Operating Instructions Levelflex FMP51, FMP52, FMP54 HART

Guided wave radar



BA01001F/00/EN/24.22-00

01.03.zz (Device firmware)

71603670 2022-12-13





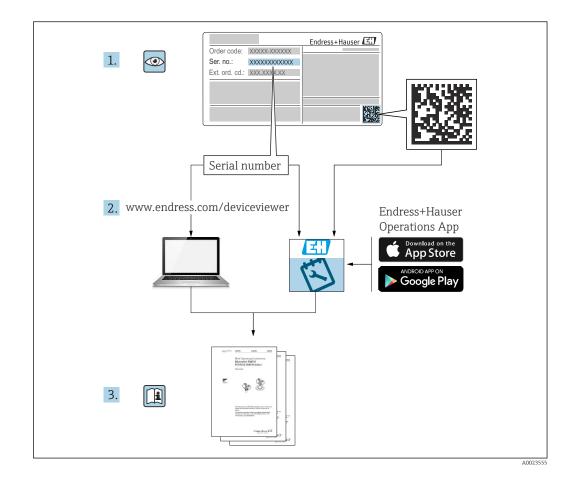


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1 Important document information

1.1 Purpose of this document

These Operating Instructions contain all the information that is required in the 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

DANGER

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

WARNING

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

A CAUTION

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

NOTICE

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

1.2.2 Electrical symbols

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Alternating current

\sim

Direct current and alternating current

Direct current

Ŧ

Ground connection

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

Protective earth (PE)

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

The ground terminals are located on the interior and exterior of the device:

- Interior ground terminal: protective earth is connected to the mains supply.
- Exterior ground terminal: device is connected to the plant grounding system.

1.2.3 Tool symbols

● ✓
Phillips head screwdriver

00

Flat blade screwdriver

0

Torx screwdriver

⊖ ∉ Allen key

ණ් Open-ended wrench

1.2.4 Symbols for certain types of information and graphics

Permitted

Procedures, processes or actions that are permitted

✓ ✓ Preferred

Procedures, processes or actions that are preferred

Forbidden Procedures, processes or actions that are forbidden

Tip Indicates additional information

Reference to documentation

Reference to graphic

Notice or individual step to be observed

1., 2., 3. Series of steps

L► Result of a step

Visual inspection

Operation via operating tool

A

Write-protected parameter

1, 2, 3, ... Item numbers

A, B, C, ... Views

 $\underline{\Lambda} \rightarrow \square$ 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 Documentation

The following types of documentation are available in the Download Area of the Endress +Hauser website (www.endress.com/downloads):

- For an overview of the scope of the associated Technical Documentation, refer to the following:
 - Device Viewer (www.endress.com/deviceviewer): Enter the serial number from the nameplate
 - *Endress+Hauser Operations app*: Enter serial number from nameplate or scan matrix code on nameplate.

1.3.1 Technical Information (TI)

Planning aid

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.

1.3.2 Brief Operating Instructions (KA)

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.

1.3.3 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.

The nameplate indicates the Safety Instructions (XA) that are relevant to the device.

1.3.4 Functional Safety Manual (FY)

Depending on the SIL approval, the Functional Safety Manual (FY) is an integral part of the Operating Instructions and applies in addition to the Operating Instructions, Technical Information and ATEX Safety Instructions.

The different requirements that apply for the protective function are described in the Functional Safety Manual (FY).

1.4 Terms and abbreviations

BA

Document type "Operating Instructions"

KA

Document type "Brief Operating Instructions"

ΤI

Document type "Technical Information"

SD

Document type "Special Documentation"

XA

Document type "Safety Instructions"

PN

Nominal pressure

MWP

Maximum working pressure The MWP is indicated on the nameplate.

ToF

Time of Flight

FieldCare

Scalable software tool for device configuration and integrated plant asset management solutions

DeviceCare

Universal configuration software for Endress+Hauser HART, PROFIBUS, FOUNDATION Fieldbus and Ethernet field devices

DTM

Device Type Manager

DD

Device Description for HART communication protocol

$\epsilon_{\rm r}$ (Dk value)

Relative dielectric constant

PLC

Programmable logic controller (PLC)

CDI

Common Data Interface

Operating tool

The term "operating tool" is used in place of the following operating software:

- FieldCare / DeviceCare, for operation via HART communication and PC
- SmartBlue app, for operation using an Android or iOS smartphone or tablet

BD

Blocking Distance; no signals are analyzed within the BD.

PLC

Programmable logic controller (PLC)

CDI

Common Data Interface

PFS

Pulse Frequency Status (Switch output)

1.5 Registered trademarks

HART®

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2 Basic safety instructions

2.1 Requirements for the personnel

The personnel for installation, commissioning, diagnostics and maintenance must fulfill the following requirements:

- Trained, qualified specialists must have a relevant qualification for this specific function and task.
- ► Are authorized by the plant owner/operator.
- Are familiar with federal/national regulations.
- Before starting work, read and understand the instructions in the manual and supplementary documentation as well as the certificates (depending on the application).
- ► Follow instructions and comply with basic conditions.

The operating personnel must fulfill the following requirements:

- Are instructed and authorized according to the requirements of the task by the facility's owner-operator.
- ► Follow the instructions in this manual.

2.2 Intended use

Application and media

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

If the limit values specified in the "Technical data" and the conditions listed in the instructions and additional documentation are observed, the measuring device may be used for the following measurements only:

- Measured process variables: level and/or interface height
- Calculable process variables: volume or mass in any shape of vessel (calculated from the level by the linearization functionality)

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

- Use the measuring device only for media to which the process-wetted materials have an adequate level of resistance.
- Observe the limit values in the "Technical data".

Incorrect use

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

Clarification of borderline cases:

 For special fluids and fluids for cleaning, Endress+Hauser is glad to provide assistance in verifying the corrosion resistance of fluid-wetted materials, but does not accept any warranty or liability.

Residual risks

Due to heat transfer from the process as well as power loss in the electronics, the temperature of the electronics housing and the assemblies contained therein (e.g. display module, main electronics module and I/O electronics module) may rise up to 80 $^{\circ}$ C (176 $^{\circ}$ F). When in operation, the sensor may reach a temperature close to the medium temperature.

Danger of burns from contact with surfaces!

 In the event of high medium temperatures, ensure protection against contact to prevent burns.

2.3 Workplace safety

When working on and with the device:

▶ Wear the required protective equipment according to federal or national regulations.

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

When loosening the joints between the individual parts of the probe rod, wear appropriate protective equipment according to the medium.

2.4 Operational safety

Risk of injury!

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

Modifications to the device

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

▶ If modifications are nevertheless required, consult with the manufacturer.

Repair

To ensure continued operational safety and reliability:

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

Hazardous area

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

- Check the nameplate to verify whether the ordered device can be put to its intended use in the hazardous area.
- Observe the specifications in the separate supplementary documentation, which is an integral part of this manual.

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 the general safety standards and legal requirements.

NOTICE

Loss of degree of protection by opening of the device in humid environments

 If the device is opened in a humid environment, the degree of protection indicated on the nameplate is no longer valid. This may also impair the safe operation of the device.

2.5.1 CE mark

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

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

2.5.2 EAC conformity

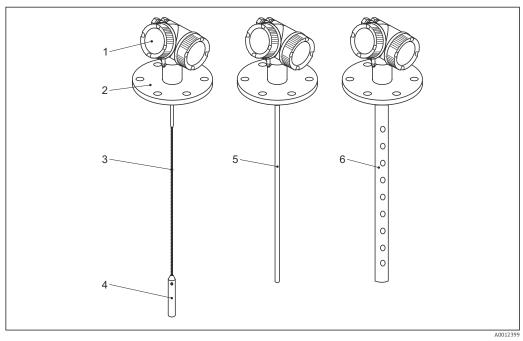
The measuring system meets the legal requirements of the applicable EAC guidelines. These are listed in the corresponding EAC Declaration of Conformity along with the standards applied.

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

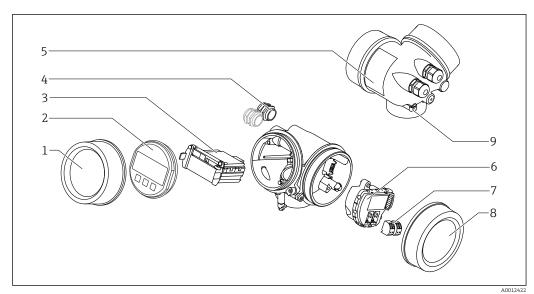
3 Product description

3.1 Product design

3.1.1 Levelflex FMP51/FMP52/FMP54/FMP55



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

4 Incoming acceptance and product identification

4.1 Incoming acceptance

Check the following during incoming acceptance:

- Are the order codes on the delivery note and the product sticker identical?
- Are the goods undamaged?
- Do the nameplate data match the ordering information on the delivery note?
- If required (see nameplate): are the Safety Instructions (XA) provided?

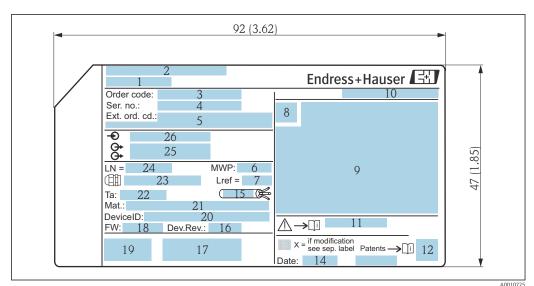
If one of these conditions is not met, please contact your Endress+Hauser sales office.

4.2 Product identification

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

Nameplate specifications

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



4.2.1 Nameplate

- **■** 3 Nameplate of the Levelflex; engineering unit: mm (in)
- 1 Device name
- 2 Manufacturer address
- 3 Order code
- 4 Serial number (Ser. no.)
- 5 Extended order code (Ext. ord. cd.)
- 6 Process pressure
- 7 Gas phase compensation: reference length
- 8 Certificate symbol
- 9 Certificate- and approval-related 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 protocol): e.g. SIL, PROFIBUS
- 18 Firmware version (FW)
- 19 CE mark, C-Tick
- 20 DeviceID
- 21 Materials in contact with process
- 22 Permitted ambient temperature (T_a)
- 23 Size of the cable gland thread
- 24 Probe length
- 25 Signal outputs
- 26 Supply voltage
- Up to 33 characters of the extended order code are indicated on the nameplate. If the extended order code contains additional characters, these cannot be displayed. However, the complete extended order code can also be displayed via the device operating menu: **Extended order code 1 to 3** parameter

5 Storage, transport

5.1 Storage temperature

- Permitted storage temperature: -40 to +80 °C (-40 to +176 °F)
- Use original packaging.
- Option for FMP51 and FMP54: -50 to +80 °C (-58 to +176 °F) This range applies if the option JN "Transmitter ambient temperature" -50 °C (-58 °F) was selected in order code 580 "Test, Certificate". If the temperature is permanently below -40 °C (-40 °F), higher failure rates can be expected.

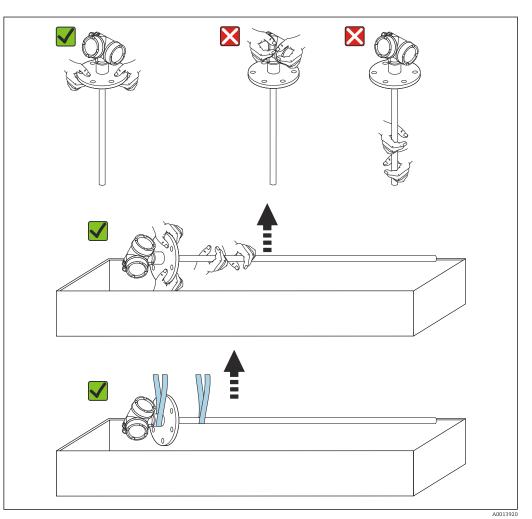
5.2 Transporting the product to the measuring point

WARNING

Housing or rod may become damaged or pull off.

Danger of injury!

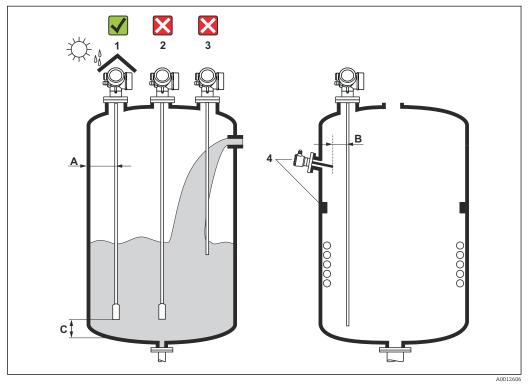
- Transport the measuring device to the measuring point in its original packaging or by the process connection.
- Always secure lifting equipment (slings, eyes, etc.) at the process connection and never lift the device by the electronic housing or probe. Pay attention to the center of gravity of the device so that it does not tilt or slip unintentionally.
- Follow the safety instructions and transport conditions for devices weighing more than 18 kg (39.6 lbs) (IEC 61010).



6 Mounting

6.1 Mounting requirements

6.1.1 Suitable mounting position



Installation conditions for Levelflex

Spacing requirements when mounting

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

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

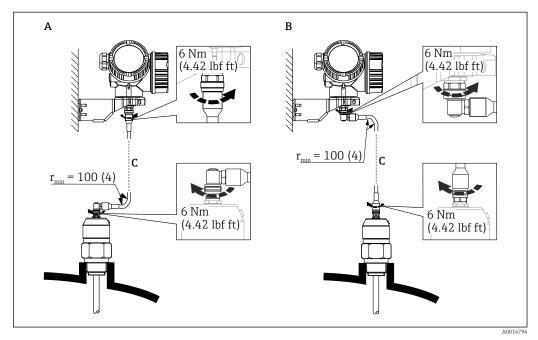
Additional conditions

- When mounting outdoors, a weather protection cover (1) can be used to protect the device against extreme weather conditions.
- In metallic vessels, preferably do not mount the probe in the center of the vessel (2), as this would lead to increased interference echoes.
 If a central mounting position cannot be avoided, it is essential to perform interference
- echo suppression (mapping) after commissioning the device.
- Do not mount the probe in the filling curtain (3).
- Avoid buckling the rope probe during installation or operation (e.g. as a result of product movement against silo wall) by selecting a suitable mounting location.
- In the case of freely suspended rope probes (probe end not fixed at the bottom), the distance between the probe rope and internal fittings, which can change due to the movement of the product, must never be less than 300 mm (12 in). Occasional contact between the probe end weight and the cone of the vessel, however, does not influence the measurement provided that the dielectric constant is at least DC = 1.8.
- When the housing is mounted in a recess (e.g. in a concrete ceiling), observe a minimum distance of 100 mm (4 in) between the cover of the connection compartment/electronics compartment and the wall. Otherwise the connection compartment/electronics compartment will not be accessible after installation.

6.1.2 Mounting under confined conditions

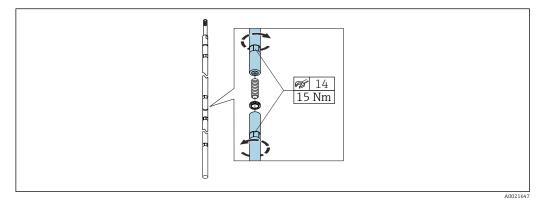
Mounting with remote probe

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



- A Angled plug at the probe
- B Angled plug at the electronics housing
- C Length of the remote cable as ordered
- Product structure, feature 600 "Probe design":
 - Version MB "Sensor remote, 3m cable"
 - Version MC "Sensor remote, 6m cable"
 - Version MD "Sensor remote, 9m cable"
- The connecting cable is included in the delivery with these versions. Minimum bending radius: 100 mm (4 inch)
- The mounting bracket for the electronics housing is included in the delivery with these versions. Mounting options:
 - Wall mounting
 - Mounting on DN32 to DN50 (1-1/4 to 2 inch) post or pipe
- The connection cable has one straight plug and one plug angled at 90°. Depending on the local conditions the angled plug can be connected at the probe or at the electronics housing.
- The probe, electronics and connection cable are mutually compatible and bear a common serial number. Only components with the same serial number may be connected to one another.

Separable probes



The use of separable rod probes (\emptyset 16 mm) is advisable in confined mounting conditions (limited distance to the ceiling).

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

The joints between the individual rod segments are secured by the enclosed Nord Lock washers. Install the pre-assembled washers in pairs, cam face to cam face.

6.1.3 Notes on the mechanical load of the probe

Tensile loading capacity of rope probes

FMP51

Rope 4mm (1/6") 316 5 kN

Rope 4mm (1/6") Alloy C 5 kN

Rope 4mm (1/6") PFA>316L 1 kN

FMP52

Rope 4mm (1/6") PFA>316 2 kN

FMP54

Rope 4mm (1/6") 316 10 kN

Lateral loading capacity (flexural strength) of rod probes

FMP51

Rod 8mm (1/3") 316L 10 Nm

Rod 12mm (1/2") 316L 30 Nm

Rod 12mm (1/2") AlloyC 30 Nm

Rod 16mm (0.63") 316L separable 30 Nm

FMP52

Rod 16mm (0.63") PFA>316L 30 Nm

FMP54

Rod 16mm (0.63") 316L 30 Nm

Rod 16mm (0.63") 316L separable 30 Nm

Lateral load (bending moment) from flow conditions

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

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

With:

c_w: coefficient of friction

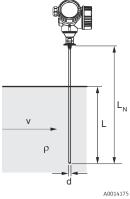
 ρ [kg/m³]: density of the medium

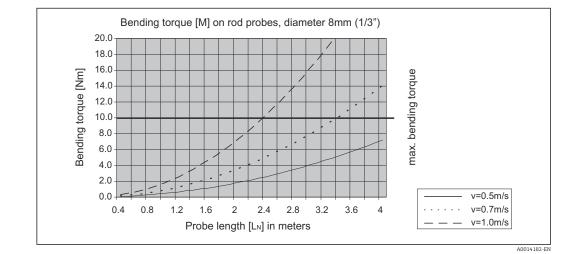
- v [m/s]: flow velocity of the medium, perpendicular to the probe rod
- d [m]: diameter of the probe rod

L [m]: level

LN [m]: probe length

Sample calculation		
Coefficient of friction $\mathbf{c}_{\mathbf{w}}$	0.9 (assuming turbulent flow - high Reynolds number)	
Density ρ [kg/m ³]	1000 (e.g. water)	
Probe diameter d [m]	0.008	
$\boldsymbol{L} = \boldsymbol{L}_N$	(unfavorable conditions)	





6.1.4 Lateral loading capacity (flexural strength) of coax probes

FMP51

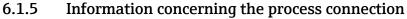
Probe Ø 21.3 mm 316L 60 Nm

Probe Ø 42.4 mm 316L 300 Nm

Probe Ø 42.4 mm AlloyC 300 Nm

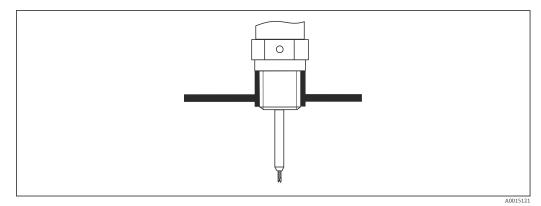
FMP54

Probe Ø 42.4 mm 316L 300 Nm



Probes are mounted on the process connection with threaded connections or flanges. If there is the danger with this installation that the probe end moves so much that it occasionally touches the vessel floor or cone, the probe may need to be shortened at the lower end and fixed in place.

Threaded connection



☑ 5 Mounting with threaded connection; flush with the vessel ceiling

Seal

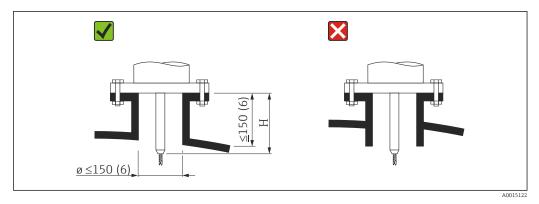
The thread and the type of seal comply with DIN 3852 Part 2, screwed plug, form A.

The following types of sealing ring can be used:

- For thread G3/4": According to DIN 7603 with dimensions 27 mm \times 32 mm
- \blacksquare For thread G1/-1/2": According to DIN 7603 with dimensions 48 mm $\,\times\,$ 55 mm

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

Nozzle installation



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

- Permissible nozzle diameter: $\leq 150 \text{ mm} (6 \text{ in})$ For larger diameters, the near-range measuring capability may be reduced. For large nozzles, see the section "Mounting in nozzles $\geq \text{DN300}$ "
- Permissible nozzle height: ≤ 150 mm (6 in) For larger heights, the near-range measuring capability may be reduced. Larger nozzle heights are possible in special cases (on request), see sections "Centering rod for FMP51 and FMP52" and "Rod extension/centering device HMP40 for FMP54".
- The end of the nozzle should be flush with the tank ceiling in order to avoid ringing effects.

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

Centering rod

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

The length of the optional centering rod determines the maximum nozzle height.

Rod extension/centering device HMP40 for FMP54

For FMP54 with rope probes, the rod extension/centering device HMP40 is available as an accessory. It must be used if the probe rope would otherwise come into contact with the lower edge of the nozzle.

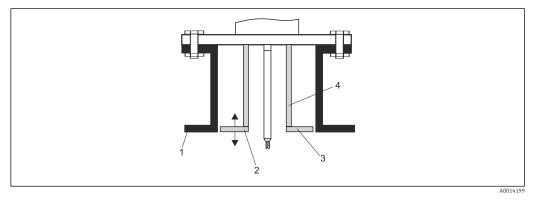
This accessory consists of the extension rod, corresponding to the nozzle height, on which a centering disk is also mounted if the nozzles are narrow or when used in bulk solids.

This component is delivered separately from the device. Order a correspondingly shorter probe length.

Only use centering disks with small diameters (DN40 and DN50) if there is no significant build-up in the nozzle above the disk. The nozzle must not become clogged with product.

Mounting in nozzles ≥ DN300

If installation in nozzles \geq 300 mm (12 in) is unavoidable, installation must be carried out in accordance with the following diagram in order to avoid interference signals in the near range.



- 1 Lower edge of the nozzle
- 2 Approximately flush with the lower edge of the nozzle (±50 mm)
- 3 Plate, nozzle Ø 300 mm (12 in) = plate Ø 280 mm (11 in); nozzle Ø \geq 400 mm (16 in) = plate Ø \geq 350 mm (14 in)
- 4 Pipe Ø 150 to 180 mm

6.1.6 Mounting cladded flanges

Note the following for cladded flanges:

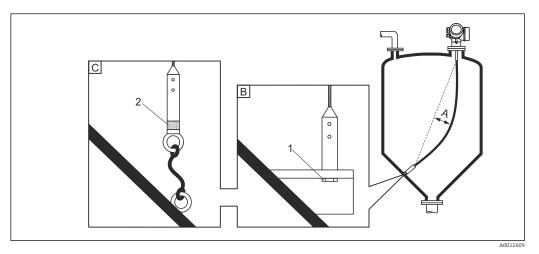
- Use the same number of flange screws as the number of flange bores provided.
 - Tighten the screws with the necessary torque (see Table).
 - Retighten after 24 hours or after the first temperature cycle.
 - Depending on the process pressure and temperature, check and retighten the screws, where necessary,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

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

Flange size	Number of screws	Tightening torque	
EN			
DN40/PN40	4	35 to 55 Nm	
DN50/PN16	4	45 to 65 Nm	
DN50/PN40	4	45 to 65 Nm	
DN80/PN16	8	40 to 55 Nm	
DN80/PN40	8	40 to 55 Nm	
DN100/PN16	8	40 to 60 Nm	
DN100/PN40	8	55 to 80 Nm	
DN150/PN16	8	75 to 115 Nm	
DN150/PN40	8	95 to 145 Nm	
ASME			
1½"/150lbs	4	20 to 30 Nm	
1½"/300lbs	4	30 to 40 Nm	
2"/150lbs	4	40 to 55 Nm	
2"/300lbs	8	20 to 30 Nm	
3"/150lbs	4	65 to 95 Nm	
3"/300lbs	8	40 to 55 Nm	
4"/150lbs	8	45 to 70 Nm	
4"/300lbs	8	55 to 80 Nm	
6"/150lbs	8	85 to 125 Nm	
6"/300lbs	12	60 to 90 Nm	
JIS			
10K 40A	4	30 to 45 Nm	
10K 50A	4	40 to 60 Nm	
10K 80A	8	25 to 35 Nm	
10K 100A	8	35 to 55 Nm	
10K 100A	8	75 to 115 Nm	

6.1.7 Securing the probe

Securing rope probes

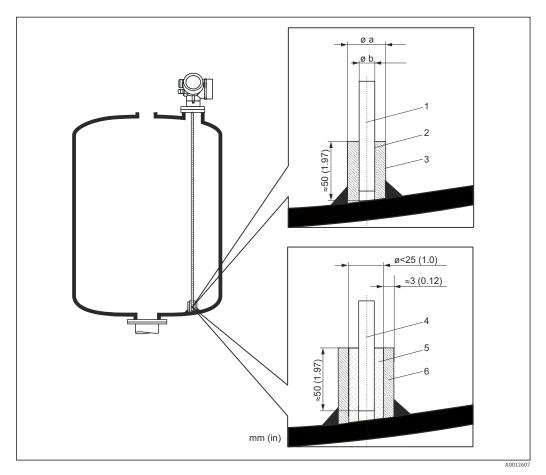


- A Rope sag: $\geq 10 \text{ mm}/(1 \text{ m probe length}) [0.12 \text{ in}/(1 \text{ ft probe length})]$
- B Reliably grounded end of probe
- C Reliably insulated end of probe
- 1 Fastener in female thread of probe end weight
- 2 Insulated fastening kit
- The end of the rope probe must be secured (fixed down) under the following conditions: If the probe would otherwise temporarily come into contact with the vessel wall, the cone, internal fittings/beams or another part of the installation
- A female thread is provided in the probe weight to secure the end of the probe: Rope 4 mm (1/6"), 316: M 14
- When fixed down, the end of the probe must be either reliably grounded or reliably insulated. Use an insulated fastening kit if it is not otherwise possible to secure the probe with a reliably insulated connection.
- If grounded fastening is used, the search for a positive probe end echo must be activated. Otherwise, automatic probe length correction is not possible. Navigation: Expert → Sensor → EOP evaluation → EOP search mode Setting: **Positive EOP** option
- To prevent an extremely high tensile load (e.g. due to thermal expansion) and the risk of the rope breaking, the rope must be slack. Required sag: ≥ 10 mm/(1 m rope length) [0.12 in/(1 ft rope length)].

Pay attention to the tensile loading capacity of rope probes.

Securing rod probes

- For WHG approval: A support is required for probe lengths \geq 3 m (10 ft).
- In general, rod probes must be secured in the event of horizontal flow (e.g. from an agitator) or strong vibrations.
- Only secure rod probes directly at the end of the probe.



Unit of measurement mm (in)

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

Probe Ø 8 mm (0.31 in)

- a < Ø 14 mm (0.55 in)
- b = Ø 8.5 mm (0.34 in)

Probe Ø 12 mm (0.47 in)

- a < Ø 20 mm (0.78 in)
- b = Ø 12.5 mm (0.52 in)

Probe Ø 16 mm (0.63 in)

- a < Ø 26 mm (1.02 in)
- b = Ø 16.5 mm (0.65 in)

NOTICE

Poor grounding of the probe end may cause incorrect measurements.

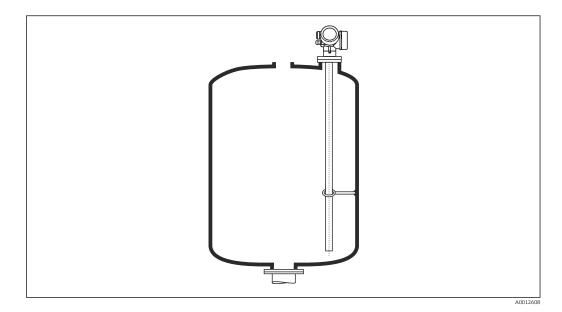
 Use a sleeve with a narrow bore to ensure good electrical contact between the sleeve and the probe rod.

NOTICE

Welding can damage the main electronics module.
Before welding: Ground the probe rod and remove the electronics.

Securing coax probes

For WHG approval: A support is required for probe lengths \ge 3 m (10 ft).



Coax probes can be secured (fixed) at any point in the ground tube.

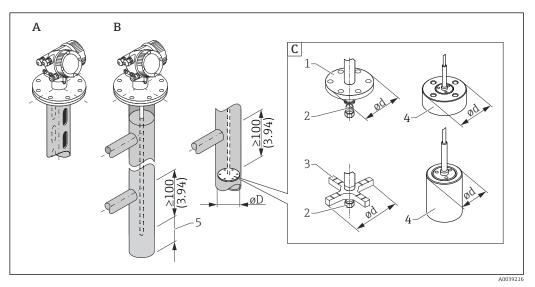
6.1.8 Special installation situations

Bypasses and stilling wells



The use of centering disks/stars/weights (available as accessories) is recommended in bypass and stilling well applications.

As the measuring signal penetrates many plastics, installation in plastic bypasses or stilling wells can produce incorrect results. For this reason use a metal bypass or stilling well.



፼ 6 Engineering unit: mm (in)

- Α Mounting in stilling well
- Mounting in bypass R
- С Centering disk/centering star/centering weight
- 1 Metal centering disk (316L) for level measurement
- 2 Securing screw; torque: 25 Nm ± 5 Nm
- Non-metal centering star (PEEK, PFA) preferred for interface measurement 3
- 4 Metal centering weight (316L) for level measurement
- 5 Minimum distance between probe end and lower edge of bypass 10 mm (0.4 in)
- Pipe diameter: > 40 mm (1.6 in) (for rod probes).
- A rod probe can be installed in pipes with a diameter of up to 150 mm (6 in). The use of a coax probe is recommended for larger pipe diameters.
- Side outlets, holes, slots and welds with a maximum inward projection of 5 mm (0.2 in) - do not affect the measurement.
- There should not be any changes in the diameter of the pipe.
- The probe must be 100 mm (4 in) longer than the lower outlet.

