 to DN50. See also Operating Instructions BA00378F/00/A2.
	
	• Material: PFA
	• Permitted process temperature range: –200 to +250 ℃ (–328 to +482 ℉)
	• Order number
	  • Probe 8 mm (0.3 in) : 71162453
	  • Probe 12 mm (0.47 in): 71157270
	  • Probe 16 mm (0.63 in): 71069065
	
	The PFA centering star can also be ordered directly with the device (Levelflex product structure, feature 610 "Accessory mounted", option OE).
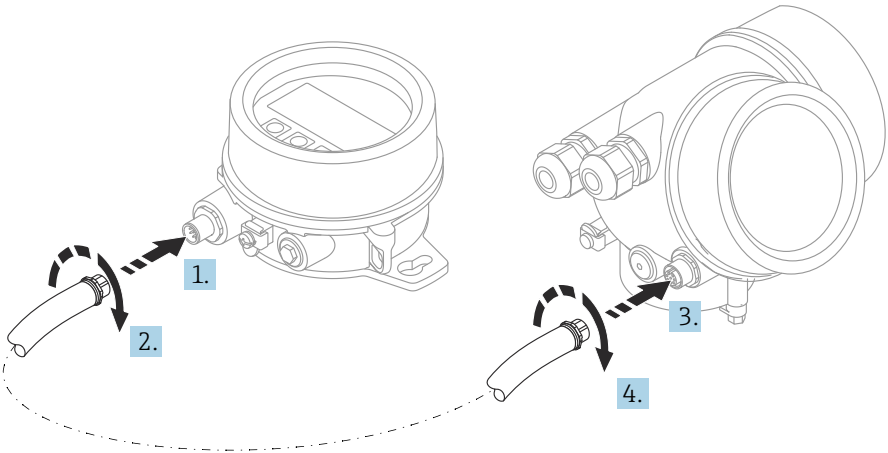
Accessories	Description

Centering star PEEK, Ø 48 to 95 mm (1.9 to 3.7 in) suitable for
 	
FMP51
	
	A0035182
	
	The centering star is suitable for probes with a rope diameter of 4 mm ($\frac{1}{6}$ in) (including coated rope probes). See also Operating Instructions SD01961F.
	• Material: PEEK
	• Permitted process temperature range: −60 to +250 ℃ (−76 to +482 ℉)
	• Order number
	  ▪ 71373490 (1x)
	  ▪ 71373492 (5x)

14.1.5   Centering weight

Accessories	Description
Centering weight 316L ⌀ 45 mm (1.77 in) suitable for FMP51	 120° Ø20 (0.79) Ø30 (1.18) 12 (0.47) 60 (2.36) Ø5,5 (0.22) Ø11 (0.43) Ø45 (1.77) 12 (0.47) A0038923
	The centering weight is suitable for probes with a rope diameter of 4 mm ($\frac{1}{6}$ in) and can be used in DN50/2" pipes. Material: 316L The centering weight can be ordered directly with the device (product structure Levelflex) or as a probe without a process connection (product structure XPF0005-) using feature 610 "Accessory mounted", version **OK** (for pipe DN50/2").

Accessories	Description
Centering weight 316L • ϕ 75 mm (2.95 in) • ϕ 95 mm (3.7 in) suitable for FMP51	 *ϕA = 52.5 mm (2.07 in) for DN80/3" pipe* *= 62.5 mm (2.47 in) for DN100/4" pipe* *ϕB = 75 mm (2.95 in) for DN80/3" pipe* *= 95 mm (3.7 in) for DN100/4" pipe* The centering weight is suitable for probes with a rope diameter of 4 mm ($\frac{1}{6}$ in) and can be used in DN80/3" or DN100/4" pipes. Material: 316L The centering weight can be ordered directly with the device (product structure Levelflex) or as a probe without a process connection (product structure XPF0005-) using feature 610 "Accessory mounted", version **OL** (for pipe DN80/3") or **OM** (for pipe DN100/4").

14.1.6   Remote display FHX50

Accessories	Description
Remote display FHX50	A0019128

- Material:
  - Plastic PBT
  - 316L/1.4404
  - Aluminum
- Degree of protection: IP68 / NEMA 6P and IP66 / NEMA 4x
- Suitable for display modules:
  - SD02 (push buttons)
  - SD03 (touch control)
- Connecting cable:
  - Cable supplied with device up to 30 m (98 ft)
  - Standard cable provided by customer onsite up to 60 m (196 ft)
- Ambient temperature: –40 to 80 ℃ (–40 to 176 ℉)

- If the remote display should be used, order the device version "Prepared for display FHX50" (feature 030, version L or M). For the FHX50, you must select option A: "Prepared for display FHX50" under feature 050 "Measuring device version".
- If the device version "Prepared for display FHX50" was not originally ordered and a FHX50 display is to be retrofitted, you must select version B "Not prepared for display FHX50" under feature 050: "Measuring device version" when ordering the FHX50. In this case, a retrofit kit for the device is supplied with the FHX50. The kit can be used to prepare the device so that the FHX50 can be used.

Use of the FHX50 may be restricted for transmitters with an approval. A device can only be retrofitted with the FHX50 if the option L or M ("Prepared for FHX50") is listed under *Basic specifications*, item 4 "Display, operation" in the Safety Instructions (XA) for the device.
Also pay attention to the Safety Instructions (XA) of the FHX50.

Retrofitting is not possible on transmitters with:
- An approval for use in areas with flammable dust (dust ignition-proof approval)
- Ex nA type of protection

For details, see document SD01007F.

14.2   Communication-specific accessories

Accessory	Description
Commubox FXA291	Connects field devices with CDI interface to the USB interface of a computer. Order code: 51516983

14.3   Service-specific accessories

Accessory	Description
DeviceCare SFE100	Configuration tool for HART, PROFIBUS and FOUNDATION Fieldbus devices 📖 Technical Information TI01134S
FieldCare SFE500	FDT-based Plant Asset Management tool. Helps to configure and maintain all field devices of your plant. By supplying status information it also supports the diagnosis of the devices. 📖 Technical Information TI00028S

14.4   System components

Accessory	Description
Graphic Data Manager Memograph M	The graphic data manager Memograph M provides information on all the relevant process variables. Measured values are recorded correctly, limit values are monitored and measuring points analyzed. The data are stored in the 256 MB internal memory and also on an SD card or USB stick. 📖 For details refer to Technical Information TI00133R and Operating Instructions BA00247R

15 Operating menu

15.1 Overview of the operating menu (display module)

Navigation ▣ Operating menu

Language	
🔧 Setup	→ 🖹 119
Device tag	→ 🖹 119
Operating mode	→ 🖹 119
Distance unit	→ 🖹 120
Tank type	→ 🖹 120
Tube diameter	→ 🖹 120
Tank level	→ 🖹 126
Distance to upper connection	→ 🖹 127
DC value	→ 🖹 127
Medium group	→ 🖹 121
Empty calibration	→ 🖹 121
Full calibration	→ 🖹 122
Level	→ 🖹 123
Interface	→ 🖹 128
Distance	→ 🖹 124
Interface distance	→ 🖹 129
Signal quality	→ 🖹 125
▸ Mapping	→ 🖹 132
Confirm distance	→ 🖹 132
Mapping end point	→ 🖹 132

Record map		→ 🗎 132	
Distance		→ 🗎 132	
‣ Advanced setup		→ 🗎 133	
Locking status		→ 🗎 133	
Access status display		→ 🗎 134	
Enter access code		→ 🗎 134	
‣ Level		→ 🗎 135	
	Medium type	→ 🗎 135	
	Medium property	→ 🗎 135	
	Process property	→ 🗎 136	
	Advanced process conditions	→ 🗎 137	
	Level unit	→ 🗎 138	
	Blocking distance	→ 🗎 138	
	Level correction	→ 🗎 139	
‣ Interface		→ 🗎 140	
	Process property	→ 🗎 140	
	DC value lower medium	→ 🗎 140	
	Level unit	→ 🗎 141	
	Blocking distance	→ 🗎 141	
	Level correction	→ 🗎 142	
	‣ Automatic DC calculation	→ 🗎 145	
		Manual thickness upper layer	→ 🗎 145
		DC value	→ 🗎 145
		Use calculated DC value	→ 🗎 145

‣ Linearization		→ 🕮 147
	Linearization type	→ 🕮 149
	Unit after linearization	→ 🕮 150
	Free text	→ 🕮 151
	Maximum value	→ 🕮 152
	Diameter	→ 🕮 153
	Intermediate height	→ 🕮 153
	Table mode	→ 🕮 153
	‣ Edit table	
		Level
		Customer value
	Activate table	→ 🕮 155
‣ Safety settings		→ 🕮 157
	Output echo lost	→ 🕮 157
	Value echo lost	→ 🕮 157
	Ramp at echo lost	→ 🕮 158
	Blocking distance	→ 🕮 138
‣ Probe settings		→ 🕮 160
	Probe grounded	→ 🕮 160
	‣ Probe length correction	→ 🕮 162
		Confirm probe length	→ 🕮 162
		Present probe length	→ 🕮 162
‣ Switch output		→ 🕮 163
	Switch output function	→ 🕮 163
	Assign status	→ 🕮 164

	Device revision	→ 🖹 185
	Device ID	→ 🖹 185
	Device type	→ 🖹 186
	Manufacturer ID	→ 🖹 186
▶ Measured values		→ 🖹 187
	Distance	→ 🖹 124
	Level linearized	→ 🖹 152
	Interface distance	→ 🖹 129
	Interface linearized	→ 🖹 152
	Thickness upper layer	→ 🖹 189
	Terminal voltage 1	→ 🖹 189
▶ Data logging		→ 🖹 190
	Assign channel 1 to 4	→ 🖹 190
	Logging interval	→ 🖹 191
	Clear logging data	→ 🖹 191
	▶ Display channel 1 to 4	→ 🖹 192
▶ Simulation		→ 🖹 194
	Assign measurement variable	→ 🖹 195
	Process variable value	→ 🖹 195
	Switch output simulation	→ 🖹 195
	Switch status	→ 🖹 196
	Device alarm simulation	→ 🖹 196
▶ Device check		→ 🖹 197
	Start device check	→ 🖹 197
	Result device check	→ 🖹 197

Last check time		→ 🗎 197
Level signal		→ 🗎 198
Launch signal		→ 🗎 198
Interface signal		→ 🗎 198

15.2   Overview of the operating menu (operating tool)

Navigation   ⊠   Operating menu

Access status tooling		→ 🖺 133
Enter access code		→ 🖺 134
▶ Level		→ 🖺 135
	Medium type	→ 🖺 135
	Medium property	→ 🖺 135
	Process property	→ 🖺 136
	Advanced process conditions	→ 🖺 137
	Level unit	→ 🖺 138
	Blocking distance	→ 🖺 138
	Level correction	→ 🖺 139
▶ Interface		→ 🖺 140
	Process property	→ 🖺 140
	DC value lower medium	→ 🖺 140
	Level unit	→ 🖺 141
	Blocking distance	→ 🖺 141
	Level correction	→ 🖺 142
	Manual thickness upper layer	→ 🖺 142
	Measured thickness upper layer	→ 🖺 143
	DC value	→ 🖺 143
	Calculated DC value	→ 🖺 143
	Use calculated DC value	→ 🖺 144
▶ Linearization		→ 🖺 147
	Linearization type	→ 🖺 149
	Unit after linearization	→ 🖺 150
	Free text	→ 🖺 151

		Backup state	→ 🗎 176
		Comparison result	→ 🗎 176
	‣ Administration		→ 🗎 178
		Define access code	
		Device reset	→ 🗎 178

⚕ Diagnostics			→ 🗎 180
	Actual diagnostics		→ 🗎 180
	Timestamp		→ 🗎 181
	Previous diagnostics		→ 🗎 181
	Timestamp		→ 🗎 181
	Operating time from restart		→ 🗎 181
	Operating time		→ 🗎 175
	‣ Diagnostic list		→ 🗎 182
		Diagnostics 1 to 5	→ 🗎 182
		Timestamp 1 to 5	→ 🗎 182
	‣ Device information		→ 🗎 184
		Device tag	→ 🗎 184
		Serial number	→ 🗎 184
		Firmware version	→ 🗎 184
		Device name	→ 🗎 184
		Order code	→ 🗎 185
		Extended order code 1 to 3	→ 🗎 185
		Device revision	→ 🗎 185
		Device ID	→ 🗎 185

| Launch signal | → 🗎 198 |
| Interface signal | → 🗎 198 |

▶ Heartbeat

15.3 "Setup" menu

🛈 • 🗑 : Indicates how to navigate to the parameter using the display and operating module
• 🗐 : Indicates how to navigate to the parameter using operating tools (e.g. FieldCare)
• 🔒 : Indicates parameters that can be locked via the access code → 🗎 59.

Navigation   🗑🗐 Setup

Device tag	🔒

Navigation	🗑🗐 Setup → Device tag
Description	Enter a unique name for the measuring point to identify the device quickly within the plant.
User entry	Character string comprising numbers, letters and special characters (32)

Operating mode	🔒

Navigation	🗑🗐 Setup → Operating mode
Prerequisite	The device has the "interface measurement" application package (available for FMP51, FMP52, FMP54) [7].
Description	Select operating mode.
Selection	• Level • Interface with capacitance [*] • Interface [*]
Factory setting	FMP51/FMP52/FMP54: **Level**

---

7) Product structure: Feature 540 "Application Package", Option EB "Interface measurement"
* Visibility depends on order options or device settings

Distance unit

Navigation	�☐ Setup → Distance unit

Description   Used for the basic calibration (Empty / Full).

Selection   *SI units*   *US units*
                         • mm   • ft
                         • m   • in

Tank type

Navigation	☐☐ Setup → Tank type

Prerequisite   Medium type (→ 🖺 135) = Liquid

Description   Select tank type.

Selection   • Metallic
                         • Bypass / pipe
                         • Non metallic
                         • Mounted outside
                         • Coaxial

Factory setting   Depending on the probe

Additional information   • Depending on the probe some of the options mentioned above may not be available or
                           there may be additional options.
                         • For coax probes and probes with metallic center washer **Tank type** parameter
                           corresponds to the type of probe and cannot be changed.

Tube diameter

Navigation	☐☐ Setup → Tube diameter

Prerequisite   Tank type (→ 🖺 120) = Bypass / pipe

Description   Specify diameter of bypass or stilling well.

User entry   0 to 9.999 m

Medium group	🔒

Navigation	◨◰ Setup → Medium group
Prerequisite	• For FMP51/FMP52/FMP54/FMP55: **Operating mode** (→ 📄 119) = **Level** • **Medium type** (→ 📄 135) = **Liquid**
Description	Select medium group.
Selection	• Others • Water based (DC >= 4)
Additional information	This parameter roughly specifies the dielectric constant (DC) of the medium. For a more detailed definition of the DC use the **Medium property** parameter (→ 📄 135).

The **Medium group** parameter presets the **Medium property** parameter (→ 📄 135) as follows:

Medium group	Medium property (→ 📄 135)
Others	Unknown
Water based (DC >= 4)	DC 4 ... 7

ℹ️ The **Medium property** parameter can be changed at a later point of time. However, when doing so, the **Medium group** parameter retains its value. Only the **Medium property** parameter is relevant for the signal evaluation.

ℹ️ The measuring range may be reduced for small dielectric constants. For details refer to the Technical Information (TI) of the respective device.

Empty calibration	🔒

Navigation	◨◰ Setup → Empty calibr.
Description	Distance between process connection and minimum level (0%).
User entry	Depending on the probe
Factory setting	Depending on the probe

Additional information
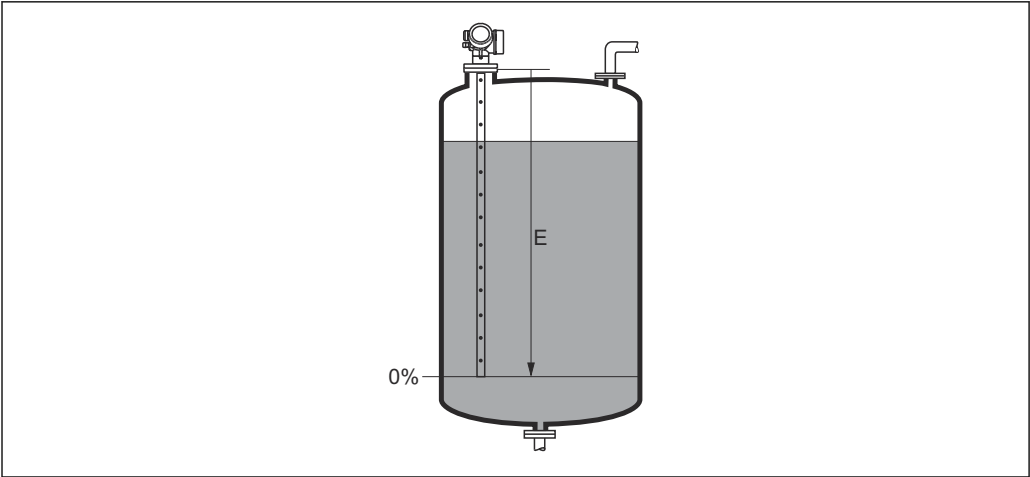
⊡ *25 Empty calibration (E) for level measurements in liquids*
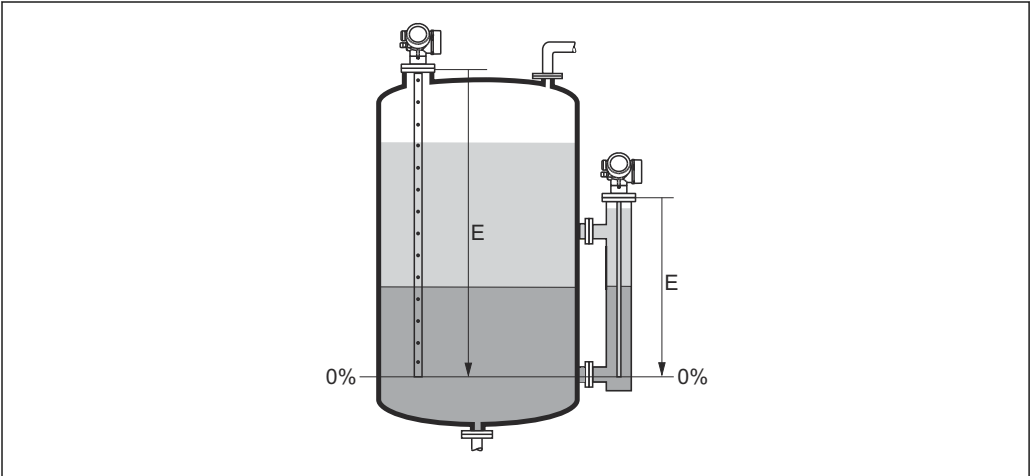
⊡ *26 Empty calibration (E) for interface measurements*

ℹ️ In the case of interface measurements the **Empty calibration** parameter is valid for both, the total and the interface level.

