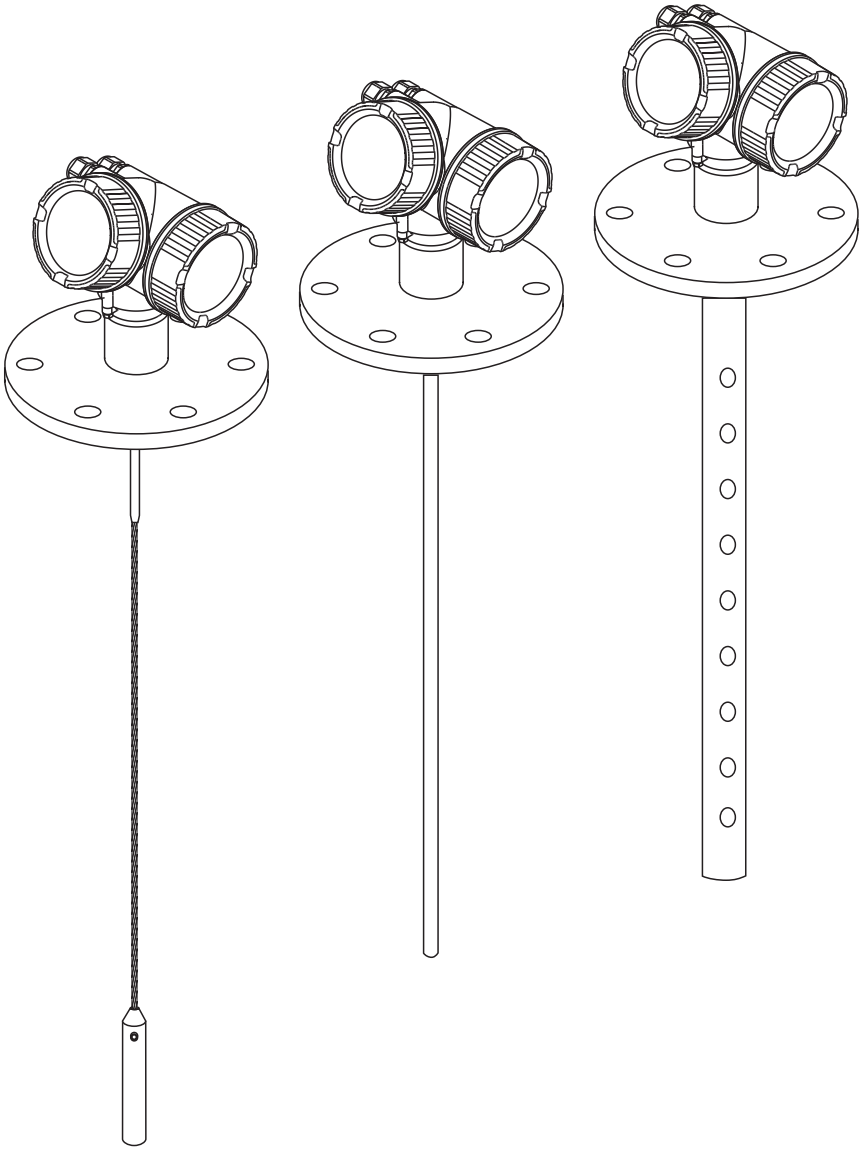
BA01957F/00/EN/01.19
71424612
2019-03-04

01.03.zz (Device firmware)

Operating Instructions
Levelflex FMP51
Modbus

Guided wave radar



Endress+Hauser
People for Process Automation

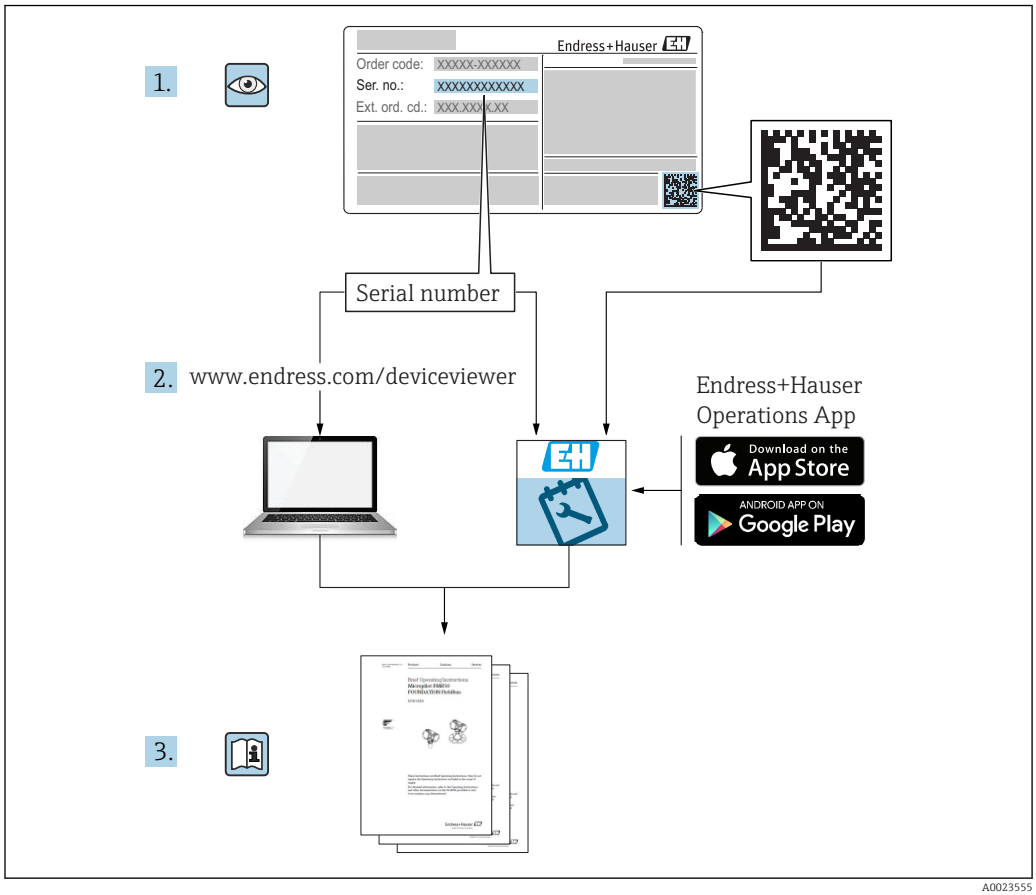

1.
Endress+Hauser
Order code: XXXXX-XXXXXX
Ser. no.: XXXXXXXXXXX
Ext. ord. cd.: XXX XXX-XX XX
Serial number
2. www.endress.com/deviceviewer
Endress+Hauser
Operations App
Download on the App Store
ANDROID APP ON Google Play
3.
A0023555

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1 Important document information

1.1 Document function

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

1.2 Symbols

1.2.1 Safety symbols

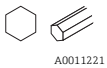
Symbol	Meaning
DANGER	**DANGER!** This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.
WARNING	**WARNING!** This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.
CAUTION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

1.2.2 Electrical symbols

Symbol	Meaning
⎓	Direct current
~	Alternating current
⎓ ~	Direct current and alternating current
⏚	**Ground connection** A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.
⏚	**Protective Earth (PE)** A terminal which must be connected to ground prior to establishing any other connections. The ground terminals are situated inside and outside the device: ▪ Inner ground terminal: Connects the protectiv earth to the mains supply. ▪ Outer ground terminal: Connects the device to the plant grounding system.

1.2.3 Tool symbols

Symbol	Meaning
 A0013442	Torx screwdriver
 A0011220	Flat blade screwdriver

Symbol	Meaning
 A0011219	Cross-head screwdriver
 A0011221	Allen key
 A0011222	Hexagon wrench

1.2.4 Symbols for certain types of information

Symbol	Meaning
	**Permitted** Procedures, processes or actions that are permitted.
	**Preferred** Procedures, processes or actions that are preferred.
	**Forbidden** Procedures, processes or actions that are forbidden.
	**Tip** Indicates additional information.
	Reference to documentation.
	Reference to page.
	Reference to graphic.
	Notice or individual step to be observed.
1., 2., 3...	Series of steps.
	Result of a step.
	Help in the event of a problem.
	Visual inspection.

1.2.5 Symbols in graphics

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

1.2.6 Symbols at the device

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

1.3 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 Designated use

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

Observing the limit values specified in the "Technical data" and listed in the Operating Instructions and supplementary documentation, the measuring device may be used for the following measurements only:
- Measured process variable: Level and/or interface
- Calculated process variable: Volume oder mass in arbitrarily shaped vessels (calculated from the level by the linearization functionality)

To ensure that the measuring device remains in proper condition for the operation time:
- Use the measuring device only for measured materials against which the process-wetted materials are adequately resistant.
- Observe the limit values in "Technical data".

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

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

Danger of burns due to heated surfaces!
- For high process temperatures: Install protection against contact in order to prevent burns.

2.3 Workplace safety

For work on and with the device:
- Wear the required personal protective equipment according to federal/national regulations.

With divisible probe rods, medium may penetrate into the joints between the indivual parts of the rod. This medium may escape when loosening the joints. In the case of dangerous (e.g. aggressive or toxic) media this may cause injuries.
- ▶ When loosening the joints between the individual parts of the probe rod: Wear appropriate protective equipment according to the medium.

2.4 Operational safety

Risk of injury.
- ▶ Operate the device in proper technical condition and fail-safe condition only.
- ▶ The operator is responsible for interference-free operation of the device.

Conversions to the device

Unauthorized modifications to the device are not permitted and can lead to unforeseeable dangers.
- ▶ If, despite this, modifications are required, consult with the manufacturer.

Repair

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

Hazardous area

To eliminate a danger for persons or for the facility when the device is used in the hazardous area (e.g. explosion protection, pressure vessel safety):
- ▶ Based on the nameplate, check whether the ordered device is permitted for the intended use in the hazardous area.
- ▶ Observe the specifications in the separate supplementary documentation that is an integral part of these Instructions.

2.5 Product safety

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

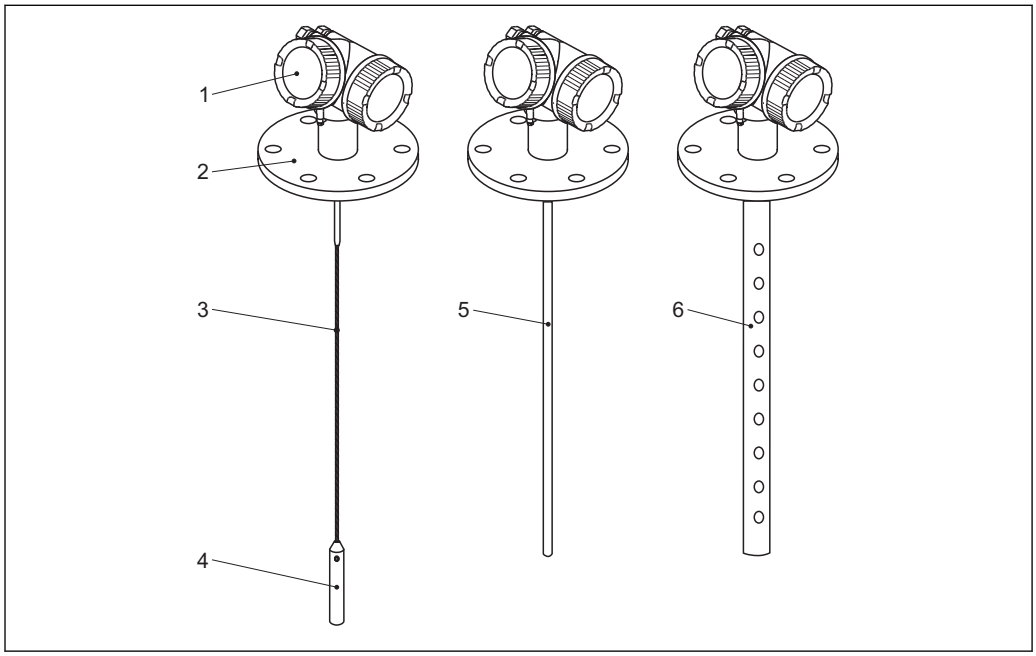
Feature 010 ("Approval")	Feature 030 ("Display, Operation")	Ex-marking
BG	L, M or N	ATEX II 3G Ex nA [ia Ga] IIC T6 Gc
BH	L, M or N	ATEX II 3G Ex ic [ia Ga] IIC T6 Gc
B3	L, M or N	ATEX II 1/2G Ex d [ia] IIC T6 Ga/Gb, ATEX II 1/2D Ex ta [ia Db] IIIC Txx°C Da/Db
IG	L, M or N	IECEx Ex nA [ia Ga] IIC T6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

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

3 Product description

3.1 Product design

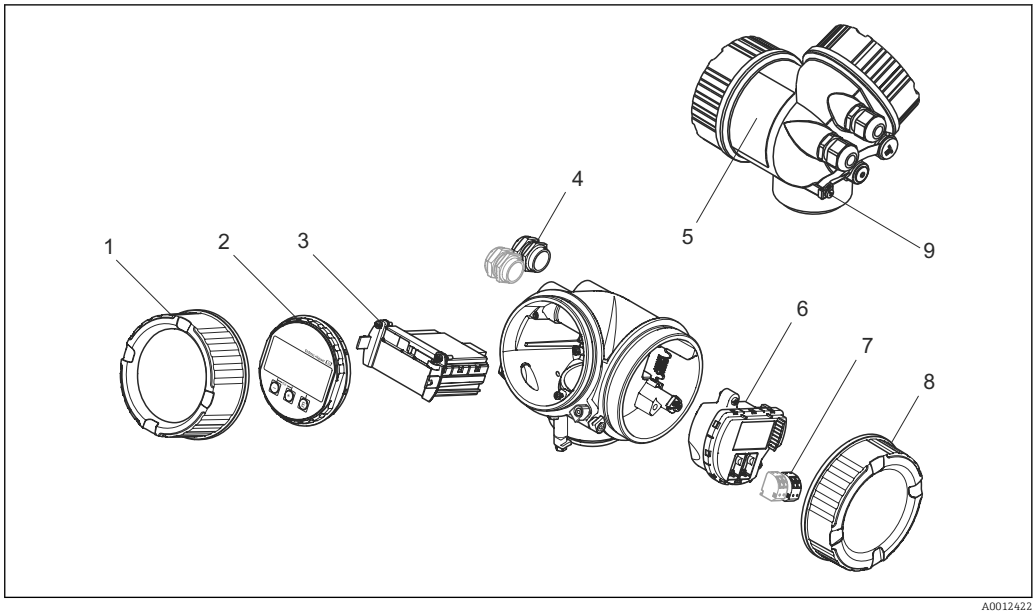
3.1.1 Levelflex FMP51



1 *Design of the Levelflex*

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

3.1.2 Electronics housing



2 *Design of the electronics housing*

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

4 Incoming acceptance and product identification

4.1 Incoming acceptance

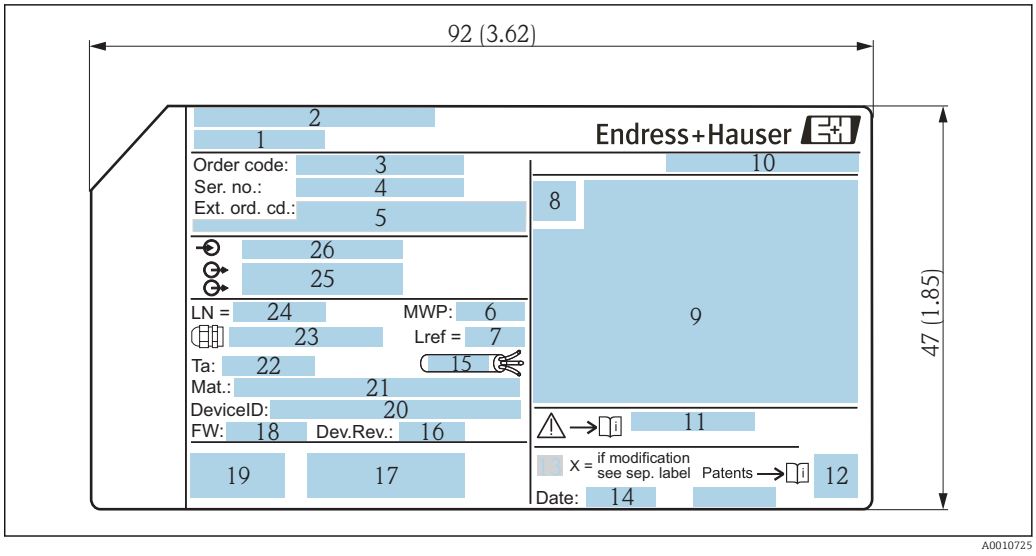
Upon receipt of the goods check the following:
- Are the order codes on the delivery note and the product sticker identical?
- Are the goods undamaged?
- Do the nameplate data match the ordering information on the delivery note?
- If required (see nameplate): Are the Safety Instructions (XA) present?

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 °C (−40 to +176 °F)
- Use the original packaging.

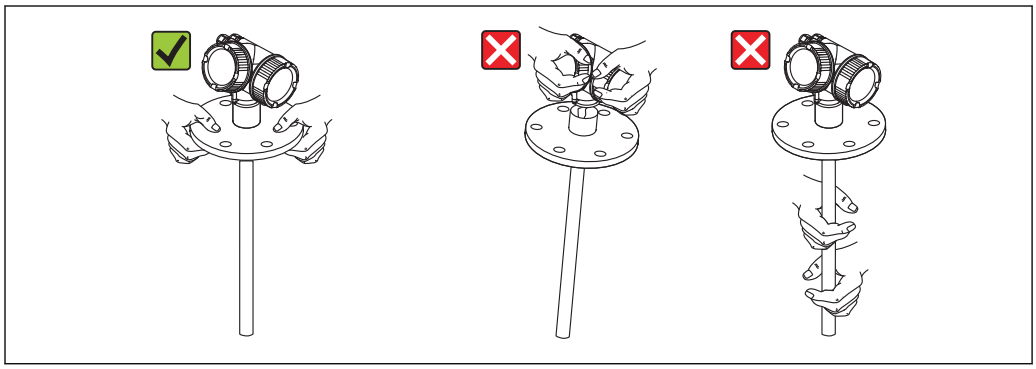
5.2 Transport product to the measuring point

⚠ WARNING

Housing or probe may be damaged or break away.

Risk of injury!

- ▶ Transport the measuring device to the measuring point in its original packaging or at the process connection.
- ▶ Do not fasten lifting devices (hoisting slings, lifting eyes etc.) at the housing or the probe but at the process connection. Take into account the mass center of the device in order to avoid unintended tilting.
- ▶ Comply with the safety instructions, transport conditions for devices over 18kg (39.6lbs) (IEC61010).

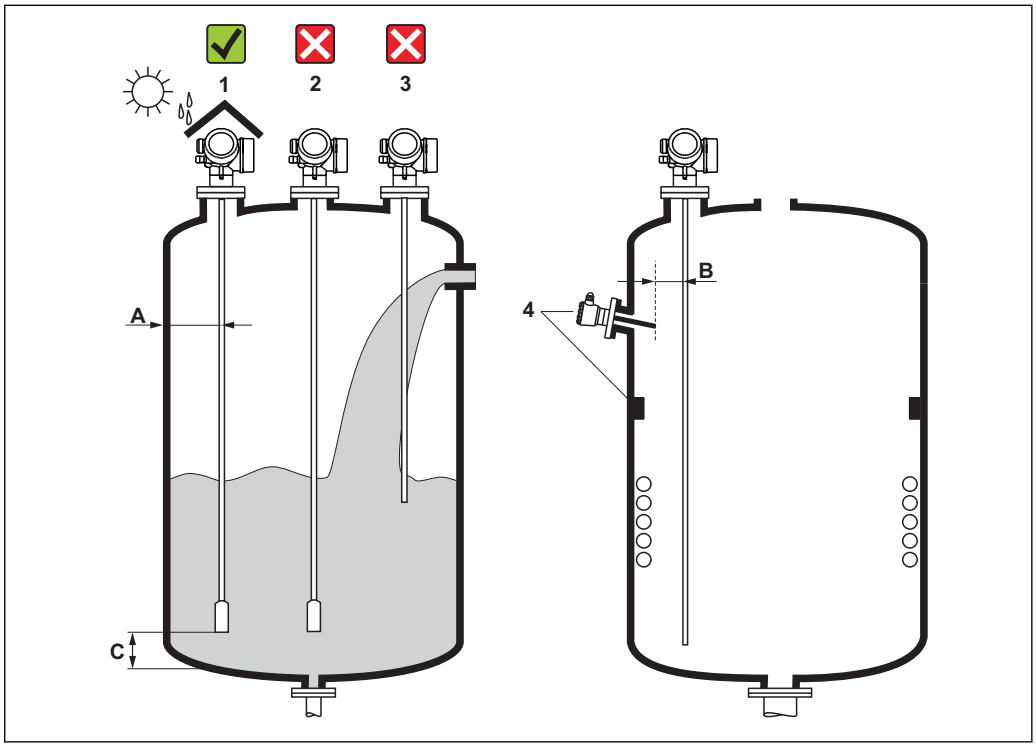


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6 Mounting

6.1 Mounting requirements

6.1.1 Suitable mounting position



4 *Mounting requirements for Levelflex*

Mounting distances

- Distance (A) between wall and rod or rope probe:
  - 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 available measuring range may be reduced.
- Distance (B) between rod or rope probe and internal fittings in the vessel: > 300 mm (12 in)
- When using more than one Levelflex:
  Minimum distance between the sensor axes: 100 mm (3.94 in)
- Distance (C) from end of probe to bottom of the vessel:
  - Rope probe: > 150 mm (6 in)
  - Rod probe: > 10 mm (0.4 in)
  - Coax probe: > 10 mm (0.4 in)

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

Additional conditions

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

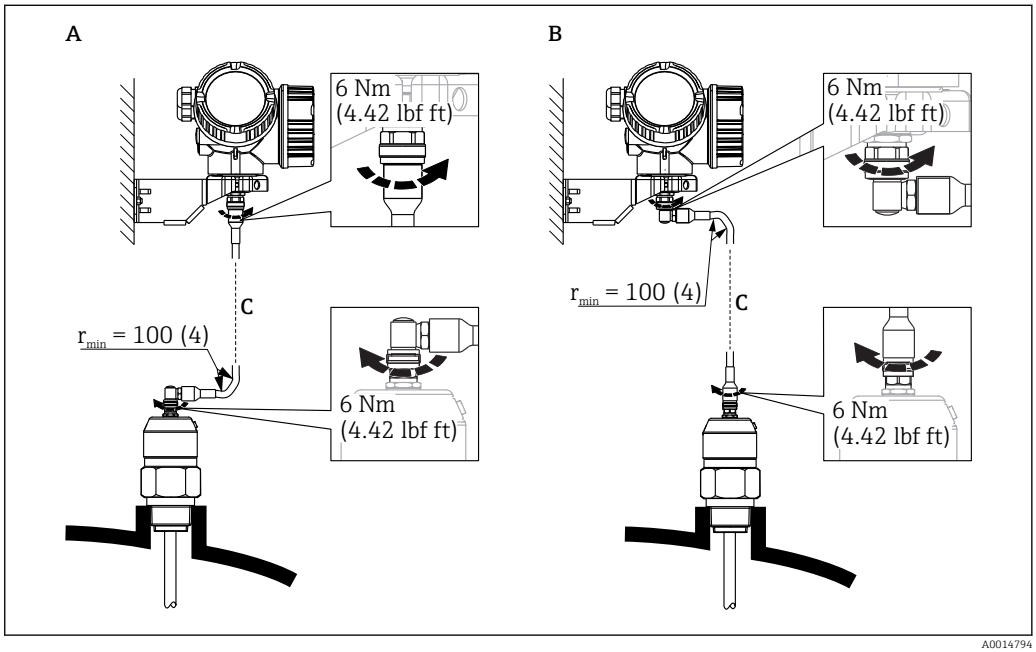
With suspended rope probes (probe end not fixed at the bottom) the distance between the probe rope and internal fittings in the tank must not fall below 300 mm (12") during the entire process. A sporadic contact between the probe weight and the cone of the vessel, however, does not influence the measurement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

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

6.1.2 Applications with restricted mounting space

Mounting with remote sensor

The device version with a remote sensor is suited for applications with restricted mounting space. In this case the electronics housing is mounted at a separate position from which it is easier accessible.

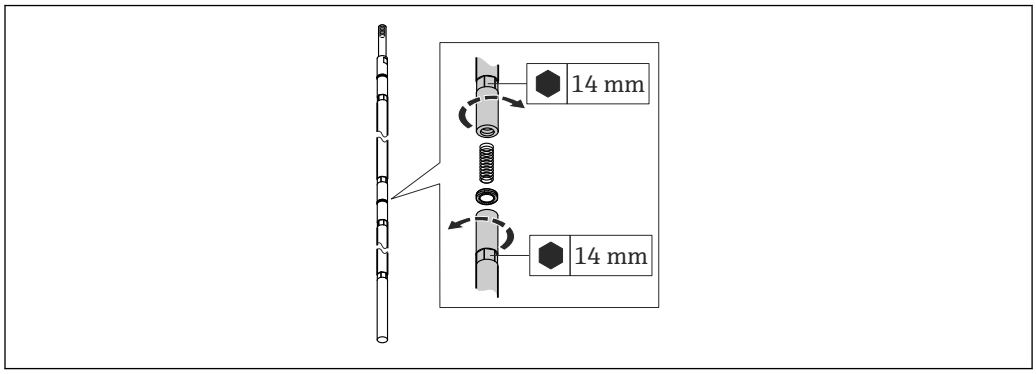


A Angled plug at the probe
B Angled plug at the electronics housing
C Length of the remote cable as ordered

- Product structure, feature 600 "Probe Design":
  - Option MB "Sensor remote, 3m/9ft cable"
  - Option MC "Sensor remote, 6m/18ft cable"
  - Option MD "Sensor remote, 9m/27ft cable"
- The remote cable is supplied with these device versions
  Minimum bending radius: 100 mm (4 inch)
- A mounting bracket for the electronics housing is supplied with these device versions.
  Mounting options:
  - Wall mounting
  - Pipe mounting; diameter: 42 to 60 mm (1-1/4 to 2 inch)
- The connection cable has got one straight and one angled plug (90°). Depending on the local conditions the angled plug can be connected at the probe or at the electronics housing.

Probe, electronics and connection cable are adjusted to match each other. They are marked by a common serial number. Only components with the same serial number shall be connected to each other.

Divisible probes



A0021647

If there is little mounting space (distance to the ceiling), it is advisable to use divisible rod probes (ϕ 16 mm).

- max. probe length 10 m (394 in)
- max. sideways capacity 30 Nm
- probes are separable several times with the following lengths of the individual parts:
  - 500 mm (20 in)
  - 1000 mm (40 in)
- torque: 15 Nm

6.1.3 Notes on the mechanical load of the probe

Tensile load limit of rope probes

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

Bending strength of rod probes

Sensor	Feature 060	Probe	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 divisible	30

Bending load (torque) through fluid flow

The formula for calculating the bending torque M impacting 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: Friction factor

ρ [kg/m³]: Density of the medium

v [m/s]: Velocity of the medium perpendicular to the probe rod

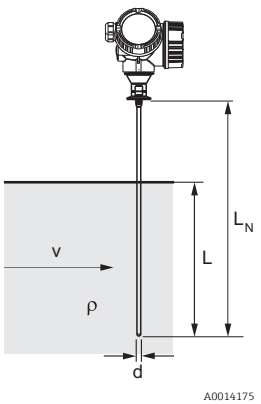
d [m]: Diameter of the probe rod

L [m]: Level

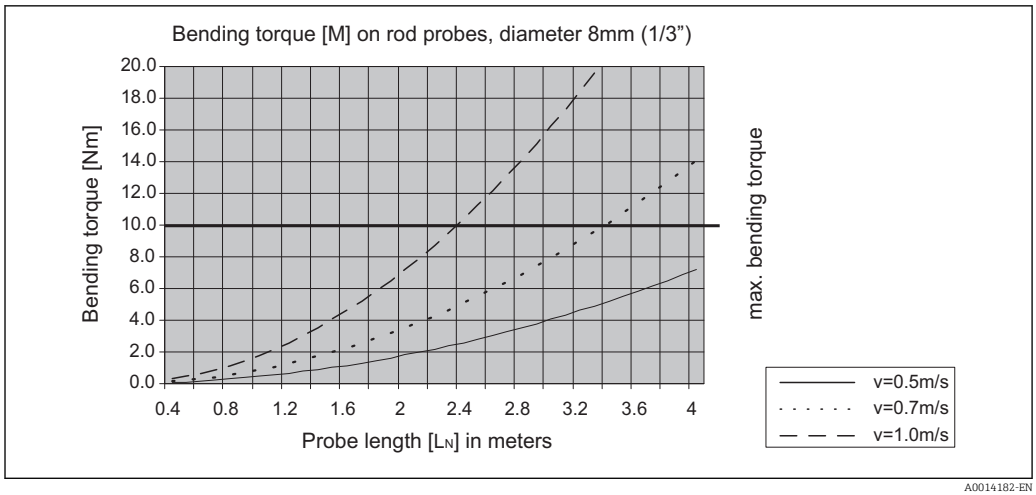
LN [m]: Probe length

Calculation example

Friction factor c_w	0,9 (on the assumption of a turbulent current - high Reynolds number)
Density ρ [kg/m³]	1000 (e.g. water)
Probe diameter d [m]	0,008
$L = L_N$	(worst case)



A0014175



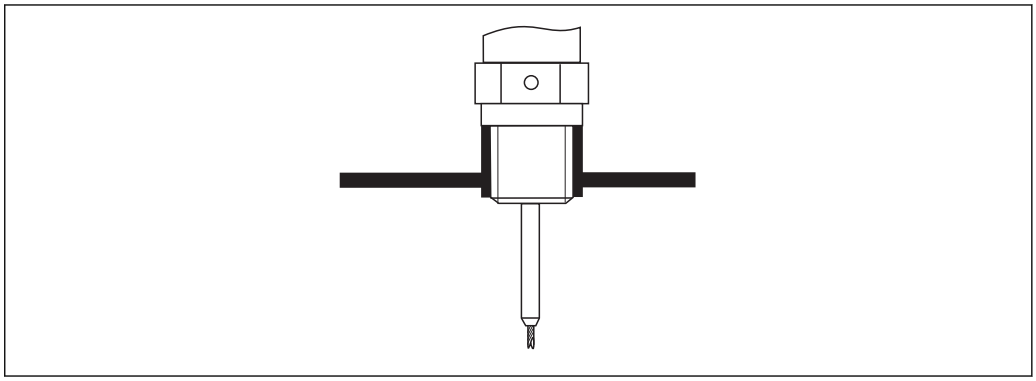
Bending strength of coax probes

Sensor	Feature 060	Process connection	Probe	Bending strength [Nm]
FMP51	UA, UB	Thread G¾ oder NPT¾	Coax 316L, Ø 21,3 mm	60
		▪ Thread G1½ or NPT1½ ▪ Flange	Coax 316L, Ø 42,4 mm	300
	UC, UD	Flange	Coax AlloyC, Ø 42,4 mm	300

6.1.4 Notes on the process connection

Probes are mounted to the process connection with threaded connections or flanges. If during this installation there is the danger that the probe end moves so much that it touches the tank floor or cone at times, the probe must, if necessary, be shortened and fixed down → 29.

Threaded connection



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

Seal

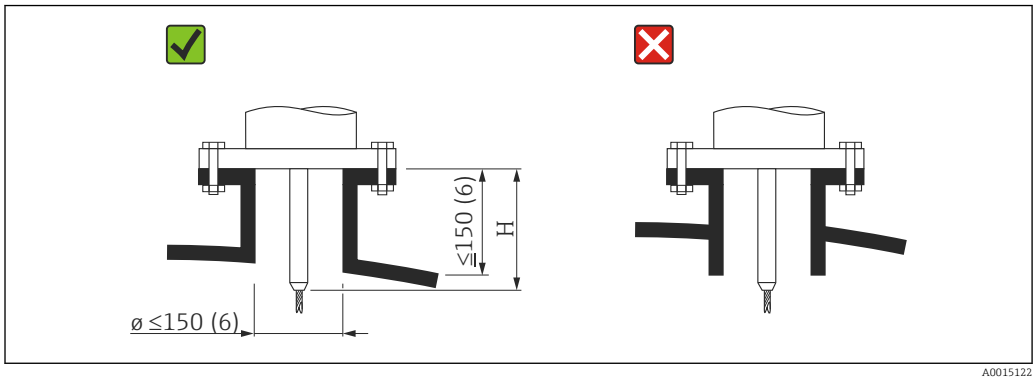
The thread as well as the type of seal comply to DIN 3852 Part 1, screwed plug form A.

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

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

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

Nozzle mounting



H Length of the center 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: → 28.
- Permissible nozzle height [2]: ≤ 150 mm (6 in).
  For a larger height the near range measuring capability may be reduced.
  Larger nozzle heights may be possible in special cases (see sections "Center rod").
- The end of the nozzle should be flush with the tank ceiling in order to avoid ringing effects.