- The probes must not touch the pipe wall within the measuring range. Support or brace the probe if necessary. All rope probes are prepared for bracing in vessels (tensioning weight with anchor hole).
- If a metal centering disk is mounted at the end of the probe rod, the signal for detecting the end of the probe is reliably defined.
 Note: The non-metal centering stars made of PEEK or PFA are recommended for interface measurements. When using metal centering disks, it is important to ensure that the lower medium covers the centering disk at all times. Otherwise, incorrect
- interface measurements can result.Coax probes can be used within any restrictions provided that the pipe diameter permits their installation.

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

Over time, the bypass fills with condensate up to the lower outlet. When levels are low, the level echo is masked by the echo of the condensate as a result. In this range, the level of the condensate is output and the correct value is only output when levels are higher. For this reason, ensure that the lower outlet is 100 mm (4 in) below the lowest level to be measured and fit a metal centering disk at the level of the lower edge of the lower outlet.

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

Assignment of centering disk/centering star/centering weight to the pipe diameter

Metal centering disk (316L)

for level measurement

Rod centering disk (Ød) 45 mm (1.77 in) for pipe diameter (ØD) DN50/2" to DN65/2½"

Rod centering disk (Ød) 75 mm (2.95 in) for pipe diameter (ØD) DN80/3" to DN100/4"

Rope centering disk (Ød) 75 mm (2.95 in)

for pipe diameter (ØD) DN80/3" to DN100/4"

Metal centering weight (316L)

for level measurement

Rope centering weight (Ød) 45 mm (1.77 in), h 60 mm (2.36 in) for pipe diameter (ØD) DN50/2"

Rope centering weight (Ød) 75 mm (2.95 in), h 30 mm (1.81 in) for pipe diameter (ØD)

DN80/3"

Rope centering weight (Ød) 95 mm (3.74 in), h 30 mm (1.81 in) for pipe diameter (ØD) DN100/4"

Non-metal centering star (PEEK)

For level and interface measurement, operating temperature: -60 to +250 °C (-76 to 482 °F)

Rod centering star (Ød) 48 to 95 mm (1.89 to 3.74 in) for pipe diameter (ØD) \geq DN50/2"

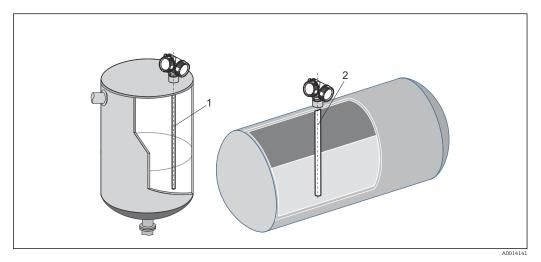
Non-metal centering star (PFA)

For level and interface measurement, operating temperature: -200 to $+250\ensuremath{\,^\circ C}$ (-328 to +482 $\ensuremath{\,^\circ F}$)

Rod centering star (Ød) 37 mm (1.46 in)

for pipe diameter (\emptyset D) \ge 40 mm (1.57 in)

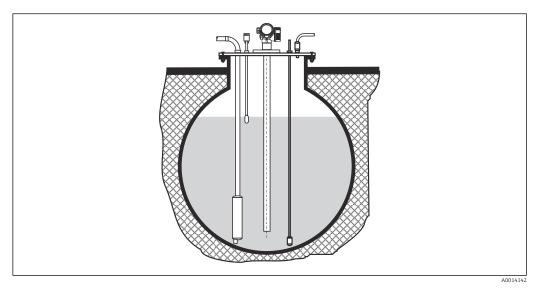
Horizontal cylindrical and vertical tanks



Coax probe 1

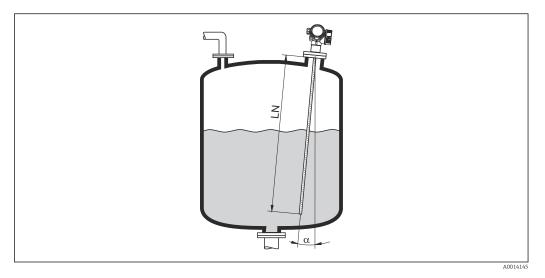
- Any distance from wall provided occasional contact is avoided.
 Use a coax probe (1) if installing in tanks with many internal fixtures or internal fixtures located close to the probe.

Underground tanks



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

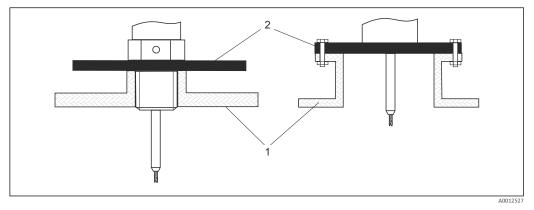
Mounting at an angle



- For mechanical reasons, the probe should be installed as vertically as possible.
- If the probe is installed at an angle, the length of the probe must be reduced depending on the angle of installation.

 - α 5 °: LN_{max.} 4 m (13.1 ft) α 10 °: LN_{max.} 2 m (6.6 ft) α 30 °: LN_{max.} 1 m (3.3 ft)

Non-metal vessels



1 Non-metal vessel

2 Metal sheet or metal flange

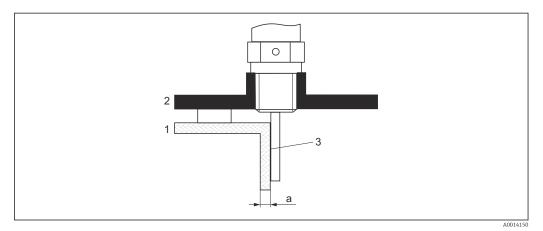
To ensure good measurement results when mounting on non-metal vessels

- Use a device with a metal flange (minimum size DN50/2").
- Alternatively: at the process connection, mount a metal sheet with a diameter of at least 200 mm (8 in) at a right angle to the probe.

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

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

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



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

Requirements

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

Note the following when mounting the device:

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

Adjustment when mounting on the vessel exterior

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

Compensation via gas phase compensation factor

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



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

1. Parameter Expert \rightarrow Sensor \rightarrow Gas phase compensation \rightarrow GPC mode

← Select the **Const. GPC factor** option.

Parameter Expert → Sensor → Gas phase compensation → Const. GPC factor
 Quotient: Enter "(actual probe length)/(measured probe length)".

Compensation via the calibration parameters

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

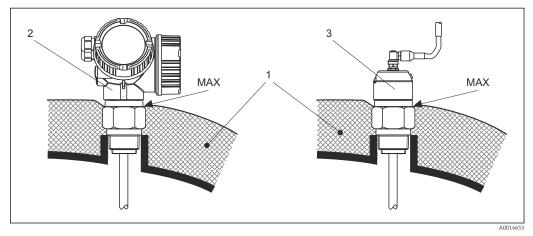
The device searches for the probe end echo in the differential curve. Therefore, the value of the measured probe length depends on the mapping curve. In order to obtain a more accurate value, it is advisable to determine the measured probe length manually using the envelope curve display in FieldCare.

1. Parameter Setup \rightarrow Empty calibration

- └ Increase the parameter value by the factor "(measured probe length)/(actual probe length)".
- 2. Parameter Setup \rightarrow Full calibration
 - └→ Increase the parameter value by the factor "(measured probe length)/(actual probe length)".
- Parameter Setup → Advanced setup → Probe settings → Probe length correction
 → Confirm probe length
 - └ Select the **Manual input** option.
- Parameter Setup → Advanced setup → Probe settings → Probe length correction
 → Present probe length
 - └ Enter the measured probe length.

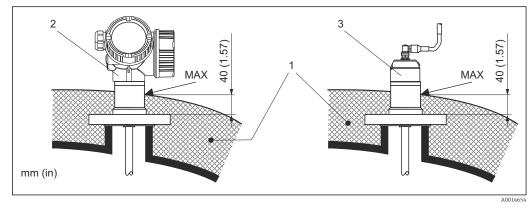
Vessel with thermal insulation

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



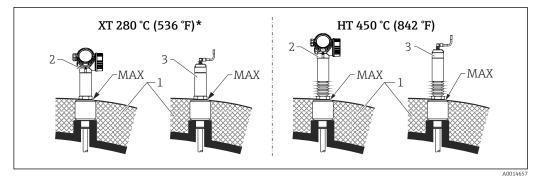
Process connection with thread

- 1 Vessel insulation
- 2 Compact device
- 3 Sensor, remote

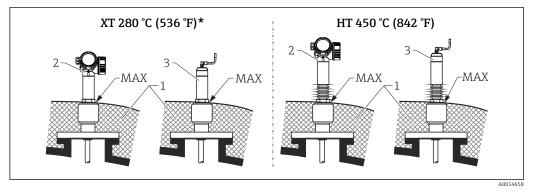


8 Process connection with flange

- 1 Vessel insulation
- 2 Compact device
- 3 Sensor, remote



- Process connection with thread sensor version XT and HT
- 1 Vessel insulation
- 2 Compact device
- 3 Sensor, remote
- * The XT version is not recommended for saturated steam above 200 °C (392 °F); the HT version should be used instead



■ 10 Process connection with flange - sensor version XT and HT

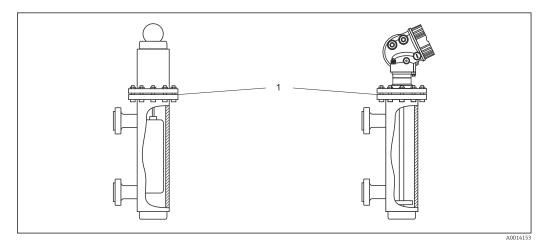
- 1 Vessel insulation
- 2 Compact device
- 3 Sensor, remote
- * The XT version is not recommended for saturated steam above 200 °C (392 °F); the HT version should be used instead

Replacing a displacer system in an existing displacer chamber

FMP51 and FMP54 are a perfect replacement for a conventional displacer system in an existing displacer chamber. Flanges that suit Fisher and Masoneilan displacer chambers are available for this purpose (special product for FMP51; feature 100 of the product structure, options LNJ, LPJ, LQJ for FMP54). Thanks to menu-guided local operation, commissioning the Levelflex only takes a few minutes. Replacement is also possible when partially filled, and wet calibration is not required.

Your benefits:

- No moving parts, therefore zero-maintenance operation.
- Not affected by process influences such as temperature, density, turbulence and vibrations.
- The rod probes can be easily shortened or replaced. Therefore, the probe can also be easily adjusted on site.



1 Flange of the displacer chamber

Planning instructions:

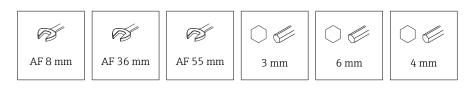
- In normal cases, use a rod probe. When installing into a metal displacer chamber up to 150 mm, you have all the advantages of a coax probe.
- Contact between the probe and the side wall must be avoided. Where necessary, use a centering disk or centering star at the bottom end of the probe.
- The centering disk or centering star must be adapted as accurately as possible to the internal diameter of the displacer chamber to also ensure correct operation around the probe end.

Additional information regarding interface measurement

- In the case of oil and water, the centering star should be positioned at the lower edge of the lower outlet (water level).
- There should not be any changes in the diameter of the pipe. Use the coax probe if necessary.
- It must be ensured that rod probes do not come into contact with the wall. Where necessary, use a centering star at the end of the probe.
- The non-metal centering stars made of PEEK or PFA are recommended for interface measurements. When using metal centering disks, it is important to ensure that the lower medium covers the centering disk at all times. Otherwise, incorrect interface measurements can result.

6.2 Mounting the measuring device

6.2.1 Tool list

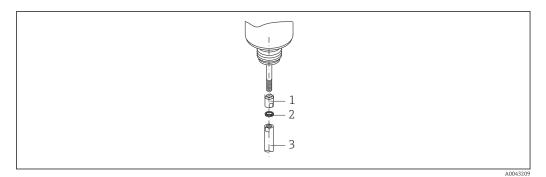


- To shorten rope probes: use a saw or bolt cutters
- To shorten rod or coax probes: use a saw
- For flanges and other process connections: use an appropriate mounting tool

6.2.2 Mounting the FMP54 rod probe

Coax probes are ready mounted and adjusted upon delivery. Once installed, they are ready for immediate use. Additional settings are not necessary.

FMP54 devices are supplied with the rod probe disassembled. The probe must be mounted as follows prior to installation:



1 Threaded sleeve

- 2 Nord Lock washers
- 3 Probe rod
- **1.** Screw the threaded sleeve onto the connection thread (M10x1) of the gland as far as the end stop. In doing so, ensure that the chamfer is oriented towards the gland.
- 2. Fit Nord Lock washers on the connection thread. Install the pre-assembled washers in pairs, cam face to cam face.
- **3.** Screw the probe rod onto the threaded bolt, hold it steady by the threaded sleeve with an open-end wrench (14 mm AF) and tighten at the wrench flats of the probe rod using an open-end wrench (14 mm AF). Torque 15 Nm.

6.2.3 Shortening the probe

Shortening rod probes

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

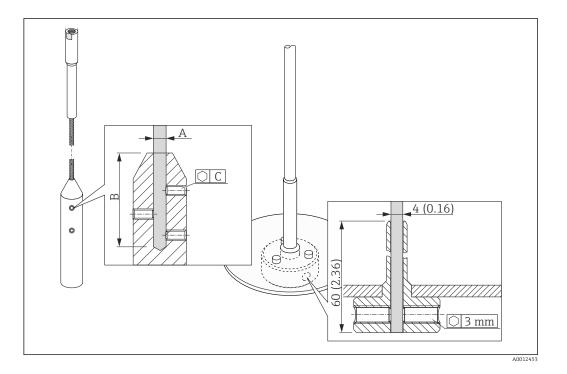
F Coated rod probes **cannot** be shortened.

Shortening rope probes

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



Coated rope probes **cannot** be shortened.



Rope material 316

- A:
- 4 mm (0.16 in)
- B:
 - 40 mm (1.6 in)
- C:
 - 3 mm; 5 Nm (3.69 lbf ft)
- 1. Using the Allen key, loosen the setscrews on the rope weight or on the fastener for the centering disk. Note: The setscrews have a clamping coating in order to prevent them from becoming loose accidentally. A higher torque is therefore required to loosen the screws.
- 2. Remove the released rope from the weight or from the sleeve.
- 3. Measure off the new rope length.
- 4. At the point to be shortened, wrap adhesive tape around the rope to prevent it from fraying.
- 5. Saw off the rope at a right angle or cut it off with a bolt cutter.
- 6. Insert the rope completely into the weight or sleeve.
- 7. Screw the setscrews back into place. Due to the clamping coating of the setscrews, it is not necessary to apply a locking compound.

Shortening coax probes

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

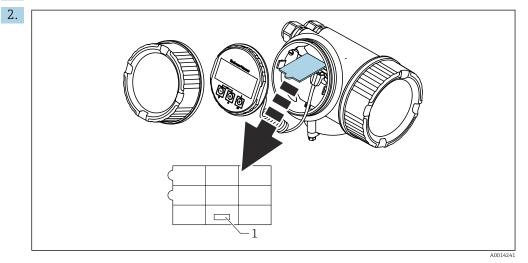
Coax probes can be shortened by a maximum of 80 mm (3.2 in) from the bottom. They have centering devices on the inside to secure the rod centrally in the pipe. A raised edge holds the centering devices in place on the rod. It is possible to shorten the probe up to approx. 10 mm (0.4 in) below the centering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

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

Entering the new probe length

After shortening the probe:

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



1 Field for the new probe length

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

6.2.4 FMP54 with gas phase compensation: Mounting the probe rod

This section only applies to the FMP54 with the gas phase compensation function (product structure: feature 540 "Application packages", option EF or EG)

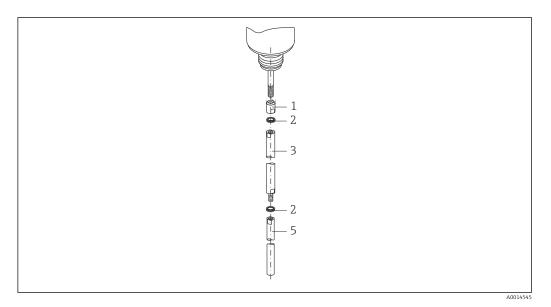
Coax probes

Coax probes with reference reflection are ready mounted and adjusted upon delivery. Once installed, they are ready for immediate use. Additional settings are not necessary.

Rod probes

Rod probes with reference reflection are supplied with the rod probe disassembled. The rod probe must be mounted as follows prior to installation:

The joints between the individual rod segments are secured by the enclosed Nord Lock washers. Install the pre-assembled washers in pairs, cam face to cam face.



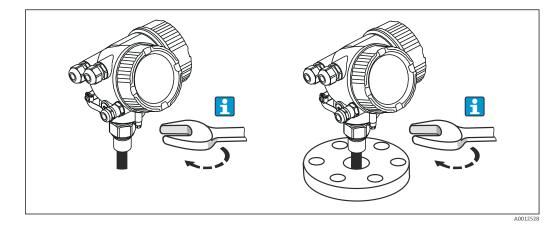
- 1 Threaded sleeve
- 2 Nord Lock washers
- 3 Probe rod; larger diameter
- 4 Probe rod; larger diameter

1. Screw the threaded sleeve onto the connection thread (M10x1) of the gland as far as the end stop. In doing so, ensure that the chamfer is oriented towards the gland.

- 2. Fit Nord Lock washers on the connection thread.
- **3.** Screw the probe rod with the larger diameter onto the connection thread and fasten it hand-tight.
- 4. Fit the second pair of Nord Lock washers on the threaded bolt.
- 5. Screw the probe rod with the smaller diameter onto the threaded bolt, hold it steady by the threaded sleeve with an open-end wrench (14 mm AF) and tighten at the wrench flats of the probe rod using an open-end wrench (14 mm AF). Torque 15 Nm.

After mounting the rod probe in the stilling well or bypass, check and - if necessary - correct the setting of the reference distance in the unpressurized state.

6.2.5 Mounting the device



Mounting devices with a threaded connection

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

- When screwing into place, turn by the hex bolt only:
 - Thread 3/4": 💉 36 mm
 - Thread 1-1/2": 💉 55 mm
 - Maximum permissible tightening torque:
 - Thread 3/4": 45 Nm
 - Thread 1-1/2": 450 Nm
 - Recommended torque when using the supplied aramid fiber seal and a process pressure of 40 bar (only FMP51, no seal is included with FMP54):
 - Thread 3/4": 25 Nm
 - Thread 1-1/2": 140 Nm
 - When installing in metal vessels, ensure there is good metal contact between the process connection and the vessel.

Mounting devices with a flange

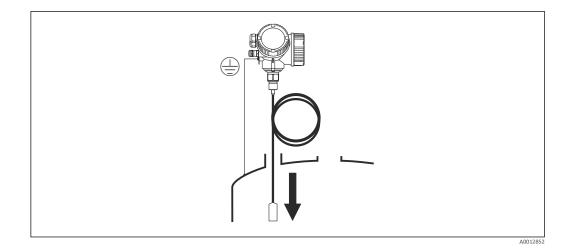
If a seal is used to mount the device, use uncoated metal screws to ensure good electrical contact between the process flange and the probe flange.

Mounting rope probes

NOTICE

Electrostatic discharge can damage the electronics.

• Ground the housing before lowering the rope probe into the vessel.



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

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

6.2.6 Mounting the "Sensor, remote" version

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

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

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

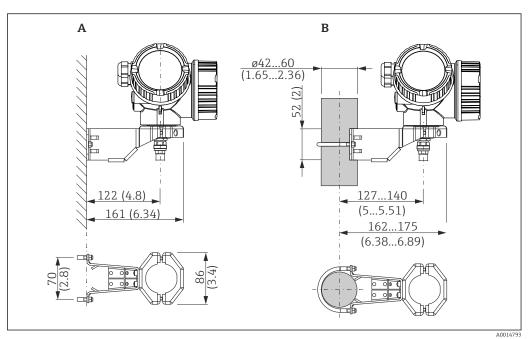
ACAUTION

Mechanical stress can damage the plugs of the connection cable or cause them to become loose.

- Mount the probe and the electronics housing securely before connecting the connecting cable.
- Lay the connecting cable in such a way that it is not exposed to mechanical stress. Minimum bending radius: 100 mm (4 in).
- ▶ When connecting the cable, connect the straight plug before you connect the angled plug. Torque for the union nuts of both plugs: 6 Nm.
- The probe, electronics and connection cable are mutually compatible and bear a common serial number. Only components with the same serial number may be connected to one another.

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

Mounting the electronics housing



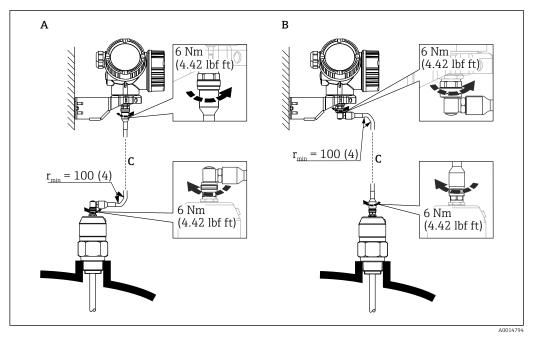
₪ 11 Mounting the electronics housing with the mounting bracket. Unit of measurement mm (in)

A Wall mounting

B Post mounting

Connecting the connecting cable

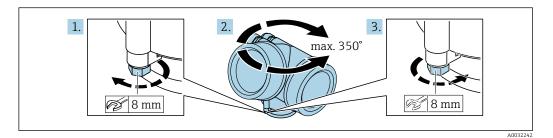




- I2 Connecting the connecting cable. The cable can be connected in the following ways:. Unit of measurement mm (in)
- A Angled plug at the probe
- B Angled plug at the electronics housing
- C Length of the remote cable as ordered

6.2.7 Turning the transmitter housing

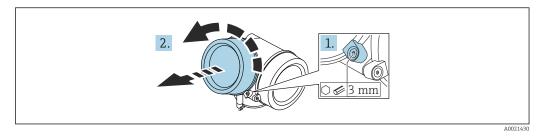
To provide easier access to the connection compartment or display module, the transmitter housing can be turned:



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

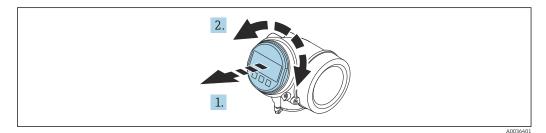
6.2.8 Turning the display

Opening the cover



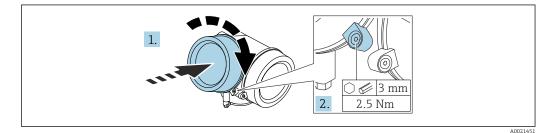
- 1. Loosen the screw of the securing clamp of the electronics compartment cover using an Allen key (3 mm) and turn the clamp 90 ° counterclockwise.
- 2. Unscrew the electronics compartment cover and check the cover seal; replace it if necessary.

Turning the display module



- 1. Pull out the display module with a gentle rotational movement.
- 2. Turn the display module to the desired position: Max. $8 \times 45^{\circ}$ in each direction.
- **3.** Feed the coiled cable into the gap between the housing and main electronics module and plug the display module into the electronics compartment until it engages.

Closing the cover of the electronics compartment



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

6.3 Post-installation check

□ Is the device undamaged (visual inspection)?

□ Does the device comply with the measuring point specifications?

- Process temperature
- Process pressure
- Ambient temperature range
- Measuring range

 \Box Are the measuring point identification and labeling correct (visual inspection)?

 $\hfill\square$ Is the device adequately protected against precipitation and direct sunlight?

□Is the device adequately protected against impact?

□Are all mounting and safety screws securely tightened?

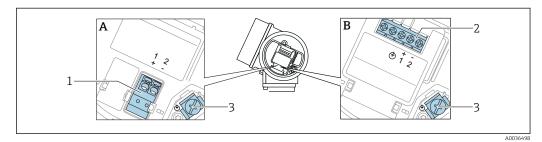
 \Box Is the device properly secured?

7 Electrical connection

7.1 Connecting requirements

7.1.1 Terminal assignment

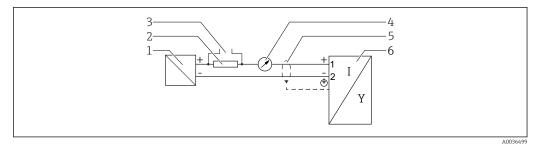
Terminal assignment, 2-wire: 4 to 20 mA HART



I3 Terminal assignment, 2-wire: 4 to 20 mA HART

- A Without integrated overvoltage protection
- *B* With integrated overvoltage protection
- 1 Connection 4 to 20 mA, HART passive: terminals 1 and 2, without integrated overvoltage protection
- 2 Connection 4 to 20 mA, HART passive: terminals 1 and 2, with integrated overvoltage protection
- 3 Terminal for cable shield

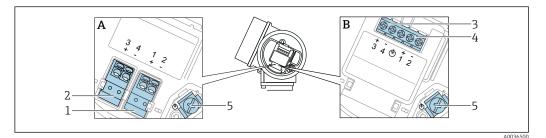
Block diagram, 2-wire: 4 to 20 mA HART



🖻 14 Block diagram, 2-wire: 4 to 20 mA HART

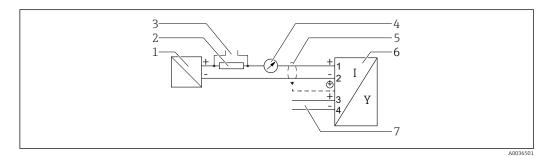
- 1 Active barrier for power supply (e.g. RN221N); observe terminal voltage
- 2 Resistor for HART communication ($\geq 250 \Omega$); observe maximum load
- 3 Connection for Commubox FXA195 or FieldXpert SFX350/SFX370 (via VIATOR Bluetooth modem)
- 4 Analog display unit; observe maximum load
- 5 Cable screen; observe cable specification
- 6 Measuring device

Terminal assignment, 2-wire: 4 to 20 mA HART, switch output



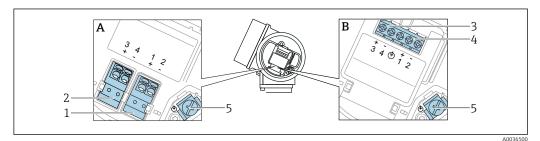
- E 15 Terminal assignment, 2-wire: 4 to 20 mA HART, switch output
- *A* Without integrated overvoltage protection
- *B* With integrated overvoltage protection
- 1 Connection 4 to 20 mA, HART passive: terminals 1 and 2, without integrated overvoltage protection
- 2 Connection, switch output (open collector): terminals 3 and 4, without integrated overvoltage protection
- 3 Connection, switch output (open collector): terminals 3 and 4, with integrated overvoltage protection
- 4 Connection 4 to 20 mA, HART passive: terminals 1 and 2, with integrated overvoltage protection
- 5 Terminal for cable shield

Block diagram, 2-wire: 4 to 20 mA HART, switch output



- 🖻 16 Block diagram, 2-wire: 4 to 20 mA HART, switch output
- 1 Active barrier for power supply (e.g. RN221N); observe terminal voltage
- 2 Resistor for HART communication ($\geq 250 \Omega$); observe maximum load
- 3 Connection for Commubox FXA195 or FieldXpert SFX350/SFX370 (via VIATOR Bluetooth modem)
- 4 Analog display unit; observe maximum load
- 5 *Cable screen; observe cable specification*
- 6 Measuring device
- 7 Switch output (open collector)

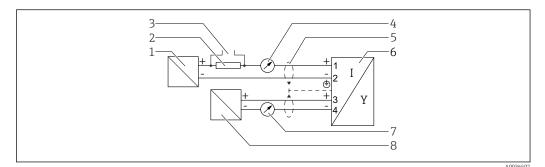
Terminal assignment, 2-wire: 4 to 20 mA HART, 4 to 20 mA



■ 17 Terminal assignment, 2-wire: 4 to 20 mA HART, 4 to 20 mA

- A Without integrated overvoltage protection
- *B* With integrated overvoltage protection
- 1 Connection current output 1, 4 to 20 mA HART passive: terminals 1 and 2, without integrated overvoltage protection
- 2 Connection current output 2, 4 to 20 mA: terminals 3 and 4, without integrated overvoltage protection
- 3 Connection current output 2, 4 to 20 mA: terminals 3 and 4, with integrated overvoltage protection
- 4 Connection current output 1, 4 to 20 mA HART passive: terminals 1 and 2, with integrated overvoltage protection
- 5 Terminal for cable shield

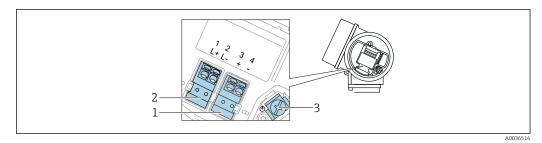
Block diagram, 2-wire: 4 to 20 mAHART, 4 to 20 mA



🖻 18 Block diagram, 2-wire: 4 to 20 mAHART, 4 to 20 mA

- 1 Active barrier for power supply (e.g. RN221N), current output 1; observe terminal voltage
- 2 Resistor for HART communication ($\geq 250 \Omega$); observe maximum load
- 3 Connection for Commubox FXA195 or FieldXpert SFX350/SFX370 (via VIATOR Bluetooth modem)
- 4 Analog display unit; observe maximum load
- 5 *Cable screen; observe cable specification*
- 6 Measuring device
- 7 Analog display unit; observe maximum load
- 8 Active barrier for power supply (e.g. RN221N), current output 2; observe terminal voltage

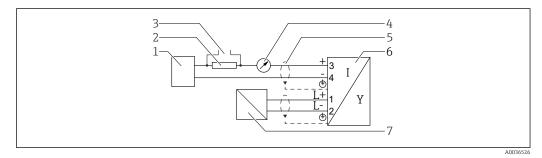
Terminal assignment, 4-wire: 4 to 20 mA HART (10.4 to 48 V_{DC})



■ 19 Terminal assignment, 4-wire: 4 to 20 mA HART (10.4 to 48 V_{DC})

- 1 Connection 4 to 20 mA HART (active): terminals 3 and 4
- 2 Connection, supply voltage: terminals 1 and 2
- 3 Terminal for cable shield

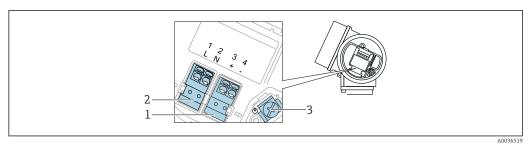
Block diagram, 4-wire: 4 to 20 mA HART (10.4 to 48 V_{DC})



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

- 1 Evaluation unit, e.g. PLC
- 2 Resistor for HART communication ($\geq 250 \Omega$); observe maximum load
- 3 Connection for Commubox FXA195 or FieldXpert SFX350/SFX370 (via VIATOR Bluetooth modem)
- 4 Analog display unit; observe maximum load
- 5 Cable screen; observe cable specification
- 6 Measuring device
- 7 Supply voltage; observe terminal voltage, observe cable specification

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



 \blacksquare 21 Terminal assignment, 4-wire: 4 to 20 mAHART (90 to 253 V_{AC})

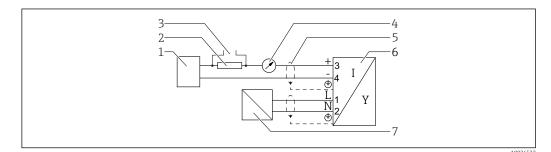
- 1 Connection 4 to 20 mA HART (active): terminals 3 and 4
- 2 Connection, supply voltage: terminals 1 and 2
- 3 Terminal for cable shield

To ensure electrical safety:

- ▶ Do not disconnect the protective ground connection.
- Disconnect the device from the supply voltage before disconnecting the protective ground.
 - Connect protective ground to the inner ground terminal (3) before connecting the supply voltage. If necessary, connect the potential matching line to the outer ground terminal.
- In order to ensure electromagnetic compatibility (EMC): do **not** ground the device exclusively via the protective ground conductor of the supply cable. Instead, the functional grounding must also be connected to the process connection (flange or threaded connection) or to the external ground terminal.