Full calibration

Navigation   ▣▣ Setup → Full calibr.

Description   Distance between minimum level (0%) and maximum level (100%).

User entry   Depending on the probe

Factory setting   Depending on the probe

Additional information
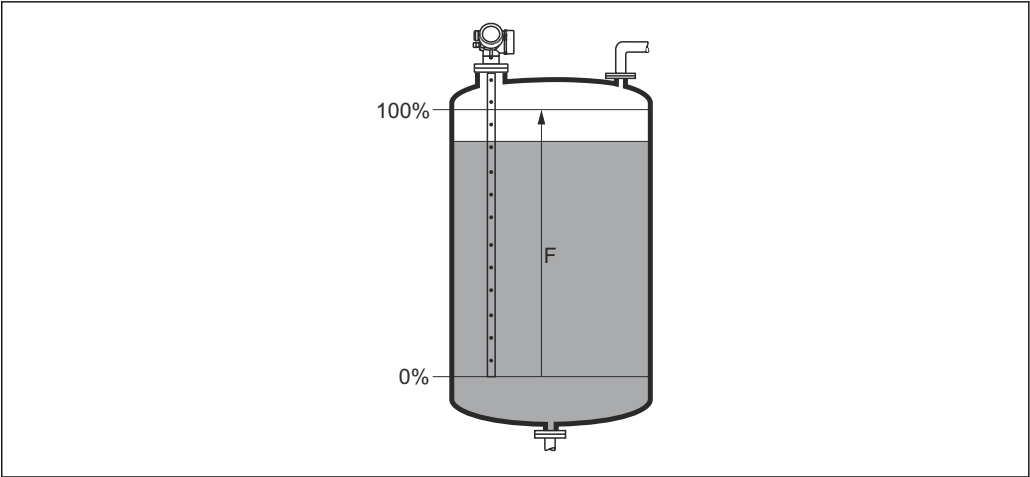
🖻 *27   Full calibration (F) for level measurements in liquids*
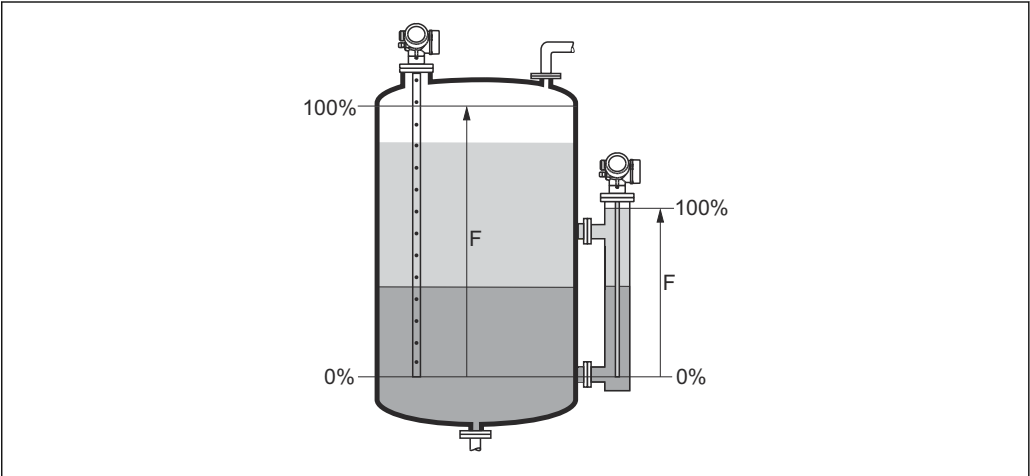
🖻 *28   Full calibration (F) for interface measurements*

ℹ️ In the case of interface measurements the **Full calibration** parameter is valid for both, the total and the interface level.

Level

Navigation   ▣▤ Setup → Level

Description   Displays measured level L_L (before linearization).

Additional information
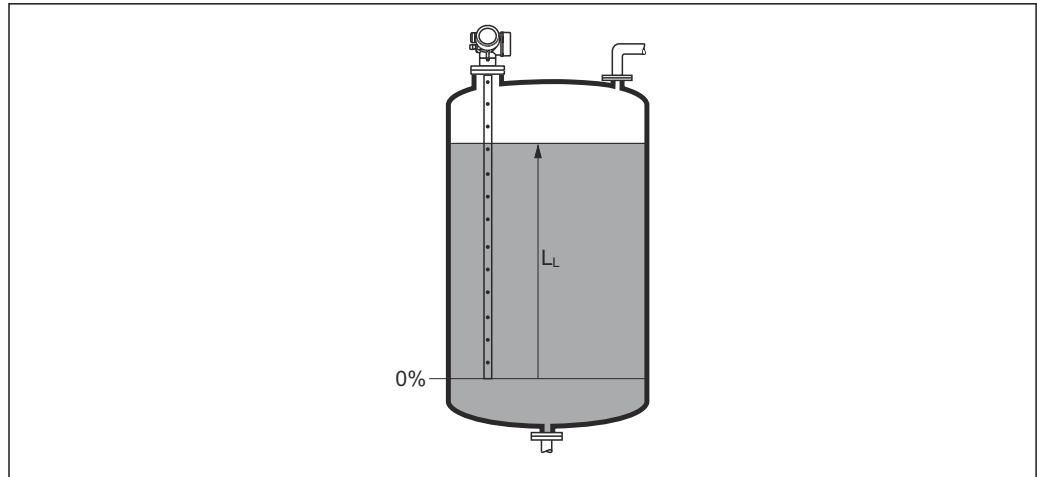
29   Level in case of liquid measurements
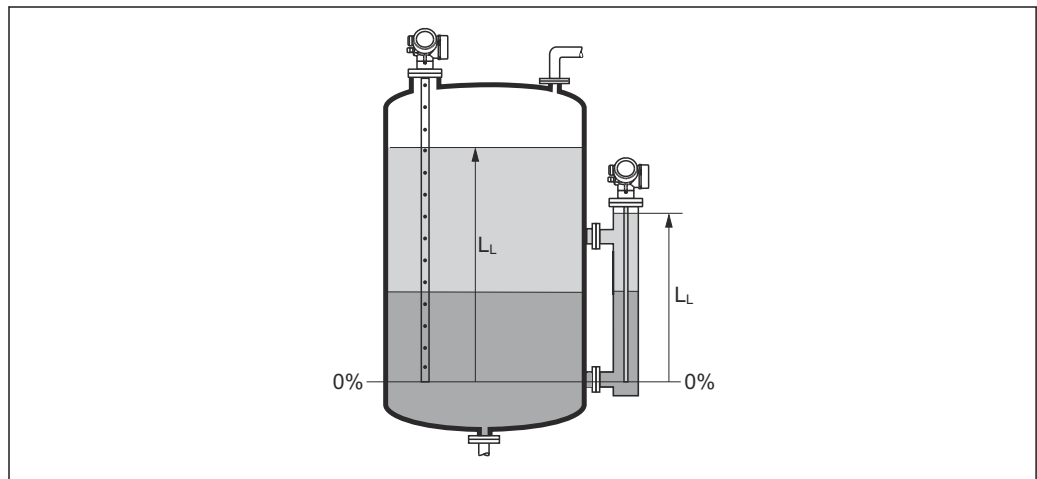
30   Level in case of interface measurements

• The unit is defined in the **Level unit** parameter (→ 🖹 138).
• In case of interface measurements, this parameter always refers to the total level.

Distance

Navigation   Setup → Distance

Description   Displays the measured distance D_L between the reference point (lower edge of the flange or threaded connection) and the level.

Additional information
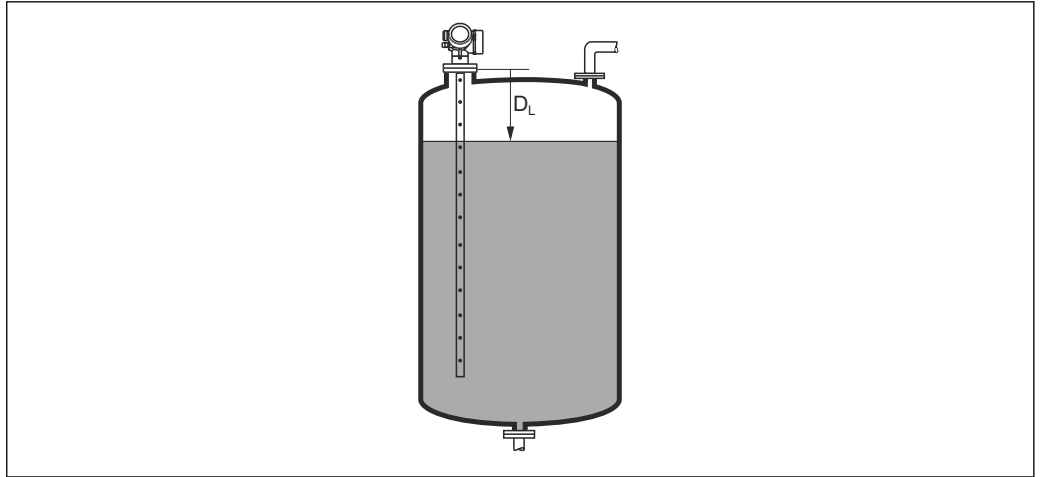
31   Distance for liquid measurements
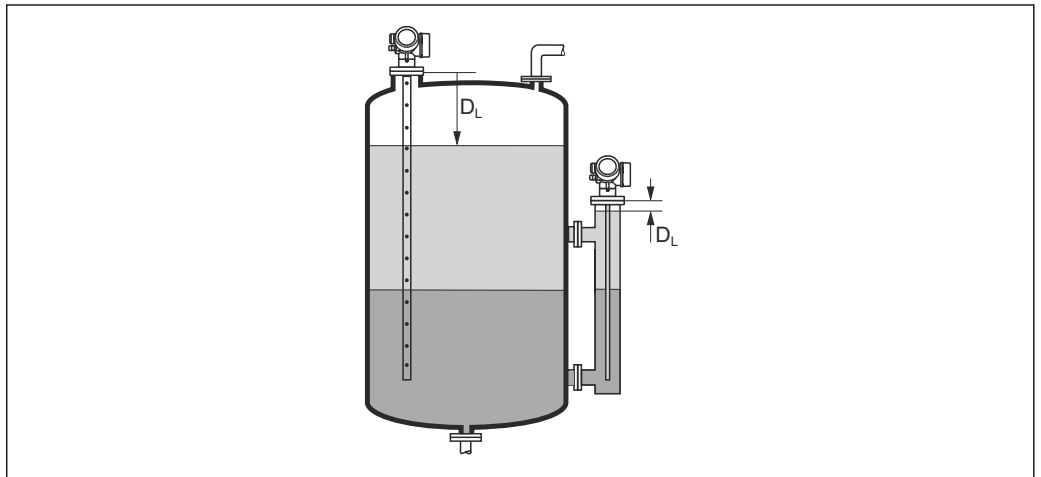
32   Distance for interface measurements

The unit is defined in the **Distance unit** parameter (→ 🖹 120).

Signal quality

Navigation   🖩🖵   Setup → Signal quality

Description   Displays the signal quality of the evaluated echo.

Additional information   **Meaning of the display options**
• **Strong**
The evaluated echo exceeds the threshold by at least 10 mV.
• **Medium**
The evaluated echo exceeds the threshold by at least 5 mV.
• **Weak**
The evaluated echo exceeds the threshold by less than 5 mV.
• **No signal**
The device does not find a usable echo.

The signal quality indicated in this parameter always refers to the currently evaluated echo: either the level/interface echo [8] or the end-of-probe echo. To differentiate between these two, the quality of the end-of-probe echo is always displayed in brackets.

In case of a lost echo (**Signal quality = No signal**) the device generates the following error message:
- F941, for **Output echo lost** (→ 🖺 157) = **Alarm**.
- S941, if another option has been selected in **Output echo lost** (→ 🖺 157).

Tank level	🔒

Navigation	🖲🖵 Setup → Tank level
Prerequisite	**Operating mode** (→ 🖺 119) = **Interface**
Description	Specify whether the tank or bypass is completely flooded or not.
Selection	• Partially filled • Fully flooded

Additional information	**Meaning of the options**
	• **Partially filled**
	  The device searches for 2 echo signals, one for the interface and one for the total level.
	• **Fully flooded**
	  The device searches for the interface level only. With this setting it is essential that the upper level signal always is within the upper blocking distance (UB) in order to avoid that it is evaluated by mistake.
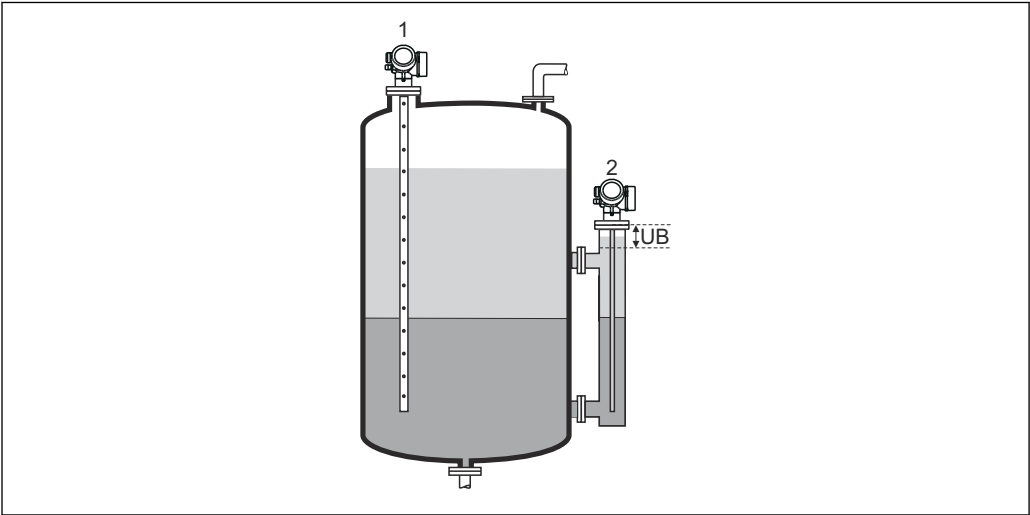
A0013173

1   Partially filled
2   Fully flooded
UB Upper blocking distance

---

8)   Of these two echos the one with the lower quality is indicated.

Distance to upper connection   ⚙

Navigation	⚙🖥 Setup → Dist. up.connect
Prerequisite	The device has the "Interface measurement" application package [9].
Description	Specify distance D_U to upper connection.
User entry	0 to 200 m
Factory setting	• For **Tank level** (→ 🖺 126) = **Partially filled**: 0 mm (0 in) • For **Tank level** (→ 🖺 126) = **Fully flooded**: 250 mm (9.8 in)
Additional information	
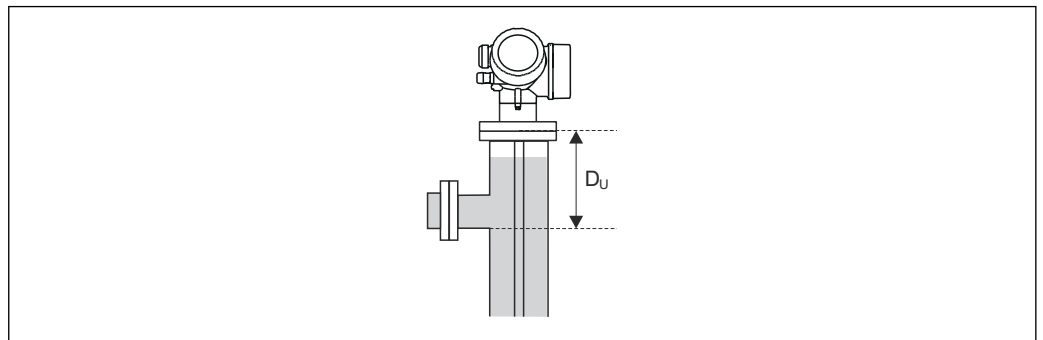
A0013174

Dependence on the "Tank level" parameter
- **Tank level** (→ 🖺 126) = **Partially filled**:
  In this case the **Distance to upper connection** parameter does not influence the measurement. Thus, the default setting needs not to be changed.
- **Tank level** (→ 🖺 126) = **Fully flooded**:
  In this case enter the distance D_U between the reference point and the lower edge of the upper connection.

DC value   ⚙

Navigation	⚙🖥 Setup → DC value
Prerequisite	The device has the "Interface measurement" application package [10].
Description	Specify the relative dielectric constant ε_r of the upper medium (DC_1).
User entry	1.0 to 100

---

9) Product structure: Feature 540 "Application Package", Option EB "Interface measurement"
10) Product structure: feature 540 "Application packages", option EB "Interface measurement"

Additional information
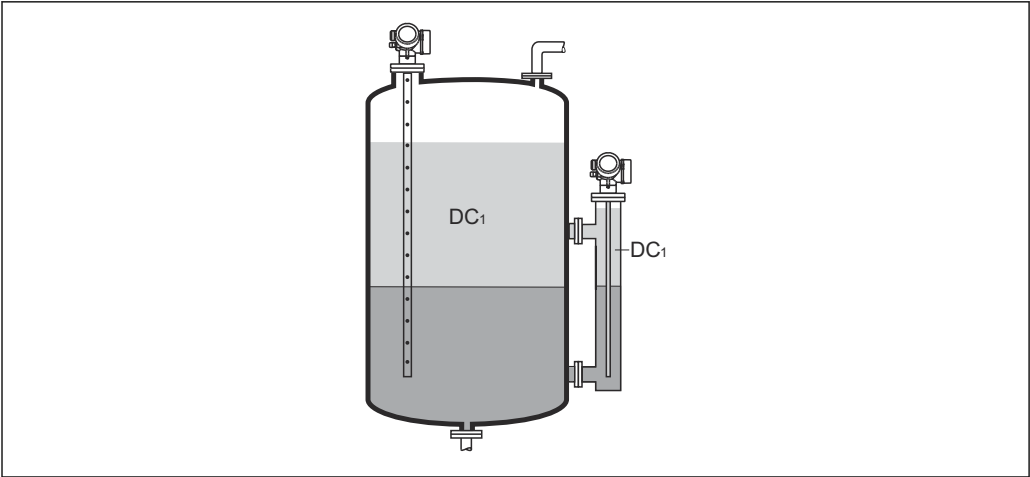
DC1   Relative dielectric constant of the upper medium.

ℹ️ For the dielectric constants (DC values) of many media commonly used in industry, please refer to:
  • Dielectric constant (DC value) Compendium CP01076F
  • The Endress+Hauser "DC Values app" (available for Android and iOS)

Interface

Navigation   ⊞⊟ Setup → Interface

Prerequisite   **Operating mode (→ 🖺 119)** = **Interface** or **Interface with capacitance**

Description   Displays the measured interface level L_I (before linearization).