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

2) Larger nozzle heights on request

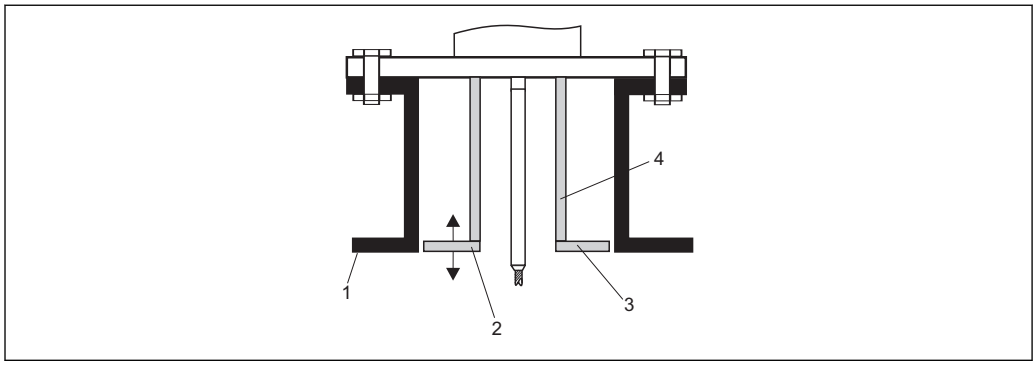
Center rod

For rope probes it may be necessary to use a version with center rod in order to prevent the probe rod from coming into contact with the nozzle wall.

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

Installation in nozzles ≥ DN300

If installation in ≥ 300mm/12" nozzles is unavoidable, installation must be carried out in accordance with the following sketch.

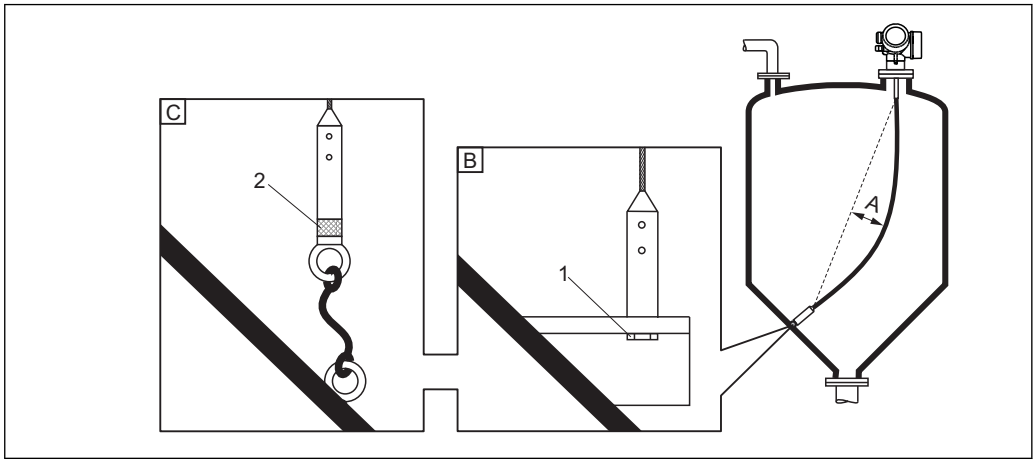


1 Lower edge of the nozzle
2 Approx. flush with the lower edge of the nozzle (± 50 mm/2")
3 Plate
4 Pipe Φ 150 to 180 mm (6 to 7 inch)

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

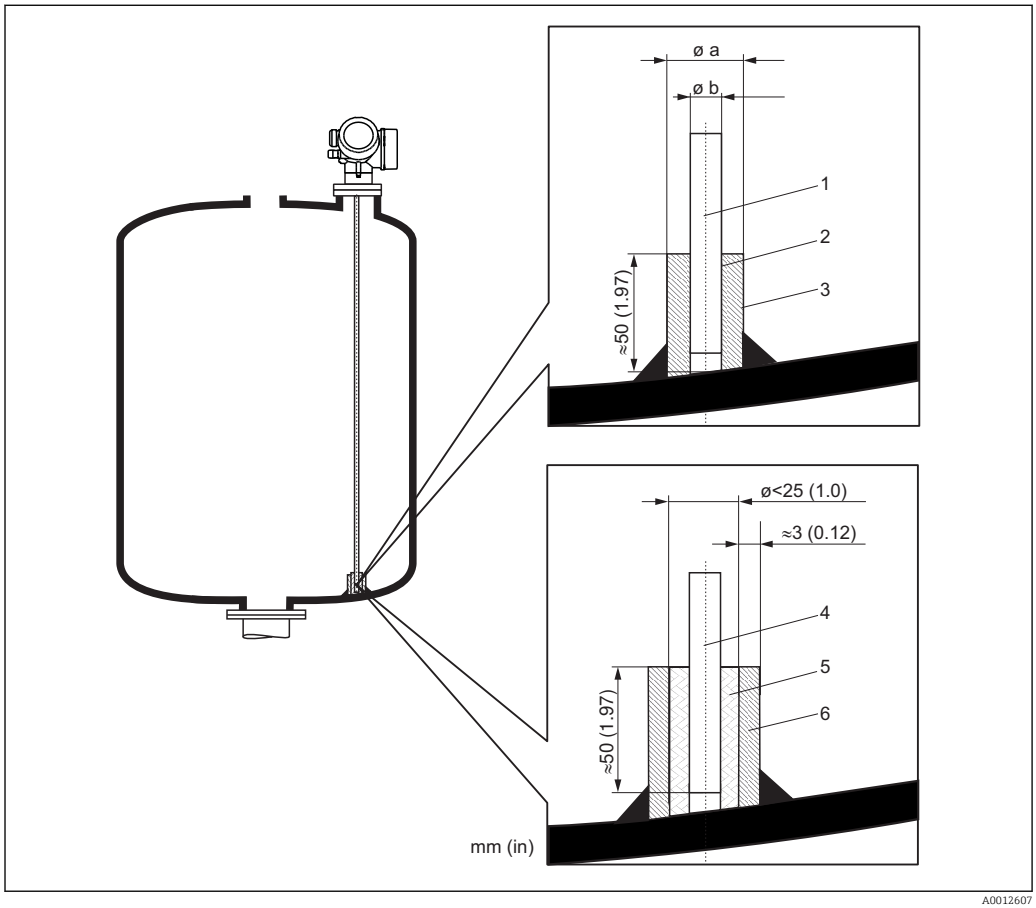


A Sag of the rope: ≥ 1 cm per 1m of the probe length (0.12 inch per 1 ft of the probe length)
B Reliably grounded end of probe
C Reliably isolated end of probe
1: Mounting and contact with a bolt
2 Mounting kit isolated

- 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: → 🖹 23

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.



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.

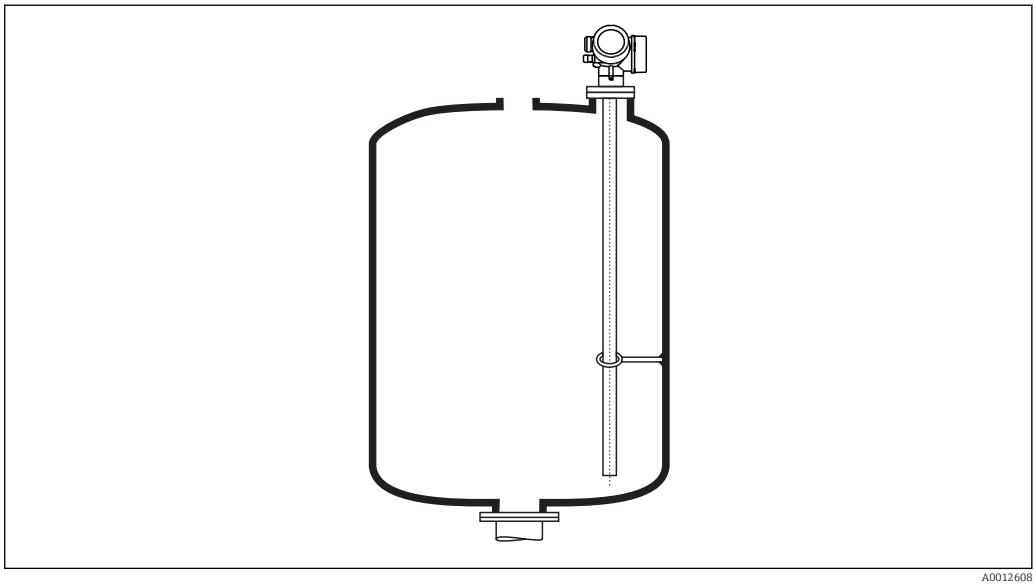
NOTICE

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.



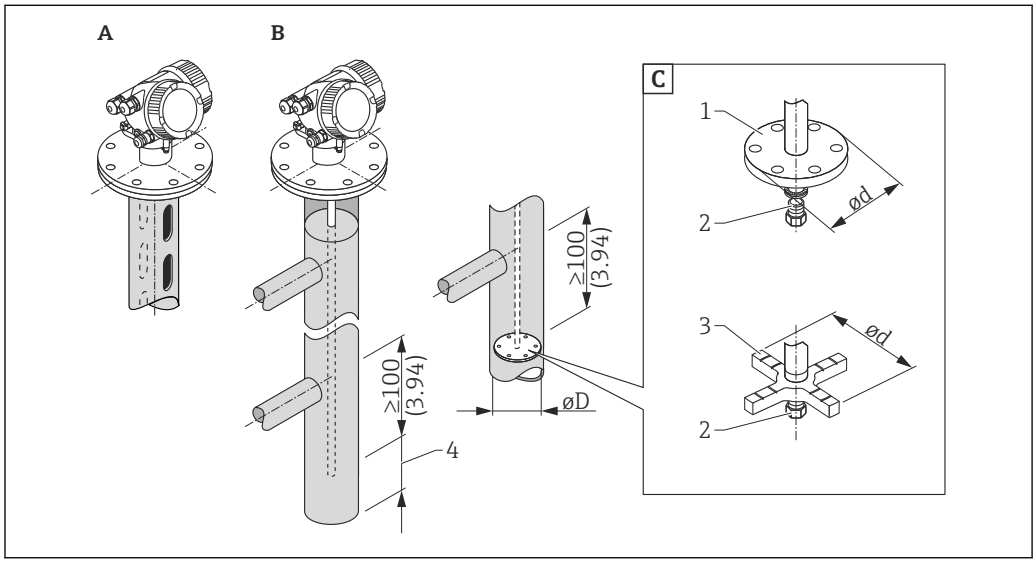
A0012608

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

6.1.6 Special mounting conditions

Bypasses and stilling wells

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



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	OA	Rod probe	75 (2,95)	316L	DN80/3" to DN100/4"
	OB	Rod probe	45 (1,77)	316L	DN50/2" to DN65/2½"
	OC	Rope probe	75 (2,95)	316L	DN80/3" to DN100/4"
Level or interface measurement	OD	Rod probe	48...95 (1,89...3,74)	PEEK [1]	≥ 50 mm (2")
	OE	Rod probe	37 (1,46)	PFA [2]	≥ 40 mm (1.57")

1) Operation temperature: –60 to +250 °C (–76 to 482 °F)
2) Operation temperature: –200 to +250 °C (–328 to +482 °F)

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)

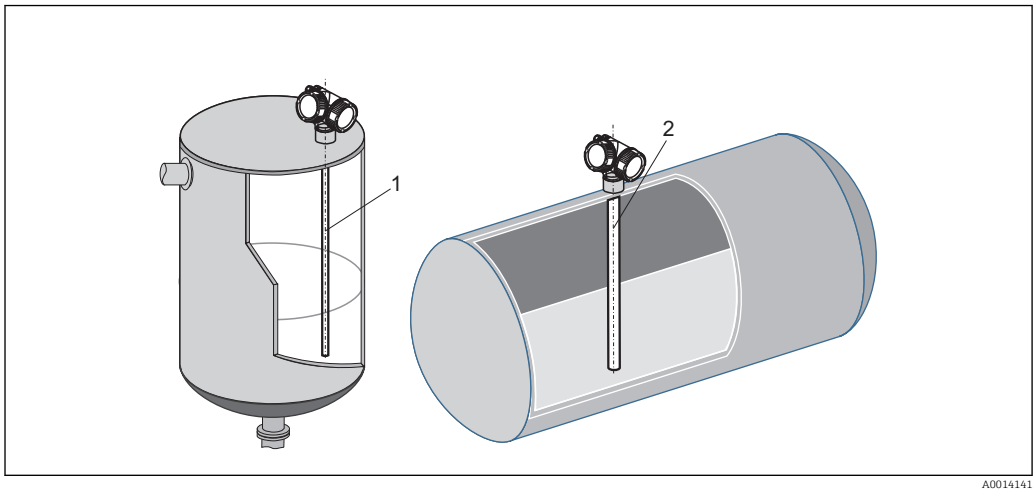
- Pipe diameter: > 40 mm (1.6") for rod probes
- Rod probe installation can take place up to a diameter size of 150 mm (6 in). In the event of larger diameters, a coax probe is recommended.
- Side disposals, holes or slits and welded joints that protrude up to approx. 5 mm (0.2") inwards do not influence 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.

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

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

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

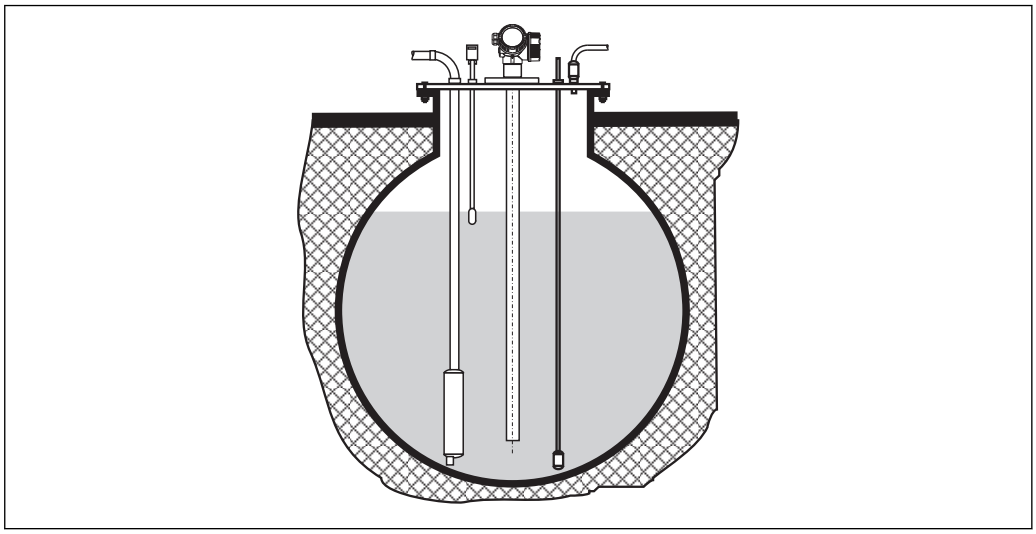
Installation in horizontal and upright cylindrical tanks



A0014141

- Any distance from wall, as long as occasional contact is prevented.
- When installing in tanks with a lot of internals or internals situated close to the probe: use a coax probe.

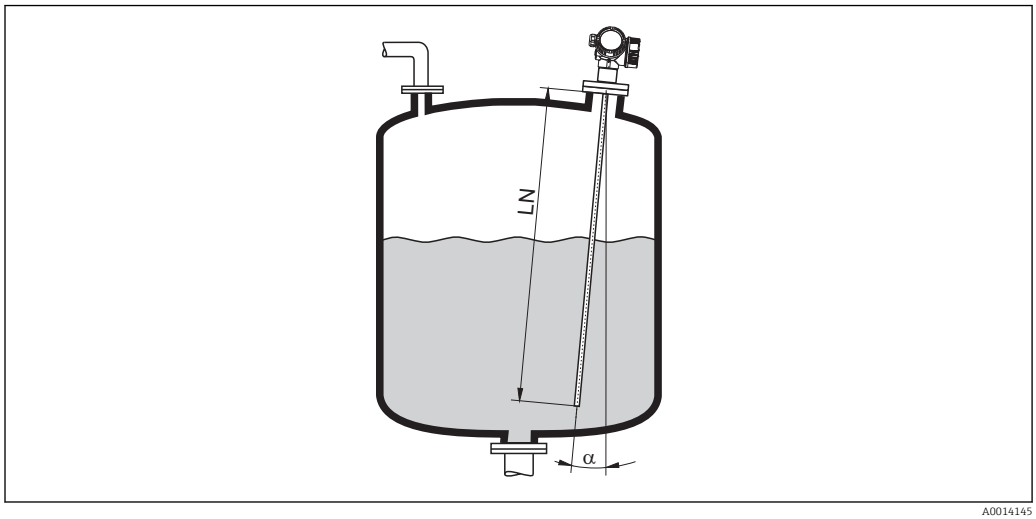
Underground tanks



A0014142

Use a coax probe for nozzles with large diameters in order to avoid reflections at the nozzle wall.

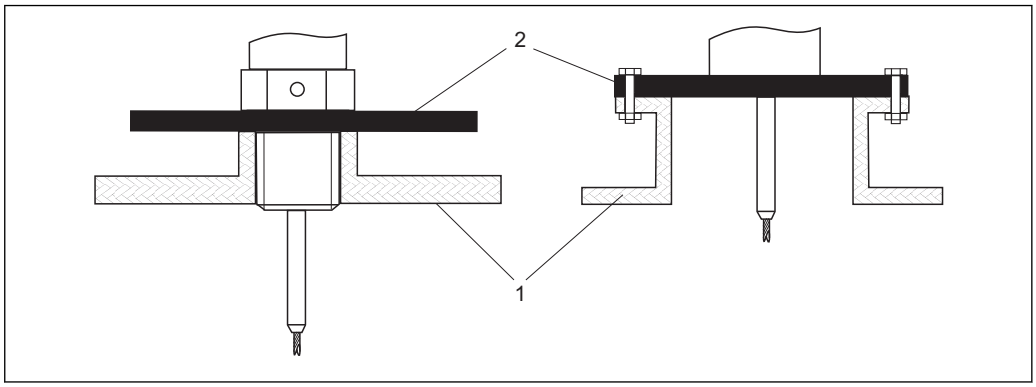
Installation at an angle



A0014145

- For mechanical reasons, the probe should be installed as vertically as possible.
- With inclined installations the probe length has to be adjusted in dependence to the installation angle.
  - 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-metallic vessels

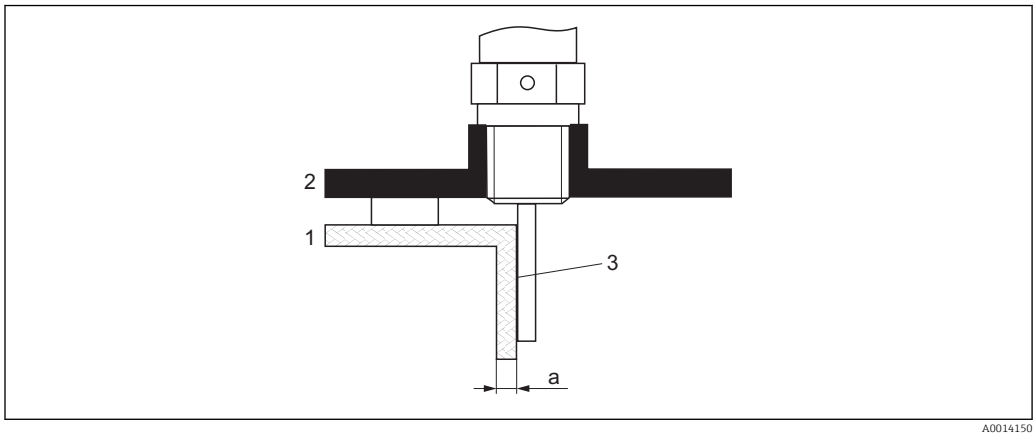


1 Non-metallic vessel
2 Metal sheet or metal flange

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

A metallic surface is not required for coax probes.

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



A0014150

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

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

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

Calibration for external probe mounting

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

Compensation with the gas phase compensation factor

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

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

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

Compensation via the calibration parameters

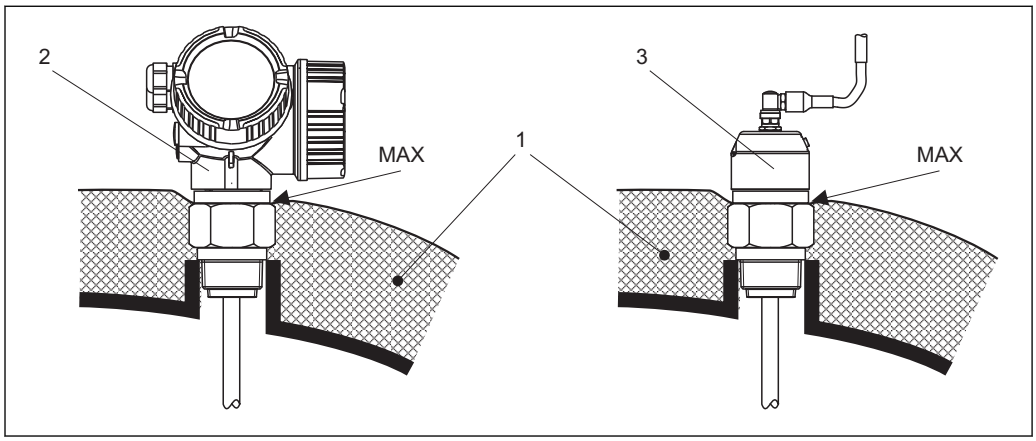
If an acutal gas phase has to be compensated for, the gas phase compensation functionality is no longer available for a correction of the external mounting. In this case the calibration parameters (**Empty calibration** and **Full calibration**) must be adjusted and a value longer than the actual probe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

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

Step	Parameter	Action
1	Setup → Empty calibration	Increase parameter value by "(Measured probe length)/(Actual probe length)".
2	Setup → Full calibration	Increase parameter value by "(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 measured probe length.

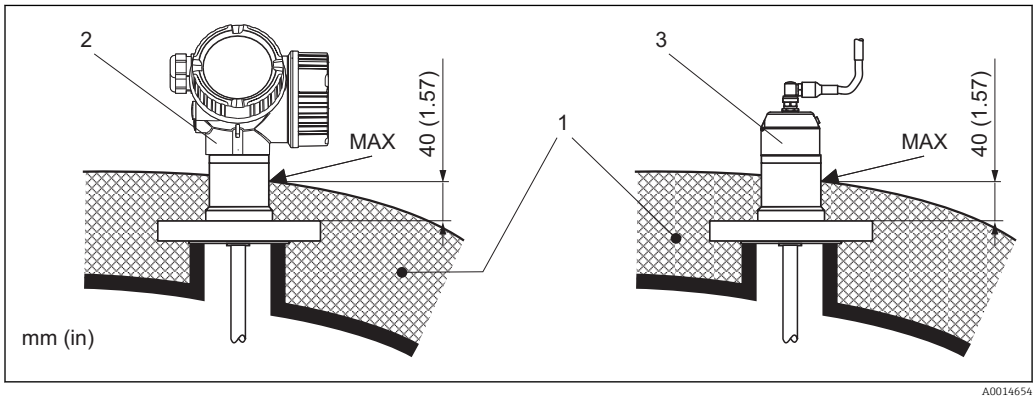
Vessels with heat insulation

If process temperatures are high, the device must be included in normal tank insulation to prevent the electronics heating up as a result of heat radiation or convection. The insulation may not exceed beyond the points labeled "MAX" in the drawings.



7 *Process connection with thread - FMP51*

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



8 *Process connection with flange - FMP51*

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

6.2 Mounting the device

6.2.1 Required mounting tools

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

6.2.2 Shortening the probe

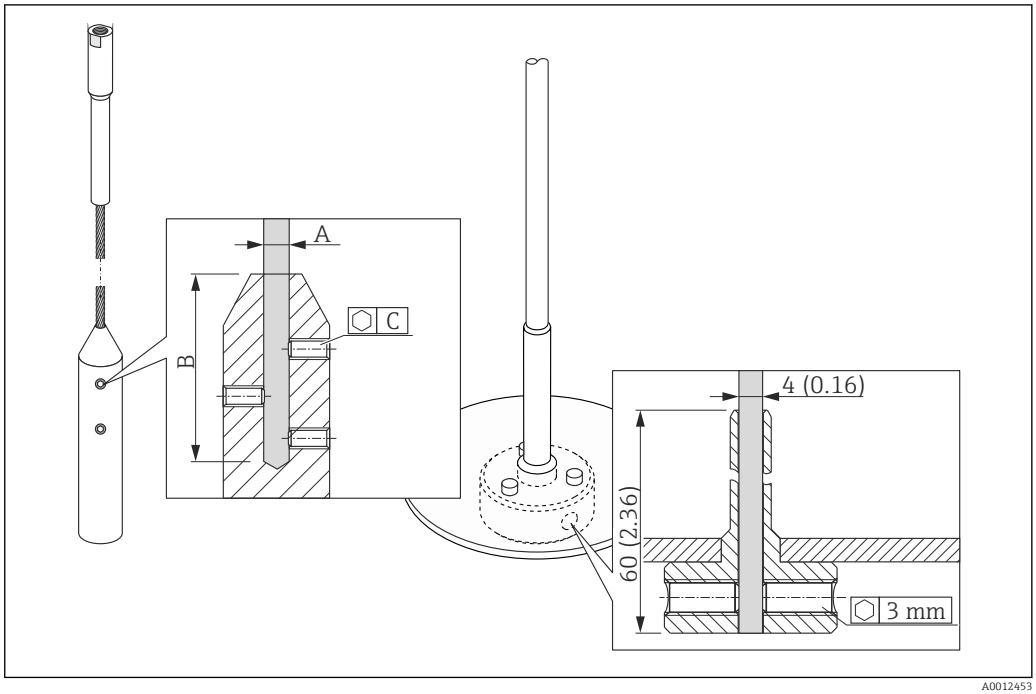
Shortening rod probes

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

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

Shortening rope probes

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



A0012453

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

1. Using an Allen key, loosen the set screws at the end-of-probe weight or the clamping sleeve of the centering disk. Note: The set screws have got a clamping coating in order to prevent accidental loosening. Thus an increased torque might be necessary to loosen them.

2. Remove released rope from the weight or sleeve.
3. Measure off new rope length.
4. Wrap adhesive tape around the rope at the point to be shortened to prevent it from fanning out.
5. Saw off the rope at a right angle or cut it off with a bolt cutter.
6. Insert the rope completely into the weight or sleeve.
7. Screw the set screws into place. Due to the clamping coating of the setscrews application of a screw locking fluid is not necessary.

Shortening coax probes

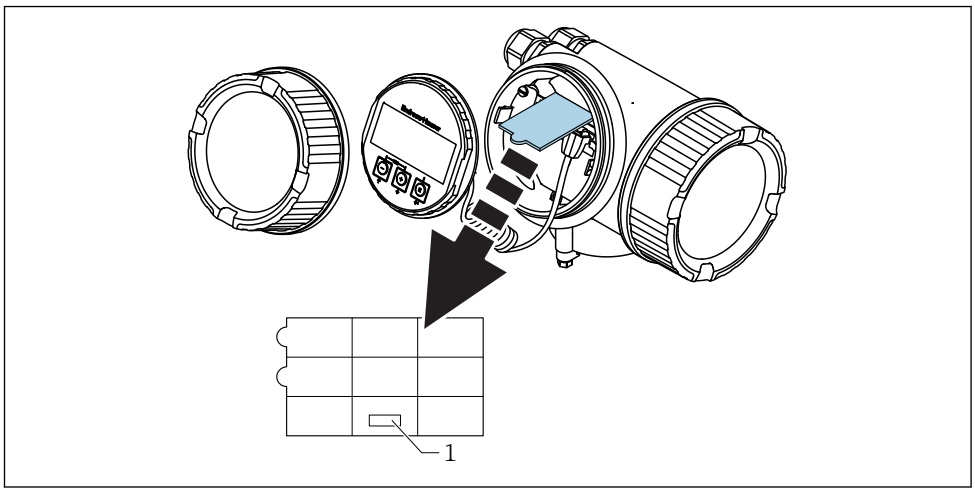
Coax probes must be shortened if the distance to the container floor or outlet cone is less than 10 mm (0.4 in).

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

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

Entering the new probe length

After shortening the probe:

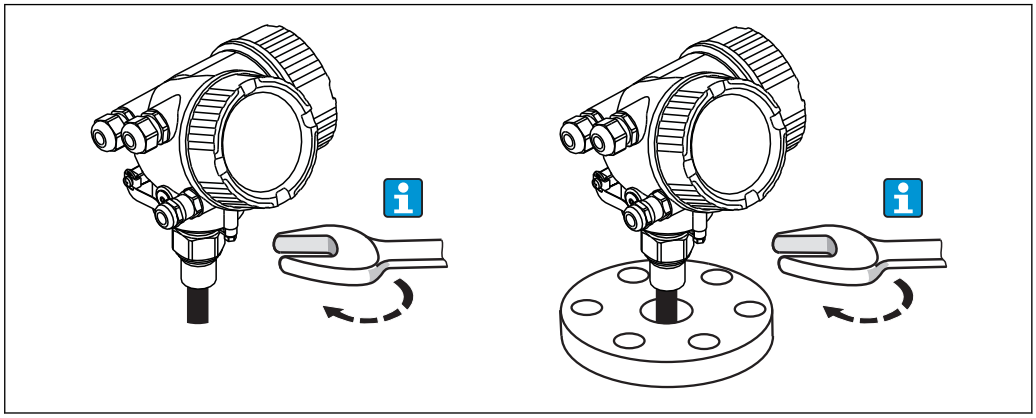
1. Go to the **Probe settings** submenu and perform a probe length correction.
2. 

1 Field for the new probe length

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

6.2.3 Mounting the device

Mounting devices with thread



A0012528

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

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

Flange mounting

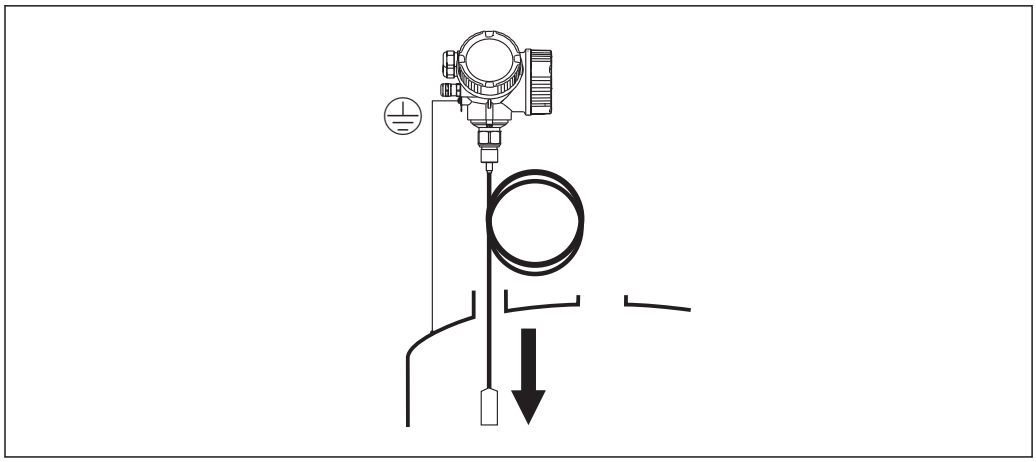
If a seal is used, be sure to use unpainted metal bolts to ensure good electrical contact between probe flange and process flange.

Mounting rope probes

NOTICE

Electrostatic discharges may damage the electronics.

► Earth the housing before lowering the rope into the vessel.



A0012852

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

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

6.2.4 Mounting the "Sensor remote" version

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

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

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

CAUTION

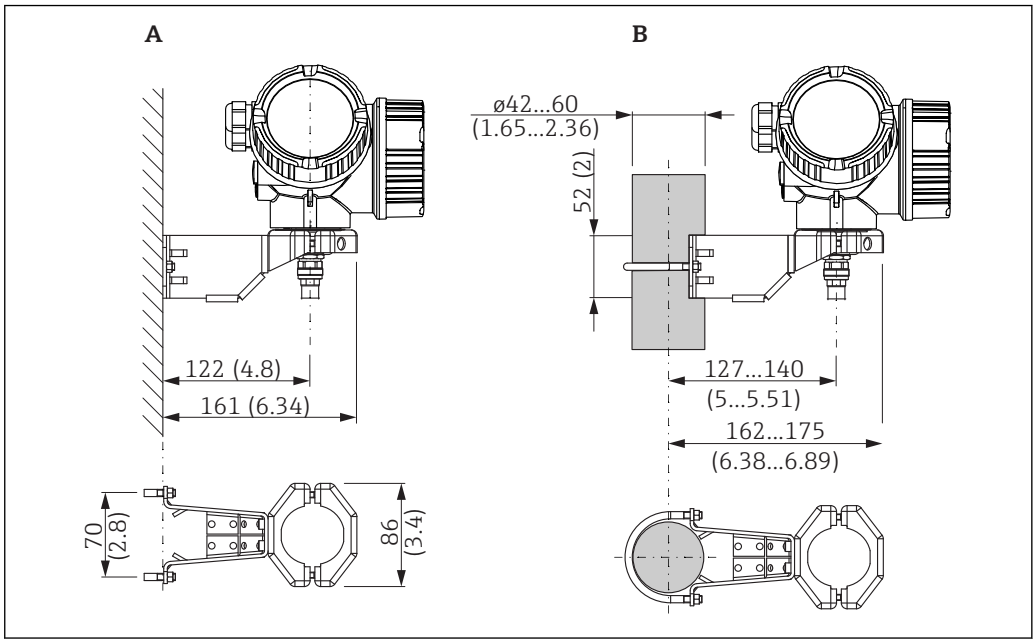
The plugs of the connection cable may be damaged by mechanical stress.