An easily accessible power switch must be installed in the proximity of the device. The power switch must be marked as a disconnector for the device (IEC/EN61010).

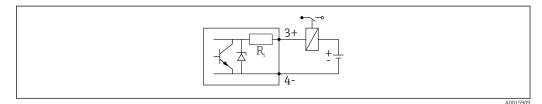
Block diagram, 4-wire: 4 to 20 mA HART (90 to 253 V_{AC})



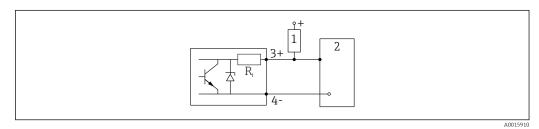
- \blacksquare 22 Block diagram, 4-wire: 4 to 20 mA HART (90 to 253 V_{AC})
- 1 Evaluation unit, e.g. PLC
- 2 Resistor for HART communication ($\geq 250 \Omega$); observe maximum load
- 3 Connection for Commubox FXA195 or FieldXpert SFX350/SFX370 (via VIATOR Bluetooth modem)
- 4 Analog display unit; observe maximum load
- 5 Cable screen; observe cable specification
- 6 Measuring device
- 7 Supply voltage; observe terminal voltage, observe cable specification

Connection examples for the switch output

For HART devices, the switch output is available as an option.



■ 23 Connection of a relay



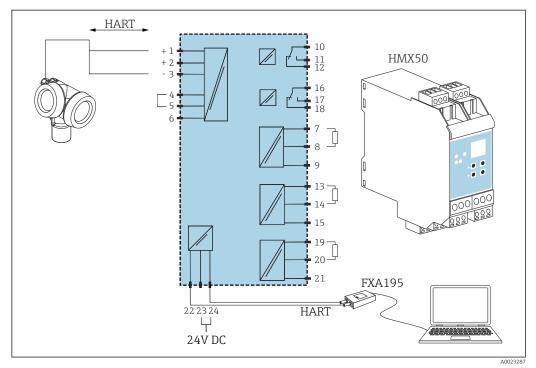
🖻 24 Connection to a digital input

- 1 Pull-up resistor
- 2 Digital input

For optimum interference immunity we recommend to connect an external resistor (internal resistance of the relay or pull-up resistor) of $< 1000 \Omega$.

HART loop converter HMX50

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



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

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

Additional documentation: TI00429F and BA00371F.

7.1.2 Cable specification

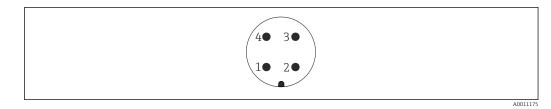
- Devices without integrated overvoltage protection Pluggable spring-force terminals for wire cross-sections 0.5 to 2.5 mm² (20 to 14 AWG)
 Devices with integrated overvoltage protection
- Screw terminals for wire cross-sections 0.2 to 2.5 mm² (24 to 14 AWG)
- For ambient temperature $T_U \ge 60 \degree C (140 \degree F)$: use cable for temperature $T_U + 20 \text{ K}$.

HART

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

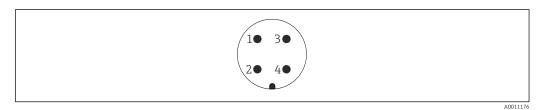
7.1.3 Device plug

In the case of the device versions with a plug, the housing does not need to be opened to connect the signal cable.



■ 26 Pin assignment of M12 plug

- 1 Signal +
- Not assigned Signal -2
- 3
- 4 Ground



■ 27 Pin assignment of 7/8" plug

- Signal -1
- Signal + Not assigned Shielding 2 3
- 4

7.1.4 Supply voltage

2-wire, 4-20mA HART, passive

2-wire; 4-20mA HART¹⁾

"Approval" ²⁾	Terminal voltage U at device	Maximum load R, depending on the supply voltage ${\rm U}_0$ of the power supply unit
 Non-hazardous Ex nA Ex ic CSA GP 	11.5 to 35 V ^{3) 4)}	R [Ω] 500
Ex ia / IS	11.5 to 30 V ⁴⁾	0 10 20 30 35 U ₀ [V] 11.5 22.5 A0035511
 Ex d / XP Ex ic[ia] Ex tD / DIP 	13.5 to 30 V ^{4) 5)}	$ \begin{array}{c} R [\Omega] \\ 500 \\ 0 \\ 0 \\ 10 \\ 10 \\ 13.5 \\ 24.5 \\ \end{array} U_0 [V] \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0$

1) Feature 020 in the product structure: option A

2) Feature 010 in the product structure

3) At ambient temperatures $T_a \le -30$ °C, a terminal voltage U ≥ 14 V is required to start the device with the minimum failure current (3.6 mA). At ambient temperatures $T_a \ge 60$ °C, a terminal voltage U ≥ 12 V is required to start the device with the minimum failure current (3.6 mA). The start-up current can be configured. If the device is operated with a fixed current I ≥ 4.5 mA (HART Multidrop mode), a voltage U ≥ 11.5 V in the entire ambient temperature range suffices.

4) If the Bluetooth module is used, the minimum supply voltage increases by 2 V.

5) At ambient temperatures $T_a \le -30$ °C, a terminal voltage U ≥ 16 V is required to start the device with the minimum failure current (3.6 mA).

2-wire; 4-20 mA HART, switch output ¹⁾

"Approval" ²⁾	Terminal voltage U at device	Maximum load R, depending on the supply voltage U_{0} of the power supply unit
 Non-hazardous Ex nA Ex nA(ia) Ex ic Ex ic[ia] Ex d[ia] / XP Ex ta / DIP CSA GP 	13.5 to 35 V ^{3) 4)}	R [Ω] 500
 Ex ia / IS Ex ia + Ex d[ia] / IS + XP 	13.5 to 30 V ^{3) 4)}	0 10 10 13.5 24.5 30 U0 V] A00

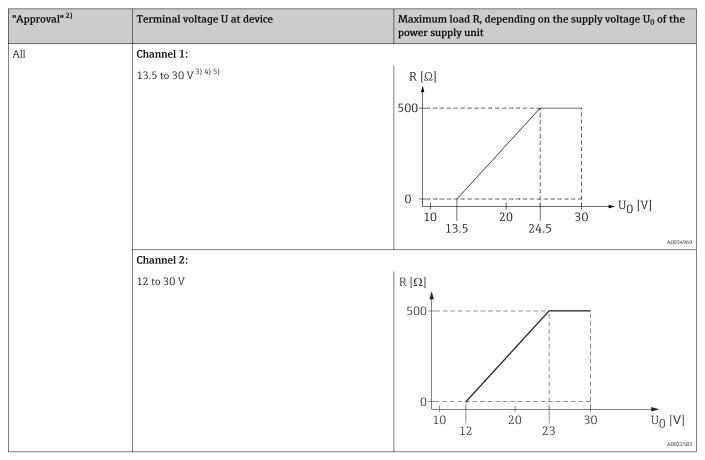
1) Feature 020 in the product structure: option B

2) Feature 010 in the product structure

3) At ambient temperatures $T_a \le -30$ °C, a terminal voltage U ≥ 16 V is required to start the device with the minimum failure current (3.6 mA).

4) If the Bluetooth module is used, the minimum supply voltage increases by 2 V.

2-wire; 4-20mA HART, 4-20mA 1)



1) Feature 020 in the product structure: option C

2) Feature 010 in the product structure

3) At ambient temperatures $T_a \le -30$ °C, a terminal voltage U ≥ 16 V is required to start the device with the minimum failure current (3.6 mA).

4) At ambient temperatures $T_a \le -40$ °C, the maximum terminal voltage must be limited to U ≤ 28 V.

5) If the Bluetooth module is used, the minimum supply voltage increases by 2 V.

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

4-wire, 4-20mA HART, active

"Power supply; output" ¹⁾	Terminal voltage U	Maximum load R_{max}
K: 4-wire 90-253VAC; 4-20mA HART	90 to 253 V_{AC} (50 to 60 Hz), overvoltage category II	500 Ω
L: 4-wire 10.4-48VDC; 4-20mA HART	10.4 to 48 V _{DC}	

1) Feature 020 in the product structure

7.1.5 Overvoltage protection

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

Integrated overvoltage protection module

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

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

Technical data		
Resistance per channel	2 × 0.5 Ω max.	
Threshold DC voltage	400 to 700 V	
Threshold impulse voltage	< 800 V	
Capacitance at 1 MHz	< 1.5 pF	
Nominal arrest impulse voltage (8/20 µs)	10 kA	

External overvoltage protection module

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

For detailed information please refer to the following documents:

- J HAW562: TI01012K
- HAW569: TI01013K

7.2 Connecting the device

WARNING

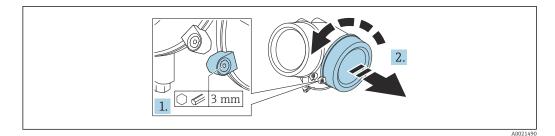
Explosion Hazard!

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

Required tools/accessories:

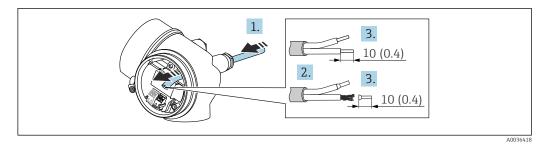
- For devices with a cover lock: Allen key AF3
- Wire stripper
- When using stranded cables: One ferrule for every wire to be connected.

7.2.1 Opening cover



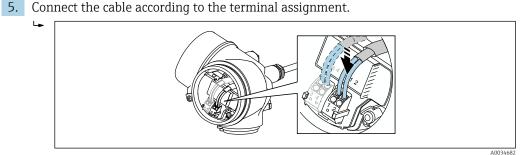
- 1. Loosen the screw of the securing clamp of the connection compartment cover using an Allen key (3 mm) and turn the clamp 90 ° counterclockwise.
- 2. Unscrew the connection compartment cover and check the cover seal; replace it if necessary.

7.2.2 Connecting



🗷 28 Engineering unit: mm (in)

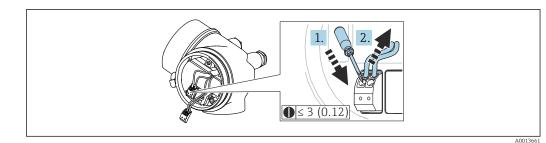
- **1.** Push the cable through the cable entry . To ensure tight sealing, do not remove the sealing ring from the cable entry.
- 2. Remove the cable sheath.
- **3.** Strip the cable ends 10 mm (0.4 in). In the case of stranded cables, also fit wire end ferrules.
- 4. Firmly tighten the cable glands.



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

7.2.3 Plug-in spring-force terminals

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

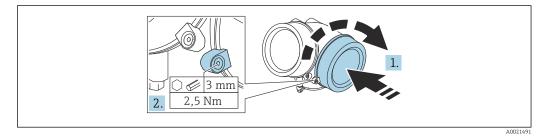


🗷 29 Engineering unit: mm (in)

To remove the cable from the terminal again:

- Using a flat-blade screwdriver ≤ 3 mm, press down on the slot between the two terminal holes
- 2. Simultaneously pull the cable end out of the terminal.

7.2.4 Closing the cover of the connection compartment



1. Screw down the cover of the connection compartment.

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

7.3 Post-connection check

 \Box Is the device or cable undamaged (visual inspection)?

□ Do the cables used comply with the requirements?

Do the mounted cables have adequate strain relief?

□Are all the cable glands installed, firmly tightened and leak-tight?

Does the supply voltage match the specifications on the nameplate?

□ Is the terminal assignment correct?

□If necessary, has a protective ground connection been established?

 \Box If supply voltage is present, is the device ready for operation and do values appear on the display module?

□ Are all the housing covers installed and tightened?

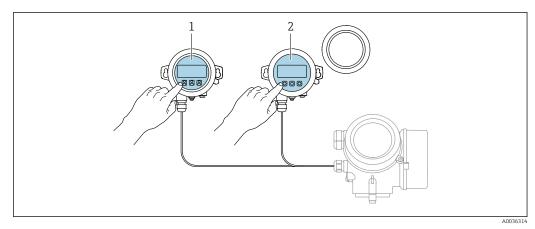
□ Is the securing clamp firmly tightened?

8 Operation methods

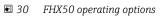
8.1 Overview

8.1.1 Local operation

Operation with	Pushbuttons	Touch Control	
Order code for "Display; Operation"	Option C "SD02"	Option E "SD03"	
Display elements	A0036312 4-line display	A0036313 4-line display white background lighting; switches to red in	
	Format for displaying measured variables and st	event of device error tatus 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 (\oplus , \Box , \mathbb{E})	external operation via touch control; 3 optical keys: +, -, E	
	Operating elements also accessible in various hazardous areas		
Additional functionality	Data backup function The device configuration can be saved in the display module.		
	Data comparison function The device configuration saved in the display module can be compared to the current device configuration. Data transfer function The transmitter configuration can be transmitted to another device using the display modu		



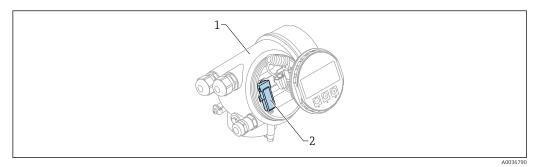
Operation with remote display and operating module FHX50 8.1.2



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

8.1.3 Operation via Bluetooth[®] wireless technology

Requirements

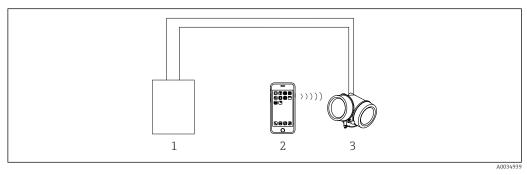


- 31 Device with Bluetooth module
- 1 Electronics housing of the device
- 2 Bluetooth module

This operation option is only available for devices with Bluetooth module. There are the following options:

- The device has been ordered with a Bluetooth module: Feature 610 "Accessory Mounted", option NF "Bluetooth"
- The Bluetooth module has been ordered as an accessory (ordering number: 71377355) and has been mounted. See Special Documentation SD02252F.

Operation via SmartBlue (app)



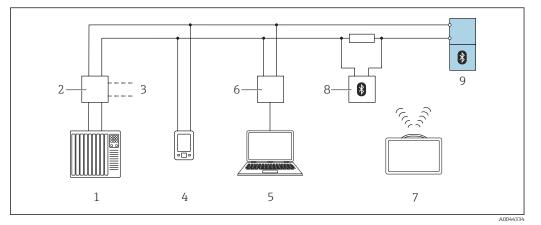
32 Operation via SmartBlue (app)

1 Transmitter power supply unit

- 2 Smartphone / tablet with SmartBlue (app)
- 3 Transmitter with Bluetooth module

8.1.4 Remote operation

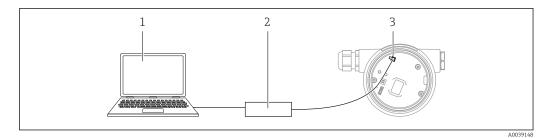
Via HART protocol



☑ 33 Options for remote operation via HART protocol

- *1 PLC (programmable logic controller)*
- 2 Transmitter power supply unit, e.g., RN42
- 3 Connection for Commubox FXA195 and AMS TrexTM device communicator
- 4 AMS TrexTM device communicator
- 5 Computer with operating tool (e.g., DeviceCare/FieldCare, AMS Device View, SIMATIC PDM)
- 6 Commubox FXA195 (USB)
- 7 Field Xpert SMT70
- 8 Bluetooth modem with connecting cable (e.g., VIATOR)
- 9 Transmitter

Via service interface (CDI)



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

8.2 Structure and function of the operating menu

Menu	Submenu / parameter	Meaning
	Language ¹⁾	Defines the operating language of the local display
Commissioning ²⁾		Launches the interactive wizard for guided commissioning. Additional settings generally do not need to be made in the other menus when the wizard is finished.
Setup	Parameter 1 Parameter N	Once values have been set for these parameters, the measurement should generally be completely configured.
	Advanced setup	 Contains additional submenus and parameters: For more customized configuration of the measurement (adaptation to special measuring conditions). For converting the measured value (scaling, linearization). For scaling the output signal.
Diagnostics	Diagnostic list	Contains up to 5 currently active error messages.
	Event logbook 3)	Contains the last 20 messages (which are no longer active).
	Device information	Contains information for identifying the device.
	Measured values	Contains all current measured values.
	Data logging	Contains the history of the individual measuring values.
	Simulation	Is used to simulate measured values or output values.
	Device check	Contains all parameters needed to check the measurement capability of the device.
	Heartbeat ⁴⁾	Contains all the wizards for the Heartbeat Verification and Heartbeat Monitoring application packages.
Expert ⁵⁾ Contains all the parameters of the device (including those that are already contained in one of the other menus). This menu is	System	Contains all higher-level device parameters that do not pertain either to the measurement or to measured value communication.
organized according to the function blocks of the device.	Sensor	Contains all parameters needed to configure the measurement.
The parameters of the Expert menu are described in: GP01000F (HART)	Output	 Contains all parameters needed to configure the analog current output. Contains all parameters needed to configure the switch output (PFS).

8.2.1 Structure of the operating menu

Menu	Submenu / parameter	Meaning
	Communication	Contains all parameters needed to configure the digital communication interface.
	Diagnostics	Contains all parameters needed to detect and analyze operational errors.

1) If you are operating via operating tools (e.g. FieldCare), the "Language" parameter is located under "Setup If you are operating via operating tools (e.g. FieldCare), the Language parameter is located under Setup \rightarrow Advanced setup \rightarrow Display" Only if operating via an FDT/DTM system Only available if operating via the local display Only available if operating via DeviceCare or FieldCare When you call up the "Expert" menu, you are always asked for an access code. If a customer-specific access

2)

3)

4) 5)

code has not been defined, "0000" must be entered.

8.2.2 User roles and related access authorization

The two user roles **Operator** and **Maintenance** have different write access to the parameters if a device-specific access code has been defined. This protects the device configuration via the local display from unauthorized access (Verweisziel existiert nicht, aber @y.link.required='true').

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	V	V	V	
Maintenance	V	V	V	V

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 Data access - Security

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 \rightarrow Advanced setup \rightarrow Administration \rightarrow Define access code \rightarrow Define access code
- 2. Define a max. 4-digit numeric code as an access code.
- 3. Repeat the numeric code in the **Confirm access code** parameter to confirm it.
 - └ The ⓓ-symbol appears in front of all write-protected parameters.

Define access code via operating tool (e.g. FieldCare)

- **1.** Navigate to: Setup \rightarrow Advanced setup \rightarrow Administration \rightarrow Define access code
- 2. Define a max. 4-digit numeric code as an access code.
 - └ Write protection is active.

Parameters that can always be changed

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

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



- If write access is activated via an access code, it can only be deactivated again via this access code $\rightarrow \square 74$.
- In the "Description of Device Parameters" documents, each write-protected parameter is identified with the 🖻-symbol.

Disabling write protection via access code

If the B symbol appears in front of a parameter on the local display, the parameter is write-protected by a device-specific access code and its value cannot currently be changed via the local display \rightarrow B 73.

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

- 1. After you press E, the input prompt for the access code appears.
- 2. Enter the access code.
 - ➡ The B -symbol in front of the parameters disappears; all previously writeprotected parameters are now re-enabled.

Deactivation of the write protection via access code

Via local display

- **1.** Navigate to: Setup \rightarrow Advanced setup \rightarrow Administration \rightarrow Define access code \rightarrow Define access code
- 2. Enter **0000**.
- 3. Repeat **0000** in the **Confirm access code** parameter to confirm.
 - └ The write protection is deactivated. Parameters can be changed without entering an access code.

Via an operating tool (e.g. FieldCare)

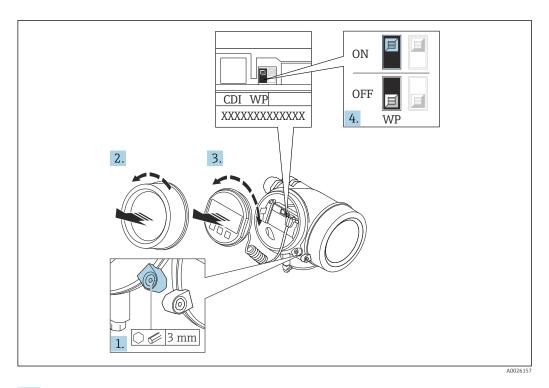
- **1.** Navigate to: Setup \rightarrow Advanced setup \rightarrow Administration \rightarrow Define access code
- 2. Enter **0000**.
 - └ The write protection is deactivated. Parameters can be changed without entering an access code.

Write protection via write protection switch

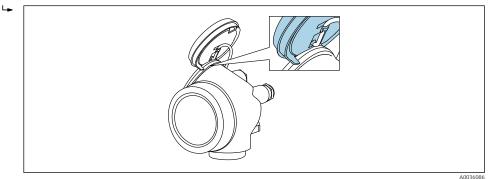
Unlike parameter write protection via a user-specific access code, this allows the user to lock write access to the entire operating menu - apart from the **"Contrast display" parameter**.

The parameter values are now read only and cannot be edited any more (exception **"Contrast display" parameter**):

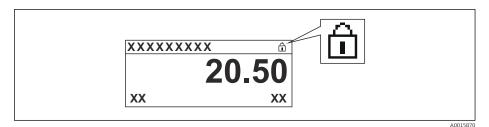
- Via local display
- Via service interface (CDI)
- Via HART protocol



- 1. Loosen the securing clamp.
- 2. Unscrew the electronics compartment cover.
- **3.** Pull out the display module with a gentle rotational movement. To make it easier to access the write protection switch, attach the display module to the edge of the electronics compartment.



- **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 hardware write protection is enabled, the Hardware locked option is displayed in the Locking status parameter. In addition, on the local display the B symbol appears in front of the parameters in the header of the operational display and in the navigation view.



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

- 5. Feed the cable into the gap between the housing and main electronics module and plug the display module into the electronics compartment in the desired direction until it engages.
- 6. Reverse the removal procedure to reassemble the transmitter.

Enabling and disabling the keypad lock

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

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

Switching on the keypad lock

SD03 display module only

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

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.

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

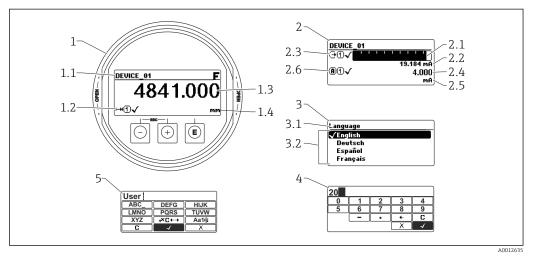
Bluetooth[®] wireless technology

Signal transmission via Bluetooth® wireless technology uses a cryptographic technique tested by the Fraunhofer Institute

- The device is not visible via *Bluetooth*[®] wireless technology without the SmartBlue app
- Only one point-to-point connection between **one** sensor and **one** smartphone or tablet is established

8.3 Display and operating module

8.3.1 Display



34 Display format on the display and operating module

- 1 Measured value display (1 value max. size)
- 1.1 Header containing tag and error symbol (if an error is active)
- 1.2 Measured value symbols
- 1.3 Measured value
- 1.4 Unit
- 2 Measured value display (bar graph + 1 value)
- 2.1 Bargraph for measured value 1
- 2.2 Measured value 1 (including unit)
- 2.3 Measured value symbols for measured value 1
- 2.4 Measured value 2
- 2.5 Unit for measured value 2
- 2.6 Measured value symbols for measured value 2
- 3 Parameter display (here: parameter with picklist)
- 3.1 Header containing parameter name and error symbol (if an error is active)
- *3.2 Picklist;* I marks the current parameter value.
- 4 Input matrix for numbers
- 5 Input matrix for alphanumeric and special characters

Display symbols for the submenus

Symbol	Meaning
A0018367	 Display/operat. Is displayed: In the main menu next to the "Display/operat." selection In the header on the left in the "Display/operat." menu
J A0018364	SetupIs displayed:In the main menu next to the "Setup" selectionIn the header on the left in the "Setup" menu
**	ExpertIs displayed:In the main menu next to the "Expert" selectionIn the header on the left in the "Expert" menu
ک ر ۸0018366	 Diagnostics Is displayed: In the main menu next to the "Diagnostics" selection In the header on the left in the "Diagnostics" menu

Status signals

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

Display symbols for locking status

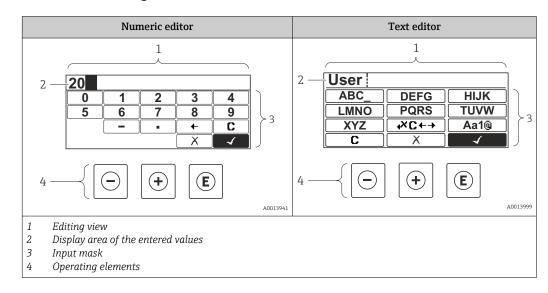
Symbol	Meaning
A0013148	Read-only parameter The parameter shown is only for display purposes and cannot be edited.
A0013150	 Device locked In front of a parameter name: The device is locked via software and/or hardware. In the header of the measured value screen: The device is locked via hardware.

Measured value symbols

Symbol		Meaning
Measured values		
~~		Level
A0	0032892	
A0	0032893	Distance
G		Current output
AO	0032908	
(A)		Measured current
AO	0032894	
\bigcirc		Terminal voltage
AO	0032895	
		Electronics or sensor temperature
AO	0032896	
Measuring channe	els	
1		Measuring channel 1
AO	0032897	
2		Measuring channel 2
A0	0032898	
Status of the meas	sured	value
	0018361	"Alarm" status The measurement is interrupted. The output assumes the defined alarm condition. A diagnostic message is generated.
	0018360	"Warning" status The device continues to measure. A diagnostic message is generated.

8.3.2 **Operating elements**

Кеу	Meaning
	Minus key
	<i>In a menu, submenu</i> Moves the selection bar upwards in a picklist.
	<i>In the text and numeric editor</i> In the input mask, moves the selection bar to the left (backwards).
	Plus key
+	<i>In a menu, submenu</i> Moves the selection bar downwards in a picklist.
A0018329	<i>In the text and numeric editor</i> In the input mask, moves the selection bar to the right (forwards).
	Enter key
	For measured value displayPressing the key briefly opens the operating menu.Pressing the key for 2 s opens the context menu.
E A0018328	 In a menu, submenu Pressing the key briefly: Opens the selected menu, submenu or parameter. Pressing the key for 2 s in a parameter: If present, opens the help text for the function of the parameter.
	 In the text and numeric editor Pressing the key briefly: Opens the selected group. Carries out the selected action. Pressing the key for 2 s confirms the edited parameter value.
	Escape key combination (press keys simultaneously)
-+++ A0032909	 In a menu, submenu Pressing the key briefly: Exits the current menu level and takes you to the next higher level. If help text is open, closes the help text of the parameter. Pressing the key for 2 s returns you to the measured value display ("home position").
	<i>In the text and numeric editor</i> Closes the text or numeric editor without applying changes.
– +E	Minus/Enter key combination (press and hold down the keys simultaneously)
A0032910	Reduces the contrast (brighter setting).
++E ^^0032911	Plus/Enter key combination (press and hold down the keys simultaneously) Increases the contrast (darker setting).