Additional information
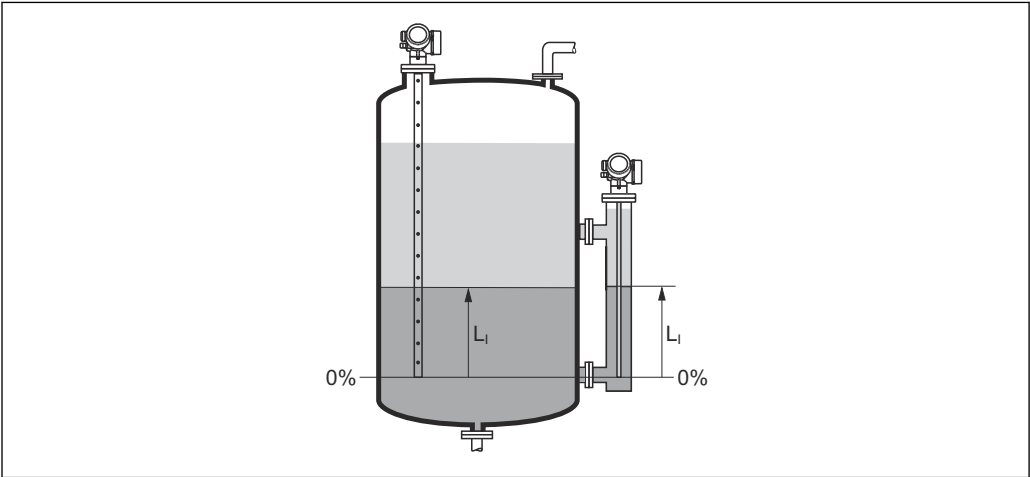
ℹ️ The unit is defined in the **Level unit** parameter (→ 🖺 138).

Interface distance

Navigation	⊞⊟	Setup → Interface dist.

Prerequisite	Operating mode (→ 🗎 119) = **Interface** or **Interface with capacitance**

Description	Displays the measured distance D_I between the reference point (lower edge of flange or threaded connection) and the interface.

Additional information	
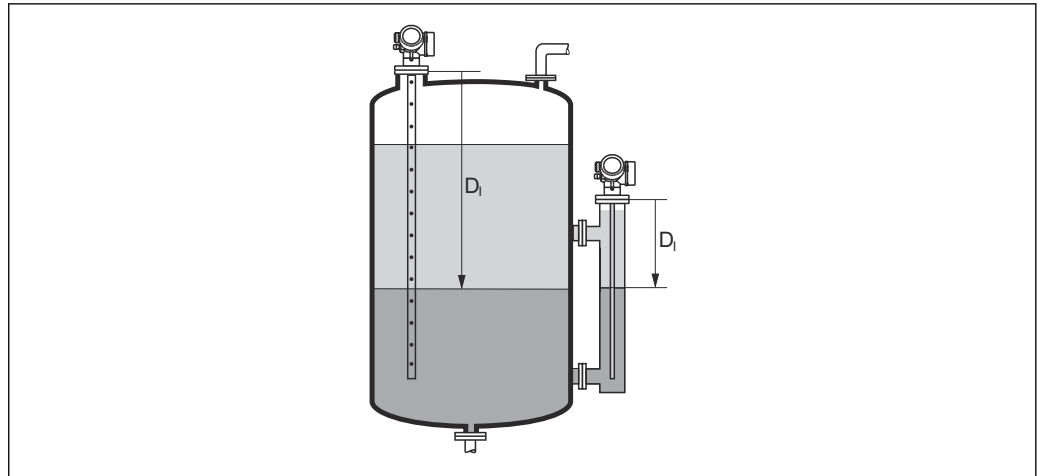
A0013202

The unit is defined in the **Distance unit** parameter (→ 🗎 120).

Confirm distance   🔒

Navigation	⊟	Setup → Confirm distance

Description	Specify, whether the measured distance matches the real distance.

Depending on the selection the device automatically sets the range of mapping.

Selection	• Manual map • Distance ok • Distance unknown • Distance too small * • Distance too big * • Tank empty • Delete map

---

*   Visibility depends on order options or device settings

Additional information	**Meaning of the options**
	• **Manual map**
	To be selected if the range of mapping is to be defined manually in the **Mapping end point** parameter (→ 🗏 131). In this case it is not necessary to confirm the distance.
	• **Distance ok**
	To be selected if the measured distance matches the actual distance. The device performs a mapping.
	• **Distance unknown**
	To be selected if the actual distance is unknown. A mapping can not be performed in this case.
	• **Distance too small**
	To be selected if the measured distance is smaller than the actual distance. The device searches for the next echo and returns to the **Confirm distance** parameter. The distance is recalculated and displayed. The comparison must be repeated until the displayed distance matches the actual distance. After this, the recording of the map can be started by selecting **Distance ok**.
	• **Distance too big** [11]
	To be selected if the measured distance exceeds the actual distance. The device adjusts the signal evaluation and returns to the **Confirm distance** parameter. The distance is recalculated and displayed. The comparison must be repeated until the displayed distance matches the actual distance. After this, the recording of the map can be started by selecting **Distance ok**.
	• **Tank empty**
	To be selected if the tank is completely empty. The device records a mapping covering the complete measuring range.
	To be selected if the tank is completely empty. The device records a mapping covering the complete measuring range minus **Map gap to LN**.
	• **Factory map**
	To be selected if the present mapping curve (if one exists) is to be deleted. The device returns to the **Confirm distance** parameter and a new mapping can be recorded.

ℹ️ When operating via the display module, the measured distance is displayed together with this parameter for reference purposes.

ℹ️ For interface measurements the distance always refers to the toatal level (not the interface level).

ℹ️ If the teaching procedure with the **Distance too small** option or the **Distance too big** option is quit before the distance has been confirmed, a map is **not** recorded and the teaching procedure is reset after 60 s.

Present mapping

Navigation	🔲	Setup → Present mapping

Description	Indicates up to which distance a mapping has already been recorded.

---

11) Only available for "Expert → Sensor → Echo tracking → **Evaluation mode** parameter" = "Short time history" or "Long time history"

Mapping end point	⌂

Navigation	▣ Setup → Map. end point
Prerequisite	Confirm distance (→ 🗎 129) = **Manual map** or **Distance too small**
Description	Specify new end of the mapping.
User entry	0 to 200 000.0 m
Additional information	This parameter defines up to which distance the new mapping is to be recorded. The distance is measured from the reference point, i.e. from the lower edge of the mounting flange or the threaded connection.

> For reference purposes the **Present mapping** parameter (→ 🗎 130) is displayed together with this parameter. It indicates up to which distance a mapping has already been recorded.

Record map	⌂

Navigation	▣ Setup → Record map
Prerequisite	Confirm distance (→ 🗎 129) = **Manual map** or **Distance too small**
Description	Start recording of the map.
Selection	• No • Record map • Delete map
Additional information	**Meaning of the options** • **No** The map is not recorded. • **Record map** The map is recorded. After the recording is completed, the new measured distance and the new mapping range appear on the display. When operating via the local display, these values must be confirmed by pressing ☑. • **Delete map** The mapping (if one exists) is deleted and the device displays the recalculated measured distance and the mapping range. When operating via the local display, these values must be confirmed by pressing ☑.

15.3.1 "Mapping" wizard

ℹ️ The **Mapping** wizard is only available when operating via the local display. When operating via an operating tool, all parameters concerning the mapping are located directly in the **Setup** menu (→ 🖺 119).

ℹ️ In the **Mapping** wizard two parameters are displayed simultaneously on the display module at any one time. The upper parameter can be edited, whereas the lower parameter is displayed for reference purposes only.

Navigation   ⊠   Setup → Mapping

Confirm distance   ⓐ

Navigation	⊠	Setup → Mapping → Confirm distance
Description	→ 🖺 129	

Mapping end point   ⓐ

Navigation	⊠	Setup → Mapping → Map. end point
Description	→ 🖺 131	

Record map   ⓐ

Navigation	⊠	Setup → Mapping → Record map
Description	→ 🖺 131	

Distance

Navigation	⊠	Setup → Mapping → Distance
Description	→ 🖺 124	

15.3.2   "Advanced setup" submenu

Navigation   ▣   Setup → Advanced setup

Locking status

Navigation	▣▣ Setup → Advanced setup → Locking status
Description	Indicates the write protection with the highest priority that is currently active.
User interface	• Hardware locked • SIL locked • CT active - defined parameters • WHG locked • Temporarily locked
Additional information	**Meaning and priorities of the types of write protection** • **Hardware locked (priority 1)** The DIP switch for hardware locking is activated on the main electronics module. This locks write access to the parameters. • **SIL locked (priority 2)** The SIL mode is activated. Writing access to the relevant parameters is denied. • **WHG locked (priority 3)** The WHG mode is activated. Writing access to the relevant parameters is denied. • **Temporarily locked (priority 4)** Write access to the parameters is temporarily locked on account of internal processes in progress in the device (e.g. data upload/download, reset etc.). The parameters can be modified as soon as the processes are complete.

⚹ On the display module, the 🔒-symbol appears in front of parameters that cannot be modified since they are write-protected.

Access status tooling

Navigation	▣ Setup → Advanced setup → Access stat.tool
Description	Shows the access authorization to the parameters via the operating tool.
Additional information	⚹ The access authorization can be changed via the **Enter access code** parameter (→ 🖹 134).

⚹ If additional write protection is active, this restricts the current access authorization even further. The write protection status can be viewed via the **Locking status** parameter (→ 🖹 133).

Access status display

Navigation		Setup → Advanced setup → Access stat.disp

Prerequisite	The device has a local display.

Description	Indicates access authorization to parameters via local display.

Additional information	The access authorization can be changed via the **Enter access code** parameter (→ 🖺 134).
	If additional write protection is active, this restricts the current access authorization even further. The write protection status can be viewed via the **Locking status** parameter (→ 🖺 133).

Enter access code

Navigation		Setup → Advanced setup → Ent. access code

Description	Enter access code to disable write protection of parameters.

User entry	0 to 9999

Additional information	• The customer-specific access code that was defined in the **Define access code** parameter (→ 🖺 178) must be entered for local operation.
	• If an incorrect access code is entered, users retain their current access authorization.
	• The write protection affects all parameters marked with the 🖻 symbol in the document. On the local display, the 🖻 symbol in front of a parameter indicates that the parameter is write-protected.
	• If no key is pressed for 10 minutes or the user goes from the navigation and editing mode back to the measured value display mode, the device automatically locks the write-protected parameters after another 60 s.
	Please contact your Endress+Hauser Sales Center if you lose your access code.

"Level" submenu

ℹ️ **Level** submenu (→ 🖺 135) is only visible for **Operating mode (→ 🖺 119) = Level**

Navigation   �@🗐   Setup → Advanced setup → Level

Medium type   🔒

Navigation	�@🗐 Setup → Advanced setup → Level → Medium type
Description	Specify type of medium.
User interface	• Liquid • Solid
Factory setting	FMP50, FMP51, FMP52, FMP53, FMP54, FMP55: **Liquid**
Additional information	The **Solid** option is only available for **Operating mode (→ 🖺 119) = Level** ℹ️ This parameter determines the value of several other parameters and strongly influences the complete signal evaluation. Therefore, it is strongly recommended **not to change** the factory setting.

Medium property   🔒

Navigation	�@🗐 Setup → Advanced setup → Level → Medium property
Prerequisite	• **Operating mode (→ 🖺 119) = Level** • **EOP level evaluation ≠ Fix DC**
Description	Specify the dielectric constant ε_r of the medium.
Selection	• Unknown • DC 1.4 … 1.6 • DC 1.6 … 1.9 • DC 1.9 … 2.5 • DC 2.5 … 4 • DC 4 … 7 • DC 7 … 15 • DC > 15
Factory setting	Depends on the **Medium type (→ 🖺 135)** and **Medium group (→ 🖺 121)** parameters.

Additional information   *Dependency of "Medium type" and "Medium group"*

Medium type (→ 🖺 135)	Medium group (→ 🖺 121)	Medium property
Solid		Unknown
Liquid	Water based (DC >= 4)	DC 4 ... 7
	Others	Unknown

ℹ️ For the dielectric constants (DC values) of many media commonly used in industry, please refer to:
• Dielectric constant (DC value) Compendium CP01076F
• The Endress+Hauser "DC Values app" (available for Android and iOS)

ℹ️ If **EOP level evaluation** = **Fix DC**, the exact dielectric constant must be specified in the **DC value** parameter (→ 🖺 127). The **Medium property** parameter therefore does not apply in this case.

Process property   🔒

Navigation   🖥️🖳 Setup → Advanced setup → Level → Process property

Description   Specify typical rate of level change.

Selection   **For "Medium type" = "Liquid"**
• Very fast > 10 m (400 in)/min
• Fast > 1 m (40 in)/min
• Standard < 1 m (40in) /min
• Medium < 10 cm (4in) /min
• Slow < 1 cm (0.4in) /min
• No filter / test

For "Medium type" = "Solid"
• Very fast > 100 m (333 ft) /h
• Fast > 10 m (33 ft) /h
• Standard < 10 m (33 ft) /h
• Medium < 1 m (3ft) /h
• Slow < 0.1 m (0.3ft) /h
• No filter / test

Additional information   The device adjusts the signal evaluation filters and the damping of the output signal to the typical rate of level change defined in this parameter:

For "Operating mode" = "Level" and "Medium type" = "Liquid"

Process property	Step response time / s
Very fast > 10 m (400 in)/min	5
Fast > 1 m (40 in)/min	5
Standard < 1 m (40in) /min	14
Medium < 10 cm (4in) /min	39
Slow < 1 cm (0.4in) /min	76
No filter / test	< 1

For "Operating mode" = "Level" and "Medium type" = "Solid"

Process property	Step response time / s
Very fast > 100 m (333 ft) /h	37
Fast > 10 m (33 ft) /h	37
Standard < 10 m (33 ft) /h	74
Medium < 1 m (3ft) /h	146
Slow < 0.1 m (0.3ft) /h	290
No filter / test	< 1

For "Operating mode" = "Interface" or "Interface with capacitance"

Process property	Step response time / s
Very fast > 10 m (400 in)/min	5
Fast > 1 m (40 in)/min	5
Standard < 1 m (40in) /min	23
Medium < 10 cm (4in) /min	47
Slow < 1 cm (0.4in) /min	81
No filter / test	2.2

Advanced process conditions   🔒

Navigation   Setup → Advanced setup → Level → Adv. conditions

Prerequisite   **Operating mode (→ 🗎 119) = Level**

Description   Specify additional process conditions (if required).

Selection   • None
                                  • Oil/Water condensate
                                  • Probe near tank bottom
                                  • Build up
                                  • Foam (>5cm/0,16ft)

Additional information   **Meaning of the options**
                                  • **Oil/Water condensate** (only **Medium type** = **Liquid**)
                                    Makes sure that in the case of two-phase media only the total level is detected (example: oil/condensate application).
                                  • **Probe near tank bottom** (only for **Medium type** = **Liquid**)
                                    Improves the empty detection, especially if the probe is mounted close to the tank bottom.
                                  • **Build up**
                                    Increases **EOP range upper area** in order to ensure a safe empty-detection even if the end-of-probe signal has shifted due to build-up.
                                    Enables a safe empty-detection even if the end-of-probe signal has shifted due to build-up.
                                  • **Foam (>5cm/0,16ft)** (only for **Medium type** = **Liquid**)
                                    Optimizes the signal evaluation in applications with foam formation.

Level unit	🔒

Navigation	🔲🔲 Setup → Advanced setup → Level → Level unit

Description	Select level unit.

Selection	*SI units* *US units*

SI units
• %
• m
• mm

US units
• ft
• in

Additional information	The level unit may differ from the distance unit defined in the **Distance unit** parameter (→ 🔲 120):

• The unit defined in the **Distance unit** parameter is used for the basic calibration (**Empty calibration (→ 🔲 121)** and **Full calibration (→ 🔲 122)**).
• The unit defined in the **Level unit** parameter is used to display the (unlinearized) level.

Blocking distance	🔒

Navigation	🔲🔲 Setup → Advanced setup → Level → Blocking dist.

Description	Specify upper blocking distance UB.

User entry	0 to 200 m

Factory setting	• For coax probes: 0 mm (0 in)

• For rod and rope probes up to 8 m (26 ft): 200 mm (8 in)
• For rod and rope probes above 8 m (26 ft): 0.025 * Sondenlänge

For FMP51/FMP52/FMP54 with the **Interface measurement** application package [12] and for FMP55:
100 mm (3.9 in) for all antenna types

Additional information	Signals in the upper blocking distance are only evaluated if they have been outside the blocking distance when the device was switched on and move into the blocking distance due to a level change during operation. Signals which are already in the blocking distance when the device is switched on, are ignored.

ℹ️ This behavior is only valid if the following two conditions are met:
• Expert → Sensor → Echo tracking → Evaluation mode = **Short time history** or **Long time history**)
• Expert → Sensor → Gas phase compensation → GPC mode= **On**, **Without correction** or **External correction**

If one of these conditions is not met, signals in the blocking distance will always be ignored.

ℹ️ A different behavior for signals in the blocking distance can be defined in the **Blocking distance evaluation mode** parameter.

ℹ️ If required, a different behavior for signals in the blocking distance can be defined by the Endress+Hauser service.

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12) Ordering feature 540 "Application Package", option EB "Interface measurement"

⊠ 33   Blocking distance (UB) for liquid measurements

Level correction	🔒

Navigation	🔘🖥 Setup → Advanced setup → Level → Level correction
Description	Specify level correction (if required).
User entry	−200 000.0 to 200 000.0 %
Additional information	The value specified in this parameter is added to the measured level (before linearization).

"Interface" submenu

Navigation   Setup → Advanced setup → Interface

Process property

Navigation   Setup → Advanced setup → Interface → Process property

Description   Specify typical rate of change for the interface position.

Selection   • Fast > 1 m (40 in)/min
                              • Standard < 1 m (40in) /min
                              • Medium < 10 cm (4in) /min
                              • Slow < 1 cm (0.4in) /min
                              • No filter / test

Additional information   The device adjusts the signal evaluation filters and the damping of the output signal to the
                              typical rate of level change defined in this parameter:

Process property	Step response time / s
Fast > 1 m (40 in)/min	5
Standard < 1 m (40in) /min	15
Medium < 10 cm (4in) /min	40
Slow < 1 cm (0.4in) /min	74
No filter / test	2.2

DC value lower medium

Navigation   Setup → Advanced setup → Interface → DC lower medium

Prerequisite   Operating mode (→ 🖺 119) = Interface or Interface with capacitance

Description   Specify the dielectric constant ε_r of the lower medium.