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

Probe, electronics and connection cable are adjusted to match each other. They are marked by a common serial number. Only components with the same serial number shall be connected to each other.

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

Mounting the electronics housing

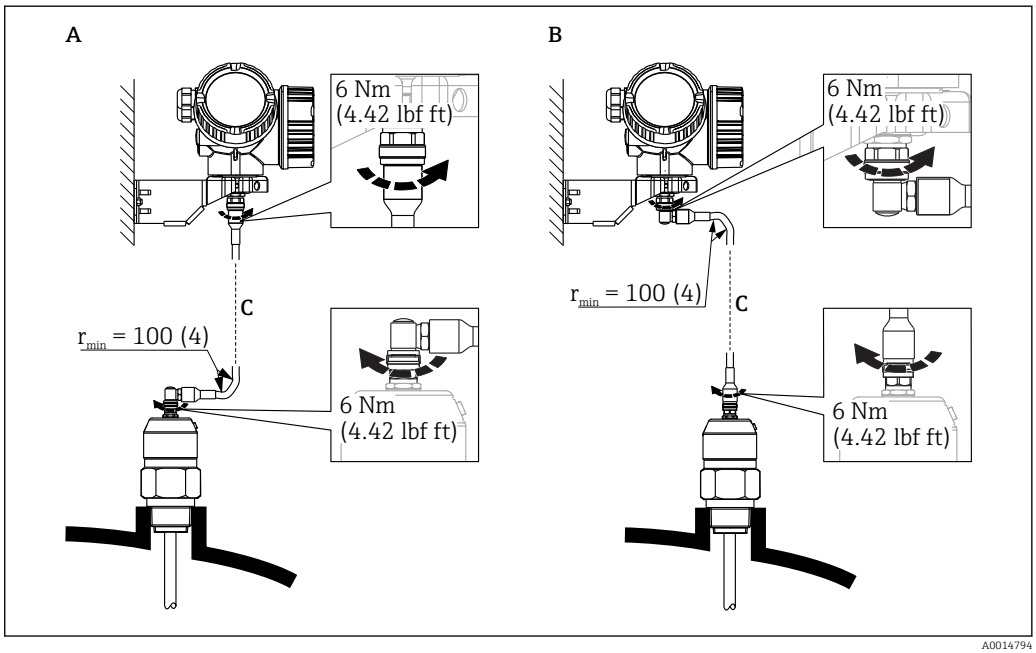


9 *Mounting the electronics housing using the mounting bracket; dimensions: mm (in)*

A Wall mounting
B Pipe mounting

Connecting the cable

Required tools:
Open-end wrench 18AF

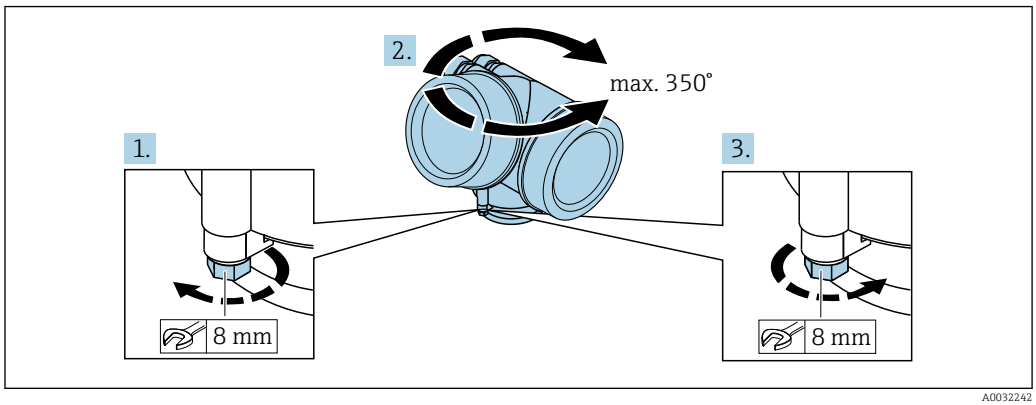


10 *Connecting the cable. There are the following possibilities:*

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

6.2.5 Turning the transmitter housing

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

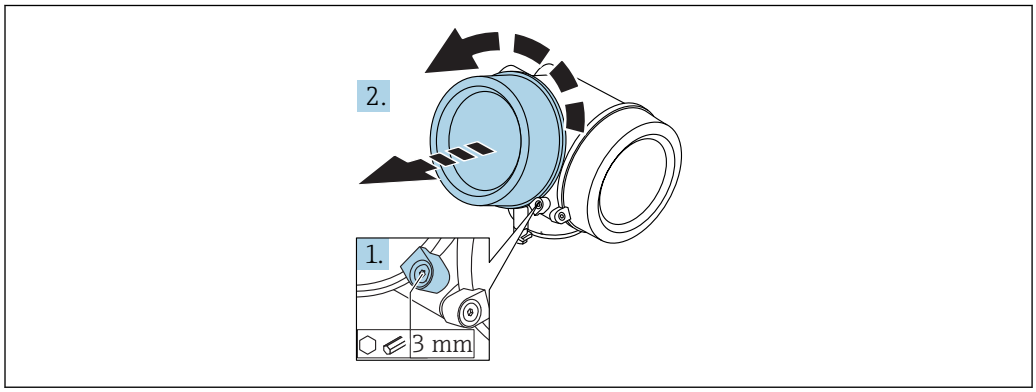


A0032242

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

6.2.6 Turning the display

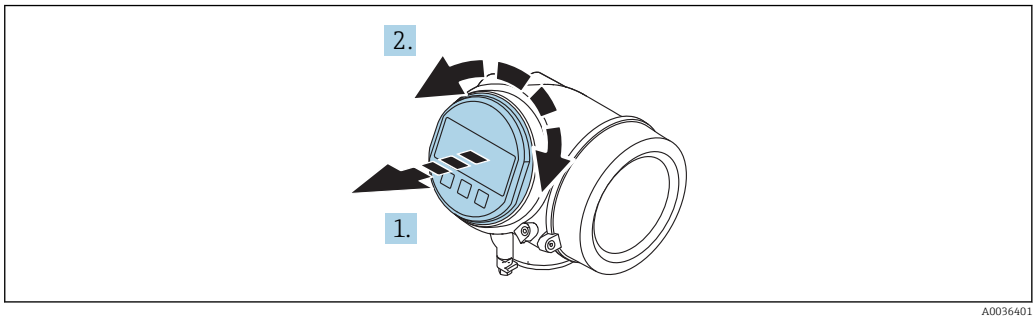
Opening cover



A0021430

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 cover and check lid gasket, replace if necessary.

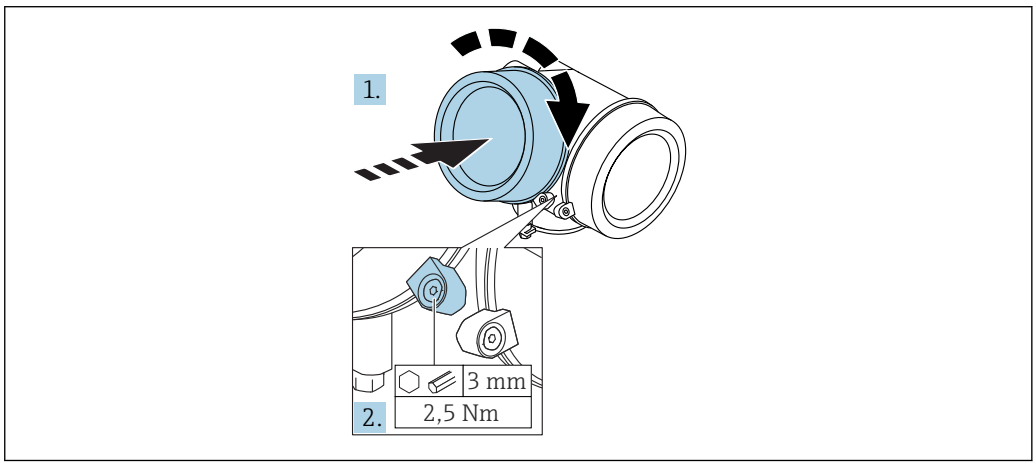
Turning the display module



A0036401

1. Pull out the display module with a gentle rotational movement.
2. Rotate 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 electronics compartment cover



A0021451

1. Screw back firmly electronics compartment cover.
2. Turning securing clamp 90 ° clockwise and tighten the clamp with 2.5 Nm using the Allen key (3 mm).

6.3 Post-installation check

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

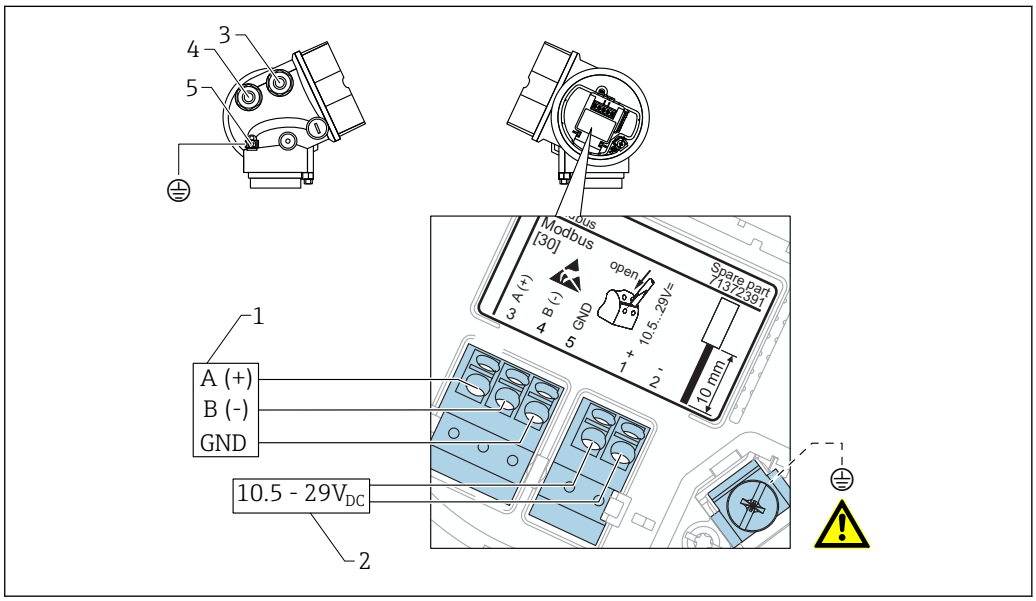
7 Electrical connection

7.1 Connection conditions

7.1.1 Terminal assignment

Modbus

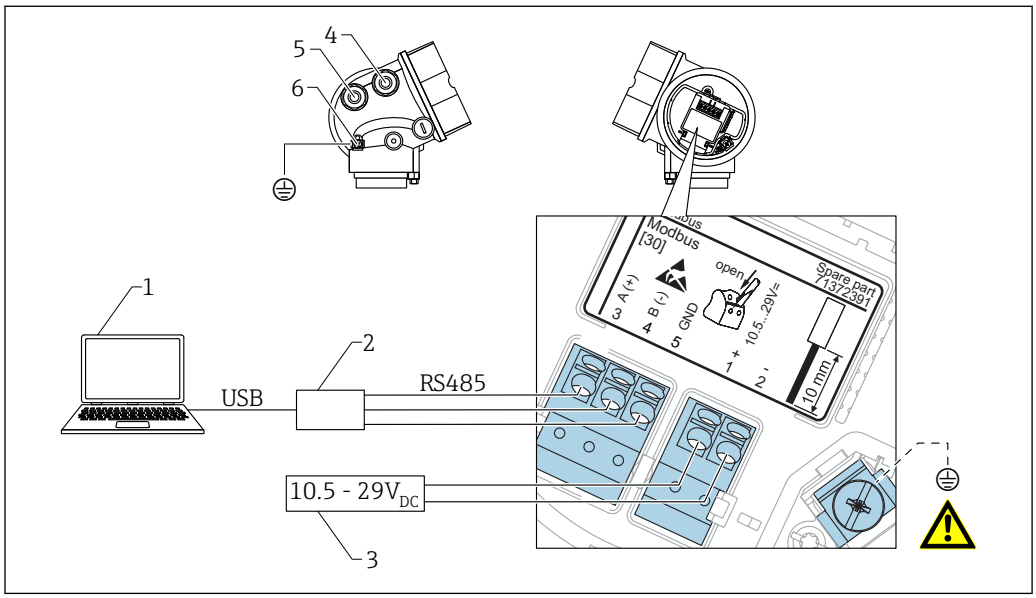
Connection to a Modbus master



1 *Modbus master*
2 *Power supply*
3 *Cable entry for Modbus connection*
4 *Cable entry for supply voltage*
5 *Protective earth connection*

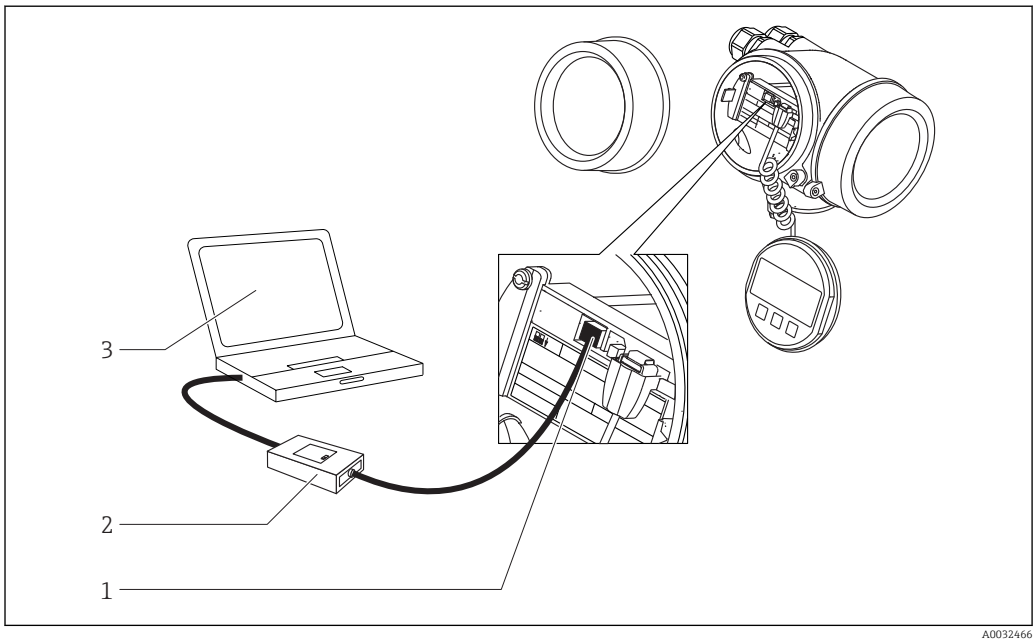
Connection to FieldCare/DeviceCare via RS485

To configure the device via FieldCare or DeviceCare, it is recommended to disconnect it from the Modbus master and to connect it to the computer via a USB to RS485 interface.



1 *Computer with FieldCare/DeviceCare*
2 *USB to RS485 interface*
3 *Power supply*
4 *Cable entry for RS485 connection*
5 *Cable entry for supply voltage*
6 *Protective earth connection*

Connection to DeviceCare/FieldCare via service interface



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 transfer mode	RTU

7.2 Connecting the measuring device

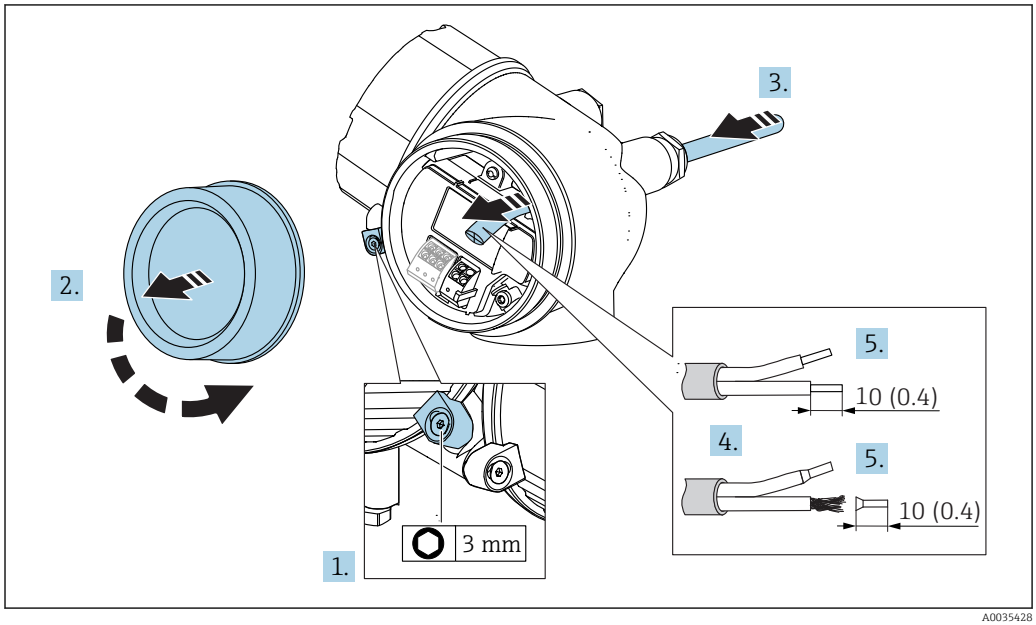
⚠ WARNING

Risk of explosion!

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

Required tools/accessories:

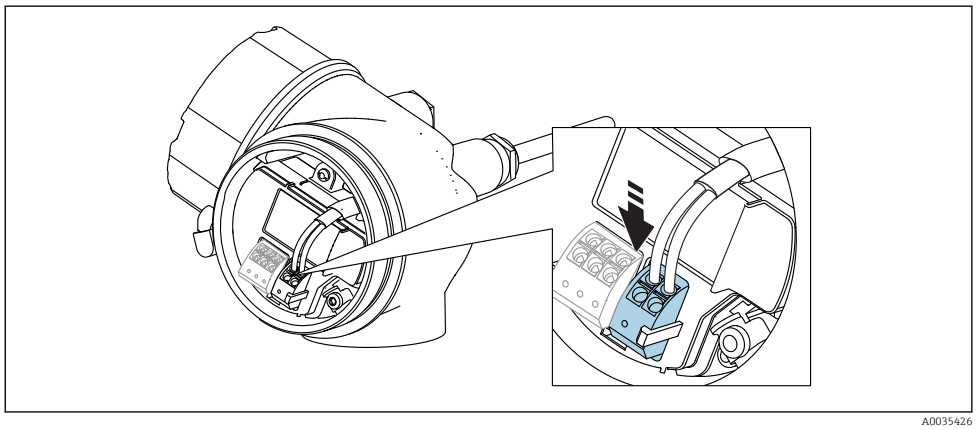
- For devices with a cover lock: Allen key AF3
- Wire stripper
- When using stranded cables: One ferrule for every wire to be connected.



11 *Dimensions: mm (in)*

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

7.



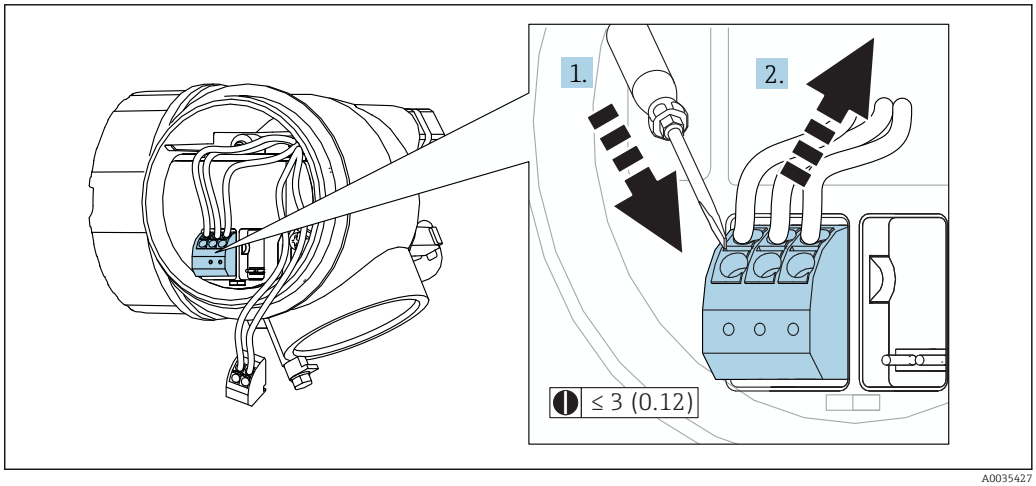
A0035426

Connect the cable in accordance with the terminal assignment → 49.

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

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



A0035427

12 *Dimensions: 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. while simultaneously pulling the cable end out of the terminal.

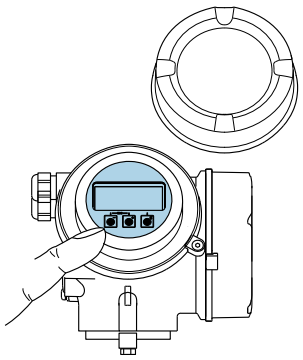
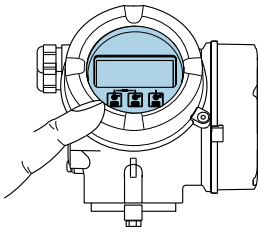
7.3 Post-connection check

❑	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 → 🖹 49?
❑	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?

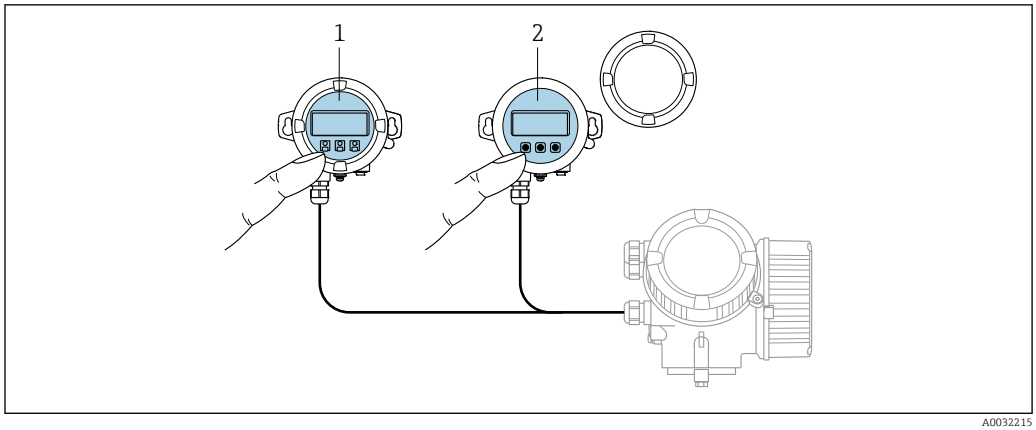
8 Operation options

8.1 Overview

8.1.1 Local operation

Operation with	*Pushbuttons*	*Touch Control*
Order code for "Display; Operation"	Option **C** "SD02"	Option **E** "SD03"
	 A0032219	 A0032221
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 °C (−4 to +158 °F) The readability of the display may be impaired at temperatures outside the temperature range.	
Operating elements	local operation with 3 push buttons (⊞, ⊟, Ⓔ)	external operation via touch control; 3 optical keys: ⊞, ⊟, Ⓔ
	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



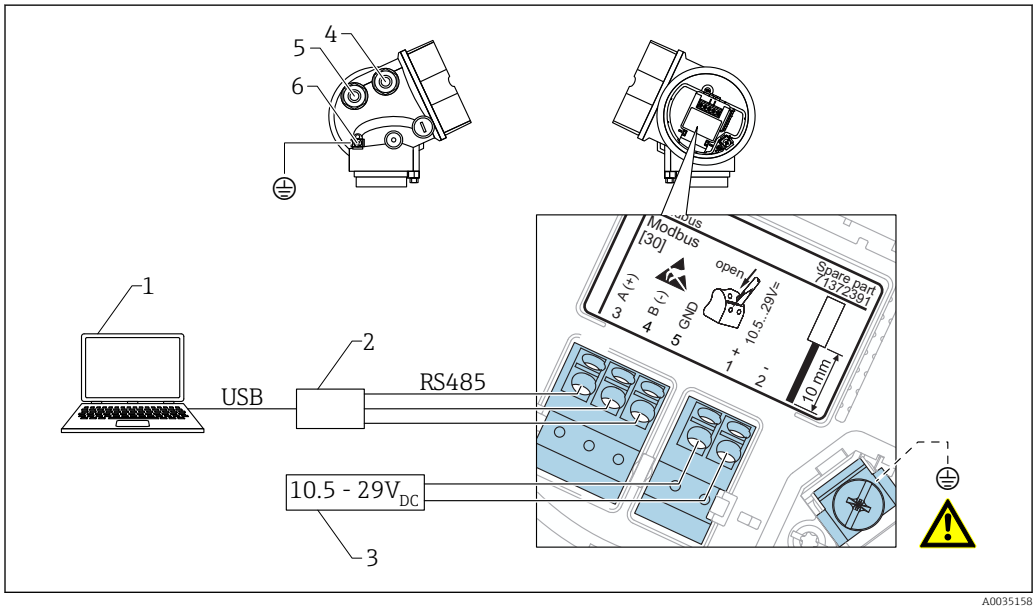
13 *FHX50 operating options*

1 *Housing of the remote display and operating module FHX50*
2 *Display and operating module SD02, push buttons; cover must be removed*
3 *Display and operating module SD03, optical keys; can be operated through the glass of the cover*

8.1.3 Remote operation

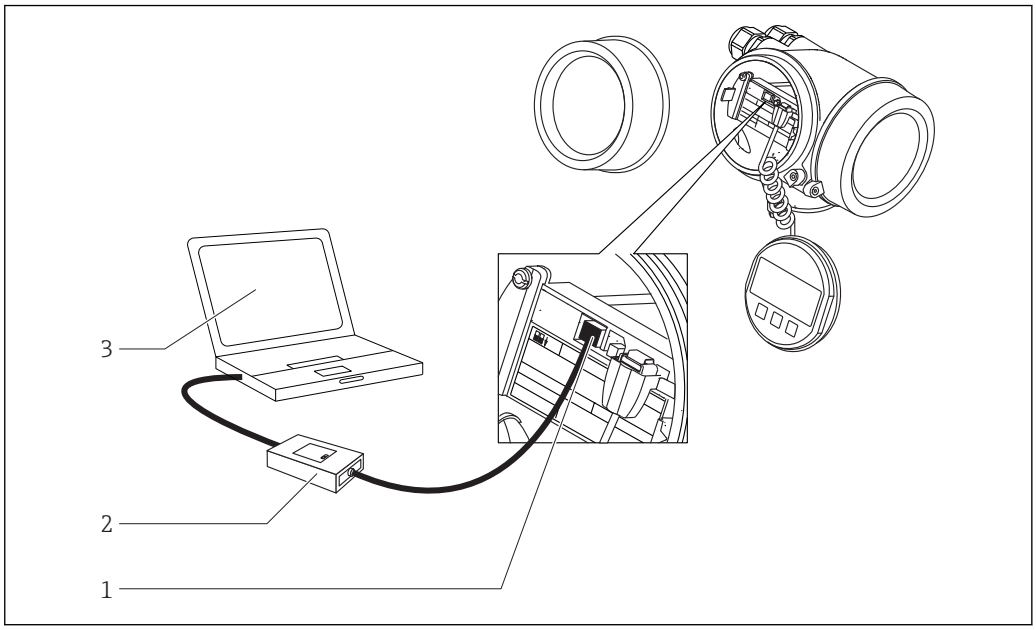
Via Modbus

To configure the device via FieldCare or DeviceCare, it is recommended to disconnect it from the Modbus Master and to connect it to the computer via a USB to RS485 interface.



1 *Computer with FieldCare/DeviceCare*
2 *Usb to RS485 interface*
3 *Power supply*
4 *Cable entry for RS485 connection*
5 *Cable entry for supply voltage*
6 *Protective earth connection*

Via service interface (CDI)



A0032466

1 Service interface (CDI) of the measuring device
2 Commubox FXA291
3 Computer with DeviceCare/FieldCare operating tool

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 on-site 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: ▪ to adapt the device to special measuring conditions. ▪ to process the measured value (scaling, linearization). ▪ to configure the signal output.
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 parameters of the device (including those that are already in one of the other menus). This menu is organized according to the function blocks of the device. The parameters of the Expert menu are described in: GP01140F (Modbus)	**System**	Contains all higher-order device parameters that do not concern the measurement or measured value communication.
	Sensor	Contains all parameters needed to configure the measurement.
	Output	Contains all parameters needed to configure the switch output (PFS).

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

1) If 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 with local operation
4) only available if operating via DeviceCare or FieldCare
5) On entering the "Expert" menu, an access code is always requested. If a customer specific access code has not been defined, "0000" has to be entered.

8.2.2 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 .→ 61.

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.

The user role with which the user is currently logged on is indicated by the **Access status display** parameter (for display operation) or **Access status tooling** parameter (for tool operation).

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.

Define access code via 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 same code in **Confirm access code** parameter.
   ↳ The 🔒-symbol appears in front of all write-protected parameters.

Define access code via 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, they 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. The device locks the write-protected parameters automatically after 60 s if the user skips back to the measured value display mode from the navigation and editing view.

- If write access is activated via access code, it can be also be deactivated only via the access code .→ 62.
- 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 on the local display in front of a parameter, the parameter is write-protected by a device-specific access code and its value cannot be changed at the moment using the local display . → 🖹 61.

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

1. After you press E, 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. **0000**.
3. Repeat **0000** in **Confirm access code** parameter.
   ↳ 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. **0000**.
   ↳ The write protection is deactivated. Parameters can be changed without entering an access code.

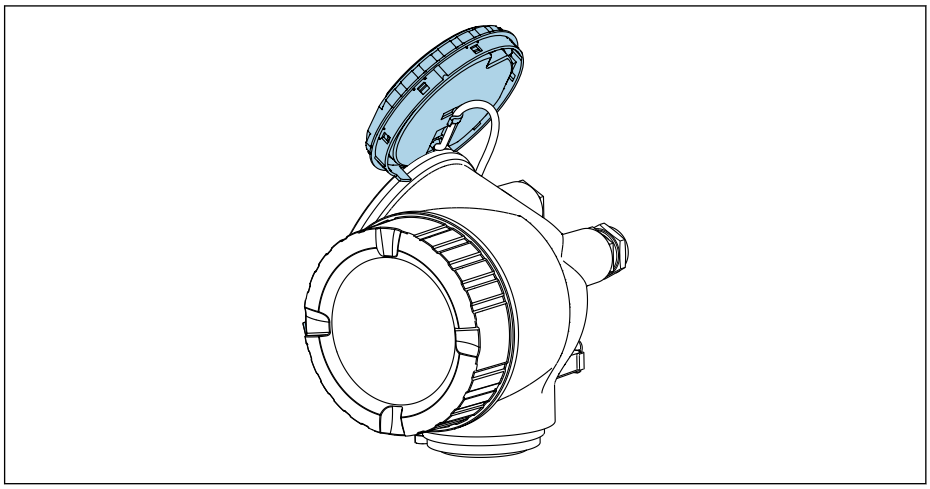
8.2.6 Write protection via write protection switch

Unlike parameter write protection via a user-specific access code, this allows write access to the entire operating menu - except for the **"Contrast display" parameter** - to be locked.

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

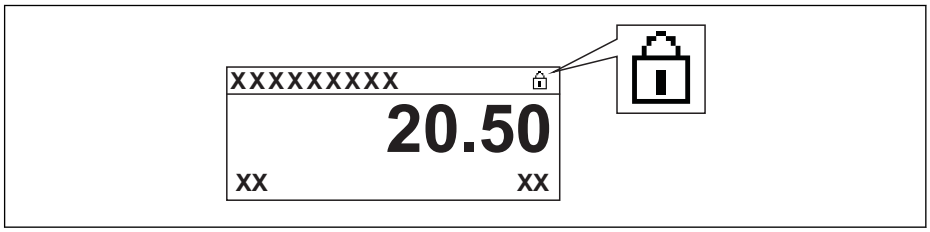
1. Loosen the securing clamp.
2. Unscrew the electronics compartment cover.

3. Pull out the display module with a gentle rotational movement. To make it easier to access the lock 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 the 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

The keypad lock makes it possible to block access to the entire operating menu via local operation. As a result, 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 the context menu.

Switching on the keypad lock

For the SD03 display 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.