8.3.3 Entering numbers and text

Input mask

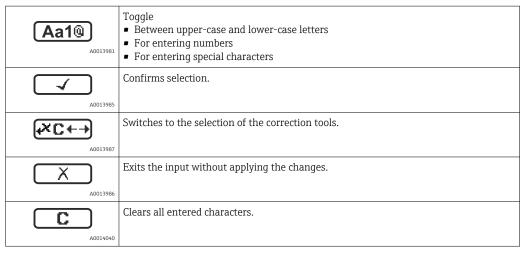
The following input and operating symbols are available in the input mask of the numeric and text editor:

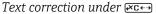
Numeric editor

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

Text editor

Symbol	Meaning
ABC_	Selection of letters from A to Z
XYZ	





Symbol	Meaning
LC 40032907	Clears all entered characters.
A0018324	Moves the input position one position to the right.
A0018326	Moves the input position one position to the left.
A0032906	Deletes one character immediately to the left of the input position.

8.3.4 Opening the context menu

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

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

Calling up and closing the context menu

The user is in the operational display.

1. Press E for 2 s.

└ The context menu opens.

XXX Setup Conf.backup disp Env. curve Keylock on

2. Press \Box + \pm 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 \pm to navigate to the desired menu.

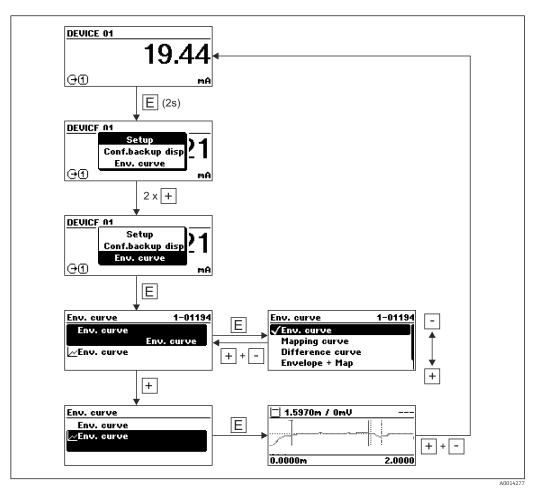
A0037872

3. Press 🗉 to confirm the selection.

└ The selected menu opens.

8.3.5 Envelope curve display on the display and operating module

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



9 Device integration via the HART protocol

9.1 Overview of the Device Description files (DD)

HART

Manufacturer ID	0x11
Device type	0x1122
HART specification	7.0
DD files	For information and files see: www.endress.com www.fieldcommgroup.org

9.2 HART device variables and measuring values

On delivery the following measuring values are assigned to the HART device varaibles:

Device variables for level measurements

Device variable	Measuring value
Primary variable (PV)	Level linearized
Secondary variable (SV)	Unfiltered distance
Tertiary variable (TV)	Absolute echo amplitude
Quaternary variable (QV)	Relative echo amplitude

Device variables for interface measurements

Device variable	Measuring value
Primary variable (PV)	Interface linearized
Secondary variable (SV)	Level linearized
Tertiary variable (TV)	Thickness upper layer
Quaternary variable (QV)	Absolute interface amplitude

The allocation of the measuring values to the device variables can be changed in the following submenu:

 $\mathsf{Expert} \rightarrow \mathsf{Communication} \rightarrow \mathsf{Output}$

10 Commissioning via SmartBlue (App)

10.1 Prerequisites

System requirements

The SmartBlue app is available for download for use with a smartphone or tablet.

- iOS devices: iPhone 5S or higher from iOS11; iPad 5th generation or higher from iOS11; iPod Touch 6th generation or higher from iOS11
- Devices with Android: from Android 6.0 and Bluetooth® 4.0

Initial password

The serial number of the device serves as the initial password when the connection is established for the first time.

Note the following if the Bluetooth module is removed from one device and installed in another device: the password that is changed by the user is only saved in the Bluetooth module and not in the device itself.

10.2 SmartBlue App

1. Scan the QR code or enter "SmartBlue" in the search field of the App Store.



🗷 35 Download link

- 2. Start SmartBlue.
- 3. Select device from livelist displayed.
- 4. Enter the login data:
 - └→ User name: admin
 - Password: serial number of the device
- 5. Tap the icons for more information.

After logging in for the first time, change the password!

10.3 Envelope curve display in SmartBlue

Envelope curves can be displayed and recorded in SmartBlue.

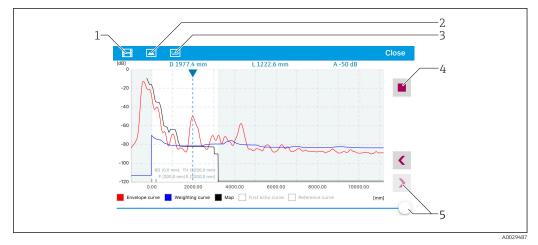
In addition to the envelope curve, the following values are displayed:

- D = Distance
- L = Level
- A = Absolute amplitude
- With screenshots, the displayed section (zoom function) is saved
- With video sequences, the whole area without zoom function is saved all the time



36 Envelope curve display (sample) in SmartBlue for Android

- 1 Record video
- 2 Create screenshot
- 3 Display mapping menu
- 4 Start/stop video recording
- 5 Move time on time axis



S7 Envelope curve display (sample) in SmartBlue for iOS

- 1 Record video
- 2 Create screenshot
- 3 Display mapping menu
- 4 Start/stop video recording
- 5 Move time on time axis

11 Commissioning using the Commissioning Wizard

A Wizard is provided in FieldCare and DeviceCare ¹⁾ that guides the user through the initial commissioning process.

1. Connect the device with FieldCare or DeviceCare.

2. Open the device in FieldCare or DeviceCare.

← The dashboard (homepage) of the device is displayed:

1			
Wizard			
Commissioning SIL/WHG confirmation)		
Instrument health status			
ОК			
Process variables - Device tag: Levelfinite for the second	2000,000	Level linearized	Thickness upper layer
	1600,000 1200,000	50,604 %	22,138 %
20 166	800,000	Absolute interface amplitude	
28,466	400,000 • 0,000	127,067 mv	

- 1 "Commissioning" button calls up the wizard
- 3. Click "Commissioning" to launch the Wizard.
- 4. Enter the appropriate value in each parameter or select the appropriate option. These values are written directly to the device.
- 5. Click "Next" to go to the next page.
- 6. Once all the pages have been completed, click "Finish" to close the Wizard.

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

¹⁾ DeviceCare is available for download at www.software-products.endress.com. To download the software, it is necessary to register in the Endress +Hauser software portal.

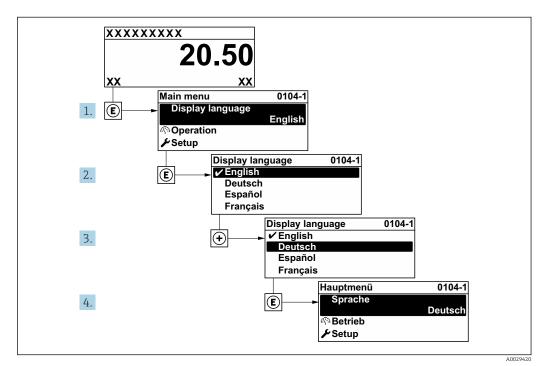
12 Commissioning via operating menu

12.1 Function check

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

12.2 Setting the operating language

Factory setting: English or ordered local language



🖻 38 Taking the example of the local display

12.3 Checking the reference distance

This section only applies to the FMP54 with the gas phase compensation function (product structure: feature 540 "Application packages", option EF or EG)

Coax probes with gas phase compensation are calibrated on delivery. Rod probes, on the other hand, must be recalibrated after mounting:

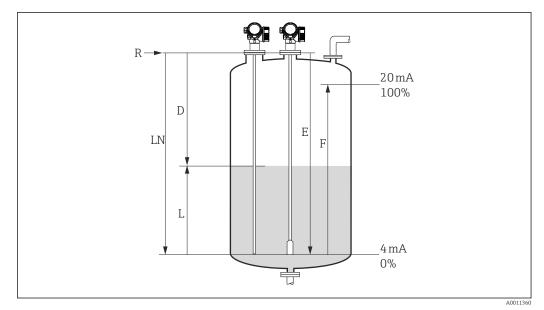
After mounting the rod probe in the stilling well or bypass, check and - if necessary correct the setting of the reference distance in the unpressurized state. The level should be at least 200 mm below the reference distance L_{ref} in order to achieve maximum accuracy.

Step	Parameter	Action
1	Expert \rightarrow Sensor \rightarrow Gas phase compensation \rightarrow GPC mode	Select the ${f On}$ option to enable gas phase compensation.
2	Expert \rightarrow Sensor \rightarrow Gas phase compensation \rightarrow Present reference distance	Check if the current reference distance displayed corresponds with the nominal value (300 mm or 550 mm, see nameplate). If yes: No further action is required. If not: Continue with Step 3.
3	Expert → Sensor → Gas phase compensation → Reference distance	Adopt the value displayed under the Present reference distance parameter. This corrects the reference distance.



For a detailed description of all parameters, see:

GP01000F, "Levelflex - Description of Device Parameters - HART"



12.4 Configuring level measurement

39 Configuration parameters for level measurement in liquids

- LN Probe length
- R Reference point of measurement
- D Distance
- L Level
- E Empty calibration (= zero point)
- F Full calibration (= span)
- If the ε_r value is lower than 7 in the case of rope probes, measurement is not possible in the area of the tensioning weight. The empty calibration *E* should not exceed *LN* - 250 mm (*LN* - 10 in) in these cases.
- 1. Setup \rightarrow Device tag
 - └ Enter device tag.

2. For devices in the "Interface measurement" application package:

- Navigate to: Setup \rightarrow Operating mode
 - ← Select the **Level** option.
- 3. Navigate to: Setup \rightarrow Distance unit
 - \blacktriangleright Select the distance unit.
- 4. Navigate to: Setup \rightarrow Tank type
 - └ Select tank type.

5. For **Tank type** parameter = Bypass / pipe:

- Navigate to: Setup → Tube diameter
 - └ Specify the diameter of the bypass or stilling well.
- 6. Navigate to: Setup \rightarrow Medium group
 - ← Specify the medium group: (Water based (DC >= 4) or Others)
- 7. Navigate to: Setup \rightarrow Empty calibration
 - └ Specify the empty distance E (distance from reference point R to 0% mark).
- 8. Navigate to: Setup \rightarrow Full calibration
 - ← Specify the full distance F (distance from the 0% mark to the 100% mark).
- 9. Navigate to: Setup \rightarrow Level
 - └ Displays the measured level L.

10. Navigate to: Setup \rightarrow Distance

- └ Displays the distance D between the reference point R and the level L.
- **11.** Navigate to: Setup \rightarrow Signal quality
 - └ Displays the signal quality of the analyzed level echo.
- 12. Operation via local display:
 - Navigate to: Setup \rightarrow Mapping \rightarrow Confirm distance
 - ← Compare the distance displayed with the actual value in order to start recording an interference echo map if necessary ²).
- **13.** Operation via operating tool:

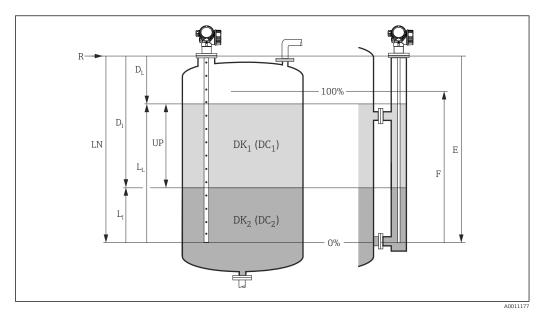
Navigate to: Setup \rightarrow Confirm distance

← Compare the distance displayed with the actual value to start recording an interference echo map (where applicable)²⁾.

²⁾ For FMP54 with gas phase compensation (product structure: feature 540 "Application Package", option "EF" or "EG"), an interference echo map may not be recorded

12.5 Configuring interface measurement

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



■ 40 Configuration parameters for interface measurement

- LN Probe length
- *R Reference point of measurement*
- DI Interface distance (distance from flange to lower medium)
- LI Interface
- DL Distance
- LL Level
- UP Thickness upper layer
- *E Empty calibration (= zero point)*
- F Full calibration (= span)
- **1.** Navigate to: Setup \rightarrow Device tag
 - ← Enter device tag.
- 2. Navigate to: Setup \rightarrow Operating mode
 - └ Select the **Interface** option.
- 3. Navigate to: Setup \rightarrow Distance unit
 - └ Select the distance unit.
- 4. Navigate to: Setup \rightarrow Tank type
 - 🕒 Select tank type.
- 5. For **Tank type** parameter = Bypass / pipe: Navigate to: Setup → Tube diameter
 - ← Specify the diameter of the bypass or stilling well.
- 6. Navigate to: Setup \rightarrow Tank level
 - Specify the tank level (Fully flooded or Partially filled)
- **7.** Navigate to: Setup \rightarrow Distance to upper connection
- 8. Navigate to: Setup \rightarrow DC value
 - \blacktriangleright Specify the relative dielectric constant ($\epsilon_r)$ of the upper medium.

- 9. Navigate to: Setup \rightarrow Empty calibration
 - └ Specify the empty distance E (distance from reference point R to 0% mark).
- 10. Navigate to: Setup \rightarrow Full calibration
 - ← Specify the full distance F (distance from the 0% mark to the 100% mark).
- 11. Navigate to: Setup \rightarrow Level
 - \leftarrow Displays the measured level L_L.
- 12. Navigate to: Setup \rightarrow Interface
 - \vdash Displays the interface height L_I.
- **13.** Navigate to: Setup \rightarrow Distance
 - \vdash Displays the distance D_L between the reference point R and the level L_L.
- 14. Navigate to: Setup \rightarrow Interface distance
 - \vdash Displays the distance D_I between the reference point R and the interface L_I.
- **15.** Navigate to: Setup \rightarrow Signal quality
 - └ Displays the signal quality of the analyzed level echo.
- **16**. Operation via local display:
 - Navigate to: Setup \rightarrow Mapping \rightarrow Confirm distance
 - ← Compare the distance displayed with the actual value in order to start recording an interference echo map if necessary ³⁾.
- **17**. Via an operating tool (e.g. FieldCare):

Navigate to: Setup \rightarrow Confirm distance

└→ Compare the distance displayed with the actual value to start recording an interference echo map (where applicable)³⁾.

³⁾ For FMP54 with gas phase compensation (product structure: feature 540 "Application Package", option "EF" or "EG"), an interference echo map may not be recorded

12.6 Recording the reference envelope curve

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

Path in the menu

Expert \rightarrow Diagnostics \rightarrow Envelope diagnostics \rightarrow Save reference curve

Meaning of the options

- No
 - No action
- Yes

The current envelope curve is saved as a reference curve.

This submenu is only visible for the "Service" user role in devices supplied with software version 01.00.zz or 01.01.zz.

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

🔹 = 🔠 🗳 🚱 🤷

🖻 41 "Load Reference Curve" function

12.7 Configuring the local display

12.7.1 Factory setting of local display for level measurements

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

12.7.2 Factory setting of local display for interface measurements

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

12.7.3 Adjusting the local display

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

12.8 Configuring the current outputs

12.8.1 Factor setting of current outputs for level measurements

Current output	Assigned measured value	4mA value	20mA value
1	Level linearized	0% or the corresponding linearized value	100% or the corresponding linearized value
2 1)	Relative echo amplitude	0 mV	2 000 mV

1) For devices with two current outputs

12.8.2 Factory setting of current outputs for interface measurements

Curre outpu	 Assigned measured value	4mA value	20mA value
1	Interface linearized	0% or the corresponding linearized value	100% or the corresponding linearized value
2 1)	Level linearized	0% or the corresponding linearized value	100% or the corresponding linearized value

1) For devices with two current outputs

12.8.3 Adjusting the current outputs

The current outputs can be adjusted in the following submenus:

Basic settings

Setup \rightarrow Advanced setup \rightarrow Current output 1 to 2

Advanced settings

Expert \rightarrow Output 1 to 2 \rightarrow Current output 1 to 2 See "Description of Device Parameters" GP01000F

12.9 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 the options available.

Path in the menu

Setup \rightarrow Advanced setup \rightarrow Configuration backup display \rightarrow Configuration management

Meaning of the options

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

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

Restore

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

Duplicate

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

- HART date code
- HART short tag
- HART message
- HART descriptor
- HART address
- Device tag
- Medium type
- Compare

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

Clear backup data

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

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

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

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

12.10 Protecting settings from unauthorized access

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

- Locking via parameters (software locking)
- Locking via write protection switch (hardware locking)

13 Diagnostics and troubleshooting

13.1 General troubleshooting

13.1.1 General errors

Error	Possible cause	Solution
Device does not respond.	Supply voltage does not match the value indicated on the nameplate.	Connect the correct voltage.
	The polarity of the supply voltage is wrong.	Correct the polarity.
	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 E simultaneously. Decrease contrast by pressing = and E simultaneously.
	The plug of the display cable is not connected correctly.	Connect the plug correctly.
	Display is defective.	Replace display.
"Communication error" is	Electromagnetic interference	Check grounding of the device.
indicated on the display when starting the device or connecting the display.	Broken display cable or display plug.	Replace display.
Duplication of parameters via display from one device to another not working. Only the "Save" and "Cancel" options are available.	Display with backup is not properly detected if a data backup was not carried out on the new device previously.	Connect display (with backup) and restart device.
Output current <3.6 mA	Signal cable connection incorrect.	Check connection.
	Electronics module is defective.	Replace electronics.
HART communication does not function.	Communication resistor missing or incorrectly installed.	Install the communication resistor (250 Ω) correctly.
	Commubox is connected incorrectly.	Connect Commubox correctly.
	Commubox is not set to "HART".	Set Commubox selector switch to "HART".
CDI communication does not work.	Wrong setting of the COM port on the computer.	Check the setting of the COM port on the computer and change it if necessary.
Device measures incorrectly.	Parameter configuration error	Check and correct the parameter configuration.
No communication with device via SmartBlue	No Bluetooth connection	Enable Bluetooth function on smartphone or tablet
	The device is already connected with another smartphone/ tablet	Disconnect the device from the other smartphone/tablet
	Bluetooth module not connected	Connect Bluetooth module (see SD02252F).
Login via SmartBlue not possible	Device is being put into operation for the first time	Enter initial password (ID of Bluetooth module) and change it

Error	Possible cause	Solution
Device cannot be operated via SmartBlue	Incorrect password entered	Enter the correct password, paying attention to lower/upper case
Device cannot be operated via SmartBlue	Password forgotten	Contact Endress+Hauser Service (www.addresses.endress.com)

Error	Possible cause	Solution
Device is not visible in the	No Bluetooth	Enable Bluetooth® function on smartphone or tablet
live list	connection	Bluetooth [®] function of sensor disabled, perform recovery sequence
Device is not visible in the live list	The device is already connected with another smartphone/ tablet	Only one point-to-point connection is established between a sensor and a smartphone or tablet
Device is visible in the live list but cannot be accessed via	Android end device	Is the location function enabled for the app, was it approved the first time?
SmartBlue		GPS or positioning function must be activated for certain Android versions in conjunction with Bluetooth®
		Activate GPS - close the app fully and restart - enable the positioning function for the app
Device is visible in the live list but cannot be accessed via SmartBlue	Apple end device	Log in as standard Enter user name "admin" Enter initial password (ID of the Bluetooth module) paying attention to lower/upper case
Login via SmartBlue not possible	Device is being put into operation for the first time	Enter initial password (ID of the Bluetooth module) and change; paying attention to lower/upper case
Device cannot be operated via SmartBlue	Incorrect password entered	Enter correct password
Device cannot be operated via SmartBlue	Password forgotten	Contact the Endress+Hauser Service department (www.addresses.endress.com)

13.1.2 Error - SmartBlue operation

13.1.3 Parametrization errors

Problem	Possible cause	Remedy
Measured value is incorrect	If measured distance (Setup → Distance) matches the real distance: Calibration error	 Check the Empty calibration parameter (→ ^(⇒) 156) and correct if necessary. Check the Full calibration parameter (→ ^(⇒) 157) and correct if necessary. Check the linearization and correct if necessary (Linearization submenu (→ ^(⇒) 182)).
	If measured distance (Setup → Distance) does not match the real distance: An interference echo is present.	Carry out mapping (Confirm distance parameter ($\rightarrow \square 164$)).
No change of measured value on filling/emptying	An interference echo is present.	Carry out mapping (Confirm distance parameter ($\rightarrow \cong 164$)).
	Buildup at the probe.	Clean the probe.
	Error in the echo tracking.	Deactivate echo tracking (Expert → Sensor → Echo tracking → Evaluation mode = History off).
Echo lost diagnostic message appears after the supply voltage is switched on.	Echo threshold too high.	Check the Medium group parameter $(\rightarrow \textcircled{D} 155)$. If necessary, select a more detailed setting with the Medium property parameter $(\rightarrow \textcircled{D} 170)$.
	Level echo suppressed.	Delete the map and record it again if necessary (Record map parameter $(\rightarrow \cong 166)$).
Device displays a level when the tank is empty.	Incorrect probe length	Perform probe length correction (Confirm probe length parameter $(\rightarrow \cong 198)$).
	Interference echo	Carry out mapping over the entire probe length when the tank is empty (Confirm distance parameter ($\rightarrow \boxtimes 164$)).
Wrong slope of the level over the entire measuring range	Wrong tank type selected.	Select the correct Tank type parameter $(\rightarrow \cong 155)$.

Parametrization errors for level measurements

Parametrization errors for interface measurements

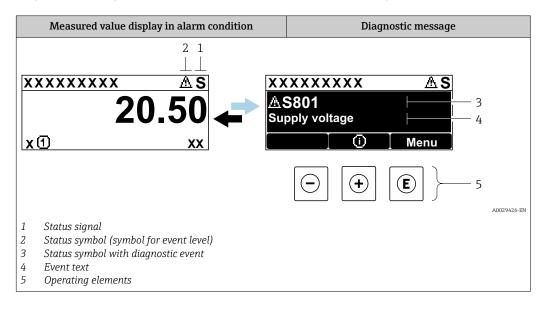
Problem	Possible cause	Remedy
With the setting Tank level = Fully flooded , the interface	The total level is detected outside the upper blocking distance.	Increase the blocking distance (Blocking distance parameter ($\rightarrow \square 173$)).
level displayed jumps to higher values when the tank is emptied.		Set Tank level parameter $(\rightarrow \square 161) =$ Partially filled .
With the setting Tank level = Partially filled , the total level displayed jumps to lower values when the tank is filled.	The total level goes to the upper blocking distance.	Reduce the blocking distance (Blocking distance parameter ($\rightarrow \square 173$)).
Incorrect slope of the interface measured value	The dielectric constant (DC value) of the upper medium is incorrectly set.	Enter the correct dielectric constant (DC value) of the upper medium (DC value parameter ($\rightarrow \textcircled{B}$ 162)).
The measured value for the interface and the total level are identical.	The echo threshold for the total level is too high due to an incorrect dielectric constant.	Enter the correct dielectric constant (DC value) of the upper medium (DC value parameter ($\rightarrow \triangleq 162$)).

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

13.2 Diagnostic information on local display

13.2.1 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.



Status signals

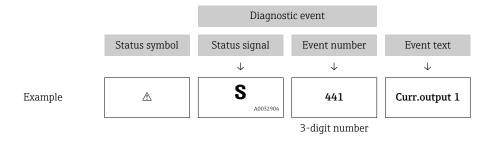
A0032902	"Failure (F)" option A device error has occurred. The measured value is no longer valid.
C	"Function check (C)" option The device is in the service mode (e.g. during a simulation).
S A0032904	 "Out of specification (S)" option The device is operated: Outside of its technical specifications (e.g. during startup or a cleaning) Outside of the configuration performed by the user (e.g. level outside the configured range)
M 40032905	"Maintenance required (M)" option Maintenance is required. The measured value is still valid.

Status symbol (symbol for event level)

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

Diagnostic event and event text

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



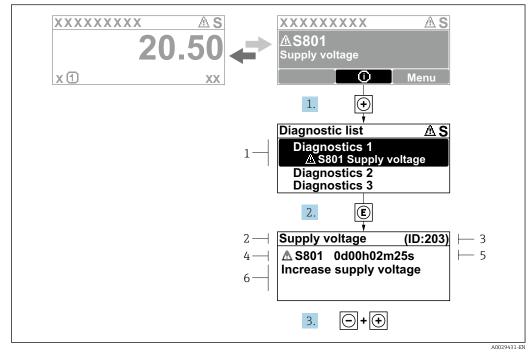
If two or more diagnostic events occur simultaneously, only the diagnostic message with the highest priority is shown. Additional queued diagnostic messages can be shown in the **Diagnostic list** submenu.

Past diagnostic messages that are no longer pending are shown as follows:

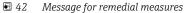
- On the local display:
 - In the **Event logbook** submenu
- In FieldCare:
 - Via the "Event List /HistoROM" function.

Operating elements

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



13.2.2 Calling up remedial measures



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

The user is in the diagnostic message.

1. Press
⊕ (① symbol).

- ← The **Diagnostic list** submenu opens.
- **2.** Select the desired diagnostic event with \pm or \Box and press \Box .
 - └ The message for the remedial measures for the selected diagnostic event opens.
- 3. Press \Box + \pm simultaneously.
 - ← The message about the remedial measures closes.

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

- 1. Press E.
 - └ The message for the remedial measures for the selected diagnostic event opens.
- 2. Press \Box + \pm simultaneously.
 - └ The message about the remedial measures closes.

13.3 Diagnostic event in the operating tool

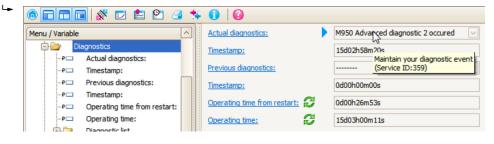
If a diagnostic event is present in the device, the status signal appears in the top left status in the operating tool along with the corresponding symbol for event level in accordance with NAMUR NE 107:

- 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.

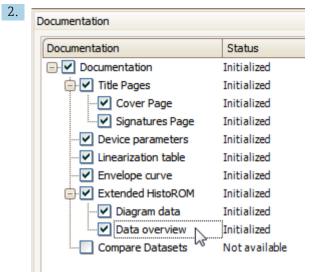


A tool tip with remedial measures for the diagnostic event appears.

B: Via the "Create documentation" function

1.	🎯 🗖 🗖 🖬 🔗 🛃 🖉 🤮	🛸 🕕 🛛 🖗			
	Menu / Variable	vo Value			
	🖹 🦢 Diagnostics	Create Documentation			
	Actual diagnostics:				

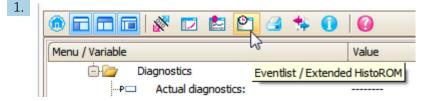
Select the "Create documentation" function.



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



Select the "Eventlist / Extended HistoROM" function.



Select the "Load Eventlist" function.

The list of events, including remedy information, is shown in the "Data overview" window.

13.4 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 \rightarrow 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 \Box + \pm simultaneously.

└ The message about the remedial measures closes.

13.5 List of diagnostic events

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
Diagnostic of s	ensor			
003	Broken probe detected	 Check map Check sensor 	F	Alarm
046	Build-up detected	Clean sensor	F	Alarm
104	HF cable	and check sealing 1. Dry HF cable connection 2. Change HF cable	F	Alarm
105	HF cable	 Tighten HF cable connection Check sensor Change HF cable 	F	Alarm
106	Sensor	 Check sensor Check HF cable Contact service 	F	Alarm
Diagnostic of e	lectronic			1
242	Software incompatible	 Check software Flash or change main electronics module 	F	Alarm
252	Modules incompatible	 Check if correct electronic modul is plugged Replace electronic module 	F	Alarm
261	Electronic modules	 Restart device Check electronic modules Change I/O Modul or main electronics 	F	Alarm
262	Module connection	 Check module connections Change electronic modules 	F	Alarm
270	Main electronic failure	Change main electronic module	F	Alarm
271	Main electronic failure	 Restart device Change main electronic module 	F	Alarm
272	Main electronic failure	 Restart device Contact service 	F	Alarm
273	Main electronic failure	 Emergency operation via display Change main electronics 	F	Alarm
275	I/O module defective	Change I/O module	F	Alarm
276	I/O module faulty	1. Restart device	F	Alarm
276	I/O module faulty	2. Change I/O module	F	Alarm
282	Data storage	 Restart device Contact service 	F	Alarm
283	Memory content	 Transfer data or reset device Contact service 	F	Alarm
311	Electronic failure	Maintenance required! 1. Do not perform reset 2. Contact service	М	Warning
Diagnostic of c	onfiguration			
410	Data transfer	1. Check connection 2. Retry data transfer	F	Alarm
411	Up-/download active	Up-/download active, please wait	С	Warning
412	Processing download	Download active, please wait	С	Warning

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
431	Trim 1 to 2	Carry out trim	С	Warning
435	Linearization	Check linearization table	F	Alarm
437	Configuration incompatible	 Restart device Contact service 	F	Alarm
438	Dataset	 Check data set file Check device configuration Up- and download new configuration 	М	Warning
441	Current output 1 to 2	 Check process Check current output settings 	S	Warning
484	Failure mode simulation	Deactivate simulation	С	Alarm
485	Simulation measured value	Deactivate simulation	С	Warning
491	Current output 1 to 2 simulation	Deactivate simulation	С	Warning
494	Switch output simulation	Deactivate simulation switch output	С	Warning
495	Diagnostic event simulation	Deactivate simulation	С	Warning
585	Simulation distance	Deactivate simulation	С	Warning
Diagnostic of p	rocess		1	1
801	Energy too low	Increase supply voltage	S	Warning
803	Current loop	1. Check wiring 2. Change I/O module	F	Alarm
825	Operating temperature	1. Check ambient temperature	S	Warning
825	Operating temperature	2. Check process temperature	F	Alarm
921	Change of reference	 Check reference configuration Check pressure Check sensor 	S	Warning
936	EMC interference	Check installation on EMC	F	Alarm
941	Echo lost	Check parameter 'DC value'	F	Alarm ¹⁾
942	In safety distance	 Check level Check safety distance Reset self holding 	S	Alarm ¹⁾
943	In blocking distance	Reduced accuracy Check level	S	Warning
944	Level range	Reduced accuracy Level at process connection	S	Warning
950	Advanced diagnostic 1 to 2 occured	Maintain your diagnostic event	М	Warning ¹⁾

1) Diagnostic behavior can be changed.