User entry   1 to 100

Additional information   🛈 For the dielectric constants (DC values) of many media commonly used in industry,
                              please refer to:
                              • Dielectric constant (DC value) Compendium CP01076F
                              • The Endress+Hauser "DC Values app" (available for Android and iOS)

                              🛈 The factory setting, $\varepsilon_r = 80$, applies for water at 20 ℃ (68 ℉).

Level unit	🔒

Navigation	🆎🖳 Setup → Advanced setup → Interface → Level unit

Description	Select level unit.

Selection	*SI units* *US units*

SI units
• %
• m
• mm

US units
• ft
• in

Additional information	The level unit may differ from the distance unit defined in the **Distance unit** parameter (→ 🖺 120):

• The unit defined in the **Distance unit** parameter is used for the basic calibration (**Empty calibration** (→ 🖺 121) and **Full calibration** (→ 🖺 122)).
• The unit defined in the **Level unit** parameter is used to display the (unlinearized) level and interface position.

Blocking distance	🔒

Navigation	🆎🖳 Setup → Advanced setup → Interface → Blocking dist.

Description	Specify upper blocking distance UB.

User entry	0 to 200 m

Factory setting	• For coax probes: 100 mm (3.9 in) • For rod and rope probes up to 8 m (26 ft): 200 mm (8 in) • For rod and rope probes above 8 m (26 ft): 0.025 * length of probe

Additional information	Echoes from within the blocking distance are not taken into account in the signal evaluation. The upper blocking distance is used

• to suppress interference echoes at the top end of the probe.
• to suppress the echo of the total level in the case of flooded bypasses.
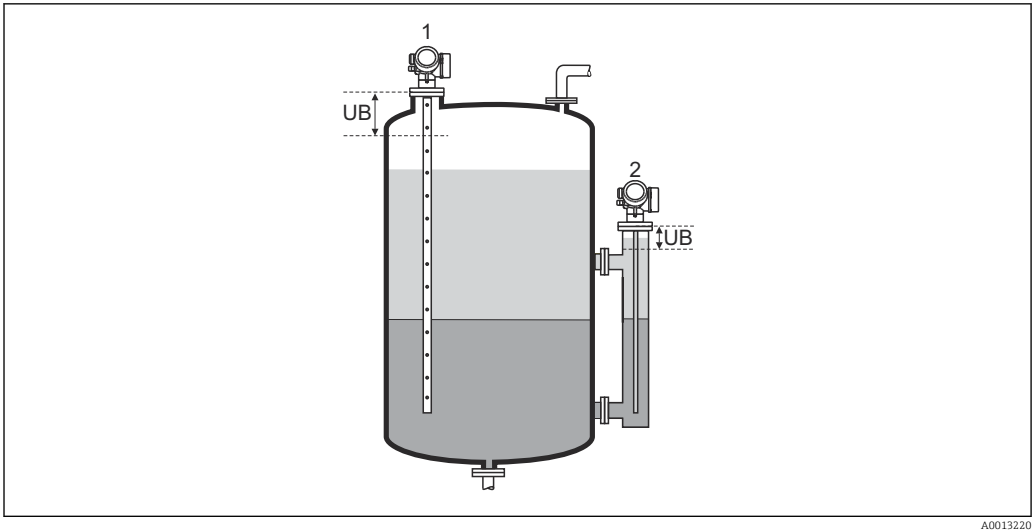
1 Suppression of interference echoes at the top end of the probe.
2 Suppression of the level signal in case of a flooded bypass.
UB Upper blocking distance

Level correction

Navigation	Setup → Advanced setup → Interface → Level correction
Description	Specify level correction (if required).
User entry	−200 000.0 to 200 000.0 %
Additional information	The value specified in this parameter is added to the measured total and interface levels (before linearization).

Manual thickness upper layer

Navigation	Setup → Advanced setup → Interface → Man.thick.up.lay
Description	Specify the manually determined interface thickness UP (i.e. the thickness of the upper medium).
User entry	0 to 200 m

Additional information
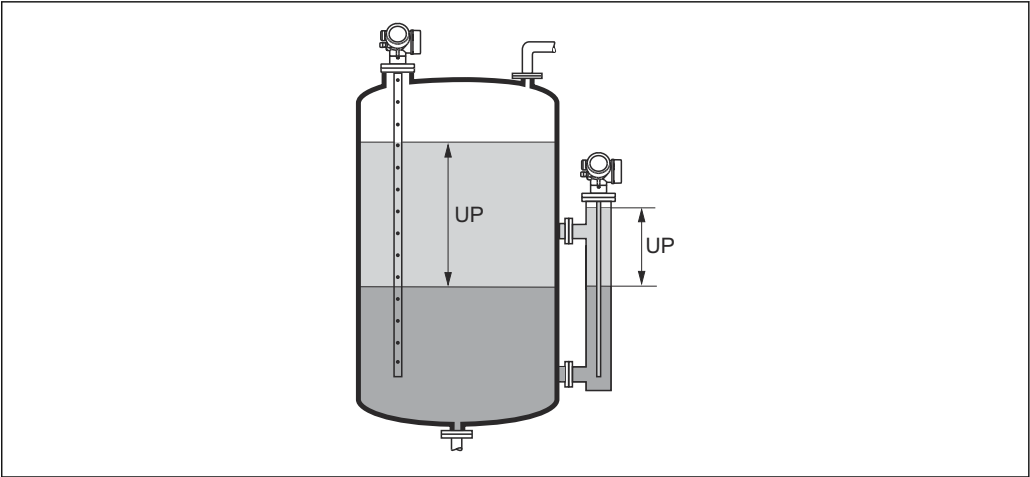
UP   Interface thickness (= thickness of upper medium)

ℹ️ On the local display, the measured interface thickness is indicated together with the manual interface thickness. By comparing these two values the device can automatically adjust the dielectric constant of the upper medium.

Measured thickness upper layer

Navigation   ⊟   Setup → Advanced setup → Interface → Meas.thick.u.lay

Description   Displays the measured interface thickness. (Thickness UP of the upper medium).

DC value   🔒

Navigation   ⊟   Setup → Advanced setup → Interface → DC value

Description   Displays relatvie dielectric constant ε_r of the upper medium (DC_1) before correction.

Calculated DC value

Navigation   ⊟   Setup → Advanced setup → Interface → Calc. DC value

Description   Displays calculated (i.e. corrected) relative dielectric constant ε_r (DC1) of the upper medium.

Use calculated DC value	⌂

Navigation	⊟ Setup → Advanced setup → Interface → Use calc. DC
Description	Specify whether the calculated dielectric constant is to be used.
Selection	• Save and exit • Cancel and exit
Additional information	**Meaning of the options** • Save and exit The calculated constant is assumed to be the correct one. • Cancel and exit The calculated dielectric constant is rejected; the previous dielectric constant remains active. ℹ On the local display, the **Calculated DC value** parameter (→ 🕮 143) is displayed together with this parameter.

"Automatic DC calculation" wizard

ℹ️ The **Automatic DC calculation** wizard is only available when operating via the local display. When operating via an operating tool, all parameters concerning the automatic DC calculation are located directly in the **Interface** submenu (→ 🖺 140)

ℹ️ In the **Automatic DC calculation** wizard two parameters are displayed simultaneously on the display module at any one time. The upper parameter can be edited, whereas the lower parameter is displayed for reference purposes only.

Navigation   ⊠   Setup → Advanced setup → Interface → Autom. DC calc.

Manual thickness upper layer   🔒

Navigation   ⊠   Setup → Advanced setup → Interface → Autom. DC calc. → Man.thick.up.lay

Description   → 🖺 142

DC value   🔒

Navigation   ⊠   Setup → Advanced setup → Interface → Autom. DC calc. → DC value

Description   → 🖺 143

Use calculated DC value   🔒

Navigation   ⊠   Setup → Advanced setup → Interface → Autom. DC calc. → Use calc. DC

Description   → 🖺 144

"Linearization" submenu
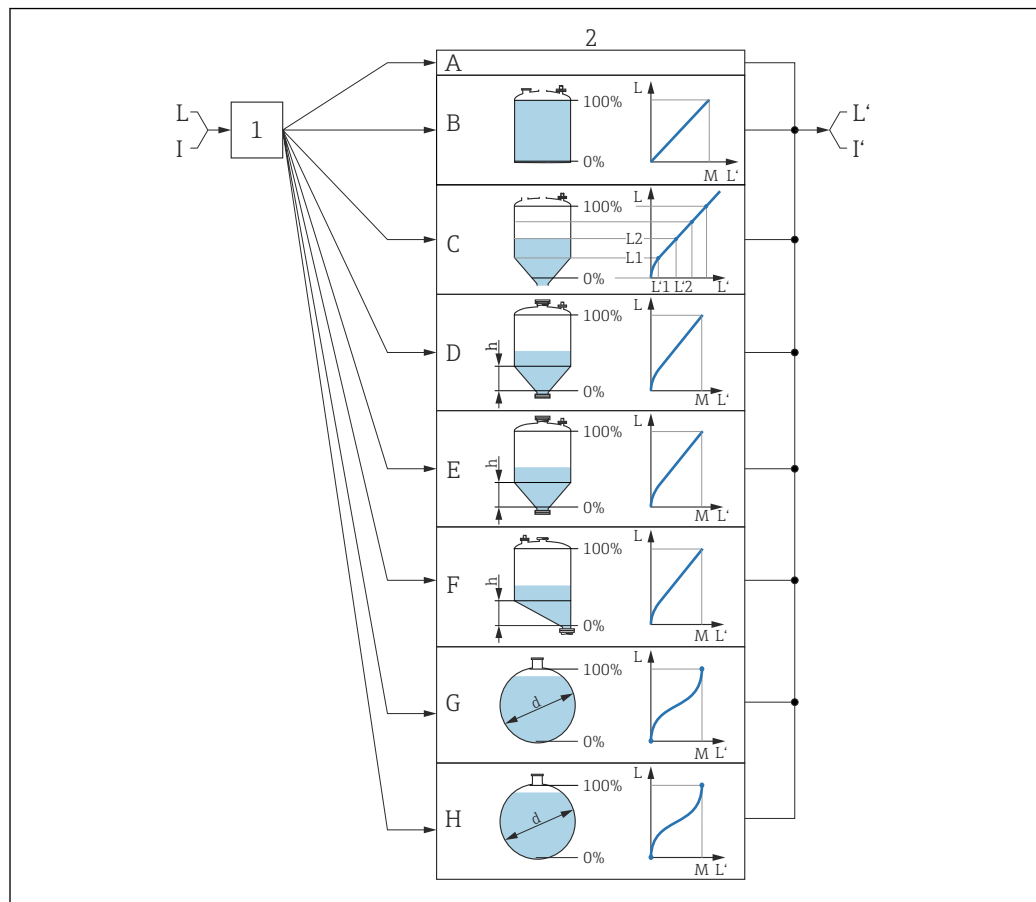
⊠ 34   Linearization: Conversion of the level and, if applicable, interface into a volume or a weight; the conversion depends on the vessel shape

1   Selection of linearization type and unit
2   Configuration of the linearization
A   Linearization type (→ 🖻 149) = None
B   Linearization type (→ 🖻 149) = Linear
C   Linearization type (→ 🖻 149) = Table
D   Linearization type (→ 🖻 149) = Pyramid bottom
E   Linearization type (→ 🖻 149) = Conical bottom
F   Linearization type (→ 🖻 149) = Angled bottom
G   Linearization type (→ 🖻 149) = Horizontal cylinder
H   Linearization type (→ 🖻 149) = Sphere
I   For "Operating mode (→ 🖻 119)" = "Interface" or "Interface with capacitance": interface before linearization (measured in the level unit)
I'   For "Operating mode (→ 🖻 119)" = "Interface" or "Interface with capacitance": interface after linearization (corresponds to volume or weight)
L   Level before linearization (measured in level unit)
L'   Level linearized (→ 🖻 152) (corresponds to volume or weight)
M   Maximum value (→ 🖻 152)
d   Diameter (→ 🖻 153)
h   Intermediate height (→ 🖻 153)

Structure of the submenu on the local display

Navigation   ⌖   Setup → Advanced setup → Linearization

‣ Linearization

       Linearization type

       Unit after linearization

       Free text

       Maximum value

       Diameter

       Intermediate height

       Table mode

       ‣ Edit table

              Level

              Customer value

       Activate table

Structure of the submenu in the operating tool (e.g. FieldCare)

Navigation   ▣   Setup → Advanced setup → Linearization

▸ Linearization

    Linearization type

    Unit after linearization

    Free text

    Level linearized

    Interface linearized

    Maximum value

    Diameter

    Intermediate height

    Table mode

    Table number

    Level

    Level

    Customer value

    Activate table

Description of the parameters

Navigation   ▣▣ Setup → Advanced setup → Linearization

Linearization type	🔒

Navigation   ▣▣ Setup → Advanced setup → Linearization → Lineariz. type

Description   Select linearization type.

Selection   • None
                            • Linear
                            • Table
                            • Pyramid bottom
                            • Conical bottom
                            • Angled bottom
                            • Horizontal cylinder
                            • Sphere

Additional information
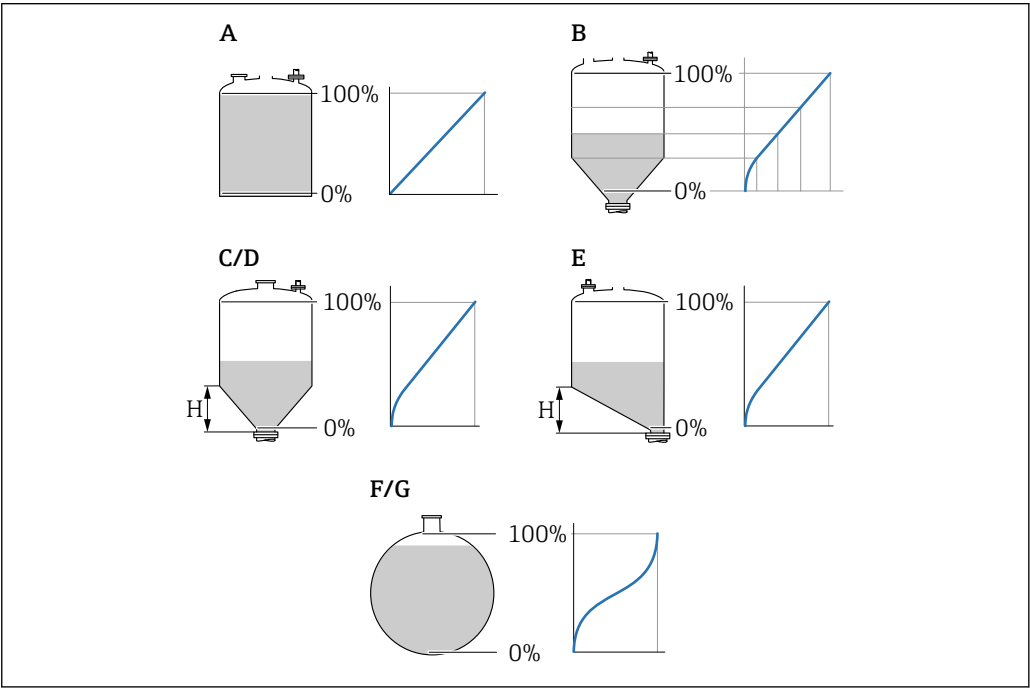
🖼 *35   Linearization types*

A   None
B   Table
C   Pyramid bottom
D   Conical bottom
E   Angled bottom
F   Sphere
G   Horizontal cylinder

Meaning of the options

- **None**
  The level is output in the level unit without being converted (linearized) beforehand.
- **Linear**
  The output value (volume/weight) is proportional to the level L. This applies, for example, to vertical cylindrical tanks and silos. The following parameters must also be specified:
  - **Unit after linearization** (→ 🗎 150)
  - **Maximum value** (→ 🗎 152): maximum volume or weight
- **Table**
  The relationship between the measured level L and the output value (volume/weight) is defined by a linearization table consisting of up to 32 pairs of values "level - volume" or "level - weight" respectively. The following parameters must also be specified:
  - **Unit after linearization** (→ 🗎 150)
  - **Table mode** (→ 🗎 153)
  - For every point in the table: **Level** (→ 🗎 155)
  - For every point in the table: **Customer value** (→ 🗎 155)
  - **Activate table** (→ 🗎 155)
- **Pyramid bottom**
  The output value corresponds to the volume or weight in a silo with a pyramid bottom. The following parameters must also be specified:
  - **Unit after linearization** (→ 🗎 150)
  - **Maximum value** (→ 🗎 152): maximum volume or weight
  - **Intermediate height** (→ 🗎 153): the height of the pyramid
- **Conical bottom**
  The output value corresponds to the volume or weight in a tank with a conical bottom. The following parameters must also be specified:
  - **Unit after linearization** (→ 🗎 150)
  - **Maximum value** (→ 🗎 152): maximum volume or weight
  - **Intermediate height** (→ 🗎 153): the height of the cone
- **Angled bottom**
  The output value corresponds to the volume or weight in a silo with an angled bottom. The following parameters must also be specified:
  - **Unit after linearization** (→ 🗎 150)
  - **Maximum value** (→ 🗎 152): maximum volume or weight
  - **Intermediate height** (→ 🗎 153): height of the angled bottom
- **Horizontal cylinder**
  The output value corresponds to the volume or weight in a horizontal cylinder. The following parameters must also be specified:
  - **Unit after linearization** (→ 🗎 150)
  - **Maximum value** (→ 🗎 152): maximum volume or weight
  - **Diameter** (→ 🗎 153)
- **Sphere**
  The output value corresponds to the volume or weight in a spherical tank. The following parameters must also be specified:
  - **Unit after linearization** (→ 🗎 150)
  - **Maximum value** (→ 🗎 152): maximum volume or weight
  - **Diameter** (→ 🗎 153)

Unit after linearization	🔒

Navigation   Setup → Advanced setup → Linearization → Unit lineariz.

Prerequisite   **Linearization type** (→ 🗎 149) ≠ None

Description	Select the unit for the linearized value.
Selection	Selection/input (uint16) • 1095 = [short Ton] • 1094 = [lb] • 1088 = [kg] • 1092 = [Ton] • 1048 = [US Gal.] • 1049 = [Imp. Gal.] • 1043 = [ft³] • 1571 = [cm³] • 1035 = [dm³] • 1034 = [m³] • 1038 = [l] • 1041 = [hl] • 1342 = [%] • 1010 = [m] • 1012 = [mm] • 1018 = [ft] • 1019 = [inch] • 1351 = [l/s] • 1352 = [l/min] • 1353 = [l/h] • 1347 = [m³/s] • 1348 = [m³/min] • 1349 = [m³/h] • 1356 = [ft³/s] • 1357 = [ft³/min] • 1358 = [ft³/h] • 1362 = [US Gal./s] • 1363 = [US Gal./min] • 1364 = [US Gal./h] • 1367 = [Imp. Gal./s] • 1358 = [Imp. Gal./min] • 1359 = [Imp. Gal./h] • 32815 = [Ml/s] • 32816 = [Ml/min] • 32817 = [Ml/h] • 1355 = [Ml/d]

Additional information   The selected unit is only used for display purposes. The measured value is **not** converted on the basis of the selected unit.