To activate the keylock manually:

1. The device is in the measured value display.
   Press E 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.

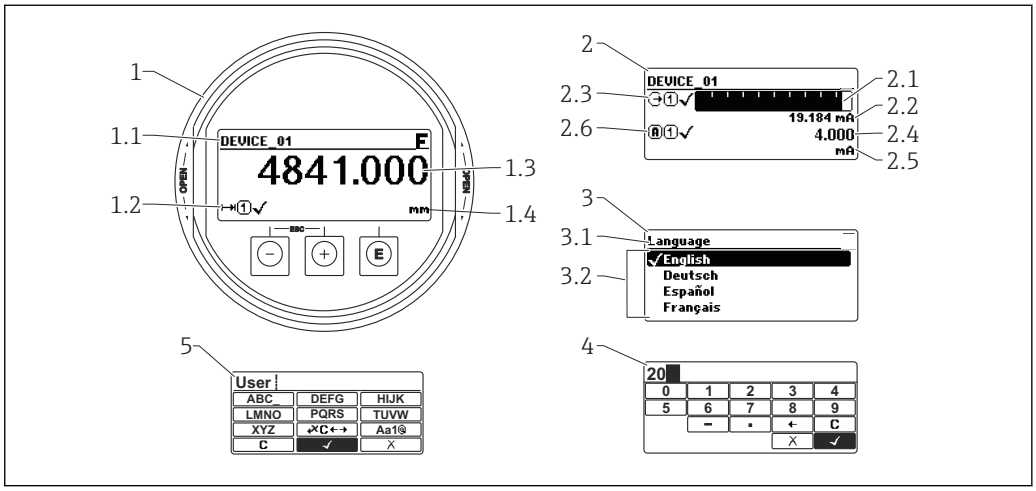
If the user attempts to access the operating menu while the keypad lock is active, the message **Keylock on** appears.

Switching off the keypad lock

1. The keypad lock is switched on.
   Press E 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 appearance



14 *Appearance of the display and operation module for on-site operation*

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

Display symbols for the submenus

Symbol	Meaning
 A0018367	**Display/operation** Is displayed: ▪ in the main menu next to the selection "Display/operation" ▪ in the header, if you are in the "Display/operation" menu
 A0018364	**Setup** Is displayed: ▪ in the main menu next to the selection "Setup" ▪ in the header, if you are in the "Setup" menu
 A0018365	**Expert** Is displayed: ▪ in the main menu next to the selection "Expert" ▪ in the header, if you are in the "Expert" menu
 A0018366	**Diagnostics** Is displayed: ▪ in the main menu next to the selection "Diagnostics" ▪ in the header, if you are in the "Diagnostics" menu

Status signals

F A0032902	**"Failure"** A device error is present. The measured value is no longer valid.
C A0032903	**"Function check"** The device is in 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 carried out by the user (e.g. level outside configured span)
M A0032905	**"Maintenance required"** Maintenance is required. The measured value is still valid.

Display symbols for the locking state

Symbol	Meaning
 A0013148	**Display parameter** Marks display-only parameters which can not 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.

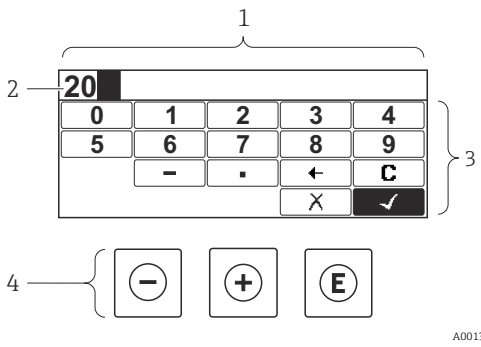
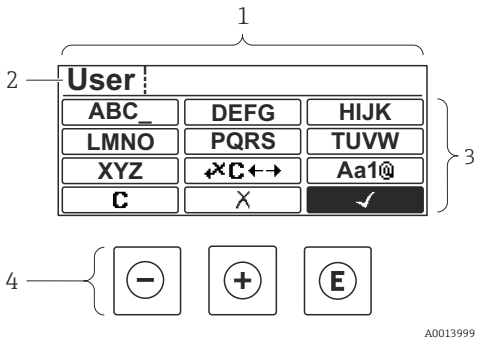
Measured value symbols

Symbol	Meaning
Measured values	
 A0032892	**Level**
 A0032893	**Distance**
 A0032908	**Current output**
 A0032894	**Measured current**
 A0032895	**Terminal voltage**
 A0032896	**Temperature of the electronics or the sensor**
Measuring channels	
 A0032897	**Measuring channel 1**
 A0032898	**Measuring channel 2**
Status of the measured value	
 A0018361	**Status "Alarm"** The measurment is interrupted. The output assumes the defined alarm value. A diagnostic message is generated.
 A0018360	**Status "Warning"** The device continues measuring. A diagnostic message is generated.

8.3.2 Operating elements

Key	Meaning
 A0018330	**Minus key** *For menu, submenu* Moves the selection bar upwards in a picklist. *For text and numeric editor* In the input mask, moves the selection bar to the left (backwards).
 A0018329	**Plus key** *For menu, submenu* Moves the selection bar downwards in a picklist. *For 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. *For menu, submenu* ▪ Pressing the key briefly Opens the selected menu, submenu or parameter. ▪ Pressing the key for 2 s for parameter: If present, opens the help text for the function of the parameter. *For 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)** *For 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"). *For 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

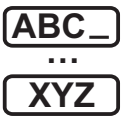
Input mask

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

Numeric editor symbols

Symbol	Meaning
 A0013998	Selection of numbers from 0 to 9.
 A0016619	Inserts decimal separator at the input position.
 A0016620	Inserts minus sign at the input position.
 A0013985	Confirms selection.
 A0016621	Moves the input position one position to the left.
 A0013986	Exits the input without applying the changes.
 A0014040	Clears all entered characters.

Text editor symbols

Symbol	Meaning
 A0013997	Selection of letters from A to Z
 A0013981	Toggle ▪ Between upper-case and lower-case letters ▪ For entering numbers ▪ For entering special characters

 A0013985	Confirms selection.
 A0013987	Switches to the selection of the correction tools.
 A0013986	Exits the input without applying the changes.
 A0014040	Clears all entered characters.

Correction symbols under

Symbol	Meaning
 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

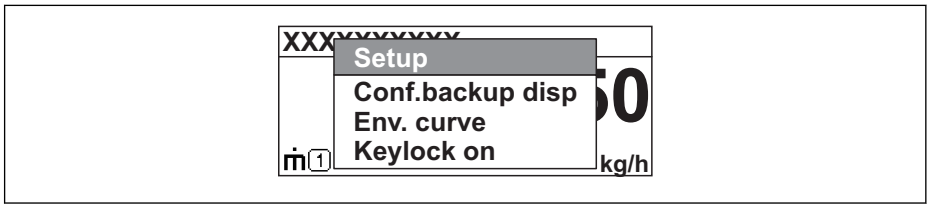
Using the context menu, the user can call up the following menus quickly and directly from the operational display:

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

Opening and closing the context menu

The user is in the operational display.

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



A0033110-EN

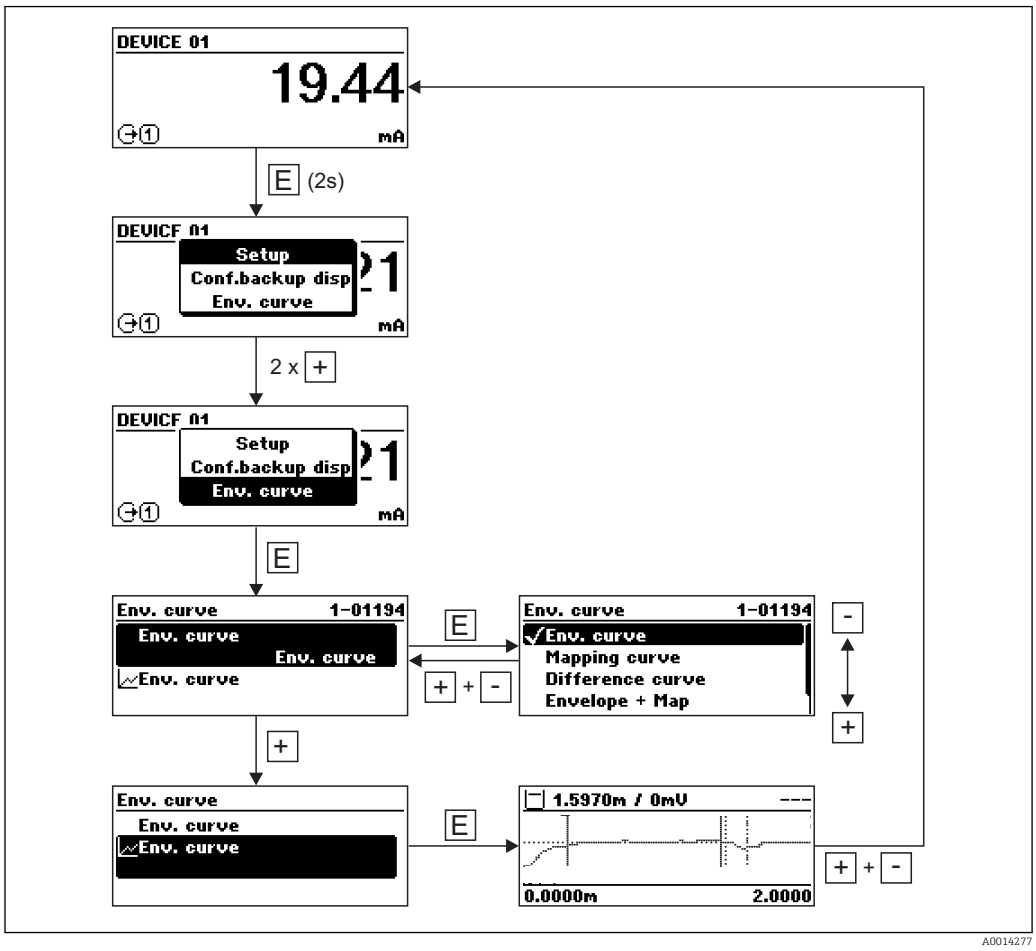
2. Press − + + simultaneously.
   ↳ The context menu is closed and the operational display appears.

Calling up the menu via the context menu

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

8.3.5 Envelope curve 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 displayed:

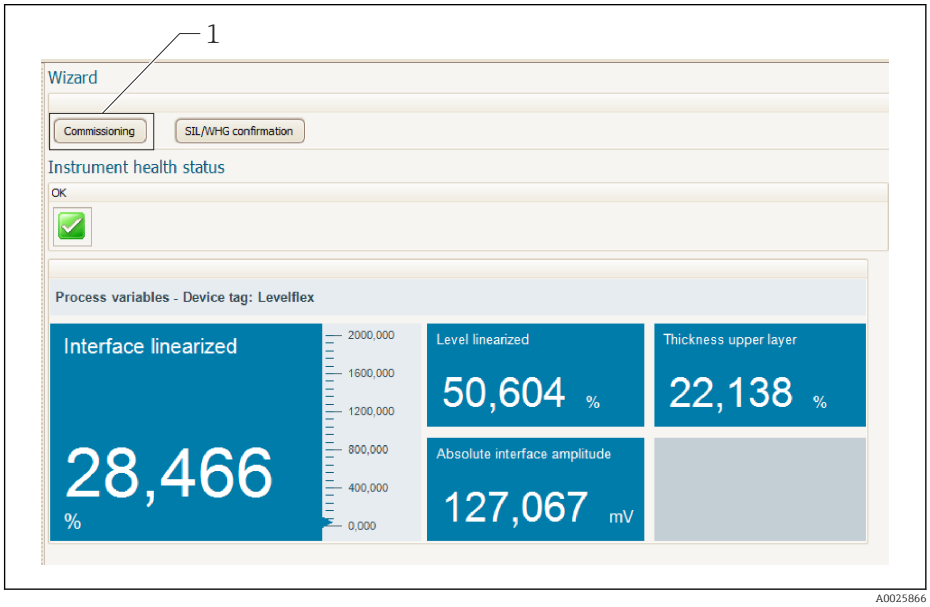


9 Commissioning via wizard

A wizard guiding the user through the initial setup is available in FieldCare and DeviceCare [3].

Configuration of the Modbus communication → 81

1. Connect the device to FieldCare or DeviceCare → 56.
2. Open the device in FieldCare or DeviceCare.
   ↳ The dashboard (home page) of the device appears:



1 "Commissioning" button calls up the wizard.

3. Click on "Commissioning" to call up the wizard.
4. Enter or select the appropriate value for each parameter. These values are immediately written to the device.
5. Click "Next" to switch to the next page.
6. After finishing the last page, click "End of sequence" to close the wizard.

If the wizard is cancelled before all necessary parameters have been set, the device may be in an undefined state. A reset to the default settings is recommended in this case.

3) DeviceCare is available for download at www.software-products.endress.com. The download requires a registration in the Endress+Hauser software portal.

10 Commissioning via operating menu

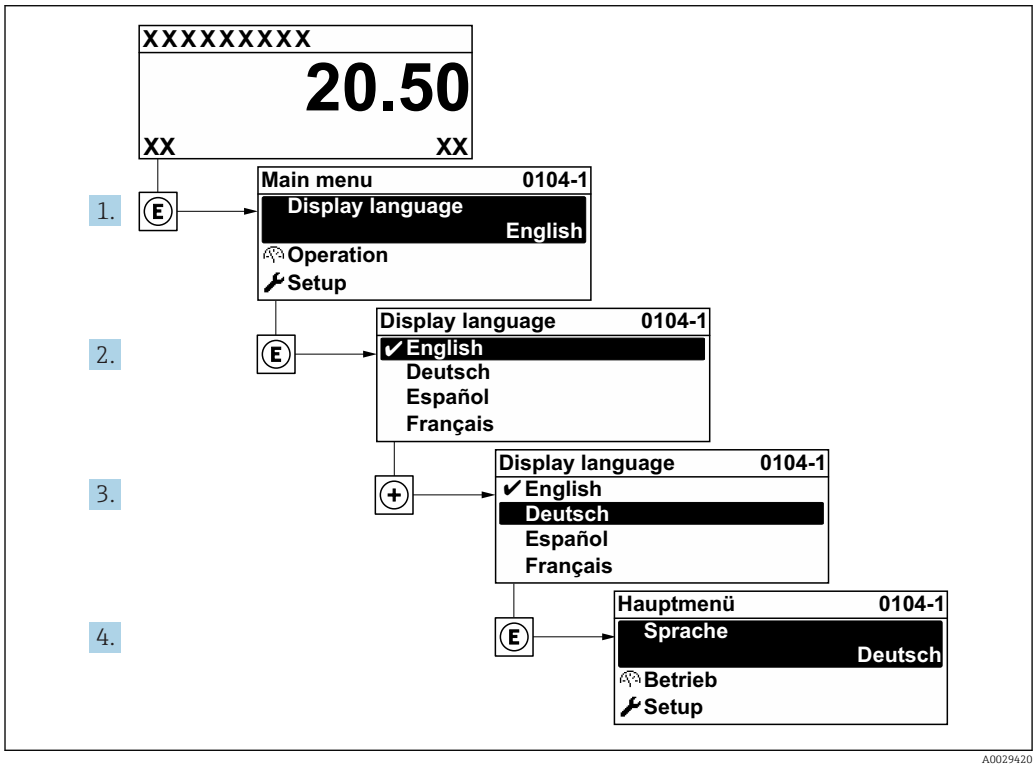
10.1 Installation and function check

Make sure that all final checks have been completed before you start up your measuring point:

- Checklist "Post-installation check" → 48
- Checklist "Post-connection check" → 54

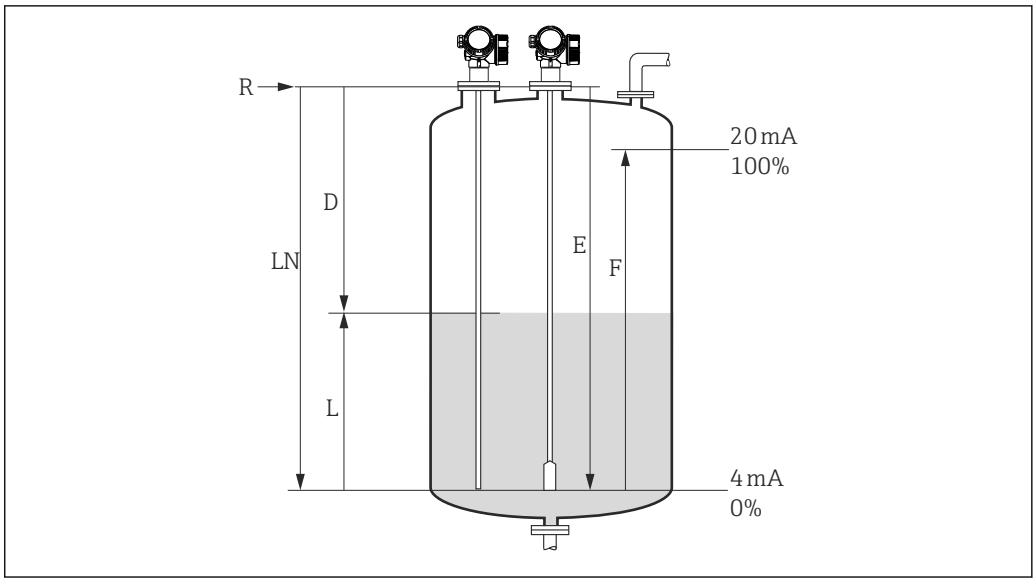
10.2 Setting the operating language

Factory setting: English or ordered local language



15 *Using the example of the local display*

10.3 Configuration of a level measurement



16 *Configuration parameters for level measurements in liquids*

LN *Length of probe*
R *Reference point of the measurement*
D *Distance*
L *Level*
E *Empty calibration (= Zero point)*
F *Full calibration (= Span)*

If for rope probes the DC value is less than 7, then measurement is not possible in the area of the straining weight. In these cases, the maximum recommended value for the empty calibration E is *LN* - 250 mm (*LN* - 10 in).

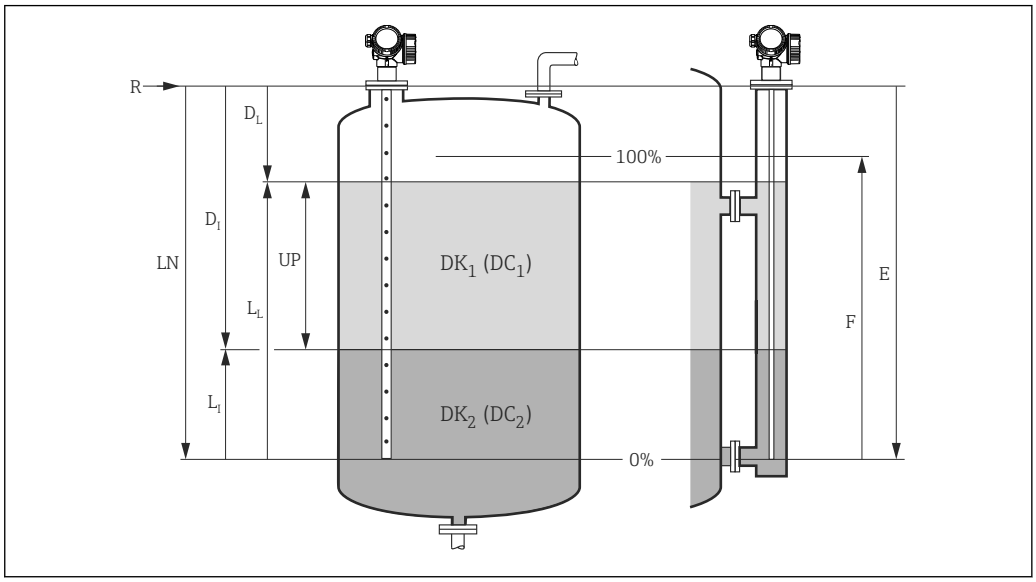
1. Setup → Device tag
   ↳ Enter tag for measuring point.
2. For devices with "interface measurement" application package:
   Navigate to:Setup → Operating mode
   ↳ Select **Level** option.
3. Navigate to: Setup → Distance unit
   ↳ Select distance unit.
4. Navigate to: Setup → Tank type
   ↳ Select tank type.
5. For Tank type = Bypass / pipe:
   Navigate to: Setup → Tube diameter
   ↳ Enter the diameter of the bypass or stilling well.
6. Navigate to: Setup → Medium group
   ↳ Select medium group: (**Water based (DC >= 4)** or **Others**)
7. Navigate to: Setup → Empty calibration
   ↳ Enter the distance E between the reference point R and the minimum level (0%).
8. Navigate to: Setup → Full calibration
   ↳ Enter distance F between the minimum (0%) and maximum (100%) level.
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 level echo.
12. For operation via local display:
    Navigate to: Setup → Mapping → Confirm distance
    ↳ Compare the displayed distance to the real distance in order to start the recording of the mapping curve if required [4)].
13. For operation via operating tool:
    Navigate to: Setup → Confirm distance
    ↳ Compare the displayed distance to the real distance in order to start the recording of the mapping curve if required [4)].

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

10.4 Configuration of an interface measurement

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



17 *Configuration parameters for interface measurements*

LN Length of probe
R Reference pioint of the measurement
DI "Interface distance" parameter (Distance from reference point to lower medium)
LI Interface
DL Distance
LL Level
UP Thickness upper layer
E "Empty calibration" parameter (= zero point)
F "Full calibration" parameter (= span)

1. Navigate to: Setup → Device tag
   ↳ Enter tag for measuring point.
2. Navigate to: Setup → Operating mode
   ↳ Select **Interface** option.
3. Navigate to: Setup → Distance unit
   ↳ Select distance unit.
4. Navigate to: Setup → Tank type
   ↳ Select tank type.
5. For Tank type = Bypass / pipe:
   Navigate to: Setup → Tube diameter
   ↳ Enter the diameter of the bypass or stilling well.
6. Navigate to: Setup → Tank level
   ↳ Select tank level (**Fully flooded** or **Partially filled**)
7. Navigate to: Setup → Distance to upper connection
   ↳ In bypasses: Enter distance from reference point R to lower edge of the upper connection; otherwise: Keep the factory setting
8. Navigate to: Setup → DC value
   ↳ Enter relative dielectric constant (ε_r) of the upper medium.

9. Navigate to: Setup → Empty calibration
   ↳ Enter the distance E between the reference point R and the minimum level (0%).
10. Navigate to: Setup → Full calibration
    ↳ Enter distance F between the minimum (0%) and maximum (100%) level.
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 level echo.
16. For operation via local display:
    Navigate to: Setup → Mapping → Confirm distance
    ↳ Compare the displayed distance to the real distance in order to start the recording of the mapping curve if required [5)].
17. For operation via operating tool (e.g. FieldCare):
    Navigate to: Setup → Confirm distance
    ↳ Angezeigte Distanz mit tatsächlichem Wert vergleichen, um gegebenenfalls die Aufnahme einer Störechoausblendungskurve zu starten [5)].

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

10.5 Recording the reference curve

After the configuration of the measurement it is recommended to record the current envelope curve as a reference curve. The reference curve can be used later on in the process for diagnostic purposes. To record the reference curve use the **Save reference curve** parameter.

Navigation 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 reference curve.

The reference curve can only be displayed in the envelope curve diagram of FieldCare after it has been loaded from the device into FieldCare. This is performed by the "Load Reference Curve" function in FieldCare:



18 The "Load Reference Curve" function

10.6 Configuration of the on-site display

10.6.1 Factory settings of the on-site 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 settings of the on-site 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 Adjustment of the on-site display

The on-site display can be adjusted in the following menu:
Setup → Advanced setup → Display

10.7 Configuration of the Modbus communication

10.7.1 Bus parameters

Bus parameter	Setting
Baud rate	Is adjusted automatically; no manual setting required
Parity	Is adjusted automatically; no manual setting required
Modbus address of the device	To be set via the HART address parameter: Expert → Communication → Configuration → HART address Range of values: 1 to 63

10.7.2 Device parameters

The following parameters are set to fixed values. Any change by the user will immediately be undone by the device.
- **Current span** = **Fixed current**
- **Fixed current** = **10 mA**

10.7.3 Process parameters

Process parameters which are to be transmitted via the bus must be assigned to one of the following HART variables:

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

These HART variables can be accessed via specific Modbus registers: → 203.

10.8 Configuration management

After commissioning, you can 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 its options.

Navigation path in the operating 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 in the HistoROM (built-in in the device) is saved to the display module of the device. The backup copy comprises the transmitter and sensor data of the device.
- **Restore**
  The last backup copy of the device configuration is copied from the display module to the HistoROM of the device. The backup copy comprises the transmitter and sensor data 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.
- **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 → 181 will not restore the original status..

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

10.9 Protection of the settings against unauthorized changes

There are two ways to protect the settings against unauthorized changes:

- Via parameter settings (software locking) → 61
- Via locking switch (hardware locking) → 62

11 Diagnostics and troubleshooting

11.1 General trouble shooting

11.1.1 General errors

Error	Possible cause	Remedial action
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 plut 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.	Exchange display.
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.	Parametrization error	Check and adjust parameterization.

11.1.2 Parametrization errors

Parametrization errors for level measurements

Error	Possible cause	Remedial action
Measured value wrong	If measured distance(Setup → Distance) matches the real distance: Calibration error	▪ Check and adjust the **Empty calibration** parameter (→ 123) if necessary. ▪ Check and adjust the **Full calibration** parameter (→ 124) if necessary. ▪ Check and adjust linearization if necessary (**Linearization** submenu (→ 149)).
	If measured distance (Setup → Distance) does not match the real distance: An interference echo affects the measurement.	Perform mapping (**Confirm distance** parameter (→ 131)).
No change of the measured value when emptying/filling the tank	An interference echo affects the measurement.	Perform mapping (**Confirm distance** parameter (→ 131)).
	Build-up at the probe.	Clean the probe.
	Error in the echo tracking	Deactivate echo tracking: Expert → Sensor → Echo tracking → Evaluation mode = **History off**).
The diagnostic message **Echo lost** appears after switching on the supply voltage.	Echo threshold too high.	Check the **Medium group** parameter (→ 123). If necessary select a more detailed setting in the **Medium property** parameter (→ 137).
	Level echo suppressed.	Delete mapping and record new mapping curve if required (**Record map** parameter (→ 133)).
Device displays a level when the tank is empty.	Incorrect probe length	Carry out probe length correction (**Confirm probe length** parameter (→ 163)).
	Interference echo	Carry out mapping over entire probe while the tank is empty (**Confirm distance** parameter (→ 131)).
Wrong slope of the level in the entire measuring range	Wrong tank type selected.	Set **Tank type** parameter (→ 122) correctly.

Parametrization errors for interface measurements

Error	Possible cause	Remedial action
With the setting **Tank level** = **Fully flooded**When, the measured interface level jumps to higher values during draining operations.	The total level is detected outside the upper blocking distance.	Increase blocking distance (**Blocking distance** parameter (→ 140)).
		Set **Tank level** parameter (→ 128) = **Partially filled**.
With the setting **Tank level** = **Partially filled**, the measured total level jumps to lower values during filling operations.	The total level runs into the upper blocking distance.	Decrease blocking distance (**Blocking distance** parameter (→ 140)).
Wrong slope of the measured interface level	Wrong dielectric constant (DC value).	Enter correct dielectric constant (DC value) of the upper medium (**DC value** parameter (→ 129)).
The measured values for the interface and the total level are identical	Echo threshold for the total level too high due to a wrong dielectric constant.	Enter correct dielectric constant (DC value) of the upper medium (**DC value** parameter (→ 129)).

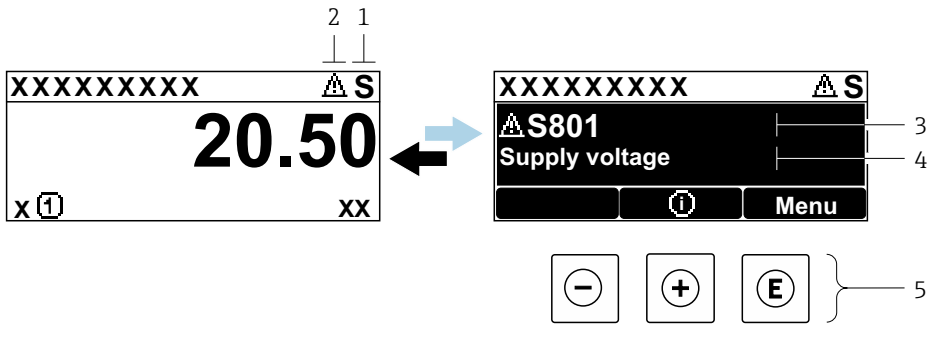
Error	Possible cause	Remedial action
If the interface layers are thin, the total level jumps to the interface level.	The thickness of the upper medium is less than 60 mm (2.4 in).	Interface measurement is only possible if the thickness of the interface is greater than 60 mm (2.4 in).
The measured interface layer jumps.	Emulsion layer present.	Emulsion layers affect the measurement. Please 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 diagnostics event*
4 *Event text*
5 *Operating elements*

Status signals

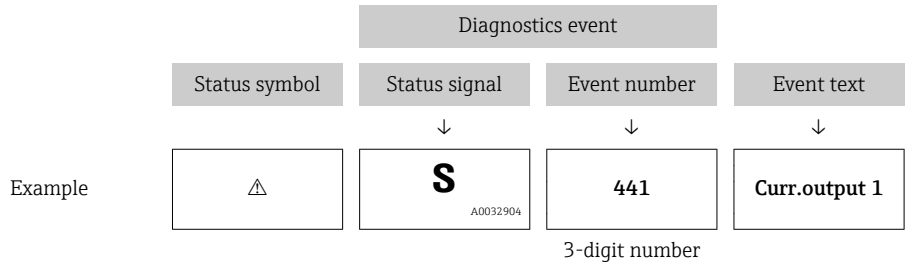
F A0032902	**"Failure (F)" option** A device error is present. The measured value is no longer valid.
C A0032903	**"Function check (C)" option** The device is in service mode (e.g. during a simulation).
S A0032904	**"Out of specification (S)" option** The device is operated: ▪ Outside of its technical specifications (e.g. during startup or a cleaning) ▪ Outside of the configuration carried out by the user (e.g. level outside configured span)
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 take on the defined alarm condition. A diagnostic message is generated.
⚠	**"Warning" status** The device continues to measure. A diagnostic message is generated.

Diagnostics event and event text

The fault can be identified using the diagnostics event. The event text helps you by providing information about the fault. In addition, the corresponding symbol is displayed before the diagnostics event.



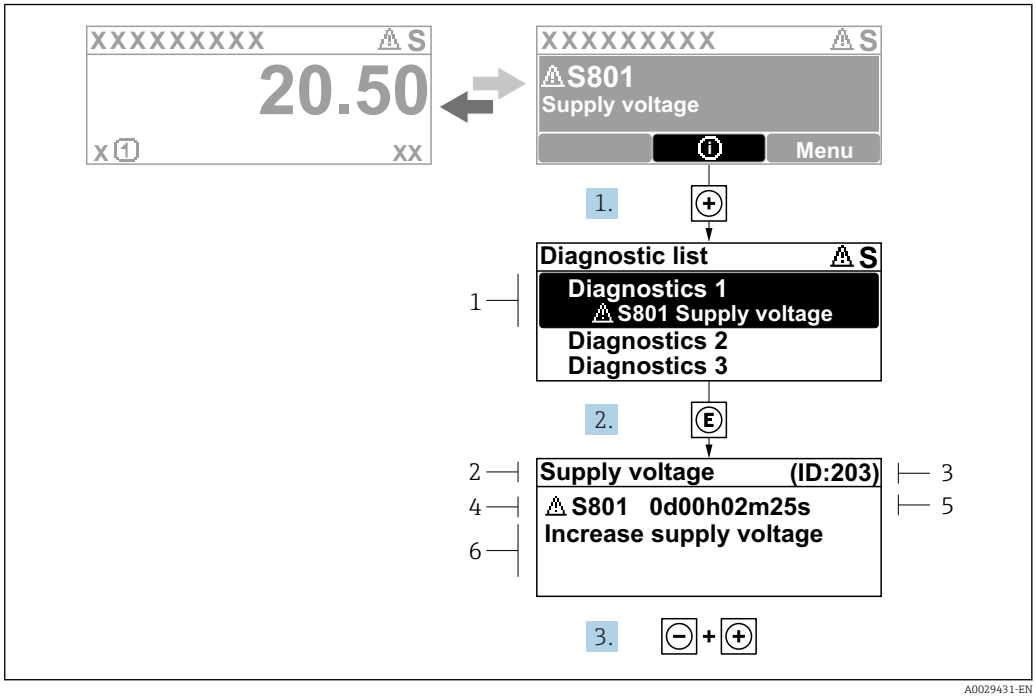
If two or more diagnostic messages are pending simultaneously, only the message with the highest priority is shown. Additional pending diagnostic messages can be shown in the **Diagnostic list** submenu.

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



19 *Message for remedial measures*

1 *Diagnostic information*
2 *Short text*
3 *Service ID*
4 *Diagnostic behavior with diagnostic code*
5 *Operation time of occurrence*
6 *Remedial measures*

The user is in the diagnostic message.

1. Press ⊞ (ⓘ-Symbol).
   ↳ **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 for the remedial measures closes.

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

1. Press Ⓔ.
   ↳ The message for the remedial measures for the selected diagnostic event opens.
2. Press ⊟ + ⊞ simultaneously.
   ↳ The message for the remedial measures closes.