13.6 Event logbook

13.6.1 Event history

A chronological overview of the event messages that have occurred is provided in the **Event list** submenu $^{4)}$.

Navigation path

 $\texttt{Diagnostics} \rightarrow \texttt{Event logbook} \rightarrow \texttt{Event list}$

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

Die Ereignishistorie umfasst Einträge zu:

- Diagnostic events
- Information events

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

 \odot : 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.

13.6.2 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

 $\mathsf{Diagnostics} \rightarrow \mathsf{Event} \ \mathsf{logbook} \rightarrow \mathsf{Filter} \ \mathsf{options}$

Filter categories

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

13.6.3 Overview of information events

Info number	Info name	
I1000	(Device ok)	
I1089	Power on	
I1090	Configuration reset	
I1091	Configuration changed	

⁴⁾ 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.

Info number	Info name		
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		
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		

Date	Firmware	Modifications	Documentation (FMP51, FMP52, FMP54, HART)			
	version		Operating Instructions	Description of Device Parameters	Technical Information	
07.2010	01.00.zz	Original software	BA01001F/00/EN/05.10	GP01000F/00/EN/05.10	TI01001F/00/EN/05.10	
01.2011	01.01.zz	 SIL integrated Improvements and bugfixes Additional languages 	 BA01001F/00/EN/10.10 BA01001F/00/EN/13.11 BA01001F/00/EN/14.11 BA01001F/00/EN/15.12 	GP01000F/00/EN/10.10GP01000F/00/EN/13.11	 TI01001F/00/EN/10.10 TI01001F/00/EN/13.11 TI01001F/00/EN/14.11 TI01001F/00/EN/15.12 TI01001F/00/EN/16.12 	
02.2014	01.02.zz	 Support of SD03 Additional languages HistoROM functionality enhanced "Advanced Diagnostics" function block integrated Improvements and bugfixes 	 BA01001F/00/EN/16.13 BA01001F/00/EN/17.14 	 GP01000F/00/EN/14.13 BA01001F/00/EN/17.14 	 TI01001F/00/EN/17.13 TI01001F/00/EN/18.14 	
04.2016	01.03.zz	 Update to HART 7 All 17 languages available in the device Improvements and bugfixes 	 BA01001F/00/EN/18.16 BA01001F/00/EN/ 19.16¹⁾ BA01001F/00/EN/ 21.18²⁾ 	GP01000F/00/EN/16.16	 TI01001F/00/EN/20.16 TI01001F/00/EN/22.16¹⁾ TI01001F/00/EN/24.18²⁾ 	

13.7 Firmware history

1) Contains information on the Heartbeat wizards currently available in the current DTM version for DeviceCare and FieldCare.

Contains information on the Bluetooth interface. 2)



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.

14 Maintenance

No special maintenance work is required.

14.1 Exterior cleaning

When cleaning the exterior, always use cleaning agents that do not corrode the surface of the housing and the seals.

14.2 General cleaning instructions

Dirt or buildup may form on the probe depending on the application. A thin, even layer has little impact on the measurement. Thick layers can dampen the signal and reduce the measuring range. Very uneven deposit formation or caking (e.g. due to crystallization) can result in incorrect measurements. In such cases, use a non-contact measuring principle, or regularly inspect the probe for contamination.

Cleaning with sodium hydroxide solution (e.g. in CIP procedures): if the coupling is wetted, larger measurement errors can occur than under reference operating conditions. Wetting can cause temporary incorrect measurements.

15 Repair

15.1 General information

15.1.1 Repair concept

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

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

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

15.1.2 Repair of Ex-certified devices

WARNING

Incorrect repair can compromise electrical safety! Explosion Hazard!

- Repairs to Ex-certified devices must be carried out by Endress+Hauser Service or by specialist personnel according to national regulations.
- Relevant standards and national regulations on hazardous areas, safety instructions and certificates must be observed.
- ► Use only original Endress+Hauser spare parts.
- Please note the device designation on the nameplate. Only identical parts may be used as replacements.
- Carry out repairs according to the instructions.
- Only the Endress+Hauser service team is permitted to modify a certified device and convert it to another certified version.

15.1.3 Replacing electronics modules

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

15.1.4 Replacing a device

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

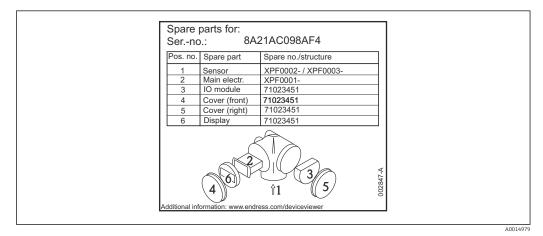
- Using the display module Prerequisite: The configuration of the old device was saved previously to the display module.
- Via FieldCare

Prerequisite: The configuration of the old device was saved previously to the computer using FieldCare.

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

15.2 Spare parts

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



43 Example for spare part nameplate in the connection compartment cover

All Measuring device serial number:

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

15.3 Return

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

1. Refer to the web page for information:

http://www.endress.com/support/return-material

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

15.4 Disposal

X

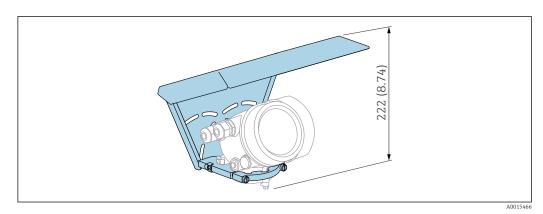
If required by the Directive 2012/19/EU on waste electrical and electronic equipment (WEEE), the product is marked with the depicted symbol in order to minimize the disposal of WEEE as unsorted municipal waste. Do not dispose of products bearing this marking as unsorted municipal waste. Instead, return them to the manufacturer for disposal under the applicable conditions.

16 Accessories

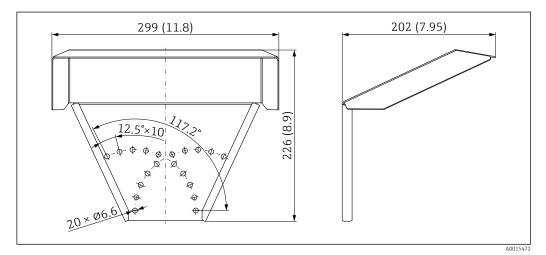
16.1 Device-specific accessories

16.1.1 Weather protection cover

The weather protection cover can be ordered together with the device via the "Accessory enclosed" product structure.



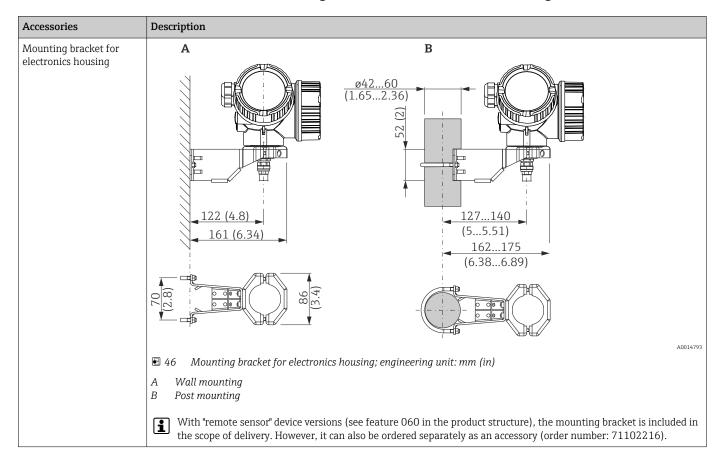
🖻 44 Height. Unit of measurement mm (in)



🖻 45 Dimensions. Unit of measurement mm (in)

Material 316L

Order number for accessories: 71162242



16.1.2 Mounting bracket for electronics housing

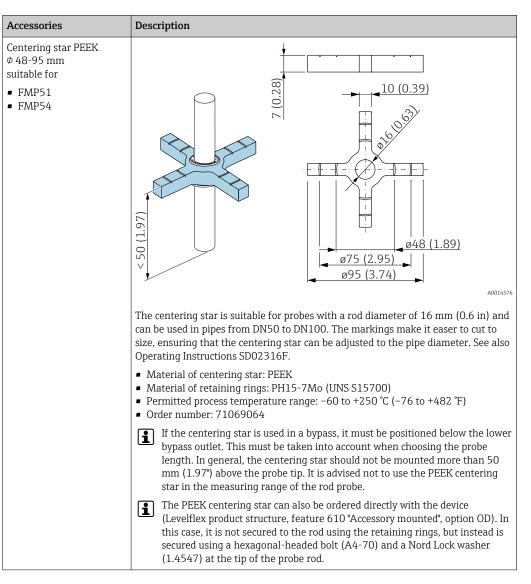
Accessories	Description			
Rod extension / centering device HMP40 Suitable for: FMP54 Permitted temperature at lower edge of nozzle: without centering disk: no restriction with centering disk: -40 to +150 °C (-40 to +302 °F) Additional information: SD01002F		ADDISS Mozzle height Extension rod		
	3 (Centering disk		
	010	Approval:		
	A	Non-hazardous area		
	M	FM DIP Cl.II Div.1 Gr.E-G N.I., Zone 21,22		
	P	CSA DIP Cl.II Div.1 Gr.G + coal dust N.I.		
	S	FM Cl.I, II, III Div.1 Gr.A-G N.I., Zone 0,1,2,20,21,22		
	U	CSA Cl.I, II, III Div.1 Gr.A-G N.I., Zone 0,1,2		
	1	ATEX II 1G		
	2	ATEX II 1D		
	020	Extension rod; height of nozzle:		
	1	115mm; 150-250mm / 6-10"		
	2	215mm; 250-350mm / 10-14"		
	3	315mm; 350-450mm / 14-18"		
	4	415mm; 450-550mm / 18-22"		
	9	Special version; TSP no. to be specified		
	030	Centering disk:		
	A	Not selected		
	В	DN40 / 1-1/2", inside-d. = 40-45mm, PPS		
	С	DN50 / 2", inside-d. = 50-57mm, PPS		
	D	DN80 / 3", inside-d. = 80-85mm, PPS		
	E	DN80 / 3", inside-d. = 76-78mm, PPS		
	G	DN100 / 4", inside-d. = 100-110mm, PPS		
	Н	DN150 / 6", inside-d. = 152-164mm, PPS		
	J	DN200 / 8", inside-d. = 210-215mm, PPS		
	К	DN250 / 10", inside-d. = 253-269mm, PPS		
	Y	Special version; TSP no. to be specified		

16.1.3 Rod extension / centering device

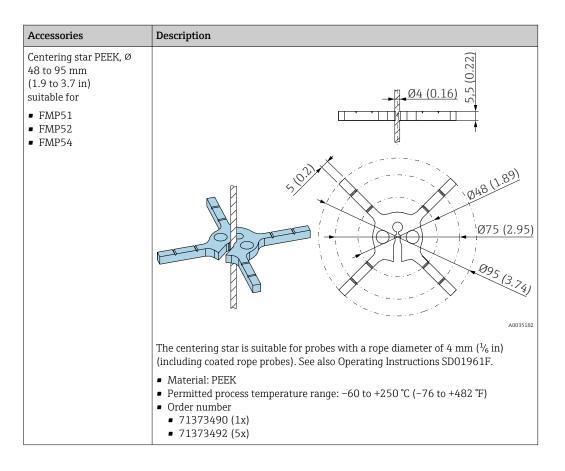
Accessories	Description
Accessories Mounting kit, insulated suitable for • FMP51 • FMP54	A0113566 47 Scope of delivery of mounting kit: 1 Insulation sleeve 2 Eye bolt To secure rope probes so that they are reliably insulated. Maximum process temperature: 150 °C (300 °F) For rope probes 4 mm (½ in) or 6 mm (1/4 in) with PA>steel : • Diameter D = 20 mm (0.8 in) • Order number: 52014249 For rope probes 6 mm (¼ in) or 8 mm (1/3 in) with PA>steel:
	 Diameter D = 25 mm (1 in) Order number: 52014250
	Due to the risk of electrostatic charge, the insulation sleeve is not suitable for use in hazardous areas! In this case, the probe must be secured so that it is reliably grounded.
	The mounting kit can also be ordered directly with the device (Levelflex product structure, feature 620 "Accessory enclosed", version PG "mounting kit, insulated, rope").

16.1.4 Mounting kit, insulated

16.1.5 Centering star

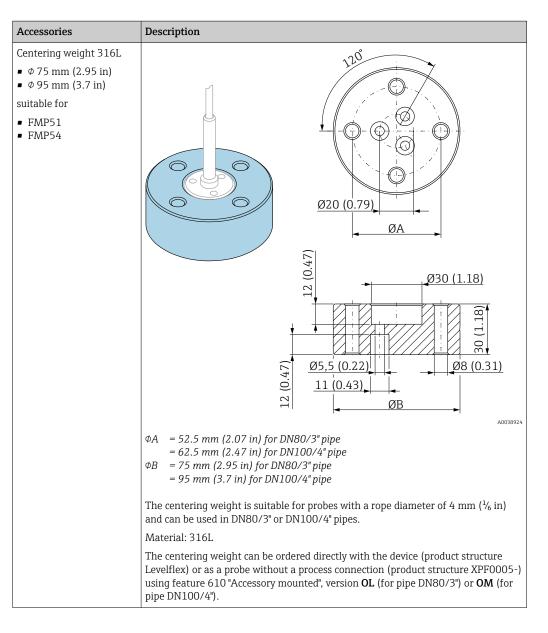


Accessories	Description
Centering star PFA	39)
 φ 16.4 mm (0.65 in) φ 37 mm (1.46 in) 	10 (0.39)
suitable for	
FMP51FMP52FMP54	A: ø16.4 (0.65) B: ø37 (1.46)
	A For probe 8 mm (0.3 in)
	B For probes 12 mm (0.47 in) and 16 mm (0.63 in)
	The centering star is suitable for probes with a rod diameter of 8 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).

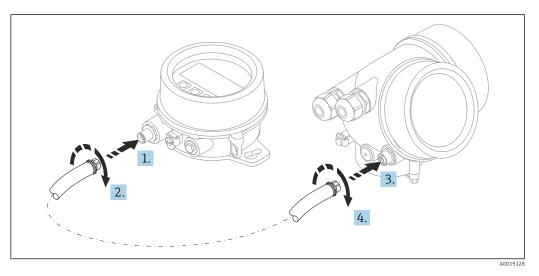


Accessories	Description
Centering weight 316L \$\overline\$ 45 mm (1.77 in) suitable for • FMP51 • FMP54	The centering weight is suitable for probes with a rope diameter of 4 mm ($\frac{1}{6}$ in) and can be used in DN50/2" pipes. Material: 316L The centering weight can be ordered directly with the device (product structure XPF0005-) using feature 610 "Accessory mounted", version OK (for pipe DN50/2").

16.1.6 Centering weight



16.1.7 Remote display FHX50



Endress+Hauser

Technical data

- 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:-40 to 80 °C (-40 to 176 °F)
- Ambient temperature (option): -50 to 80 °C (-58 to 176 °F) ⁵⁾

Ordering information

• If the remote display is to be used, the device version "Prepared for display FHX50" must be ordered.

For the FHX50, the option "Prepared for display FHX50" must be selected under "Measuring device version".

- If a measuring device has not been ordered with the version "Prepared for display FHX50" and is to be retrofitted with an FHX50, the version "Not prepared for display FHX50" must be ordered for the FHX50 under "Measuring device version". 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 may only be retrofitted with the FHX50 if the option "Prepared for FHX50" is listed in the associated Safety Instructions (XA) under *Basic specifications*, "Display, operation".

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)
- Type of protection Ex nA

For details, see the "Special Documentation" SD01007F

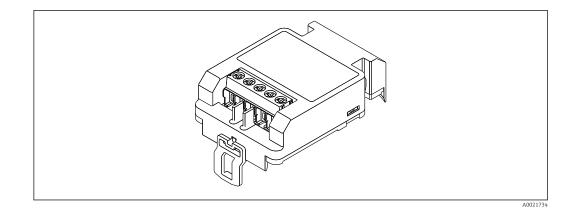
16.1.8 Overvoltage protection

The surge arrester for loop-powered devices can be ordered together with the device via the "Accessory mounted" section of the product order structure.

The surge arrester can be used for loop-powered devices.

- 1-channel devices OVP10
- 2-channel devices OVP20

⁵⁾ This range applies if the option JN "Transmitter ambient temperature" -50 °C (-58 °F) was selected in feature 580 "Test, Certificate". If the temperature is permanently below -40 °C (-40 °F), higher failure rates can be expected.



Technical data

- Resistance per channel: $2 \times 0.5 \ \Omega_{max}$
- Threshold DC voltage: 400 to 700 V
- Threshold surge voltage: < 800 V
- Capacitance at 1 MHz: < 1.5 pF
- Nominal leakage current (8/20 µs): 10 kA
- Suitable for conductor cross-sections: 0.2 to 2.5 mm² (24 to 14 AWG)

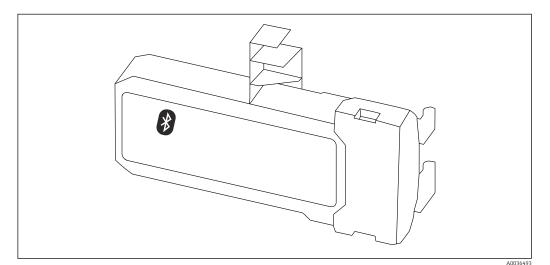
If retrofitting:

- Order number for 1-channel devices (OVP10): 71128617
- Order number for 2-channel devices (OVP20): 71128619
- The use of the OVP module may be restricted depending on the transmitter approval. A device may only be retrofitted with the OVP module if the option *NA* (overvoltage protection) is listed under *Optional specifications* in the Safety Instructions (XA) associated with the device.
- In order to keep the necessary safety distances when using the surge arrester module, the housing cover also needs to be replaced when the device is retrofitted.
 Depending on the housing type, the suitable cover can be ordered using the following order number:
 - Housing GT18: 71185516
 - Housing GT19: 71185518
 - Housing GT20: 71185517

For details, see the "Special Documentation" SD01090F

16.1.9 Bluetooth module BT10 for HART devices

The Bluetooth module BT10 can be ordered together with the device via the "Accessory mounted" section of the product order structure.



Technical data

- Quick and easy setup with the SmartBlue app
- No additional tools or adapters needed
- Signal curve via SmartBlue (app)
- Encrypted single point-to-point data transmission (tested by Fraunhofer Institute) and password-protected communication via Bluetooth[®] wireless technology
- Range under reference conditions:
 - > 10 m (33 ft)
- When the Bluetooth module is used, the minimum supply voltage of the device increases by up to 3 V.

If retrofitting:

- Order number: 71377355
- The use of the Bluetooth module may be restricted depending on the transmitter approval. A device may only be retrofitted with the Bluetooth module if the option *NF* (Bluetooth module) is listed under *Optional specifications* in the Safety Instructions (XA) associated with the device.

For details, see the "Special Documentation" SD02252F

16.2 Communication-specific accessories

Commubox FXA195 HART

For intrinsically safe HART communication with FieldCare via the USB interface

For details, see "Technical Information" TIO0404F

Commubox FXA291

Connects Endress+Hauser field devices with a CDI interface (= Endress+Hauser Common Data Interface) and the USB port of a computer or laptop Order number: 51516983

For details, see "Technical Information" TI00405C

HART Loop Converter HMX50

Is used to evaluate and convert dynamic HART process variables to analog current signals or limit values

Order number: 71063562

For details, see "Technical Information" TI00429F and Operating Instructions BA00371F

WirelessHART adapter SWA70

- Is used for the wireless connection of field devices
- The WirelessHART adapter can be easily integrated into field devices and existing infrastructures, offers data protection and transmission safety and can be operated in parallel with other wireless networks

For details, see Operating Instructions BA00061S

Fieldgate FXA42

Fieldgates enable communication between connected 4 to 20 mA, Modbus RS485 and Modbus TCP devices and SupplyCare Hosting or SupplyCare Enterprise. The signals are transmitted either via Ethernet TCP/IP, WLAN or mobile communications (UMTS). Advanced automation capabilities are available, such as an integrated Web-PLC, OpenVPN and other functions.



For details, see "Technical Information" TI01297S and Operating Instructions BA01778S.

SupplyCare Enterprise SCE30B

Inventory management software that displays the level, volume, mass, temperature, pressure, density or other parameters of tanks. The parameters are recorded and transmitted by means of gateways like Fieldgate FXA42, Connect Sensor FXA30B or other gateway types.

This Web-based software is installed on a local server and can also be visualized and operated with mobile terminals such as a smartphone or tablet.

For details, see Technical Information TI01228S and Operating Instructions BA00055S

SupplyCare Hosting SCH30

Inventory management software that displays the level, volume, mass, temperature, pressure, density or other parameters of tanks. The parameters are recorded and transmitted by means of gateways like Fieldgate FXA42, Connect Sensor FXA30B or other gateway types.

SupplyCare Hosting is offered as a hosting service (Software as a Service, SaaS). In the Endress+Hauser portal, the user is provided with the data over the Internet.



For details, see Technical Information TI01229S and Operating Instructions BA00050S

Field Xpert SFX350

Field Xpert SFX350 is a mobile computer for commissioning and maintenance. It enables efficient device configuration and diagnostics for HART and FOUNDATION Fieldbus devices in the **non-Ex area**.



For details, see Operating Instructions BA01202S

Field Xpert SFX370

Field Xpert SFX370 is a mobile computer for commissioning and maintenance. It enables efficient device configuration and diagnostics for HART and FOUNDATION Fieldbus devices in the non-Ex area and the Ex area.

For details, see Operating Instructions BA01202S **1**

16.3Service-specific accessories

DeviceCare SFE100

Configuration tool for HART, PROFIBUS and FOUNDATION Fieldbus field devices



Technical Information TI01134S

FieldCare SFE500

FDT-based plant asset management tool

It can configure all smart field units in your system and helps you manage them. By using the status information, it is also a simple but effective way of checking their status and condition.



Technical Information TI00028S

16.4 System components

Memograph M graphic data manager

The Memograph M graphic data manager 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 a SD card or USB stick.



Technical Information TI00133R and Operating Instructions BA00247R

RN221N

Active barrier with power supply for safe separation of 4 to 20 mA standard signal circuits. Offers bidirectional HART transmission.

Technical Information TI00073R and Operating Instructions BA00202R

RN221

Supply unit for powering two 2-wire measuring devices solely in the non-Ex area. Bidirectional communication is possible via the HART communication jacks.



Technical Information TI00081R and Brief Operating Instructions KA00110R

17 Operating menu

17.1 Overview of the operating menu (SmartBlue)

Navigation

SmartBlue

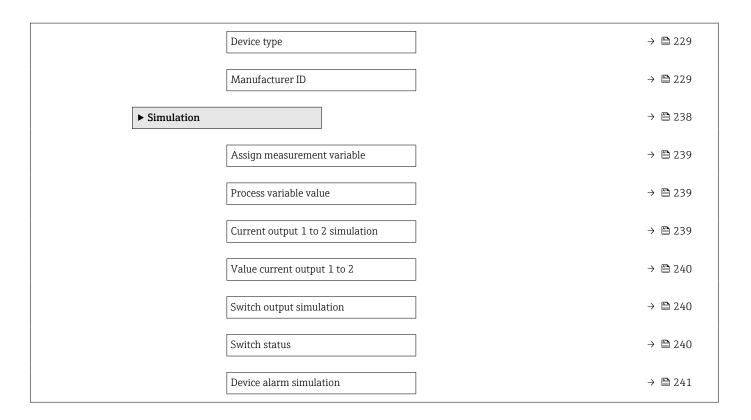
🖌 Setup			→ 🖺 154
	Device tag		→ 🖺 154
	Operating mode		→ 🖺 154
	Distance unit		→ 🖺 154
	Tank type		→ 🖺 155
	Tube diameter		→ 🖺 155
	Tank level]	→ 🖺 161
	Distance to upper connection]	→ 🗎 161
	DC value]	→ 🗎 162
	Medium group]	→ 🗎 155
	Empty calibration]	→ 🗎 156
	Full calibration		→ 🗎 157
	Level]	→ 🗎 158
	Interface		→ 🗎 163
	Distance		→ 🖺 159
	Interface distance		→ 🗎 164
	Signal quality		→ 🗎 160
	Confirm distance]	→ 🗎 164
	Present mapping]	→ 🖺 165
	Mapping end point]	→ 🖺 166

Record map			→ 🗎 166
► Advanced s	setup		→ 🗎 168
	Locking status		→ 🗎 168
	Access status too	ling	→ ➡ 168
	Enter access code	2	→ 🗎 169
	► Level		→
		Medium type	→ 🗎 170
		Medium property	→ 🗎 170
		Process property	→ 🗎 171
		Advanced process conditions	→ 🗎 172
		Level unit	→ 🗎 173
		Blocking distance	→ 🗎 173
		Level correction	→ 🗎 174
	► Interface		→ 🗎 175
		Process property	→ 🗎 175
		DC value lower medium	→ 🗎 175
		Level unit	→ 🗎 176
		Blocking distance	→ 🗎 176
		Level correction	→ 🗎 177
		Manual thickness upper layer	→ 🗎 177
		Measured thickness upper layer	→ ➡ 178
		DC value	→ ➡ 178
		Calculated DC value	→ ● 178
		Use calculated DC value	→

► Linearization		\rightarrow E	182
	Linearization type) → @	184
	Unit after linearization		185
	Free text		186
	Level linearized		187
	Interface linearized) → @	187
	Maximum value		187
	Diameter	→ @	188
	Intermediate height		188
	Table mode		188
	Table number		189
			109 190
	Level		
	Level		190
	Customer value) → @	190
	Activate table	\rightarrow	190
► Probe setting	S	\rightarrow	197
	Probe grounded		197
	Present probe length	\rightarrow	197
	Confirm probe length	ightarrow	198
► Safety setting	JS		192
	Output echo lost		192
	Value echo lost		192
	Ramp at echo lost		193
	Blocking distance		173

	► Current output 1	to 2	→ 🗎 200
		Assign current output	→ 🗎 200
		Current span	→ 🗎 201
		Fixed current	→ 🗎 202
		Damping output	→ 🖺 202
		Failure mode	→ 🖺 202
		Failure current	→ 🗎 203
		Output current 1 to 2	→ 🗎 204
	► Switch output		→ 🗎 205
		Switch output function	→ 🗎 205
		Assign status	→ 🗎 206
		Assign limit	→ 🗎 206
		Assign diagnostic behavior	→ 🗎 206
		Switch-on value	→ 🗎 207
		Switch-on delay	→ 🗎 208
		Switch-off value	→ 🗎 208
		Switch-off delay	→ 🗎 209
		Failure mode	→ 🗎 209
		Switch status	→ 🗎 209
		Invert output signal	→ 🗎 209
억 Diagnostics]		→ 🗎 223
Actual diagnostics			→ 🗎 223
Timestamp			→ 🗎 223
Previous diagnostic	S		→ 🗎 223
Timestamp			→ 🖺 224

Operating time from	n restart	→ 🗎 224
Operating time		→ 🖺 217
► Diagnostic list		→ 🖺 225
	Diagnostics 1 to 5	→ 🖺 225
	Timestamp 1 to 5	→ 🖺 225
► Measured value	S	→ 🖺 230
	Distance	→ 🗎 159
	Level linearized	→ 🖺 187
	Interface distance	→ 🖺 164
	Interface linearized	→ 🖺 187
	Thickness upper layer	→ 🖺 232
	Output current 1 to 2	→ 🖺 204
	Measured current 1	→ 🖺 232
	Terminal voltage 1	→ 🖺 233
► Device informat	ion	→ 🗎 227
	Device tag	→ 🗎 227
	Serial number	→ 🖺 227
	Firmware version	→ 🖺 227
	Device name	→ 🖺 227
	Order code	→ 🖺 228
	Extended order code 1 to 3	→ 🖺 228
	Device revision	→ 🗎 228
	Device ID	→ 🗎 228



17.2 Overview of the operating menu (display module)

Navigation Operating menu Language 🗲 Setup → 🗎 154 Device tag → 🖺 154 Operating mode → 🖺 154 → 🗎 154 Distance unit Tank type → 🗎 155 Tube diameter → 🖺 155 Tank level → 🗎 161 → 🗎 161 Distance to upper connection DC value → 🗎 162 Medium group → 🖺 155 Empty calibration → 🗎 156 → 🗎 157 Full calibration → 🗎 158 Level Interface → 🗎 163 Distance → 🖺 159 Interface distance → 🖺 164 Signal quality → 🗎 160 ► Mapping → 🗎 167 Confirm distance → 🗎 167 → 🗎 167 Mapping end point