Distance-to-distance linearization is also possible, i.e. a linearization from the level unit to another length unit. Select the **Linear** linearization mode for this purpose. To specify the new level unit, select the **Free text** option in the **Unit after linearization** parameter and enter the unit in the **Free text** parameter (→ 🖺 151).

Free text   🔒

Navigation	🖩🖵 Setup → Advanced setup → Linearization → Free text
Prerequisite	Unit after linearization (→ 🖺 150) = **Free text**
Description	Enter unit symbol.

| User entry | Up to 32 alphanumerical characters (letters, numbers, special characters) |

Level linearized

Navigation	▤ Setup → Advanced setup → Linearization → Level linearized
Description	Displays linearized level.
Additional information	• The unit is defined by the **Unit after linearization** parameter → 🖺 150. • For interface measurements, this parameter always refers to the total level.

Interface linearized

Navigation	▤ Setup → Advanced setup → Linearization → Interf. lineariz
Prerequisite	Operating mode (→ 🖺 119) = **Interface** or **Interface with capacitance**
Description	Displays the linearized interface height.
Additional information	The unit is defined in the **Unit after linearization** parameter → 🖺 150.

Maximum value

Navigation	▤▤ Setup → Advanced setup → Linearization → Maximum value
Prerequisite	**Linearization type (→ 🖺 149)** has one of the following values: • Linear • Pyramid bottom • Conical bottom • Angled bottom • Horizontal cylinder • Sphere
Description	Linearized value corresponding to a level of 100%.
User entry	−50 000.0 to 50 000.0 %

Diameter	🔒

Navigation	Setup → Advanced setup → Linearization → Diameter
Prerequisite	Linearization type (→ 🖺 149) has one of the following values: • Horizontal cylinder • Sphere
Description	Diameter of the cylindrical or spherical tank.
User entry	0 to 9 999.999 m
Additional information	The unit is defined in the **Distance unit** parameter (→ 🖺 120).
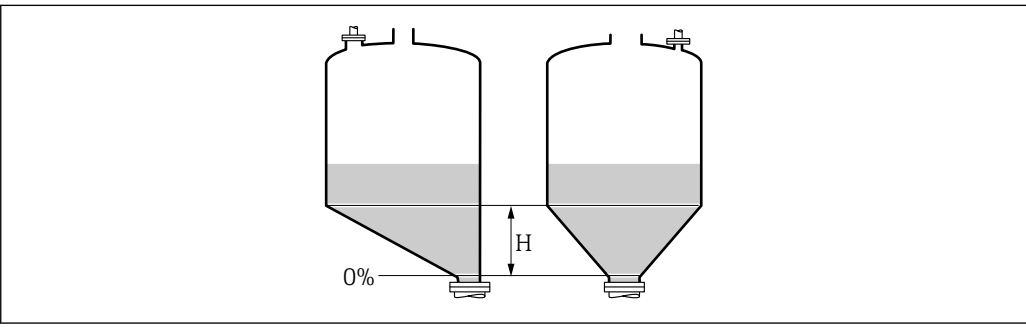
Intermediate height	🔒

Navigation	Setup → Advanced setup → Linearization → Intermed. height
Prerequisite	Linearization type (→ 🖺 149) has one of the following values: • Pyramid bottom • Conical bottom • Angled bottom
Description	Height of the pyramid, conical or angled bottom.
User entry	0 to 200 m
Additional information	

H   Intermediate height

The unit is defined in the **Distance unit** parameter (→ 🖺 120).

Table mode	🔒

Navigation	Setup → Advanced setup → Linearization → Table mode
Prerequisite	Linearization type (→ 🖺 149) = Table
Description	Select editing mode of the linearization table.

Selection	• Manual • Semiautomatic • Clear table • Sort table
Additional information	**Meaning of the options** • **Manual** The level and the associated linearized value are entered manually for each linearization point. • **Semiautomatic** The level is measured by the device for each linearization point. The associated linearized value is entered manually. • **Clear table** Deletes the existing linearization table. • **Sort table** Rearranges the linerization points into an ascending order. **Conditions the linearization table must meet:** • The table may consist of up to 32 pairs of values "Level - Linearized Value". • The table must be monotonic (monotonically increasing or decreasing). • The first linearization point must refer to the minimum level. • The last linearization point must refer to the maximum level. ℹ Before entering a linearization table, the values for **Empty calibration** (→ 🖩 121) and **Full calibration** (→ 🖩 122) must be set correctly. If values of the table need to be changed after the full or empty calibration have been changed, a correct evaluation is only ensured if the existing table is deleted and the complete table is entered again. To do so delete the existing table (**Table mode** (→ 🖩 153) = **Clear table**). Then enter a new table. **How to enter the table** • Via FieldCare The table points can be entered via the **Table number** (→ 🖩 154), **Level** (→ 🖩 155) and **Customer value** (→ 🖩 155) parameters. As an alternative, the graphic table editor may be used: Device Operation → Device Functions → Additional Functions → Linearization (Online/Offline) • Via local display Select the **Edit table** submenu to call up the graphic table editor. The table is displayed and can be edited line by line. ℹ The factory setting for the level unit is "%". If you want to enter the linearization table in physical units, you must select the appropriate unit in the **Level unit** parameter (→ 🖩 138) beforehand.

Table number	🔒
Navigation	Setup → Advanced setup → Linearization → Table number
Prerequisite	**Linearization type** (→ 🖩 149) = **Table**
Description	Select table point you are going to enter or change.
User entry	1 to 32

Level (Manual)   🔒

Navigation	🖬 Setup → Advanced setup → Linearization → Level
Prerequisite	• **Linearization type** (→ 🖺 149) = Table • **Table mode** (→ 🖺 153) = Manual
Description	Enter level value of the table point (value before linearization).
User entry	Signed floating-point number

Level (Semiautomatic)

Navigation	🖬 Setup → Advanced setup → Linearization → Level
Prerequisite	• **Linearization type** (→ 🖺 149) = Table • **Table mode** (→ 🖺 153) = **Semiautomatic**
Description	Displays measured level (value before linearization). This value is transmitted to the table.

Customer value   🔒

Navigation	🖬 Setup → Advanced setup → Linearization → Customer value
Prerequisite	**Linearization type** (→ 🖺 149) = Table
Description	Enter linearized value for the table point.
User entry	Signed floating-point number

Activate table   🔒

Navigation	🖩🖬 Setup → Advanced setup → Linearization → Activate table
Prerequisite	**Linearization type** (→ 🖺 149) = **Table**
Description	Activate (enable) or deactivate (disable) the linearization table.
Selection	• Disable • Enable

Additional information	**Meaning of the options** • **Disable** The measured level is not linearized. If **Linearization type (→ 🖺 149)** = **Table** at the same time, the device issues error message F435. • **Enable** The measured level is linearized according to the table.

ℹ️ When editing the table, the **Activate table** parameter is automatically reset to **Disable** and must be reset to **Enable** after the table has been entered.

"Safety settings" submenu

Navigation   ⓘⓔ Setup → Advanced setup → Safety sett.

Output echo lost	ⓐ

Navigation	ⓘⓔ Setup → Advanced setup → Safety sett. → Output echo lost
Description	Output signal in case of a lost echo.
Selection	• Last valid value • Ramp at echo lost • Value echo lost • Alarm

Additional information	**Meaning of the options**
	• **Last valid value**
	  The last valid value is kept in the case of a lost echo.
	• **Ramp at echo lost** [13]
	  In the case of a lost echo the output value is continously shifted towards 0% or 100%.
	  The slope of the ramp is defined in the **Ramp at echo lost** parameter (→ 🖺 158).
	• **Value echo lost** [13]
	  In the case of a lost echo the output assumes the value defined in the **Value echo lost** parameter (→ 🖺 157).
	• **Alarm**
	  In the case of a lost echo the device generates an alarm; see the **Failure mode** parameter

Value echo lost	ⓐ

Navigation	ⓘⓔ Setup → Advanced setup → Safety sett. → Value echo lost
Prerequisite	**Output echo lost** (→ 🖺 157) = **Value echo lost**
Description	Output value in case of a lost echo
User entry	0 to 200000.0 %
Additional information	Use the unit which has been defined for the measured value output: • without linearization: **Level unit** (→ 🖺 138) • with linearization: **Unit after linearization** (→ 🖺 150)

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13)   Only visible if "Linearization type (→ 🖺 149)" = "None"

Ramp at echo lost	🔒

Navigation	🎛️🖥️ Setup → Advanced setup → Safety sett. → Ramp echo lost
Prerequisite	Output echo lost (→ 🗎 157) = **Ramp at echo lost**
Description	Slope of the ramp in the case of a lost echo
User entry	Signed floating-point number

Additional information
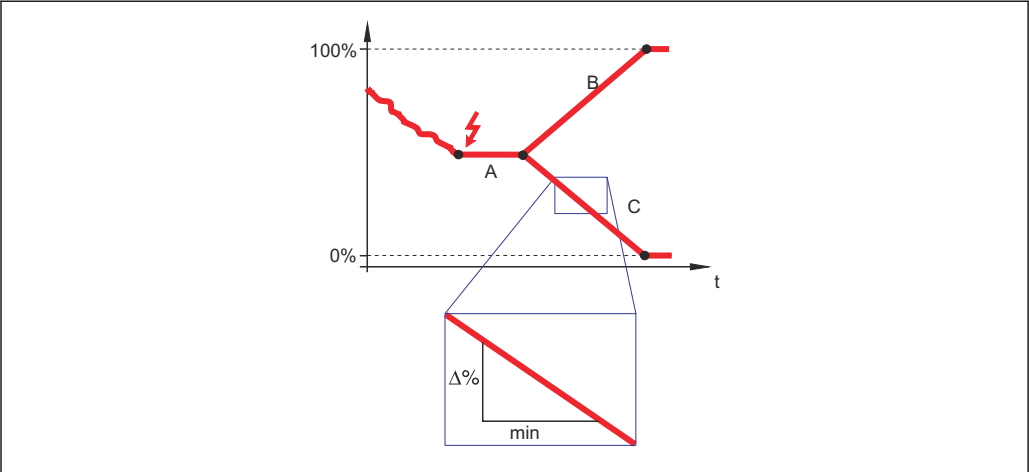
A0013269

A   Delay time echo lost
B   Ramp at echo lost (→ 🗎 158) (positive value)
C   Ramp at echo lost (→ 🗎 158) (negative value)

- The unit for the slope of the ramp is "percentage of the measuring range per minute" (%/min).
- For a negative slope of the ramp: The measured value is continuously decreased until it reaches 0%.
- For a positive slope of the ramp: The measured value is continuosly increased until it reaches 100%.

Blocking distance	🔒

Navigation	🎛️🖥️ Setup → Advanced setup → Safety sett. → Blocking dist.
Description	Specify upper blocking distance UB.
User entry	0 to 200 m
Factory setting	• For coax probes: 0 mm (0 in) • For rod and rope probes up to 8 m (26 ft): 200 mm (8 in) • For rod and rope probes above 8 m (26 ft): 0.025 * Sondenlänge

For FMP51/FMP52/FMP54 with the **Interface measurement** application package [14] and for FMP55:
100 mm (3.9 in) for all antenna types

Additional information   Signals in the upper blocking distance are only evaluated if they have been outside the blocking distance when the device was switched on and move into the blocking distance due to a level change during operation. Signals which are already in the blocking distance when the device is switched on, are ignored.

> This behavior is only valid if the following two conditions are met:
> - Expert → Sensor → Echo tracking → Evaluation mode = **Short time history** or **Long time history**)
> - Expert → Sensor → Gas phase compensation → GPC mode= **On**, **Without correction** or **External correction**
>
> If one of these conditions is not met, signals in the blocking distance will always be ignored.

> A different behavior for signals in the blocking distance can be defined in the **Blocking distance evaluation mode** parameter.

> If required, a different behavior for signals in the blocking distance can be defined by the Endress+Hauser service.
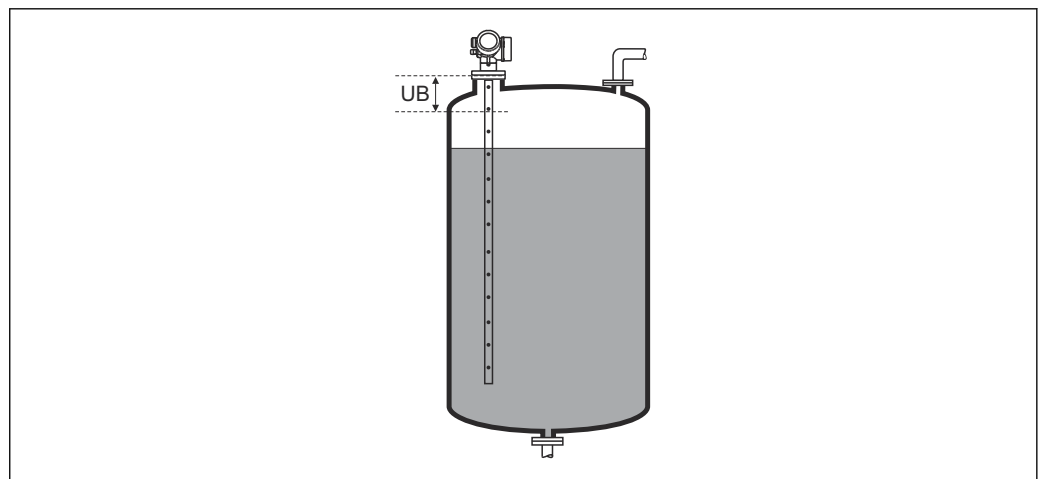
🖼 36   Blocking distance (UB) for liquid measurements

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14)   Ordering feature 540 "Application Package", option EB "Interface measurement"

"Probe settings" submenu

The **Probe settings** submenu helps to ensure that the end of probe signal within the envelope curve is correctly assigned by the evaluation algorithm. The assignment is correct if the length of probe indicated by the device matches the acutal lenght of the probe. The automatic probe length correction can only be performed if the probe is installed in the vessel and is completely uncovered (no medium). For partially filled vessels and if the probe length is known, select **Confirm probe length (→ 🗎 161) = Manual input** in order to enter the value manually.

ℹ️ If a mapping (interference echo suppression) has been recorded after shortening the probe, it is no longer possible to perform an automatic probe length correction. In this case there are two options:
  • Delete the map using the **Record map** parameter (→ 🗎 131) before performing the automatic probe length correction. After the probe length correction, a new map can be recorded using the **Record map** parameter (→ 🗎 131).
  • Alternative: Select **Confirm probe length (→ 🗎 161) = Manual input** and enter the probe length manually into the **Present probe length** parameter → 🗎 160.

ℹ️ An automatic probe length correction is only possible after the correct option has been selected in the **Probe grounded** parameter (→ 🗎 160).

Navigation   🖩🖵   Setup → Advanced setup → Probe settings

Probe grounded   🔒

Navigation	🖩🖵 Setup → Advanced setup → Probe settings → Probe grounded
Prerequisite	Operating mode (→ 🗎 119) = Level
Description	Specify whether the probe is grounded.
Selection	• No • Yes

Present probe length   🔒

Navigation	🖵 Setup → Advanced setup → Probe settings → Pres. length
Description	• In most cases: Displays the length of the probe according to the currently measured end-of-probe signal. • For **Confirm probe length (→ 🗎 161) = Manual input**: Enter actual length of probe.
User entry	0 to 200 m

Confirm probe length	⌧

Navigation	⊟ Setup → Advanced setup → Probe settings → Confirm length
Description	Select, whether the value displayed in the **Present probe length** parameter → 🕮 160 matches the actual length of the probe. Based on this input, the device performs a probe length correction.
Selection	• Probe length OK • Probe length too small • Probe length too big • Probe covered • Manual input • Probe length unknown

Additional information	**Meaning of the options**
	• **Probe length OK**
	  To be selected if the indicated length is correct. An adjustment is not required. The device quits the sequence.
	• **Probe length too small**
	  To be selected if the displayed length is smaller than the actual length of the probe. A different end of probe signal is allocated and the newly calculated length is displayed in the **Present probe length** parameter → 🕮 160. This procedure has to be repeated until the displayed value matches the actual length of the probe.
	• **Probe length too big**
	  To be selected if the displayed length is bigger than the actual length of the probe. A different end of probe signal is allocated and the newly calculated length is indicated in the **Present probe length** parameter → 🕮 160. This procedure has to be repeated until the displayed value matches the actual length of the probe.
	• **Probe covered**
	  To be selected if the probe is (partially or completely) covered. A probe length correction is impossible in this case. The device quits the sequence.
	• **Manual input**
	  To be selected if no automatic probe length correction is to be performed. Instead, the actual length of the probe must be entered manually into the **Present probe length** parameter → 🕮 160 [15].
	• **Probe length unknown**
	  To be selected if the acutal length of the probe is unknown. A probe length correction is impossible in this case and the device quits the sequence.
	.

---

[15] When operated via FieldCare, the **Manual input** option needs not to be selected explicitly. In FieldCare the length of the probe can always be edited.

"Probe length correction" wizard

ℹ️ The **Probe length correction** wizard is only available when operating via the local display. When operating via an operating tool, all parameters concerning the probe length correction are located directly in the **Probe settings** submenu (→ 🖺 160).

Navigation   🔘🖳 Setup → Advanced setup → Probe settings → Prob.length corr

---

Confirm probe length   🔒

Navigation   🔘 Setup → Advanced setup → Probe settings → Prob.length corr → Confirm length

Description   → 🖺 161

Present probe length   🔒

Navigation   🔘🖳 Setup → Advanced setup → Probe settings → Prob.length corr → Pres. length

Description   → 🖺 160

"Switch output" submenu

ℹ️ The **Switch output** submenu (→ 🖺 163) is only visible for devices with switch output. [16]

Navigation   ⏹️▣   Setup → Advanced setup → Switch output

Switch output function	🔒

Navigation	⏹️▣ Setup → Advanced setup → Switch output → Switch out funct
Description	Defines the function of the switch output.
	'Off' The switch output is always open (non-conductive)
	'On' The switch output is always closed (conductive).
	'Diagnostic behavior' The switch output is normally closed and is only opened if a diagnostic event is present.
	'Limit' The switch output is normally closed and is only opened if a measured variable exceeds a defined limit.
	'Digital output' The switch output is controlled by one of the digital output blocks of the device.
Selection	• Off • On • Diagnostic behavior • Limit • Digital Output

Additional information	**Meaning of the options**
	• **Off**
	  The output is always open (non-conductive).
	• **On**
	  The output is always closed (conductive).
	• **Diagnostic behavior**
	  The output is normally closed and is only opened if a diagnostic event is present. The **Assign diagnostic behavior** parameter (→ 🖺 164) determines for which type of event the output is opened.
	• **Limit**
	  The output is normally closed and is only opened if a measured variable exceeds or falls below a defined limit. The limit values are defined by the following parameters:
	  • **Assign limit** (→ 🖺 164)
	  • **Switch-on value** (→ 🖺 165)
	  • **Switch-off value** (→ 🖺 166)
	• **Digital Output**
	  The switching state of the output tracks the output value of a DI function block. The function block is selected in the **Assign status** parameter (→ 🖺 164).