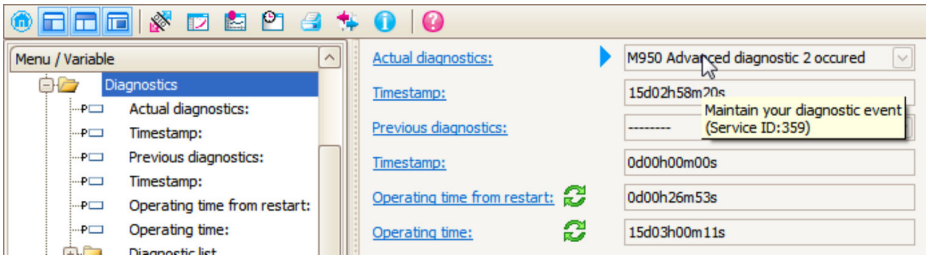
11.3 Diagnostic event in the operating tool

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

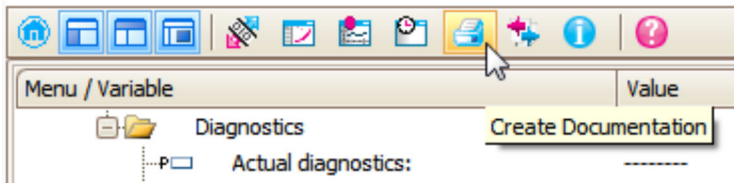
1. Navigate to the **Diagnostics** menu.
   ↳ In the **Actual diagnostics** parameter, the diagnostic event is shown with event text.
2. On the right in the display range, hover the cursor over the **Actual diagnostics** parameter.
   ↳



A tool tip with remedial measures for the diagnostic event appears.

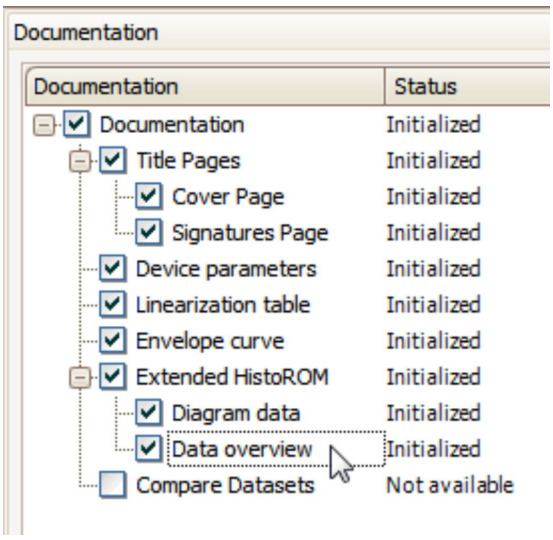
B: Via the "Create documentation" function

1.



Select the "Create documentation" function.

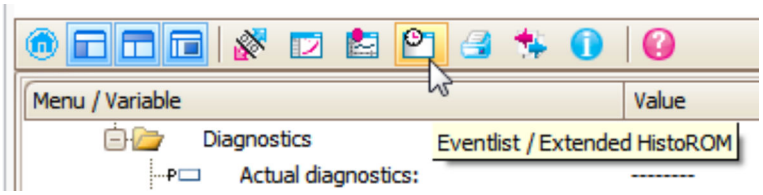
2.



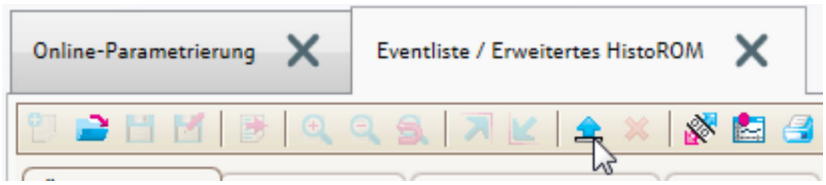
Make sure "Data overview" is marked.

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 E
   ↳ The message for the remedial measures for the selected diagnostic event opens.
2. Press − + + simultaneously.
   ↳ The message about the remedial measures closes.

11.5.2 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 Parameters	Technical Information
04.2016 [1]	01.03.zz	▪ Update to HART 7 ▪ All 17 operating languages 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 Repairs

13.1 General information on repairs

13.1.1 Repair concept

The Endress+Hauser repair concept assumes that the devices have a modular design and that repairs can be done by the Endress+Hauser service or specially trained customers.

Spare parts are contained in suitable kits. They contain the related replacement instructions.

For more information on service and spare parts, contact the Service Department at Endress+Hauser.

13.1.2 Repairs to Ex-approved devices

When carrying out repairs to Ex-approved devices, please note the following:

- Repairs to Ex-approved devices may only be carried out by trained personnel.
- Comply with the prevailing standards, national Ex-area regulations, safety instructions (XA) and certificates.
- Only use original spare parts.
- When ordering a spare part, please note the device designation on the nameplate. Only replace parts with identical parts.
- Carry out repairs according to the instructions. On completion of repairs, carry out the specified routine test on the device.
- It is not allowed to convert a certified device into a different certified variant.
- Document all repair work.

13.1.3 Replacement of an electronics module

If an electronics module has been replaced, it is not necessary to perform a new basic setup as the calibration parameters are stored in the HistoROM which is located in the housing. However, after exchanging the main electronics module it may be necessary to record a new mapping (interference echo suppression).

13.1.4 Replacement of a device

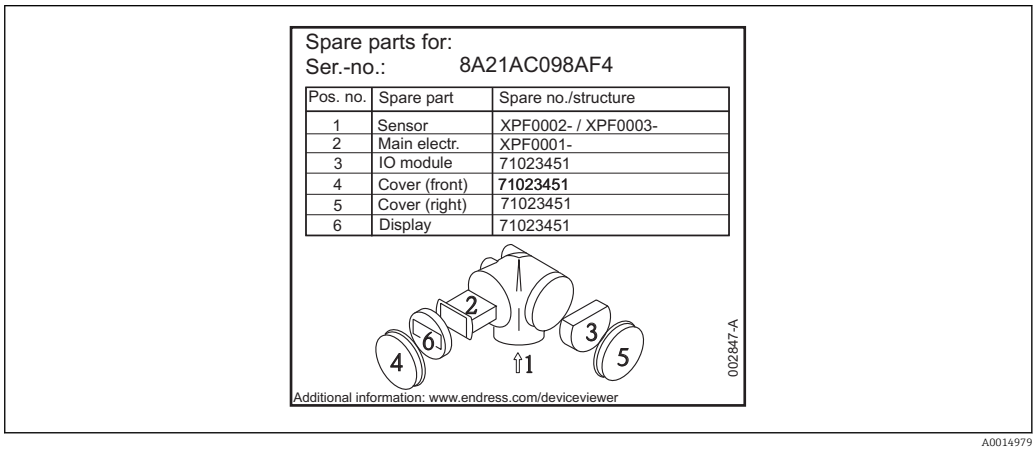
After a complete device or electronic module has been replaced, the parameters can be downloaded into the instrument again in one of the following ways:

- Via the display module
  Condition: The configuration of the old device has been saved in the display module
  → 178.
- Via FieldCare
  Condition: The configuration of the old device has been saved to the computer via FieldCare.

You can continue to measure without carrying out a new setup. Only a linearization and a tank map (interference echo suppression) have to be recorded again.

13.2 Spare parts

- A few interchangeable measuring device components are identified by a spare part nameplate. This contains information about the spare part.
- The connection compartment cover of the device contains a spare part nameplate that includes the following information:
  - A list of the most important spare parts for the measuring device, including their ordering information.
  - The URL for the *W@M Device Viewer* (www.endress.com/deviceviewer): There, all spare parts for the measuring device are listed, including the order code, and can be ordered. If available, the corresponding Installation Instructions can also be downloaded there.



20 Example for spare part nameplate in connection compartment cover

Measuring device serial number:
- Is 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 measuring device must be returned if it is need of repair or a factory calibration, or if the wrong measuring device has been delivered or ordered. Legal specifications require Endress+Hauser, as an ISO-certified company, to follow certain procedures when handling products that are in contact with the medium.

To ensure safe, swift and professional device returns, please refer to the procedure and conditions for returning devices provided on the Endress+Hauser website at http://www.endress.com/support/return-material

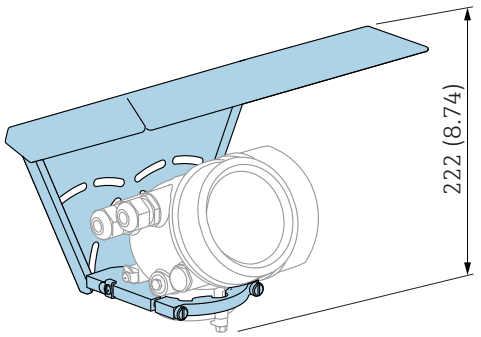
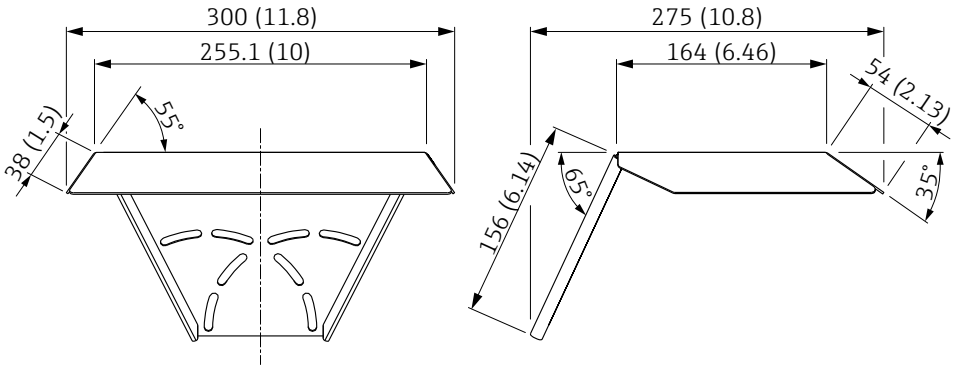
13.4 Disposal

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

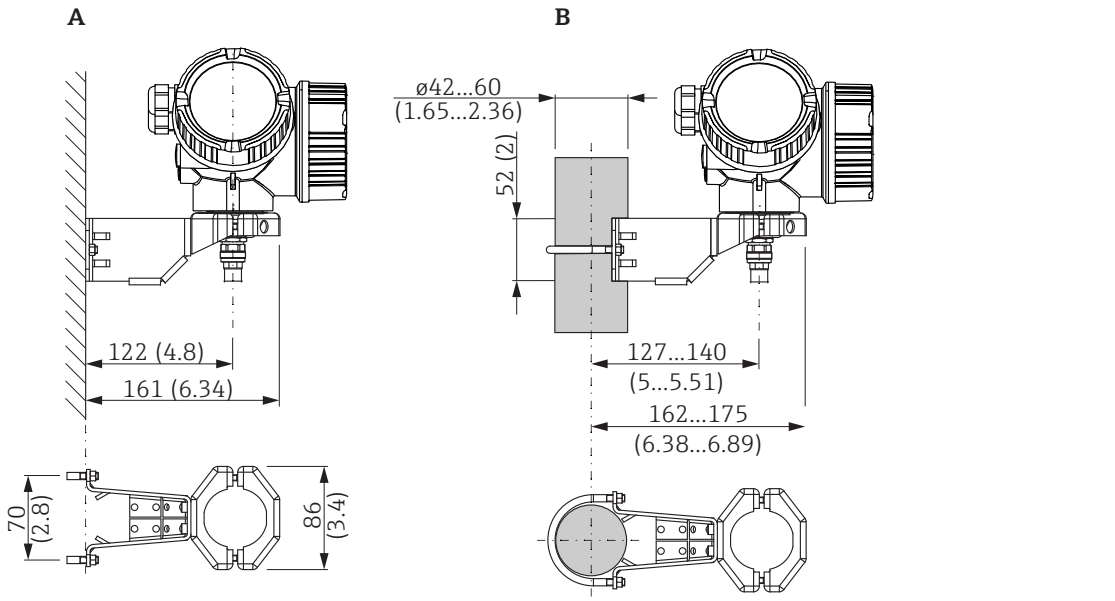
14 Accessories

14.1 Device-specific accessories

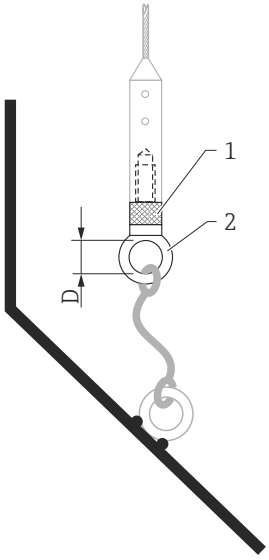
14.1.1 Weather protection cover

Accessory	Description
Weather protection cover	 A0015466  A0015472 *21 Weather protection cover; Dimensions: mm (in)* The weather protection cover can be ordered together with the device (product structure, feature 620 "Accessory Enclosed", option PB "Weather Protection Cover"). Alternatively, it can be separately ordered as an accessory; order code 71162242.

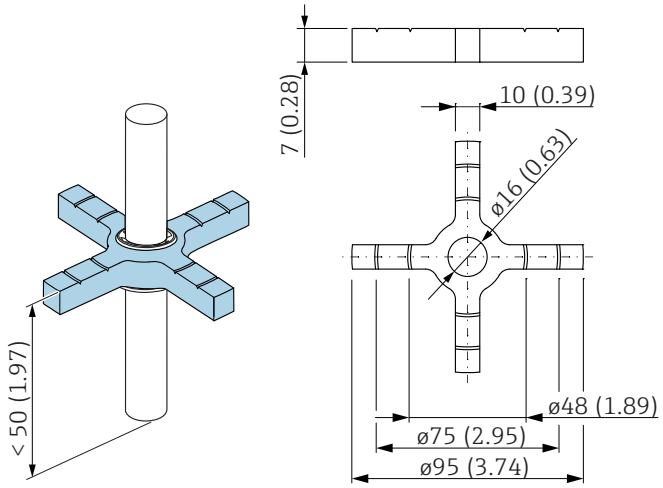
14.1.2 Mounting bracket for the electronics housing

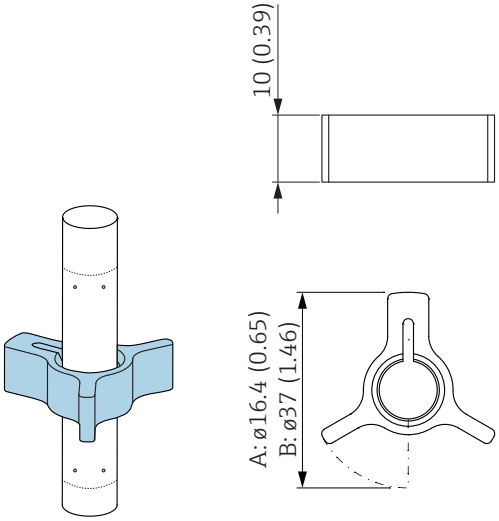
Accessory	Description
Mounting bracket for the electronics housing	 *22 Mounting bracket for the electronics housing; Dimensions: mm (in)* *A Wall mounting* *B Pipe mounting* For the "Sensor remote" device version (see feature 060 of the product structure), the mounting bracket is part of the delivery. If required, it can also be ordered as an accessory (order code 71102216).

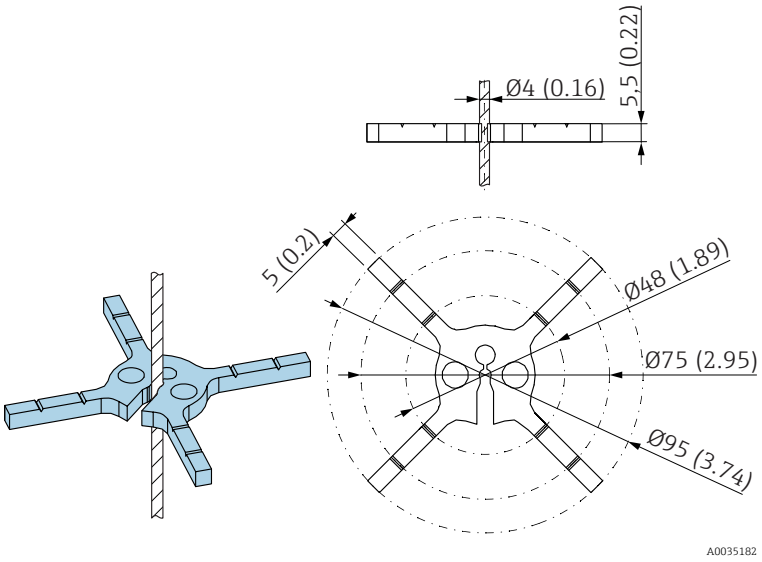
14.1.3 Mounting kit, isolated

Accessory	Description
Mounting kit, isolated can be used for FMP51	 A0013586 *23 Scope of supply of the mounting kit:* *1 Insulating sleeve* *2 Eye-bolt* For reliably insulated fixing of the probe. Maximum process temperature: 150 °C (300 °F) For rope probes 4 mm (⅙ in) or 6 mm (1/4 in) with PA>steel: ▪ Diameter D = 20 mm (0.8 in) ▪ Order-No.: 52014249 For rope probes 6 mm (¼ in) or 8 mm (1/3 in) with PA>steel: ▪ Diameter D = 25 mm (1 in) ▪ Order-No.: 52014250 Due to the risk of electrostatic charge, the insulating sleeve is not suitable for use in hazardous areas. In these cases the fixing must be reliably grounded. The mounting kit can also be ordered directly with the device (see the Levelflex product structure, feature 620 "Accessory Enclosed", option PG "Mounting kit, isolated, rope").

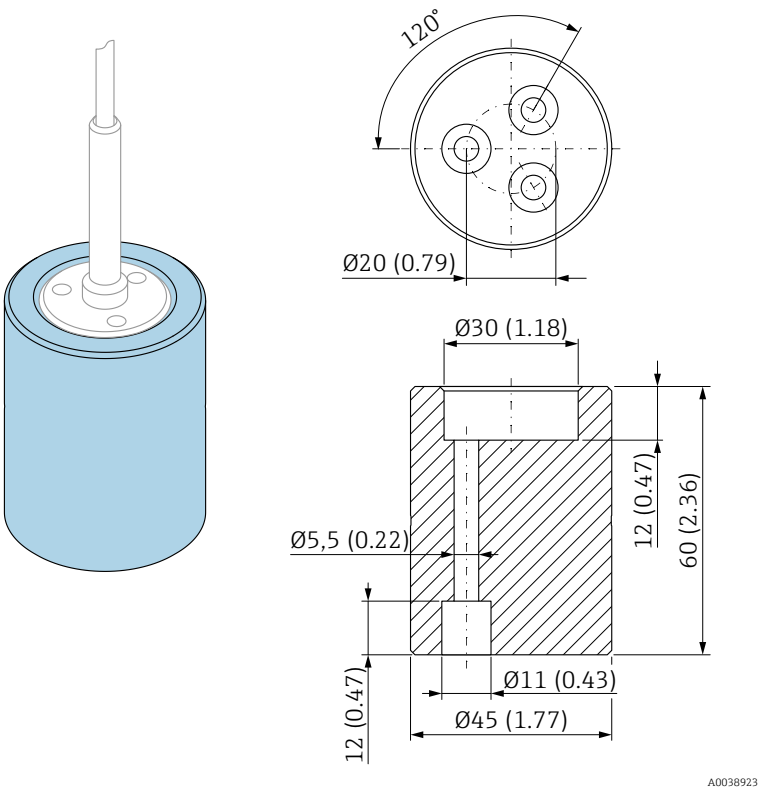
14.1.4 Centering star

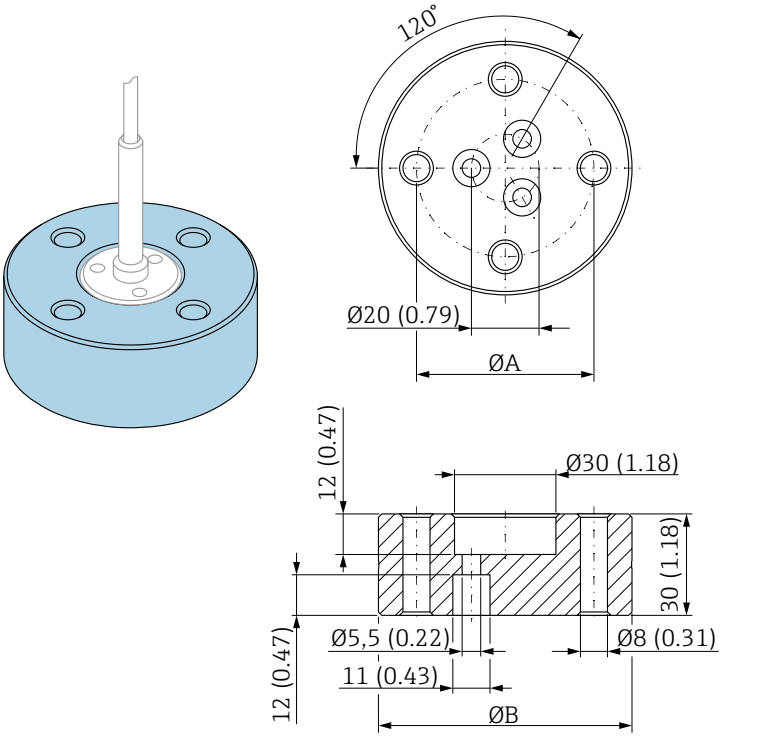
Accessories	Description
Centering star PEEK ϕ 48-95 mm suitable for ▪ FMP51 ▪ FMP54	 A0014576 The centering star is suitable for probes with a rod diameter of 16 mm (0.6 in) and can be used in pipes from DN50 to DN100. The markings make it easer to cut to size, ensuring that the centering star can be 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 °C (−76 to +482 °F) ▪ Order number: 71069064 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. 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 circlips, 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 ▪ FMP52 ▪ FMP54	 *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 °C (−328 to +482 °F) ▪ 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).

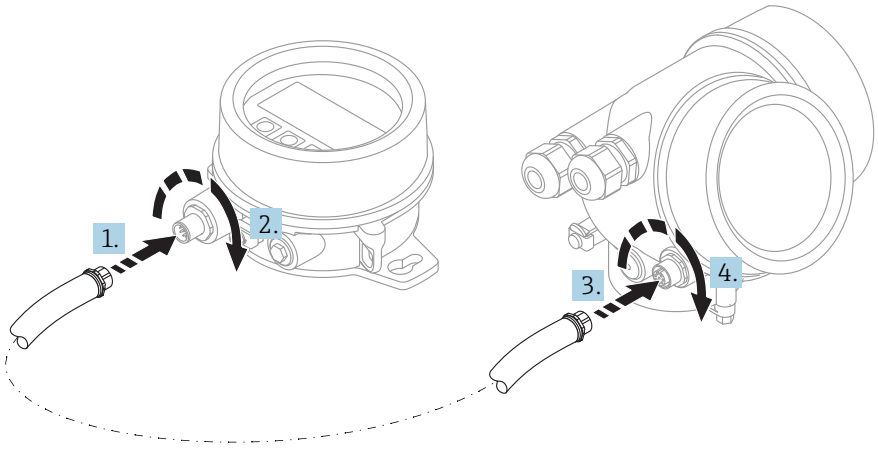
Accessories	Description
Centering star PEEK, Ø 48 to 95 mm (1.9 to 3.7 in) suitable for ▪ FMP51 ▪ FMP52 ▪ FMP54	 The centering star is suitable for probes with a rope diameter of 4 mm (⅙ in) (including coated rope probes). See also Operating Instructions SD01961F. ▪ Material: PEEK ▪ Permitted process temperature range: −60 to +250 °C (−76 to +482 °F) ▪ Order number – 71373490 (1x) – 71373492 (5x)

14.1.5 Centering weight

Accessories	Description
Centering weight 316L ϕ 45 mm (1.77 in) suitable for ▪ FMP51 ▪ FMP54	 The centering weight is suitable for probes with a rope diameter of 4 mm (⅙ in) and can be used in DN50/2" pipes. Order number: 71420755 (for DN50/2" pipe) The centering weight can also be ordered directly with the device (Levelflex product structure, feature 610 "Accessory mounted", option OK (for DN50/2" pipe)).

Accessories	Description
Centering weight 316L ▪ ϕ 75 mm (2.95 in) ▪ ϕ 95 mm (3.7 in) suitable for ▪ FMP51 ▪ FMP54	 *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 (⅙ in) and can be used in DN80/3" or DN100/4" pipes. ▪ Material: 316L ▪ Order number – 71420822 (for DN80/3" pipe) – 71420824 (for DN100/4" pipe) The centering weight can also be ordered directly with the device (Levelflex product structure, feature 610 "Accessory mounted", option OL (for DN80/3" pipe) or OM (for DN100/4" pipe)).

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 supplied by customer up to 60 m (196 ft) ▪ Ambient temperature range: –40 to 80 °C (–40 to 176 °F) ▪ 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

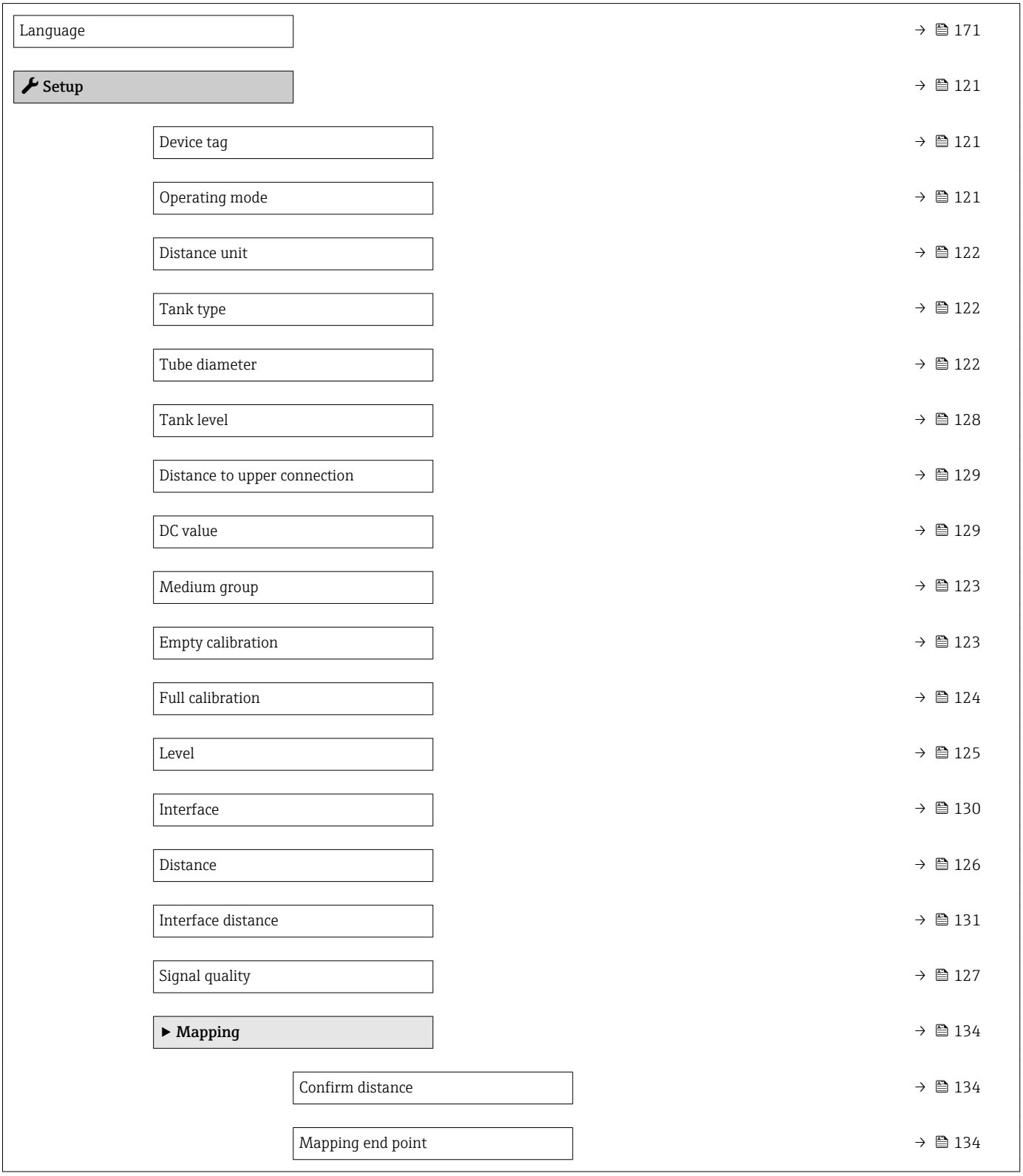
14.4 System components

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



- Record map → 134
- Distance → 134
- ▶ **Advanced setup** → 135
  - Locking status → 135
  - Access status display → 136
  - Enter access code → 136
  - ▶ **Level** → 137
    - Medium type → 137
    - Medium property → 137
    - Process property → 138
    - Advanced process conditions → 139
    - Level unit → 140
    - Blocking distance → 140
    - Level correction → 141
  - ▶ **Interface** → 142
    - Process property → 142
    - DC value lower medium → 142
    - Level unit → 143
    - Blocking distance → 143
    - Level correction → 144
    - ▶ **Automatic DC calculation** → 147
      - Manual thickness upper layer → 147
      - DC value → 147
      - Use calculated DC value → 147

- ▶ **Linearization** → 149
  - Linearization type → 151
  - Unit after linearization → 152
  - Free text → 153
  - Maximum value → 154
  - Diameter → 154
  - Intermediate height → 155
  - Table mode → 155
  - ▶ **Edit table**
    - Level → 157
    - Customer value → 157
  - Activate table → 157
- ▶ **Safety settings** → 159
  - Output echo lost → 159
  - Value echo lost → 159
  - Ramp at echo lost → 160
  - Blocking distance → 140
- ▶ **Probe settings** → 162
  - Probe grounded → 162
  - ▶ **Probe length correction** → 164
    - Confirm probe length → 164
    - Present probe length → 164
- ▶ **Switch output** → 165
  - Switch output function → 165
  - Assign status → 166

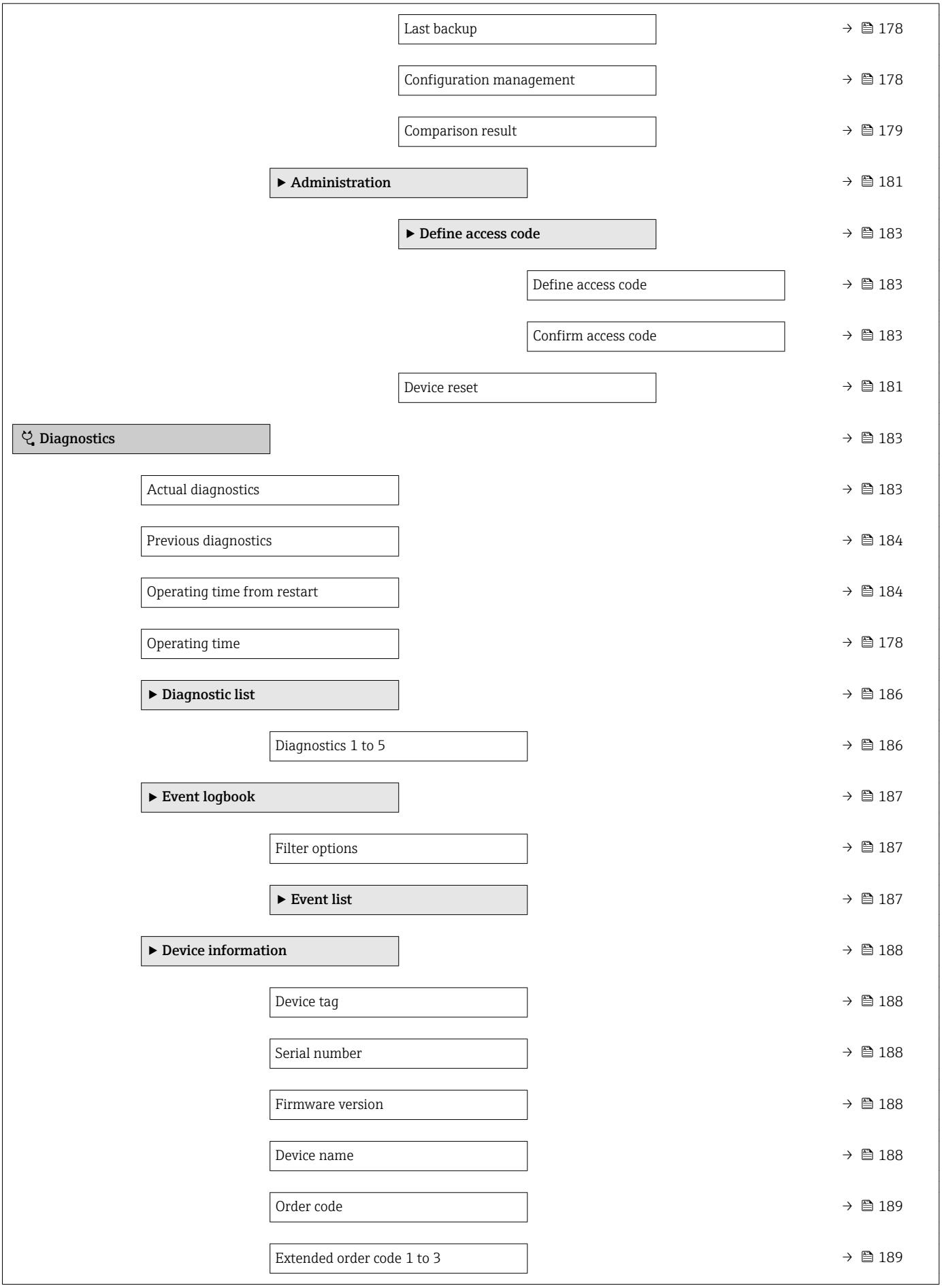
- Assign limit → 166
- Assign diagnostic behavior → 166
- Switch-on value → 167
- Switch-on delay → 168
- Switch-off value → 168
- Switch-off delay → 169
- Failure mode → 169
- Switch status → 169
- Invert output signal → 169