	Record map]	→ 🗎 167
	Distance]	→ 🗎 167
► Advanced setup]		→ 🗎 168
	Locking status]	→ 🗎 168
	Access status displa	у]	→ 🗎 169
	Enter access code]	→ 🗎 169
	► Level]	→ 🗎 170
		Medium type		→ 🗎 170
		Medium property		→ 🗎 170
		Process property		→ 🗎 171
		Advanced process c	onditions	→ 🗎 172
		Level unit		→ 🗎 173
		Blocking distance		→ 🗎 173
		Level correction		→ 🗎 174
	► Interface			→ 🗎 175
		Process property	-	→ 🗎 175
		DC value lower med	ium	→ 🗎 175
		Level unit		→ 🗎 176
		Blocking distance		→ 🗎 176
		Level correction		→ 🗎 177
		► Automatic DC ca	lculation	→ 🗎 180
			Manual thickness upper layer	→ 🗎 180
			DC value	→ 🗎 180
			Use calculated DC value	→ 🗎 180
			L	

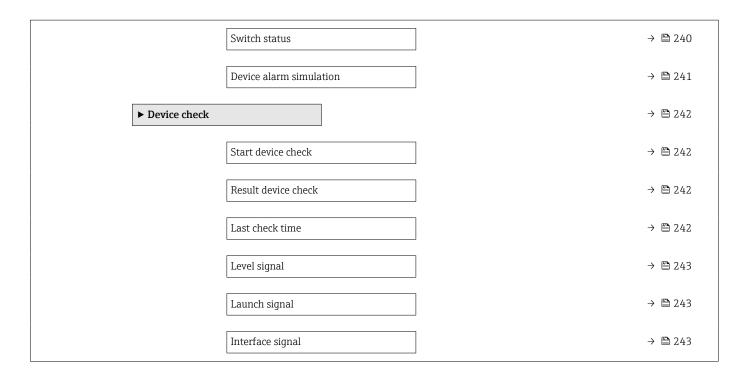
► Linearization			→ 🗎 182
	Linearization type		→ 🗎 184
	Unit after linearizat	ion	→ 🗎 185
	Free text		→ 🗎 186
	Maximum value		→ 🗎 187
	Diameter		→ 🗎 188
	Intermediate height	:	→ 🗎 188
	Table mode		→ 188
	► Edit table		
		Level	
		Customer value	
	Activate table		→ 🗎 190
► Safety settings			→ 🗎 192
	Output echo lost		→ <a>Pmin 192
	Value echo lost		→ 🗎 192
	Ramp at echo lost		→ 🗎 193
	Blocking distance		→ 🗎 173
► SIL/WHG confirm	nation]	→ 🗎 195
► Deactivate SIL/V	VHG]	→ 🗎 196
	Reset write protectio	on	→ 🗎 196
	Code incorrect		→ 🖺 196

► Probe settings		→ 🗎 197
	Probe grounded	→ 🗎 197
	► Probe length correction	→ 🖺 199
	Confirm probe length	→ 🗎 199
	Present probe length	→ 🗎 199
► Current output	1 to 2	→ 🖺 200
	Assign current output	→ 🗎 200
	Current span	→ 🗎 201
	Fixed current	→ 🗎 202
	Damping output	→ 🖺 202
	Failure mode	→ 🗎 202
	Failure current	→ 🗎 203
	Output current 1 to 2	→ 🗎 204
► Switch output		→ 🗎 205
K	Switch output function	→ 🖺 205
		→ 🗎 206
	Assign status	
	Assign limit	→ 🖺 206
	Assign diagnostic behavior	→ 🖺 206
	Switch-on value	→ 🗎 207
	Switch-on delay	→ 🗎 208
	Switch-off value	→ 🗎 208
	Switch-off delay	→ 🗎 209
	Failure mode	→ 🖺 209
	Switch status	→ 🗎 209
	Invert output signal	→ 🗎 209

► Display		→ 🗎 211
	Language	→ 🗎 211
	Format display	→ 🗎 211
	Value 1 to 4 display	→ 🗎 213
	Decimal places 1 to 4	→ 🗎 213
	Display interval	→ 🗎 214
	Display damping	→ 🗎 214
	Header	→ 🗎 214
	Header text	→ 🗎 215
	Separator	→ 🗎 215
	Number format	→ 🗎 215
	Decimal places menu	→ 🗎 215
	Backlight	→ 🗎 216
	Contrast display	→ 🗎 216
► Configuration b	ackup display	→ 🗎 217
	Operating time	→ 🗎 217
	Last backup	→ 🗎 217
	Late Suchap	, = 21/

	217 218 220 222	
→ @	220	
→	222	
→	222	
→ 🖺	222	
→	220	
→	223	
→	223	
→	223	
→	224	
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→ 🖺	226	
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		 → → ● 227 → ● 227 → ● 228 → ● 228 → ● 228 → ● 228

Device ID]	→ 🗎 228
Device type			→ 🗎 229
Manufacturer ID]	→ 🗎 229
► Measured values			→ 🖺 230
Distance			→ 🗎 159
Level linearized			→ 🗎 187
Interface distance			→ 🖺 164
Interface linearized]	→ 🗎 187
Thickness upper lay	er]	→ 🖺 232
Output current 1 to	2		→ 🖺 204
Measured current 1]	→ 🗎 232
Terminal voltage 1			→ 🗎 233
► Data logging			→ 🖺 234
Assign channel 1 to	4]	→ 🗎 234
Logging interval			→ 🖺 235
Clear logging data			→ 🗎 235
► Display channel	1 to 4		→ 🗎 236
► Simulation			→ 🗎 238
Assign measuremen	it variable		→ 🗎 239
Process variable valu	16		→ 🗎 239
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Value current outpu	t 1 to 2		→ 🗎 240
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17.3 Overview of the operating menu (operating tool)

Navigation

Operating menu

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	Operating mode	→ 🖺 154
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	Tank type	→ 🗎 155
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	Interface signal	→ 🗎 243
► Heartbeat		→ 🗎 244

Device tag		
Navigation		
Description	Enter a unique name for the measuring point to identify the device quickly within the plant.	
User entry	Character string comprising numbers, letters and special characters (32)	
Operating mode		A
Navigation		
Prerequisite	The device has the "interface measurement" application package (available for FMP51 FMP52, FMP54) ⁶⁾ .	,
Description	Select operating mode.	
Selection	 Level Interface with capacitance * Interface * 	
Factory setting	FMP51/FMP52/FMP54: Level	
Distance unit		A
Navigation	Image: Setup → Distance unit	
Description	Used for the basic calibration (Empty / Full).	

US units

■ ft ■ in

17.4 "Setup" menu

- 📾 : Indicates how to navigate to the parameter using the display and operating module
 - Indicates how to navigate to the parameter using operating tools (e.g. FieldCare)
 - 🟦 : Indicates parameters that can be locked via the access code.

Navigation

🛛 🖃 Setup

SI units

• mm

• m

Selection

 ⁶⁾ Product structure: Feature 540 "Application Package", Option EB "Interface measurement"
 * Visibility depends on order options or device settings

Â

Tank type

Navigation Prerequisite	Setup → Tank type Medium type (→ 🗎 170) = 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		Ê
Navigation		
Prerequisite	 Tank type (→ ^B 155) = Bypass / pipe The probe is coated. 	
Description	Specify diameter of bypass or stilling well.	
User entry	0 to 9.999 m	

Medium group

Navigation	
Prerequisite	 For FMP51/FMP52/FMP54/FMP55: Operating mode (→ [™] 154) = Level Medium type (→ [™] 170) = Liquid
Description	Select medium group.
Selection	 Others Water based (DC >= 4)
Additional information	This parameter roughly specifies the dielectric constant (DC) of the medium. For a more detailed definition of the DC use the Medium property parameter ($\rightarrow \square 170$).

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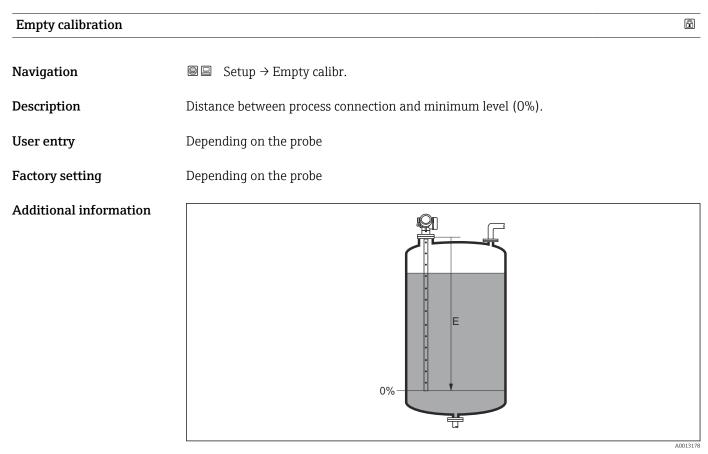
The **Medium group** parameter presets the **Medium property** parameter ($\rightarrow \implies 170$) as follows:

Medium group	Medium property ($\rightarrow \square 170$)
Others	Unknown
Water based (DC \geq = 4)	DC 4 7

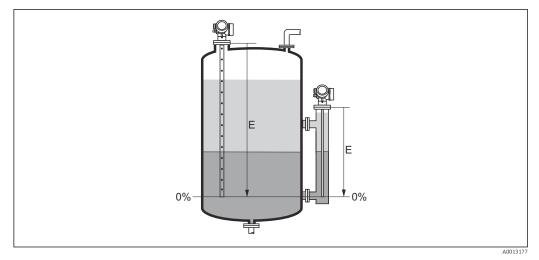


The **Medium property** parameter can be changed at a later point of time. However, when doing so, the **Medium group** parameter retains its value. Only the **Medium property** parameter is relevant for the signal evaluation.

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



48 Empty calibration (E) for level measurements in liquids



Empty calibration (E) for interface measurements

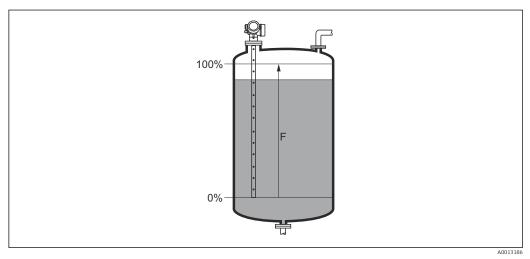
In the case of interface measurements the **Empty calibration** parameter is valid for both, the total and the interface level.

Full calibration

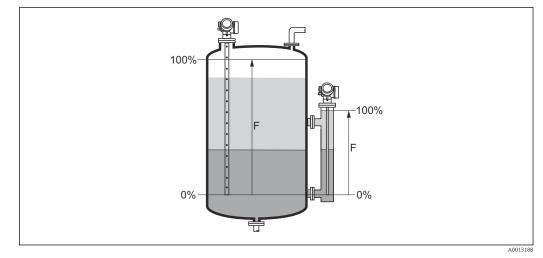
Navigation \square Setup \rightarrow Full calibr.

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

- **User entry** Depending on the probe
- Factory setting Depending on the probe
- Additional information



■ 50 Full calibration (F) for level measurements in liquids



■ 51 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.

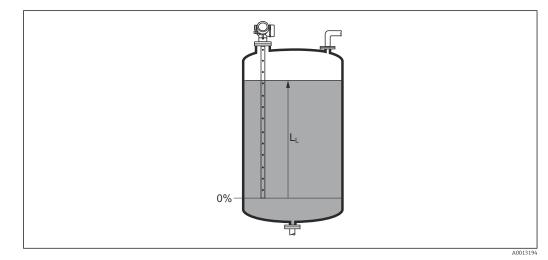
Level

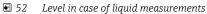
Navigation

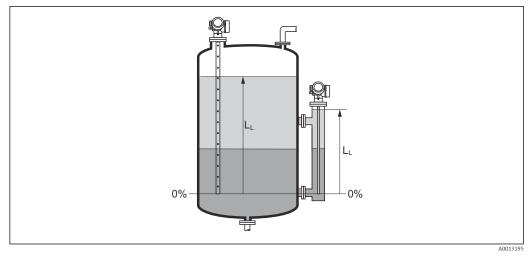
Description

Displays measured level L_L (before linearization).

Additional information







■ 53 Level in case of interface measurements

The unit is defined in the Level unit parameter (→
173).
In case of interface measurements, this parameter always refers to the total level.

Distance

Navigation

 \bigcirc □ Setup → Distance

Description

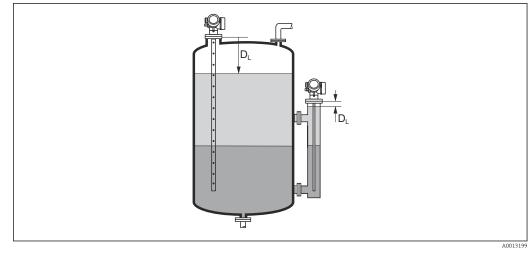
Displays the measured distance D_L between the reference point (lower edge of the flange or threaded connection) and the level.

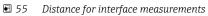
DL

Additional information

54 Distance for liquid measurements

A0013198





The unit is defined in the **Distance unit** parameter ($\rightarrow \square 154$). -

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 ⁷⁾ 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 (→ □ 192) = Alarm.

- tput echo lost ($\rightarrow \cong 192$) Alarm.
- S941, if another option has been selected in Output echo lost (→
 ¹ 192).

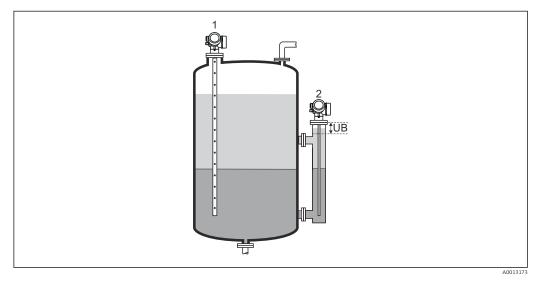
⁷⁾ Of these two echos the one with the lower quality is indicated.

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Tank level

Navigation	Image: Imag
Prerequisite	Operating mode (→ 🗎 154) = Interface
Description	Specify whether the tank or bypass is completely flooded or not.
Selection	Partially filledFully flooded
Additional information	 Meaning of the options Partially filled The device searches for 2 echo signals, one for the interface and one for the total level. Fully flooded

The device searches for the interface level only. With this setting it is essential that the upper level signal always is within the upper blocking distance (UB) in order to avoid that it is evaluated by mistake.



- Partially filled 1
- 2 Fully flooded UB Upper blocking distance

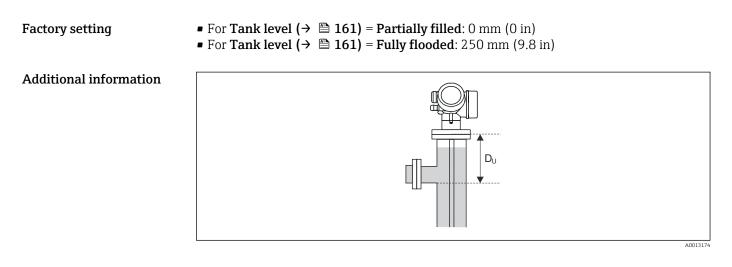
Distance to upper connection		
Navigation	Image: Setup → Dist. up.connect	

Prerequisite The device has the "Interface measurement" application package⁸⁾.

Description Specify distance D_U to upper connection.

User entry 0 to 200 m

⁸⁾ Product structure: Feature 540 "Application Package", Option EB "Interface measurement"



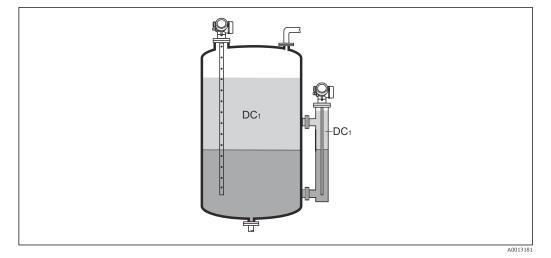
Dependence on the "Tank level" parameter

- Tank level (→
 ^(⇒) 161) = 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 ($\Rightarrow \square 161$) = 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 \rightarrow DC value	
Prerequisite	The device has the "Interface measurement" application package ⁹⁾ .	
Description	Specify the relative dielectric constant $\epsilon_{\rm r}$ of the upper medium (DC_1).	
User entry	1.0 to 100	

⁹⁾ Product structure: feature 540 "Application packages", option EB "Interface measurement"

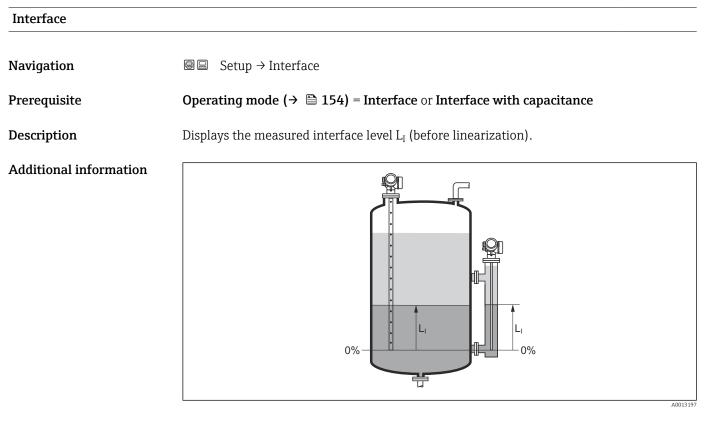
Additional information



DC1 Relative dielectric constant of the upper medium.

For the dielectric constants (DC values) of many media commonly used in industry, please refer to:

- Dielectric constant (DC value) Compendium CP01076F
- The Endress+Hauser "DC Values app" (available for Android and iOS)





The unit is defined in the **Level unit** parameter ($\rightarrow \square$ 173).

Interface distance

Navigation

 \blacksquare □ Setup → Interface dist.

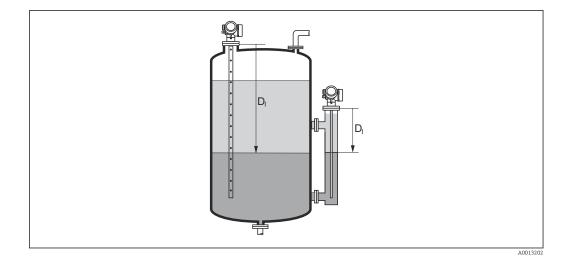
Prerequisite

Description

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

Operating mode (→ 🗎 **154)** = **Interface** or **Interface with capacitance**

Additional information



The unit is defined in the **Distance unit** parameter ($\rightarrow \triangleq 154$).

Confirm distance		
Navigation	□ Setup \rightarrow Confirm distance	
Description	Specify, whether the measured distance matches the real distance. Depending on the selection the device automatically sets the range of mapping.	
Selection	 Manual map Distance ok Distance unknown Distance too small * Distance too big * 	

- Tank empty
- Delete map

^{*} Visibility depends on order options or device settings

Additional information

Meaning of the options

Manual map

To be selected if the range of mapping is to be defined manually in the **Mapping end point** parameter ($\rightarrow \square$ 166). 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 ¹⁰

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.

¹⁰⁾ Only available for "Expert → Sensor → Echo tracking → Evaluation mode parameter" = "Short time history" or "Long time history"

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Mapping end point

Navigation	Setup \rightarrow Map. end point
Prerequisite	Confirm distance ($\Rightarrow \square 164$) = Manual map or Distance too small
Description	Specify new end of the mapping.
User entry	0 to 200 000.0 m
Additional information	This parameter defines up to which distance the new mapping is to be recorded. The distance is measured from the reference point, i.e. from the lower edge of the mounting flange or the threaded connection.
	For reference purposes the Present mapping parameter (→

Record map		
Navigation	□ Setup \rightarrow Record map	
Prerequisite	Confirm distance ($\Rightarrow \square 164$) = Manual map or Distance too small	
Description	Start recording of the map.	
Selection	NoRecord mapDelete map	
Additional information	 Meaning of the options No No The map is not recorded. Record map The map is recorded. After the recording is completed, the new measured distance at 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 new pressing ☑. 	ired

	17.4.1 "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 (→ 154).
	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 \blacksquare Setup \rightarrow Mapping
Confirm distance	۵
Navigation	Setup → Mapping → Confirm distance
Description	→ 🗎 164
Mapping end point	<u>ක</u>
Navigation	Setup \rightarrow Mapping \rightarrow Map. end point
Description	→ 🗎 166
Record map	۵
Navigation	Setup → Mapping → Record map
Description	→ 🗎 166
Distance	
Navigation	Setup → Mapping → Distance
Description	→ 🗎 159

17.4.2 "Advanced setup" submenu

```
Navigation \square Setup \rightarrow Advanced setup
```

Locking status	
Navigation	Image: 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 access are write-protected.

Access status tooling

Navigation	$ \qquad \qquad$
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 $(\rightarrow \cong 169)$.
	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 ($\rightarrow \square 168$).

Access status display		
Navigation		
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 $(\rightarrow \cong 169)$.	
	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 ($\rightarrow \square 168$).	

Enter access code	
Navigation	Setup \rightarrow Advanced setup \rightarrow Ent. access code
Description	Enter access code to disable write protection of parameters.
User entry	0 to 9 999
Additional information	 The customer-specific access code that was defined in the Define access code parameter (→) 220) must be entered for local operation. If an incorrect access code is entered, users retain their current access authorization. The write protection affects all parameters marked with the) symbol in the document. On the local display, the) symbol in front of a parameter indicates that the parameter is write-protected. If no key is pressed for 10 minutes or the user goes from the navigation and editing mode back to the measured value display mode, the device automatically locks the write-protected parameters after another 60 s. Please contact your Endress+Hauser Sales Center if you lose your access code.

"Level" submenu

Level submenu ($\rightarrow \cong 170$) is only visible for **Operating mode (\rightarrow \cong 154) = Level**

Navigation \square Setup \rightarrow Advanced setup \rightarrow Level

Medium type	l	
Navigation		
Description	Specify type of medium.	
User interface	LiquidSolid	
Factory setting	FMP50, FMP51, FMP52, FMP53, FMP54, FMP55: Liquid	
Additional information	 The Solid option is only available for Operating mode (→ ≅ 154) = Level This parameter determines the value of several other parameters and strongly influences the complete signal evaluation. Therefore, it is strongly recommended no to change the factory setting. 	ot

Medium property		
Navigation	Image: Boundary Setup → Advanced setup → Level → Medium property	
Prerequisite	 Operating mode (→	
Description	Specify the dielectric constant $\boldsymbol{\epsilon}_r$ of the medium.	
Selection	 Unknown DC 1.4 1.6 DC 1.6 1.9 DC 1.9 2.5 DC 2.5 4 DC 4 7 DC 7 15 DC > 15 	
Factory setting	Depends on the Medium type ($ ightarrow extsf{B}$ 170) and Medium group ($ ightarrow extsf{B}$ 155) parameters	J .

Additional information

Dependency of "Medium type" and "Medium group"

Medium type (→ 🗎 170)	Medium group (→ 🗎 155)	Medium property
Solid		Unknown
Liquid	Water based (DC \geq = 4)	DC 4 7
	Others	Unknown

For the dielectric constants (DC values) of many media commonly used in industry, please refer to:

- Dielectric constant (DC value) Compendium CP01076F
- The Endress+Hauser "DC Values app" (available for Android and iOS)

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Process property		۵
Navigation	Image: Boost and the set of	ss property
Description	Specify typical rate of level change.	
Selection	For "Medium type" = "Liquid" Very fast > 10 m (400 in)/min Fast > 1 m (40 in)/min Standard < 1 m (40in) /min Medium < 10 cm (4in) /min Slow < 1 cm (0.4in) /min No filter / test	
	For "Medium type" = "Solid" • Very fast > 100 m (333 ft) /h • Fast > 10 m (33 ft) /h • Standard < 10 m (33 ft) /h • Medium < 1 m (3ft) /h • Slow < 0.1 m (0.3ft) /h • No filter / test	
Additional information	The device adjusts the signal evaluation filters a typical rate of level change defined in this paran For "Operating mode" = "Level" and "Medium type"	neter:
	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

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" = "Level" and "Medium type" = "Solid"

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

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

Advanced process conditions

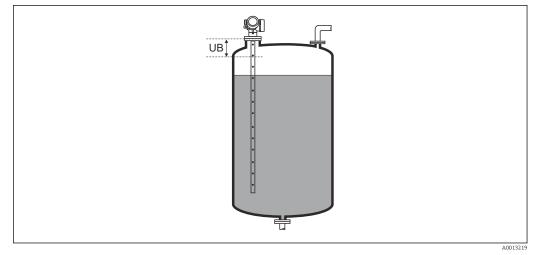
Navigation	Setup → Advanced setup → Level → Adv. conditions	
Prerequisite	Operating mode (→ 🗎 154) = Level	
Description	Specify additional process conditions (if required).	
Selection	 None Oil/Water condensate Probe near tank bottom Build up Foam (>5cm/0,16ft) 	
Additional information	 Meaning of the options Oil/Water condensate (only Medium type = Liquid) Makes sure that in the case of two-phase media only the total level is detected (example: oil/condensate application). Probe near tank bottom (only for Medium type = Liquid) Improves the empty detection, especially if the probe is mounted close to the tank bottom. Build up Increases EOP range upper area in order to ensure a safe empty-detection even if the end-of-probe signal has shifted due to build-up. Enables a safe empty-detection even if the end-of-probe signal has shifted due to build-up. Foam (>5cm/0,16ft) (only for Medium type = Liquid) Optimizes the signal evaluation in applications with foam formation. 	

A

Level unit			A
Navigation		tup \rightarrow Level \rightarrow Level unit	
Description	Select level unit.		
Selection	SI units • % • m • mm	US units • ft • in	
Additional information	 The level unit may differ from the distance unit defined in the Distance unit paramete (→ ^{(⇒} 154): The unit defined in the Distance unit parameter is used for the basic calibration (Em) 		
	calibration ($\rightarrow \cong 156$) as	and Full calibration ($\rightarrow \cong 157$). vel unit parameter is used to display the (unlinearized) leve	

Blocking distance	
Navigation	
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 ¹¹⁾ 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.

¹¹⁾ Ordering feature 540 "Application Package", option EB "Interface measurement"



■ 56 Blocking distance (UB) for liquid measurements

Level correction	
Navigation	
Description	Specify level correction (if required).
User entry	-200000.0 to 200000.0 %
Additional information	The value specified in this parameter is added to the measured level (before linearization).

"Interface" submenu

Navigation \square Setup \rightarrow Advanced setup \rightarrow Interface

Process property		۵
Navigation	Interface →	Process property
Description	Specify typical rate of change for the interfac	e position.
Selection	 Fast > 1 m (40 in)/min Standard < 1 m (40in) /min Medium < 10 cm (4in) /min Slow < 1 cm (0.4in) /min No filter / test 	
Additional information	The device adjusts the signal evaluation filter typical rate of level change defined in this part	s and the damping of the output signal to the rameter:
	Process property	Step response time / s
	Fast > 1 m (40 in)/min	5
	Standard < 1 m (40in) (min	16

	, , , , , , , , , , , , , , , , , , ,
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	$ \blacksquare \blacksquare Setup \rightarrow Advanced setup \rightarrow Interface \rightarrow DC lower medium $
Prerequisite	Operating mode ($\Rightarrow \square 154$) = Interface or Interface with capacitance
Description	Specify the dielectric constant ϵ_r of the lower medium.
User entry	1 to 100
Additional information	 For the dielectric constants (DC values) of many media commonly used in industry, please refer to: Dielectric constant (DC value) Compendium CP01076F The Endress+Hauser "DC Values app" (available for Android and iOS)

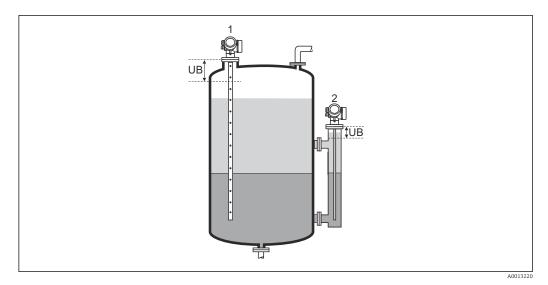
The factory setting, $\varepsilon_r = 80$, applies for water at 20 °C (68 °F).

A

Level unit			
Navigation		tup \rightarrow Interface \rightarrow Level unit	
Description	Select level unit.		
Selection	SI units ■ % ■ m ■ mm	US units ■ ft ■ in	
Additional information	The level unit may differ fro $(\rightarrow \cong 154)$:	m the distance unit defined in the Distance unit parameter	
	calibration ($\rightarrow \implies 156$) as	stance unit parameter is used for the basic calibration (Emp nd Full calibration (→ 曽 157)). vel unit parameter is used to display the (unlinearized) leve	

Blocking distance		
Navigation	$ \blacksquare \square \text{Setup} \rightarrow \text{Advanced setup} \rightarrow \text{Interface} \rightarrow \text{Blocking dist.} $	
Description	Specify upper blocking distance UB.	
User entry	0 to 200 m	
Factory setting	 For coax probes: 100 mm (3.9 in) For rod and rope probes up to 8 m (26 ft): 200 mm (8 in) For rod and rope probes above 8 m (26 ft): 0.025 * length of probe 	
Additional information	Echoes from within the blocking distance are not taken into account in the signal evaluation. The upper blocking distance is used	

- to suppress interference echoes at the top end of the probe.to suppress the echo of the total level in the case of flooded bypasses.



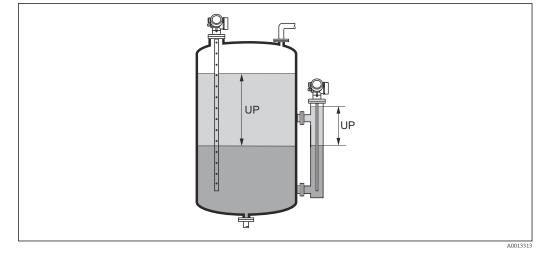
Suppression of interference echoes at the top end of the probe.
 Suppression of the level signal in case of a flooded bypass.
 UB Upper blocking distance

Level correction	8
Navigation	Interface → Level correction
Description	Specify level correction (if required).
User entry	-200000.0 to 200000.0 %
Additional information	The value specified in this parameter is added to the measured total and interface levels (before linearization).