	ℹ️ The **Off** and **On** options can be used to simulate the switch output.

---

[16]   Ordering feature 020 "Power supply; Output", option B, E or G

Assign status	🔒

Navigation	🔘🖥 Setup → Advanced setup → Switch output → Assign status

Prerequisite   Switch output function (→ 🖿 163) = **Digital Output**

Description   Assigns a Discrete Output Block or an Advanced Diagnostic Block to the switch output.

Selection   • Off
                        • Digital output AD 1
                        • Digital output AD 2

Additional information The **Digital output AD 1** and **Digital output AD 2** options refer to the Advanced
                        Diagnostic Blocks. A switch signal generated in these blocks can be transmitted via the
                        switch output.

Assign limit	🔒

Navigation	🔘🖥 Setup → Advanced setup → Switch output → Assign limit

Prerequisite   Switch output function (→ 🖿 163) = **Limit**

Description   Defines which process variable will be checked for limit violation.

Selection   • Off
                        • Level linearized
                        • Distance
                        • Interface linearized *
                        • Interface distance *
                        • Thickness upper layer *
                        • Terminal voltage
                        • Electronic temperature
                        • Measured capacitance *
                        • Relative echo amplitude
                        • Relative interface amplitude *
                        • Absolute echo amplitude
                        • Absolute interface amplitude *

Assign diagnostic behavior	🔒

Navigation	🔘🖥 Setup → Advanced setup → Switch output → Assign diag. beh

Prerequisite   Switch output function (→ 🖿 163) = **Diagnostic behavior**

Description   Defines to which behavior of diagnostic events the switch output reacts.

---

*   Visibility depends on order options or device settings

Selection	• Alarm
	• Alarm or warning
	• Warning

Switch-on value	🔒

Navigation	🔲🔳 Setup → Advanced setup → Switch output → Switch-on value
Prerequisite	**Switch output function** (→ 🔲 163) = **Limit**
Description	Defines the switch-on point. The output is closed if the assigned process variable rises above this point.
User entry	Signed floating-point number
Additional information	The switching behavior depends on the relative position of the **Switch-on value** and **Switch-off value** parameters:

Switch-on value > Switch-off value
- The output is closed if the measured value is larger than **Switch-on value**.
- The output is opened if the measured value is smaller than **Switch-off value**.
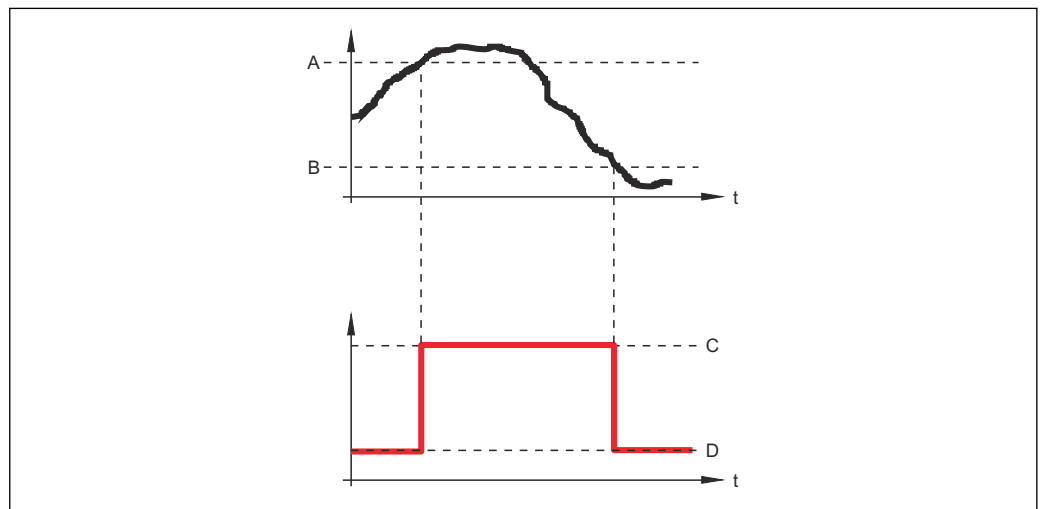
A   Switch-on value
B   Switch-off value
C   Output closed (conductive)
D   Output opened (non-conductive)

Switch-on value < Switch-off value
- The output is closed if the measured value is smaller than **Switch-on value**.
- The output is opened if the measured value is larger than **Switch-off value**.

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A   Switch-on value
B   Switch-off value
C   Output closed (conductive)
D   Output opened (non-conductive)

Switch-on delay   🔒

Navigation	🔠🔲 Setup → Advanced setup → Switch output → Switch-on delay
Prerequisite	• Switch output function (→ 🖺 163) = **Limit** • Assign limit (→ 🖺 164) ≠ **Off**
Description	Defines the delay applied before the output is switched on.
User entry	0.0 to 100.0 s

Switch-off value   🔒

Navigation	🔠🔲 Setup → Advanced setup → Switch output → Switch-off value
Prerequisite	**Switch output function** (→ 🖺 163) = **Limit**
Description	Defines the switch-off point. The output is opened if the assigned process variable falls below this point.
User entry	Signed floating-point number
Additional information	The switching behavior depends on the relative position of the **Switch-on value** and **Switch-off value** parameters; description: see the **Switch-on value** parameter (→ 🖺 165).

Switch-off delay	⬚

Navigation	⚇⚃ Setup → Advanced setup → Switch output → Switch-off delay
Prerequisite	• Switch output function (→ 🕮 163) = Limit • Assign limit (→ 🕮 164) ≠ Off
Description	Defines the delay applied before the output is switched off.
User entry	0.0 to 100.0 s

Failure mode	⬚

Navigation	⚇⚃ Setup → Advanced setup → Switch output → Failure mode
Prerequisite	Switch output function (→ 🕮 163) = Limit or Digital Output
Description	Defines the state of the switch output in case of an error.
Selection	• Actual status • Open • Closed

Additional information

Switch status	

Navigation	⚇⚃ Setup → Advanced setup → Switch output → Switch status
Description	Current status of the switch output.

Invert output signal	⬚

Navigation	⚇⚃ Setup → Advanced setup → Switch output → Invert outp.sig.
Description	'No' The switch output behaves as per its parameter setting. 'Yes' The switching behavior is inverted as compared to its parameter setting.
Selection	• No • Yes

Additional information   **Meaning of the options**
- **No**
  The behavior of the switch output is as described above.
- **Yes**
  The states **Open** and **Closed** are inverted as compared to the description above.

"Display" submenu

i **Display** submenu is only visible if a display module is connected to the device.

Navigation   ⊞⊟   Setup → Advanced setup → Display

Language	

Navigation	⊞⊟ Setup → Advanced setup → Display → Language
Description	Set display language.
Selection	• English • Deutsch * • Français * • Español * • Italiano * • Nederlands * • Portuguesa * • Polski * • русский язык (Russian) * • Svenska * • Türkçe * • 中文 (Chinese) * • 日本語 (Japanese) * • 한국어 (Korean) * • Bahasa Indonesia * • tiếng Việt (Vietnamese) * • čeština (Czech) *
Factory setting	The language selected in feature 500 of the product structure. If no language has been selected: **English**
Additional information	

Format display	

Navigation	⊞⊟ Setup → Advanced setup → Display → Format display
Description	Select how measured values are shown on the display.
Selection	• 1 value, max. size • 1 bargraph + 1 value • 2 values • 1 value large + 2 values • 4 values

---

*   Visibility depends on order options or device settings

Additional information
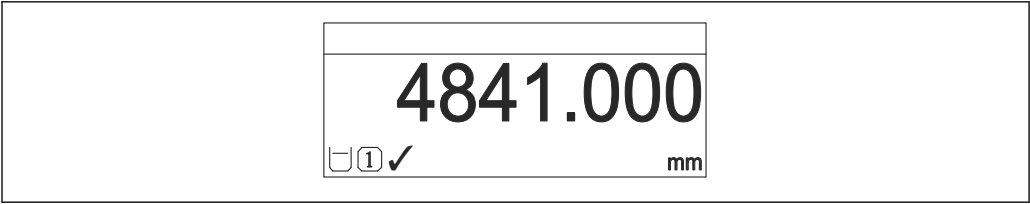
37 "Format display" = "1 value, max. size"
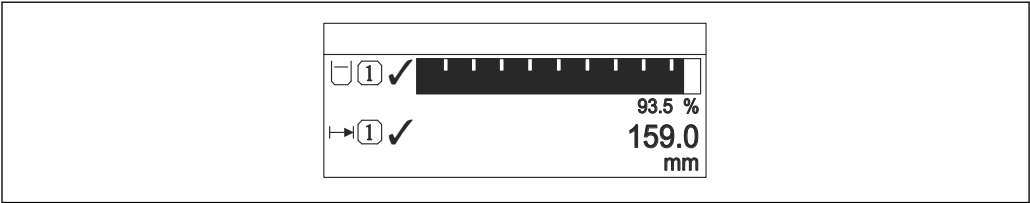
38 "Format display" = "1 bargraph + 1 value"
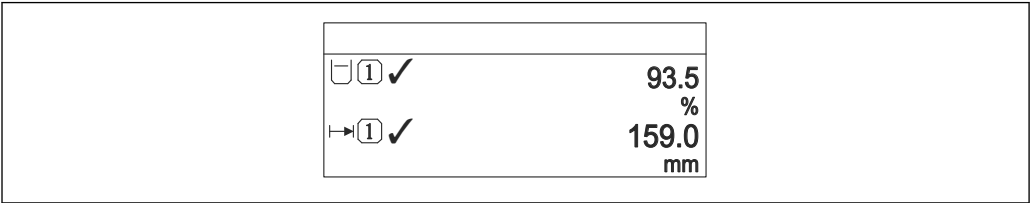
39 "Format display" = "2 values"
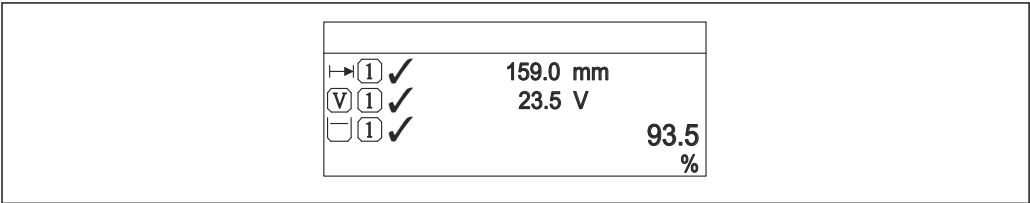
40 "Format display" = "1 value large + 2 values"
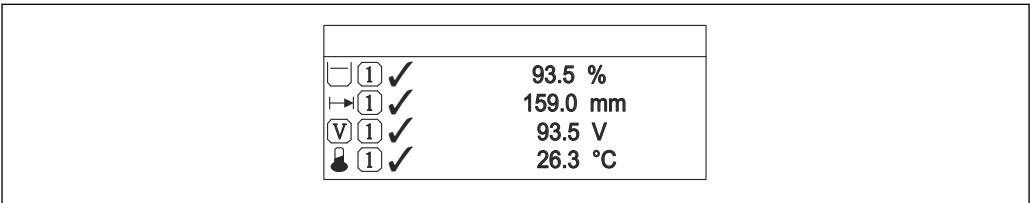
41 "Format display" = "4 values"

- The **Value 1 to 4 display** → 🖹 171 parameters specify which measured values are shown on the display and in which order.
- If more measured values are specified than the current display mode permits, the values alternate on the device display. The display time until the next change is configured in the **Display interval** parameter (→ 🖹 172).

Value 1 to 4 display	🔒

Navigation	🎛🖥 Setup → Advanced setup → Display → Value 1 display
Description	Select the measured value that is shown on the local display.
Selection	• Level linearized • Distance • Interface linearized * • Interface distance * • Thickness upper layer * • Current output 1 • Measured current • Current output 2 * • Terminal voltage • Electronic temperature • Measured capacitance * • Analog output adv. diagnostics 1 • Analog output adv. diagnostics 2
Factory setting	**For level measurements** • Value 1 display: Level linearized • Value 2 display: Distance • Value 3 display: Current output 1 • Value 4 display: None **For interface measurements and one current output** • Value 1 display: Interface linearized • Value 2 display: Level linearized • Value 3 display: Thickness upper layer • Value 4 display: Current output 1 **For interface measurements and two current outputs** • Value 1 display: Interface linearized • Value 2 display: Level linearized • Value 3 display: Current output 1 • Value 4 display: Current output 2

Decimal places 1 to 4	🔒

Navigation	🎛🖥 Setup → Advanced setup → Display → Decimal places 1
Description	This selection does not affect the measurement and calculation accuracy of the device.
Selection	• x • x.x • x.xx • x.xxx • x.xxxx
Additional information	The setting does not affect the measuring or computational accuracy of the device.

---

* Visibility depends on order options or device settings

Display interval	

Navigation	�🔲🔲 Setup → Advanced setup → Display → Display interval
Description	Set time measured values are shown on display if display alternates between values.
User entry	1 to 10 s
Additional information	This parameter is only relevant if the number of selected measuring values exceeds the number of values the selected display format can display simultaneously.

Display damping	🔒

Navigation	🔲🔲 Setup → Advanced setup → Display → Display damping
Description	Set display reaction time to fluctuations in the measured value.
User entry	0.0 to 999.9 s

Header	🔒

Navigation	🔲🔲 Setup → Advanced setup → Display → Header
Description	Select header contents on local display.
Selection	• Device tag • Free text
Additional information	
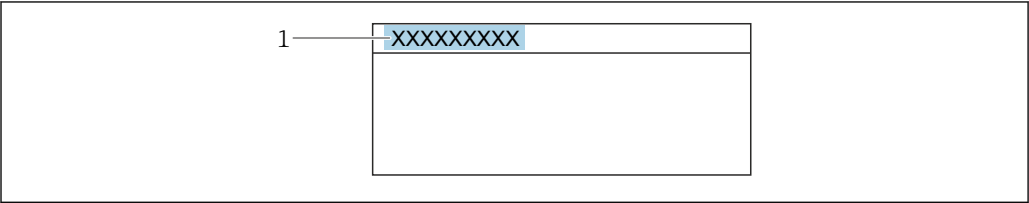
1   Position of the header text on the display

Meaning of the options

• **Device tag**
  Is defined in the **Device tag** parameter (→ 🗎 119).
• **Free text**
  Is defined in the **Header text** parameter (→ 🗎 173).

Header text   🔒

Navigation	🔊🖳 Setup → Advanced setup → Display → Header text
Prerequisite	Header (→ 🖺 172) = Free text
Description	Enter display header text.
User entry	Character string comprising numbers, letters and special characters (12)
Additional information	The number of characters which can be displayed depends on the characters used.

Separator   🔒

Navigation	🔊🖳 Setup → Advanced setup → Display → Separator
Description	Select decimal separator for displaying numerical values.
Selection	• . • ,

Number format   🔒

Navigation	🔊🖳 Setup → Advanced setup → Display → Number format
Description	Choose number format for the display.
Selection	• Decimal • ft-in-1/16"
Additional information	The ft-in-1/16" option is only valid for distance units.

Decimal places menu   🔒

Navigation	🔊🖳 Setup → Advanced setup → Display → Dec. places menu
Description	Select number of decimal places for the representation of numbers within the operating menu.
Selection	• x • x.x • x.xx • x.xxx • x.xxxx

Additional information	• Is only valid for numbers in the operating menu (e.g. **Empty calibration**, **Full calibration**), but not for the measured value display. The number of decimal places for the measured value display is defined in the **Decimal places 1 to 4** → 🖹 171 parameters. • The setting does not affect the accuracy of the measurement or the calculations.

Backlight

Navigation	🔘🖫 Setup → Advanced setup → Display → Backlight
Prerequisite	The device has the SD03 local display (with optical keys).
Description	Switch the local display backlight on and off.
Selection	• Disable • Enable

Additional information	**Meaning of the options**
	• **Disable**
	  Switches the backlight off.
	• **Enable**
	  Switches the backlight on.
	
	ℹ️ Regardless of the setting in this parameter the backlight may be automatically switched off by the device if the supply voltage is too low.

Contrast display

Navigation	🔘🖫 Setup → Advanced setup → Display → Contrast display
Description	Adjust local display contrast setting to ambient conditions (e.g. lighting or reading angle).
User entry	20 to 80 %
Factory setting	Dependent on the display.
Additional information	ℹ️ Setting the contrast via push-buttons: • Darker: press the ⊡⊡ buttons simultaneously. • Brighter: press the ⊡⊡ buttons simultaneously.

"Configuration backup display" submenu

ℹ️ This submenu is only visible if a display module is connected to the device.

The configuration of the device can be saved to the display module at a certain point of time (backup). The saved configurateion can be restored to the device if required, e.g. in order to bring the device back into a defined state. The configuration can also be transferred to a different device of the same type using the display module.

ℹ️ Configurations can only be exchanged between devices which are in the same operating mode (see the **Operating mode** parameter (→ 🖺 119)).

Navigation   ☷☱   Setup → Advanced setup → Conf.backup disp

Operating time

Navigation   ☷☱   Setup → Advanced setup → Conf.backup disp → Operating time

Description   Indicates how long the device has been in operation.

Additional information   *Maximum time*

9 999 d (≈ 27 years)

Last backup

Navigation   ☷☱   Setup → Advanced setup → Conf.backup disp → Last backup

Description   Indicates when the last data backup was saved to the display module.

Configuration management   🔒

Navigation   ☷☱   Setup → Advanced setup → Conf.backup disp → Config. managem.

Description   Select action for managing the device data in the display module.

Selection   • Cancel
                               • Execute backup
                               • Restore
                               • Duplicate
                               • Compare
                               • Clear backup data

Additional information	Meaning of the options

Meaning of the options

• **Cancel**

No action is executed and the user exits the parameter.

• **Execute backup**

A backup copy of the current device configuration in the HistoROM (built-in in the device) is saved to the display module of the device.

• **Restore**

The last backup copy of the device configuration is copied from the display module to the HistoROM of the device.