▶ **Display** → 171

- Language → 171
- Format display → 171
- Value 1 to 4 display → 173
- Decimal places 1 to 4 → 173
- Display interval → 174
- Display damping → 174
- Header → 174
- Header text → 175
- Separator → 175
- Number format → 175
- Decimal places menu → 176
- Backlight → 176
- Contrast display → 177

▶ **Configuration backup display** → 178

- Operating time → 178


Last backup → 178
Configuration management → 178
Comparison result → 179
▶ Administration → 181
▶ Define access code → 183
Define access code → 183
Confirm access code → 183
Device reset → 181
Diagnostics → 183
Actual diagnostics → 183
Previous diagnostics → 184
Operating time from restart → 184
Operating time → 178
▶ Diagnostic list → 186
Diagnostics 1 to 5 → 186
▶ Event logbook → 187
Filter options → 187
▶ Event list → 187
▶ Device information → 188
Device tag → 188
Serial number → 188
Firmware version → 188
Device name → 188
Order code → 189
Extended order code 1 to 3 → 189

- Device revision → 189
- Device ID → 189
- Device type → 190
- Manufacturer ID → 190
- ▶ **Measured values** → 191
  - Distance → 126
  - Level linearized → 153
  - Interface distance → 131
  - Interface linearized → 154
  - Thickness upper layer → 193
  - Terminal voltage 1 → 193
- ▶ **Data logging** → 194
  - Assign channel 1 to 4 → 194
  - Logging interval → 195
  - Clear logging data → 195
  - ▶ **Display channel 1 to 4** → 196
- ▶ **Simulation** → 198
  - Assign measurement variable → 199
  - Process variable value → 199
  - Switch output simulation → 199
  - Switch status → 200
  - Device alarm simulation → 200
- ▶ **Device check** → 201
  - Start device check → 201
  - Result device check → 201

	Last check time	→ 201
	Level signal	→ 202
	Launch signal	→ 202
	Interface signal	→ 202

15.2 Overview of the operating menu (operating tool)

Navigation Operating menu

Setup → 121

- Device tag → 121
- Operating mode → 121
- Distance unit → 122
- Tank type → 122
- Tube diameter → 122
- Medium group → 123
- Empty calibration → 123
- Full calibration → 124
- Level → 125
- Distance → 126
- Signal quality → 127
- Tank level → 128
- Distance to upper connection → 129
- DC value → 129
- Interface → 130
- Interface distance → 131
- Confirm distance → 131
- Present mapping → 132
- Mapping end point → 133
- Record map → 133
- ▶ **Advanced setup** → 135
  - Locking status → 135

Access status tooling → 135

Enter access code → 136

▶ **Level** → 137

- Medium type → 137
- Medium property → 137
- Process property → 138
- Advanced process conditions → 139
- Level unit → 140
- Blocking distance → 140
- Level correction → 141

▶ **Interface** → 142

- Process property → 142
- DC value lower medium → 142
- Level unit → 143
- Blocking distance → 143
- Level correction → 144
- Manual thickness upper layer → 144
- Measured thickness upper layer → 145
- DC value → 145
- Calculated DC value → 145
- Use calculated DC value → 146

▶ **Linearization** → 149

- Linearization type → 151
- Unit after linearization → 152
- Free text → 153

	Level linearized	→ 153
	Interface linearized	→ 154
	Maximum value	→ 154
	Diameter	→ 154
	Intermediate height	→ 155
	Table mode	→ 155
	Table number	→ 156
	Level	→ 157
	Level	→ 157
	Customer value	→ 157
	Activate table	→ 157
▶ **Safety settings**		→ 159
	Output echo lost	→ 159
	Value echo lost	→ 159
	Ramp at echo lost	→ 160
	Blocking distance	→ 140
▶ **Probe settings**		→ 162
	Probe grounded	→ 162
	Present probe length	→ 162
	Confirm probe length	→ 163
▶ **Switch output**		→ 165
	Switch output function	→ 165
	Assign status	→ 166
	Assign limit	→ 166
	Assign diagnostic behavior	→ 166

Switch-on value → 167

Switch-on delay → 168

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Switch-off delay → 169

Failure mode → 169

Switch status → 169

Invert output signal → 169

▶ **Display** → 171

Language → 171

Format display → 171

Value 1 to 4 display → 173

Decimal places 1 to 4 → 173

Display interval → 174

Display damping → 174

Header → 174

Header text → 175

Separator → 175

Number format → 175

Decimal places menu → 176

Backlight → 176

Contrast display → 177

▶ **Configuration backup display** → 178

Operating time → 178

Last backup → 178

Configuration management → 178

- Backup state → 179
- Comparison result → 179
- ▶ **Administration** → 181
  - Define access code → 183
  - Device reset → 181
- **Diagnostics** → 183
  - Actual diagnostics → 183
  - Timestamp → 184
  - Previous diagnostics → 184
  - Timestamp → 184
  - Operating time from restart → 184
  - Operating time → 178
  - ▶ **Diagnostic list** → 186
    - Diagnostics 1 to 5 → 186
    - Timestamp 1 to 5 → 186
  - ▶ **Device information** → 188
    - Device tag → 188
    - Serial number → 188
    - Firmware version → 188
    - Device name → 188
    - Order code → 189
    - Extended order code 1 to 3 → 189
    - Device revision → 189
    - Device ID → 189

Device type → 190

Manufacturer ID → 190

▶ **Measured values** → 191

Distance → 126

Level linearized → 153

Interface distance → 131

Interface linearized → 154

Thickness upper layer → 193

Terminal voltage 1 → 193

▶ **Data logging** → 194

Assign channel 1 to 4 → 194

Logging interval → 195

Clear logging data → 195

▶ **Simulation** → 198

Assign measurement variable → 199

Process variable value → 199

Switch output simulation → 199

Switch status → 200

Device alarm simulation → 200

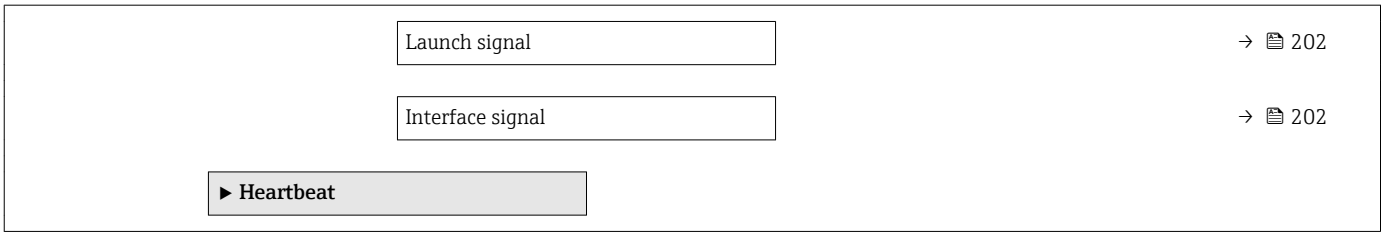
▶ **Device check** → 201

Start device check → 201

Result device check → 201

Last check time → 201

Level signal → 202



15.3 "Setup" menu

- : Marks the navigation path to the parameter via the display and operating module.
- : Marks the navigation path to the parameter via an operating tool (e.g. FieldCare).
- : Marks parameters which can be locked via the software locking → 61.

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..

Factory setting FMP5x

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

Factory setting m

Tank type

Navigation Setup → Tank type

Prerequisite **Medium type (→ 137)** = **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 (→ 122)** = **Bypass / pipe**
- The probe is coated.

Description Specify diameter of bypass or stilling well.

User entry 0 to 9.999 m

Factory setting 0.0384 m

Medium group

Navigation Setup → Medium group

Prerequisite
- For FMP51/FMP52/FMP54/FMP55: **Operating mode (→ 121)** = **Level**
- **Medium type (→ 137)** = **Liquid**

Description Select medium group.

Selection
- Others
- Water based (DC >= 4)

Factory setting Others

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 (→ 137).

The **Medium group** parameter presets the **Medium property** parameter (→ 137) as follows:

Medium group	Medium property (→ 137)
Others	Unknown
Water based (DC >= 4)	DC 4 … 7

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.

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

Empty calibration

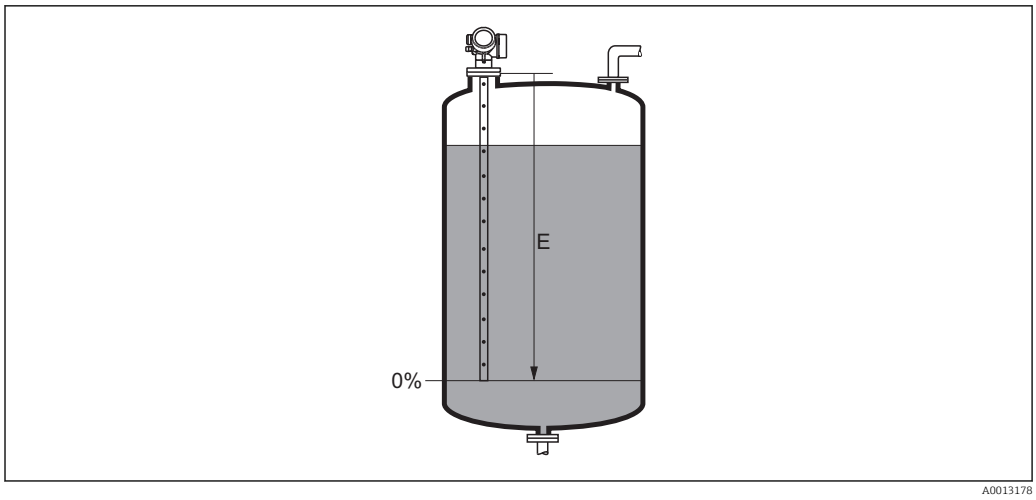
Navigation Setup → Empty calibration

Description Distance between process connection and minimum level (0%)..

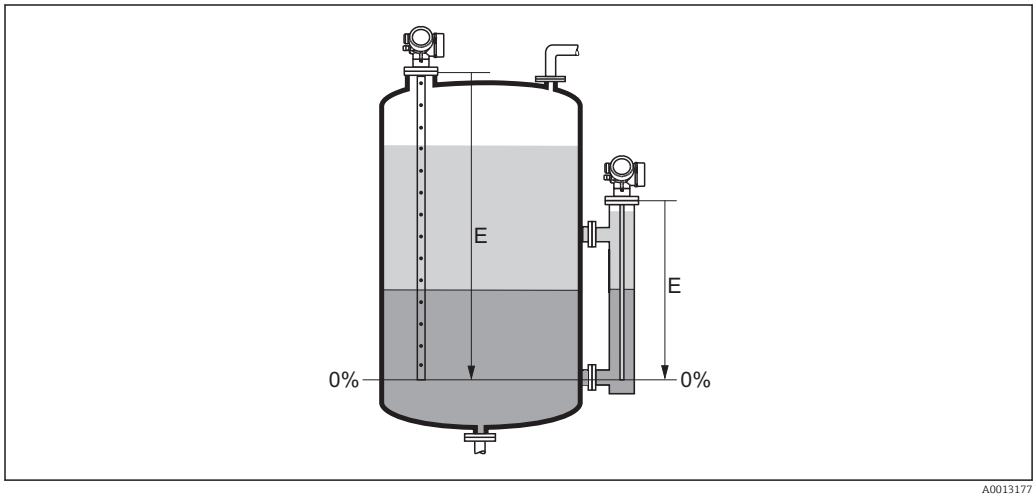
User entry Depending on the probe

Factory setting Depending on the probe

Additional information



24 *Empty calibration (E) for level measurements in liquids*



25 *Empty calibration (E) for interface measurements*

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

Full calibration

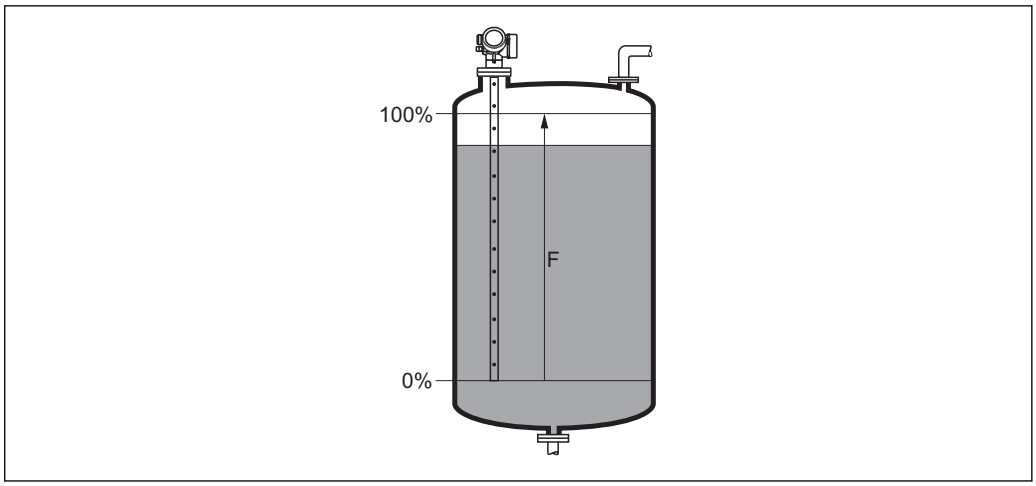
Navigation Setup → Full calibration

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

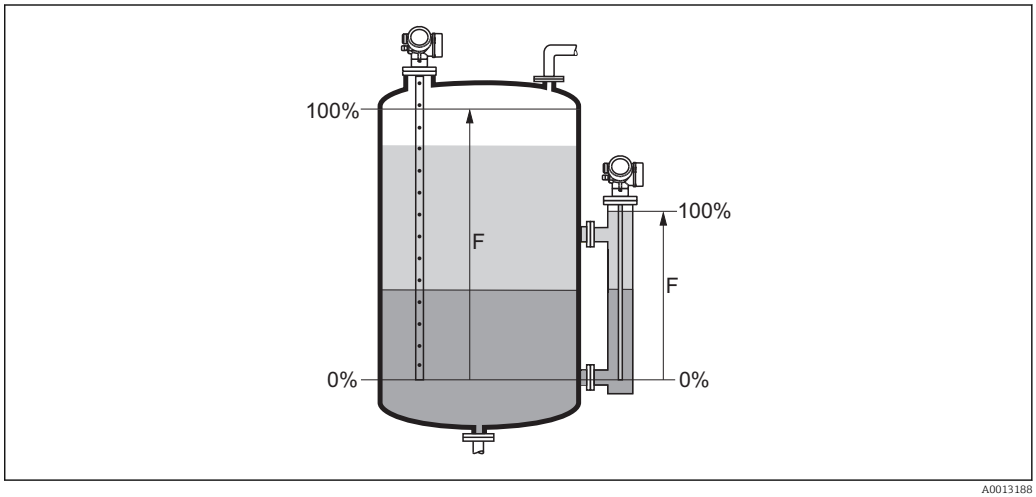
User entry Depending on the probe

Factory setting Depending on the probe

Additional information



26 *Full calibration (F) for level measurements in liquids*



27 *Full calibration (F) for interface measurements*

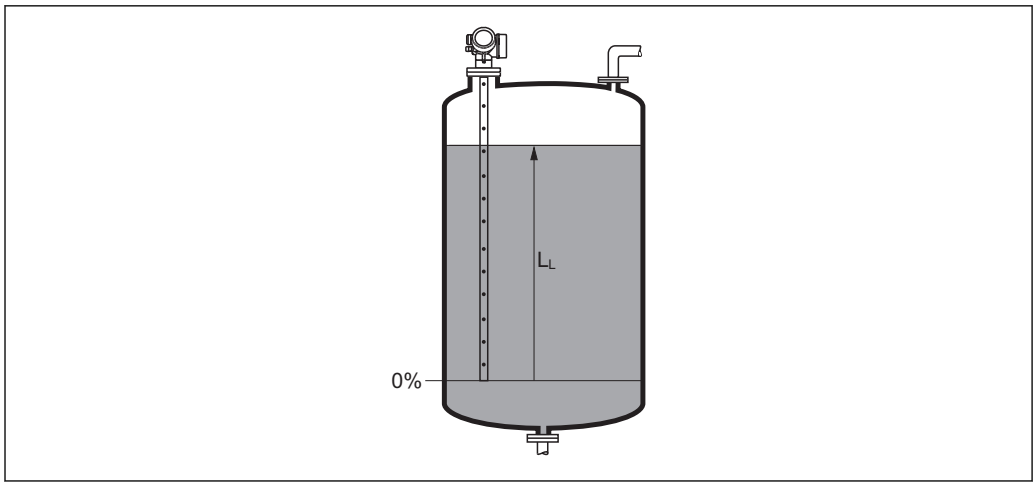
In the case of interface measurements the **Full calibration** parameter is valid for both, the total and the interface level.

Level

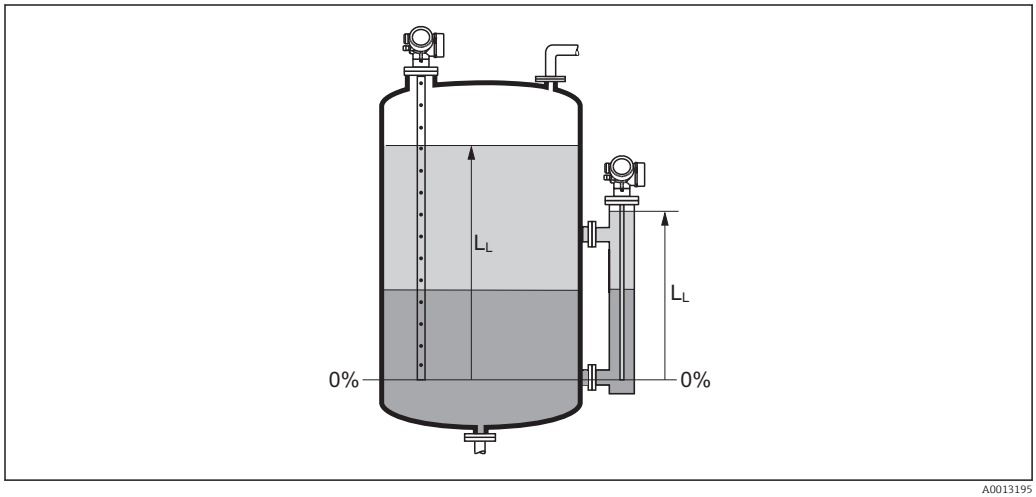
Navigation Setup → Level

Description Displays measured level L_L (before linearization).

Additional information



28 *Level in case of liquid measurements*



29 *Level in case of interface measurements*

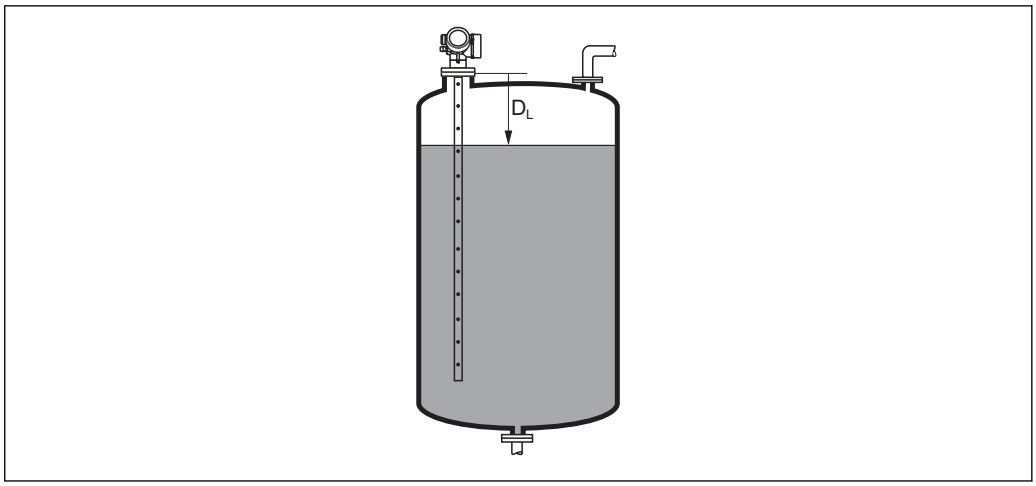
- The unit is defined in the **Level unit** parameter (→ 140).
- In case of interface measurements, this parameter always refers to the total level.

Distance

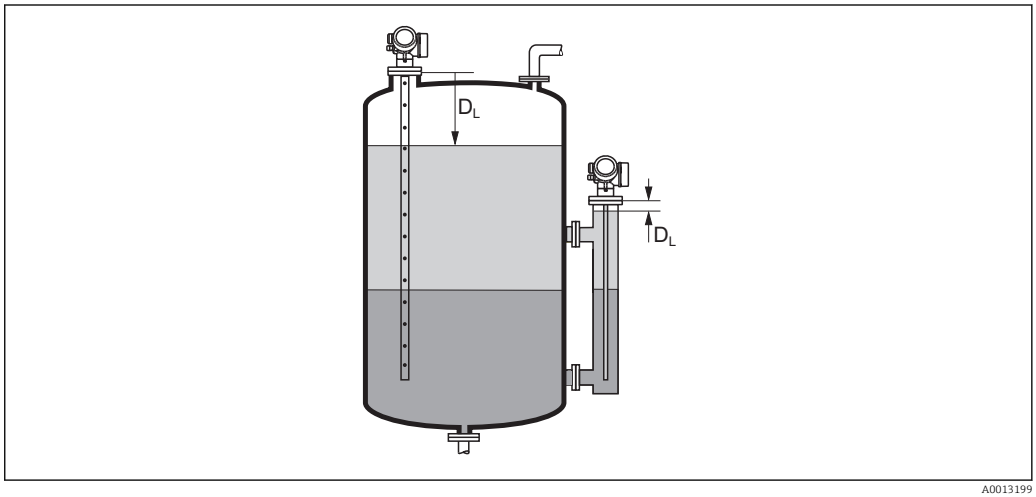
Navigation Setup → Distance

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

Additional information



30 *Distance for liquid measurements*



31 *Distance for interface measurements*

The unit is defined in the **Distance unit** parameter (→ 122).

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 (→ 159) = Alarm**.
- S941, if another option has been selected in **Output echo lost (→ 159)**.

Tank level

Navigation Setup → Tank level

Prerequisite **Operating mode (→ 121) = Interface**

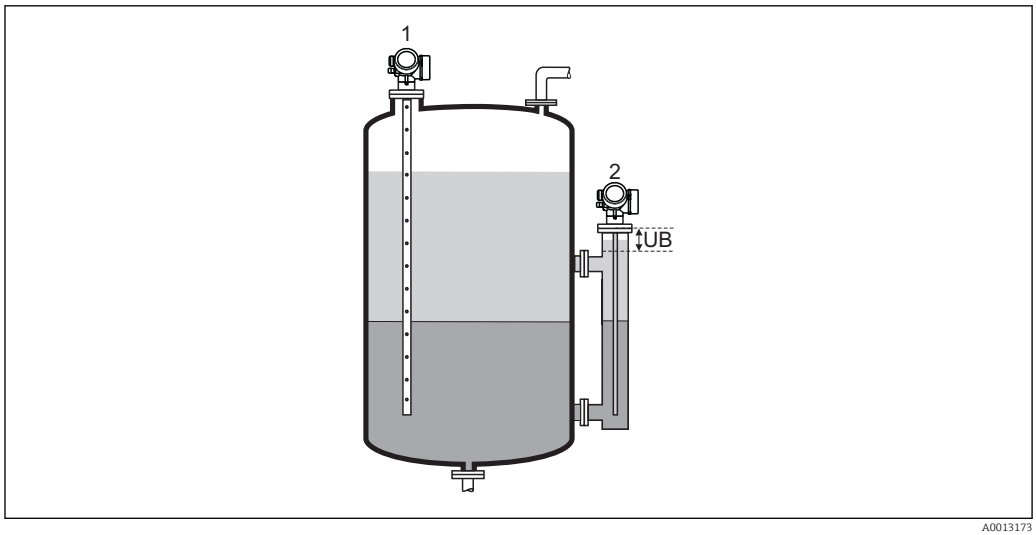
Description Specify whether the tank or bypass is completely flooded or not.

Selection
- Partially filled
- Fully flooded

Factory setting Partially filled

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.



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 → Distance to upper connection

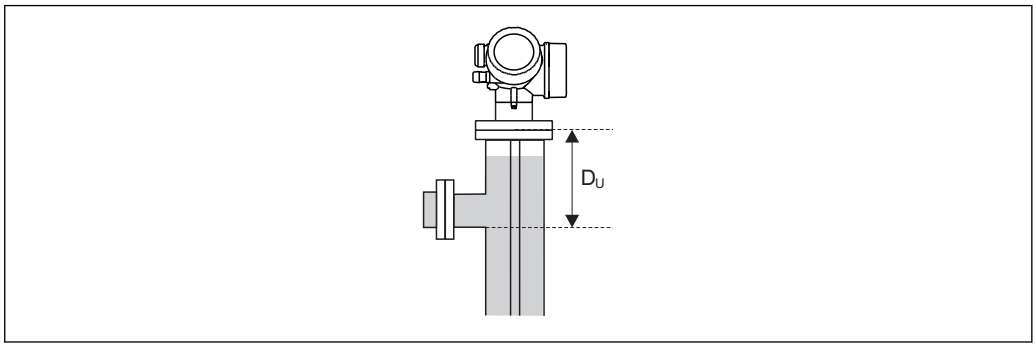
Prerequisite The device has the "Interface measurement" application package [9].

Description Specify distance D_U to upper connection.

User entry 0 to 200 m

Factory setting
- For **Tank level (→ 128)** = **Partially filled**: 0 mm (0 in)
- For **Tank level (→ 128)** = **Fully flooded**: 250 mm (9.8 in)

Additional information



A0013174

Dependence on the "Tank level" parameter
- **Tank level (→ 128)** = **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 (→ 128)** = **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].

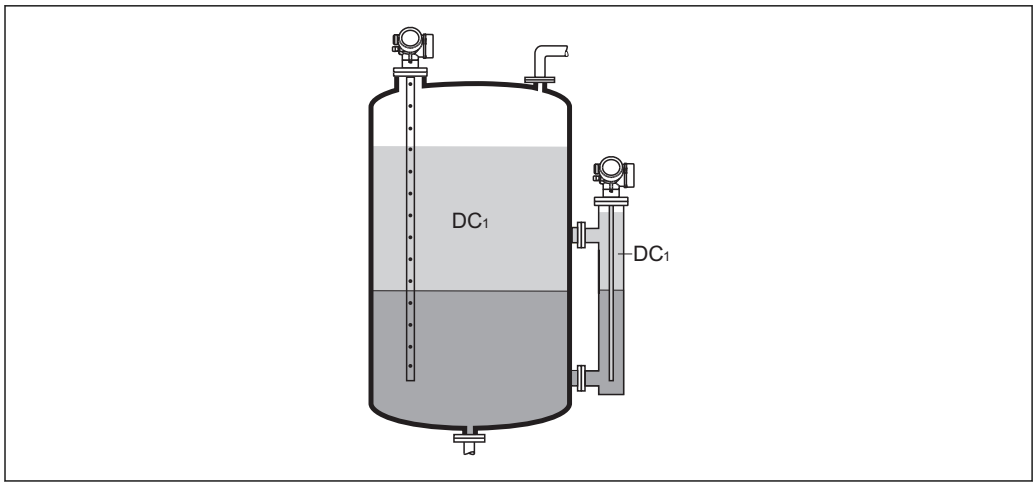
Description Specify relative dielectric constant ε_r of the upper medium (DC_1).

User entry 1.0 to 100

Factory setting 2.0

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

Additional information



DC1 Relative dielectric constant of the upper medium.

For dielectric constants (DC values) of many media commonly used in various industries refer to:
- the Endress+Hauser DC manual (CP01076F)
- the Endress+Hauser "DC Values App" (available for Android and iOS)

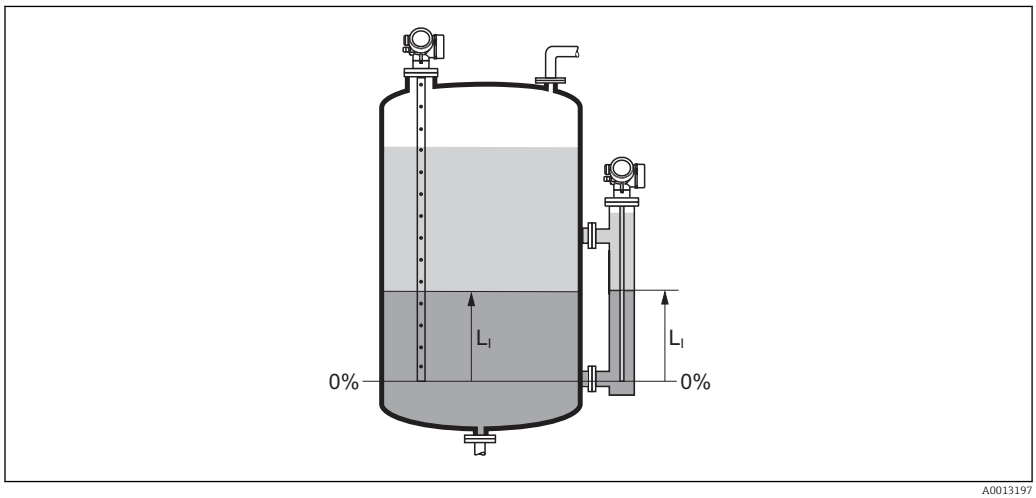
Interface

Navigation Setup → Interface

Prerequisite **Operating mode (→ 121)** = **Interface** or **Interface with capacitance**

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

Additional information



The unit is defined in the **Level unit** parameter (→ 140).

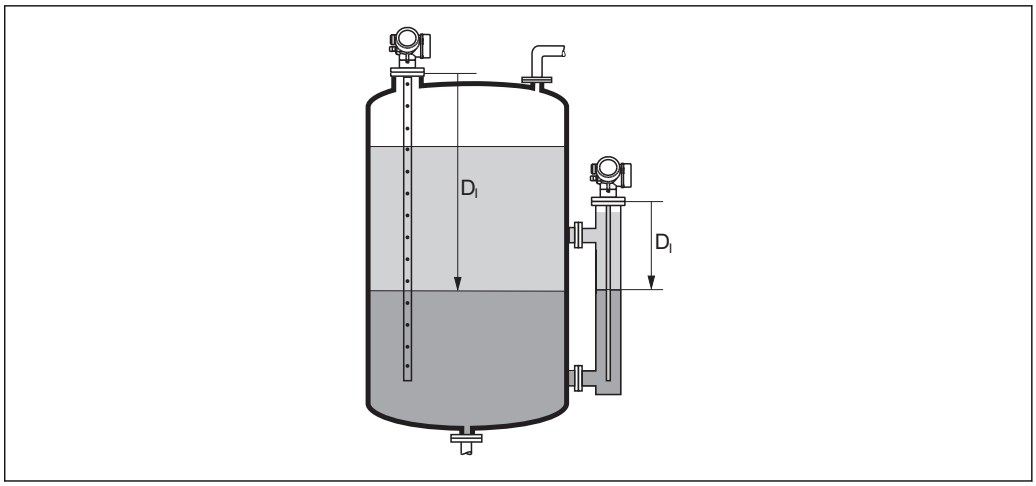
Interface distance

Navigation Setup → Interface distance

Prerequisite **Operating mode (→ 121)** = **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 (→ 122).

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

Factory setting Distance unknown

* 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 (→ 133). 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.

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

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

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.

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

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 → Mapping end point

Prerequisite **Confirm distance (→ 131)** = **Manual map** or **Distance too small**

Description Specify new end of the mapping.

User entry 0 to 200 000.0 m

Factory setting 0.1 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 (→ 132) 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 (→ 131)** = **Manual map** or **Distance too small**

Description Start recording of the map.

Selection
- No
- Record map
- Delete map

Factory setting No

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

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 (→ 121).

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 → 131

Mapping end point

Navigation Setup → Mapping → Mapping end point

Description → 133

Record map

Navigation Setup → Mapping → Record map

Description → 133

Distance

Navigation Setup → Mapping → Distance

Description → 126

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 status tooling

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 (→ 136).

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 (→ 135).

Access status display

Navigation Setup → Advanced setup → Access status display

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 (→ 136).

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 (→ 135).

Enter access code

Navigation Setup → Advanced setup → Enter access code

Description Enter access code to disable write protection of parameters.

User entry 0 to 9999

Additional information

- For local operation, the customer-specific access code, which has been defined in the **Define access code** parameter (→ 181), has to be entered.
- If an incorrect access code is entered, the user retains his current access authorization.
- The write protection affects all parameters marked with the -symbol in this 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 min, or the user switches 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

The **Level** submenu (→ 137) is only visible for **Operating mode (→ 121)** = **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 (→ 121)** = **Level**

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 (→ 121)** = **Level**
- **EOP level evaluation** ≠ **Fix DC**

Description Specify relative 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 Dependent on **Medium type (→ 137)** and **Medium group (→ 123)**.

Additional information

Dependency on "Medium type" and "Medium group"

Medium type (→ 137)	Medium group (→ 123)	Medium property
Solid		Unknown
Liquid	Water based (DC >= 4)	DC 4 ... 7
	Others	Unknown

For dielectric constants (DC values) of many media commonly used in various industries refer to:
- the Endress+Hauser DC manual (CP01076F)
- the Endress+Hauser "DC Values App" (available for Android and iOS)

For **EOP level evaluation** = **Fix DC**, the exact dielectric constant has to be entered into the **DC value** parameter (→ 129). Therefore, the **Medium property** parameter is not available 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

Factory setting Standard < 1 m (40in) /min

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 → Advanced process conditions

Prerequisite **Operating mode (→ 121)** = **Level**

Description Specify additional process conditions (if required).