Manual thickness upper la	iyer	Â]
Navigation		Setup \rightarrow Advanced setup \rightarrow Interface \rightarrow Man.thick.up.lay	
Description	Spec medi	fy the manually determined interface thickness UP (i.e. the thickness of the upper um).	

User entry 0 to 200 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 \rightarrow Advanced setup \rightarrow Interface \rightarrow Meas.thick.u.lay	
Description	Displ	ays the measured interface thickness. (Thickness UP of the upper medium).	
DC value			
Navigation		Setup \rightarrow Advanced setup \rightarrow Interface \rightarrow DC value	
Description	Displ	ays relatvie dielectric constant $\epsilon_{\rm r}$ of the upper medium (DC_1) before correction.	
Calculated DC value			
Navigation		Setup \rightarrow Advanced setup \rightarrow Interface \rightarrow Calc. DC value	
Description	Displ medi	ays calculated (i.e. corrected) relative dielectric constant $\epsilon_{\rm r}$ (DC1) of the upper um.	

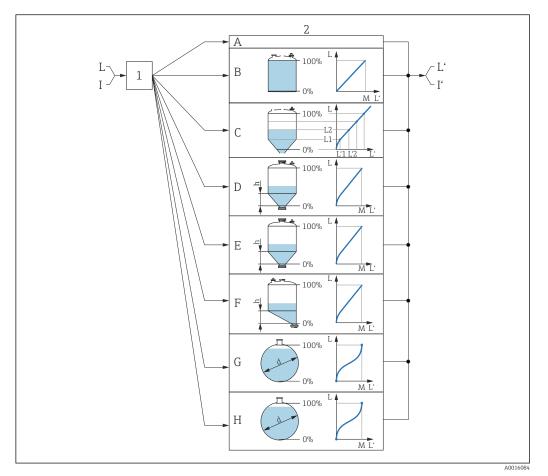
	ß
$ \qquad \qquad$	
Specify whether the calculated dielectric constant is to be used.	
Save and exitCancel and exit	
 Meaning of the options Save and exit The calculated constant is assumed to be the correct one. Cancel and exit The calculated dielectric constant is rejected; the previous dielectric constant remain active. 	IS
	 Specify whether the calculated dielectric constant is to be used. Save and exit Cancel and exit 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 remain

In the local display, the **Calculated DC value** parameter ($\rightarrow \implies 178$) is displayed together with this parameter.

Endress+Hauser

	"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 (→ 🖺 175)	
	In the Automatic DC calculation wizard two parameters are displayed simultaneor on the display module at any one time. The upper parameter can be edited, whereas the lower parameter is displayed for reference purposes only.	
	NavigationImage: Setup \rightarrow Advanced setup \rightarrow Interface \rightarrow Autom. DC calc.	
Manual thickness upper l	ayer	Â
Navigation	$\begin{tabular}{lllllllllllllllllllllllllllllllllll$	
Description	→ 🗎 177	
DC value		
Navigation		
Description	→ 🗎 178	
Use calculated DC value		
Navigation	\square Setup → Advanced setup → Interface → Autom. DC calc. → Use calc. DC	
Description	→ 🗎 179	

"Linearization" submenu



- 57 Linearization: Conversion of the level and, if applicable, interface into a volume or a weight; the conversion depends on the vessel shape
- 1 Selection of linearization type and unit
- 2 Configuration of the linearization
- A Linearization type ($\rightarrow \square 184$) = None
- B Linearization type ($\rightarrow \square 184$) = Linear
- C Linearization type ($\rightarrow \square 184$) = Table
- D Linearization type ($\Rightarrow \square 184$) = Pyramid bottom
- *E* Linearization type ($\rightarrow \square 184$) = Conical bottom
- F Linearization type ($\rightarrow \square 184$) = Angled bottom
- G Linearization type ($\rightarrow \square 184$) = Horizontal cylinder
- *H* Linearization type ($\rightarrow \square 184$) = Sphere
- I For "Operating mode ($\rightarrow \cong 154$)" = "Interface" or "Interface with capacitance": interface before linearization (measured in the level unit)
- I' For "Operating mode ($\Rightarrow \cong 154$)" = "Interface" or "Interface with capacitance": interface after linearization (corresponds to volume or weight)
- *L* Level before linearization (measured in level unit)
- L' Level linearized ($\rightarrow \square 187$) (corresponds to volume or weight)
- *M* Maximum value ($\rightarrow \square 187$)
- d Diameter ($\rightarrow \square 188$)
- h Intermediate height ($\rightarrow \square 188$)

Linearization type	
Unit after linearization	
Free text	
Maximum value	
Diameter	
Intermediate height	
Table mode	
► Edit table	
Level	
Customer value	

Structure of the submenu on the local display

Navigation \blacksquare Setup \rightarrow Advanced setup \rightarrow Linearization

Structure	of the	submenu	in	the	operatina	tool	le.a.	FieldCare)
							1	

Navigation

 $\mathsf{Setup} \to \mathsf{Advanced} \ \mathsf{setup} \to \mathsf{Linearization}$

► Linearization		
Linearization type		
Unit after linearizat	ion	
Free text		
Level linearized		
Interface linearized		
Maximum value		
Diameter		
Intermediate height		
Table mode		
Table number		
Level		
Level		
Customer value		
Activate table		

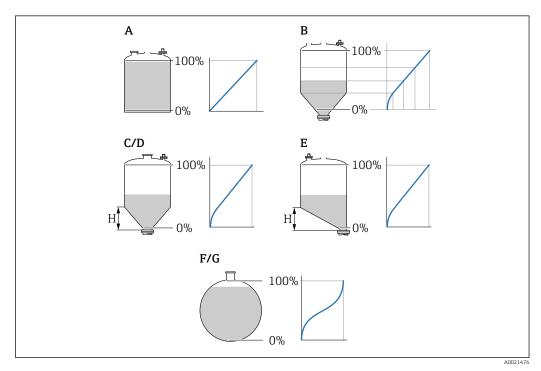
Description of the parameters

Navigation \square Setup \rightarrow Advanced setup \rightarrow Linearization

Linearization type Image: Setup → Advanced setup → Linearization → Lineariz. type Navigation Select linearization type. Description Select linearization type. Selection • None • Linear • Table • Pyramid bottom • Conical bottom • Angled bottom • Angled bottom • Horizontal cylinder • Horizontal cylinder

Sphere

Additional information



☑ 58 Linearization types

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

Meaning of the options

None

The level is output in the level unit without being converted (linearized) beforehand.

Linear

The output value (volume/weight) is proportional to the level L. This applies, for example, to vertical cylindrical tanks and silos. The following parameters must also be specified:

- Unit after linearization ($\rightarrow \triangleq 185$)
- Maximum value (→ 🗎 187): maximum volume or weight
- Table

The relationship between the measured level L and the output value (volume/weight) is defined by a linearization table consisting of up to 32 pairs of values "level - volume" or "level - weight" respectively. The following parameters must also be specified:

- Unit after linearization ($\rightarrow \square$ 185)
- Table mode (→
 188)
- For every point in the table: Level (→
 [™] 190)
- For every point in the table: **Customer value (→** 🗎 190)
- Activate table ($\rightarrow \triangleq 190$)
- Pyramid bottom

The output value corresponds to the volume or weight in a silo with a pyramid bottom. The following parameters must also be specified:

- Unit after linearization ($\rightarrow \square$ 185)
- Maximum value (→ 🗎 187): maximum volume or weight
- Intermediate height (→
 [™] 188): the height of the pyramid
- Conical bottom

The output value corresponds to the volume or weight in a tank with a conical bottom. The following parameters must also be specified:

- Unit after linearization ($\rightarrow \square$ 185)
- Maximum value (→ 🗎 187): maximum volume or weight
- Intermediate height (→
 □ 188): the height of the cone
- Angled bottom

The output value corresponds to the volume or weight in a silo with an angled bottom. The following parameters must also be specified:

- Unit after linearization ($\rightarrow \square$ 185)
- Maximum value (→ 🗎 187): maximum volume or weight
- Intermediate height (→ 🗎 188): height of the angled bottom
- Horizontal cylinder

The output value corresponds to the volume or weight in a horizontal cylinder. The following parameters must also be specified:

- Unit after linearization ($\rightarrow \square$ 185)
- Maximum value (→ 🗎 187): maximum volume or weight
- Diameter (→ 🗎 188)
- Sphere

The output value corresponds to the volume or weight in a spherical tank. The following parameters must also be specified:

- Unit after linearization ($\rightarrow \square$ 185)
- Maximum value (→ 🗎 187): maximum volume or weight
- Diameter (→
 188)

Unit after linearization

£

Navigation	Setup → Advanced setup → Linearization → Unit lineariz.
Prerequisite	Linearization type (→ 🗎 184) ≠ None

Description	Select the unit for the linearized value.
Selection	Selection/input (uint16) 1095 = [short Ton] 1094 = [lb] 1088 = [kg] 1092 = [Ton] 1048 = [US Gal.] 1049 = [Imp. Gal.] 1043 = [ft3] 1035 = [dm3] 1035 = [dm3] 1038 = [l] 1034 = [m3] 1038 = [l] 1041 = [h] 1342 = [%] 1010 = [m] 1012 = [mm] 1012 = [mm] 1013 = [ft] 1013 = [ft] 1351 = [l/s] 1352 = [l/min] 1352 = [l/min] 1352 = [l/s] 1354 = [m3/s] 1348 = [m3/min] 1357 = [ft3/min] 1358 = [ft3/h] 1363 = [US Gal./s] 1364 = [US Gal./h] 1367 = [Imp. Gal./h] 1358 = [Ml/d] 2815 = [Ml/min] 2815 = [Ml/min] 2815 = [Ml/min] 2817 = [Ml/min] 2817 = [Ml/min]
Additional information	The selected unit is only used for display purposes. The measured value is not converted on the basis of the selected unit. Distance-to-distance linearization is also possible, i.e. a linearization from the level unit for the part the Linear linearization media for this number.
	unit to another length unit. Select the Linear linearization mode for this purpose. To specify the new level unit, select the Free text option in the Unit after linearization parameter and enter the unit in the Free text parameter ($\rightarrow \square$ 186).

Free text		Â
Navigation	Image: Setup → Advanced setup → Linearization → Free text	
Prerequisite	Unit after linearization ($\rightarrow \square$ 185) = Free text	
Description	Enter unit symbol.	

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

Level linearized		
Navigation		Setup \rightarrow Advanced setup \rightarrow Linearization \rightarrow Level linearized
Description	Displa	ys linearized level.
Additional information	i	The unit is defined by the Unit after linearization parameter $\rightarrow \cong 185$. For interface measurements, this parameter always refers to the total level.

Interface linearized				
Navigation	□ Setup \rightarrow Advanced setup \rightarrow Linearization \rightarrow Interf. lineariz			
Prerequisite	Operating mode ($\Rightarrow \square 154$) = Interface or Interface with capacitance			
Description	Displays the linearized interface height.			
Additional information	The unit is defined in the Unit after linearization parameter $\rightarrow \square$ 185.			

Maximum value		
Navigation		
Prerequisite	 Linearization type (→ ^B 184) has one of the following values: Linear Pyramid bottom Conical bottom Angled bottom Horizontal cylinder Sphere 	
Description	Linearized value corresponding to a level of 100%.	
User entry	-50 000.0 to 50 000.0 %	

Diameter

£

Navigation	□ Setup → Advanced setup → Linearization → Diameter
Prerequisite	 Linearization type (→ ^B 184) has one of the following values: Horizontal cylinder Sphere
Description	Diameter of the cylindrical or spherical tank.
User entry	0 to 9 999.999 m
Additional information	The unit is defined in the Distance unit parameter ($\rightarrow \implies 154$).

Intermediate height		A
Navigation	Setup → Advanced setup → Linearization → Intermed. height	
Prerequisite	 Linearization type (→ 184) has one of the following values: Pyramid bottom Conical bottom Angled bottom 	
Description	Height of the pyramid, conical or angled bottom.	
User entry	0 to 200 m	
Additional information		A0013264

H Intermediate height

The unit is defined in the **Distance unit** parameter ($\Rightarrow \square 154$).

Table mode		Â
Navigation	$ \blacksquare \square \text{Setup} \rightarrow \text{Advanced setup} \rightarrow \text{Linearization} \rightarrow \text{Table mode} $	
Prerequisite	Linearization type ($\rightarrow \square$ 184) = Table	
Description	Select editing mode of the linearization table.	

Selection

- Manual
- Semiautomatic
- Clear table
- Sort table

Additional information

Meaning of the options

Manual

The level and the associated linearized value are entered manually for each linearization point.

Semiautomatic

The level is measured by the device for each linearization point. The associated linearized value is entered manually.

- Clear table Deletes the existing linearization table.
- Sort table
 Rearranges the linerization points into an ascending order.

Conditions the linearization table must meet:

- The table may consist of up to 32 pairs of values "Level Linearized Value".
- The table must be monotonic (monotonically increasing or decreasing).
 - The first linearization point must refer to the minimum level.
 - The last linearization point must refer to the maximum level.

Before entering a linearization table, the values for **Empty calibration** ($\rightarrow \equiv 156$) and **Full calibration** ($\rightarrow \equiv 157$) 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** $(\rightarrow \square 188) =$ **Clear table**). Then enter a new table.

How to enter the table

Via FieldCare

The table points can be entered via the **Table number** ($\rightarrow \cong 189$), **Level** ($\rightarrow \cong 190$) and **Customer value** ($\rightarrow \cong 190$) parameters. As an alternative, the graphic table editor may be used: Device Operation \rightarrow Device Functions \rightarrow Additional Functions \rightarrow 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 $(\rightarrow \cong 173)$ beforehand.

If a decreasing table is entered, the values for 20 mA and 4 mA of the current output are interchanged. That means: 20 mA refers to the lowest level, whereas 4 mA refers to the highest level.

Table number		
Navigation	$ \qquad \qquad$	
Prerequisite	Linearization type ($\rightarrow \triangleq 184$) = Table	
Description	Select table point you are going to enter or change.	

Operating menu	Levelflex FMP51, FMP52, FN	AP54 HARI
User entry	1 to 32	
Level (Manual)		Â
Navigation	$ \qquad \qquad$	
Prerequisite	 Linearization type (→ 184) = Table Table mode (→ 188) = Manual 	
Description	Enter level value of the table point (value before linearization).	
User entry	Signed floating-point number	
Level (Semiautomatic)		
Navigation	$ \qquad \qquad$	
Prerequisite	 Linearization type (→ ☐ 184) = Table Table mode (→ ☐ 188) = Semiautomatic 	
Prerequisite Description		o the table.
-	• Table mode ($\rightarrow \square$ 188) = Semiautomatic	o the table.
Description	• Table mode ($\rightarrow \square$ 188) = Semiautomatic	
Description Customer value	 Table mode (→ 🗎 188) = Semiautomatic Displays measured level (value before linearization). This value is transmitted to 	
Description Customer value Navigation	 Table mode (→ 🖹 188) = Semiautomatic Displays measured level (value before linearization). This value is transmitted to General Setup → Advanced setup → Linearization → Customer value 	
Description Customer value Navigation Prerequisite	 Table mode (→ 🖹 188) = Semiautomatic Displays measured level (value before linearization). This value is transmitted to Setup → Advanced setup → Linearization → Customer value Linearization type (→ 🖺 184) = Table 	
Description Customer value Navigation Prerequisite Description User entry	 Table mode (→ 🖹 188) = Semiautomatic Displays measured level (value before linearization). This value is transmitted to Setup → Advanced setup → Linearization → Customer value Linearization type (→ 🖺 184) = Table Enter linearized value for the table point. 	
Description Customer value Navigation Prerequisite Description User entry	 Table mode (→ 🖹 188) = Semiautomatic Displays measured level (value before linearization). This value is transmitted to □ Setup → Advanced setup → Linearization → Customer value Linearization type (→ 🖺 184) = Table Enter linearized value for the table point. Signed floating-point number 	۵
Description Customer value Navigation Prerequisite Description User entry Activate table	 Table mode (→ 🗎 188) = Semiautomatic Displays measured level (value before linearization). This value is transmitted to Setup → Advanced setup → Linearization → Customer value Linearization type (→ 🗎 184) = Table Enter linearized value for the table point. Signed floating-point number 	۵
Description Customer value Navigation Prerequisite Description User entry Activate table Navigation	 Table mode (→ 🖹 188) = Semiautomatic Displays measured level (value before linearization). This value is transmitted to Setup → Advanced setup → Linearization → Customer value Linearization type (→ 🖺 184) = Table Enter linearized value for the table point. Signed floating-point number 	۵

Additional information

Meaning of the options

Disable

The measured level is not linearized.

If **Linearization type** ($\rightarrow \implies 184$) = **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

 $\blacksquare \square \quad \text{Setup} \rightarrow \text{Advanced setup} \rightarrow \text{Safety sett.}$

Output echo lost	8
Navigation	
Description	Output signal in case of a lost echo.
Selection	 Last valid value Ramp at echo lost Value echo lost Alarm
Additional information	 Meaning of the options Last valid value The last valid value is kept in the case of a lost echo. Ramp at echo lost ¹²⁾ 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 (→ 🗎 193). Value echo lost ¹²⁾ In the case of a lost echo the output assumes the value defined in the Value echo lost parameter (→ 🗎 192). Alarm In the case of a lost echo the device generates an alarm; see the Failure mode parameter (→ 🗎 202)

Value echo lost		

Navigation	$ \blacksquare \square Setup \rightarrow Advanced setup \rightarrow Safety sett. \rightarrow Value echo lost $
Prerequisite	Output echo lost (→ 🗎 192) = Value echo lost
Description	Output value in case of a lost echo
User entry	0 to 200000.0 %
Additional information	 Use the unit which has been defined for the measured value output: without linearization: Level unit (→ 🗎 173) with linearization: Unit after linearization (→ 🗎 185)

A

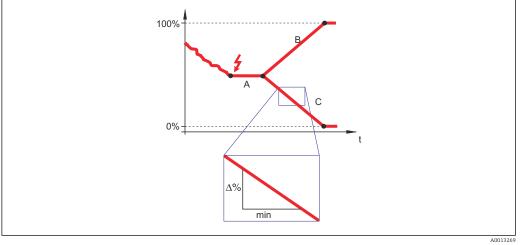
¹²⁾ Only visible if "Linearization type ($\rightarrow \square 184$)" = "None"

Â

Ramp at echo lost	
-------------------	--

Navigation	Image: Setup → Advanced setup → Safety sett. → Ramp echo lost
Prerequisite	Output echo lost (→ 🗎 192) = Ramp at echo lost
Description	Slope of the ramp in the case of a lost echo
User entry	Signed floating-point number

Additional information



A Delay time echo lost

B Ramp at echo lost ($\rightarrow \square$ 193) (positive value)

- *C* Ramp at echo lost ($\rightarrow \square 193$) (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	Image: Setup → Advanced setup → Safety sett. → Blocking dist.	
Description	Specify upper blocking distance UB.	
User entry	0 to 200 m	
Factory setting	 For coax probes: 0 mm (0 in) For rod and rope probes up to 8 m (26 ft): 200 mm (8 in) For rod and rope probes above 8 m (26 ft): 0.025 * Sondenlänge 	

For FMP51/FMP52/FMP54 with the **Interface measurement** application package ¹³⁾ and for FMP55:

100 mm (3.9 in) for all antenna types

Additional information

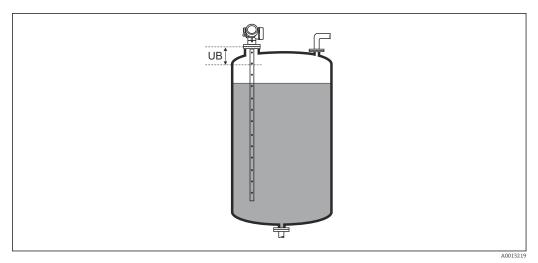
Signals in the upper blocking distance are only evaluated if they have been outside the blocking distance when the device was switched on and move into the blocking distance due to a level change during operation. Signals which are already in the blocking distance when the device is switched on, are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

- This behavior is only valid if the following two conditions are met: f
 - Expert \rightarrow Sensor \rightarrow Echo tracking \rightarrow Evaluation mode = **Short time history** or **Long** time history)
 - Expert \rightarrow Sensor \rightarrow Gas phase compensation \rightarrow 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 F the Endress+Hauser service.



🛃 59 Blocking distance (UB) for liquid measurements

¹³⁾ Ordering feature 540 "Application Package", option EB "Interface measurement"

"SIL/WHG confirmation" wizard

The **SIL/WHG confirmation** wizard is only available for devices with SIL or WHG approval (Feature 590: "Additional Approval", option LA: "SIL" or LC: "WHG overfill prevention") which are currently **not** in the SIL- or WHG-locked state.

The **SIL/WHG confirmation** wizard is required to lock the device according to SIL or WHG. For details refer to the "Functional Safety Manual" of the respective device, which describes the locking procedure and the parameters of the sequence.

Navigation B Setup \rightarrow Advanced setup \rightarrow SIL/WHG confirm.

"Deactivate SIL/WHG" wizard

The **Deactivate SIL/WHG** wizard (→
□ 196) is only visible if the device is SIL-locked or WHG-locked. For details refer to the "Functional Safety Manual" of the respective device.

Navigation \blacksquare Setup \rightarrow Advanced setup \rightarrow Deactiv. SIL/WHG

Reset write protection		
Navigation		
Description	Enter unlocking code.	
User entry	0 to 65 535	
Code incorrect		Ê
Navigation		
Description	Indicates that a wrong unlocking code has been entered. Select procedure.	
Selection	Reenter codeAbort sequence	

"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 length 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 (\rightarrow \square 198) = 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 (→
 ^(⇒) 166) before performing the automatic probe length correction. After the probe length correction, a new map can be recorded using the **Record map** parameter (→
 ^(⇒) 166).
 - Alternative: Select Confirm probe length (→
 ^(⇒) 198) = Manual input and enter the probe length manually into the Present probe length parameter →
 ^(⇒) 197.

An automatic probe length correction is only possible after the correct option has been selected in the **Probe grounded** parameter ($\rightarrow \cong 197$).

Navigation \square Setup \rightarrow Advanced setup \rightarrow Probe settings

Probe grounded		
Navigation		
Prerequisite	Operating mode (→ 🗎 154) = Level	
Description	Specify whether the probe is grounded.	
Selection	NoYes	

Present probe length		Â
Navigation	□ Setup \rightarrow Advanced setup \rightarrow Probe settings \rightarrow Pres. length	
Description	 In most cases: Displays the length of the probe according to the currently measured end-of-prisignal. For Confirm probe length (→ 198) = Manual input: Enter actual length of probe. 	robe
User entry	0 to 200 m	

Confirm probe length	8
Navigation	□ Setup \rightarrow Advanced setup \rightarrow Probe settings \rightarrow Confirm length
Description	Select, whether the value displayed in the Present probe length parameter $\rightarrow \boxminus 197$ matches the actual length of the probe. Based on this input, the device performs a probe length correction.
Selection	 Probe length OK Probe length too small Probe length too big Probe covered Manual input Probe length unknown
Additional information	Meaning of the options • Probe length OK To be selected if the indicated length is correct. An adjustment is not required. The device quits the sequence. • Probe length too small To be selected if the displayed length is smaller than the actual length of the probe. A different end of probe signal is allocated and the newly calculated length is displayed in the Present probe length parameter → 🗎 197. 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 → 🗎 197. 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 → 🗎 197 ¹⁴ . • 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.

¹⁴⁾ 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 ($\rightarrow \square$ 197).	
	Navigation $\blacksquare \square$ Setup \rightarrow Advanced setup \rightarrow Probe settings \rightarrow Problemgth corr	r
Confirm probe length		
Navigation	$\begin{tabular}{lllllllllllllllllllllllllllllllllll$	
Description	→ 🗎 198	
Present probe length		A
Navigation	$ \blacksquare \square Setup \rightarrow Advanced setup \rightarrow Probe settings \rightarrow Prob.length corr \rightarrow Pres. length $	
Description	→ 🗎 197	

"Current output 1 to 2" submenu

The **Current output 2** submenu ($\Rightarrow \triangleq 200$) is only available for devices with two current outputs.

Navigation \square Setup \rightarrow Advanced setup \rightarrow Curr.output 1 to 2

Assign current output 1	to 2		ſ	
Navigation	🗟 🛛 Setup → Advan	ced setup → Curr.output 1 to	o 2 → Assign curr.	
Description	Select process variable	Select process variable for current output.		
Selection	 Level linearized Distance Electronic temperature Relative echo amplitude Analog output adv. diagnostics 1 Analog output adv. diagnostics 2 			
	Additionally for Ope Interface linearized Interface distance Thickness upper lay Relative interface a	er	or "Interface with capacitance":	
Factory setting	 For level measureme Current output 1: Le Current output 2¹⁵⁾ 	evel linearized		
	 For interface measur Current output 1: In Current output 2¹⁶⁾ 	terface linearized		
Additional information	Definition of the curre	nt range for the process vari	ables	
	Process variable	4 mA value	20 mA value	
	Level linearized	0 % ¹⁾ or the associated linearized value	100 % $^{2)}$ or the associated linearized value	

Level linearized	0 % ¹⁾ or the associated linearized value	100 $\%$ $^{2)}$ or the associated linearized value	
Distance	0 (i.e. level is at the reference point)	Empty calibration ($\rightarrow \square$ 156) (i.e. level is at 0 %)	
Electronic temperature	−50 °C (−58 °F)	100 °C (212 °F)	
Relative echo amplitude	0 mV 2 000 mV		
Analog output adv. diagnostics 1/2	depending on the parametrization of the Advanced Diagnostics		
Interface linearized	$ \begin{array}{ c c c c } 0\%^{1)} \text{ or the associated} \\ \text{linearized value} \end{array} \qquad 100\%^{2)} \text{ or the associated linearized value} \\ \end{array} $		
Interface distance	0 (i.e. interface at the reference point) Empty calibration (→		

¹⁵⁾ only for devices with two current outputs

¹⁶⁾ only for devices with two current outputs

Process variable	4 mA value	20 mA value
Thickness upper layer	0 % ¹⁾ or the associated linearized value	100 % $^{2)}$ or the associated linearized value
Relative interface amplitude	0 mV	2 000 mV

1) the 0% level is defined by **Empty calibration** parameter ($\Rightarrow \square 156$)

2) The 100% level is defined by **Full calibration** parameter ($\Rightarrow \square 157$)

It may be necessary to adjust the 4mA and 20mA values to the application (especially in the case of the **Analog output adv. diagnostics 1/2** option).

This can be done by the following parameters:

- Expert \rightarrow Output \rightarrow Current output 1 to 2 \rightarrow Turn down
- Expert \rightarrow Output \rightarrow Current output 1 to 2 \rightarrow 4 mA value
- Expert \rightarrow Output \rightarrow Current output 1 to 2 \rightarrow 20 mA value

Current span				Ê
Navigation	$ \blacksquare \blacksquare \text{Setup} \to A $	Advanced setup → Curr.outp	put 1 to 2 \rightarrow Current span	
Description	Determines the	current range used to trans	mit the measured value.	
	'420mA': Measured variat	ole: 420 mA		
	'420mA NAM Measured variab	UR': vle: 3.8 20.5 mA		
	'420mA US': Measured variat	ole: 3.9 20.8 mA		
	'Fixed current': Measured variable transmitted via HART only			
	Note: Currents below 3	3.6 mA or above 21.95 mA	can be used to signal an a	alarm.
Selection	 420 mA 420 mA NAMUR 420 mA US Fixed current 			
Additional information	Meaning of the c	options		
	Option	Current range for process variable	Lower alarm signal level	Upper alarm signal level
	420 mA	4 to 20.5 mA	< 3.6 mA	> 21.95 mA
	420 mA NAMUR	3.8 to 20.5 mA	< 3.6 mA	> 21.95 mA

Option	Current range for process variable	Lower alarm signal level	Upper alarm signal level
420 mA US	3.9 to 20.8 mA	< 3.6 mA	> 21.95 mA
Fixed current	Constant current, defined in the Fixed current parameter ($\rightarrow \square 202$).		

In the case of an error, the output current assumes the value defined in the Failure mode parameter (→
 ¹ 202).

- If the meausred value is out of the measuring range, **Current output** diagnostic message is issued.
- In a HART multidrop loop only one device can use the analog current to transmit a signal. For all other devices one must set:
 - Current span = Fixed current

Fixed current		
Navigation		
Prerequisite	Current span ($\Rightarrow \cong 201$) = Fixed current	
Description	Define constant value of the output current.	

User entry 4 to 22.5 mA

Damping output		
Navigation	Image: Setup → Advanced setup → Curr.output 1 to 2 → Damping out.	
Description	Reaction time of the output signal on fluctuation in the measured value.	
User entry	0.0 to 999.9 s	
Additional information	Fluctuations of the measured value affect the output current with an exponential delay, the time constant τ of which is defined in this parameter. With a small time constant th output reacts immediately to changes of the measured value. With a big time constant t reaction of the output is more delayed. For $\tau = 0$ (factory setting) there is no damping.	e

Failure mode		Â
Navigation	Image: Setup → Advanced setup → Curr.output 1 to 2 → Failure mode	
Prerequisite	Current span (→ 🖹 201) ≠ Fixed current	

Description	Defines which current the output assumes in the case of an error. 'Min.': < 3.6mA 'Max.': > 21.95mA 'Last valid value': Last valid value before occurrence of the error. 'Actual value': Output current is equal to the measured value; error is ignored. 'Defined value': User defined value.
Selection	 Min. Max. Last valid value Actual value Defined value
Additional information	 Meaning of the options Min. The current output adopts the value of the lower alarm level according to the Current span parameter (→ ● 201). Max. The current output adopts the value of the upper alarm level according to the Current span parameter (→ ● 201). Last valid value The current remains constant at the last value it hat before the error occurred. Actual value The output current follows the actual measured value; the error is ignored. Defined value The output current assumes the value defined in the Failure current parameter (→ ● 203). The error behavior of other output channels is not influenced by these settings but is defined in separate parameters.