• **Duplicate**

The transmitter configuration is duplicated to another device using the transmitter display module. The following parameters, which characterize the individual measuring point are **not** included in the transmitted configuration:

• HART date code
• HART short tag
• HART message
• HART descriptor
• HART address
• Device tag
• Medium type

• **Compare**

The device configuration saved in the display module is compared to the current device configuration of the HistoROM. The result of this comparison is displayed in the **Comparison result** parameter (→ 🖺 176).

• **Clear backup data**

The backup copy of the device configuration is deleted from the display module of the device.

🛈 While this action is in progress, the configuration cannot be edited via the local display and a message on the processing status appears on the display.

🛈 If an existing backup is restored to a different device using the **Restore** option, it may occur that some device functionalities are no longer available. In some cases even a device reset will not restore the original status.

In order to transmit a configuration to a different device, the **Duplicate** option should always be used.

Backup state

Navigation	🔘🔲 Setup → Advanced setup → Conf.backup disp → Backup state

Description	Displays which backup action is currently in progress.

Comparison result

Navigation	🔘🔲 Setup → Advanced setup → Conf.backup disp → Compar. result

Description	Comparison between present device data and display backup.

Additional information   **Meaning of the display options**
- **Settings identical**
  The current device configuration of the HistoROM is identical to the backup copy in the display module.
- **Settings not identical**
  The current device configuration of the HistoROM is not identical to the backup copy in the display module.
- **No backup available**
  There is no backup copy of the device configuration of the HistoROM in the display module.
- **Backup settings corrupt**
  The current device configuration of the HistoROM is corrupt or not compatible with the backup copy in the display module.
- **Check not done**
  The device configuration of the HistoROM has not yet been compared to the backup copy in the display module.
- **Dataset incompatible**
  The data sets are incompatible and can not be compared.

> To start the comparison, set **Configuration management** (→ 🗎 175) = **Compare**.

> If the transmitter configuration has been duplicated from a different device by **Configuration management** (→ 🗎 175) = **Duplicate**, the new device configuration in the HistoROM is only partially identical to the configuration stored in the display module: Sensor specific properties (e.g. the mapping curve) are not duplicated. Thus, the result of the comparison will be **Settings not identical**.

"Administration" submenu

Navigation   ▢   Setup → Advanced setup → Administration

Define access code   🔒

Navigation	▢	Setup → Advanced setup → Administration → Def. access code
Description		Define release code for write access to parameters.
User entry		0 to 9999

Additional information

ℹ️ If the factory setting is not changed or if "0" is entered, the parameters are not write-protected and the device configuration data can therefore always be modified. The user is logged on in the "Maintenance" role.

ℹ️ The write protection affects all parameters marked with the 🔒 symbol in the document. On the local display, the 🔒 symbol in front of a parameter indicates that the parameter is write-protected.

ℹ️ Once the access code has been defined, write-protected parameters can only be modified if the access code is entered in the **Enter access code** parameter (→ 🖺 134).

ℹ️ Please contact your Endress+Hauser Sales Center if you lose the access code.

ℹ️ If operating via the local display: the new access code is only valid once it has been confirmed in the **Confirm access code** parameter (→ 🖺 180).

Device reset   🔒

Navigation	▨▢	Setup → Advanced setup → Administration → Device reset
Description		Reset the device configuration - either entirely or in part - to a defined state.

Selection

- Cancel
- To fieldbus defaults [**]
- To factory defaults
- To delivery settings
- Of customer settings
- To transducer defaults
- Restart device

[**]   Visibility depends on communication

Additional information

Meaning of the options
- **Cancel**
  No action
- **To factory defaults**
  All parameters are reset to the order-code specific factory setting.
- **To delivery settings**
  All parameters are reset to the delivery setting. The delivery setting may differ from the factory default if customer specific settings have been ordered.
  This option is only visible if customer specific settings have been ordered.
- **Of customer settings**
  All customer parameters are reset to their factory setting. Service parameters, however, remain unchanged.
- **To transducer defaults**
  Every measurment-related parameter is reset to its factory setting. Service parameters and communication-related parameters, however, remain unchanged.
- **Restart device**
  The restart resets every parameter which is stored in the volatile memory (RAM) to the factory setting (e.g. measured value data). The device configuration remains unchanged.

"Define access code" wizard

ℹ️ The **Define access code** wizard is only available when operating via the local display. When operating via an operating tool, the **Define access code** parameter is located directly in the **Administration** submenu. The **Confirm access code** parameter is not available for operation via operating tool.

Navigation   ⊞   Setup → Advanced setup → Administration → Def. access code

---

Define access code   🔒

Navigation   ⊞   Setup → Advanced setup → Administration → Def. access code → Def. access code

Description   → 🕮 178

Confirm access code   🔒

Navigation   ⊞   Setup → Advanced setup → Administration → Def. access code → Confirm code

Description   Confirm the entered access code.

User entry   0 to 9999

15.4   "Diagnostics" menu

Navigation   ⊞🗐   Diagnostics

Actual diagnostics

Navigation   ⊞🗐   Diagnostics → Actual diagnos.

Description   Displays current diagnostic message.

Additional information   The display consists of:
• Symbol for event behavior
• Code for diagnostic behavior
• Operating time of occurrence
• Event text

ℹ️ If several messages are active at the same time, the messages with the highest priority is displayed.

ℹ️ Information on what is causing the message, and remedy measures, can be viewed via the ⓘ symbol on the display.

Timestamp

| Navigation | ▣ | Diagnostics → Timestamp |

Description   Displays the timestamp for the currently active diagnostic message.

Previous diagnostics

| Navigation | ◉▣ | Diagnostics → Prev.diagnostics |

Description   Displays the last diagnostic message which has been active before the current message.

Additional information   The display consists of:
- Symbol for event behavior
- Code for diagnostic behavior
- Operating time of occurrence
- Event text

The condition displayed may still apply. Information on what is causing the message, and remedy measures, can be viewed via the ⓘ symbol on the display.

Timestamp

| Navigation | ▣ | Diagnostics → Timestamp |

Description   Shows the timestamp of the previous diagnostic message.

Operating time from restart

| Navigation | ◉▣ | Diagnostics → Time fr. restart |

Description   Displays the time the device has been in operation since the last device restart.

Operating time

| Navigation | ◉▣ | Diagnostics → Operating time |

Description   Indicates how long the device has been in operation.

Additional information   *Maximum time*

9 999 d (≈ 27 years)

15.4.1   "Diagnostic list" submenu

Navigation   🖳🖿   Diagnostics → Diagnostic list

Diagnostics 1 to 5

Navigation   🖳🖿   Diagnostics → Diagnostic list → Diagnostics 1

Description   Display the current diagnostics messages with the highest to fifth-highest priority.

Additional information The display consists of:
- Symbol for event behavior
- Code for diagnostic behavior
- Operating time of occurrence
- Event text

Timestamp 1 to 5

Navigation   🖳🖿   Diagnostics → Diagnostic list → Timestamp 1 to 5

Description   Timestamp of the diagnostic message.

15.4.2   "Event logbook" submenu

The **Event logbook** submenu is only available when operating via the local display.
When operating via FieldCare, the event list can be displayed in the FieldCare
function "Event List / HistoROM".

Navigation   Diagnostics → Event logbook

Filter options	

Navigation	Diagnostics → Event logbook → Filter options
Description	Define which category of event messages is shown in the Events list submenu.
Selection	• All • Failure (F) • Function check (C) • Out of specification (S) • Maintenance required (M) • Information (I)
Additional information	• This parameter is only used for operation via the local display. • The status signals are categorized according to NAMUR NE 107.

"Event list" submenu

The **Event list** submenu displays the history of past events of the category selected in the
Filter options parameter (→ 🖺 183). A maximum of 100 events are displayed in
chronological order.

The following symbols indicate whether an event has occurred or has ended:
- 🔄: Event has occurred
- 🔄: Event has ended

Information on what is causing the message, and remedy instructions, can be viewed
via the ⓘ-button.

Display format
- For event messages in category I: information event, event text, "recording event" symbol
  and time the event occurred
- For event messages in category F, M, C, S (status signal): diagnostics event, event text,
  "recording event" symbol and time the event occurred

Navigation   Diagnostics → Event logbook → Event list

15.4.3   "Device information" submenu

Navigation   ⊠⊡   Diagnostics → Device info

Device tag

Navigation	⊠⊡ Diagnostics → Device info → Device tag
Description	Enter the name for the measuring point.
User interface	Character string comprising numbers, letters and special characters

---

Serial number

Navigation	⊠⊡ Diagnostics → Device info → Serial number
Description	Shows the serial number of the measuring device.
Additional information	**Uses of the serial number** • To identify the device quickly, e.g. when contacting Endress+Hauser. • To obtain specific information on the device using the Device Viewer: www.endress.com/deviceviewer The serial number is also indicated on the nameplate.

Firmware version

Navigation	⊠⊡ Diagnostics → Device info → Firmware version
Description	Shows the device firmware version installed.
User interface	xx.yy.zz
Additional information	For firmware versions differing only in the last two digits ("zz") there is no difference concerning functionality or operation.

Device name

Navigation	⊠⊡ Diagnostics → Device info → Device name
Description	Shows the name of the transmitter.

Order code   🔒

Navigation	🔘🔲 Diagnostics → Device info → Order code
Description	Shows the device order code.
User interface	Character string comprising numbers, letters and special characters
Additional information	The order code is generated from the extended roder code, which defines all device features of the product structure. In contrast, the device features can not be read directly from the order code.

Extended order code 1 to 3   🔒

Navigation	🔘🔲 Diagnostics → Device info → Ext. order cd. 1
Description	Display the three parts of the extended order code.
User interface	Character string comprising numbers, letters and special characters
Additional information	The extended order code indicates the version of all the features of the product structure and thus uniquely identifies the device.

Device revision

Navigation	🔘🔲 Diagnostics → Device info → Device revision
Description	Shows the device revision with which the device is registered with the HART Communication Foundation.
Additional information	The device revision is used to allocate the correct Device Description file (DD) to the device.

Device ID

Navigation	🔘🔲 Diagnostics → Device info → Device ID
Description	Shows the device ID for identifying the device in a HART network.
Additional information	In addition to the Device type and Manufacturer ID, the Device ID is part of the unique device identification (Unique ID) which characterizes each HART device unambiguously.

Device type

Navigation	🔲🔲	Diagnostics → Device info → Device type
Description		Shows the device type with which the measuring device is registered with the HART Communication Foundation.
Additional information		

Manufacturer ID

Navigation	🔲🔲	Diagnostics → Device info → Manufacturer ID
Description		Use this function to view the manufacturer ID with which the measuring device is registered with the HART Communication Foundation.
User interface		2-digit hexadecimal number
Factory setting		0x11 (for Endress+Hauser)

15.4.4 "Measured values" submenu

Navigation   ⊞⊟ Diagnostics → Measured val.

Distance

Navigation	⊞⊟ Diagnostics → Measured val. → Distance
Description	Displays the measured distance D_L between the reference point (lower edge of the flange or threaded connection) and the level.
Additional information	
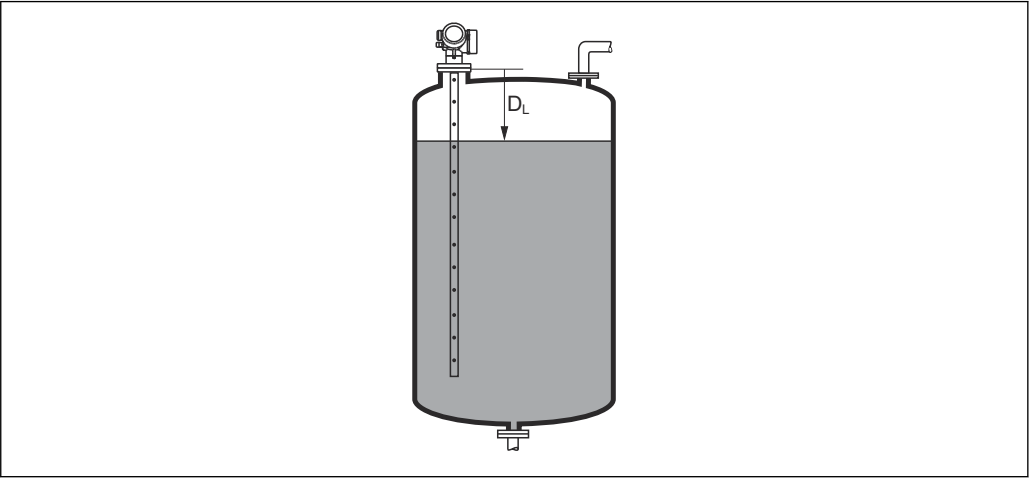
⊞ 42   Distance for liquid measurements
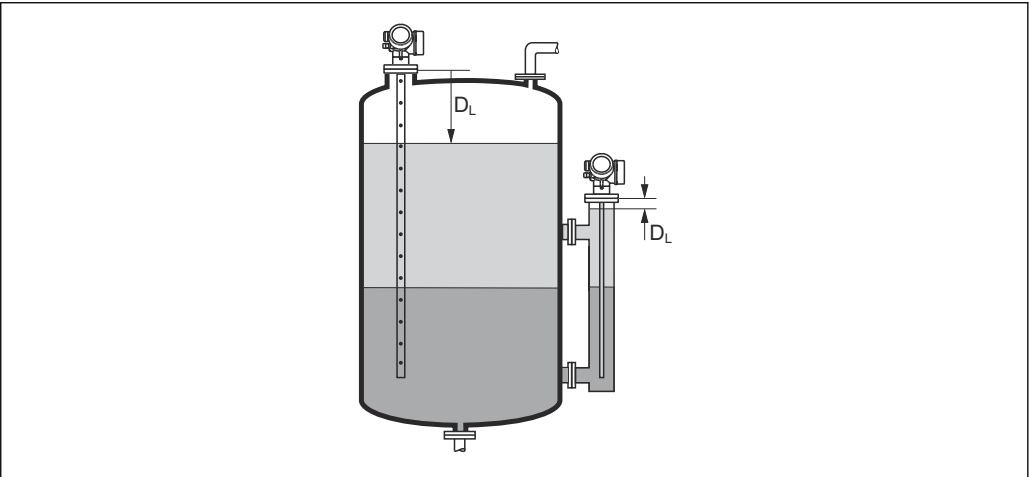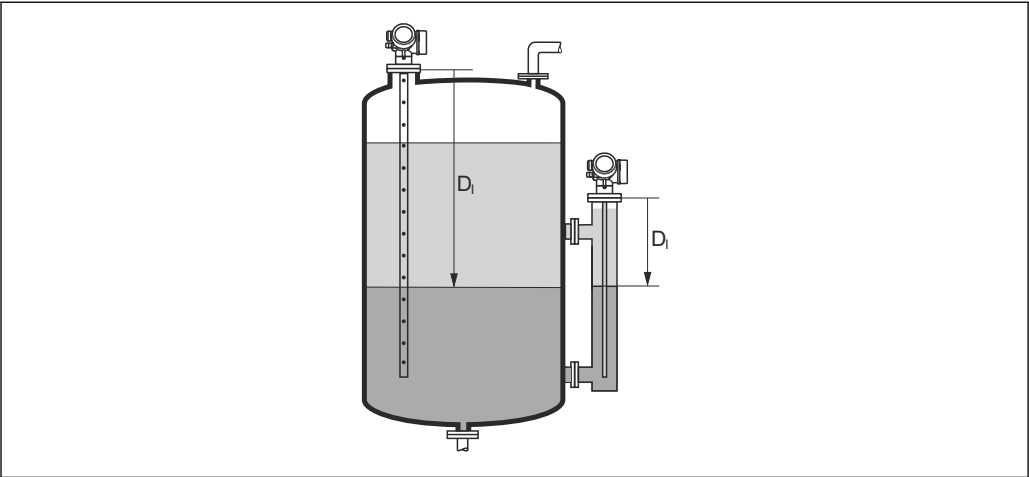
⊞ 43   Distance for interface measurements

The unit is defined in the **Distance unit** parameter (→ 🖺 120).

Level linearized	
Navigation	ⓘⓔ Diagnostics → Measured val. → Level linearized
Description	Displays linearized level.
Additional information	ⓘ • The unit is defined by the **Unit after linearization** parameter → 🖫 150. • For interface measurements, this parameter always refers to the total level.

Interface distance	
Navigation	ⓘⓔ Diagnostics → Measured val. → Interface dist.
Prerequisite	**Operating mode (→ 🖫 119)** = **Interface** or **Interface with capacitance**
Description	Displays the measured distance D_I between the reference point (lower edge of flange or threaded connection) and the interface.
Additional information	
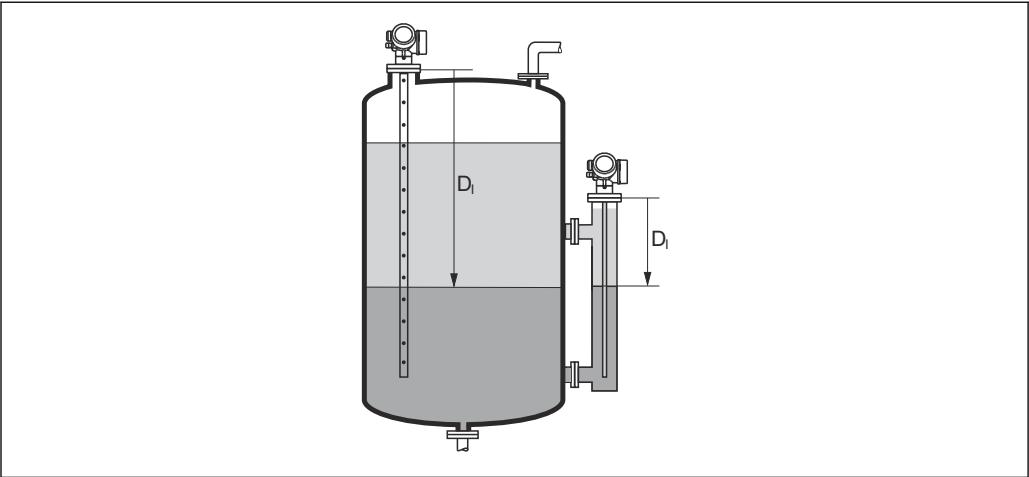
ⓘ The unit is defined in the **Distance unit** parameter (→ 🖫 120).

Interface linearized	
Navigation	ⓘⓔ Diagnostics → Measured val. → Interf. lineariz
Prerequisite	**Operating mode (→ 🖫 119)** = **Interface** or **Interface with capacitance**
Description	Displays the linearized interface height.
Additional information	ⓘ The unit is defined in the **Unit after linearization** parameter → 🖫 150.