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

Factory setting None

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
- %
- m
- mm

US units
- ft
- in

Factory setting %

Additional information The level unit may differ from the distance unit defined in the **Distance unit** parameter (→ 122):

- The unit defined in the **Distance unit** parameter is used for the basic calibration (**Empty calibration (→ 123)** and **Full calibration (→ 124)**).
- The unit defined in the **Level unit** parameter is used to display the (unlinearized) level.

Blocking distance

Navigation Setup → Advanced setup → Level → Blocking distance

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

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

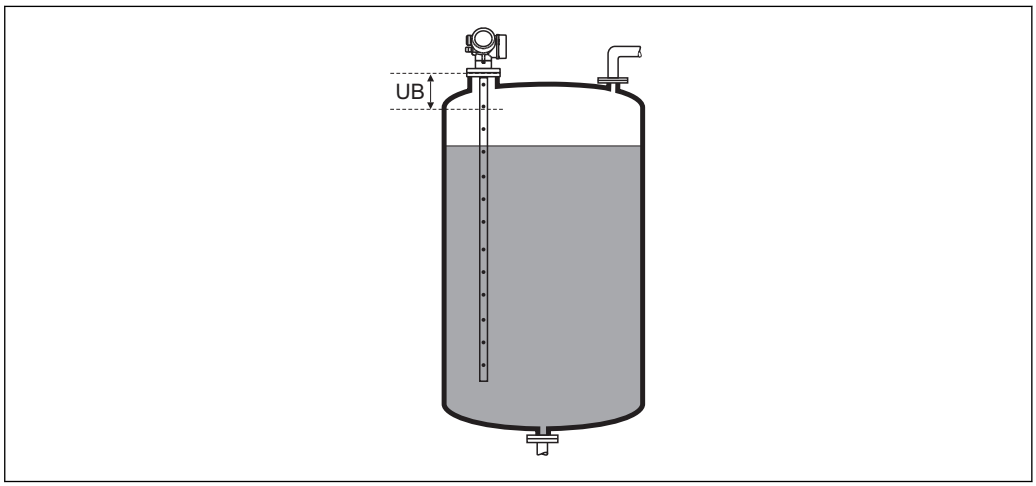
due to a level change during operation. Signals which are already in the blocking distance when the device is switched on, are ignored.

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.



32 *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 %

Factory setting 0.0 %

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

Factory setting Standard < 1 m (40in) /min

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 value lower medium

Prerequisite **Operating mode (→ 121) = Interface** or **Interface with capacitance**

Description Specify the relative dielectric ocnstant ε_r of the lower medium.

User entry 1 to 100

Factory setting 80.0

Additional information For dielectric constants (DC values) of many media commonly used in various industries refer to:
- the Endress+Hauser DC manual (CP01076F)
- the Endress+Hauser "DC Values App" (available for Android and iOS)

The factory setting, $\varepsilon_r = 80$, is valid for water at 20 °C (68 °F).

Level unit

Navigation Setup → Advanced setup → Interface → Level unit

Description Select level unit.

Selection

SI units
- %
- m
- mm

US units
- ft
- in

Factory setting %

Additional information The level unit may differ from the distance unit defined in the **Distance unit** parameter (→ 122):

- The unit defined in the **Distance unit** parameter is used for the basic calibration (**Empty calibration (→ 123)** and **Full calibration (→ 124)**).
- 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 distance

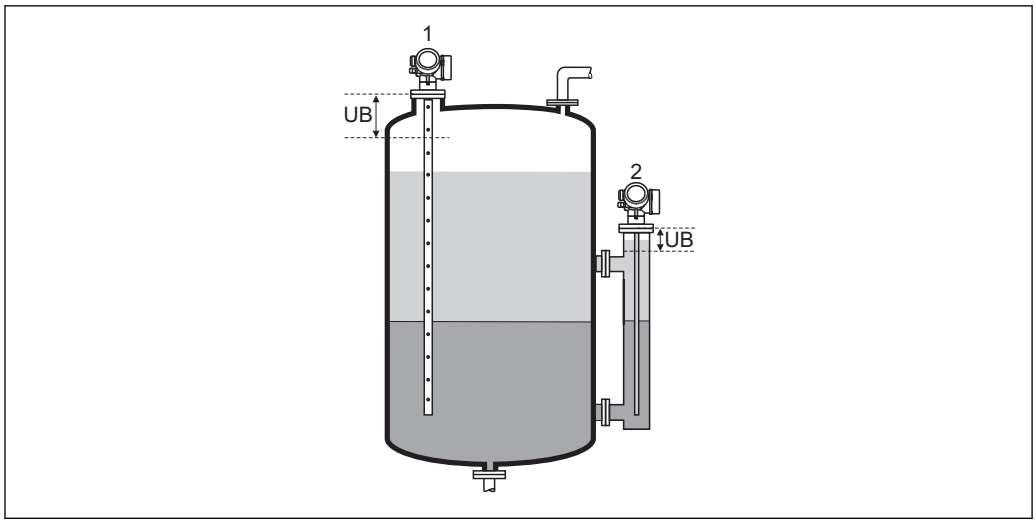
Description Specify upper blocking distance UB.

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 %

Factory setting 0.0 %

Additional information The value specified in this parameter is added to the measured total and interface levels (before linearization).

Manual thickness upper layer

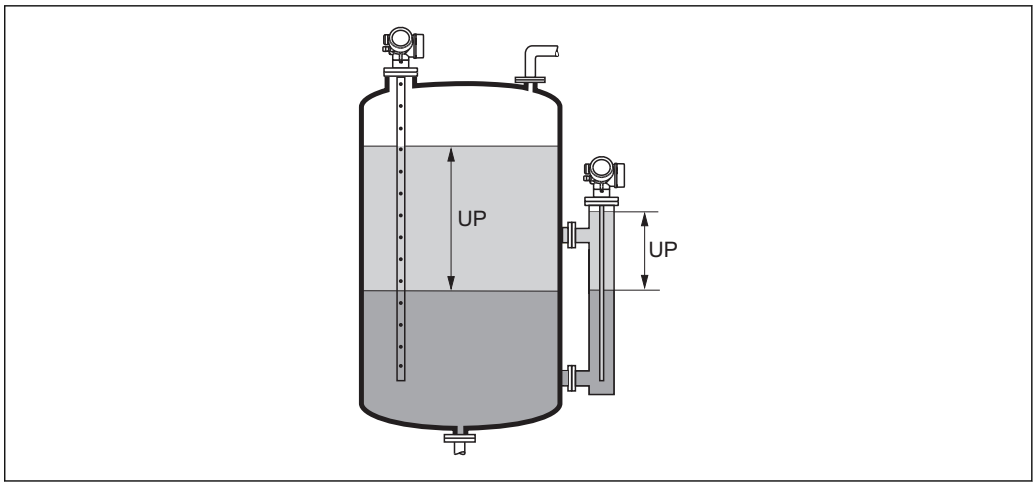
Navigation Setup → Advanced setup → Interface → Manual thickness upper layer

Description Specify the manually determined interface thickness UP (i.e. the thickness of the upper medium).

User entry 0 to 200 m

Factory setting 0 m

Additional information



UP Interface thickness (= thickness of upper medium)

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 → Measured thickness upper layer

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 → Calculated 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 calculated DC value

Description Specify whether the calculated dielectric constant is to be used.

Selection
- Save and exit
- Cancel and exit

Factory setting 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.

On the local display, the **Calculated DC value** parameter (→ 145) is displayed together with this parameter.

"Automatic DC calculation" wizard

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 (→ 142)

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 → Automatic DC calculation

Manual thickness upper layer

Navigation Setup → Advanced setup → Interface → Automatic DC calculation → Manual thickness upper layer

Description → 144

DC value

Navigation Setup → Advanced setup → Interface → Automatic DC calculation → DC value

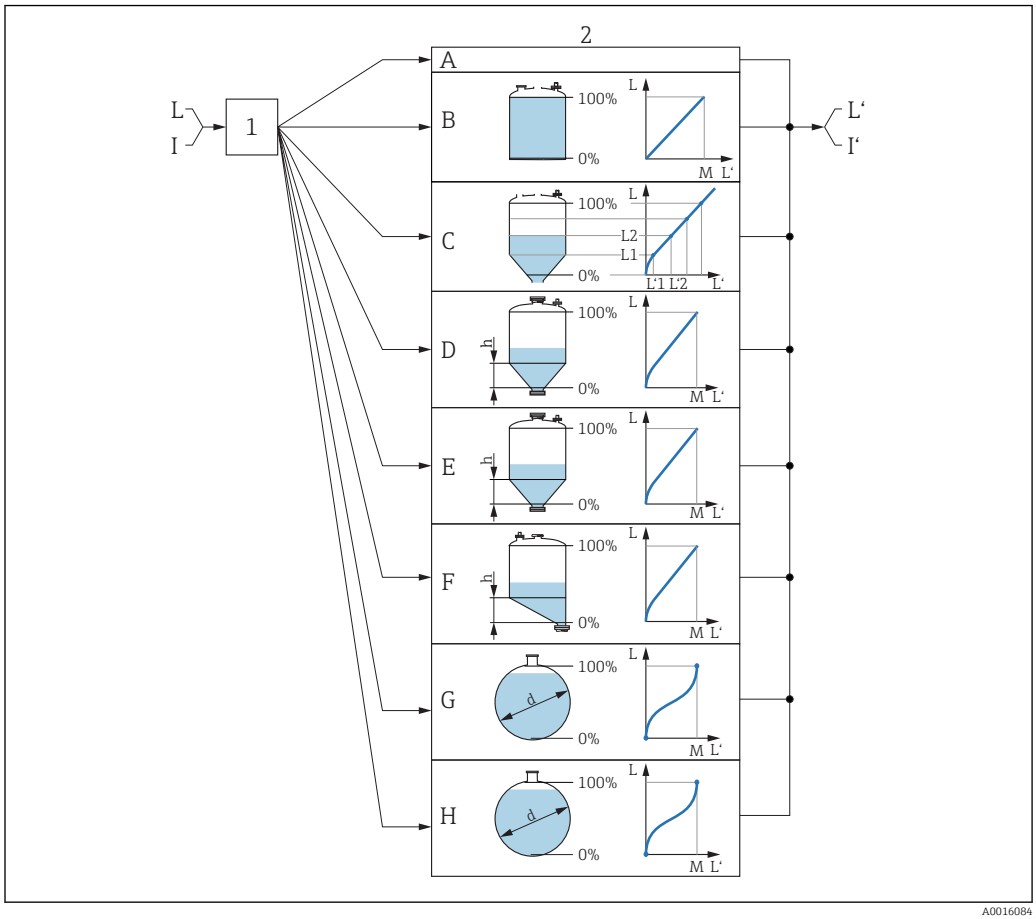
Description → 145

Use calculated DC value

Navigation Setup → Advanced setup → Interface → Automatic DC calculation → Use calculated DC value

Description → 146

"Linearization" submenu

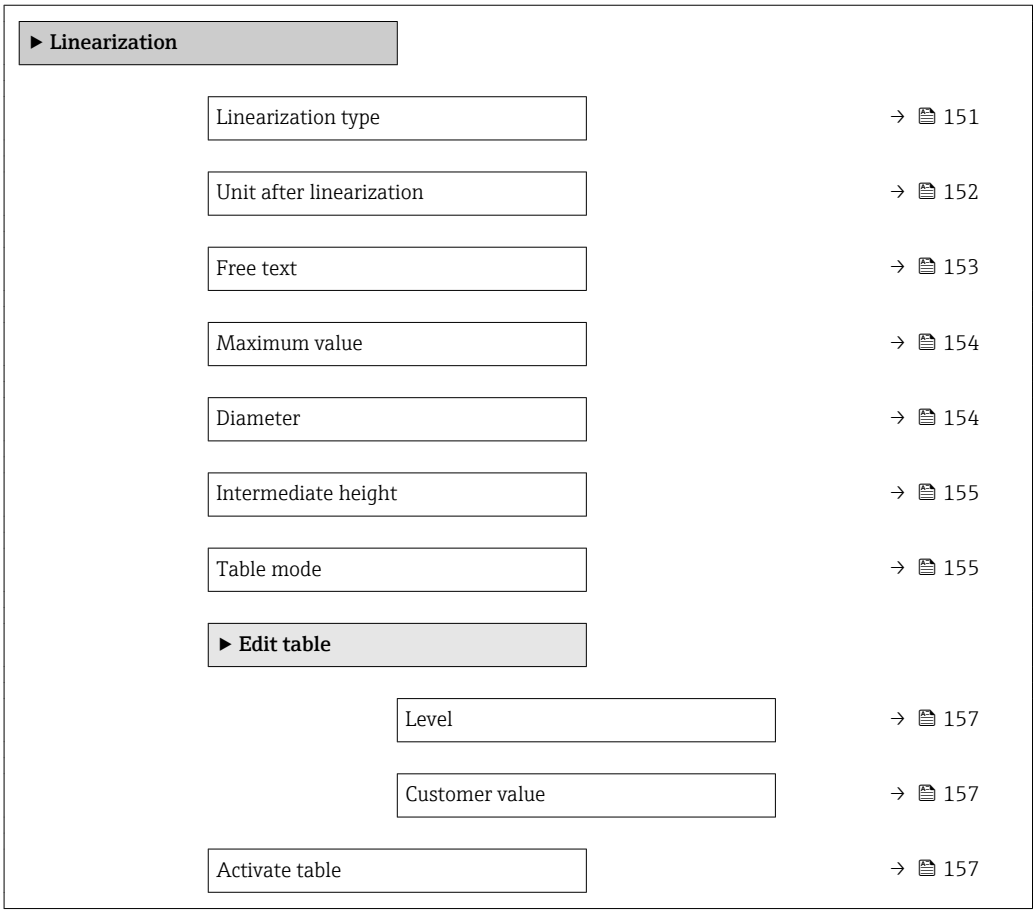


33 *Linearization: Transformation of the level and (if relevant) the interface height into a volume or weight; the transformation is dependent on the shape of the vessel.*

1 Selection of linearization type and unit
2 Configuration of the linearization
A Linearization type (→ 151) = None
B Linearization type (→ 151) = Linear
C Linearization type (→ 151) = Table
D Linearization type (→ 151) = Pyramid bottom
E Linearization type (→ 151) = Conical bottom
F Linearization type (→ 151) = Angled bottom
G Linearization type (→ 151) = Horizontal cylinder
H Linearization type (→ 151) = Sphere
I For "Operating mode (→ 121)" = "Interface" or "Interface with capacitance": Interface before linearization (measured in distance units)
I' For "Operating mode (→ 121)" = "Interface" or "Interface with capacitance": Interface after linearization (corresponds to volume or weight)
L Level before linearization (measured in distance units)
L' Level linearized (→ 153) (corresponds to volume or weight)
M Maximum value (→ 154)
d Diameter (→ 154)
h Intermediate height (→ 155)

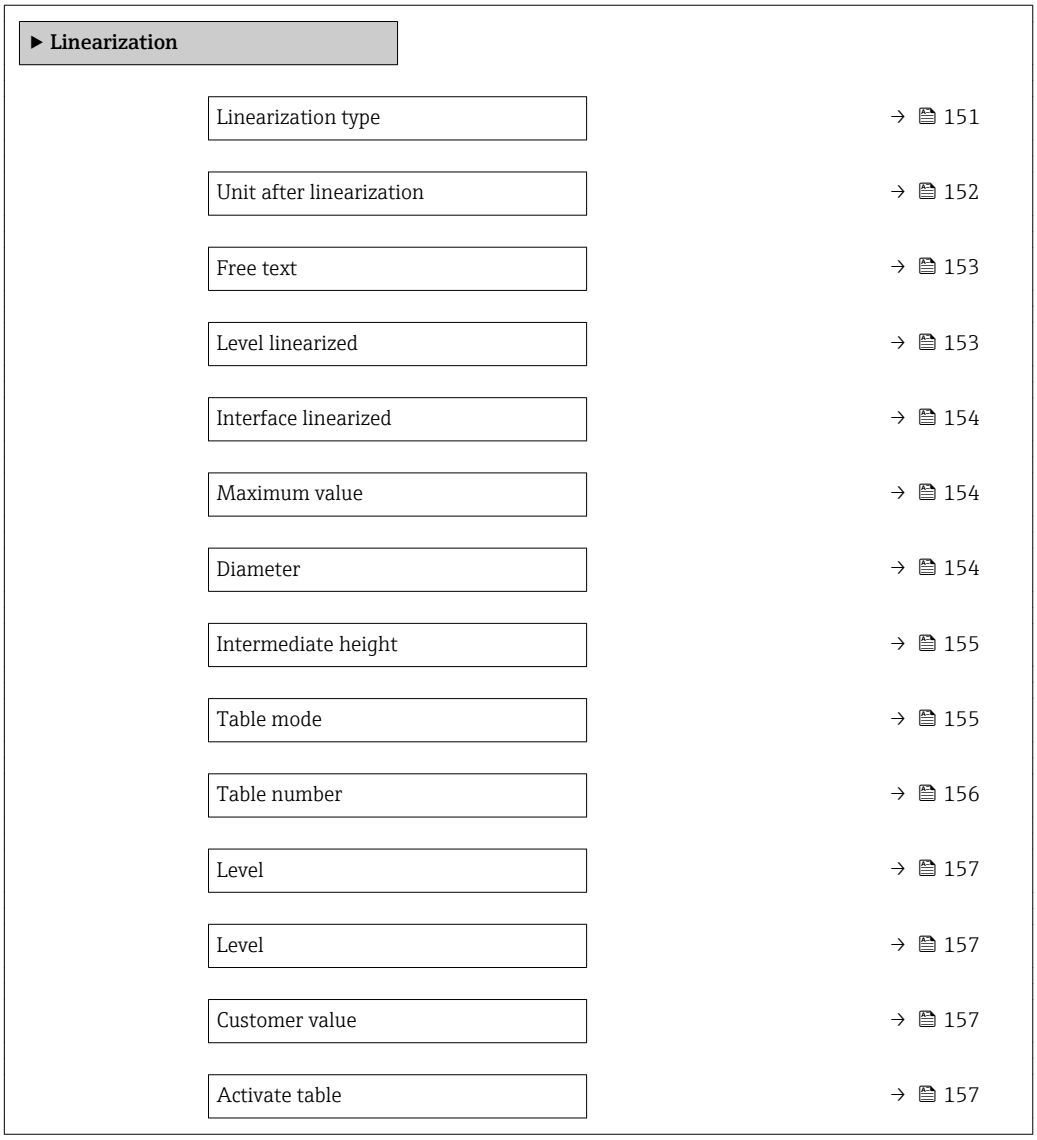
Structure of the submenu on the display module

Navigation Setup → Advanced setup → Linearization



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

Navigation Setup → Advanced setup → Linearization



Description of parameters

Navigation Setup → Advanced setup → Linearization

Linearization type

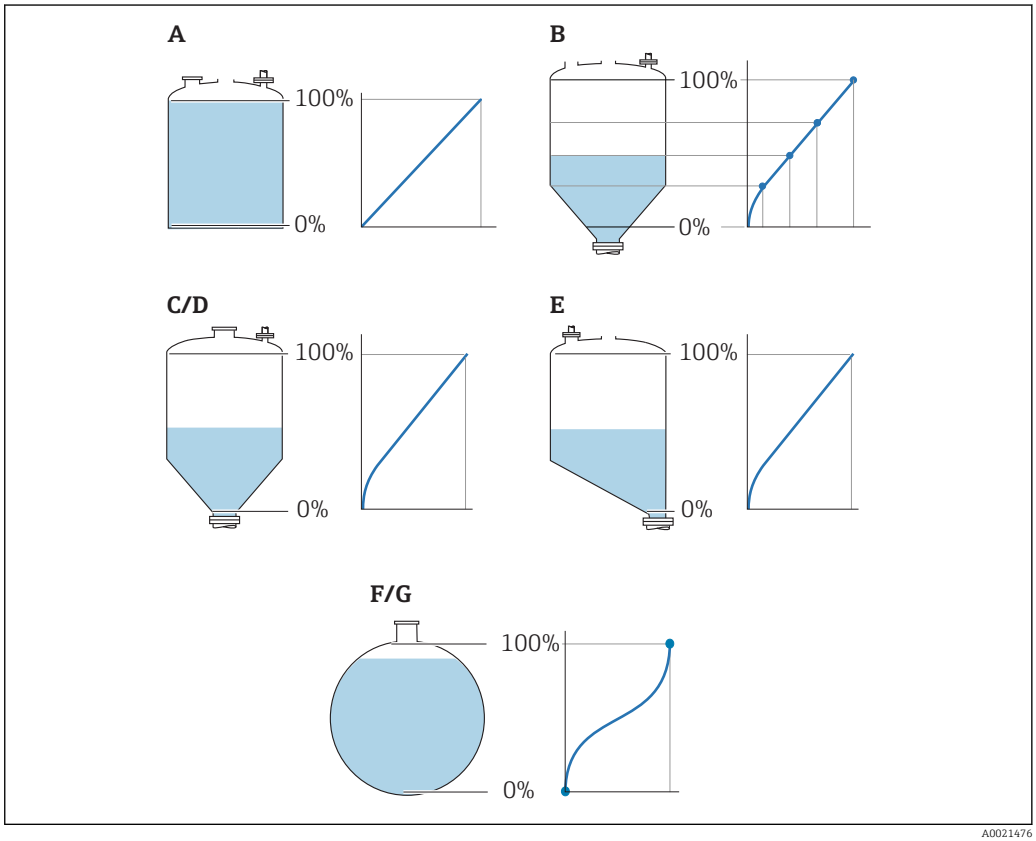
Navigation Setup → Advanced setup → Linearization → Linearization type

Description Select linearization type.

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

Factory setting None

Additional information



34 *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 transmitted in the level unit without linearization.
- **Linear**
  The output value (volume/weight) is directly proportional to the level L. This is valid, for example, for vertical cylinders. The following additional parameters have to be specified:
  – **Unit after linearization (→ 152)**
  – **Maximum value (→ 154)**: Maximum volume or weight
- **Table**
  The relationship between the measured level L and the output value (volume/weight) is given by a linearization table consisting of up to 32 pairs of values "level - volume" or "level - weight", respectively. The following additional parameters have to be specified:
  – **Unit after linearization (→ 152)**
  – **Table mode (→ 155)**
  – For each table point: **Level (→ 157)**
  – For each table point: **Customer value (→ 157)**
  – **Activate table (→ 157)**
- **Pyramid bottom**
  The output value corresponds to the volume or weight in a silo with pyramid bottom. The following additional parameters have to be specified:
  – **Unit after linearization (→ 152)**
  – **Maximum value (→ 154)**: Maximum volume or weight
  – **Intermediate height (→ 155)**: The height of the pyramid
- **Conical bottom**
  The output value corresponds to the volume or weight in a tank with conical bottom. The following additional parameters have to be specified:
  – **Unit after linearization (→ 152)**
  – **Maximum value (→ 154)**: Maximum volume or weight
  – **Intermediate height (→ 155)**: The height of the conical part of the tank
- **Angled bottom**
  The output value corresponds to the volume or weight in a silo with an angled bottom. The following additional parameters have to be specified:
  – **Unit after linearization (→ 152)**
  – **Maximum value (→ 154)**: Maximum volume or weight
  – **Intermediate height (→ 155)**: Height of the angled bottom
- **Horizontal cylinder**
  The output value corresponds to the volume or weight in a horizontal cylinder. The following additional parameters have to be specified:
  – **Unit after linearization (→ 152)**
  – **Maximum value (→ 154)**: Maximum volume or weight
  – **Diameter (→ 154)**
- **Sphere**
  The output value corresponds to the volume or weight in a spherical tank. The following additional parameters have to be specified:
  – **Unit after linearization (→ 152)**
  – **Maximum value (→ 154)**: Maximum volume or weight
  – **Diameter (→ 154)**

Unit after linearization

Navigation Setup → Advanced setup → Linearization → Unit after linearization

Prerequisite **Linearization type (→ 151)** ≠ None

Description Select unit of the lineaized value.

Selection

SI units
- STon
- t
- kg
- cm^3
- dm^3
- m^3
- hl
- l
- %
- mm
- m

US units
- lb
- UsGal
- ft^3
- ft
- in

Imperial units
impGal

Custom-specific units
Free text

Factory setting

%

Additional information

The selected unit is only used to be indicated on the display. The measured value is **not** transformed according to the selected unit.

It is also possible to configure a distance-to-distance linearization, i.e. a transformation from the level unit to a different distance unit. To do so, select the **Linear** linearization mode. In order to define the new level unit, select the **Free text** option in the **Unit after linearization** parameter and enter the required unit into the **Free text** parameter (→ 153).

Free text

Navigation

Setup → Advanced setup → Linearization → Free text

Prerequisite

Unit after linearization (→ 152) = Free text

Description

Enter unit symbol.

User entry

Up to 32 alphanumerical characters (letters, numbers, special characters)

Factory setting

Free text

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 → 152.
- For interface measurements, this parameter always refers to the total level.

Interface linearized

Navigation Setup → Advanced setup → Linearization → Interface linearized

Prerequisite **Operating mode (→ 121)** = **Interface** or **Interface with capacitance**

Description Displays the linearized interface height.

Additional information The unit is defined in the **Unit after linearization** parameter → 152.

Maximum value

Navigation Setup → Advanced setup → Linearization → Maximum value

Prerequisite **Linearization type (→ 151)** 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 %

Factory setting 100.0 %

Diameter

Navigation Setup → Advanced setup → Linearization → Diameter

Prerequisite **Linearization type (→ 151)** 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

Factory setting 2 m

Additional information The unit is defined in the **Distance unit** parameter (→ 122).

Intermediate height

Navigation Setup → Advanced setup → Linearization → Intermediate height

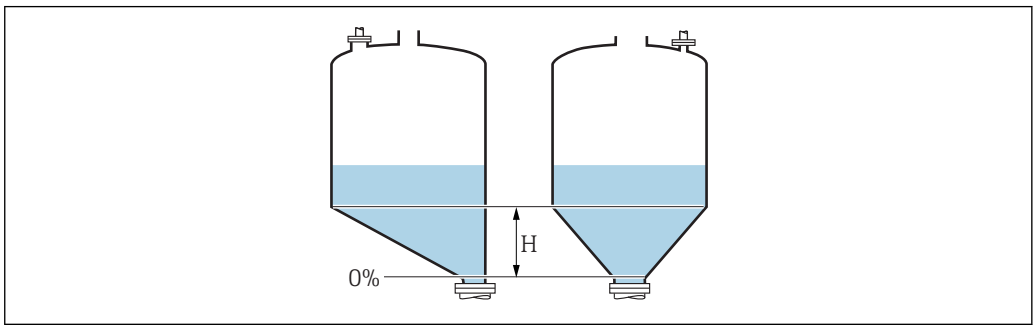
Prerequisite **Linearization type (→ 151)** has one of the following values:
- Pyramid bottom
- Conical bottom
- Angled bottom

Description Height of the pyramid, conical or angled bottom.

User entry 0 to 200 m

Factory setting 0 m

Additional information



H Intermediate height

The unit is defined in the **Distance unit** parameter (→ 122).

Table mode

Navigation Setup → Advanced setup → Linearization → Table mode

Prerequisite **Linearization type (→ 151)** = **Table**

Description Select editing mode of the linearization table.

Selection
- Manual
- Semiautomatic
- Clear table
- Sort table

Factory setting Manual

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.

Before entering a linearization table, the values for **Empty calibration (→ 123)** and **Full calibration (→ 124)** 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 (→ 155)** = **Clear table**). Then enter a new table.

How to enter the table
- Via FieldCare
  The table points can be entered via the **Table number (→ 156)**, **Level (→ 157)** and **Customer value (→ 157)** 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.

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 (→ 140) beforehand.

Table number

Navigation Setup → Advanced setup → Linearization → Table number

Prerequisite **Linearization type (→ 151)** = **Table**

Description Select table point you are going to enter or change.

User entry 1 to 32

Factory setting 1

Level (Manual)

Navigation Setup → Advanced setup → Linearization → Level

Prerequisite
- **Linearization type (→ 151)** = Table
- **Table mode (→ 155)** = Manual

Description Enter level value of the table point (value before linearization).

User entry Signed floating-point number

Factory setting 0 %

Level (Semiautomatic)

Navigation Setup → Advanced setup → Linearization → Level

Prerequisite
- **Linearization type (→ 151)** = **Table**
- **Table mode (→ 155)** = **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 (→ 151)** = **Table**

Description Enter linearized value for the table point.

User entry Signed floating-point number

Factory setting 0 %

Activate table

Navigation Setup → Advanced setup → Linearization → Activate table

Prerequisite **Linearization type (→ 151)** = **Table**

Description Activate (enable) or deactivate (disable) the linearization table.

Selection
- Disable
- Enable

Factory setting Disable

Additional information

Meaning of the options

- **Disable**
  The measured level is not linearized.
  If **Linearization type (→ 151)** = **Table** at the same time, the device issues error message F435.
- **Enable**
  The measured level is linearized according to the table.

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 settings

Output echo lost

Navigation Setup → Advanced setup → Safety settings → Output echo lost

Description Output signal in case of a lost echo.

Selection
- Last valid value
- Ramp at echo lost
- Value echo lost
- Alarm

Factory setting Last valid value

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 (→ 160).
- **Value echo lost** [13)]
  In the case of a lost echo the output assumes the value defined in the **Value echo lost** parameter (→ 159).
- **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 settings → Value echo lost

Prerequisite **Output echo lost (→ 159)** = **Value echo lost**

Description Output value in case of a lost echo

User entry 0 to 200 000.0 %

Factory setting 0.0 %

Additional information Use the unit which has been defined for the measured value output:
- without linearization: **Level unit (→ 140)**
- with linearization: **Unit after linearization (→ 152)**

13) Only visible if "Linearization type (→ 151)" = "None"

Ramp at echo lost

Navigation Setup → Advanced setup → Safety settings → Ramp at echo lost

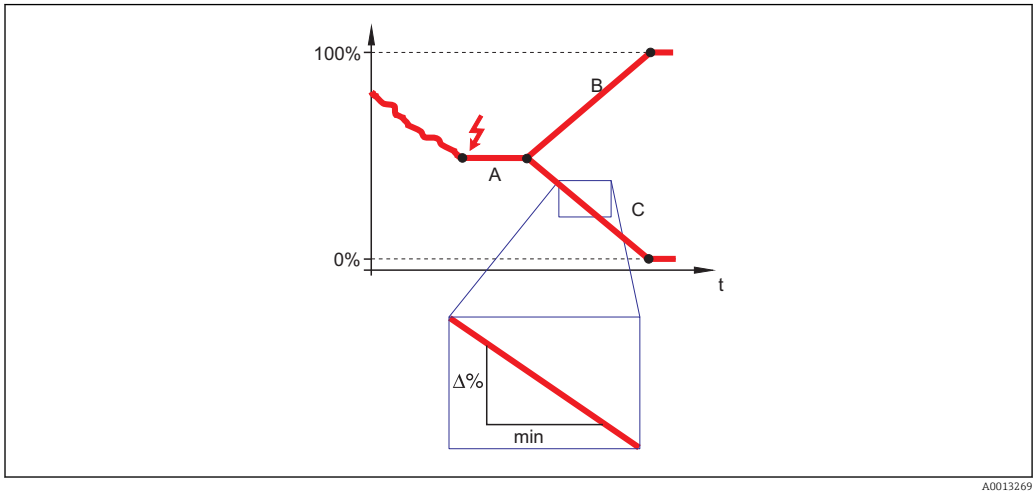
Prerequisite **Output echo lost (→ 159) = Ramp at echo lost**

Description Slope of the ramp in the case of a lost echo

User entry Signed floating-point number

Factory setting 0.0 %/min

Additional information



A Delay time echo lost
B Ramp at echo lost (→ 160) (positive value)
C Ramp at echo lost (→ 160) (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 settings → Blocking distance

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

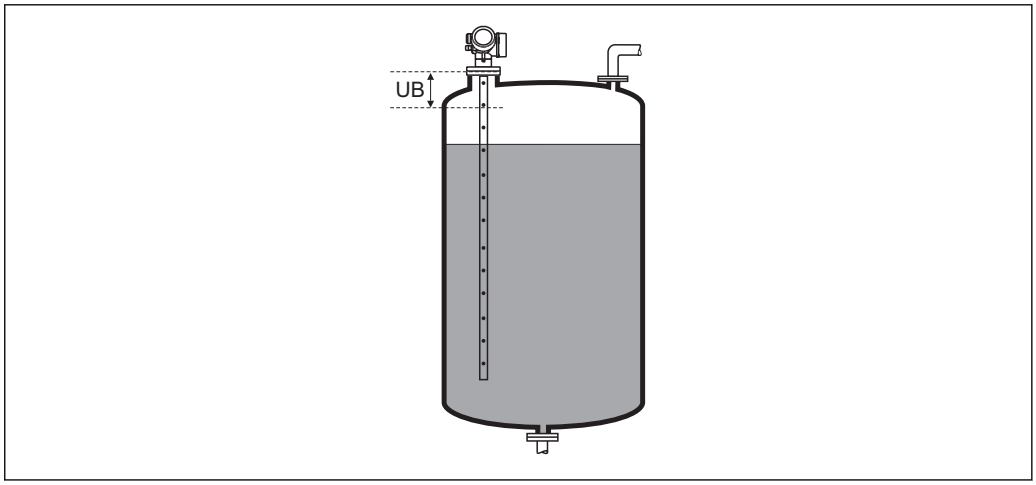
Signals in the upper blocking distance are only evaluated if they have been outside the blocking distance when the device was switched on and move into the blocking distance due to a level change during operation. Signals which are already in the blocking distance when the device is switched on, are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



35 Blocking distance (UB) for liquid measurements

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 (→ 163)** = **Manual input** in order to enter the value manually.