Failure current		ß
Navigation	■ Setup \rightarrow Advanced setup \rightarrow Curr.output 1 to 2 \rightarrow Failure current	
Prerequisite	Failure mode ($\rightarrow \cong 202$) = Defined value	
Description	Defines which current the output assumes in case of an error.	
User entry	3.59 to 22.5 mA	

Output current 1 to 2	
Navigation	■ Setup \rightarrow Advanced setup \rightarrow Curr.output 1 to 2 \rightarrow Output curr. 1 to 2
Description	Shows the actual calculated value of the output current.

"Switch output" submenu



The **Switch output** submenu ($\rightarrow \textcircled{B} 205$) is only visible for devices with switch output. ¹⁷⁾

Navigation □ □ Setup \rightarrow Advanced setup \rightarrow Switch output

Switch output function	<u> </u>
Navigation	Image: Boundary Setup → Advanced setup → Switch output → Switch out funct
Description	Defines the function of the switch output.
	'Off' The switch output is always open (non-conductive)
	'On' The switch output is always closed (conductive).
	'Diagnostic behavior' The switch output is normally closed and is only opened if a diagnostic event is present.
	'Limit' The switch output is normally closed and is only opened if a measured variable exceeds a defined limit.
	'Digital output' The switch output is controlled by one of the digital output blocks of the device.
Selection	 Off On Diagnostic behavior Limit Digital Output
Additional information	 Meaning of the options Off The output is always open (non-conductive). On The output is always closed (conductive). Diagnostic behavior The output is normally closed and is only opened if a diagnostic event is present. The Assign diagnostic behavior parameter (→ ≅ 206) 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 (→ ≅ 206) Switch-on value (→ ≅ 207) Switch-off value (→ ≅ 208) 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 (→ ≅ 206). The Off and On options can be used to simulate the switch output.

¹⁷⁾ Ordering feature 020 "Power supply; Output", option B, E or G

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Assign status

Navigation	Setup → Advanced setup → Switch output → Assign status
Prerequisite	Switch output function ($\Rightarrow \cong 205$) = Digital Output
Description	Assigns a Discrete Output Block or an Advanced Diagnostic Block to the switch output.
Selection	 Off Digital output AD 1 Digital output AD 2
Additional information	The Digital output AD 1 and Digital output AD 2 options refer to the Advanced Diagnostic Blocks. A switch signal generated in these blocks can be transmitted via the switch output.

Assign limit		
Navigation		
Prerequisite	Switch output function ($\rightarrow \cong 205$) = Limit	
Description	Defines which process variable will be checked for limit violation.	
Selection	 Off Level linearized Distance Interface linearized * Interface distance * Thickness upper layer * Terminal voltage Electronic temperature Measured capacitance * Relative echo amplitude Relative interface amplitude * Absolute echo amplitude * 	

Assign diagnostic behavior

Navigation	$\textcircled{B} \Box \text{Setup} \rightarrow \text{Advanced setup} \rightarrow \text{Switch output} \rightarrow \text{Assign diag. beh}$
Prerequisite	Switch output function ($\Rightarrow \triangleq 205$) = Diagnostic behavior
Description	Defines to which behavior of diagnostic events the switch output reacts.

^{*} Visibility depends on order options or device settings

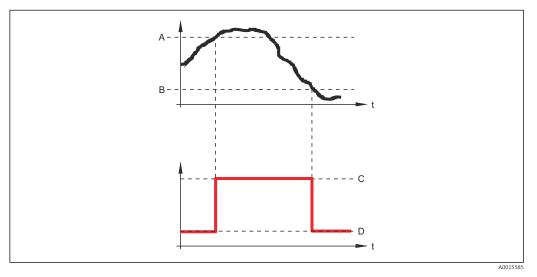
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Selection

Alarm

- Alarm or warning
- Warning

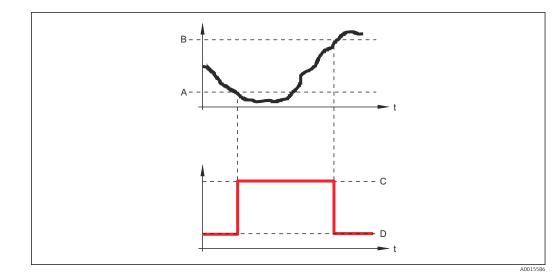
Switch-on value		
Navigation	Image: Setup → Advanced setup → Switch output → Switch-on value	
Prerequisite	Switch output function ($\rightarrow \cong 205$) = Limit	
Description	Defines the switch-on point. The output is closed if the assigned process variable rises above this point.	
User entry	Signed floating-point number	
Additional information	The switching behavior depends on the relative position of the Switch-on value and Switch-off value parameters:	
	 Switch-on value > Switch-off value The output is closed if the measured value is larger than Switch-on value. The output is opened if the measured value is smaller than Switch-off value. 	



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

Switch-on value < Switch-off value

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



- Α
- В
- С
- Switch-on value Switch-off value Output closed (conductive) Output opened (non-conductive) D

Switch-on delay

Navigation	$ \blacksquare \Box Setup \rightarrow Advanced setup \rightarrow Switch output \rightarrow Switch-on delay $
Prerequisite	 Switch output function (→ ≧ 205) = Limit Assign limit (→ ≧ 206) ≠ Off
Description	Defines the delay applied before the output is switched on.
User entry	0.0 to 100.0 s

Switch-off value

Navigation	$ \blacksquare \blacksquare Setup \rightarrow Advanced setup \rightarrow Switch output \rightarrow Switch-off value $
Prerequisite	Switch output function ($\rightarrow \cong 205$) = Limit
Description	Defines the switch-off point. The output is opened if the assigned process variable falls below this point.
User entry	Signed floating-point number
Additional information	The switching behavior depends on the relative position of the Switch-on value and Switch-off value parameters; description: see the Switch-on value parameter ($\rightarrow \square 207$).

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Switch-off delay		
Navigation	Image: Boundary Setup → Advanced setup → Switch output → Switch-off delay	
Prerequisite	 Switch output function (→ ^B 205) = Limit Assign limit (→ ^B 206) ≠ Off 	
Description	Defines the delay applied before the output is switched off.	
User entry	0.0 to 100.0 s	
Failure mode		
Navigation	Setup → Advanced setup → Switch output → Failure mode	
Prerequisite	Switch output function ($\Rightarrow \cong 205$) = Limit or Digital Output	
Description	Defines the state of the switch output in case of an error.	
Selection	Actual statusOpenClosed	
Additional information		
Switch status		
Navigation	Image: Setup → Advanced setup → Switch output → Switch status	
Description	Current status of the switch output.	
Invert output signal		
Navigation	■ Setup → Advanced setup → Switch output → Invert outp.sig.	
-		
Description	'No' The switch output behaves as per its parameter setting.	
	'Yes' The switching behavior is inverted as compared to its parameter setting.	
Selection	NoYes	

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

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

Navigation

 $\blacksquare \Box \quad \text{Setup} \rightarrow \text{Advanced setup} \rightarrow \text{Display}$

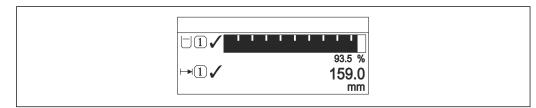
Language	
Navigation	
Description	Set display language.
Selection	 English Deutsch * Français * Français * Español * Italiano * Nederlands * Portuguesa * Polski * pyccкий язык (Russian) * Svenska * Türkçe * 中文 (Chinese) * 日本語 (Japanese) * 한국어 (Korean) * Bahasa Indonesia * tiếng Việt (Vietnamese) * čeština (Czech) *
Factory setting	The language selected in feature 500 of the product structure. If no language has been selected: English
Additional information	1
Format display	
Navigation	Setup → Advanced setup → Display → Format display
Description	Select how measured values are shown on the display.
Selection	 1 value, max. size 1 bargraph + 1 value 2 values 1 value large + 2 values 4 values

^{*} Visibility depends on order options or device settings

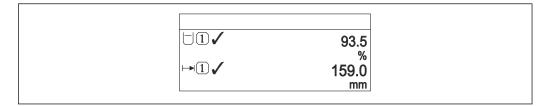
Additional information



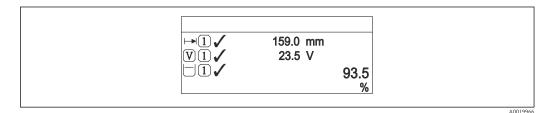
🕑 60 "Format display" = "1 value, max. size"



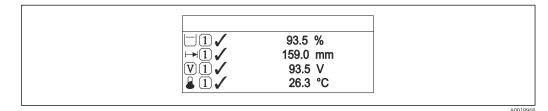
61 "Format display" = "1 bargraph + 1 value"



62 "Format display" = "2 values"



63 "Format display" = "1 value large + 2 values"



64 "Format display" = "4 values"

- The Value 1 to 4 display → 🗎 213 parameters specify which measured values are shown on the display and in which order.

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Value 1 to 4 display		
Navigation	Image: Boundary 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	Image: 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.xxx x.xxx 	
Additional information	The setting does not affect the measuring or computational accuracy of the device.	

^{*} Visibility depends on order options or device settings

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

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

Header	

Navigation	
Description	Select header contents on local display.
Selection	Device tagFree text
Additional information	1 XXXXXXXXX

1—		

1 Position of the header text on the display

Meaning of the options

- Device tag Is defined in the Device tag parameter (→ ☐ 154).
 Free text
 - Is defined in the **Header text** parameter ($\rightarrow \square 215$).

Header text		
Navigation	Image: Setup → Advanced setup → Display → Header text	
Prerequisite	Header (→ 🖺 214) = Free text	
Description	Enter display header text.	
User entry	Character string comprising numbers, letters and special characters (12)	
Additional information	The number of characters which can be displayed depends on the characters used.	

Separator		Â
Navigation	$ \blacksquare \square Setup \rightarrow Advanced setup \rightarrow Display \rightarrow Separator $	
Description	Select decimal separator for displaying numerical values.	
Selection	• . • ,	

Image: Setup → Advanced setup → Display → Number format	
Choose number format for the display.	
Decimalft-in-1/16"	
The ft-in-1/16 " option is only valid for distance units.	
	 Choose number format for the display. Decimal ft-in-1/16"

Decimal places menu	6
Navigation	□ □ Setup → Advanced setup → Display → Dec. places menu
Description	Select number of decimal places for the representation of numbers within the operating menu.
Selection	 X X.X X.XX X.XXX X.XXX

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 →
 ⁽²⁾ 213 parameters.
- The setting does not affect the accuracy of the measurement or the calculations.

Backlight	
Navigation	Image: 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	DisableEnable
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.

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 ⓒ ⓒ buttons simultaneously.

Brighter: press the ⊕ € 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 ($\rightarrow \triangleq 154$)).

Navigation \square Setup \rightarrow Advanced setup \rightarrow Conf.backup disp

Operating time	
Navigation	Setup → Advanced setup → Conf.backup disp → Operating time
Description	Indicates how long the device has been in operation.
Additional information	Maximum time 9999 d (≈ 27 years)

Last backup	
Navigation	Setup → Advanced setup → Conf.backup disp → Last backup
Description	Indicates when the last data backup was saved to the display module.

Configuration man	agement	
Navigation	Image: Bear of the setup → Conf.backup disp → Config. managem.	
Description	Select action for managing the device data in the display module.	
Selection	 Cancel Execute backup Restore Duplicate Compare Clear backup data 	

Additional information Meaning of the options

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 ($\rightarrow \cong 218$).

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 Image: Setup → Advanced setup → Conf.backup disp → Backup state Description Displays which backup action is currently in progress. Comparison result Image: Setup → Advanced setup → Conf.backup disp → Compar. result Navigation Image: Setup → Advanced setup → Conf.backup disp → Compar. result

Description Comparison between present device data and display backup.

Additional information

Meaning of the display options

Settings identical

The current device configuration of the HistoROM is identical to the backup copy in the display module.

Settings not identical

The current device configuration of the HistoROM is not identical to the backup copy in the display module.

- No backup available There is no backup copy of the device configuration of the HistoROM in the display module.
- Backup settings corrupt

The current device configuration of the HistoROM is corrupt or not compatible with the backup copy in the display module.

- Check not done The device configuration of the HistoROM has not yet been compared to the backup copy in the display module.
- Dataset incompatible

The data sets are incompatible and can not be compared.

To start the comparison, set **Configuration management** ($\rightarrow \cong 217$) = **Compare**.

If the transmitter configuration has been duplicated from a different device by **Configuration management** ($\rightarrow \textcircled{} 217$) = **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

Define access code	3	ì
Navigation	$ \qquad \qquad$	
Description	Define release code for write access to parameters.	
User entry	0 to 9 999	
Additional information	If the factory setting is not changed or if "0" is entered, the parameters are not write- protected and the device configuration data can therefore always be modified. The user is logged on in the "Maintenance" role.	
	The write protection affects all parameters marked with the 🗃 symbol in the document. On the local display, the 🔒 symbol in front of a parameter indicates that the parameter is write-protected.	
	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 $(\rightarrow \cong 169)$.	
	Please contact your Endress+Hauser Sales Center if you lose the access code.	
	If operating via the local display: the new access code is only valid once it has been confirmed in the Confirm access code parameter ($\rightarrow \square 222$).	

Device reset		
Navigation	Image: Setup → Advanced setup → Administration → Device reset	
Description	Reset the device configuration - either entirely or in part - to a defined state.	
Selection	 Cancel To factory defaults To delivery settings Of customer settings To transducer defaults Restart device 	
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 factory default if customer specific settings have been ordered. This option is only visible if customer specific settings have been ordered. 	m the

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.

	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 no available for operation via operating tool.	-
	NavigationImage: Setup \rightarrow Advanced setup \rightarrow Administration \rightarrow Def. access code	õ
Define access code		
		<u> </u>
Navigation	$\begin{tabular}{lllllllllllllllllllllllllllllllllll$	
Description	→ 🖺 220	
Confirm access code		£
Navigation		
Description	Confirm the entered access code.	
User entry	0 to 9 999	

"Define access code" wizard

17.5 "Diagnostics" menu

Navigation

■ ■ Diagnostics

Actual diagnostics	
Navigation	Image Big
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 ① symbol on the display.

Timestamp	
Navigation	□ Diagnostics \rightarrow Timestamp
Description	Displays the timestamp for the currently active diagnostic message.
Previous diagnostics	
Navigation	Image Diagnostics → Prev.diagnostics
Description	Displays the last diagnostic message which has been active before the current message.
Additional information	The display consists of: • Symbol for event behavior • Code for diagnostic behavior • Operating time of occurrence • Event text
	The condition displayed may still apply. Information on what is causing the message, and remedy measures, can be viewed via the ④ symbol on the display.

Timestamp	
Navigation	□ Diagnostics \rightarrow Timestamp
Description	Shows the timestamp of the previous diagnostic message.
Operating time from rest	art
Navigation	
Description	Displays the time the device has been in operation since the last device restart.
Operating time	
Navigation	Image Diagnostics → Operating time
Description	Indicates how long the device has been in operation.
Additional information	Maximum time
	9999 d (≈ 27 years)

17.5.1 "Diagnostic list" submenu

Navigation \square Diagnostics \rightarrow Diagnostic list

Diagnostics 1 to 5	
Navigation	□ □ Diagnostics \rightarrow Diagnostic list \rightarrow 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 \rightarrow Diagnostic list \rightarrow Timestamp 1 to 5

Timestamp of the diagnostic message.

Description

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

17.5.2 "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 \square Diagnostics \rightarrow Event logbook

"Event list" submenu

The **Event list** submenu displays the history of past events of the category selected in the **Filter options** parameter ($\rightarrow \cong 226$). A maximum of 100 events are displayed in chronological order.

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

- ①: Event has occurred
- 🕞: Event has ended

Information on what is causing the message, and remedy instructions, can be viewed via the ①-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

17.5.3 "Device information" submenu

Navigation \square Diagnostics \rightarrow Device info

Device tag	
Navigation	□ Diagnostics → Device info → Device tag □
Description	Enter the name for the measuring point.
User interface	Character string comprising numbers, letters and special characters
Serial number	
Navigation	Image: Barbon Diagnostics → Device info → Serial number
Description	Shows the serial number of the measuring device.
Additional information	 Uses of the serial number To identify the device quickly, e.g. when contacting Endress+Hauser. To obtain specific information on the device using the Device Viewer: www.endress.com/deviceviewer The serial number is also indicated on the nameplate.

Firmware version	
Navigation	■ Diagnostics \rightarrow Device info \rightarrow 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	
Description	Shows the name of the transmitter.

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

Extended order code 1 to 3		Â
Navigation	B □ Diagnostics → Device info → Ext. order cd. 1	
Description	Display the three parts of the extended order code.	
User interface	Character string comprising numbers, letters and special characters	
Additional information	The extended order code indicates the version of all the features of the product structuand thus uniquely identifies the device.	ıre

Device revision	
Navigation	
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.

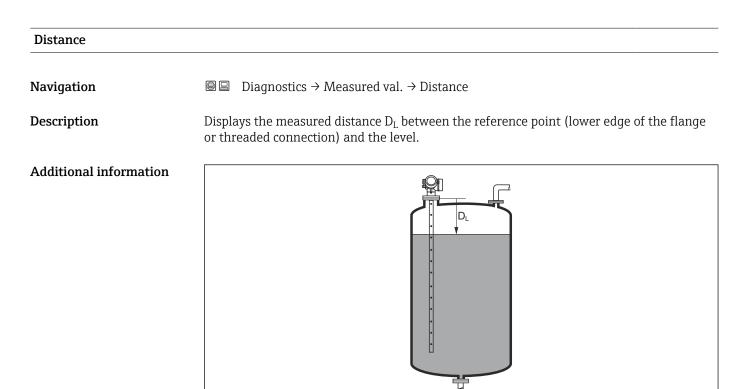
Device ID	
Navigation	B □ Diagnostics → Device info → Device ID
Description	Shows the device ID for identifying the device in a HART network.
Additional information	In addition to the Device type and Manufacturer ID, the Device ID is part of the unique device identification (Unique ID) which characterizes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

Device type	
Navigation	
Description	Shows the device type with which the measuring device is registered with the HART Communication Foundation.
Additional information	1

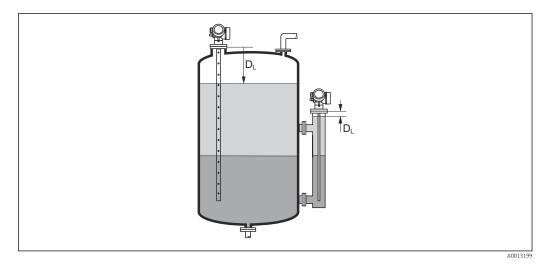
Manufacturer ID	Manufacturer ID		
Navigation	Image of the second secon		
Description	Use this function to view the manufacturer ID with which the measuring device is registered with the HART Communication Foundation.		
User interface	2-digit hexadecimal number		
Factory setting	0x11 (for Endress+Hauser)		

17.5.4 "Measured values" submenu

Navigation \square \square Diagnostics \rightarrow Measured val.



65 Distance for liquid measurements



66 Distance for interface measurements

The unit is defined in the **Distance unit** parameter ($\rightarrow \square 154$).

A0013198

Level linearized	
Navigation	
Description	Displays linearized level.
Additional information	 The unit is defined by the Unit after linearization parameter → ■ 185. For interface measurements, this parameter always refers to the total level.

Interface distance Navigation Image: Diagnostics → Measured val. → Interface dist. Prerequisite Operating mode (→ Image: Displays the measured distance D₁ between the reference point (lower edge of flange or threaded connection) and the interface. Additional information Image: Displays the measured distance D₁ between the reference point (lower edge of flange or threaded connection) and the interface.

The unit is defined in the **Distance unit** parameter ($\rightarrow \triangleq 154$).

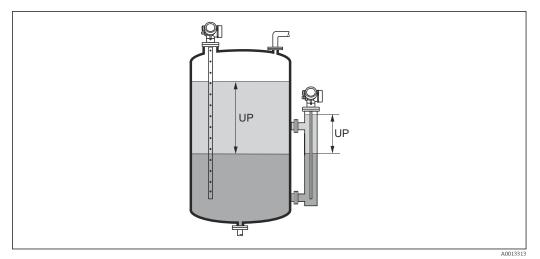
Interface linearized	
Navigation	
Prerequisite	Operating mode ($\Rightarrow \triangleq 154$) = Interface or Interface with capacitance
Description	Displays the linearized interface height.
Additional information	185. The unit is defined in the Unit after linearization parameter $\rightarrow \equiv 185$.

Thickness upper layer

- **Navigation** \square Diagnostics \rightarrow Measured val. \rightarrow Thickn.upp.layer
- Prerequisite
- Description
- Displays the upper interface thickness (UP).

Operating mode (→ 🗎 **154)** = **Interface** or **Interface with capacitance**

Additional information



UP Thickness upper layer

The unit is defined by the **Unit after linearization** parameter $\rightarrow \cong$ 185.

Output current 1 to 2	2
Navigation	
Description	Shows the actual calculated value of the output current.
Measured current 1	
Navigation	
Prerequisite	Only available for current output 1
Description	Shows the current value of the current output which is currently measured.

Terminal voltage 1	
Navigation	
Description	Shows the current terminal voltage that is applied at the output.

17.5.5 "Data logging" submenu

Assign channel 1 to 4		Ê
Navigation	Image and the set of the set	
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 * Relative interface amplitude * Relative interface amplitude * Absolute EOP amplitude EOP shift Noise of signal Calculated DC value * Analog output adv. diagnostics 1 Analog output adv. diagnostics 2 	
Additional information	A total of 1000 measured values can be logged. This means: 1000 data points if 1 logging channel is used 500 data points if 2 logging channels are used 333 data points if 3 logging channels are used 250 data points if 4 logging channels are used If the maximum number of data points is reached, the oldest data points in the data log are cyclically overwritten in such a way that the last 1000, 500, 333 or 250 measured	I
	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

A Logging interval Navigation Diagnostics \rightarrow Data logging \rightarrow Logging interval Diagnostics \rightarrow Data logging \rightarrow Logging interval Description Define the logging interval tlog for data logging. This value defines the time interval between the individual data points in the memory. User entry 1.0 to 3 600.0 s Additional information This parameter defines the interval between the individual data points in the data log, and thus the maximum loggable process time T $_{log}$: • If 1 logging channel is used: T $_{log} = 1000 \cdot t_{log}$ • If 2 logging channels are used: $T_{log} = 500 \cdot t_{log}$ • If 3 logging channels are used: T $_{log}$ = 333 \cdot t $_{log}$ • If 4 logging channels are used: $T_{log} = 250 \cdot t_{log}$ Once this time elapses, the oldest data points in the data log are cyclically overwritten such that a time of T log always remains in the memory (ring memory principle). The logged data are deleted if this parameter is changed. Example When using 1 logging channel • $T_{log} = 1000 \cdot 1 s = 1000 s \approx 16.5 min$ • $T_{log} = 1000 \cdot 10 \text{ s} = 1000 \text{ s} \approx 2.75 \text{ h}$ • $T_{log} = 1000 \cdot 80 \text{ s} = 80000 \text{ s} \approx 22 \text{ h}$

• $T_{log}^{109} = 1000 \cdot 3600 \text{ s} = 3600000 \text{ s} \approx 41 \text{ d}$

Clear logging data		Â
Navigation	 □ Diagnostics → Data logging → Clear logging □ Diagnostics → Data logging → Clear logging 	
Description	Clear the entire logging data.	
Selection	CancelClear data	

"Display channel 1 to 4" submenu

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

The **Display channel 1 to 4** submenus invoke a diagram of the logging history of the respective channel.

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175.77	trubh
40.69 kg/h	
	-100s Ó

- 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 \oplus and \Box simultaneaously.

Navigation

□ Diagnostics → Data logging → Displ.channel 1 to 4

17.5.6 "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.

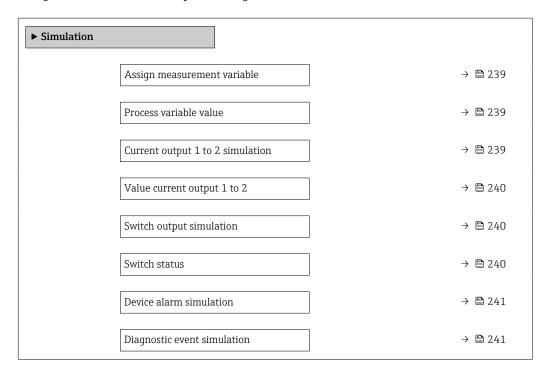
Conditions which can be simulated

Condition to be simulated	Associated parameters
Specific value of a process variable	 Assign measurement variable (→ ^B 239) Process variable value (→ ^B 239)
Specific value of the output current	 Current output simulation (→ [●] 239) Value current output (→ [●] 240)
Specific state of the switch output	 Switch output simulation (→ 🗎 240) Switch status (→ 🖺 240)
Existence of an alarm	Device alarm simulation ($\rightarrow \square 241$)
Existence of a specific diagnostic message	Diagnostic event simulation (→ 🗎 241)

Structure of the submenu

Navigation

Expert \rightarrow Diagnostics \rightarrow Simulation



Description of parameters

Navigation 🗐 🗐 Exper

 $\blacksquare \blacksquare \quad \text{Expert} \rightarrow \text{Diagnostics} \rightarrow \text{Simulation}$

Assign measurement variable		
Navigation	\blacksquare Expert → Diagnostics → Simulation → Assign meas.var.	
Description	Defines the process variable to be simulated.	
Selection	 Off Level Interface * Thickness upper layer * Level linearized Interface linearized Thickness linearized 	
Additional information	 The value of the variable to be simulated is defined in the Process variable value parameter (→ B 239). If Assign measurement variable ≠ Off, a simulation is active. This is indicated by a diagnotic message of the <i>Function check (C)</i> category. 	

Process variable value		Ê
Navigation	Image: Boundary System Simulation → Proc. var. value $Proc. var. value$	
Prerequisite	Assign measurement variable (→ 🗎 239) ≠ Off	
Description	Defines the value of the selected variable. The outputs assume values or states according to this value.	
User entry	Signed floating-point number	
Additional information	Downstream measured value processing and the signal output use this simulation value this way, users can verify whether the measuring device has been configured correctly.	

Current output 1 to 2 simulation

Navigation	Image: Barbon Simulation → Curr.out. 1 to 2 sim. Image: Simulation → Curr.out. 1 to 2 sim.
Description	Switch the simulation of the current output on and off.

A

^{*} Visibility depends on order options or device settings

Selection	OffOn	
Additional information	An active simulation is indicated by a diagnostic message of the <i>Function check (C)</i> category.	
Value current output 1 to 2		
Navigation	Image: Barbon Simulation → Value curr.out 1 to 2 Image: Simulation → Value curr.out 1 to 2	

5	
Prerequisite	Current output simulation ($\rightarrow \cong 239$) = On
Description	Defines the value of the simulated output current.
User entry	3.59 to 22.5 mA
Additional information	The current output assumes the value specified in this parameter. In this way, users can verify the correct adjustment of the current output and the correct function of connected control units.

Switch output simu	llation	
Navigation	Image: Barbon Simulation → Switch sim.	
Description	Switch the simulation of the switch output on and off.	
Selection	OffOn	

Switch status		
Navigation	$ \blacksquare \blacksquare \text{Expert} \rightarrow \text{Diagnostics} \rightarrow \text{Simulation} \rightarrow \text{Switch status} $	
Prerequisite	Switch output simulation ($\rightarrow \square 240$) = On	
Description	Current status of the switch output.	

Additional information	The switch status assumes the value defined in this parameter. This helps to check correct
	operation of connected control units.

Open Closed

Selection

Device alarm simulation		£
Navigation	■ Expert → Diagnostics → Simulation → Dev. alarm sim.	
Description	Switch the device alarm on and off.	
Selection	OffOn	
Additional information	When selecting the On option, the device generates an alarm. This helps to check the correct output behavior of the device in the case of an alarm.	
	An active simulation is indicated by the C484 Failure mode simulation diagnostic message.	
Diagnostic event simulati	on	Â

Navigation	$\blacksquare \blacksquare \text{Expert} \rightarrow \text{Diagnostics} \rightarrow \text{Simulation} \rightarrow \text{Diag. event sim.}$
Description	Select the diagnostic event to be simulated.
	Note: To terminate the simulation, select 'Off'.
Additional information	When operated via the local display, the selection list can be filtered according to the event categories (Diagnostic event category parameter).

17.5.7 "Device check" submenu

Navigation \square \square Diagnostics \rightarrow Device check

Start device check		£
Navigation		
Description	Start a device check.	
Selection	NoYes	
Additional information	In the case of a lost echo a device check can not be performed.	
Result device check		
Navigation		
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	
Description	Displays the operating time at which the last device check has been performed.
User interface	Character string comprising numbers, letters and special characters

Level signal

Navigation	B □ 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	
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	
Prerequisite	 Operating mode (→ ^{(→}) 154) = 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



"Heartbeat" submenu

The **Heartbeat** submenu is only available via **FieldCare** or **DeviceCare**. It contains the wizards which are part of the **Heartbeat Verification** and **Heartbeat Monitoring** application packages.

Detailed description SD01872F

Navigation

□ □ Diagnostics → Heartbeat

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