Thickness upper layer

Navigation	⑥⑤ Diagnostics → Measured val. → Thickn.upp.layer
Prerequisite	Operating mode (→ 📄 119) = **Interface** or **Interface with capacitance**
Description	Displays the upper interface thickness (UP).
Additional information	
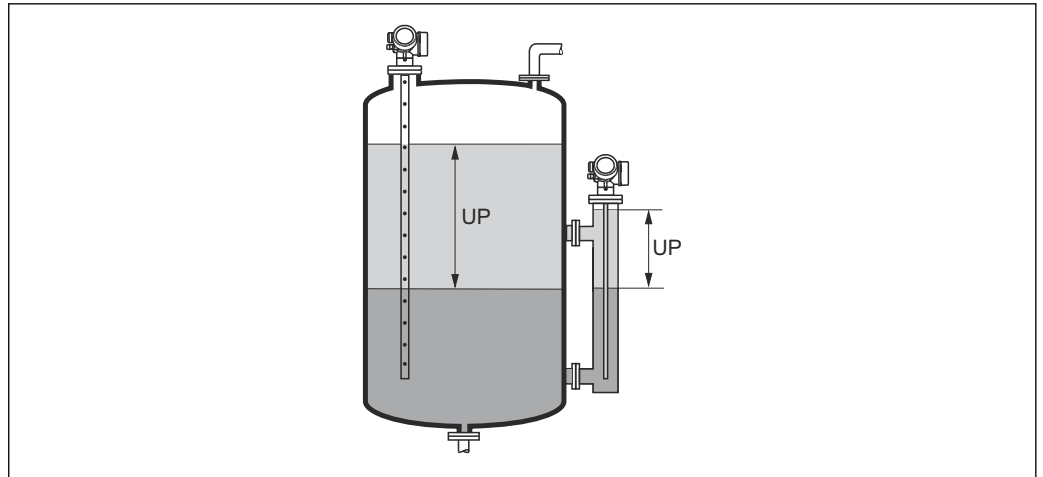
UP   Thickness upper layer

The unit is defined by the **Unit after linearization** parameter → 📄 150.

Terminal voltage 1

Navigation	⑥⑤ Diagnostics → Measured val. → Terminal volt. 1
Description	Shows the current terminal voltage that is applied at the output.

15.4.5 "Data logging" submenu

Navigation ▣▤ Diagnostics → Data logging

Assign channel 1 to 4	🔒

Navigation	▣▤ Diagnostics → Data logging → Assign chan. 1 to 4
Description	Assign a process variable to logging channel.

Selection
- Off
- Level linearized
- Distance
- Unfiltered distance
- Interface linearized *
- Interface distance *
- Unfiltered interface distance
- Thickness upper layer *
- Current output 1
- Measured current
- Current output 2 *
- Terminal voltage
- Electronic temperature
- Measured capacitance *
- Absolute echo amplitude
- Relative echo amplitude
- Absolute interface amplitude *
- Relative interface amplitude *
- Absolute EOP amplitude
- EOP shift
- Noise of signal
- Calculated DC value *
- Analog output adv. diagnostics 1
- Analog output adv. diagnostics 2

Additional information
A total of 1000 measured values can be logged. This means:
- 1000 data points if 1 logging channel is used
- 500 data points if 2 logging channels are used
- 333 data points if 3 logging channels are used
- 250 data points if 4 logging channels are used

If the maximum number of data points is reached, the oldest data points in the data log are cyclically overwritten in such a way that the last 1000, 500, 333 or 250 measured values are always in the log (ring memory principle).

ℹ️ The logged data are deleted if a new option is selected in this parameter.

---

* Visibility depends on order options or device settings

Logging interval	🔒

Navigation	▣	Diagnostics → Data logging → Logging interval
	▣	Diagnostics → Data logging → Logging interval

Description   Define the logging interval tlog for data logging. This value defines the time interval between the individual data points in the memory.

User entry   1.0 to 3 600.0 s

Additional information   This parameter defines the interval between the individual data points in the data log, and thus the maximum loggable process time T_{log}:

• If 1 logging channel is used: $T_{log} = 1000 \cdot t_{log}$
• If 2 logging channels are used: $T_{log} = 500 \cdot t_{log}$
• If 3 logging channels are used: $T_{log} = 333 \cdot t_{log}$
• If 4 logging channels are used: $T_{log} = 250 \cdot t_{log}$

Once this time elapses, the oldest data points in the data log are cyclically overwritten such that a time of T_{log} always remains in the memory (ring memory principle).

🛈 The logged data are deleted if this parameter is changed.

Example

When using 1 logging channel
• $T_{log} = 1000 \cdot 1\ s = 1\,000\ s \approx 16.5\ min$
• $T_{log} = 1000 \cdot 10\ s = 1\,000\ s \approx 2.75\ h$
• $T_{log} = 1000 \cdot 80\ s = 80\,000\ s \approx 22\ h$
• $T_{log} = 1000 \cdot 3\,600\ s = 3\,600\,000\ s \approx 41\ d$

Clear logging data	🔒

Navigation	▣	Diagnostics → Data logging → Clear logging
	▣	Diagnostics → Data logging → Clear logging

Description   Clear the entire logging data.

Selection   • Cancel
                       • Clear data

"Display channel 1 to 4" submenu

The **Display channel 1 to 4** submenus are only available for operation via the local display. When operating via FieldCare, the logging diagram can be displayed in the FieldCare function "Event List / HistoROM" .

The **Display channel 1 to 4** submenus invoke a diagram of the logging history of the respective channel.
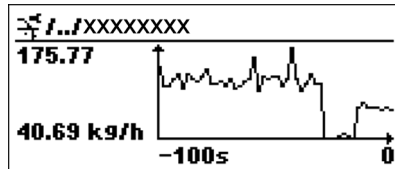
- x-axis: depending on the number of selected channels, 250 to 1000 measured values of a process variable are displayed.
- y-axis: covers the approximate measured value span and constantly adapts this to the measurement.

To return to the operating menu, press ⊞ and ⊟ simultaneaously.

Navigation   ⊞⊟   Diagnostics → Data logging → Displ.channel 1 to 4

15.4.6   "Simulation" submenu

The **Simulation** submenu is used to simulate specific measuring values or other conditions. This helps to check the correct configuration of the device and connected control units.

Conditions which can be simulated

Condition to be simulated	Associated parameters
Specific value of a process variable	▪ Assign measurement variable (→ 🖺 195) ▪ Process variable value (→ 🖺 195)
Specific state of the switch output	▪ Switch output simulation (→ 🖺 195) ▪ Switch status (→ 🖺 196)
Existence of an alarm	Device alarm simulation (→ 🖺 196)
Existence of a specific diagnostic message	Diagnostic event simulation (→ 🖺 196)

Structure of the submenu

Navigation　　　⊡　　Expert → Diagnostics → Simulation

‣ Simulation		
Assign measurement variable	→ 🖺 195	
Process variable value	→ 🖺 195	
Switch output simulation	→ 🖺 195	
Switch status	→ 🖺 196	
Device alarm simulation	→ 🖺 196	
Diagnostic event simulation	→ 🖺 196	

Description of parameters

Navigation   ▣▢   Expert → Diagnostics → Simulation

Assign measurement variable   ⬚

Navigation	▣▢ Expert → Diagnostics → Simulation → Assign meas.var.
Description	Defines the process variable to be simulated.
Selection	• Off • Level • Interface * • Thickness upper layer * • Level linearized • Interface linearized • Thickness linearized
Additional information	• The value of the variable to be simulated is defined in the **Process variable value** parameter (→ 🖹 195). • If **Assign measurement variable** ≠ **Off**, a simulation is active. This is indicated by a diagnostic message of the *Function check (C)* category.

Process variable value   ⬚

Navigation	▣▢ Expert → Diagnostics → Simulation → Proc. var. value
Prerequisite	Assign measurement variable (→ 🖹 195) ≠ **Off**
Description	Defines the value of the selected variable. The outputs assume values or states according to this value.
User entry	Signed floating-point number
Additional information	Downstream measured value processing and the signal output use this simulation value. In this way, users can verify whether the measuring device has been configured correctly.

Switch output simulation   ⬚

Navigation	▣▢ Expert → Diagnostics → Simulation → Switch sim.
Description	Switch the simulation of the switch output on and off.

---

*   Visibility depends on order options or device settings

Selection	• Off
	• On

Switch status	🔒

Navigation	🖩🖵 Expert → Diagnostics → Simulation → Switch status
Prerequisite	Switch output simulation (→ 🖺 195) = On
Description	Current status of the switch output.
Selection	• Open
	• Closed
Additional information	The switch status assumes the value defined in this parameter. This helps to check correct operation of connected control units.

Device alarm simulation	🔒

Navigation	🖩🖵 Expert → Diagnostics → Simulation → Dev. alarm sim.
Description	Switch the device alarm on and off.
Selection	• Off
	• On
Additional information	When selecting the **On** option, the device generates an alarm. This helps to check the correct output behavior of the device in the case of an alarm.
	An active simulation is indicated by the ⊗C484 **Failure mode simulation** diagnostic message.

Diagnostic event simulation	🔒

Navigation	🖩🖵 Expert → Diagnostics → Simulation → Diag. event sim.
Description	Select the diagnostic event to be simulated.
	Note:
	To terminate the simulation, select 'Off'.
Additional information	When operated via the local display, the selection list can be filtered according to the event categories (**Diagnostic event category** parameter).

15.4.7 "Device check" submenu

Navigation   ⊞⊟ Diagnostics → Device check

Start device check   🔒

Navigation   ⊞⊟ Diagnostics → Device check → Start dev. check

Description   Start a device check.

Selection   • No
                         • Yes

Additional information   In the case of a lost echo a device check can not be performed.

Result device check

Navigation   ⊞⊟ Diagnostics → Device check → Result dev.check

Description   Displays the result of the device check.

Additional information   **Meaning of the display options**
                         • **Installation ok**
                           Measurement possible without restrictions.
                         • **Accuracy reduced**
                           A measurement is possible. However, the measuring accuracy may be reduced due to the
                           signal amplitudes.
                         • **Measurement capability reduced**
                           A measurement is currently possible. Howerver, there is the risk of an echo loss. Check
                           the mounting position of the device and the dielectric constant of the medium.
                         • **Check not done**
                           No device check has been performed.

Last check time

Navigation   ⊞⊟ Diagnostics → Device check → Last check time

Description   Displays the operating time at which the last device check has been performed.

User interface   Character string comprising numbers, letters and special characters

Level signal

Navigation	◎▤ Diagnostics → Device check → Level signal
Prerequisite	Device check has been performed.
Description	Displays result of the device check for the level signal.
User interface	• Check not done • Check not OK • Check OK
Additional information	For **Level signal** = **Check not OK**: Check the mounting position of the device and the dielectric constant of the medium.

Launch signal

Navigation	◎▤ Diagnostics → Device check → Launch signal
Prerequisite	Device check has been performed.
Description	Displays result of the display check for the launch signal.
User interface	• Check not done • Check not OK • Check OK
Additional information	For **Launch signal** = **Check not OK**: Check the mounting position of the device. In non-metallic vessels use a metal plate or a metal flange.

Interface signal

Navigation	◎▤ Diagnostics → Device check → Interface signal
Prerequisite	• **Operating mode** (→ 🗎 119) = **Interface** or **Interface with capacitance** • Device check has been performed.
Description	Displays result of the device check for the interface signal.
User interface	• Check not done • Check not OK • Check OK

15.5   Modbus register assignment

15.5.1   Register table

Register	Parameter	Data type	Swap mode	Description
10	Main version	UINT16	-	Main firmware version code
11	Major version	UINT16	-	Major firmware version code
12	Minor version	UINT16	-	Minor firmware version code
13	Build no. software	UINT16	-	Firmware build number
100	Old status	UINT32	-	Only zeros
102	Primary variable (PV)	UINT32	CDAB	First HART variable
104	Secondary variable (SV)	UINT32	CDAB	Second HART variable
106	Tertiary variable (TV)	UINT32	CDAB	Third HART variable
108	Quaternary variable (QV)	UINT32	CDAB	Fourth HART variable
110	Status	UINT64	-	See "Format of the status bytes" → 🖺 201
114	Diagnostics	UINT64	CDAB	See "Format of the diagnostic bytes" → 🖺 200
118	PV unit	UINT16	-	Unit of the first HART variable
119	SV unit	UINT16	-	Unit of the second HART variable
120	TV unit	UINT16	-	Unit of the third HART variable
121	QV unit	UINT16	-	Unit of the fourth HART variable
122	Variable 19 unit	UINT16	-	Unit of variable 19
123	Variable 20 unit	UINT16	-	Unit of variable 20
199	Additional status	UINT16	-	• 1: Device locked • 2: Device unlocked
1300	Old status	UINT32	-	All zeros
1302	Primary variable (PV)	UINT32	CDAB	First HART variable
1304	Secondary variable (SV)	UINT32	CDAB	Second HART variable
1306	Tertiary variable (TV)	UINT32	CDAB	Third HART variable
1308	Quaternary variable (QV)	UINT32	CDAB	Fourth HART variable
1310	Status	UINT64	-	See "Format of the status bytes" → 🖺 201
1314	Diagnostics	UINT64	CDAB	See "Format of the diagnostic bytes" → 🖺 200
1400	Old status	UINT32	-	All zeros
1402	Primary variable (PV)	UINT32	CDAB	First HART variable
1404	Status	UINT64	-	See "Format of the status bytes" → 🖺 201
1414	Secondary variable (SV)	UINT32	CDAB	Second HART variable
1416	Status	UINT64	-	See "Format of the status bytes" → 🖺 201
1426	Tertiary variable (TV)	UINT32	CDAB	Third HART variable
1428	Status	UINT64	-	See "Format of the status bytes" → 🖺 201
1438	Quaternary variable (QV)	UINT32	CDAB	Fourth HART variable
1440	Status	UINT64	-	See "Format of the status bytes" → 🖺 201
2000	Old status	UINT32	-	All zeros
2002	Primary variable (PV)	UINT32	ABCD	First HART variable
2004	Secondary variable (SV)	UINT32	ABCD	Second HART variable
2006	Tertiary variable (TV)	UINT32	ABCD	Third HART variable

Register	Parameter	Data type	Swap mode	Description
2008	Quaternary variable (QV)	UINT32	ABCD	Fourth HART variable
2010	Status	UINT64	-	See "Format of the status bytes" → 🖺 201
2014	Diagnostics	UINT64	ABCD	See "Format of the diagnostic bytes" → 🖺 200
2100	Old status	UINT32	-	All zeros
2102	Primary variable (PV)	UINT32	DCBA	First HART variable
2104	Secondary variable (SV)	UINT32	DCBA	Second HART variable
2106	Tertiary variable (TV)	UINT32	DCBA	Third HART variable
2108	Quaternary variable (QV)	UINT32	DCBA	Fourth HART variable
2110	Status	UINT64	-	See "Format of the status bytes" → 🖺 201
2114	Diagnostics	UINT64	DCBA	See "Format of the diagnostic bytes" → 🖺 200
2200	Old status	UINT32	-	All zeros
2202	Primary variable (PV)	UINT32	BADC	First HART variable
2204	Secondary variable (SV)	UINT32	BADC	Second HART variable
2206	Tertiary variable (TV)	UINT32	BADC	Third HART variable
2208	Quaternary variable (QV)	UINT32	BADC	Fourth HART variable
2210	Status	UINT64	-	See "Format of the status bytes" → 🖺 201
2214	Diagnostics	UINT64	BADC	See "Format of the diagnostic bytes" → 🖺 200

15.5.2   Format of the diagnostic bytes
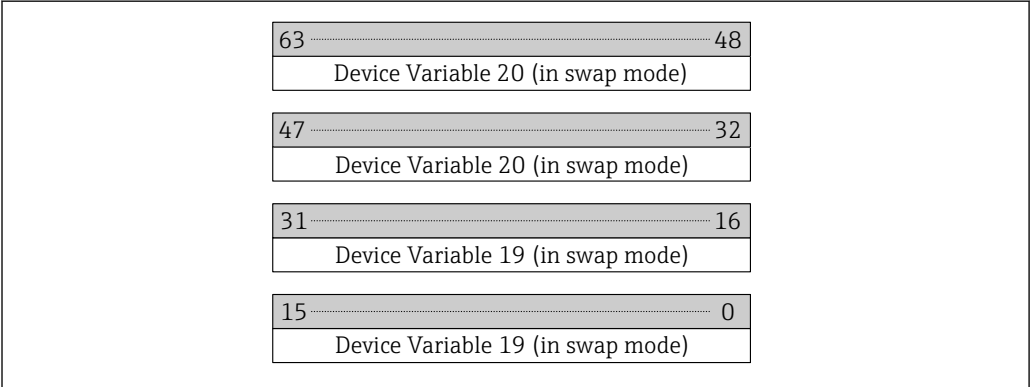
A0043330

ℹ️ "Device Variable 19" and "Device Variable 20" are derived from HART Command 9.

15.5.3   Format of the status bytes

| 63 .... 48 |
| Bad Modbus Message Counter |

| 47 .... 32 |
| IOM to MB Timeout Counter |

| 31 .... 24 | 23 .... 16 |
| Device Status Byte 15 | Device Status Byte 14 |

| 15 .... 8 | 7 .... 0 |
| Device Status Byte 3 | Device Status Byte 0 |
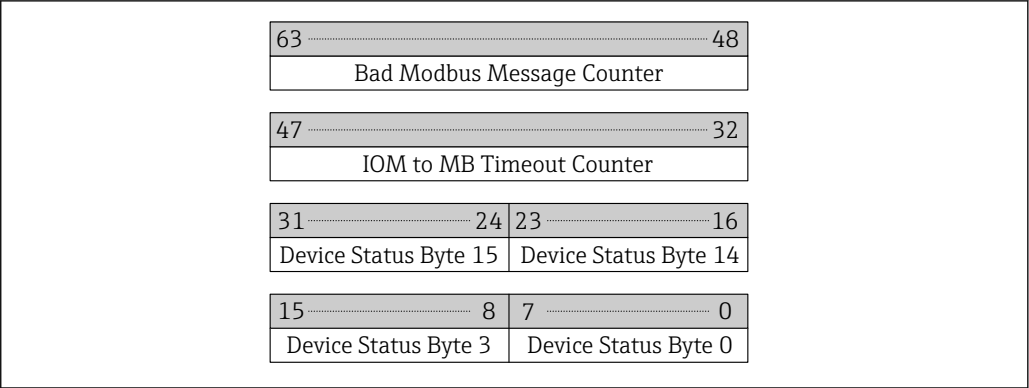
A0043329

The device status is determined from HART Command 48.

If one of the following status bits is set by the device, the measured value changes to 9999.99. This is intended to alert the user to the fact that there is a problem with the device.

Byte	Bit	Meaning
3	5	⊗F273 Main electronic failure
3	6	⊗F275 I/O module failure
14	1	⊗F104 HF cable
14	2	⊗F105 HF cable
14	3	⊗F106 Sensor
15	4	⊗F270 Main electronic failure
15	5	⊗F271 Main electronic failure
15	6	⊗F272 Main electronic failure

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