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 (→ 133) before performing the automatic probe length correction. After the probe length correction, a new map can be recorded using the **Record map** parameter (→ 133).
- Alternative: Select **Confirm probe length (→ 163)** = **Manual input** and enter the probe length manually into the **Present probe length** parameter → 162.

An automatic probe length correction is only possible after the correct option has been selected in the **Probe grounded** parameter (→ 162).

Navigation Setup → Advanced setup → Probe settings

Probe grounded

Navigation Setup → Advanced setup → Probe settings → Probe grounded

Prerequisite **Operating mode (→ 121)** = **Level**

Description Specify whether the probe is grounded.

Selection
- No
- Yes

Factory setting No

Present probe length

Navigation Setup → Advanced setup → Probe settings → Present probe length

Description
- In most cases:
  Displays the length of the probe according to the currently measured end-of-probe signal.
- For **Confirm probe length (→ 163)** = **Manual input**:
  Enter actual length of probe.

User entry 0 to 200 m

Factory setting 4 m

Confirm probe length

Navigation Setup → Advanced setup → Probe settings → Confirm probe length

Description Select, whether the value displayed in the **Present probe length** parameter → 162 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

Factory setting Probe length OK

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 → 162. 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 → 162. 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 → 162 [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

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 (→ 162).

Navigation Setup → Advanced setup → Probe settings → Probe length correction

Confirm probe length

Navigation Setup → Advanced setup → Probe settings → Probe length correction → Confirm probe length

Description → 163

Present probe length

Navigation Setup → Advanced setup → Probe settings → Probe length correction → Present probe length

Description → 162

"Switch output" submenu

The **Switch output** submenu (→ 165) 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 output function

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

Factory setting Off

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 (→ 166) 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 (→ 166)**
  – **Switch-on value (→ 167)**
  – **Switch-off value (→ 168)**
- **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 (→ 166).

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 (→ 165)** = **Digital Output**

Selection
- Off
- Digital output AD 1
- Digital output AD 2

Factory setting Off

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 (→ 165)** = **Limit**

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 *

Factory setting Off

Assign diagnostic behavior

Navigation Setup → Advanced setup → Switch output → Assign diagnostic behavior

Prerequisite **Switch output function (→ 165)** = **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

Factory setting Alarm

Switch-on value

Navigation Setup → Advanced setup → Switch output → Switch-on value

Prerequisite **Switch output function (→ 165) = Limit**

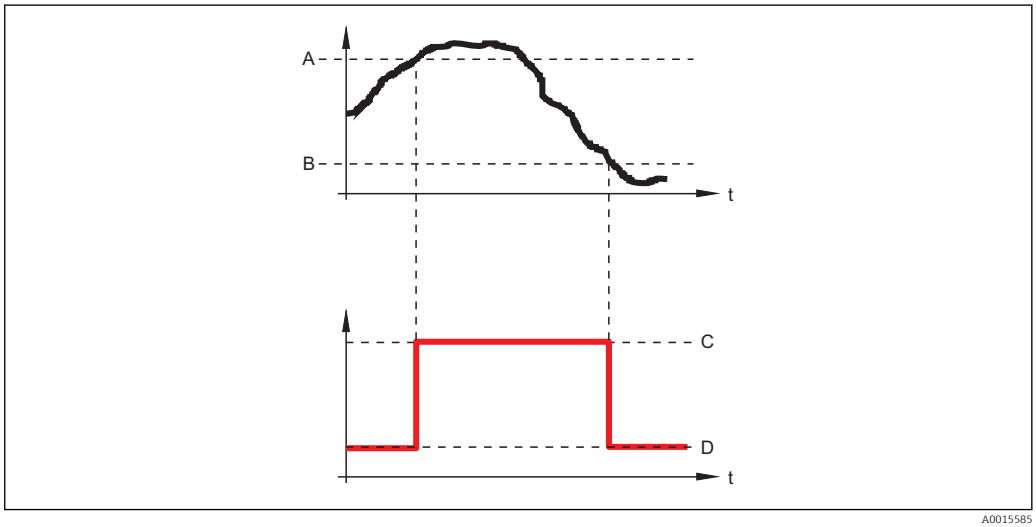
Description Defines the switch-on point. The output is closed if the assigned process variable rises above this point..

User entry Signed floating-point number

Factory setting 0

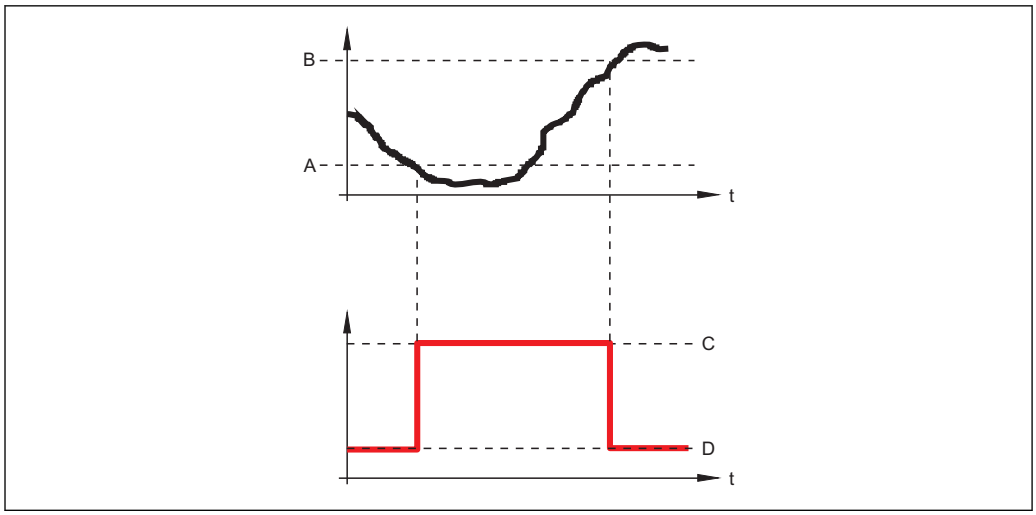
Additional information The switching behavior depends on the relative position of the **Switch-on value** and **Switch-off value** parameters:

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**.



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 (→ 165) = Limit**
- **Assign limit (→ 166) ≠ Off**

Description Defines the delay applied before the output is switched on..

User entry 0.0 to 100.0 s

Factory setting 0.0 s

Switch-off value

Navigation Setup → Advanced setup → Switch output → Switch-off value

Prerequisite **Switch output function (→ 165) = 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

Factory setting 0

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 (→ 167).

Switch-off delay

Navigation Setup → Advanced setup → Switch output → Switch-off delay

Prerequisite
- **Switch output function (→ 165)** = **Limit**
- **Assign limit (→ 166)** ≠ **Off**

Description Defines the delay applied before the output is switched off..

User entry 0.0 to 100.0 s

Factory setting 0.0 s

Failure mode

Navigation Setup → Advanced setup → Switch output → Failure mode

Prerequisite **Switch output function (→ 165)** = **Limit** or **Digital Output**

Description Defines the state of the switch output in case of an error..

Selection
- Actual status
- Open
- Closed

Factory setting Open

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 output signal

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

Factory setting No

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

The **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

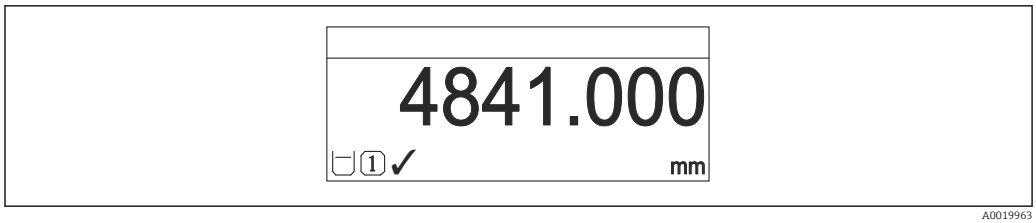
Description Select how measured values are shown on the display.

Selection
- 1 value, max. size
- 1 bargraph + 1 value
- 2 values
- 1 value large + 2 values
- 4 values

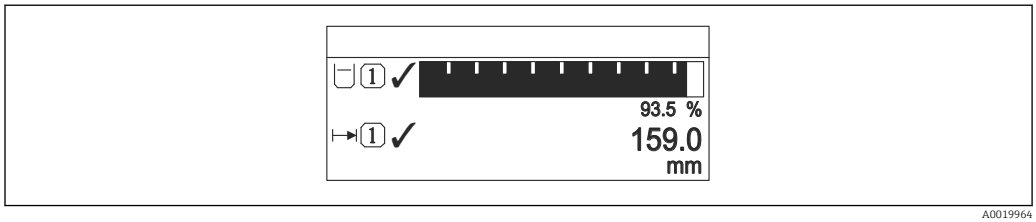
Factory setting 1 value, max. size

* Visibility depends on order options or device settings

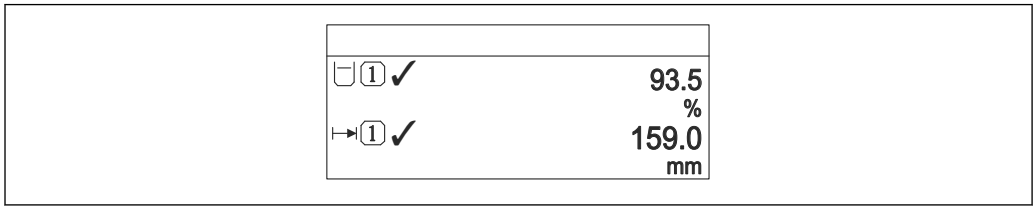
Additional information



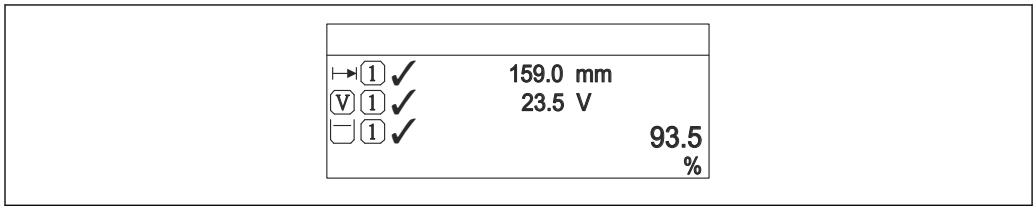
36 *"Format display" = "1 value, max. size"*



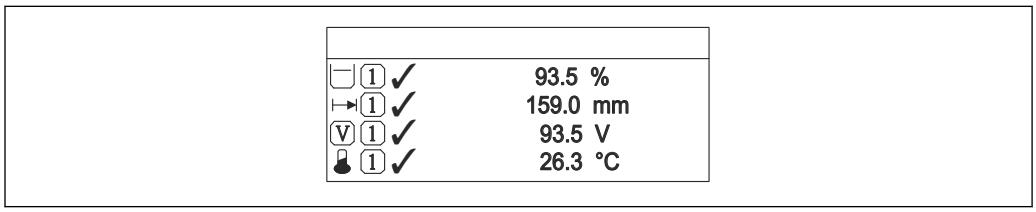
37 *"Format display" = "1 bargraph + 1 value"*



38 *"Format display" = "2 values"*



39 *"Format display" = "1 value large + 2 values"*



40 *"Format display" = "4 values"*

- The **Value 1 to 4 display** → 173 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 (→ 174).

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

Factory setting x.xx

* Visibility depends on order options or device settings

Additional information The setting does not affect the measuring or computational accuracy of the device.

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

Factory setting 5 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

Factory setting 0.0 s

Header

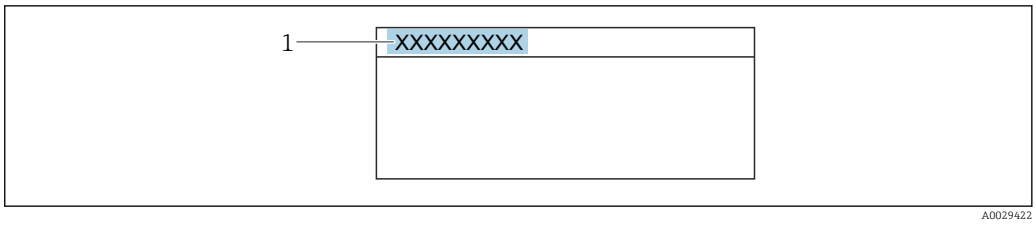
Navigation Setup → Advanced setup → Display → Header

Description Select header contents on local display.

Selection
- Device tag
- Free text

Factory setting Device tag

Additional information



1 Position of the header text on the display

Meaning of the options

- **Device tag**
  Is defined in the **Device tag** parameter (→ 121)
- **Free text**
  Is defined in the **Header text** parameter (→ 175)

Header text

Navigation Setup → Advanced setup → Display → Header text

Prerequisite **Header (→ 174) = Free text**

Description Enter display header text.

Factory setting ----------

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
- .
- ,

Factory setting .

Number format

Navigation Setup → Advanced setup → Display → Number format

Description Choose number format for the display.

Selection
- Decimal
- ft-in-1/16"

Factory setting Decimal

Additional information The **ft-in-1/16"** option is only valid for distance units.

Decimal places menu

Navigation Setup → Advanced setup → Display → Decimal 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

Factory setting 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** parameters. → 173
- 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

Factory setting Disable

Additional information

Meaning of the options
- **Disable**
  Switches the backlight off.
- **Enable**
  Switches the backlight on.

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 Setting the contrast via push-buttons:
- Darker: press the ⊖ E buttons simultaneously.
- Brighter: press the ⊕ E buttons simultaneously.

"Configuration backup display" submenu

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.

Configurations can only be exchanged between devices which are in the same operating mode (see the **Operating mode** parameter (→ 121)).

Navigation Setup → Advanced setup → Configuration backup display

Operating time

Navigation Setup → Advanced setup → Configuration backup display → 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 → Configuration backup display → Last backup

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

Configuration management

Navigation Setup → Advanced setup → Configuration backup display → Configuration management

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

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

Factory setting Cancel

Additional information

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 (→ 179).
- **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 → Configuration backup display → Backup state

Description Displays which backup action is currently in progress.

Comparison result

Navigation Setup → Advanced setup → Configuration backup display → Comparison 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 (→ 178)** = **Compare**.

If the transmitter configuration has been duplicated from a different device by **Configuration management (→ 178)** = **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 → Define access code

Description Define release code for write access to parameters.

User entry 0 to 9 999

Factory setting 0

Additional information

If the factory setting is not changed or 0 is defined as the access code, the parameters are not write-protected and the configuration data of the device can then always be modified. The user is logged on in the *Maintenance* role.

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

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 (→ 136).

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

For display operation: The new access code is only valid after it has been confirmed in the **Confirm access code** parameter (→ 183).

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

Factory setting Cancel

** 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

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 → Define access code

Define access code

Navigation Setup → Advanced setup → Administration → Define access code → Define access code

Description → 181

Confirm access code

Navigation Setup → Advanced setup → Administration → Define access code → Confirm access code

Description Confirm the entered access code.

User entry 0 to 9 999

Factory setting 0

15.4 "Diagnostics" menu

Navigation Diagnostics

Actual diagnostics

Navigation Diagnostics → Actual diagnostics

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

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

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 → Previous 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 → Operating time from 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

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)

Factory setting All

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 (→ 187). 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 information

Device tag

Navigation Diagnostics → Device information → Device tag

Description Enter the name for the measuring point.

Factory setting FMP5x

Serial number

Navigation Diagnostics → Device information → 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 information → 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 information → Device name

Description Shows the name of the transmitter.

Order code

Navigation Diagnostics → Device information → Order code

Description Shows the device order code.

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 information → Extended order code 1

Description Display the three parts of the extended order code.

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 information → 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 information → 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 information → Device type

Description Shows the device type with which the measuring device is registered with the HART Communication Foundation.

Additional information The device type is needed to allocate the suitable Device Description (DD) to the device.

Manufacturer ID

Navigation Diagnostics → Device information → 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

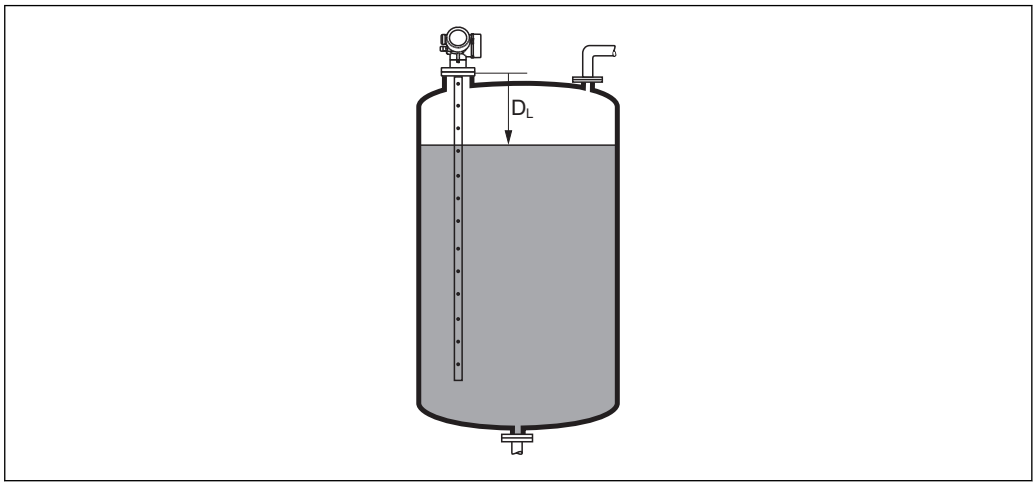
Navigation Diagnostics → Measured values

Distance

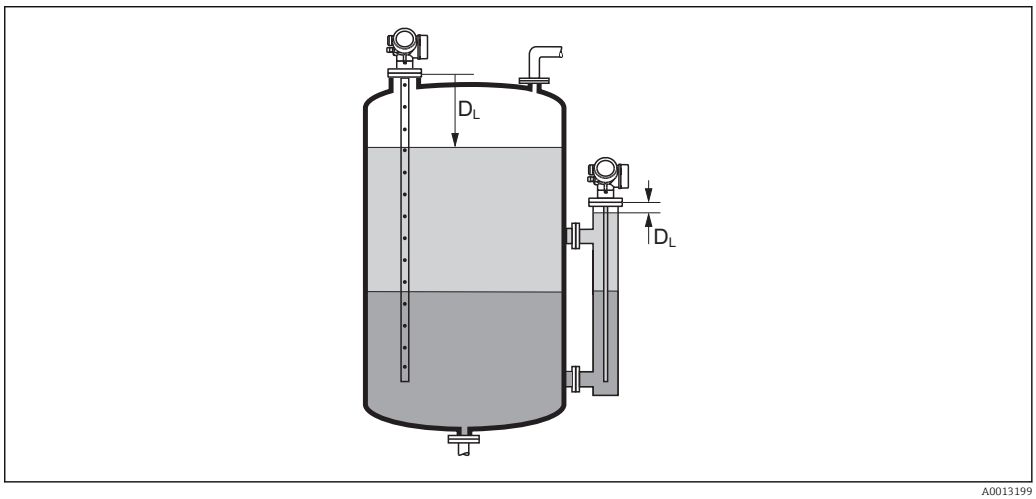
Navigation Diagnostics → Measured values → Distance

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

Additional information



41 *Distance for liquid measurements*



42 *Distance for interface measurements*

The unit is defined in the **Distance unit** parameter (→ 122).

Level linearized

Navigation Diagnostics → Measured values → Level linearized

Description Displays linearized level.

Additional information
- The unit is defined by the **Unit after linearization** parameter → 152.
- For interface measurements, this parameter always refers to the total level.

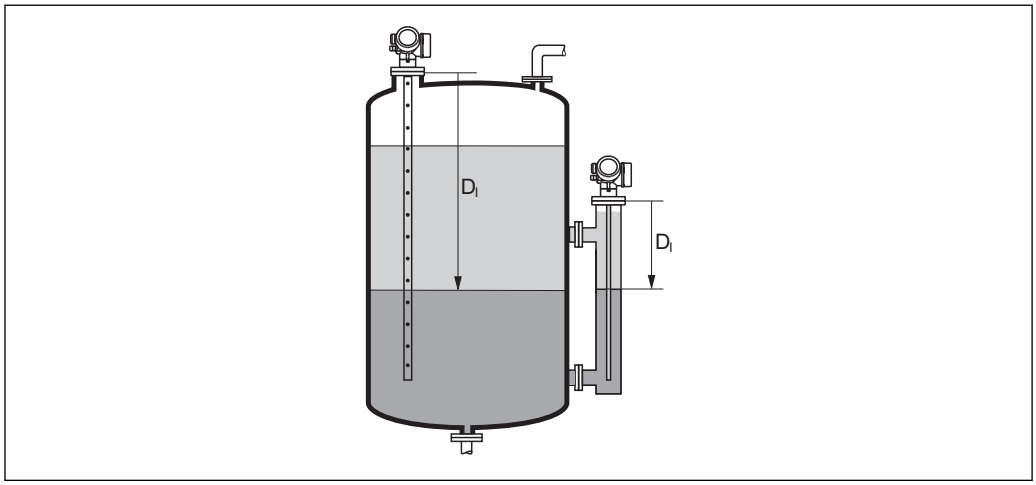
Interface distance

Navigation Diagnostics → Measured values → Interface distance

Prerequisite **Operating mode (→ 121)** = **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 (→ 122).

Interface linearized

Navigation Diagnostics → Measured values → Interface linearized

Prerequisite **Operating mode (→ 121)** = **Interface** or **Interface with capacitance**

Description Displays the linearized interface height.

Additional information The unit is defined in the **Unit after linearization** parameter → 152.

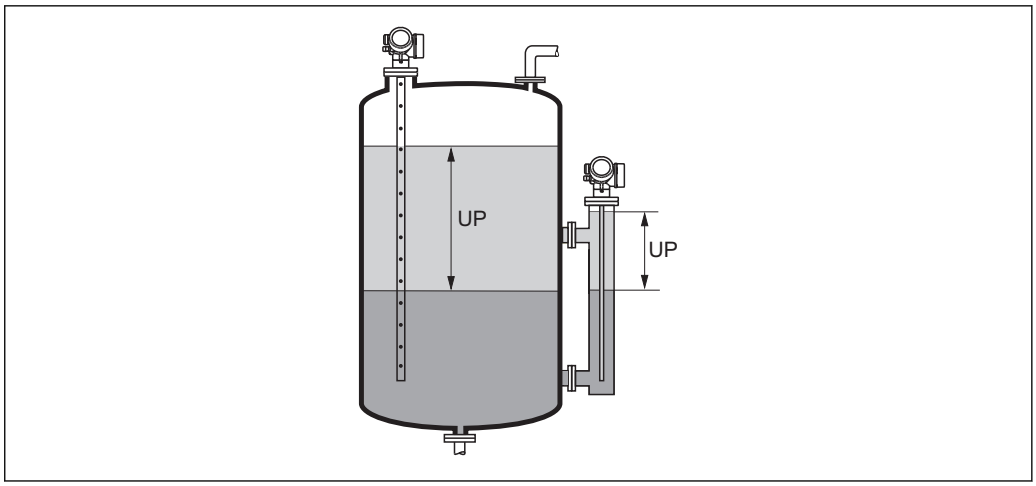
Thickness upper layer

Navigation Diagnostics → Measured values → Thickness upper layer

Prerequisite **Operating mode (→ 121)** = **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 → 152.

Terminal voltage 1

Navigation Diagnostics → Measured values → Terminal voltage 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 channel 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

Factory setting Off

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).

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

Factory setting

30.0 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 ≈ 16.5 min
- $T_{log} = 1000 \cdot 10$ s = 1 000 s ≈ 2.75 h
- $T_{log} = 1000 \cdot 80$ s = 80 000 s ≈ 22 h
- $T_{log} = 1000 \cdot 3\,600$ s = 3 600 000 s ≈ 41 d

Clear logging data

Navigation

Diagnostics → Data logging → Clear logging data

Diagnostics → Data logging → Clear logging data

Description

Clear the entire logging data.

Selection

- Cancel
- Clear data

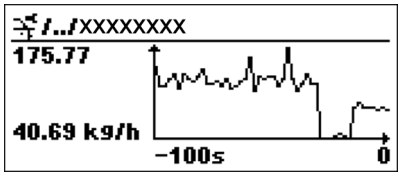
Factory setting

Cancel

"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 → Display channel 1 to 4

15.4.6 "Simulation" submenu

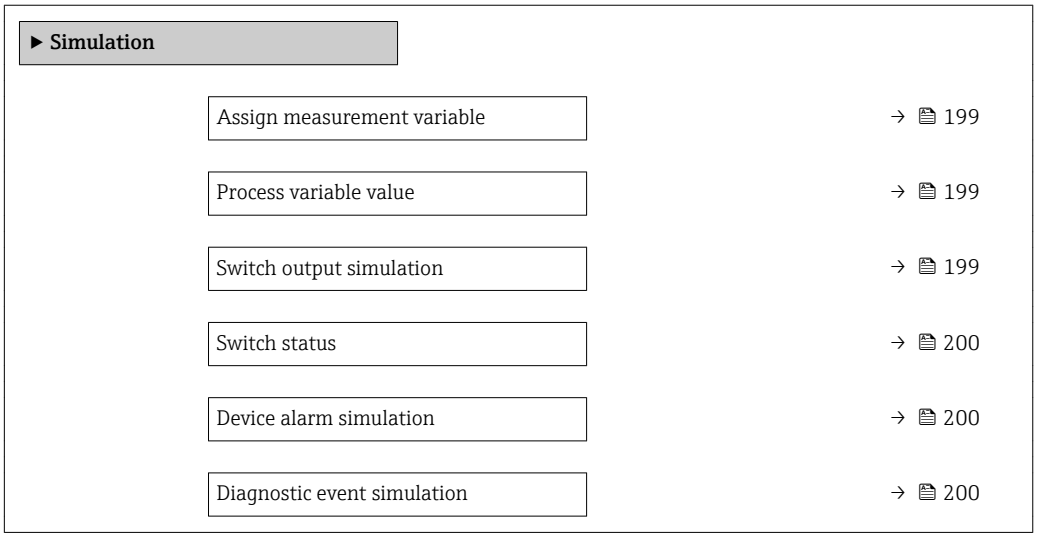
The **Simulation** submenu is used to simulate specific measuring values or other conditions. This helps to check the correct configuration of the device and connected control units.

Conditions which can be simulated

Condition to be simulated	Associated parameters
Specific value of a process variable	▪ Assign measurement variable (→ 199) ▪ Process variable value (→ 199)
Specific state of the switch output	▪ Switch output simulation (→ 199) ▪ Switch status (→ 200)
Existence of an alarm	Device alarm simulation (→ 200)
Existence of a specific diagnostic message	Diagnostic event simulation (→ 200)

Structure of the submenu

Navigation Expert → Diagnostics → Simulation



Description of parameters

Navigation Expert → Diagnostics → Simulation

Assign measurement variable

Navigation Expert → Diagnostics → Simulation → Assign measurement variable

Selection
- Off
- Level
- Interface *
- Thickness upper layer *
- Level linearized
- Interface linearized
- Thickness linearized

Factory setting Off

Additional information
- The value of the variable to be simulated is defined in the **Process variable value** parameter (→ 199).
- If **Assign measurement variable ≠ Off**, a simulation is active. This is indicated by a diagnotic message of the *Function check (C)* category.

Process variable value

Navigation Expert → Diagnostics → Simulation → Process variable value

Prerequisite **Assign measurement variable (→ 199) ≠ Off**

User entry Signed floating-point number

Factory setting 0

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 output simulation

Description Switch the simulation of the switch output on and off.

Selection
- Off
- On

* Visibility depends on order options or device settings

Factory setting Off

Switch status

Navigation Expert → Diagnostics → Simulation → Switch status

Prerequisite **Switch output simulation (→ 199) = On**

Description Current status of the switch output..

Selection
- Open
- Closed

Factory setting Open

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 → Device alarm simulation

Description Switch the device alarm on and off.

Selection
- Off
- On

Factory setting Off

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 diagnostic message **C484 Failure mode simulation**.

Diagnostic event simulation

Navigation Expert → Diagnostics → Simulation → Diagnostic event simulation

Description Select the diagnostic event to be simulated. Note: To terminate the simulation, select 'Off'..

Factory setting 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 device check

Description Start a device check.

Selection
- No
- Yes

Factory setting No

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

Result device check

Navigation Diagnostics → Device check → Result device 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.

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 (→ 121)** = **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

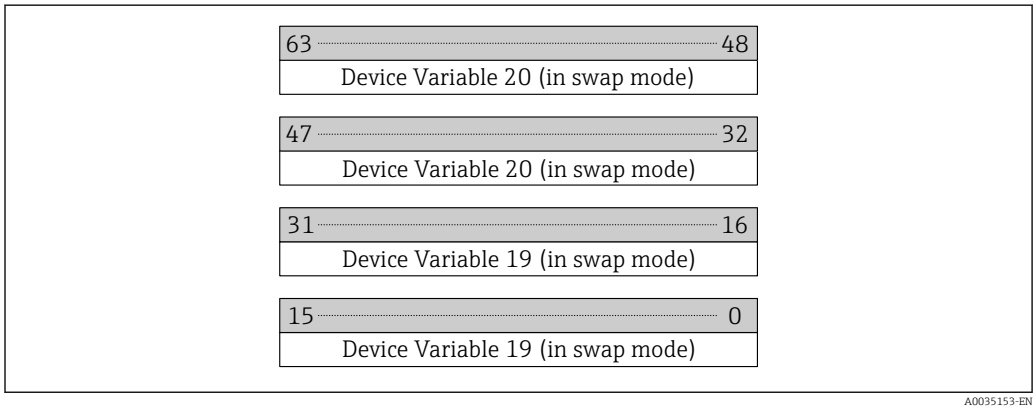
15.5 Modbus register assignment

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" → 🖹 205
114	Diagnostics	UINT64	CDAB	See "Format of the diagnostic bytes" → 🖹 204
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" → 🖹 205
1314	Diagnostics	UINT64	CDAB	See "Format of the diagnostic bytes" → 🖹 204
1400	Old status	UINT32	-	All zeros
1402	Primary variable (PV)	UINT32	CDAB	First HART variable
1404	Status	UINT64	-	See "Format of the status bytes" → 🖹 205
1414	Secondary variable (SV)	UINT32	CDAB	Second HART variable
1416	Status	UINT64	-	See "Format of the status bytes" → 🖹 205
1426	Tertiary variable (TV)	UINT32	CDAB	Third HART variable
1428	Status	UINT64	-	See "Format of the status bytes" → 🖹 205
1438	Quaternary variable (QV)	UINT32	CDAB	Fourth HART variable
1440	Status	UINT64	-	See "Format of the status bytes" → 🖹 205
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" → 205
2014	Diagnostics	UINT64	ABCD	See "Format of the diagnostic bytes" → 204
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" → 205
2114	Diagnostics	UINT64	DCBA	See "Format of the diagnostic bytes" → 204
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" → 205
2214	Diagnostics	UINT64	BADC	See "Format of the diagnostic bytes" → 204

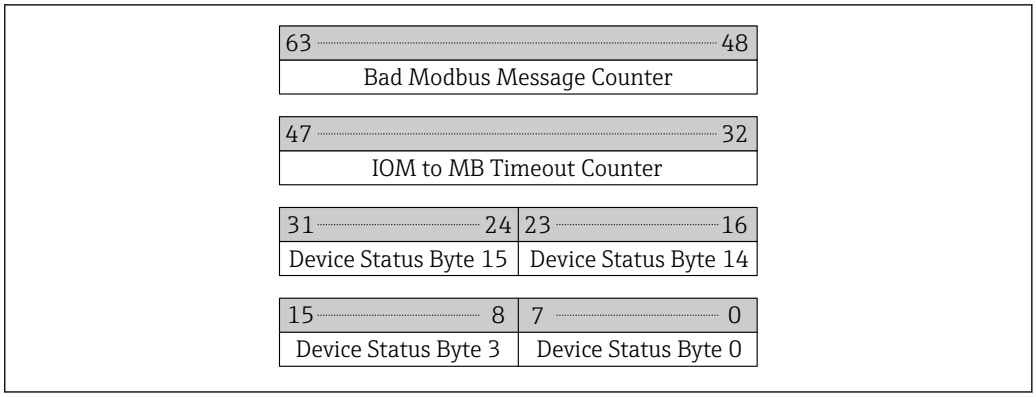
15.5.2 Format of the diagnostic bytes



A0035153-EN

"Device Variable 19" and "Device Variable 20" are obtained from HART command 9.

15.5.3 Format of the status bytes



A0035152-EN

The device status is obtained 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 to annunciate to the user there is an issue 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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